# MILITARY HANDBOOK

# DESIGN PROCEDURES FOR

# PASSIVE SOLAR BUILDINGS

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DEPARTMENT OF DEFENSE
Washington, DC 20301

Passive Solar Design Procedures

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# FOREWORD

The energy efficiency of buildings at Naval installations can be greatly improved through the use of passive solar heating strategies. These strategies are universally applicable to new buildings of small to moderate size and are also applicable to many existing buildings that are suitable for retrofit. The purpose of this handbook is to provide the tools needed by professionals involved in building design and/or evaluation who wish to reduce the consumption of non-renewable energy resources for space heating. Three types of tools are provided. First, a general discussion of the basic concepts and principles of passive solar heating is presented to familiarize the reader with this technology. Second, a set of guidelines is presented for use during schematic design or for initial screening if an evaluation is being performed. These guidelines enable the user to quickly define a building that will perform in a cost effective manner at the intended building site. Finally, a quantitative design-analysis procedure is presented that enables the user to obtain an accurate estimate of the auxiliary heating requirements of a particular passive solar design. This procedure may be used to refine a schematic design based on the guidelines already mentioned, or may be used to compare the merits of candidate designs in a proposal evaluation.

These design procedures are an extension and refinement of an earlier five-volume set of publications entitled "Design Calculation Procedure for Passive Solar Houses at Navy Installations in:

Regions with Cold Climates - Volume I" CR 82.002
East Coast Regions with Temperate Climates - Volume II" CR 82.003,
Regions with Warm Humid Climates - Volume III" CR 82.004,
The Pacific Northwest - Volume IV" CR 82.005,
Warm California Climates - Volume V" CR 82.006.

The following improvements and additions should increase the usefulness of the new manual:

- The design analysis procedure has been streamlined and is much faster than the original method.

- Performance correlations for 187 reference passive solar designs representing eight different types of systems are now available.

- The design procedure has been generalized by characterizing different climates with appropriate weather parameters, thereby eliminating the need for separate regional documents.

- The new document is applicable to townhouses and larger dormitory-type buildings as well as detached single-family residences. Office buildings or other structures of moderate size are also amenable to analysis by the new procedures.

- Performance correlations for passive solar retrofits to concrete block and metal buildings are included in the manual. Because of the prevalence of these types of construction at Naval installations, the retrofit correlations should be especially useful.

- Procedures for estimating and minimizing the incremental cooling load associated with passive heating systems are provided.

- A procedure for estimating the effect of control strategy on performance is provided.

The present form of the design procedures may be updated in succeeding years as the results of future research become available. In particular, a quantitative treatment of passive cooling strategies is planned. In the meantime, this edition will enable the user to design or retrofit buildings in a manner that greatly reduces the use of non-renewable energy resources for space heating.

Acknowledgments. This Military Handbook is a result of a cooperative effort between the Naval Civil Engineering Laboratory (NCEL) and Los Alamos National Laboratory (LANL). The NCEL personnel include Edward R. Durlak and Charles R. Miles. The LANL personnel include W. O. Wray (principal author), and Claudia Peck, Elaine Best, Bob Jones, Doug Balcomb, Gloria Lazarus, Bob McFarland, Franz Biehl, and Horn Schnurr.

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# 1. SCOPE

1.1 Passive solar buildings: A general description. A passive solar building is one that derives a substantial fraction of its heat from the sun using only natural processes to provide the necessary energy flows. Thermal conduction, free convection, and radiation transport therefore replace the pumps, blowers, and controllers associated with active solar heating systems. The elements of a passive solar heating system tend to be closely integrated with the structure for which heat is provided. South facing windows, for example, may serve as apertures through which solar energy is admitted to the building, and thermal storage may be provided by inherent structural mass. Solar radiation absorbed inside the building is converted to heat, part of which meets the current heat load whereas the remainder is stored in the structural mass for later use after the sun has set.

Because of the integral nature of passive solar buildings, it is not possible to design the structure independent of the heating system as is usually done with active systems. Instead, it is necessary to consider the solar characteristics of the building from the initial phases of the design process to completion of the construction documents. A well designed passive solar building is comfortable, energy efficient, and very reliable because of its inherent operational simplicity. However, a poor design, lacking some or all of these desirable characteristics, may be very difficult to modify after construction is complete and the problems become manifest. It has therefore been necessary to develop a new approach to building design that couples solar/thermal considerations with the more traditional concerns of form and structure.

This document does not address daylighting in a quantitative manner nor does it deal with passive cooling as a design strategy. However, the extent to which the summer cooling load may be aggravated by passive heating systems is quantified and various countermeasures are suggested.

1.2 Purpose of the design procedures. The purpose of these procedures is to make the results of recent scientific research on passive solar energy accessible to professionals involved in building design or design evaluation. By so doing, this new technology can be transferred from the research laboratory to the drawing board and the construction site. A successful transfer will undoubtedly improve the energy efficiency of new buildings as well as many existing buildings that are suitable for retrofit.

This document is addressed principally to prospective Navy contractors for design and construction of passive solar buildings. However, because good passive solar designs are of little value if they are rejected in favor of more conventional but less efficient structures, the design analysis procedures presented herein are also intended for use by engineers and architects involved in the evaluation process. The calculations that are involved are based on the use of simple tables and graphs. An arithmetical calculator is the only tool required.

1.3 Organization and use of the design procedures. The material in this handbook is organized such that there is a progression from general principles at the beginning to more detailed and specific information toward the

conclusion. This organization parallels the architectural design process whereby the designer begins with gross building characteristics in schematic design, proceeds to refinements and more detail in design development, and finally completes the design with construction documents. This handbook provides step by step procedures for establishing the solar/thermal characteristics of a building during schematic design and design development. Worksheets are provided throughout as aids to the user in following the design procedures quickly and accurately.

In 4.1, the basic concepts describing the physical characteristics and operating principles of the various types of passive solar heating systems are addressed. The cooling implications of using these systems on buildings is also discussed in general terms. This section should provide the background needed before proceeding to a discussion of climatic considerations in 4.2.

In 4.2, variations in climate and the broad implications of those variations for passive solar design are addressed. Two contour maps of the continental United States are presented. The first map divides the country into four climate regions based on the importance of conservation measures for reducing the space heating load of buildings; the four regions are thus indicative of the severity of the winter climate. The second map defines five-climate regions on the basis of availability of solar energy as a space heating resource. These two maps help one develop a feel for the geographic distribution of passive solar potential because areas of high potential are those in which severe winter conditions coincide with high solar availability.

Guidelines for schematic design are presented in 4.3. These guidelines will enable the designer to specify the gross characteristics of a building in a manner that assures good solar/thermal performance in a specified climate region. Alternately, the guidelines are appropriate for use as evaluation tools during the initial screening of designs submitted by prospective contractors. In either case, final decisions should be deferred until a complete design analysis, as described in 4.4 and 5.1, has been performed to fine tune a design under development or to evaluate each candidate design surviving the initial screening of contractor proposals.

The introduction to design analysis (4.4) is intended to prepare the reader for subsequent applications. Applied design analysis procedures appropriate for use during design development are presented in 5.1. Worksheets are provided that enable the user to estimate auxiliary heat requirements, assess potential winter overheating problems, determine the incremental cooling load, and evaluate the cost effectiveness of the system. Procedures for refining the design on the basis of analysis results are reviewed in 5.2.

In 5.3, example calculations are presented that illustrate application of the design procedures to a four plex family housing unit. This realistic example should prepare the reader for his first experience with passive solar design or evaluation. Finally, a summary of the important points to remember is presented in 5.4.

This handbook should provide enough information and guidance to enable a designer to produce cost effective, energy efficient passive solar buildings at any point in the continental United States.

## 2. REFERENCED DOCUMENTS.

2.1 Other Government publications. The following other Government documents publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

NAVAL CIVIL ENGINEERING LABORATORY

CR 82.002 - Design Calculation Procedure for Passive Solar Houses in Regions with Cold Climate, Volume I.
CR 82.003 - Design Calculation Procedure for Passive Solar Houses at Navy Installations in East Coast Regions with Temperate Climate, Volume II.
CR 82.004 - Design Calculation Procedure for Passive Solar Houses at Navy Installations in Regions with Warm, Humid Climate, Volume III.
CR 82.005 - Design Calculation Procedure for Passive Solar Houses at Navy Installations in the Pacific Northwest, Volume IV.
CR 82.006 - Design Calculation Procedure for Passive Solar Houses at Navy Installations in Warm California Climates, Volume V.
CR 83.040 - Passive Solar Design Procedures for Naval Installations.

(Application for copies should be addressed to NCEL, Port Hueneme, CA 93041.)

DEPARTMENT OF ENERGY
LOS ALAMOS NATIONAL LABORATORY (LANL)

DOE/CS-0127/2 - Passive Solar Design Handbook, Volume Two.
DOE/CS-0127/3 - Passive Solar Design Handbook, Volume Three.

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

(Copies of publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The documents cited in this section are for guidance and information.

American Society of Heating, Refrigeration, and Air Conditioning Engineers Handbook (ASHRAE), 1977 Fundamentals Volume.

ASHRAE Journal. (N. E. Hager, Jr.) December 1983, pp. 29-32.

Input Data for Solar Systems. (V. Cinquemani, J. R. Owenby, and R. G. Baldwin) Ashville, NC, National Climatic Center, November 1978.

Generation of Typical Meteorological Years for 26 SOLMET Stations. (I. Hall, R. Prarie, H. Anderson, and Eldon Boes) SAND78-1601, Albuquerque, Sandia Laboratories, August 1978.

Thermal Shutters and Shades. (William A. Surcliff) Brickhouse Publishing Company, Andover, Massachusetts, 1980.

"How to Design Fixed Overhangs". (Andrew Lau) Solar Age, February 1983, pp 32-38.

(Non-Government standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

# 3. DEFINITIONS

3.1 Definitions of acronyms and symbols used in this handbook.

[alpha] - solar aperture absorptance.

[alpha]$_{ir}$ - infrared absorptance.

[W-DELTA]$T_{I}$ - temperature increment without ventilation (deg.F).

[theta] - tilt of solar collector relative to vertical plane (degrees).

[rho] - density (lb/ft$^{3}$).

[tau] - building time constant (hr).

[open phi] - azimuth of solar collector (degrees).

a - city parameter.

$A_{a}$ - actual roof area (ft$^{2}$).

$A_{c}$ - solar collection area (ft$^{2}$).

$(A_{c}/A_{f})_{o}$ - reference ratio of collector area to floor area.

$A_{e}$ - external surface area of a building or thermal zone (ft$^{2}$).

$A_{f}$ - heated floorspace (ft$^{2}$).

$A_{g}$ - ground floor area (ft$^{2}$).

$A_{i}$ - mass area of element i (ft$^{2}$).

$A_{m}$ - thermal storage mass surface area (ft$^{2}$).

$A_{n}$ - non-south window area (ft$^{2}$).

$A_{p}$ - projected area of solar collection aperture on a vertical plane (ft$^{2}$).

$A_{r}$ - roof area projected on a horizontal plane (ft$^{2}$).

$A_{s}$ - total south wall area (ft$^{2}$).

$A_{w}$ - wall area (ft$^{2}$).

ACH - air changes per hour.

ADR - air density ratio.

c - specific heat (Btu/lb-deg.F).

C - capital invested ($).

D - solar declination (degrees).

DF - diurnal heat capacity thickness function.

DD - heating degree days (deg.F-day).

$DD_{a}$ - annual heating degree days (deg.F-day/yr).

$DD_{act}$ - annual heating degree days based on actual average indoor temperature (deg.F-day/yr).

$DD_{m}$ - heating degree days for harshest winter month in a particular location (deg.F-day/month).

DHC - diurnal heat capacity (Btu/deg.F).

$e_{d}$ - delivery efficiency.

$e_{t}$ - total system efficiency.

$e_{u}$ - utilization efficiency.

$(e_{u})_{a}$ - annual utilization efficiency.

E - annual energy saved (MMBtu/yr).

EF - effective heat capacity heat thickness function.

$EF_{i}$ - effective heat capacity heat thickness function for element i.

EHC - effective heat capacity (Btu/deg.F).

f - area factor.

F - scale factor.

G - effective aperture conductance (Btu/deg.F-day $ft^{2}$).

h - ceiling height (ft).

hr - duration (hours).

k - thermal conductivity (Btu/deg.F-ft-hr).

$K_{b}$ - frontflow/backflow parameter for thermosiphoning air panels.

l - thickness (ft).

L - latitude (degrees).

LC - load coefficient (Btu/deg.F-day).

LCR - load collector ratio (Btu/deg.F-day $ft^2$).

m - reference month.

N - number of months in heating season.

NGL - number of glazings.

$NGL_{n}$ - number of glazings of nonsouth windows.

NLC - net load coefficient (Btu/deg.F-day).

$NLC_{e}$ - exterior zone (Btu/deg.F-day).

$NLC_{i}$ - interior zone (Btu/deg.F-day).

NSF - non-south window fraction.

NZONE - number of zones.

P - period of diurnal cycle.

$P_{g}$ - ground floor perimeter (ft).

$P_{t}$ - total external perimeter of the heated floorspace (ft).

PR - productivity (Btu/$ft^2$).

$Q_{act}$ - actual annual heating load (Btu/yr).

$Q_{A}$ - auxiliary heat requirement (Btu).

$(Q_{A})_{a}$ - annual auxiliary heat requirement (Btu).

$Q_{D}$ - delivered solar energy (Btu).

$(Q_{D})_{a}$ - annual delivered solar energy (Btu).

$Q_{E}$ - excess solar energy during reference month (Btu)

$Q_{I}$ - annual incremental cooling load (Btu).

$Q_{int}$ - internal heat generation rate (Btu/day).

$Q_{L}$ - effective building heat load (Btu).

$(Q_{L})_{a}$ - annual effective building heat load (Btu).

$Q_{N}$ - net building heat load (Btu).

$Q_{S}$ - utilizable solar heat (Btu).

$Q_{SL}$ - steady state building heat load (Btu).

QS - monthly solar radiation transmitted through an arbitrarily oriented solar collector (Btu/$ft^2$-month).

QSA - annual solar radiation transmitted through an arbitrarily oriented solar collector (Btu/$ft^2$-yr).

QTAn - annual solar radiation transmitted through a vertical, south facing aperture with n glazings arbitrarily oriented (Btu/$ft^2$-yr).

$R_{d}$ - thermal resistance of decorative floor or wall covering (deg.F-$ft^2$-hr/Btu).

$R_{tot}$ - total thermal resistance of the roof (deg.F-$ft^2$-hr/Btu).

R-value - thermal resistance of a material layer or set of layers (deg.F-$ft^2$-hr/Btu).

RBASE - thermal resistance of basement walls (deg.F-$ft^2$-hr/Btu).

RPERIM - thermal resistance of perimeter insulation (deg.F-$ft^2$-hr/Btu).

RROOF - thermal resistance of the roof (deg.F-$ft^2$-hr/Btu).

RTAP - thermal resistance of insulation layer in a thermosiphoning air panel (deg.F-$ft^2$-hr/Btu).

RWALL - thermal resistance of the wall (deg.F-$ft^2$-hr/Btu).

s - heat capacity scale factor (Btu/deg.F-$ft^2$).

S - solar radiation absorbed per square foot of collector (Btu/$ft^2$).

$S_{T}$ - total absorbed solar radiation (Btu).

SHF - solar heating fraction for reference month.

$SHF_{a}$ - annual solar heating fraction.

SLR - monthly solar load ratio.

$SLR_{m}$ - minimum monthly solar load ratio.

SLR* - scaled solar load ratio.

$T_{act}$ - actual average indoor temperature (deg.F).

$T_{ave}$ - average thermostat setpoint (deg.F).

$T_{b}$ - base temperature (deg.F).

$T_{e}$ - effective thermostat setpoint (deg.F).

$T_{set}$ - thermostat setpoint (deg.F).

$\bar{T}$ - average room temperature with ventilation (deg.F).

$\bar{T}_{max}$ - average maximum room temperature without ventilation (deg.F).

TAP - thermosiphoning air panels.

THICK - thermal storage mass thickness (ft).

TLC - total load coefficient (Btu/deg.F-day).

$TLC_{e}$ - effective total load coefficient (Btu/deg.F-day).

$TLC_{S}$ - steady state total load coefficient (Btu/deg.F-day).

TMY - typical meteorological year.

$U_{c}$ - steady state conductance of the passive solar aperture (Btu/hr-$ft^2$-deg.F).

VTn - solar radiation transmitted monthly through a vertical south facing aperture with n glazings (Btu/$ft^2$-month).

x - dimensionless thickness.

X - overhang length (ft).

Y - separation (ft).

# 4. GENERAL REQUIREMENTS

4.1 Basic concepts. The concepts introduced herein are limited to those that are further developed within the remainder of the design procedures. Thus a comprehensive treatment is rejected in favor of one that is directed at areas of particular interest to the Navy in which our understanding is sufficient to warrant a quantitative treatment.

4.1.1 Direct gain heating. Direct gain buildings are passive solar heating systems in which sunlight is introduced directly to the living space through windows or other glazed apertures as indicated schematically in figure 1. As with all passive solar systems, it is important that the apertures face south or near south in order to achieve high solar gains during the winter heating season and low solar gains during the summer cooling season.

Thermal storage mass is essential to the performance and comfort of direct gain buildings. A building that has inadequate mass will overheat and require ventilation, which entails a loss of heat that might otherwise have been stored for night time use. Generally, it is desirable to employ structural mass as a storage medium in order to take advantage of the improved economics associated with multiple use. Insulation should always be placed on the outside of massive elements of the building shell rather than on the inside in order to reduce heat Losses without isolating the mass from the living space. Concrete floor slabs can contribute to the heat capacity of a building provided they are not isolated by carpets and cushioning pads. Heat losses from the slab can be limited by placing perimeter insulation on the outside of the foundation walls. If the structure is fairly light, the heat capacity can be effectively increased by placing water containers in the interior. A variety of attractive containers are available commercially.

An overhang, also illustrated in figure 1, is used to shade the solar aperture from the high summer sun while permitting rays from the low winter sun to penetrate and warn the inside of the building. In climates having particularly warm and sunny summers, an overhang may not be sufficient to prevent significant aggravation of the summer cooling load. Sky diffuse and ground reflected radiation enter the living space despite the presence of an overhang and must be blocked by external covers or internal shades. Using movable insulation on direct gain apertures has the advantage of reducing night time heat losses during the winter-as well as eliminating unwanted solar gains during the summer.

Direct gain buildings involve less departure from conventional construction than other types of passive solar systems and are therefore cheaper and more readily accepted by most occupants. However, they are subject to overheating, glare, and fabric degradation if not carefully designed; these problems can be minimized by distributing the sunlight admitted to the building as uniformly as possible through appropriate window placement and the use of diffusive blinds or glazing materials. When properly designed for their location, direct gain buildings provide an effective means of reducing energy consumption for space heating without sacrifice of comfort or aesthetic values.

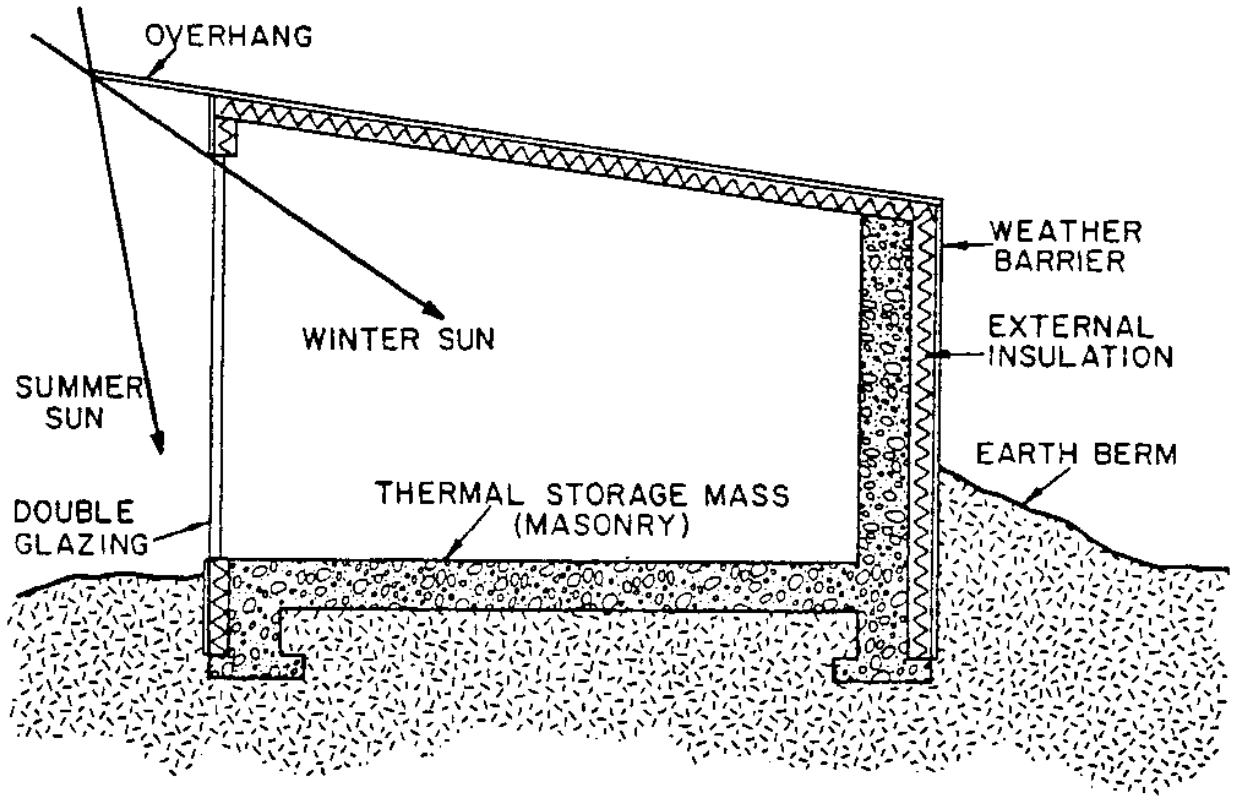



FIGURE 1. Direct gain heating system.

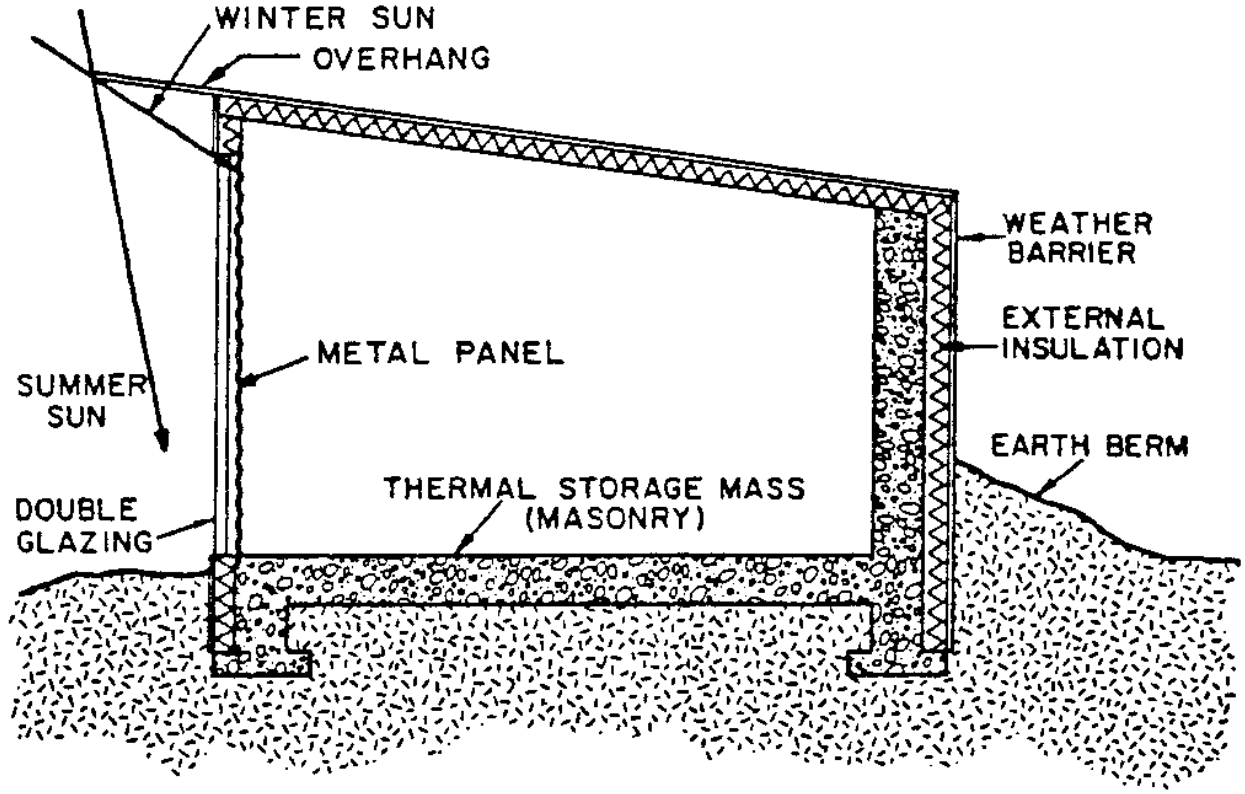



FIGURE 2. Radiant panel system.

4.1.2 Daylighting. The daylight delivered to the interior of direct gain buildings is an additional resource that is available year-round. Pleasing uniform illumination can be achieved by using blinds that reflect sunlight toward white diffusive ceilings. The artificial lighting system in many buildings imposes a significant load on the cooling system that may be reduced by daylighting because the fraction of visible light in the solar spectrum is greater than the visible fraction of incandescent or fluorescent lighting.

4.1.3 Radiant panels. Radiant panels are simple passive solar systems that are inexpensive and well suited as retrofits to metal buildings. A sketch of a radiant panel system is presented in figure 2. Note that the solar aperture consists of one or more layers of glazing material placed over an uninsulated metal panel. The metal panel would ordinarily be a part of the building shell so that a retrofit is constructed by simply glazing an appropriate area on the south side of the structure. Any insulation or other poorly conducting material should be removed from the inner surface of the glazed portion of the metal panel to facilitate heat transfer to the interior.

Solar radiation is absorbed on the outer surface of the metal panel after passing through the glazings. The panel becomes hot and gives up heat to the interior by radiation and convection. Thermal mass must be included inside the building shell as with direct gain systems. Usually, only a concrete slab will be available before retrofitting a metal building and it may sometimes be necessary to add water containers to achieve the desired thermal capacitance. Radiant panels perform on a par with direct gain buildings and are likely to be less expensive when used as retrofits to metal buildings.

4.1.4 Thermosiphoning air panels. Thermosiphoning air panels (TAPs) are also appropriate for use on metal buildings either as retrofits or in new construction. Two configurations occur in practice and the first, which is referred to as a frontflow system, is illustrated in figure 3. Again there are one or more glazing layers over an absorbing metal surface but, in this case, the metal panel is insulated on the back side. Heat transfer to the interior occurs via circulation vents cut through the metal panel and its insulation at the upper and lower extremes. Solar radiation absorbed on the the outer surface of the panel is converted to heat and convected to the adjacent air which then rises due to buoyancy forces and passes through the upper vent into the living space. The warm air leaving the gap between the inner glazings and the absorber is replaced by cooler air from the building interior that enters through the lower vents. In this manner, a buoyancy driven loop is established and sustained as long as the temperature in the air gap exceeds that in the living space. Passive backdraft dampers or manually operated vent closures must be employed to prevent reverse circulation at night. Backdraft dampers are usually made of a lightweight plastic material suspended above a metal grid such that air flows freely in one direction but is blocked should the flow attempt to reverse.

The second type of TAP configuration, illustrated in figure 4, is called a backflow system. In a backflow system, the flow channel is behind the absorber plate rather than in front of it. An insulated stud wall is constructed a few inches behind the metal panel and vents are then cut at the top and bottom of the wall. Air in the flow channel thus formed is heated by convection from the back of the absorber panel and a circulation loop is established in the same manner as in a frontflow system.

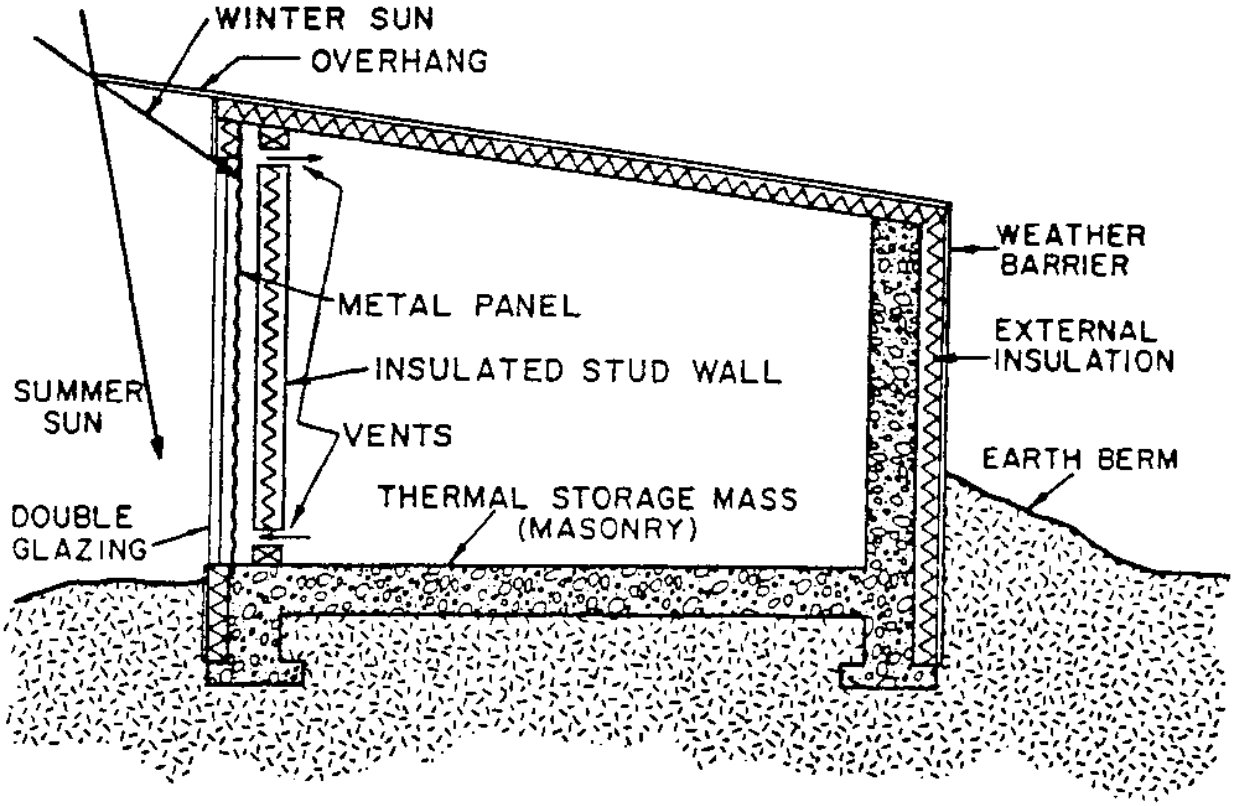



FIGURE 3. Frontflow TAP system.

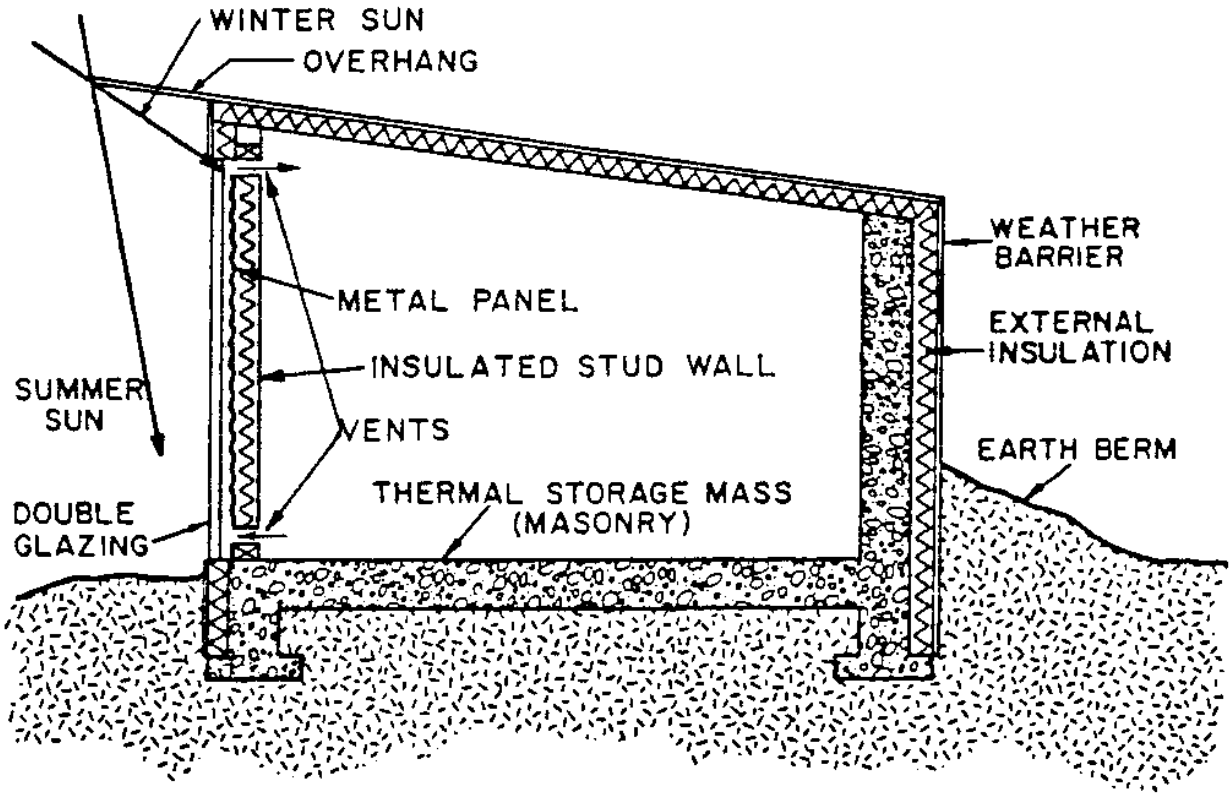



FIGURE 4. Backflow TAP system.

TAPs have thermal storage requirements similar to those of direct gain and radiant panel systems. Generally speaking, the best performance will be obtained from passive solar systems associated with high heat capacity structures. Although a backflow TAP performs slightly better than a comparable system in the frontflow configuration, the difference is not significant and construction costs should govern any choice between the two. Both TAP configurations outperform radiant panels and direct gain systems with comparable glazings and thermal storage mass. This performance edge is due to the low aperture conductance of TAPs, which can be insulated to arbitrary levels, thereby limiting night time heat loss.

4.1.5 Thermal storage walls. A thermal storage wall is a passive solar heating system in which the primary thermal storage medium is placed directly behind the glazings of the solar aperture, as illustrated in figure 5. The outer surface of the massive wall is painted a dark color or coated with a selective surface to promote absorption of solar radiation. Solar radiation absorbed on the outer surface of the wall is converted to heat and conducted (or convected in the case of the water walls) to the inner surface where it is radiated and convected to the living space. Heat transfer to the living space is sometimes augmented by the addition of circulation vents placed at the top and bottom of the mass wall. These vents function in the same manner as the vents in a TAP system except that only a portion of the solar heat delivered by the system passes through the vents.

A thermal storage wall provides an effective buffer between outside ambient conditions and the building interior; night time heat losses are reduced during the cold winter months, and during the summer, unwanted heat gains are limited. This moderating effect generally enables thermal storage walls to outperform direct gain systems. There are many types of thermal storage walls distinguished by the type of storage medium employed. The options included in the design procedures are reviewed in the following subsections.

4.1.5.1 Trombe wall. A Trombe wall is a thermal storage wall that employs solid, high density masonry as the primary thermal storage medium. Appropriate thicknesses range from 6 to 18 inches depending on the solar availability at the building site. Sunny climates require relatively thicker walls due to the increased thermal storage requirements. The wall may be vented or unvented. A vented wall is slightly more efficient and provides a quicker warm up in the morning but may overheat buildings containing little secondary thermal storage mass in the living space.

4.1.5.2 Concrete block wall. Ordinarily, a thermal storage wall would not be constructed of concrete building blocks, because solid masonry walls have a higher heat capacity and yield better performance. However, concrete block buildings are very common in the Navy and offer many excellent opportunities for passive solar retrofits. The south facing wall of a concrete block building can be converted to a thermal storage wall by simply painting the block a dark color and covering it with one or more layers of glazing. Walls receiving this treatment yield a net heat gain to the building that usually covers the retrofit costs rather quickly. The relatively low heat capacity of concrete block walls is offset somewhat by the large amount of secondary thermal storage mass usually available in these buildings. Concrete floor slabs and massive partitions between zones help prevent overheating and otherwise improve the performance of concrete block thermal storage walls.

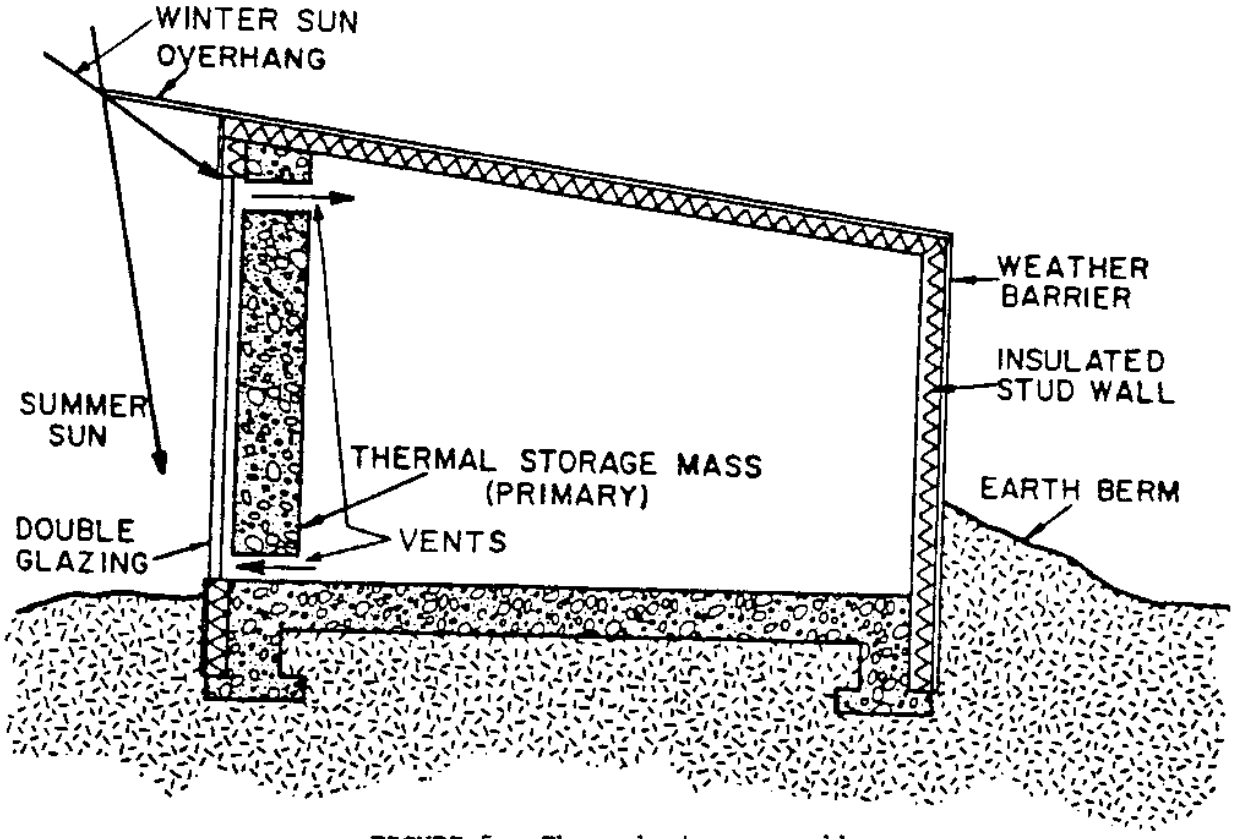



FIGURE 5. Thermal storage wall.

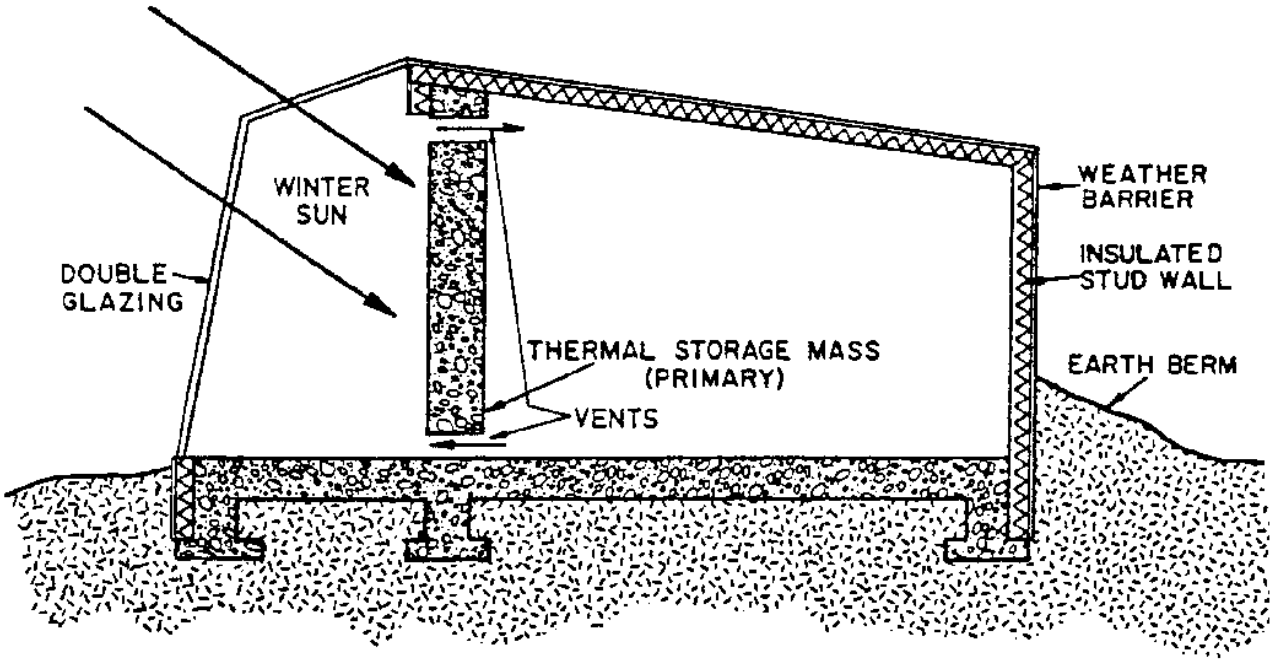



FIGURE 6. Sunspace.

Concrete block thermal storage walls may also be introduced during the construction of new buildings. For new construction, however, it is advisable to take advantage of the superior performance of solid masonry walls by filling the cores of the block in the thermal storage wall with mortar as it is erected. This process is inexpensive and the resulting performance increment covers the increased cost. The design procedures developed herein are applicable to 8-inch concrete block thermal storage walls with filled or unfilled cores.

4.1.5.3 Water wall. As the name implies, water walls are thermal storage walls that use containers of water placed directly behind the aperture glazings as the thermal storage medium. The advantage over masonry walls is that water has a volumetric heat capacity about twice that of high density concrete; it is therefore possible to achieve the same heat capacity available in a Trombe wall while using only half the space. Furthermore, a water wall can be effective at much higher heat capacities than a Trombe wall because natural convection within the container leads to an nearly isothermal condition that utilizes all of the water regardless of the wall thickness. The high thermal storage capacity of water walls makes them especially appropriate in climates that have a lot of sunshine.

4.1.6 Sunspaces. There are many possible configurations for a sunspace but all of them share certain basic characteristics; a representative schematic is presented in figure 6. Sunlight enters the sunspace through south facing glazing that may be vertical or inclined or a combination of the two and is absorbed primarily on mass surfaces within the enclosure; the mass may be masonry or water in appropriate containers and is generally located along the north wall and in the floor. The massive elements provide thermal storage that moderates the temperature in the enclosure and the rate of heat delivery to the living space located behind the north wall. Operable windows and circulation vents in the north wall provide for heat transfer by thermal convection from the sunspace to the living space. The north wall may be an insulated stud wall placed behind containers of water or a masonry wall through which some of the heat in the sunspace is delivered to the building interior by thermal conduction as occurs in a Trombe wall. A sunspace may be semi-enclosed by the main structure such that only the south facing aperture is exposed to ambient air, or may be simply attached to the main structure along the north wall of the sunroom, leaving the end walls exposed.

The temperature in a sunspace is not thermostatically controlled but is generally moderate enough for human habitation during most of the day and appropriate for growing plants year round. Amenities are thus provided that compensate for the somewhat higher cost of sunspaces relative to other types of passive solar heating systems.

4.1.7 Incremental cooling load. Unfortunately, not all of the heat delivered to the living space by a passive solar heating system is useful to the occupants. During the winter heating season, part of the delivered solar energy will cause the building to overheat unless ventilation is employed to limit the indoor temperature. It is to be expected that some overheating will occur in most passive solar buildings, but too much excess heat is indicative of a poor design: it may be that the solar aperture is too large or that inadequate thermal storage mass has been provided. During the summer cooling

season, a passive solar heating system continues to function although the increased solar elevation angle reduces the radiation flux transmitted through the glazings, particularly if an overhang is employed. However, all heat delivered to the building during the cooling season is unwanted and must be removed either by ventilation or by evaporative or vapor compression cooling systems. A poorly designed passive heating system can significantly aggravate the summer cooling load of a building.

In the design procedures, the sum of all unwanted heat delivered to a building by the passive heating system will be referred to as the incremental cooling load. This is clearly an important parameter because it represents the cooling penalty associated with various passive solar designs.

4.2 General climatic considerations.

4.2.1 Characteristic weather parameters. All of the discussion in this section is based on two weather parameters that, in certain combinations, may be used to characterize climates with respect to the potential effectiveness of conservation and passive solar measures in reducing energy consumption for space heating.

The first of these important parameters is the heating degree days, which is represented by the symbol DD and has units of deg.F-day. In these procedures, DD is calculated by summing the difference between the base temperature and the outside ambient temperature over each hour in the time period of interest and dividing the result by 24 hr/day; all negative terms are omitted from the sum. The base temperature is the thermostat setpoint adjusted to account for the presence of internal heat sources; the time period of interest is usually one month or one year. This method of calculating DD differs from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) approach and was selected because it yields better accuracy when applied to the analysis of passive solar buildings. Furthermore, the hourly data required for such a calculation is available in the Typical Meteorological Year (TMY) data base that is used consistently throughout these procedures (from Input Data for Solar Systems and Generation of Typical Meteorolgical Years for 26 SOLMET Stations). The heating degree days is an important weather parameter because the amount of heat lost from a building during a particular time period is directly proportional to DD, i.e., if a building is moved from one location to another having twice as many degree days, the heat loss from the building will double.

The second important weather parameter is VT2, the amount of solar energy transmitted through a vertical, south facing, double glazed aperture during a specific time period. The V in VT2 stands for vertical, the T indicates transmitted radiation, and the 2 represents the two glazing layers. The parameter VT2 is important because it quantifies the solar resource available for passive space heating.

In the following sections, combinations of VT2 and DD will be used to characterize climates with regard to the relative importance of conservation and passive solar measures for reducing auxiliary heat consumption in buildings.

4.2.2 Importance of conservation measures. The fraction of the monthly heating load of a building that can be met by passive solar strategies depends on certain characteristics of the building design, and for double glazed systems, which are by far the most common, on the ratio VT2/DD; the details of the relationship between the solar heating fraction (SHF) and VT2/DD will be addressed later in 4.4 and 5.1. For the present, it is sufficient to know that the parameter VT2/DD provides an accurate measure of the passive solar potential of a given climate during any selected month. It follows that by considering the value of VT2/DD for each month in the heating season, it is possible to assess the passive solar potential of the climate-for the full annual cycle. One way to do this might be to average VT2/DD over all months in the heating season, but that approach would ignore the fact that it is more important to have high solar heating fractions in cold months with high values of DD than it is in warm months with low values of DD. The solution to this dilemma is to to determine the degree day weighted average of VT2/DD as follows:

$$(VT2/DD)_{ave} = \sum_{m=1}^{N} [(VT2/DD)_m \text{ [multiplied by] } (DD_m/DD_a)]$$

where the index, m, is the month number, N is the number of months in the heating season, and $DD_a$ is the annual heating degree days. The quantity $(VT2/DD)_{ave}$ provides the desired measure of the annual passive solar potential of various climates. High values of $(VT2/DD)_{ave}$ are associated with high values of SHF and conversely. It follows that in climates having low values of $(VT2/DD)_{ave}$, conservation measures such as insulation, storm windows, weather stripping, etc., will be more important than in climates having high values. If only a small portion of the building load can be displaced with solar energy, then reduction of that load through the use of conservation measures clearly becomes a top priority.

A map of the continental United States with contours of constant $(VT2/DD)_{ave}$ is presented in figure 7. The values of $(VT2/DD)_{ave}$ on the uppermost, middle, and lowest contours are 30, 50, and 90 Btu/deg.F-ft$^2$-day, respectively. The three contour lines divide the map into four climate regions that are referred to as mild (MI), moderate (MO), harsh (HA), and very harsh (VH). General descriptions of these climate regions and qualitative comments regarding regionally appropriate design are presented in the next four subsections.

4.2.2.1 Mild climates. The mild climate region includes the southern third of California and Arizona, small parts of the southern extremes of New Mexico, Texas, and Louisiana, and most of the Florida peninsula.

In the mild region the winter heating load varies from small to nil and in any case, there is plenty of sunshine available to meet whatever loads do arise. Generally, the small heat loads can be displaced with inexpensive radiant panels or direct gain systems having relatively small solar collection apertures. However, summer cooling loads in this region can be quite high, usually exceeding the winter heating load several times over. It is therefore particularly important to assure that the incremental cooling load associated with the passive heating system does not negate the small savings realized during the winter heating season. The use of defensive countermeasures such

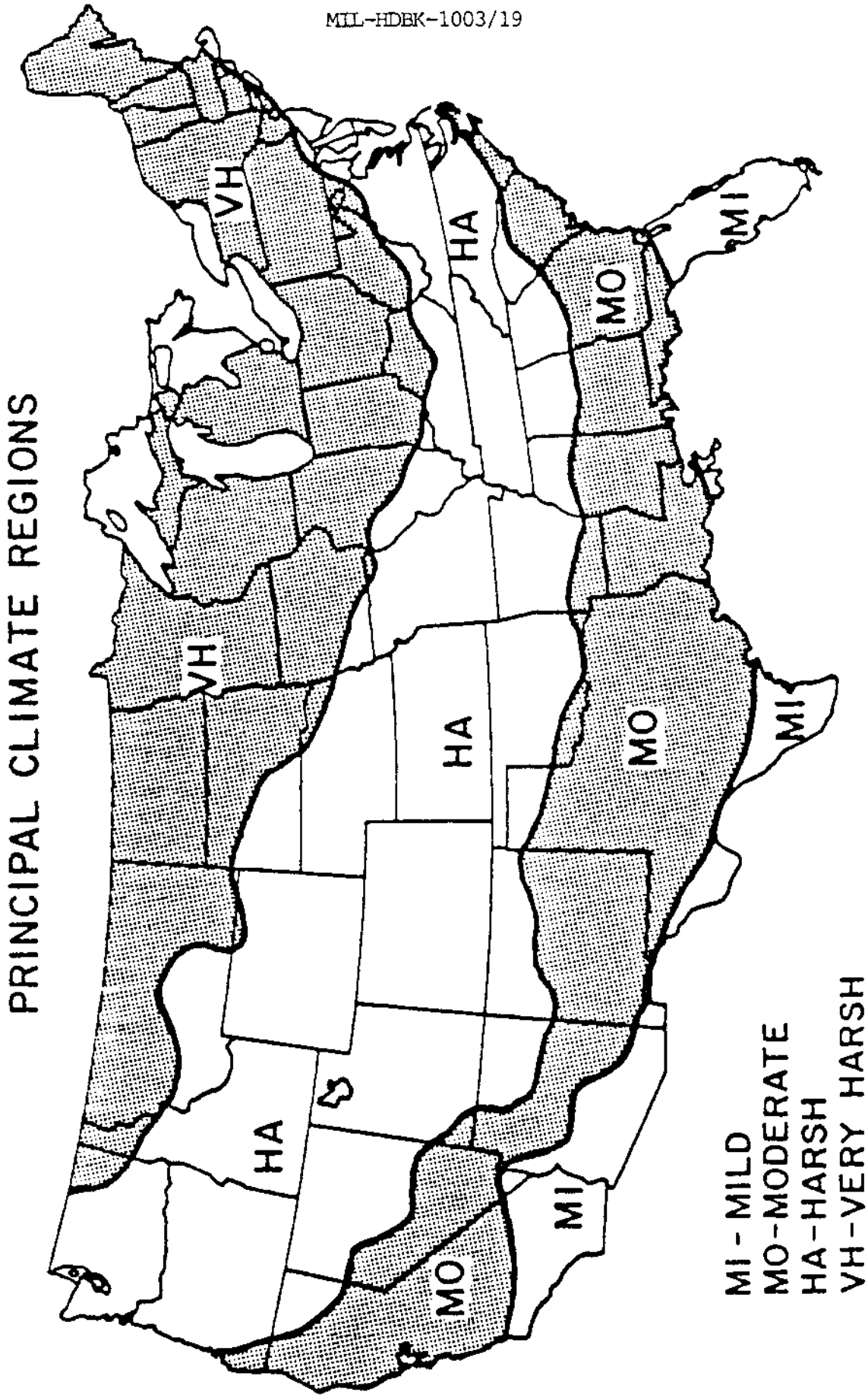



FIGURE 7. Principal climate regions.

as adjustable shades and shutters that shield the solar aperture from direct and diffuse sunlight during the cooling season is essential. The term defensive cooling refers to strategies or devices that prevent excess heat from entering a building, in contrast to procedures for removing such heat with air conditioning equipment after it has gained entry. Because of the high SHFs obtainable in the mild region, conservation measures are not as important as in regions further north.

4.2.2.2 Moderate climates. The moderate region includes most of California, the southern half of Nevada, the central third of Arizona, and most of New Mexico, Texas, Louisiana, Mississippi, Alabama, Georgia, and South Carolina. The Florida panhandle and most of the North Carolina coast are also included.

Thermal storage walls, sunspaces, thermosiphoning air panels, and direct gain systems are all appropriate in this region. The solar apertures will be larger than in the mild region and more thermal insulation will be required. Defensive cooling strategies are also important to overall performance.

4.2.2.3 Harsh climates. The harsh region includes most of Washington, Oregon, Idaho, Nevada, Wyoming, Utah, Colorado, Nebraska, Kansas, Oklahoma, Missouri, Arkansas, Kentucky, Tennessee, Virginia, and North Carolina. Northern parts of Arizona, New Mexico, Texas, Mississippi, Alabama, Georgia, and South Carolina are also included as well as southern parts of Montana, South Dakota, Iowa, Illinois, Indiana, and West Virginia. Finally, the harsh region includes coastal areas in Massachusetts, Rhode Island, New York, New Jersey, Maryland, and all of Delaware.

At the northern extremes of the harsh region, night insulation should be considered on direct gain apertures. Otherwise, all passive systems discussed in 4.1 may be adequate in this region; heating loads are substantial making conservation measures very important. Despite the large heating loads, defensive cooling strategies are still required to assure positive net energy savings.

4.2.2.4 Very harsh climates. The very harsh region includes all of North Dakota, Minnesota, Wisconsin, Michigan, Ohio, Vermont, New Hampshire, and Maine; most of Montana, South Dakota, Iowa, Illinois, Indiana, West Virginia, Connecticut, Pennsylvania, and Massachusetts; and parts of Washington, Idaho, Wyoming, Nebraska, Kentucky, Virginia, Maryland, New Jersey, and Rhode Island.

Near the boundary between the harsh and very harsh regions or in areas with greater than average sunshine, direct gain systems without night insulation may still be viable provided the aperture is kept fairly small. Thermal storage walls and sunspaces will function well in this region although night insulation may be desirable near the northern boundary; TAPs are a good choice because arbitrarily high levels of fixed insulation can be placed between the collector surface and the living space. Heavy use of conservation measures is critical to performance in the very harsh region. Defensive cooling strategies, though less of a concern than in regions with milder winter climates, should not be ignored.

4.2.3 Solar availability. As previously discussed, the parameter VT2 provides a measure of the availability of solar radiation as a space heating resource during a specified time period. If VT2 were evaluated for the duration of the winter heating season the result would provide some indication of the potential of the site for passive solar heating applications. However, it is more important to have high solar availability during the colder months of the heating season than during the warmer months, and the straight summation involved in evaluation of VT2 does not reflect this fact. A better measure of the effective solar availability is obtained by taking the degree day weighted average of the monthly VT2s that occur during the heating season as follows:

$$VT2_{ave} = \sum_{m=1}^{N} [VT2 \text{ [multiplied by] } (DD_m/DD_a)] \quad \text{(Equation 4.1)}$$

A map of the continental United States with contours of constant $VT2_{ave}$ is presented in figure 8. The contours are defined by $VT2_{ave}$ values of 30, 25, 20, and 15. The four contours divide the map into five regions that are labeled most sunny (MS), very sunny (VS), sunny (SU), cloudy (CL), and very cloudy (VC). These five regions cut across the four principal climate regions defined in figure 7 and form subregions that are related to the appropriate size of solar apertures. As a general rule, the sunnier subregions of a particular principal climate region should have the larger solar apertures.

The ideal climate for passive solar applications is one in which high solar availability coincides with a large heat load; large apertures are appropriate in such a climate. In the continental United States, the best climates for passive solar design lie in the subregion formed by the most sunny and harsh climate regions. Solar apertures should be relatively small in the mild climate region because the heat load is small, and relatively small in the very harsh region because solar availability is low. Some general comments on the solar regions defined in figure 8 are presented below.

4.2.3.1 Most sunny region. This region is limited to the desert southwest and includes major parts of Nevada, Arizona, and New Mexico. Subregions in which the most sunny region overlaps the harsh region are ideal for passive solar heating because of the coincidence of a substantial heating load and excellent solar availability. The most sunny/moderate subregion is also quite good for passive solar heating.

4.2.3.2 Very sunny region. The very sunny region forms a complex crescent that bounds the most sunny region. It forms a large, very sunny/harsh subregion in which passive solar applications are very beneficial.

4.2.3.3 Sunny region. The sunny region forms a still larger crescent about the very sunny region, and includes parts of Florida, Alabama, Georgia, South Carolina, North Carolina, and Virginia. The sunny area cuts completely across the country from North to South and forms subregions with all four principal climate zones. A broad range of passive solar designs is viable across these subregions.

4.2.3.4 Clouds region. The cloudy region also traverses the country from north to south and forms four types of subregions among which many passive designs are feasible. Parts of the Pacific northwest, the Midwest, and the eastern seaboard are included in the cloudy region.

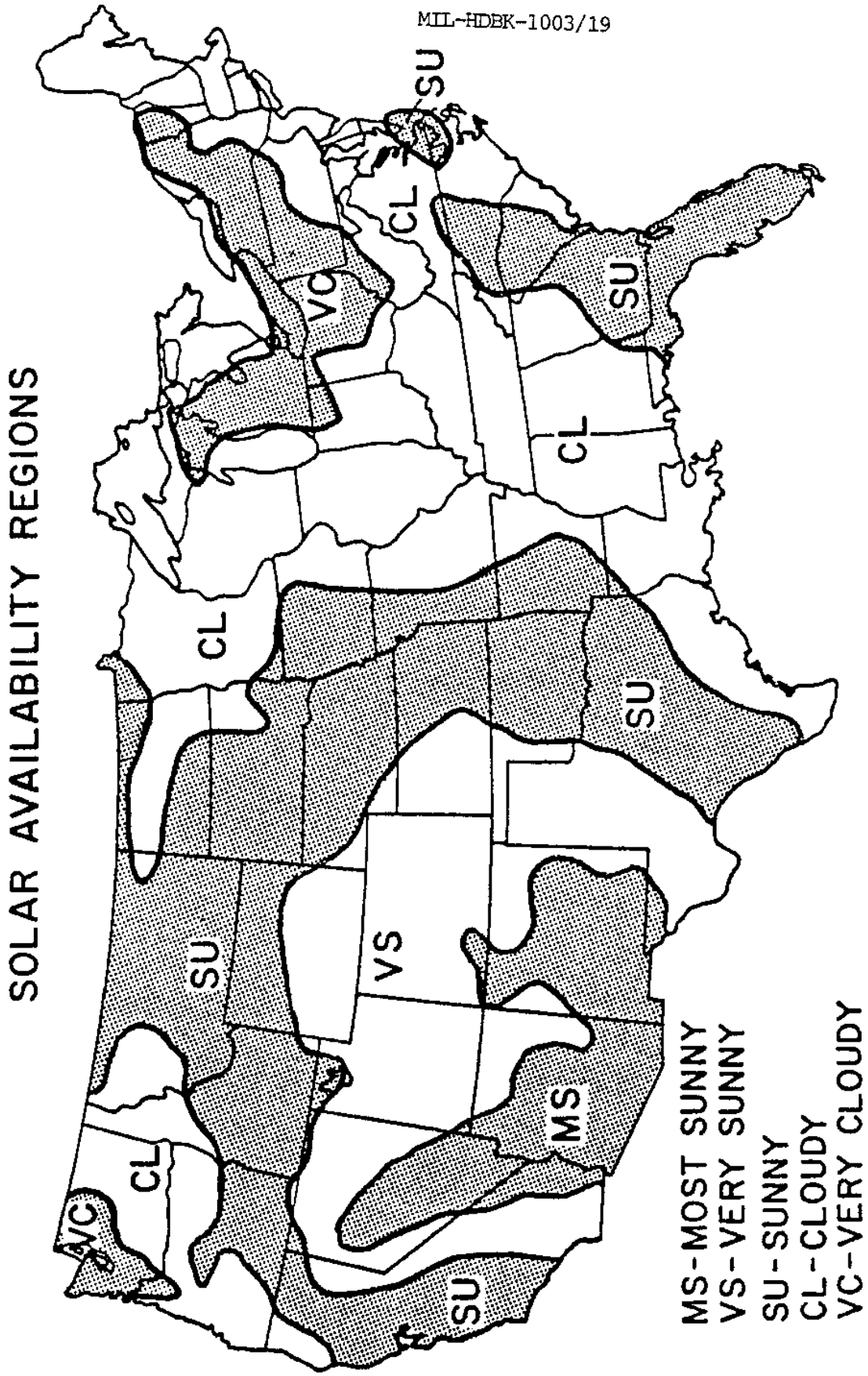



FIGURE 8. Solar availability regions.

4.2.3.5 Very cloudy region. The very cloudy region includes only the extreme Pacific Northwest and the central to eastern Great Lakes area. The Great Lakes area, where the very cloudy region overlaps the very harsh region, is the poorest location in the continental United States for passive solar heating. The Pacific northwest area overlaps the Harsh climate region and is slightly better suited for passive solar applications.

Schematic design guidelines that are related to the climate regions appearing in figures 7 and 8 are presented in 4.3.

4.3 Guidelines for schematic design. The objective during schematic design is to develop a rough idea of what the final building will be like. The designer is not concerned with detail at this point but seeks only to establish the basic shape, dimensions, materials, window areas, and insulation levels that will characterize the design; in these procedures, the characteristics of the passive solar heating system are added to the list of more traditional architectural concerns.

The guidelines in this chapter provide starting point values for the basic passive solar design parameters; if the user already has a good idea what his building will be like he may skip to 4.4 where the fundamentals of design analysis are introduced.

4.3.1 Building shape and orientation. Passive solar buildings are usually elongated in the east-west direction so that a large south-facing surface is presented to the low winter sun for solar heating, and small east and west-facing surfaces are presented to the northerly rising and setting summer sun to reduce unwanted solar gains. The aspect ratio (east-west dimension divided by north-south dimension) should be at least 5/3, and much larger values are appropriate for large dormitory-like structures.

Ideally, passive solar buildings should be no more than two zones deep in the north-south direction. The two zone limit on depth generally allows solar heat collected on the south side of the building to be transported for use to the north side, thereby improving thermal performance. Multi-story buildings are well suited to passive solar design, particularly if the above recommendations on aspect ratio and depth are observed, because of the large vertical surface that may be presented to the winter sun for solar absorption.

Orientations that depart from true south by up to 30 degrees are permissible; performance penalties will usually be less than 10 percent. An easterly bias is preferred in applications that require a rapid warm up in the morning, whereas a westerly bias will sometimes improve the performance of buildings that are occupied in the evening because of the improved phasing of heat source and heat load.

4.3.2 East, west, and north windows. Windows not facing south should be kept small while complying with local building codes. Particularly in the colder climates, it is best to place most of the nonsouth window area on the east or west side of the building to take advantage of winter solar gains available during the early morning and late afternoon.

All windows, including those facing south, should have at least two glazing layers, and in the harsh and very harsh regions, triple or even quadruple glazing should be considered. Especially in the warmer climates, drapes or better still, movable opaque covers or shades, as described in Thermal Shutters and Shades, are recommended as means to prevent unwanted sunlight from entering the windows during the summer.

4.3.3 Passive heating system characteristics. The interaction between a passive heating system and its environment is a complex process that involves many subtle phenomena. The complexity of the interaction makes it difficult to determine exactly what type of passive system will perform best in a given climate. Ultimately, detailed design analysis calculations of the type to be described later in these procedures may be required to make the final decision. However, a few generalizations may be cited that are useful for selecting candidate systems during the schematic phase of design.

The general rules for system selection are based on the steady state conductance ($U_{\Gamma c \urcorner}$) of the passive solar aperture. The aperture conductance is the amount of heat that would be lost through the solar aperture if the outside ambient temperature were maintained at 1deg.F below the indoor temperature for a period of one hour; the units of $U_{\Gamma c \urcorner}$ are Btu/deg.F-ft$^{\llcorner 2 \lrcorner}$-hr. It is generally true that systems with low values of $U_{\Gamma c \urcorner}$ are better suited for use in areas having relatively severe winter climates than are systems with larger aperture conductances. The climate regions based on the importance of conservation measures that are illustrated in figure 7 provide a convenient measure of winter severity. The selection process based on aperture conductance may be further refined by the observation that it is also more important to have a small $U_{\Gamma c \urcorner}$ in regions that receive relatively little sun; the solar availability contour map in figure 8 is useful in making this secondary assessment. In summary, passive solar systems having low aperture conductances are recommended for use in regions having severe winter climates with little sunshine. The steady state aperture conductances of thirteen representative passive solar heating systems is presented in table I to aid in the preliminary selection process.

The first system in table I, a single glazed direct gain building, is not recommended in any climate region because of the large aperture conductance; even in a mild winter climate where the heating load may not be a problem, the summer cooling load can be seriously aggravated by single glazed apertures. Systems 2 through 5, or any other system with comparable values of $U_{\Gamma c \urcorner}$, are well suited for use in the mild climate region. In the moderate region, systems 2 through 9 are appropriate, and in the harsh region systems 4 through 14 may be considered. Finally, in the very harsh region, systems 9 through 14 will yield the best results. Within each of the principal climate regions, the recommended systems having the larger conductances are more appropriate in the sunnier subregions. These guidelines may be useful during the initial system selection process, but the designer should feel free to also consider other systems. In particular, a small amount of direct gain is almost always an asset when combined with other systems having lower aperture conductances. Of course, in the colder regions, it is desireable to place more layers of glazing in the direct gain apertures than would be used in milder climates.

TABLE I. Steady state aperture conductances of passive systems.

| System Number | System Type | $U_{[c]}$ (Btu/hr-ft$^2$-deg.F) |
|---|---|---|
| 1 | Single glazed direct gain. | 1.10 |
| 2 | Double glazed direct gain. | 0.49 |
| 3 | Single glazed radiant panel. | 0.49 |
| 4 | Double glazed radiant panel. | 0.31 |
| 5 | Triple glazed direct gain. | 0.31 |
| 6 | Double glazed direct gain with R-9 night insulation. | 0.27 |
| 7 | Double glazed 12-inch Trombe wall. | 0.24 |
| 8 | Double glazed attached sunspace with 40 degree tilt from vertical, masonry common wall, and opaque end walls. | 0.23 |
| 9 | Double glazed 12 inch Trombe wall with R-9 night insulation. | 0.15 |
| 10 | Single glazed front flow TAP with R-11 insulated wall. | 0.073 |
| 11 | Double glazed front flow TAP with R-11 insulated wall. | 0.068 |
| 12 | Double glazed backflow TAP with R-11 insulated wall. | 0.064 |
| 13 | Double glazed attached sunspace with 40 tilt from vertical, R-20 insulated common wall, and opaque end walls. | 0.043 |
| 14 | Double glazed backflow TAP with R-20 insulated wall. | 0.041 |

A more complete list of aperture conductances is available in Appendix A; those appearing in table I provide a representative sample that spans the full range of realistic possibilities and is adequate for the present discussion.

4.3.4 Sizing overhangs. The purpose of a fixed overhang is to reduce unwanted solar gains during the summer while allowing the low winter sun to illuminate the solar aperture and provide heat to the building interior. Sizing an overhang is a difficult problem because the heating season is not symmetrical about the winter solstice, but tends to be displaced toward the new year. Therefore, a design that provides adequate protection from overheating in the fall may tend to reduce the amount of solar energy available for needed space heating in late winter or spring. Since an overhang does not provide protection from sky diffuse or ground reflected radiation, it is often necessary to provide additional countermeasures to prevent overheating during the cooling season. For this reason, the currently accepted design practice is to size an overhang such that the performance of the passive heating system is minimally affected, and employ additional countermeasures against overheating as required. The sizing procedure introduced below is based on "How to Design Fixed Overhangs", by Andrew Lau.

The contour map presented in figure 9 gives the last month for which full illumination of a solar aperture facing within 20 degrees of true south is desired. This map is one of several presented by Lau and represents a direct gain building with an aperture size of 15 percent to 25 percent of the floor area on a moderately well insulated house (R-19 to R-30 roof, R-11 to R-19 wall, 0.5 to 0.75 air changes per hour). Use of the map in figure 9 will yield conservatively sized fixed overhangs in that there should be no degradation of passive solar performance during the heating season although there may be some tendency toward overheating in the fall. Movable shading devices should be employed to control overheating due to asymmetry of the heating season.

After determining the last month for which total illumination of the aperture will be allowed, it is an easy matter to fix the overhang geometry. The overhang length is denoted by X and the separation is given by Y, as indicated in figure 10. The ratio X/Y is related to the latitude (L) minus the declination (D) and this relationship is represented graphically in figure 11. The quantity (L-D) may be read from one of the four contour maps in figure 12 that represent the months of January, February, March, and April. Briefly summarizing the sizing procedure, the user first determines the last month of total illumination from the contour map in figure 9; then he reads (L-D) from the contour map for that month from figure 12; finally, the length to separation ratio is obtained from the plot in figure 11.

Summer shading is enhanced by selecting the largest practical overhang separation and then calculating the length from the ratio X/Y. Constraints on building geometry will generally limit the overhang separation.

4.3.5 Insulation levels. starting point values for thermal insulation are recommended on the basis of principal climate region and building size, and geometry. The R-values (thermal resistance in deg.F-ft$^2$-hr/Btu) of walls, including installed insulation and other layers, should lie in the intervals indicated in figure 13 for small (1500 ft$^2$), one story, single family detached residences. The values suggested in figure 13 are consistent with the results of a study presented in DOE/CS-0127/3, Passive Solar Design Handbook, Volume Three, on the economics of mixing conservation and passive solar strategies that was conducted for the United States Department of Energy.

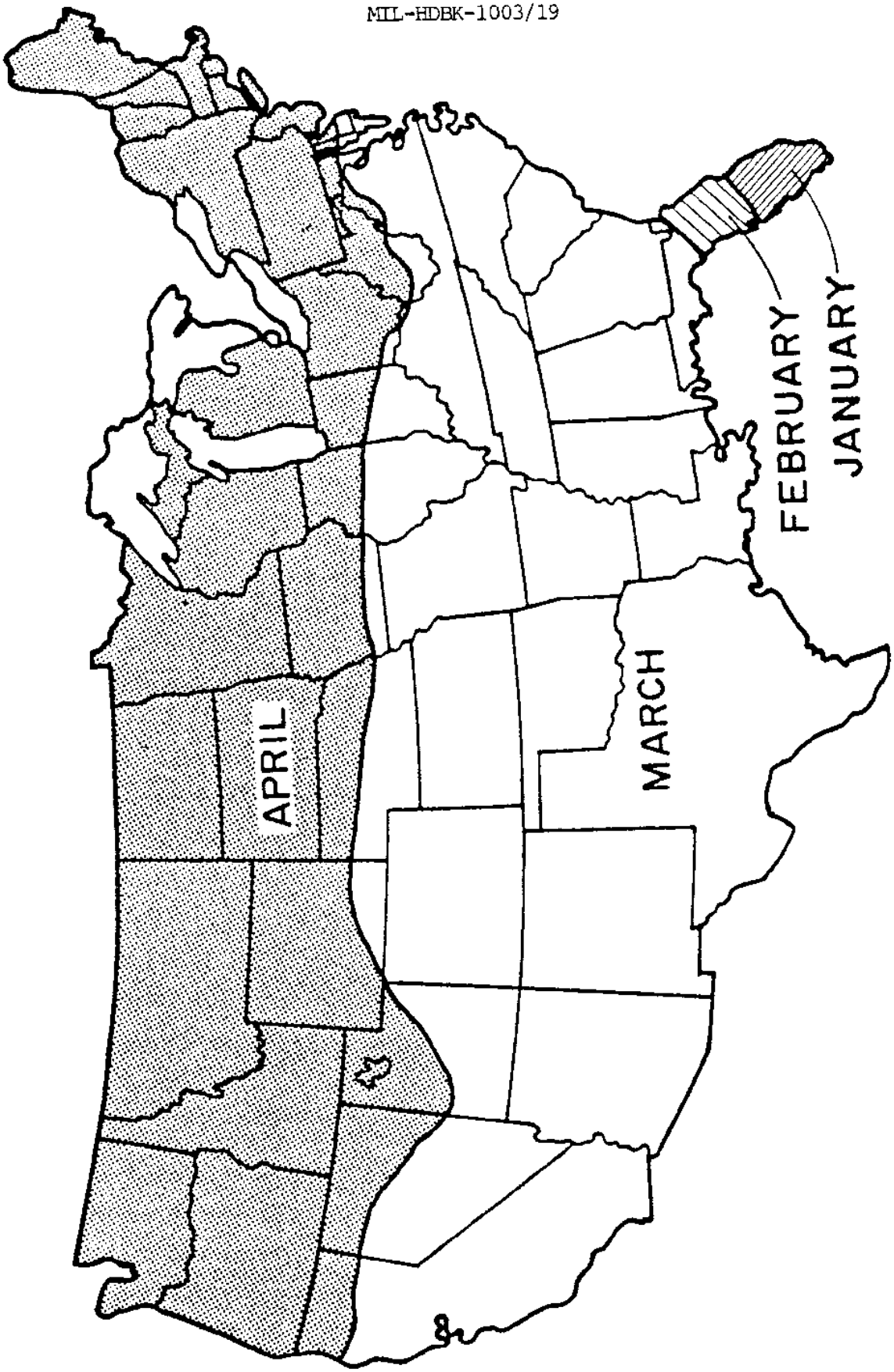
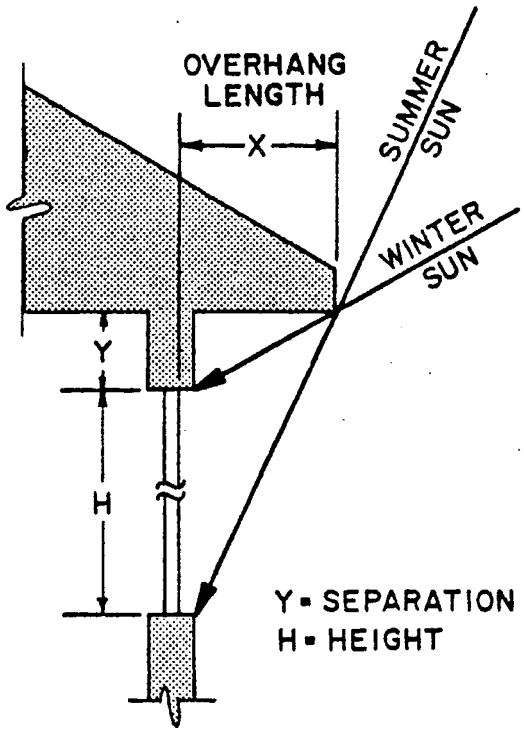



FIGURE 9. Last month for full illumination of solar aperture facing within 20 degrees of true south.




SEPARATION RATIO = Y/H
OVERHANG RATIO = X/H

FIGURE 10. Overhanging geometry

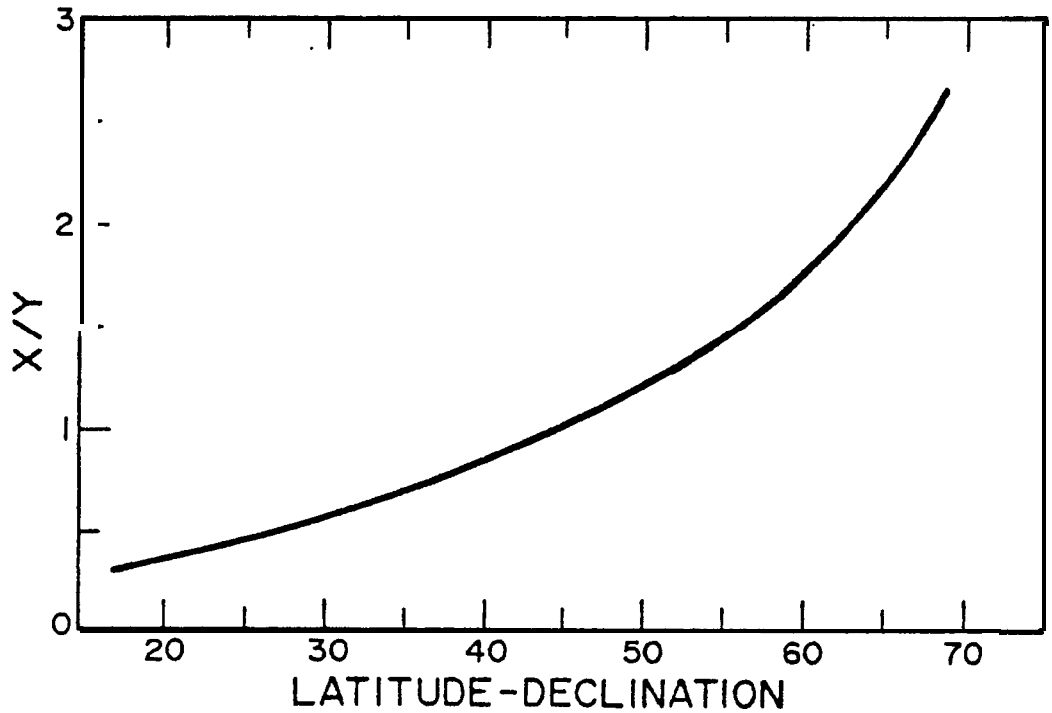



FIGURE 11. Ratio X/Y related to (Latitude - declination).

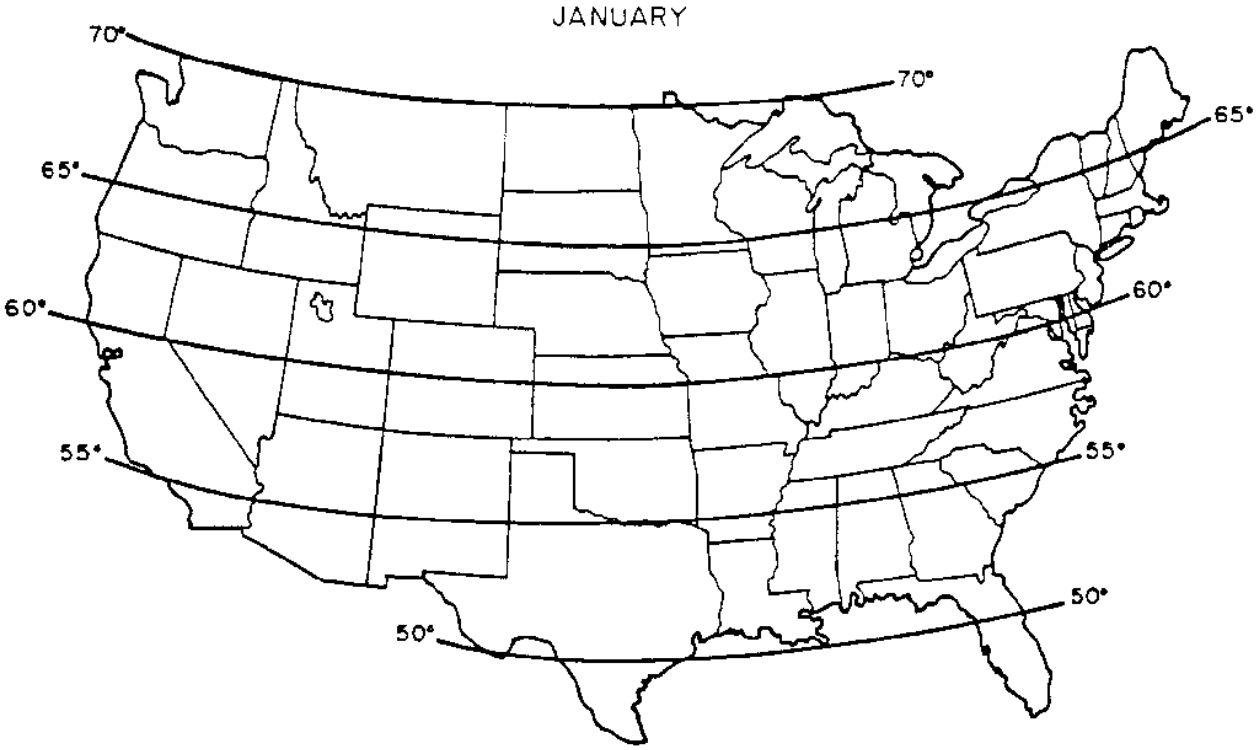



FIGURE 12(a). (Latitude - Declination) for January.

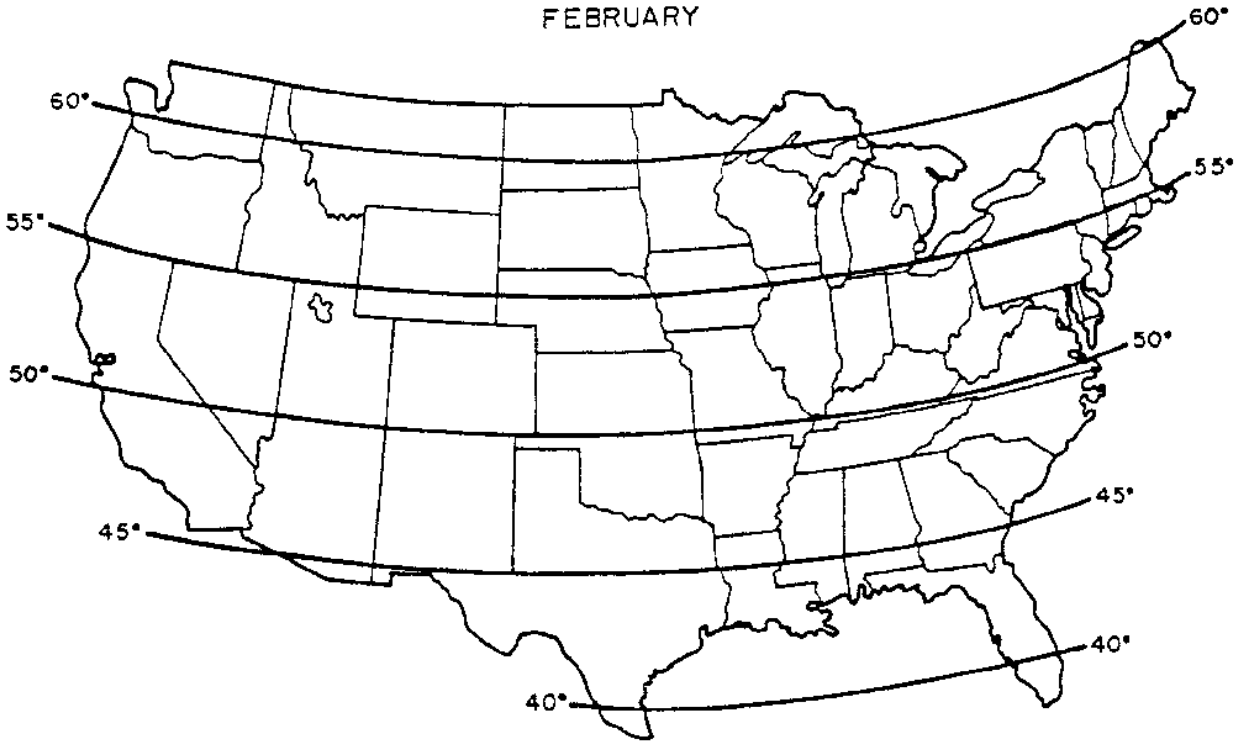



FIGURE 12(b). (Latitude - Declination) for February.

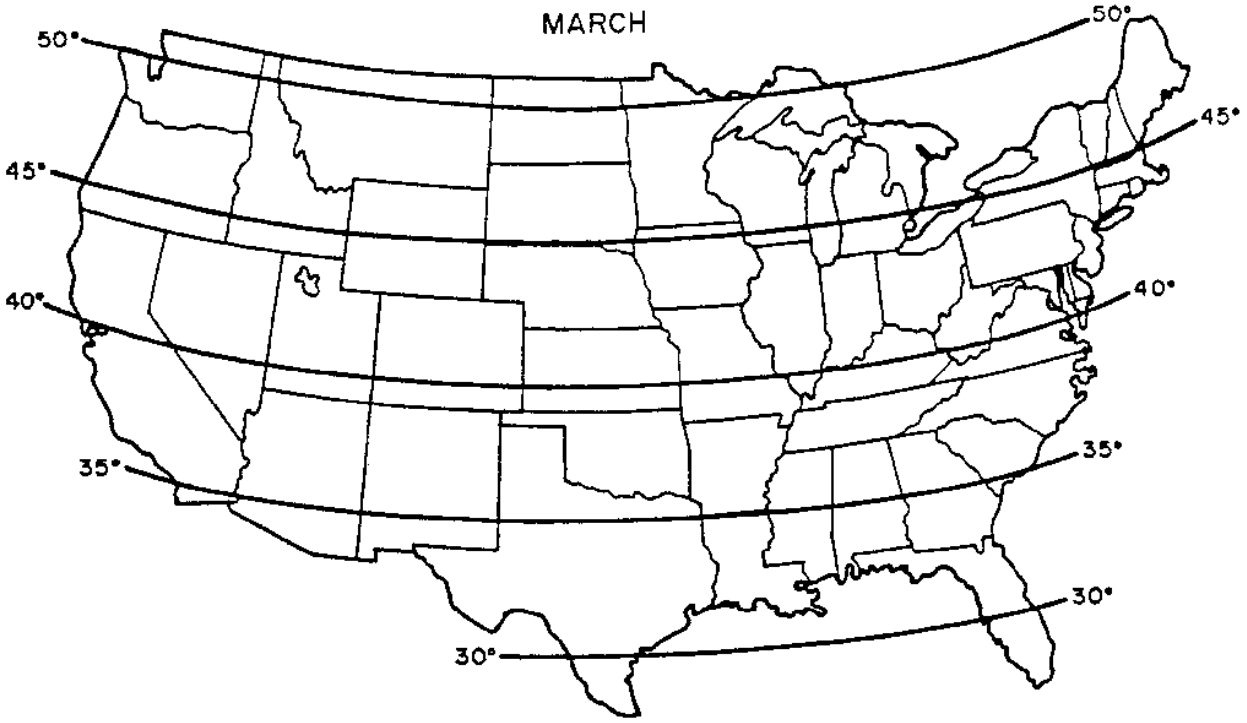



FIGURE 12(c). (Latitude - Declination) for March.

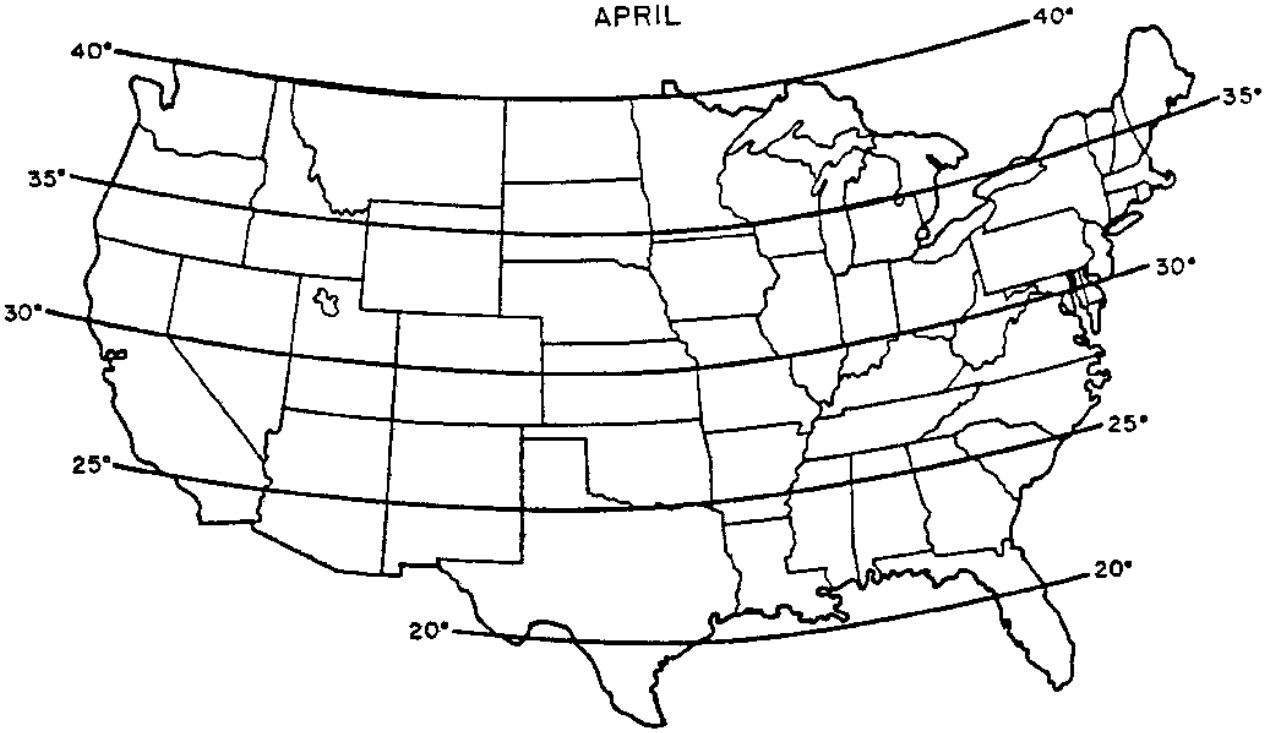



FIGURE 12(d). (Latitude - Declination) for April.

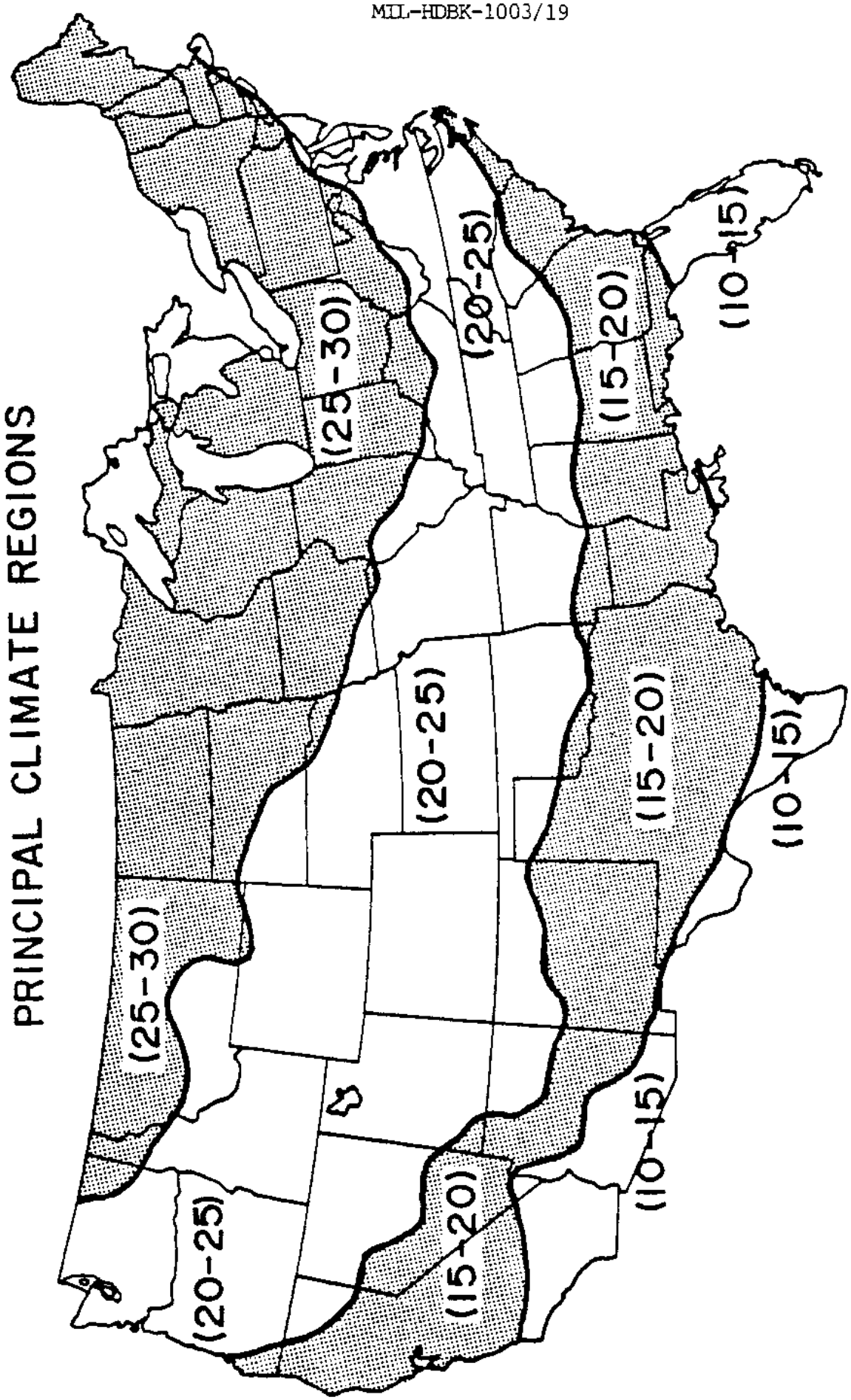



FIGURE 13. Principal climate regions (R-values).

Larger buildings derive a greater benefit from incidental heating by internal sources because of the reduced external surface area relative to the heated floor area. For two story, single family residences, townhouses, and dormitories or office buildings, the R-values of the wall insulation should be scaled down from the values in figure 13 according to the following formula:

$$RWALL = 1/3\ (A_{\lceil e \rceil}/A_{\lceil f \rceil})\ RWALL_{\lceil o \rceil} \qquad \text{(Equation 4.2)}$$

where RWALL is the scaled R-value of the wall insulation and $RWALL_{\lceil o \rceil}$ is the reference value for a small, one story building. Furthermore, $A_{\lceil e \rceil}$ is the external surface area of the building (ground level floors are included, for example, but common walls between townhouse units are not), and $A_{\lceil f \rceil}$ is the heated floorspace of the building. Equation 4.2 credits larger buildings for their more effective utilization of internal source heating during the winter by allowing reduced levels of wall insulation.

For three reasons, it is common practice to employ higher levels of insulation in the ceiling than the wall:

a. It is cheaper to insulate the ceiling than the wall.

b. Stratification causes larger heat loss rates per unit area of ceiling than per unit wall area.

c. Solar gains on roofs during the summer can cause unwanted heating of the living space beyond that caused by high ambient air temperature.

The total-R-value of the roof structure should therefore be scaled directly with the wall R-value as follows:

$$RROOF = 1.5\ RWALL \qquad \text{(Equation 4.3)}$$

Heat losses through building perimeters and fully bermed basement walls are limited by contact with the soil so that insulation levels need not be so high as for exposed external walls. The following formulas yield reasonable insulation levels for these surfaces:

$$RPERIM = 0.75\ RWALL \qquad \text{(Equation 4.4)}$$

$$RBASE = 0.75\ RWALL \qquad \text{(Equation 4.5)}$$

Ordinarily, floors are not insulated so as to assure that pipes located below do not freeze. Because of widely varying conditions beneath ground level floors, it is difficult to recommend specific insulation levels. Nevertheless, provided there is no problem with pipes freezing, a reasonable value might be:

$$RFLOOR = 0.5\ RWALL \qquad \text{(Equation 4.6)}$$

The insulation levels recommended above are intended only as starting point values. Design analysis calculations described in later sections should be performed before fixing any important design variables.

4.3.6 Infiltration. Many older buildings have infiltration rates as high as 1.5 air changes per hour (ACH). A reduction to 1.0 ACH may be achieved by employing a plastic vapor barrier; taking care to seal all joints and foam any cracks will generally further reduce the infiltration rate to 0.5 ACH. It is strongly recommended that the infiltration rate be limited to 0.5 ACH for both new construction and retrofits whenever possible. Since extremely low rates may be hazardous to the occupants' health due to the accumulation of indoor pollutants, further reductions in infiltration heat loss should be attempted only through the use of window heat recovery units. Extensive use of these units can yield effective infiltration rates as low as 0.187 and under certain circumstances, the additional expense involved may be justifiable.

4.3.7 Solar collection area. The solar collection areas recommended in this section are intended to be used as starting point values for the design analysis procedure discussed in 4.4 and 5.1; they are based on the following assumptions:

a. The recommendations presented in the preceeding sections on insulation levels and infiltration rates are followed.

b. The levelized heating fuel cost is $18.55/MMBtu.

c. The heating efficiency is unity.

d. The payback period is ten years.

The last three assumptions imply that the ratio of annual energy saved to capital invested (E/C) is 5.4 MMBtu/K$. Furthermore, the system productivity (PR) which is defined as the amount of energy saved annually per square foot of collector, is given by the product of E/C and the system dependent cost per square foot of solar collection aperture. For small variations of the fuel costs from the assumed value of $18.55/MMBtu, the aperture size may be adjusted at one-third the rate of fuel cost variation. In other words, a 9 percent increase in fuel cost should be compensated for by a 3 percent increase in aperture size.

Nine representative passive solar systems are included in the sizing rules presented in this section. The nine systems and their associated costs per $ft^2$ of aperture are described in table II. Thermal storage mass is characterized by the thickness in inches (THICK), and by the ratio of the mass surface area to the area of the collection aperture ($A_m/A_c$). For sunspaces, the area of the collection aperture is taken to be the area projected on a vertical plane. For all systems, the thermal storage material is high density concrete.

Contour maps of recommended aperture size expressed as percent of floor area are presented in sequence for each of the systems in table II in figures 14 through 22. (Note: Large apertures occur where high solar availability coincides with a large heat load. Small apertures occur where the solar availability is low or the heat load is small.) These aperture sizes, used in conjunction with the previously recommended insulation and infiltration levels, will yield an E/C of 5.4 and a payback period of ten years for the

TABLE II. Representative passive system costs.[*]

| System Number | Figure Number | System Type | Cost ($/ft$^2$) |
|---|---|---|---|
| 1 | 14 | Double glazed direct gain with THICK = 4 and $A_m/A_c$ = 3. | 12 |
| 2 | 15 | Double glazed direct gain with THICK = 4 and $A_m/A_c$ = 6. | 12 |
| 3 | 16 | Double glazed, vented Trombe wall with THICK = 12. | 15 |
| 4 | 17 | Double glazed radiant panel with THICK = 4 and $A_m/A_c$ = 3. | 12 |
| 5 | 18 | Double glazed radiant panel with THICK = 4 and $A_m/A_c$ = | 12 |
| 6 | 19 | Double glazed thermosiphoning air panel with THICK = 4 and $A_m/A_c$ = 3. | 14 |
| 7 | 20 | Double glazed thermosiphoning airpanel with THICK = 4 and $A_m/A_c$ = 6. | 14 |
| 8 | 21 | Double glazed attached sunspace with glazing tilted 50 degrees to the horizontal and THICK = 12. | 18 |
| 9 | 22 | Double glazed semi-enclosed sunspace with vertical glazing and THICK = 12. | 15 |

[*]Based on typical costs observed by Los Alamos National Laboratory during the 1984-1985 period.

nine systems specifically described; similar results can be achieved for other related systems by employing the contour map that is most representative of the system of interest. Similar results are achieved because related systems that operate at higher efficiencies than the six reference cases tend to be more expensive and therefore, require higher productivities in order to pay for themselves in about ten years. The higher productivities can be achieved by keeping the aperture size about equal to that recommended for the cheaper but less efficient systems included in table II. A similar argument holds for systems that are less efficient than the related reference cases.

The aperture sizes given in figures 14 through 22 are for single family detached residences with 1500 $ft^2$ of heated floorspace. For larger or multi-story buildings, the ratio of collector area to floor area should be scaled according to the following formula:

$$A_c/A_f = 1/3\ (A_e/A_f)(A_c/A_f)_o \qquad \text{(Equation 4.7)}$$

where $A_e$ is the external surface area of the building and $(A_c/A_f)_o$ is the reference area ratio read from the appropriate contour map. This building size correction is intended to compensate for the fact that heat from internal sources provides a higher fraction of the building heat load in larger buildings.

The sizing rules presented above are intended for apertures facing due south but may be applied to cases involving departures of up to 30 degrees without incurring serious error. Generally, the performance penalty for a passive solar system that is thirty degrees off south is about 10 percent. These initial values should, as previously stated, be checked by design analysis calculations before proceeding to construction documents.

4.3.8 Thermal storage mass. The amount of thermal storage mass required per square foot of solar aperture depends primarily on the solar availability at the building site. The relative solar availability in the continental United States is given by the contour map in figure 8.

Masonry thermal storage walls and sunspaces with masonry common walls generally employ a wall thickness of about 12 inches of high density material. This thickness is quite appropriate in the sunny region and to a large extent, in the adjacent cloudy and very sunny regions. However, in the most sunny region a wall thickness of 18 inches should be employed to protect against overheating and fully utilize the available resource. In the very sunny region, wall thicknesses may range from 12 inches to 18 inches depending on which boundary the building site is nearest. At the other extreme, mass walls in the very cloudy region need only be 6 inches thick and in the adjacent cloudy region, thicknesses may range from 6 inches to 12 inches depending on position relative to the boundaries. When water containers are used for thermal storage, either in sunspaces or thermal storage walls, equivalent thicknesses comparable to those recommended for masonry walls are appropriate in all solar availability regions; however, because the heat capacity of water is roughly twice that of high density masonry, significant downward revisions may be permissible.

Direct gain apertures, radiant panels, and TAPs all use interior mass for heat storage. Ideally, the interior mass should have a high density and be distributed in thicknesses of 2 inches to 6 inches. Appropriate area ratios ($A_m/A_c$) are 3 in the very cloudy region, 3 to 6 in the cloudy region, 6 in the sunny region, 6 to 9 in the very sunny region and 9 in the most sunny region. Equivalent or somewhat smaller volumes of water may be used instead of masonry in lightly constructed buildings.

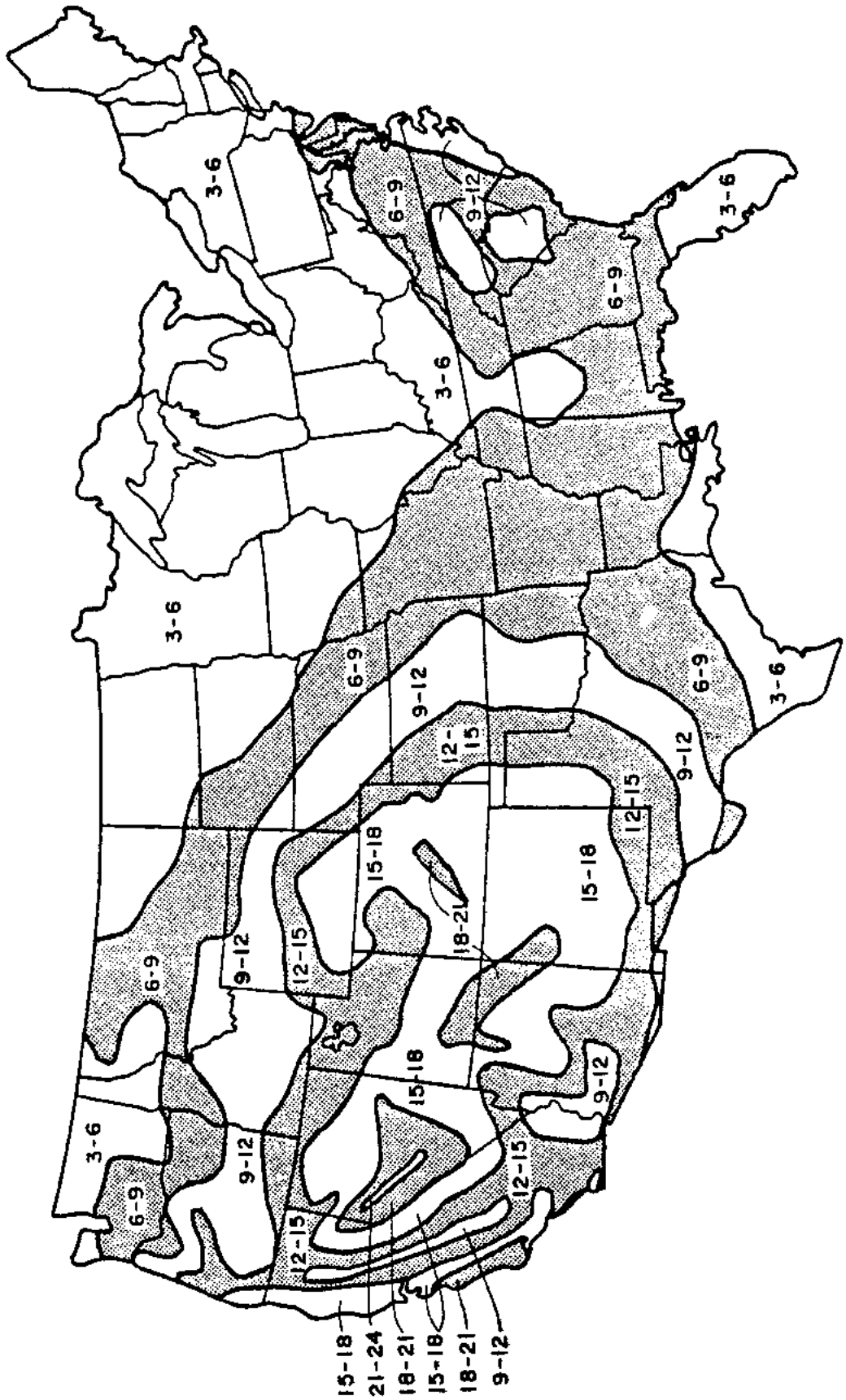



FIGURE 14. Solar aperture area in percent of floorspace area (System 1).

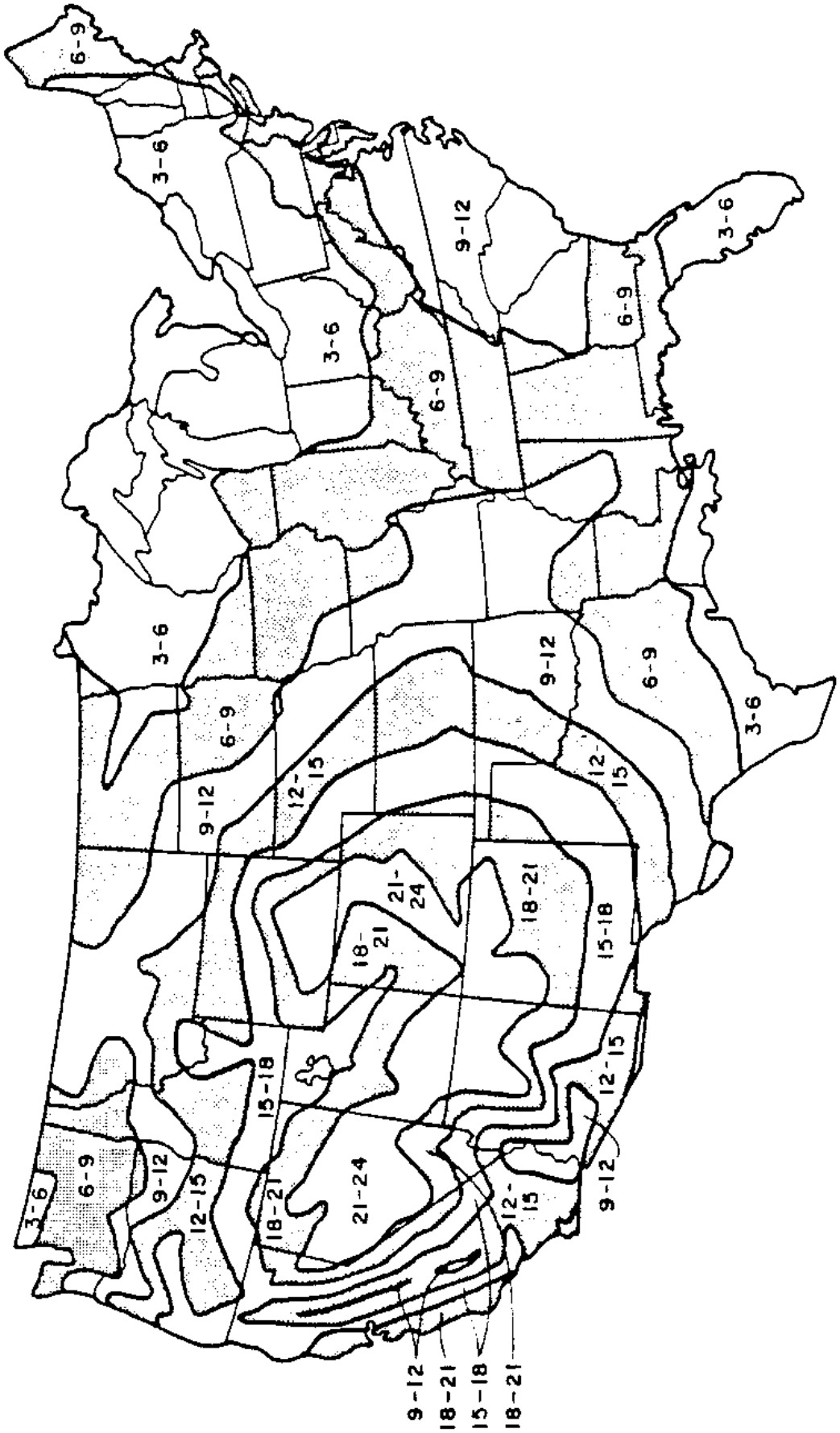



FIGURE 15. Solar aperture area in percent of floorspace area (System 2).

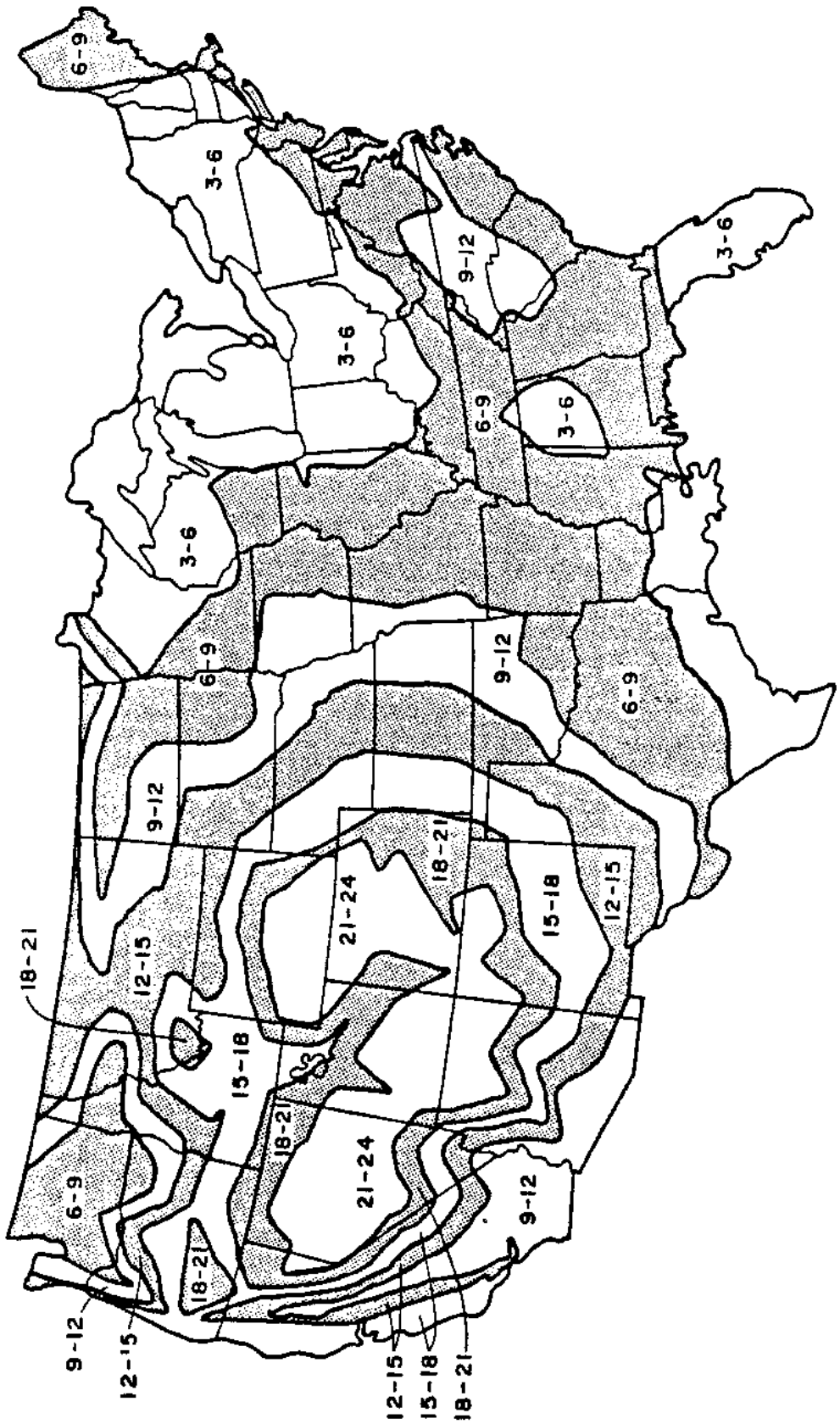



FIGURE 16. Solar aperture area in percent of floorspace area (System 3).

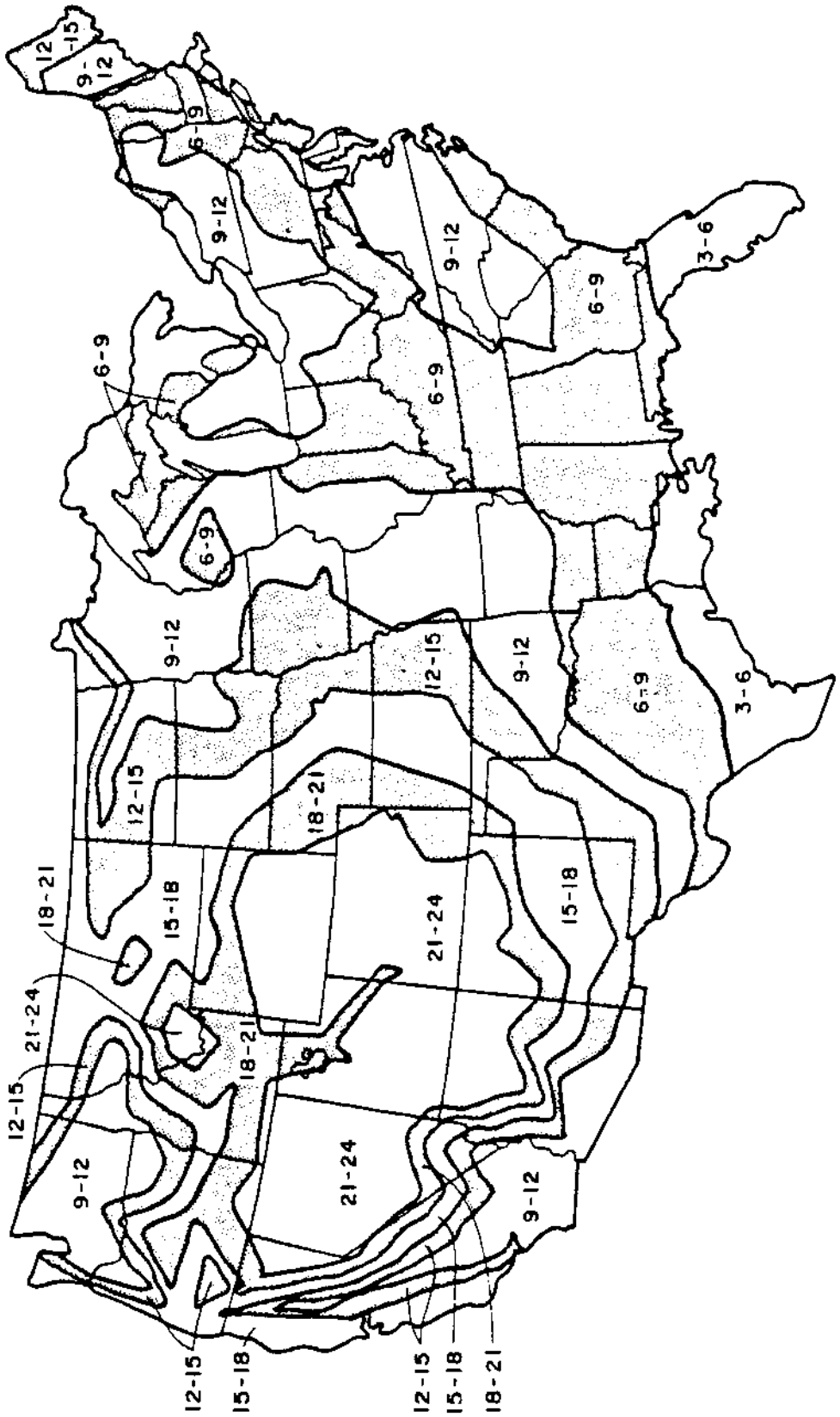



FIGURE 17. Solar aperture area in percent of floorspace area (System 4).

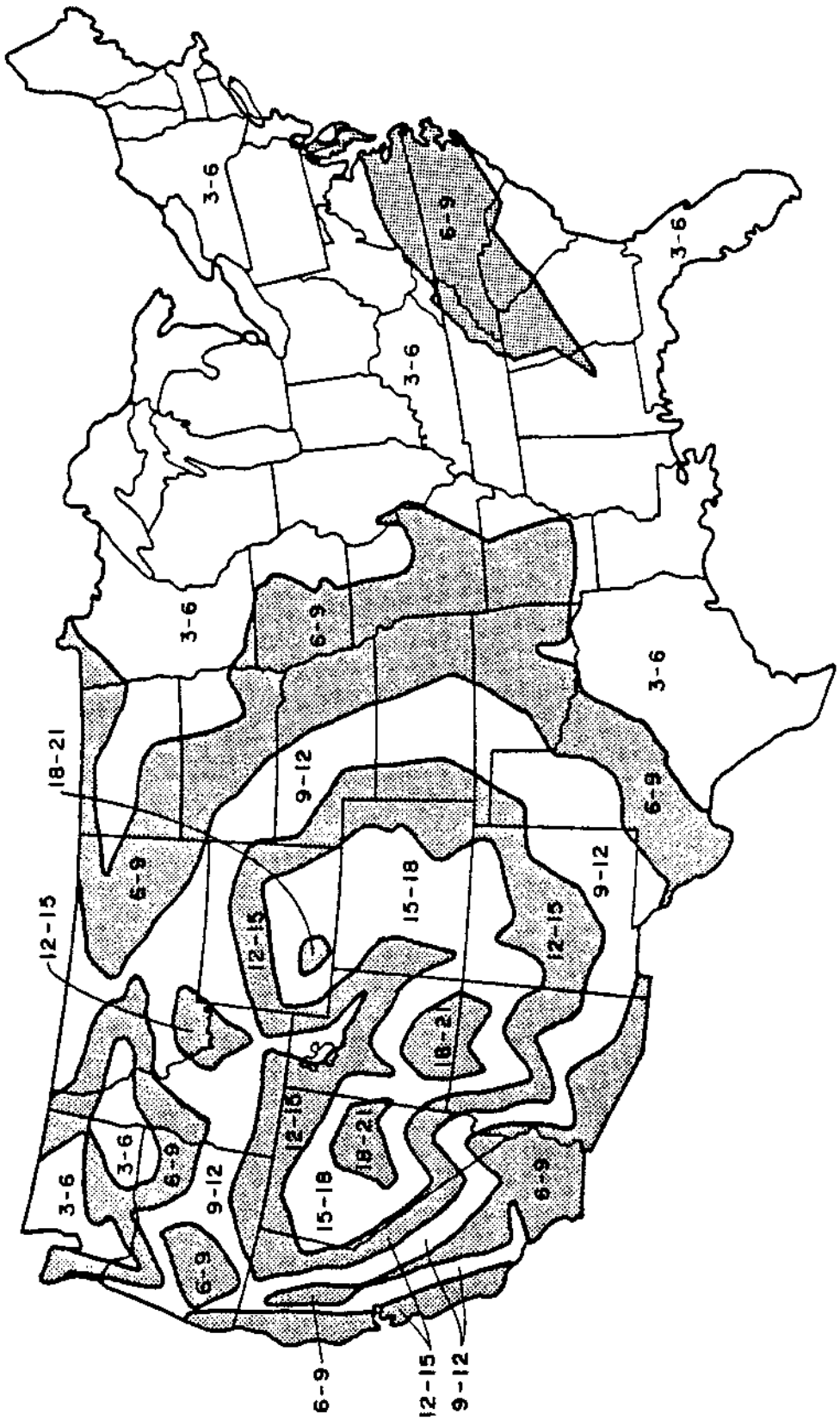



FIGURE 18. Solar aperture area in percent of floorspace area (System 5).

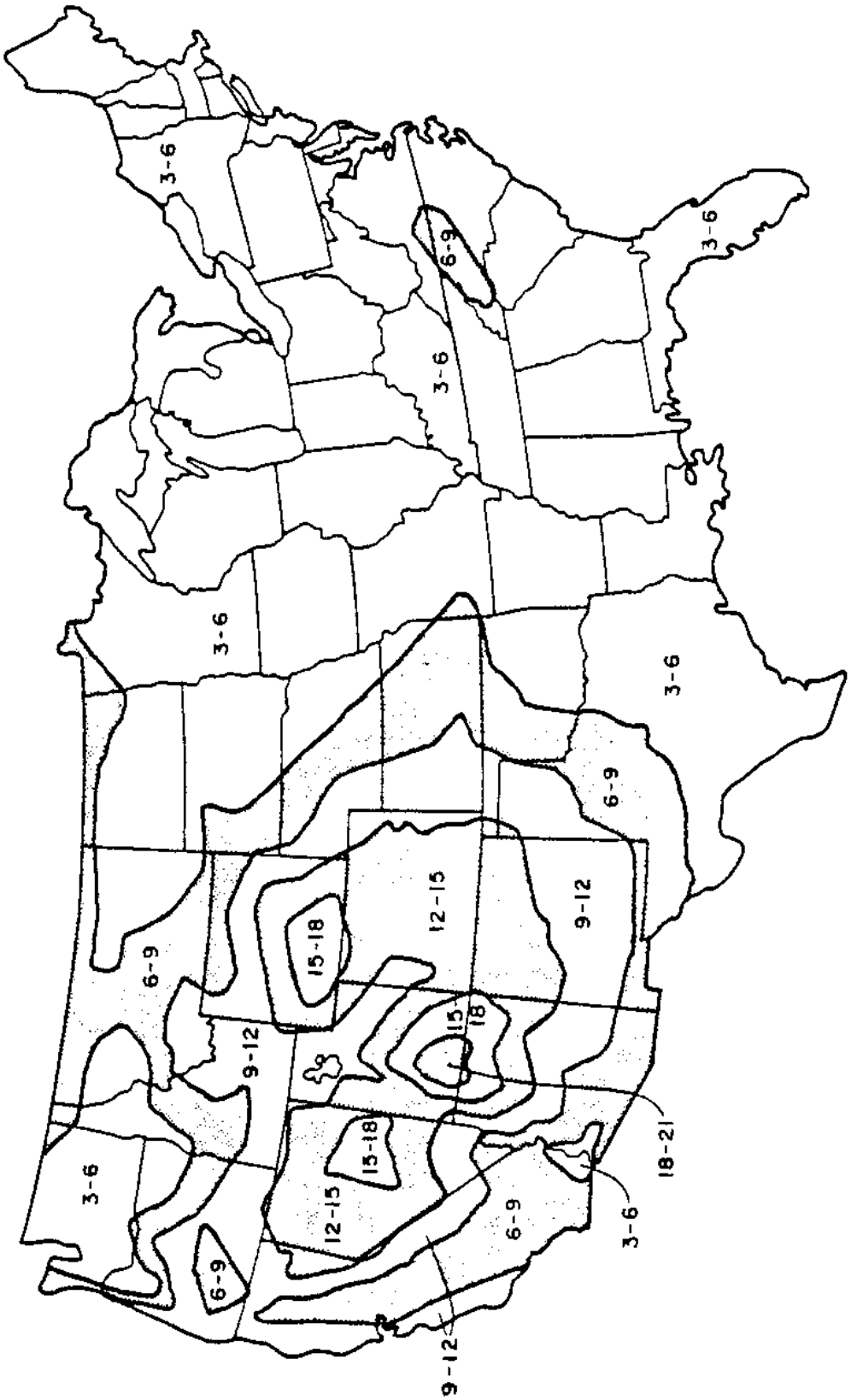



FIGURE 19. Solar aperture area in percent of floorspace area (System 6).

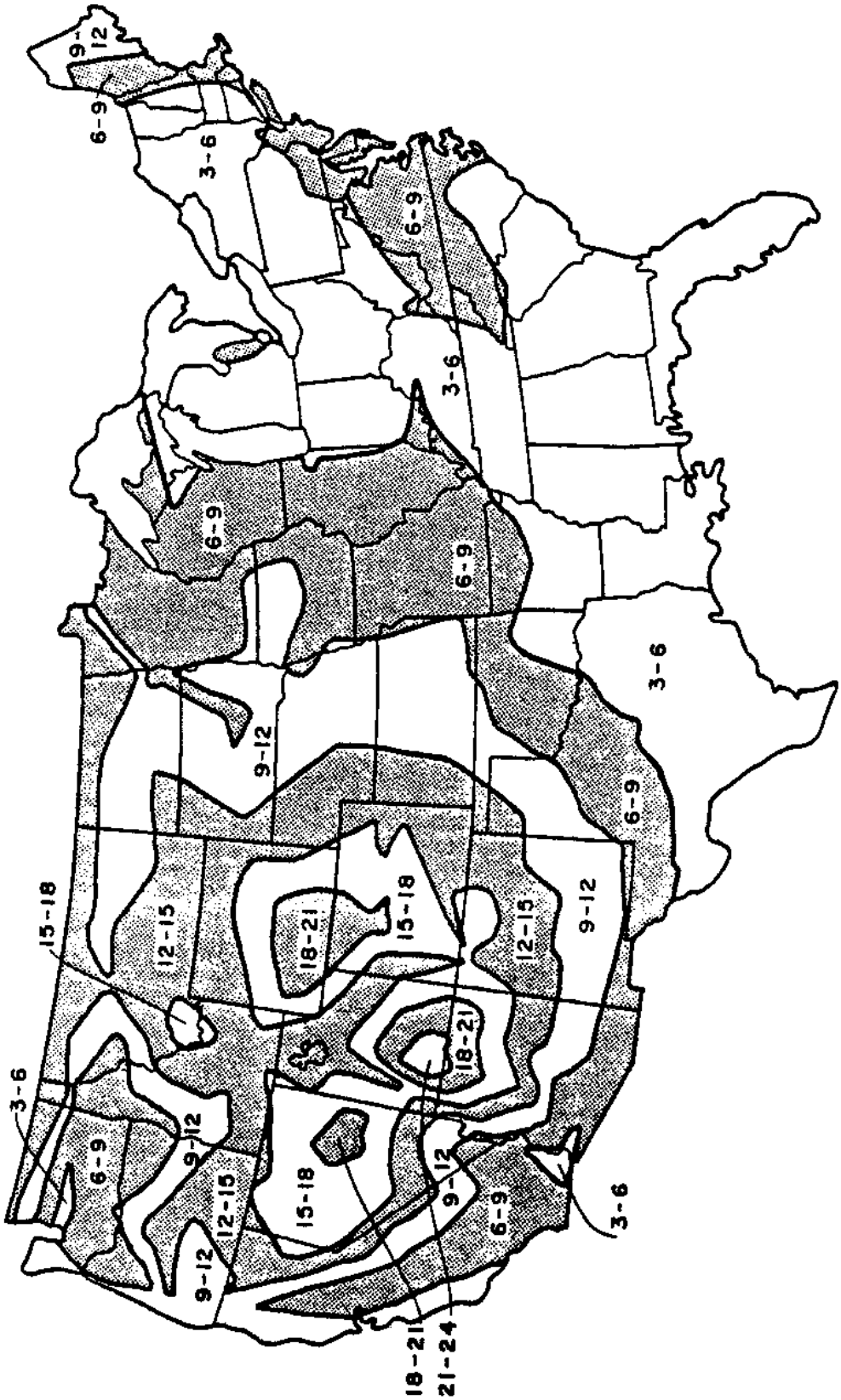



FIGURE 20. Solar aperture area in percent of floorspace area (System 7).

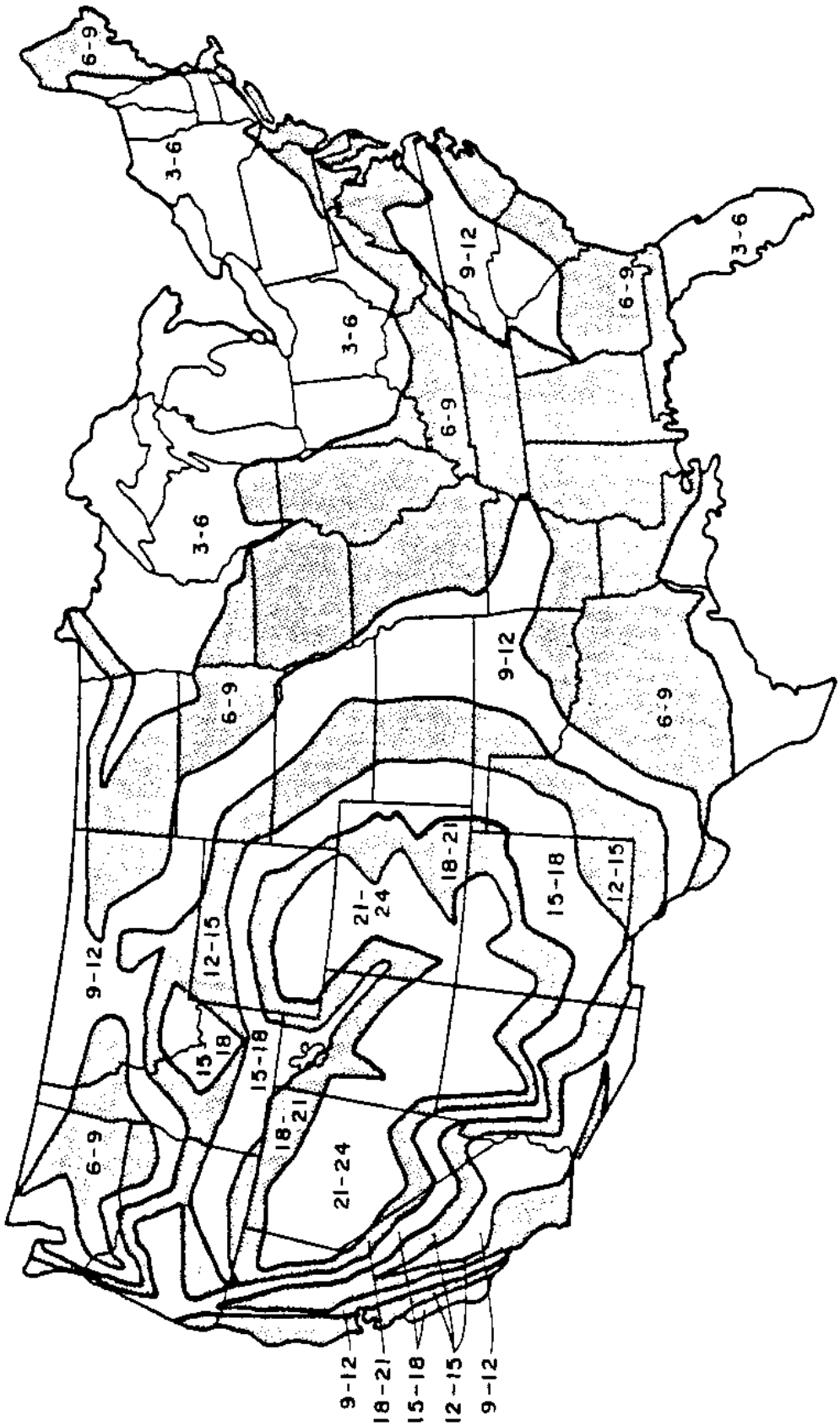



FIGURE 21. Solar aperture area in percent of floorspace area (System 8).

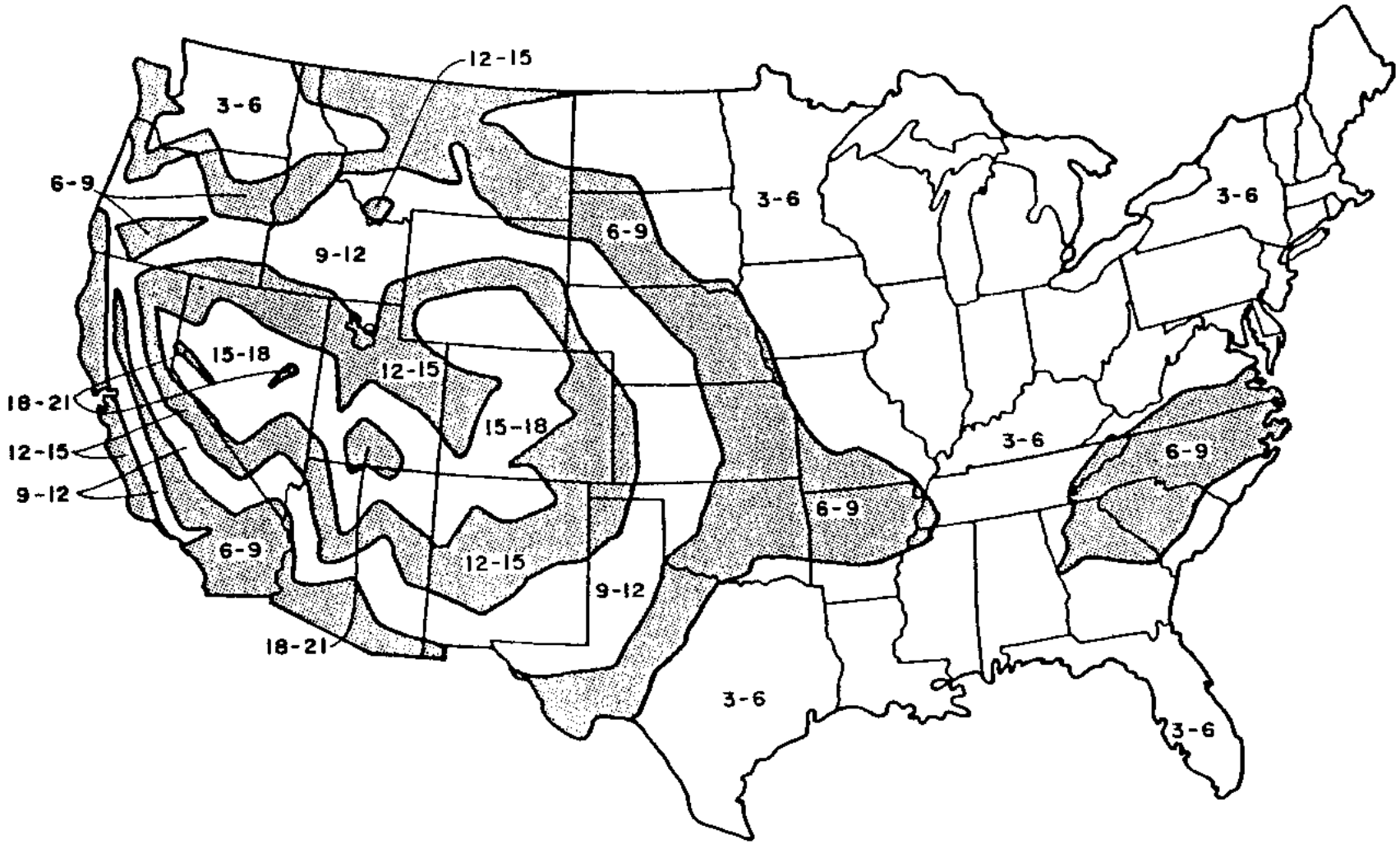



FIGURE 22. Solar aperture area in percent of floorspace area (System 9).

4.3.9 Schematic design worksheet. Worksheet 1 is provided as an aid in organizing and recording the results of the schematic design process described in this chapter. The worksheet is self-explanatory and employs previously defined notation except for the total external perimeter of the heated floorspace ($P_{\lceil t \rceil}$). The floorspace may occupy one or more levels in a building, and $P_{\lceil t \rceil}$ comprises the external perimeter of all levels to be included in the analysis. Thus, for a two-story building that is being analyzed as a single unit, $P_{\lceil t \rceil}$ is the perimeter of the ground floor plus the perimeter of the upper floor. If the two-story unit is a duplex consisting of two distinct thermal zones separated by a vertical plane, it would be appropriate to analyze the thermal zones separately. In this case, the length of the common wall separating the two zones must be subtracted from the perimeter of each level of the zone under consideration.

Additional worksheets will be presented later as more detailed design analysis procedures are introduced. Having once read and understood these design procedures, the user will be able to rapidly specify appropriate starting-point values for the primary passive solar parameters. The user may then proceed to completion of a detailed method for design analysis and refinement using only the worksheets and graphical or tabular information provided in this document. An example calculation presented in 5.3 illustrates the entire process.

4.4 Fundamentals of design analysis. The guidelines presented in 4.3 should enable the designer to specify initial values for the design variables that are most strongly related to energy efficient performance in passive solar buildings. Before proceeding any further with the design, an analysis that provides an estimate of the buildings performance should be conducted. By repeating the analysis with selected values of the primary variables it is possible to fine tune the original design in a manner that is consistent with the performance and economic goals of the project. The design analysis procedure introduced herein is quick and accurate in application and therefore well suited to the design of energy efficient buildings. Before discussing the procedure, a set of essential concepts and definitions is presented below.

4.4.1 Terminology.

4.4.1.1 Solar collection area. The area of the glazed portions of the solar collection aperture ($A_{\lceil c \rceil}$) has units of $ft^{\lfloor 2 \rfloor}$.

4.4.1.2 Projected area. In order to analyze sunspaces that have tilted glazings, it is necessary to know the area of the collector that is projected on a vertical plane. The tilt relative to vertical is given by [theta], and the required relationship is:

$A_{\lceil p \rceil}$ = $A_{\lceil c \rceil}$ [multiplied by] cos ([theta]) (Equation 4.8)

The projected area ($A_{\lceil p \rceil}$) should be used in place of $A_{\lceil c \rceil}$ for design analysis work on sunspaces.

4.4.1.3 Transmitted solar radiation. The symbols VT1, VT2, and VT3 represent the amount of solar radiation that is transmitted through one square foot of vertical, south-facing solar aperture during a specific one-month period for single, double, and triple glazed systems, respectively. The corresponding annual sums are indicated by the symbols QTA1, QTA2, and QTA3. In the general case for which the aperture is either tilted or not south-facing, QS is used for the monthly sum and QSA represents the annual sum. The units of all transmitted radiation quantites are (Btu/ft$^2$) per unit time.

4.4.1.4 Solar aperture absorptance. The solar aperture absorptance ([alpha]) is the fraction of transmitted solar radiation that is absorbed by the passive heating system. The part not absorbed is lost back through the glazing by reflection.

4.4.1.5 Absorbed solar radiation. The amount of radiation absorbed by a passive solar heating system per square foot of aperture (S) is given by the product of the transmitted radiation and the absorptance. In the general case, for a one-month period, we have:

S = [alpha] [multiplied by] QS. (Equation 4.9)

The units of S are (Btu/ft$^2$) per unit time. The total amount of solar radiation absorbed by a particular system ($S_T$) is given by the product of S and $A_c$ (or $A_p$ where appropriate) and has units of Btu per unit time.

4.4.1.6 Net load coefficient. The net load coefficient (NLC) is defined as the amount of heat that would be required to maintain the air temperature in a building -1deg.F above the outdoor ambient temperature for a period of one day if no heat losses or gains were allowed through the solar aperture. Thus the NLC, which is expressed in units of Btu/deg.F-day, provides a measure of how effectively the nonsolar elements of a building have been sealed and weatherstripped to reduce infiltration and insulated to reduce heat loss by conduction. A procedure for obtaining a quick estimate of the NLC will be presented in 5.1.1.

4.4.1.7 Load collector ratio. The load collector ratio (LCR) is the NLC divided by the solar collection area ($A_c$), or, in the case of sunspaces with tilted glazings, it is the NLC divided by the projected area ($A_p$). The units of LCR are Btu/deg.F-day ft$^2$ and the defining equation is:

LCR NLC/$A_c$ (Equation 4.10)

4.4.1.8 Total load coefficient. The total load coefficient (TLC) is the sum of the NLC and the load coefficient of the solar aperture and as such, provides a measure of the total building heat loss with no credit taken for solar gains.

One of two values for the solar aperture conductance may be selected depending on the application at hand. If the steady state aperture conductance ($U_c$), expressed in Btu/hr-ft$^2$-deg.F, is selected, then:

$TLC_s$ = NLC + 24 [multiplied by] $U_c$ [multiplied by] $A_c$ (Equation 4.11)

where $TLC_{s}$ is the steady state total load coefficient. If on the other hand, the effective aperture conductance (G), expressed in Btu/deg.F-day $ft^{2}$, is selected, then:

$$TLC_{e} = NCL + G \text{ [multiplied by] } A_{c} \qquad \text{(Equation 4.12)}$$

where $TLC_{e}$ is the effective total load coefficient. The effective conductance (G) is a system correlation parameter, as will be expanded on in 5.1.1, and includes the effect of solar aperture dynamics. The appropriate choice of TLC parameters will be specified for each application in these procedures.

4.4.1.9 Thermostat setpoint. The thermostat setpoint ($T_{set}$) is the temperature setting of the thermostat that controls the auxiliary heating system.

4.4.1.10 Diurnal heat capacity. The diurnal heat capacity (DHC) is the amount of heat that can be stored in the thermal mass of a building, per unit room air temperature swing, during the first half of a 24-hour cycle and returned to the space during the second half of the cycle. The performance of passive solar buildings is enhanced when the DHC is elevated. Procedures for calculating this important parameter will be presented in 5.1. The DHC has units of Btu/deg.F.

4.4.1.11 Effective heat capacity. The effective heat capacity (EHC) is a correlating parameter that relates the thermal performance of otherwise identical direct gain buildings that have arbitrary thermal storage media arranged in various geometric configurations. As such, the EHC, which has units of Btu/deg.F of solar aperture, provides a measure of the amount of heat that may be stored in the thermal mass of a building during one day and returned to the room air on the same day or on succeeding days at times and rates that lead to improvements in building performance. Improvements in solar thermal performance occur when stored solar energy is delivered to the room air in phase with the building thermal load, thereby reducing auxiliary heating requirements. A nomograph for the EHC will be presented in 5.1.

4.4.1.12 Effective thermostat setpoint. The analysis methods presented in this document require the use of a constant thermostat setpoint. Because control strategies involving nightime setbacks are advantageous due to the resultant reduction in auxiliary heat consumption, a procedure has been developed for relating building and control parameters to a constant effective thermostat setpoint ($T_{e}$); this procedure is described in 5.1. The temperature $T_{e}$ should be used in place of $T_{set}$ for the analysis of any building that employs a control strategy.

4.4.1.13 Base temperature. The base temperature ($T_{b}$) is the thermostat setpoint (or the effective setpoint) adjusted in a manner that accounts for internal-source heating by people, lights, appliances, office equipment, or any other device not primarily intended as an auxiliary heat source. The base temperature is given by:

$$T_{b} = T_{set} - Q_{int}/TLC_{s}, \qquad \text{(Equation 4.13)}$$

where $Q_{int}$ (Btu/day) is the internal heat generation rate. Use of $T_{b}$ rather than $T_{set}$ in heat loss calculations is a simple and reasonably accurate way to include the effect of internal source heating on building performance. Unless other information is available, $Q_{int}$ can be taken equal to 20,000 Btu/day per person.

4.4.1.14 Heating degree days. The heating degree days (DD) is the hourly summation of the difference between a specified base temperature and the ambient temperature for a certain time interval, where only positive terms are included in the summation, and the result is divided by 24. The units of DD are deg.F-day and the time interval of interest is generally one month or one year.

4.4.1.15 Effective building heat load. The effective building heat load ($Q_{L}$) is given by the product of the effective total load coefficient and the heating degree days for the time period of interest. Thus:

$$Q_{L} = TLC_{e} \text{ [multiplied by] } DD , \qquad \text{(Equation 4.14)}$$

where the units of $Q_{L}$ are Btu.

4.4.1.16 Net building heat load. The net building heat load ($Q_{N}$) is the product of the net load coefficient and the heating degree days for the time period of interest. The defining equation is:

$$Q_{N} = NLC \text{ [multiplied by] } DD , \qquad \text{(Equation 4.15)}$$

and the units are Btu.

4.4.1.17 Steady state heat load. The steady state heat load ($Q_{SL}$) is the actual total heat load for a specified time period. The defining equation is:

$$Q_{SL} = TLC_{s} \text{ [multiplied by] } DD \qquad \text{(Equation 4.16)}$$

and the units are Btu.

4.4.1.18 Solar load ratio. The solar load ratio (SLR) is the ratio of the amount of solar radiation absorbed by the system to the effective building heat load. The defining equation is

$$SLR = S \text{ [multiplied by] } A_{c}/Q_{L} , \qquad \text{(Equation 4.17)}$$

or

$$SLR = S_{T}/Q_{L} \qquad \text{(Equation 4.18)}$$

For tilted apertures in sunspaces, $A_{p}$ must be substituted for $A_{c}$. The solar load ratio is dimensionless.

4.4.1.19 Auxiliary heat requirement. The auxiliary heat requirement ($Q_A$) is the amount of heat that must be supplied by a conventional back-up heating system to maintain the building temperature at $T_{set}$ for a specified time period; the time period of interest usually has a duration of one month or one year. If a building receives no solar heat, $Q_A$ will equal the building heat load whereas $Q_A$ will be zero if the entire load is met by solar energy. The auxiliary heat requirement is the bottom line measure of passive solar heating performance.

4.4.1.20 Solar heating fraction. The solar heating fraction (SHF) is defined by the equation:

$$SHF = 1 - Q_A/Q_L \quad , \qquad \text{(Equation 4.19)}$$

and is dimensionless.

4.4.2 Heat to load ratio nomograph. The primary design analysis tool provided in these procedures is the nomograph for the annual heat to load ratio, $(Q_A/Q_L)_a$, presented in figure 23. In this figure, the quantity $(Q_A/Q_L)_a$ is plotted as a function of the minimum monthly scaled solar load ratio, SLR*, for a series of values for the city parameter (a). The city parameter depends primarily on geographic location; tabulated values are presented in the weather tables in Appendix B, which will be fully explained in 5.1. The scaled solar load ratio is given by the relation:

$$SLR^* = F \text{ [multiplied by] } SLR_m \quad , \qquad \text{(Equation 4.20)}$$

where F is a system dependent scale factor that is tabulated along with G, $U_c$, and other system-dependent parameters in Appendix A; a complete explanation of Appendix A is included in 5.1. The quantity $SLR_m$ is the minimum monthly solar load ratio for the building of interest at the selected location; $SLR_m$ can easily be evaluated using data provided in the weather tables.

Having obtained the heat to load ratio from figure 23, it is an easy matter to calculate the annual auxiliary heat requirement as follows:

$$(Q_A)_a = (Q_A/Q_L)_a \text{ [multiplied by] } (Q_L)_a \quad , \qquad \text{(Equation 4.21)}$$

where $(Q_L)_a$ is the annual effective building heat load.

4.4.3 System efficiencies.

4.4.3.1 Delivery efficiency. The delivery efficiency ($e_d$) is defined as the fraction of absorbed solar energy that is actually delivered to the living space, or:

$$e_d = Q_D/S_T \quad , \qquad \text{(Equation 4.22)}$$

where $Q_D$ is the delivered energy.

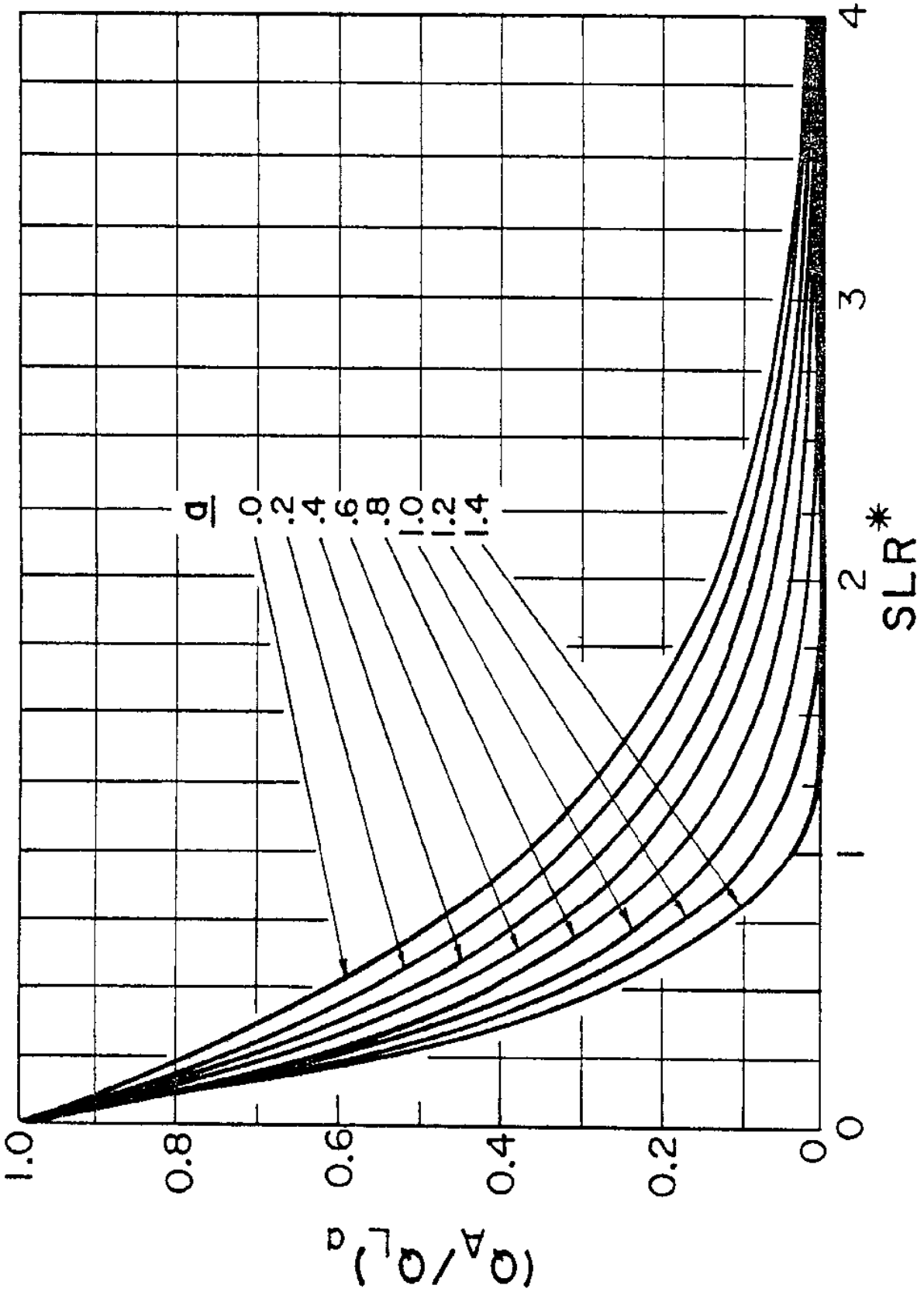



FIGURE 23. Annual heat to load ratio.

Direct gain buildings have a delivery efficiency of unity because the living space itself is the solar collector. Thermal storage walls, on the other hand, absorb energy on their outer surface and deliver heat to the interior by conduction through a masonry medium or by convection through water. Radiant panels must radiate and convect heat to the interior subsequent to absorption on the outer surface whereas TAPs convect heat to the interior through vents provided for that purpose. Regardless of what transport mechanism is involved, all passive solar systems except direct gain have delivery efficiencies less than one because part of the absorbed energy is lost back out through the glazing before it can be delivered to the interior. The delivery efficiencies of all passive solar systems addressed in this document are tabulated in Appendix A.

4.4.3.2 Utilization efficiency. The utilization efficiency ($e_{[u]}$) is the fraction of delivered solar energy that provides useful heat. The defining equation is:

$$e_{[u]} = Q_{[S]} Q_{[D]} \quad \text{(Equation 4.23)}$$

where:

$$Q_{[S]} = Q_{[SL]} - Q_{[A]} \quad \text{(Equation 4.24)}$$

is the utilizable solar heat. Systems with low utilization efficiencies are to be avoided because delivered solar energy that is not utilizable must be vented to avoid overheating the building. Typically, direct gain systems will have relatively low utilization efficiencies although overheating can be kept within acceptable limits by sizing the aperture properly and providing adequate thermal storage mass.

4.4.3.3 Total efficiency. The total system efficiency ($e_{[t]}$) is the fraction of absorbed solar energy that ultimately provides useful solar heat, or:

$$e_{[t]} = Q_{[S]} / S_{[T]} \quad \text{(Equation 4.25)}$$

which is equivalent to:

$$e_{[t]} = e_{[d]} \text{ [multiplied by] } e_{[u]} \quad \text{(Equation 4.26)}$$

Thus, $e_{[t]}$ depends on the efficiencies of delivery and utilization, and is an excellent measure of solar heating potential.

# 5. DETAILED ENGINEERING

## 5.1 Applied design analysis.

5.1.1 Net load coefficient worksheet. A simple procedure for estimating the net load coefficient is presented in this section. The method was adapted from DOE/CS-0127/2 and DOE/CS-0127/3, DOE Passive Solar Design Handbook, Volumes Two and Three; and although originally intended for single-family detached residences and small office buildings, is readily applicable to more complex structures.

The procedure consists of adding together several estimated contributions to building heat loss as outlined on Worksheet 2. In order to determine the heat loss contributions, a number of design parameters must be specified. Start by recording the total external perimeter ($P_{\lceil t \rceil}$) from Worksheet 1. Next, specify the area ($A_{\lceil g \rceil}$), and external perimeter ($P_{\lceil g \rceil}$) of the ground floor alone followed by the horizontally projected roof area ($A_{\lceil r \rceil}$) and the total south wall area ($A_{\lceil s \rceil}$) including windows and other solar apertures.

Continuing to specify parameters for Worksheet 2, you will need the ceiling height (h) and the non-south window fraction (NSF) which is defined as the fraction of all external walls, except that facing south, that is occupied by windows. The non-south window fraction will normally be between 0.05, for a situation with minimal window area, and 0.10 for a case with ample window area. Next, enter the number of glazings in the non-south windows ($NGL_{\lceil n \rceil}$) and the infiltration rate in air changes per hour (ACH). Finish this part of the worksheet by entering the air density ratio (ADR) which is a function of elevation as illustrated in figure 24. Since many Navy bases are located near sea level an ADR of unity is frequently appropriate.

In the next part of Worksheet 2, two parameters, the non-south window area ($A_{\lceil n \rceil}$) and the wall area ($A_{\lceil w \rceil}$) must be calculated using previously recorded quantities. The wall area is defined as the total area of all external walls excluding windows and solar apertures.

The various contributions to building heat loss are calculated and summed in the final part of the worksheet. The necessary equations are given and all parameters called for are available from the first two parts of Worksheet 2 or from Worksheet 1. A list of R-values of building materials from NCEL CR 82.002 is presented in table III and R-values for air films and air spaces, also from NCEL CR 82.002 are given in table IV. The original source of the data is the ASHRAE Fundamentals Handbook. The information in tables III and IV is useful for calculating the total R-value of layered elements in the building shell; simply add together the R-values of each layer, air gap and air film to get the total R-value.

Calculate RROOF of a vaulted ceiling with no attic by determining the total R-value of the roof and scaling that value to the horizontally projected area as follows:

$$RROOF = R_{\lceil tot \rceil} \text{ [multiplied by] } (A_{\lceil a \rceil}/A_{\lceil r \rceil}) \quad , \qquad \text{(Equation 5.1)}$$

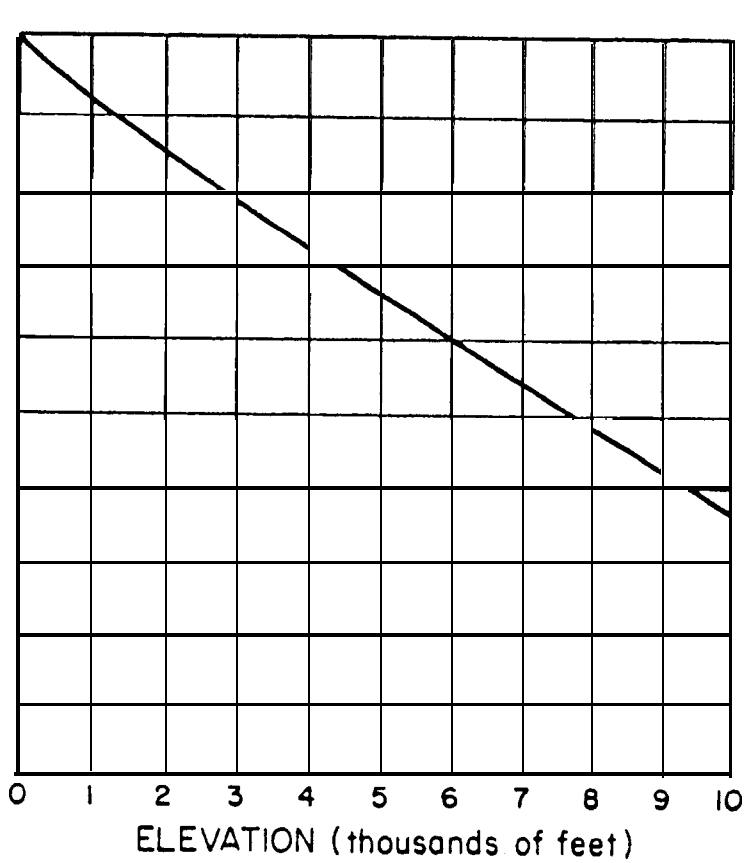



FIGURE 24. Air density ratio versus elevation.

where $A_a$ is the actual roof area and $R_{tot}$ is the total R-value of the roof element. If the roof is pitched over a horizontal ceiling with an attic, tw possibilities exist: (1) If the attic is vented RROOF is the total R-value the ceiling alone; (2) If the attic is not vented, RROOF is the sum of the roof contribution, given by equation 5.1, and the ceiling contribution, plus an allowance for the air gap between the two. If the surfaces bounding the attic are non-reflective, use an R-value of 0.6 for the air gap and a value 1.3 if the surfaces are highly reflective.

Worksheet 2 is designed to help the user obtain an estimate of the NLC after completing the schematic design process outlined on Worksheet 1. Alternately, the second worksheet may be used as the starting point on subsequent trial designs as the user iterates to improve the performance of his building.

If the building of interest is a townhouse or other larger structure containing more than one control zone, Worksheet 2 may still be used to estimate the NLC. By including the complete structure in the analysis, as though only one thermal zone were present, one can determine the overall los characteristics of the building and estimate the total size of all solar apertures required to provide a certain level of performance. However, this overall approach does not help the user to partition the solar aperture amon the various thermal zones.

TABLE III. R-Factors of building materials.

| Material and Description | Density (lb/ft$^3$) | R-Value per inch thickness | R-Value for listed thickness |
|---|---|---|---|
| Building boards, panels, flooring | | | |
| Asbestos cement board | 120 | 0.25 | -- |
| Asbestos cement board 1/8-inch | 120 | -- | 0.03 |
| Gypsum or plaster board 3/8-inch | 50 | -- | 0.32 |
| Gypsum or plaster board 1/2-inch | 50 | -- | 0.45 |
| Plywood (see Siding materials) | 34 | 1.25 | -- |
| Sheating, wood fiber | | | |
| (impregnated or coated) 25/32-inch | 20 | -- | 2.06 |
| Wood fiber board (laminated or homogenous) | 26 | 2.38 | -- |
| Wood fiber, hardboard type | 65 | 0.72 | -- |
| Wood fiber, hardboard type 1/4-inch | 65 | -- | 0.18 |
| Wood subfloor 25/32-inch | -- | -- | 0.98 |
| Wood hardwood finish 3/4-inch | -- | -- | 0.68 |
| Building paper | | | |
| Vapor-permeable felt | -- | -- | 0.06 |
| Vapor-seal, 2 layers of mopped 15 lb felt | -- | -- | 0.12 |
| Vapor-seal plastic film | -- | -- | negl. |
| Finish materials | | | |
| Carpet and fibrous pad | -- | -- | 2.08 |
| Carpet and rubber pad | -- | -- | 1.23 |
| Cork tile 1/8-inch | -- | -- | 0.28 |
| Terrazzo 1-inch | -- | -- | 0.08 |
| Tile (asphalt, linoleum, vinyl, rubber) | -- | -- | 0.05 |
| Gypsum board 1/2-inch | -- | -- | 0.45 |
| Gypsum board 5/8-inch | -- | -- | 0.56 |
| Hardwood flooring 25/32-inch | -- | -- | 0.68 |
| Insulating materials | | | |
| Blankets and batts: | | | |
| Mineral wool, fibrous form (from rock, | 0.5 | 3.12 | -- |
| slag, or glass) | 1.5-4.0 | 3.12 | -- |
| Wood fiber | 3.2-3.6 | 4.00 | -- |
| Boards and slabs: | | | |
| Cellular glass 30deg.F | 9 | 2.70 | -- |
| Cork board 30deg.F | 6.5-8.0 | 3.85 | -- |
| 30deg.F | 12 | 3.45 | -- |
| Glass fiber 90deg.F | 4.0-9.0 | 3.85 | -- |
| 30deg.F | | 4.55 | -- |
| Expanded rubber (rigid) 75deg.F | 4.5 | 4.55 | -- |
| Expanded polyurethane (R-11 blown; | | | |
| 1-inch thickness or more) 100deg.F | 1.5-2.5 | 5.56 | -- |
| 25deg.F | | 5.88 | -- |
| Expanded polystyrene, extruded 75deg.F | 1.9 | 3.85 | -- |
| 30deg.F | | 4.17 | -- |

TABLE III. R-Factors of building materials. (Cont.)

| Material and Description | | Density (lb/ft$^3$) | R-Value per inch thickness | R-Value for listed thickness |
|---|---|---|---|---|
| Expanded polystyrene molded beads | 75deg.F | 1.0 | 3.57 | -- |
| | 30deg.F | | 3.85 | -- |
| Mineral fiberboard | | | | |
| Core or roof insulation | | 16-17 | 2.94 | -- |
| Acoustical tile | | 21 | 2.70 | -- |
| Mineral fiberboard, molded acoustical tile | | 23 | 2.38 | -- |
| Wood or cane fiberboard | | | | |
| acoustical tile | 1/2-inch | -- | -- | 1.19 |
| interior finish | | 15 | 2.86 | -- |
| insulating roof deck | 1-inch | -- | -- | 2.78 |
| | 2-inch | -- | -- | 5.56 |
| | 3-inch | -- | -- | 8.33 |
| Shredded wood (cemented, preformed slabs) | | 22 | 1.67 | -- |
| Loose fills: | | | | |
| Macerated paper or pulp | | 2.5-3.5 | 3.57 | -- |
| Mineral wool | 90deg.F | 2.0-5.0 | 3.33 | -- |
| | 30deg.F | | 4.10 | -- |
| Perlite (expanded) | 90deg.F | 5.0-8.0 | 2.63 | -- |
| | 30deg.F | | 2.74 | -- |
| Vermiculite (expanded) | 90deg.F | 7.0-8.2 | 2.08 | -- |
| | 30deg.F | | 2.27 | -- |
| Sawdust or shavings | | 8.0-15 | 2.22 | -- |
| Masonry materials, concretes | | | | |
| Cement mortar | | 116 | 0.20 | -- |
| Gypsum-fiber concrete (87.5 percent gypsum, 12.5 percent concrete) | | 51 | 0.60 | -- |
| Lightweight aggregates | | 120 | 0.19 | -- |
| (expanded shale, clay or slate; | | 100 | 0.28 | -- |
| expanded slags, or cinders; | | 80 | 0.40 | -- |
| pumice; perlite or vermiculite; | | 60 | 0.59 | -- |
| cellular concretes) | | 40 | 0.86 | -- |
| | | 20 | 1.43 | -- |
| Sand and gravel or stone aggregate (oven-dried) | | 140 | 0.11 | -- |
| Sand and gravel or stone aggregate (not-dried) | | 140 | 0.08 | -- |
| Stucco | | 116 | 0.20 | -- |
| Masonry units | | | | |
| Brick, common (typical value) | | 120 | 0.20 | -- |
| Brick, face (typical value) | | 130 | 0.11 | -- |
| Clay tile, hollow | | | | |
| 1 cell deep | 3-inch | -- | -- | 0.80 |
| 1 cell deep | 4-inch | -- | -- | 1.11 |
| 2 cells deep | 6-inch | -- | -- | 1.52 |
| 2 cells deep | 8-inch | -- | -- | 1.85 |
| 3 cells deep | 10-inch | -- | -- | 2.22 |
| 3 cells deep | 12-inch | -- | -- | 2.50 |

TABLE III. R-Factors of building materials. (Cont.)

| Material and Description | | Density (lb/ft³) | R-Value per inch thickness | R-Value for listed thickness |
|---|---|---|---|---|
| Concrete block, 3 oval core | | | | |
| Sand and gravel aggregate | 4-inch | -- | -- | 0.71 |
| | 8-inch | -- | -- | 1.11 |
| | 12-inch | -- | -- | 1.28 |
| Cinder aggregate | 3-inch | -- | -- | 0.86 |
| | 4-inch | -- | -- | 1.11 |
| | 8-inch | -- | -- | 1.72 |
| | 12-inch | -- | -- | 1.89 |
| Lightweight aggregate | 3-inch | -- | -- | 1.27 |
| (expanded shale, clay or slate | 4-inch | -- | -- | 1.50 |
| or slag; pumice) | 8-inch | -- | -- | 2.00 |
| | 12-inch | -- | -- | 2.72 |
| Concrete blocks, rectangular core | | | | |
| Sand and gravel aggregate | | | | |
| 2 core, 36 lb[*] | 8-inch | -- | -- | 1.04 |
| same, filled cores[**] | | -- | -- | 1.93 |
| Lightweight aggregates | | | | |
| 3 core, 19 lb[*] | 6-inch | -- | -- | 1.65 |
| same, filled cores[**] | | -- | -- | 2.99 |
| 2 core, 24 lb[*] | 8-inch | -- | -- | 2.18 |
| same, filled cores[**] | | -- | -- | 5.03 |
| 3 core, 38 lb[*] | 12-inch | -- | -- | 2.48 |
| same, filled cores[**] | | -- | -- | 5.82 |
| Stone, lime or sand | | -- | 0.08 | -- |
| Granite, marble | | 150-175 | 0.05 | -- |
| Adobe | 10-inch | -- | -- | 2.78 |
| | 14-inch | -- | -- | 3.89 |
| Plastering Materials | | | | |
| Cement plaster, sand aggregate | | 116 | 0.20 | -- |
| Gypsum plaster | | | | |
| Lightweight aggregate | 1/2-inch | 45 | -- | 0.32 |
| Lightweight aggregate | 3/8-inch | 45 | -- | 0.39 |
| Same, on metal lath | 3/4-inch | -- | -- | 0.47 |
| Perlite aggregate | | 45 | 0.67 | -- |
| Sand aggregate | | 105 | 0.18 | -- |
| Same, on metal lath | 3/4-inch | -- | -- | 0.10 |
| Same, on wood lath | 3/4-inch | -- | -- | 0.40 |
| Vermiculite aggregate | | 45 | 0.59 | -- |
| Roofing materials | | | | |
| Asbestos-cement shingles | | 120 | -- | 0.21 |
| Asphalt roll roofing | | 70 | -- | 0.15 |
| Built-up roofing | 3/8-inch | 70 | -- | 0.44 |
| Slate roofing | 1/2-inch | -- | -- | 0.05 |
| Wood shingles | | -- | -- | 0.94 |

TABLE III. R-Factors of building materials. (Cont.)

| Material and Description | Density (lb/ft$^3$) | R-Value per inch thickness | R-Value for listed thickness |
|---|---|---|---|
| Built-up roofing | -- | -- | 0.33 |
| Siding materials | | | |
| Shingles | | | |
| Asbestos-cement | 120 | -- | 0.21 |
| Wood, 16-inch with 7-1/2-inch exposure | -- | -- | 0.80 |
| Wood, double 16-inch width with 12-inch exposure | -- | -- | 1.19 |
| Wood, plus insulating backer board 6/16-inch | -- | -- | 1.40 |
| Siding | | | |
| Asbestos-cement lapped 1/4-inch | -- | -- | 0.21 |
| Asphalt roof siding | -- | -- | 0.15 |
| Asphalt insulating siding 1/2-inch | -- | -- | 1.46 |
| Wood, drop (1-inch X 8-inch) | -- | -- | 0.79 |
| Wood, drop (1/2-inch X 8-inch lapped) | -- | -- | 0.81 |
| Wood, bevel (3/4-inch X 10-inch lapped) | -- | -- | 1.05 |
| Plywood, lapped 3/8-inch | -- | -- | 0.59 |
| Plywood 1/4-inch | -- | -- | 0.31 |
| 3/8-inch | -- | -- | 0.47 |
| 1/2-inch | -- | -- | 0.62 |
| 5/8-inch | -- | -- | 0.78 |
| 3/4-inch | -- | -- | 0.94 |
| Stucco | 116 | 0.20 | -- |
| Sheathing, insulating board 1/2-inch | -- | -- | 1.32 |
| (regular density) 25/32-inch | -- | -- | 2.04 |
| Woods | | | |
| Hardwoods (maple, oak) | 45 | 0.91 | -- |
| Softwoods (fir, pine) | 32 | 1.25 | -- |
| 25/32-inch | 32 | -- | 0.98 |
| 1-5/8-inch | 32 | -- | 2.03 |
| 2-5/8-inch | 32 | -- | 3.28 |
| 3-5/8-inch | 32 | -- | 4.55 |
| Particle board | | | |
| Low density, 37 lb/ft$^3$ 1-inch | -- | -- | 1.85 |
| Medium density, 50 lb/ft$^3$ 1-inch | -- | -- | 1.06 |
| High density, 62.5 lb/ft$^3$ 1-inch | -- | -- | 0.85 |
| Wood doors, solid core 1-inch | -- | -- | 1.56 |
| 1-1/4-inch | -- | -- | 1.82 |
| 1-1/2-inch | -- | -- | 2.04 |
| 2-inch | -- | -- | 2.33 |

[*]Weights of blocks approximately 7-5/8-inch high by 15-3/8-inch long.

[**]Vermiculite, perlite, or mineral wool insulation.

TABLE IV. R-values of air films and air spaces.

| Type and Orientation of Air Film | Direction of Heat Flow | R-value for Air Film on: Non-reflective surface | Fairly reflective surface | Highly reflective surface |
|---|---|---|---|---|
| Still air: | | | | |
| Horizontal | up | 0.61 | 1.10 | 1.32 |
| Horizontal | down | 0.92 | 2.70 | 4.55 |
| 45deg. slope | up | 0.62 | 1.14 | 1.37 |
| 45deg. slope | down | 0.76 | 1.67 | 2.22 |
| Vertical | across | 0.68 | 1.35 | 1.70 |
| Moving air: | | | | |
| 15 mph wind | any[*] | 0.17 | -- | -- |
| 7.5 mph wind | any[**] | 0.25 | -- | -- |

| Orientation & Thickness of Air Space | Direction of Heat Flow | R-value for Air Space Facing: Non-reflective surface | Fairly reflective surface | Highly reflective surface |
|---|---|---|---|---|
| Horizontal 1/4" | up[*] | 0.87 | 1.71 | 2.23 |
| 4" | | 0.94 | 1.99 | 2.73 |
| 3/4" | up[**] | 0.76 | 1.63 | 2.26 |
| 4" | | 0.80 | 1.87 | 2.75 |
| 3/4" | down[*] | 1.02 | 2.39 | 3.55 |
| 1-1/2" | | 1.14 | 3.21 | 5.74 |
| 4" | | 1.23 | 4.02 | 8.94 |
| 3/4" | down[**] | 0.84 | 2.08 | 3.25 |
| 1-1/2" | | 0.93 | 2.76 | 5.24 |
| 4" | | 0.99 | 3.38 | 8.03 |
| 45deg. slope 3/4" | up[*] | 0.94 | 2.02 | 2.78 |
| 4" | | 0.96 | 2.13 | 3.00 |
| 3/4" | up[**] | 0.81 | 1.90 | 2.81 |
| 4" | | 0.82 | 1.98 | 3.00 |
| 3/4" | down[*] | 1.02 | 2.40 | 3.57 |
| 4" | | 1.08 | 2.75 | 4.41 |
| 3/4" | down[**] | 0.84 | 2.09 | 3.34 |
| 4" | | 0.90 | 2.50 | 4.36 |
| Vertical 3/4" | across[*] | 1.01 | 2.36 | 3.48 |
| 4" | | 1.01 | 2.34 | 3.45 |
| 3/4" | across[**] | 0.84 | 2.10 | 3.28 |
| 4" | | 0.91 | 2.16 | 3.44 |

One side of the air space is a non-reflective surface.

[*]Winter conditions.

[**]Summer conditions.

A more accurate and general approach for multi-zone structures involves calculating the NLC separately for each control zone in the structure. In order to implement this approach, the user must apply Worksheet 2 for each control zone, bearing in mind the following differences in interpretation:

a. Floors, ceilings, or walls that separate one control zone from another should be excluded from the summation of terms that contribute to the NLC. This procedure is equivalent to assuming there is no heat transfer between zones.
b. The total perimeter of each control zone is calculated as before by taking the combined length of all external walls of all floors. In this case, however, the perimeter of each floor will not necessarily form a closed loop because walls that separate control zones (these walls are always internal) must be excluded.

In summary, Worksheet 2 may be used to obtain an estimate of the total NLC of any structure or, applying the above constraints, to find the component NLC of any zone in a complex structure.

5.1.2 Calculation of the EHC and the DHC. The EHC of any direct gain or radiant panel building with multiple thermal storage elements is given by:

$$EHC = \frac{45.5\,[1 - e^{-0.22\,(A_m/A_c)}]}{(A_m/A_c)}$$

$$\sum_{i=1}^{N} A_i \text{ [multiplied by] } s_i \text{ [multiplied by] } EF_i \qquad \text{(Equation 5.2)}$$

where the indicated summation is taken over the N thermal storage elements. The total mass surface area ($A_m$) equals the sum of the individual surface areas ($A_i$) of the mass elements in the building, or:

$$A_m = \sum_{i=1}^{N} A_i \qquad \text{(Equation 5.3)}$$

The quantity $s_i$ in equation 5.2 is a heat capacity scale factor that is related to the material properties of element i through the relation:

$$s_i = 1.95\,[\text{SQRT}\,[\text{rho}]_i c_i] \qquad \text{(Equation 5.4)}$$

where $[\text{rho}]_i$ and $c_i$ are the density and specific heat, respectively, of the material in element i. The quantity $EF_i$ is the EHC thickness function for element i and is plotted as a function of x, the dimensionless thickness in figure 25. The dimensionless thickness of element i is:

$$x_i = 0.362 \text{ [multiplied by] } 1_i \text{ [multiplied by] } [\text{SQRT}\,[\text{rho}]_i c_i / k_i] \qquad \text{(Equation 5.5)}$$

where $1_i$ is the thickness, in feet, of element i and $k_i$ is its thermal conductivity. In order to determine the EHC of a building, calculate $x_i$ for each element and determine the associated values of $EF_i$ from figure 25. Then, multiply each thickness function by the heat capacity scale factor ($s_i$) and the mass area ($A_i$) and sum the results. Then, substitute the summation into equation 5.2. Mass elements not located in direct gain zones should be included in the EHC calculation if the zones are convectively coupled to the solar rooms. However, convectively coupled mass is not as effective as radiatively coupled mass. Therefore, the thickness function for convectively coupled mass elements should be multiplied by 0.4 before summing with the other contributions.

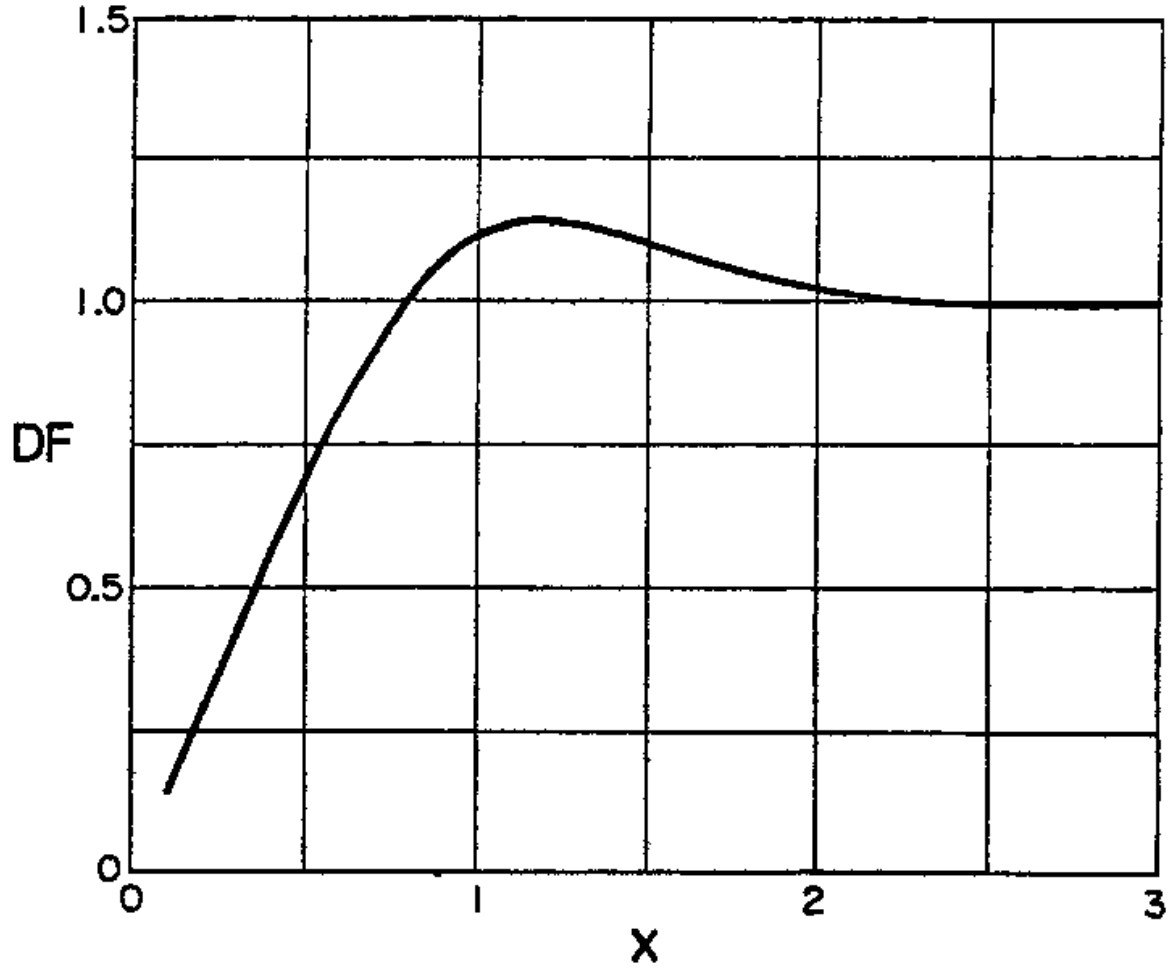



FIGURE 26. The DHC thickness function (DF) vs x.

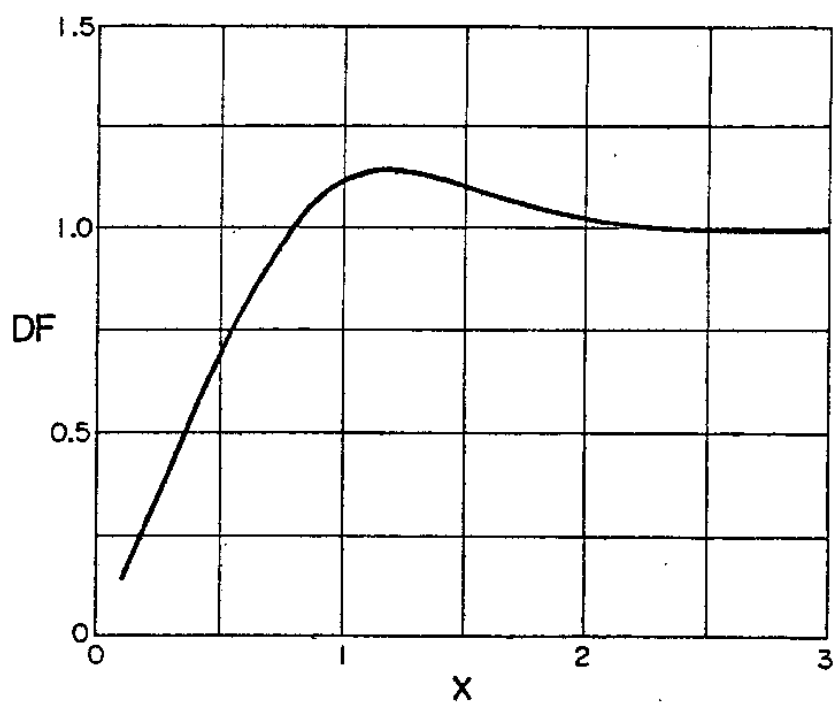



FIGURE 26. The DHC thickness function (DF) vs x.

It is usually not necessary to account for the heat storage contribution of all surfaces in a direct gain zone. Frequently, the thermal storage effect is dominated by one or two relatively thick layers of high density masonry material. A wooden frame structure on a concrete floor slab, for example, can be accurately modeled by including only the concrete slab in the EHC calculation. For the special case in which one thermal storage element dominates the building reponse, the EHC given by equation 5.2 reduces to:

$$EHC = 45.5\ [1 - e^{-0.22\ (A_m/A_c)}]\ \text{[multiplied by]}\ s\ \text{[multiplied by]}\ EF \qquad \text{(Equation 5.6)}$$

The diurnal heat capacity of a building is given by:

$$DHC = \sum_{i=1}^{N} A_i\ \text{[multiplied by]}\ s_i\ \text{[multiplied by]}\ DF_i \qquad \text{(Equation 5.7)}$$

where, again, the summation is carried out over the N thermal storage elements in the building. The quantity $DF_i$ is the DHC thickness function and is plotted as a function of x in figure 26. When the DHC is used to determine the time constant of a particular building or set of rooms comprising a single thermal zone, all massive elements contained in the zone, whether in a solar room or not, should be included in the summation. In applications that involve determination of temperature swings in solar rooms, all elements that are radiatively coupled to the solar source (as in rooms having direct gain apertures or radiant panels) should be included in the summation; contributions from mass elements that are convectively coupled to the solar source are included in the summation only after multiplying their DHC thickness functions by 0.4. If only one radiating coupled mass element is contained in the thermal zone of interest, the DHC given by equation 5.7 reduces to:

$$DHC = A_m\ \text{[multiplied by]}\ s\ \text{[multiplied by]}\ DF \qquad \text{(Equation 5.8)}$$

5.1.3 System parameters. Tables of system parameters for a large set of reference designs are presented in Appendix A. The reference designs include direct gain buildings, radiant panels, thermosiphoning air panels, unvented Trombe walls, vented Trombe walls, water walls, concrete block walls, and sunspaces. The system parameters include the scale factor (F), the effective aperture conductance (G), the steady state aperture conductance ($U_c$) and the effective aperture absorptance ([alpha]). For those systems with interior mass, $DHC/A_c$ is included and, for direct gain buildings and radiant panels, $EHC/A_c$ is also specified. The user must select the reference design that most closely resembles his own and use the associated parameters from Appendix A in the subsequent design analysis.

The characteristics of the reference designs will be discussed by system type in the subsections that follow. However, some of the design characteristics are common to all systems and these common properties are listed in table V.

5.1.3.1 Direct gain buildings. A set of 81 reference direct gain designs are included in Appendix A. The 81 designs were selected by choosing three appropriate values for each of the four principal design variables and

allowing all possible combinations of those variables (Note: 3 x 3 x 3 x 3 = 81 combinations). The principal design variables and associated values are:

$A_m/A_c$ = 3, 6, 9

THICK = 2, 4, 6 (inches)

R-value = 0, 4, 9 (deg.F-$ft^2$-hr/Btu)

NGL = 1, 2, 3

where $A_m/A_c$ is the ratio of the thermal storage mass surface area to the solar collection area, THICK is the thermal storage mass thickness in inches, R-value is the thermal resistance of the solar aperture with night insulation in place, and NGL is the number of glazings in the aperture.

The thermal storage mass in the direct gain systems is high density concrete with the following properties:

| | | | | |
|---|---|---|---|---|
| density | [rho] | = | 150 | lb/$ft^3$ |
| specific heat | c | = | 0.2 | Btu/lb-deg.F |
| thermal conductivity | k | = | 1.0 | Btu/deg.F-$ft^2$-hr |

The concrete is assigned a solar absorptance of 0.8 and an infrared emittance of 0.9. Twenty percent of the transmitted and internally reflected solar radiation is assumed to be absorbed on non-massive surfaces and rapidly convected to the room air.

Properties of other building materials that can provide thermal storage are listed in table VI. Any of these other materials can be substituted for the concrete in the reference designs. The procedure is to simply select the reference design that has an EHC closest to the design under consideration and the same NGL and R-value. It is not necessary to match the parameters THICK or $A_m/A_c$. If the contemplated design does not have an EHC close to one of the reference values, linear interpolation may be employed on the values of F and G.

If interpolation on the EHC is used to determine F and G, then $U_c$ is read from either of the reference designs involved in the interpolation. (The values of $U_c$ will be identical because both systems involved must have the desired NGL and R-value.) The best estimate of [alpha] is obtained from the reference design having the desired NGL and an $A_m/A_c$ ratio closest to the design under consideration.

The effect on performance of decorative coverings placed over mass surfaces is included in the analysis by multiplying the EHC by the factor:

[alpha]/(1.31 [multiplied by] $R_d$ + 0.8) , (Equation 5.9)

where $R_d$ is the thermal resistance or R-value of the decorative covering and [alpha] is the solar absorptance of its surface; this factor was derived on the basis of steady state energy balance research reported in the ASHRAE Journal.

TABLE V. Reference design characteristics.

| | |
|---|---|
| **Glazing Properties** | |
| Transmission characteristics | diffuse |
| Orientation | south |
| Index of refraction | 1.526 |
| Extinction coefficient | 0.5 in.$^{-1}$ |
| Thickness of each pane | 1/8 in. |
| Air gap between panes | 1/2 in. |
| **Thermal Control** | |
| Room temperature | 65deg.F to 75deg.F |
| Internal heat generation | none |
| **Night Insulation** | |
| Thermal resistance | R-4 or R-9 |
| In place, solar time | 5:30 p.m. to 7:30 a.m. |
| **Solar Radiation Assumptions** | |
| Shading | none |
| Ground diffuse reflectance | 0.3 |

TABLE VI. Properties of building materials (from ASHRAE Handbook and Produ Directory, 1977 Fundamentals).

| Material | Density, [rho] lb/ft$^3$ | Specific Heat, c (Btu/lb-deg.F) | Thermal conductivity, k (Btu/deg.F-ft-hr) | [r |
|---|---|---|---|---|
| Magnesite Brick | 158 | 0.22 | 2.20 | 76 |
| Marble | 162 | 0.21 | 1.50 | 51 |
| Concrete (high density reference) | 150 | 0.20 | 1.00 | 30 |
| Plaster | 132 | 0.43 | 0.42 | 23 |
| Chrome brick | 200 | 0.17 | 0.67 | 22 |
| Fireclay brick | 112 | 0.20 | 0.58 | 13 |
| Concrete (stone) | 144 | 0.16 | 0.54 | 12 |
| Concrete (lightweight aggregate) | 120 | 0.21 | 0.43 | 10 |
| Brick, building | 123 | 0.20 | 0.40 | 9 |
| Adobe | | | 0.38 | 6 |
| Sand | 95 | 0.19 | 0.19 | 3 |
| Gypsum board | 50 | 0.26 | 0.10 | 1 |

[*]Private communication from J. C. Hedstrom, Los Alamos National Laboratory. Adobe absorbs moisture readily, and properites can vary widely with moisture content. The thermal conductivity is particularly sensitive.

If multiple storage elements are present, the appropriate correction factor must be applied to each element individually. R-values for finish materials are included in table III and solar absorptances are available in table VII which, though not specfically directed at finish materials, does indicate the variation of [alpha] with color. For convectively coupled mass elements, set [alpha] equal to 0.8, the reference design value, regardless of surface color.

5.1.3.2 Radiant panels. Three reference designs are available for simple radiant panels. Double glazing is used in all cases. The distance between the inner glazing and the metal absorber plate is 1-inch and the plate has a solar absorptance of 0.95 and an infrared emittance of 0.9. The thermal storage medium is high density concrete. The concrete thickness is 4 inches and the area ratio may be 3, 6, or 9. System parameters, including the EHC are provided in Appendix A. Systems may be analyzed with other thermal storage materials or configurations by employing the EHC as described in 5.1.3.1. For radiant panels, however, the [alpha] in equation 5.4 is the infrared absorptance ($[alpha]_{ir}$) rather than the solar absorptance. Therefore, to correct for the presence of decorative coverings, use the formula:

$[alpha]_{ir}/(1.48$ [multiplied by] $R_{d} + 0.9)$ (Equation 5.10)

The infrared absorptance of most building or finish materials is about 0.9.

5.1.3.3 Thermosiphoning air panels. There are 18 reference designs for TAP systems that include both single and double glazed apertures. The solar absorptance of the metal panel is 0.95 and the infrared emittance is 0.9. The thermal storage medium is high density concrete and all combinations of 2, 4, and 6 inch thicknesses with $A_{m}/A_{c}$ ratios of 3, 6, and 9 are available. The flow channel depth is 3.5 inches and, for the backflow systems, the absorber surface is 1 inch behind the inner glazing. The upper and lower vents are 8 feet apart and have a total area equal to 6 percent of the panel area.

The R-value of insulation between the back of the flow channel and the room air (RTAP) is R-11. If any other value is desired for RTAP, one has only to calculate the effective aperture conductance and the steady state aperture conductance from the following equations:

$G = 24/[RTAP + K_{b} + (NGL - 1) + 3.7]$ (Equation 5.11)

$U_{c} = G/24$ (Equation 5.12)

where $K_{b}$ is a parameter whose value is one for a backflow system and zero otherwise. The scale factor (F) does not vary with RTAP or $K_{b}$ but is dependent on NGL. Note that the correlations presented in Appendix A are for frontflow systems with RTAP = 11. For backflow systems, $e_{d} = 0.58$ for single glazed systems and $e_{d} = 0.69$ for double glazed systems.

5.1.3.4 Trombe walls. The Trombe wall reference designs are split into two subcategories: vented and unvented. For both subcategories, the parameters that are varied among the Trombe wall reference designs are the thermal storage capacity (expressed also in terms of wall thicknesses varying from 6 to 18 inches), the number of glazings (1, 2, or 3), the wall surface (flat black or selective), night insulation (none or R-9), and the masonry

TABLE VII. Solar absorptance of various materials.*

| Material | Solar Absorptance |
|---|---|
| Flat black paint | 0.95 |
| Black lacquer | 0.92 |
| Dark gray paint | 0.91 |
| Black concrete | 0.91 |
| Dark blue lacquer | 0,91 |
| Black oil paint | 0.90 |
| Stafford blue bricks | 0.89 |
| Dark olive drab paint | 0.89 |
| Dark brown paint | 0.88 |
| Dark blue-gray paint | 0.88 |
| Azure blue or dark green lacquer | 0.88 |
| Brown concrete | 0.85 |
| Medium brown paint | 0.84 |
| Medium light brown paint | |
| Brown or green lacquer | 0.79 |
| Medium rust paint | 0.78 |
| Light gray oil paint | 0.75 |
| Red oil paint | 0.74 |
| Red bricks | 0.70 |
| Uncolored concrete | 0.65 |
| Moderately light buff bricks | 0.60 |
| Medium dull green paint | 0.59 |
| Medium orange paint | 0.58 |
| Medium yellow paint | 0.58 |
| Medium blue paint | 0.51 |
| Medium Kelly green paint | 0.51 |
| Light green paint | 0.47 |
| White semi-gloss paint | 0.30 |
| White gloss paint | 0.25 |
| Silver paint | 0.25 |
| White lacquer | 0.21 |

*This table is meant to serve as a guide only. Variations in texture, tone, overcoats, pigments, etc., can vary these values.

properties ([rho]ck products of 7.5, 15, or 30, where 30 corresponds to the high density concrete used in the reference designs of other system types). The 21 combinations of these parameters used for both the vented and unvented Trombe wall reference designs are presented in Appendix A.

Certain characteristics of the Trombe wall reference designs are fixed. These fixed characteristics are listed in table VIII.

TABLE VIII. Trombe wall reference design characteristics.

| | |
|---|---|
| Optical Properties | |
| Solar absorptance of wall surface (black) | 0.95 |
| Solar absorptance of selective surface | 0.90 |
| Infrared emittance of wall surface | 0.90 |
| Infrared emittance of selective surface | 0.10 |
| Thermocirculation vents | |
| Total vent area (percent of wall area) | 6 |
| Vertical separation of vents (feet) | 8 |

5.1.3.5 Water walls. The parameters varied in the water wall reference designs are the thermal storage capacity or wall thickness (3, 6, 9, 12, 18, or 24 inches), the number of glazings (1, 2, or 3), the optical properties of the wall surface (flat black or selective), and the night insulation (none or R-9). The optical properties for the flat black and selective surface walls are the same as those specified for Trombe walls in table VIII. system parameters for fifteen reference designs are presented in Appendix A.

5.1.3.6 Concrete block walls. Eight reference designs for unvented thermal storage walls constructed of 8-inch x 8-inch x 16-inch concrete building blocks are provided in Appendix A. The concrete blocks used to develop the correlations weighed about 25 pounds each and had two hollow rectangular cores. The eight reference designs include single and double glazed systems with and without mortar filling in the cores; the systems may employ R-9 night insulation or none. The optical properties of the surface are the same as for a flat black Trombe wall as specified in table VIII.

The concrete block wall reference designs include secondary thermal storage mass in the floor. The floor is 4-inch thick high density concrete and has an area three times the size of the glazed block wall. The massive floor was included in the reference designs to more realistically represent typical concrete block building construction.

5.1.3.7 Sunspaces. The principal sunspace glazing is assumed to face due south. Thus, wall locations are referred to by the compass directions: the principal glazing is the south wall, the principal common wall is the north wall, and the end walls are the east and west walls.

Two types of sunspaces are defined according to the degree of integration with the rest of the building. One type is the attached sunspace, whose north wall is common with adjoining rooms and 30-feet wide in the east-west direction. The other type is the semi-enclosed sunspace that has three common walls, the north, the east, and the west. The semi-enclosed sunspaces are 24-feet wide (east-west) and 12-feet deep (north-south). The north common wall is 9-feet high in all reference designs.

One geometrical shape of the attached sunspace and two of the semi-enclosed sunspace are treated. The attached sunspace has a single plane of glazing on the south wall, tilted up from the horizontal by 50 degrees. The two semi-enclosed geometries are: (1) a single, vertical plane of glazing on the south wall, and (2) a single 50-degree tilted plane of glazing on the south wall. These three geometrical configurations are illustrated in figure 27.

The reference designs include two types of common wall between the sunspace and the adjacent building. One is lightweight and insulated, corresponding to a frame wall with a thermal resistance of R-20; and one is uninsulated 12-inch thick high density concrete as used in the direct gain designs. In the lightweight wall configuration, there is a row of water containers in the sunspace for thermal storage. The row extends the full east-west width of the sunspace. The containers are twice as high as they are deep. The water volume is 1 $ft^3/ft^2$ of common wall area. The containers are on the sunspace floor immediately adjacent to the common wall and are thermally coupled to the wall and floor by radiation and convection through the sunspace air.

Both wall configurations include thermocirculation vents in the common wall whose areas total 6 percent of the north wall area. The vent centers are separated by a height of 8 feet. There is no reverse thermocirculation.

For each geometry and wall configuration, movable insulation may or may not be applied at night to the sunspace glazing. When used, the night insulation has a thermal resistance of R-9 and is in place from 5:30 p.m. to 7:30 p.m. solar time. The end walls of the sunspace are insulated to R-20 and have no glazing.

The sunspace floor is a 6-inch thick slab of masonry material with a thermal conductivity of 0.5 Btu/deg.F-ft-hr and a volumetric heat capacity of 30 $Btu/ft^3$. There is conduction through underlying soil to a fixed temperature deep in the earth and through perimeter insulation to the ambient air.

The surfaces of the common wall on the sunspace side have solar absorptance of 0.7 if they are lightweight and 0.8 if they are masonry. The water containers have a solar absorptance of 0.9. The sunspace floor has a solar absorptance of 0.8. The other surfaces (ceiling and end walls) have solar absorptance of 0.3.

A sunspace infiltration rate of 0.5 air changes per hour is assumed in all reference designs. Auxiliary heating prevents the sunspace temperature from falling below 45deg.F and ventilation is assumed to limit the maximum sunspace temperature to 95deg.F if possible.

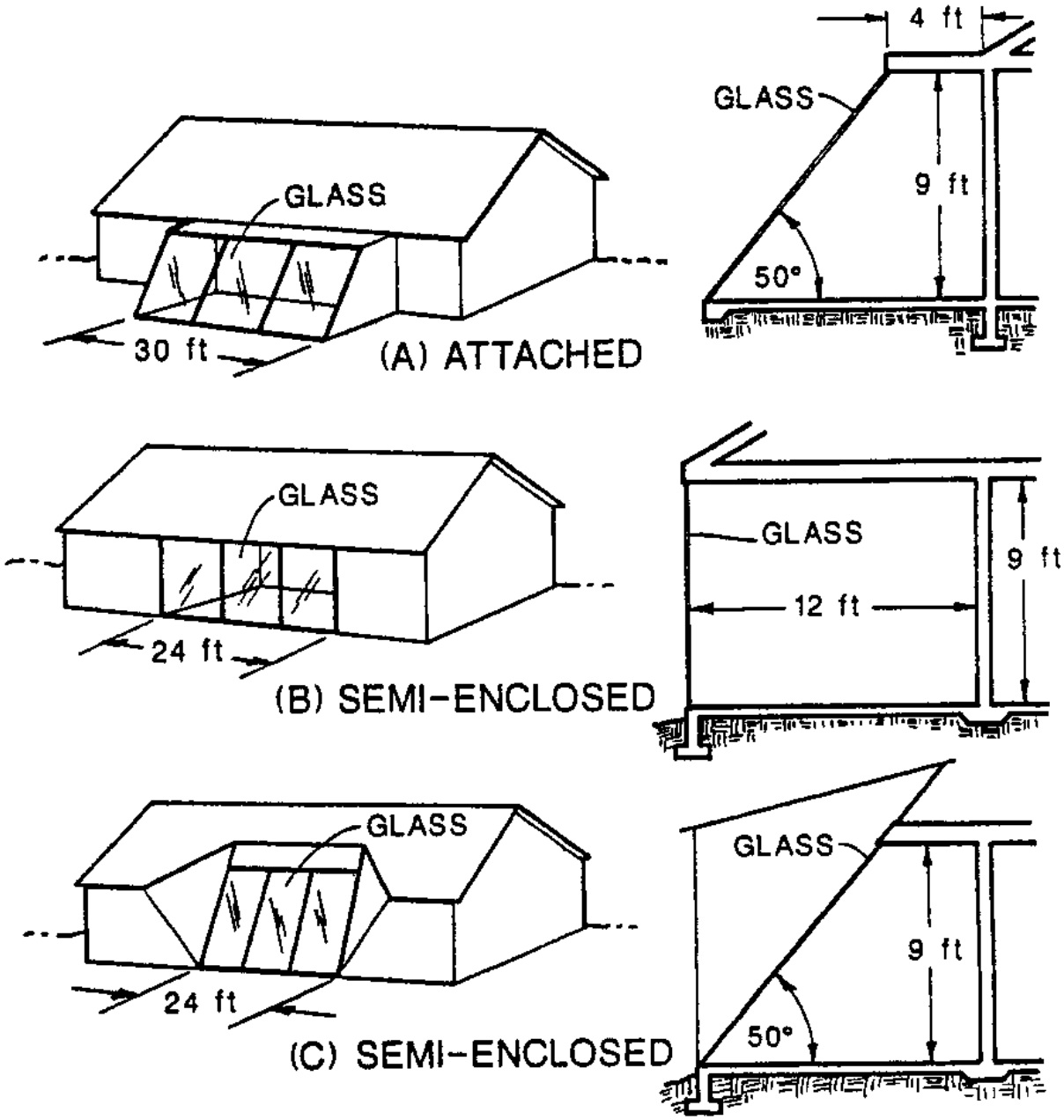



**FIGURE 27.** **Sunspace geometries (not to scale).**

The system parameters F, G, $U_{[c]}$, and [alpha] are listed in Appendix A for 16 reference sunspace designs. Minor variations from the geometry, optical properties, and insulation R-values specified in the preceeding paragraphs will not greatly effect system performance. To maintain high performance use plenty of thermal storage mass with a high solar absorptance, light colors on lightweight surfaces, and high R-values on east and west walls and on insulated common walls. The effect of sunspace glazing tilt may be included in the performance analysis process as will be described later. Remember that sunspace analysis is conducted in terms of the projected area of the solar aperture ($A_{[p]}$) rather than the actual area.

5.1.4 System parameter worksheet. Worksheet 3 is provided to help keep track of the various system parameters that must be calculated or obtained from Appendix A. Note that the worksheet allows for the presence of two passive solar heating systems on a building and provides formulas for calculating the properties of the resulting mixed system.

The first step in filling out the worksheet is to calculate the thermal storage characteristics of the building. For direct gain or radiant panel systems, the EHC must be determined. If the thermal storage mass properties and configuration correspond closely to one of the reference designs in Appendix A, simply enter the specified $EHC/A_{c}$ in the indicated blank on the worksheet; the diurnal heat capacity per $ft^2$ of aperture, $DHC/A_{c}$, is then found from the same reference design. Otherwise, it will be necessary to calculate the EHC and the DHC as described in 5.1.2 and to evaluate $DHC/A_{c}$ as outlined below.

Among the remaining reference designs, only TAPS and concrete block Trombe walls have specified levels of interior mass. For the concrete block Trombe walls, the interior mass provides secondary thermal storage to the wall itself and only one representative level is treated (high density concrete with a thickness of 4 inches and a surface area three times greater than the block wall area). The TAP reference designs have the same interior mass options available for direct gain systems. The DHCs for concrete block walls and TAPs are specified in Appendix A for the reference designs.

After entering values of the $EHC/A_{c}$ and $DHC/A_{c}$ on Worksheet 3, proceed to the first (or only) set of system parameters. Enter the system type and number (from Appendix A). If interpolation on the EHC has been employed, enter the numbers of both systems involved. Then enter the first set of system parameters on the worksheet. Finally, enter the size of the first solar collection aperture (using projected area for sunspaces).

If two types of passive solar systems are present on the building, proceed to the next part of the worksheet and enter a second set of parameters. Next, calculate the area fractions of the two systems and use the formulas provided on the worksheet to calculate the parameters for the mixture.

5.1.5 Effective thermostat setpoint. Auxiliary heat consumption can often be reduced significantly by setting back the thermostat at night. In order to include this strategy in our design analysis calculations, it is necessary to determine the effective thermostat setpoint, $T_{e}$, for use in the base temperature calculation.

The first step is to calculate the average thermostat setting from the following equation:

$$T_{ave} = T_{1}(hr_{1}/P) + T_{2}(hr_{2}/P) \qquad \text{(Equation 5.13)}$$

where $T_{1}$ and $hr_{1}$ are the temperature and duration (in hours) of the first setting, $T_{2}$ and $hr_{2}$ are the temperature and duration of the second setting, and P is the period of the diurnal cycle (24 hours).

Next, determine the building time constant given by:

$$[tau] = 24 \text{ [multiplied by] } DHC/(NLC + 24 \text{ [multiplied by] } U_{\lceil c \rceil} \text{ [multiplied by] } A_{\lceil c \rceil}) \qquad \text{(Equation 5.14)}$$

All parameters in this equation are available from the first three worksheets.

Finally, the effective thermostat setpoint is obtained from the relation:

$$T_{\lceil e \rceil} = T_{\lceil 1 \rceil} - e^{\lfloor -0.1[tau]/P \rfloor} (T_{\lceil 1 \rceil} - T_{\lceil ave \rceil}) \qquad \text{(Equation 5.15)}$$

Use $T_{\lceil e \rceil}$ in place of $T_{\lceil set \rceil}$ whenever a night time setback strategy is employed.

5.1.6 Base temperature worksheet. Worksheet 4 is provided to help the user determine the base temperature for either a constant thermostat setting or for a night time setback strategy as outlined in the preceeding section. All of the equations needed are provided on the worksheet. Remember that $Q_{\lceil int \rceil}$ is the internal heat generation rate in Btu/day by people, lights, and appliances. Unless other information is available, use $Q_{\lceil int \rceil}$ = 20,000 Btu/day per occupant.

5.1.7 Weather parameters. Having recorded the NLC on Worksheet 2, the system parameters (F, G, $U_{\lceil c \rceil}$, and [alpha]) on Worksheet 3, and the base temperature on Worksheet 4, evaluate the weather parameters that are needed for design analysis of passive solar heating systems. The required parameters are the transmitted radiation to degree day ratio (VTn/DD) and the city parameter (a). These quantities are tabulated for 210 cities in the continental United States in Appendix B. Provision is made for obtaining parameter values for single, double, or triple glazed systems operating at base temperatures ranging from 30deg.F to 80deg.F. The solar aperture may depart from true south by 60 degrees to the east or west and may be tilted 60 degrees from the vertical. Use of the tables in Appendix B is discussed in the following subsections.

5.1.7.1 Transmitted radiation to degree day ratio. First, locate the city of interest in Appendix B. The locations are alphabetized, first by state and second by city within each state. Next, locate the column with the appropriate value of the base temperature $T_{\lceil b \rceil}$. Base temperatures ranging from 30deg.F to 80deg.F are provided; interpolation may be required. Having located the correct column, read and record the value from the row labeled VT1/DD, VT2/DD, or VT3/DD, depending on whether the system of interest is single, double, or tripled glazed. (Note: The minimum monthly value of VTn/DD is tabulated in these columns and the reference month (m) is indicated in parentheses.) If the symbol NA (not applicable) appears, it is an indication that, for the specified base temperature, solar heating is not required.

5.1.7.2 City parameter. The city parameter (a) is obtained from the same column in which VTn/DD was found; again, interpolation may be required. The number is read from the row marked "PARAMETER A" under the reading "SOUTH-VERT". The adjustment required for off-south or tilted apertures is discussed next.

5.1.7.3 Off-south or tilted apertures. If the orientation of the solar aperture is not due south and vertical, the weather parameters must be corrected according to the following equations:

$$a = a_{\lceil o \rceil}[1 + A1([theta]/100) + A2([theta]/100)^{\lfloor 2 \rfloor} + A3([theta]/100)^{\lfloor 2 \rfloor}([psi]/100) + A4([psi]/100) + A5([psi]/100)^{\lfloor 2 \rfloor}] \quad , \qquad \text{(Equation 5.16)}$$

$$VTn/DD = (VTn/DD)_{\lceil o \rceil}[1 + B1([theta]/100) + B2([theta]/100)^{\lfloor 2 \rfloor} + B3([theta]/100)^{\lfloor 2 \rfloor}([psi]/100) + B4([psi]/100) + B5([psi]100)^{\lfloor 2 \rfloor}] \quad , \qquad \text{(Equation 5.17)}$$

where $a_{\lceil o \rceil}$ and $(VTn/DD)_{\lceil o \rceil}$ are the south-vertical values. The coefficients, A1 through A5 and B1 through B5, are obtained from labeled rows in the weather tables in the column having the desired base temperature. Interpolation between two base temperatures may be necessary. The angle [theta] is the azimuth of a normal to the aperture with due south taken as zero and east as positive. The angle [psi] is the tilt of the aperture relative to a vertical position, i.e., [psi] is zero for a vertical aperture. Equations 5.11 and 5.12 are applicable to azimuths of up to +/-60 degrees and tilts of up to 60 degrees.

5.1.8 Weather parameter worksheet. Worksheet 5 is provided to guide the user through the process of obtaining and recording weather data needed for design analysis. The first part of the worksheet calls for data about the building location and the annual heating degree days. The next two parts are parallel and provided a step by step procedure for calculating the weather parameters needed for each of two separate passive solar heating systems that may serve the building. If only one system is present, make only one set of entries on the worksheet. Also, if two systems that have the same number of glazings, the same orientation, and the same tilt are present, only one set of entries on the worksheet is required.

Finally, the last part of the worksheet provides equations for calculating the mixed system weather parameters in the event two non-similar systems are present. Record the results of these calculations in the indicated blanks.

5.1.9 Auxiliary heat consumption worksheet. Determination of the auxiliary heat requirements is outlined on Worksheet 6. First, the scaled solar load ratio of the system is calculated on the basis of parameters previously recorded on Worksheets 2, 3, 4, and 5. The annual heat to load ratio is read off the nomograph in figure 23 using the calculated value of the scaled solar load ratio and the city parameter recorded on Worksheet 5. Finally, the auxiliary heat required annually is obtained by multiplying the heat to load ratio by the annual building load. Worksheet 6 guides the user through the calculation and provides a written record of performance analysis results.

5.2 Design refinement. The discussion presented in the following subsections advises the user on how to modify the design just analyzed on the worksheets if the results obtained were not satisfactory.

5.2.1 System economics. The ratio of annual energy saved to capital invested (E/C), in MMBtu/K$, is a useful economic parameter. The annual energy saved is given by:

$$E = Q_{[N]} - Q_{[A]} \quad , \qquad \text{(Equation 5.18)}$$

where $Q_{[A]}$ is the annual auxiliary heat requirement from Worksheet 6 and $Q_{[N]}$ is the net annual load. The formula for net annual load is:

$$Q_{[N]} = \text{NLC [multiplied by] } DD_{[a]} \quad , \qquad \text{(Equation 5.19)}$$

where NLC is the net load coefficient from Worksheet 2 and $DD_{[a]}$ is the annual heating degree days from Worksheet 5. Note that aperture losses are not included in equation 5.19 so that the passive heating system is not inappropriately credited with saving energy by meeting its own load.

The capital invested (C) is the total cost of the passive solar heating system. The heating system cost depends on the design and on location dependent costs for materials and construction. This parameter must be estimated by the user.

Clearly, the E/C ratio can be increased by reducing the auxiliary heat requirement and/or the system cost. Guidance for improving solar heating performance is provided in the following section on system efficiency.

5.2.2 System efficiencies.

5.2.2.1 System efficiency worksheet for reference month. Worksheet 7 is provided for calculation of the system efficiencies during the reference month (m) noted beneath the base temperature in the weather tables. The reference month is the harshest month in the heating season, for a particular base temperature, in that the associated value of VTn/DD is a minimum.

In the first part of the worksheet, equations and blanks are provided for calculating and recording the values of the effective total load coefficient ($TLC_{[e]}$) and the solar heating fraction (SHF). These two quantities are then substituted into the equation for $e_{[t]}$ that follows.

The second part of the worksheet merely provides a blank for recording the value of the delivery efficiency ($e_{[d]}$) that is tabulated for all systems in Appendix B.

In the final part of the worksheet, the utilization efficiency ($e_{[u]}$) is calculated from the indicated formula.

5.2.2.2 Improving total system efficiency. It is convenient to think in terms of improving the total system efficiency by increasing the magnitude of its factors, $e_{[d]}$ and $e_{[u]}$.

The delivery efficiency is defined as the fraction of the solar heat absorbed by the system that is actually delivered to the living space. For direct gain systems, this quantity is always unity because the living space is the absorber. For other systems, $e_{d}$ is always less than 1 and can be increased by adding additional layers of glazing or employing a selective surface. Both of these strategies decrease heat losses from the absorber surface to ambient conditions. The delivery efficiency could also be increased by decreasing the thickness of thermal storage walls. This strategy, however, is not advisable because it can result in an offsetting decrease in $e_{u}$.

The utilization efficiency is the fraction of the heat delivered to the building interior that is used to meet the building heat load. The un-utilized heat must be ventilated to avoid overheating the living space. The utilization efficiency therefore provides a useful measure of thermal comfort and convenience. Systems having values of $e_{u}$ below 0.6 should be avoided and values of 0.7 and above are advisable. The principal strategy for increasing $e_{u}$ is to add more thermal storage mass. Thus, thermal storage wall thickness may be increased and additional mass layers may be added to direct gain or radiant panel buildings. In fact, the addition of interior mass can be used to improve the utilization efficiency of any passive heating system although the effect can presently be quantified only for direct gain or radiant panel buildings.

A low utilization efficiency can also indicate that the solar aperture is too large. If the annual heat to load ratio is fairly small, for example 0.2 or less, and the utilization efficiency is below 0.6, the aperture size should be reduced. An excessively large aperture may yield good performance in terms of energy savings, as indicated by low values of $(Q_{A}/Q_{L})_{a}$, but may be uncomfortable and inconvenient as indicated by low values of $e_{u}$.

5.2.3 Worksheet for average maximum temperature during reference month. A step by step procedure for estimating the average maximum room temperature (assuming no heat is ventilated) during the reference month is presented in Worksheet 8. The first step is to calculate $Q_{D}$, the solar energy delivered to the living space. As specified on the worksheet, $Q_{D}$ is the product of [alpha] and $A_{c}$ (Worksheet 3), $e_{d}$ (Worksheet 7), $VT_{n}/DD$ (Worksheet 5), and DD, the heating degree days for the reference month. Values of DD are tabulated in Appendix B for a series of base temperatures in each included city.

The second step is to calculate the excess solar energy during the reference month. The amount of solar energy utilized is given by the product of $e_{u}$ and $Q_{D}$, so the excess heat ($Q_{E}$) is given by the product of $(1 - e_{u})$ and $Q_{D}$ as indicated on the worksheet.

Next, the average room temperature (T) that would prevail in the living space, if excess solar heat were ventilated, is calculated from the empirical equation given on Worksheet 8; the solar heating fraction (SHF) is available on Worksheet 7. The temperature increment without ventilation ([W-DELTA]$T_{I}$) is then calculated by dividing the excess solar energy by the number of days in the reference month and the DHC of the building. The average maximum temperature in the living space without ventilation ($T_{max}$) is then obtained by summing T and [W-DELTA]$T_{I}$.

High values of $\bar{T}_{max}$ indicate that the building is a poor design and may overheat badly causing discomfort to the occupants. Inspection of the equations on Worksheet 8 indicates that $\bar{T}_{max}$ may be reduced by:

a. Reducing the solar collection area ($A_c$).

b. Increasing the utilization efficiency ($e_u$).

c. Increasing the diurnal heat capacity (DHC).

5.2.4 Annual incremental cooling load. The annual incremental cooling load ($Q_I$) associated with a passive solar heating system is defined here as that part of the solar energy delivered to the living space that must be removed from the building to avoid exceeding a specified maximum temperature thereby maintaining a comfortable environment. This definition includes excess heat delivered to the building during the winter months and does not account for the beneficial potential of ventilation. Furthermore, the calculation procedure presented in this section does not include the effect of such defensive countermeasures as overhangs, drapes, shades, or covers. Therefore, the incremental cooling load should be considered to be a worst case indicator that emphasizes the need to employ ventilation and shading on passive solar buildings. Also, $Q_I$ provides a basis for comparing passive solar designs in terms of their tendency to aggravate the cooling load.

5.2.4.1 Delivered solar energy worksheet. Worksheet 9 presents the steps required to calculate $(Q_D)_a$, the total solar heat delivered to the living space during a one year period. This quantity is needed in connection with the incremental cooling load calculation.

The first step is to read the total annual transmitted solar radiation, OTAn, from the row marked DUE SOUTH AND VERTICAL. The number n in QTAn indicates whether the system is single, double, or triple glazed. Next, read coefficients, C1 through C5, from the following row marked AZIMUTH AND TILT COEF. The transmitted radiation, corrected for azimuth and tilt, can then be calculated from the following formula:

$$QTAn = (QTAn)_o [1 + C1([theta]/100) + C2([theta]/100)^2 + C3([theta]/100)^2([psi]/100) + C4([psi]/100) + C5([psi]/100)^2] \quad \text{(Equation 5.20)}$$

This quantity should be entered in the worksheet in the blank labeled (QTAn). Note that mixtures of two systems are allowed and that the mixing algorithm for $(Q_D)_a$ is provided on the worksheet.

5.2.4.2 Incremental cooling load worksheet. The incremental cooling load may be determined by following the procedure set forth on Worksheet 10. The first step is to calculate the annual heat to load ratio using a thermostat setting that is 10deg.F below the maximum temperature to be tolerated in the living space. If this setting is the same as the one previously employed in the heating analysis, no new calculations are required. Otherwise, Worksheets 4, 5, and 6 must be re-done to determine the new value of $(Q_A/Q_L)_a$.

Having determined the heat to load ratio, $Q_{A}$ is found as indicated on Worksheet 6, and the annual solar heating fraction, $SHF_{a}$, is calculated from the equation given on Worksheet 10. Then, the annual utilization efficiency, $(e_{u})_{a}$, can be calculated using the indicated equation.

Next, calculate $T_{act}$, the actual indoor temperature (the annual average) from the equation provided on the worksheet. Use the previously determined value for $(e_{u})_{a}$. Then, using $T_{act}$ in place of $T_{set}$, obtain a new base temperature from Worksheet 4. Enter the weather tables in the column indicated by the new base temperature and read the actual heating degree days, $DD_{act}$, from the row marked MONTHLY DD. Enter this quantity on the worksheet.

Finally, calculate $Q_{act}$, the actual annual heating load, from the equation provided on Worksheet 10, and then evaluate $Q_{I}$ by subtracting $Q_{act}$ from the sum of $Q_{D}$ and $Q_{A}$. Thus, the incremental cooling load is the difference between the amount of heat put into the building (solar plus auxiliary) and the amount actually lost to the outside.

5.2.4.3 Reducing the incremental cooling load. The incremental cooling load can be reduced by employing systems with higher utilization efficiencies, smaller apertures, or more thermal storage mass. During the heating season and early and late in the cooling season, ventilation can be employed to remove most of the excess heat. Overhangs can reduce delivery of unwanted solar heat to the living space as can drapes and shades in direct gain buildings. However, external shutters or covers are by far the most effective means of reducing or even eliminating the incremental cooling load.

5.3 Example calculations for a four-plex family housing unit.

5.3.1 Description of the building. In this section an example is presented that illustrates use of the schematic design guidelines in 4.3 and the design analysis procedures in 5.1 and 5.2. To illustrate the special problems associated with multizone design, a four-plex family housing unit was selected for consideration.

A sketch of the four-plex unit to be solarized is presented in figure 28. The long dimension of the structure is oriented 15 degrees east of true south, the departure presumably resulting from some constraint at the building site. Each individual two story family section has a length of 37 feet and a depth of 23 feet. The heated floorspace of each section is therefore about 1700 $ft^2$ and the total floorspace of the building is 6800 $ft^2$. In the following sections this family housing unit will be solarized as a direct gain system located in Norfolk, Virginia.

5.3.2 Schematic design parameters. Begin by filling out Worksheet 1 as illustrated in the example. Using the dimensions given in figure 28 and the formulas on the worksheet, it is an easy matter to obtain the "Building Size Parameters" and determine that the external surface area to floor area ratio is 2.91. Note that the total heated floorspace of the four-plex unit is being used in the analysis; this approach will yield the total solar aperture size and auxiliary heat requirement for the building. (An approximate procedure for partitioning the aperture area between inner and outer sections of the unit will be discussed later, as will section by section analysis.)

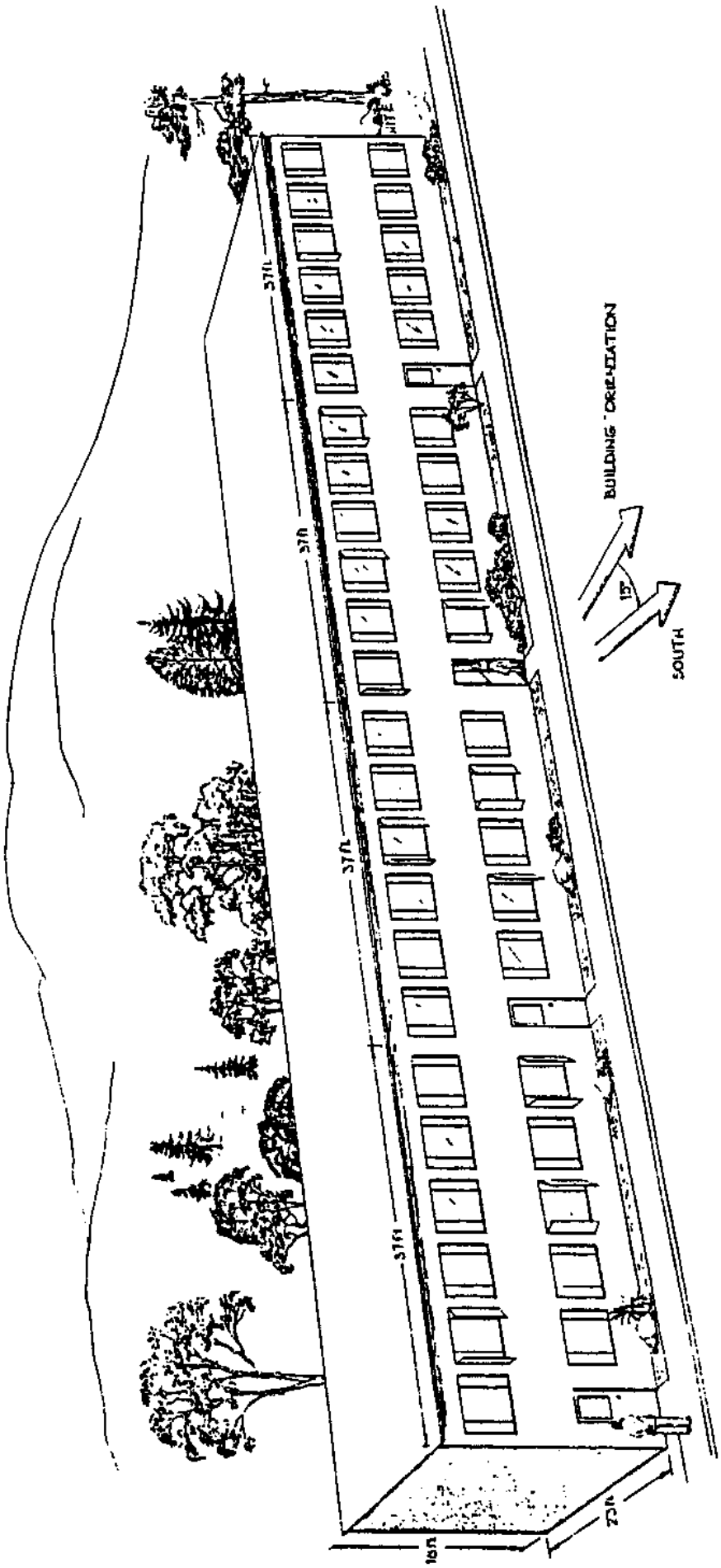



FIGURE 28. Four-plex family housing unit.

Next, select a reference value for wall insulation, $RWALL_{[o]}$, from the contour map in figure 13. As Norfolk is slightly below the middle of the harsh climate range on the east coast, an R-value just below the middle of the recommended range is selected, that is, $RWALL_{[o]} = 22$. After correcting for building size, RWALL becomes 21. Values for roof and perimeter insulation are easily obtained from the scaling formulas indicated on the worksheet.

The aperture size ratio (expressed in percent of floorspace) for a reference 1500 $ft^2$ building is read from the contour map in figure 15. Selecting the maximum value for the region encompassing Norfolk, we obtain:

$$(A_{[c]}/A_{[f]})_{[o]} = 0.12 \ ,$$

where the fractional value is indicated rather than the percentage value. This ratio is then scaled for building size (using the formula on the worksheet) to obtain a total solar collection area of:

$$A_{[c]} = 791 \ ft^2 \ .$$

Enter this number on the worksheet and finally, enter the azimuth of 15 degrees at the bottom.

5.3.3 Net load coefficient. A copy of Worksheet 2 is provided for the example calculation. The total external perimeter includes both floors and totals 684 feet. The ground floor area and perimeter are 3,400 $ft^2$ and 342 feet, respectively. The roof area (horizontal projection) is the same as the ground floor area and the south wall area, including windows, is 2,664 $ft^2$. A value of 0.05 is selected for the non-south window fraction and the windows are assumed to be double glazed. The infiltration rate is assumed to be 0.6 air changes per hour and the air density ratio is set at 1.0, the sea level value.

In the next part of the worksheet, the non-south window area and the wall area are calculated using the indicated equations and previously determined parameters.

Finally, in the last part of the worksheet, the various components of the net load coefficient are calculated and summed to obtain the value of NLC = 28,248.

5.3.4 System parameters. The next task is to record the system parameters on Worksheet 3 which is provided for this example. First, record the system type, direct gain, and then proceed to determine whether or not the thermal storage mass corresponds to a reference design. If the thermal mass does not correspond closely to a reference design it will be necessary to perform detailed calculations to determine $EHC/A_{[c]}$ and $DHC/A_{[c]}$.

Assume that the only significant high mass elements in the building are the 4-inch thick high density concrete floor slabs, and that heat is stored in these slabs through their upper surfaces. The total surface area available for storage is therefore 6,800 $ft^2$. However, mass that is not located in rooms containing direct gain apertures is only 40 percent as effective as that in direct gain rooms; this reduced effectiveness occurs because remote mass

is convectively coupled to the solar heat source rather than radiatively coupled. If we assume that only 50 percent of the floor slab area is located in direct gain rooms, then the surface area available for storage is:

$$0.5 \times 6{,}800 + 0.4 \times (0.5) \times 6{,}800 = 4{,}760 \text{ ft}^2 \quad .$$

Dividing this number by $A_c$ = 791 $ft^2$ from Worksheet 1 yields a mass to collector area ratio of:

$$A_m/A_c = 6.02 \quad .$$

If the concrete slabs are covered with dark brown ([alpha] = 0.88 from table VII) linoleum tile ($R_d$ = 0.05 from table III) the floor covering correction factor has a value of 1.01 (see equation 5.9). This correction factor is close to 1 because the thermal resistance of the tile is offset by the enhanced solar absorptance. The effective area ratio of the thermal storage mass therefore remains very nearly equal to 6, which is a reference design value.

Employing the four digit numbering system used for direct gain buildings in Appendix A, the first digit, which corresponds to the $A_m/A_c$ ratio, is taken as 6. The floor slab thickness has already been specified as 4 inches (of high density concrete), so the second digit in the system is 4. Finally, selecting a night-insulated system with an R-value of 4deg.F-$ft^2$-hr/Btu and two glazing layers, we obtain a system number of 6442 and record that number on the worksheet. Since the four-plex unit corresponds closely to this reference design, we are able to obtain an EHC/$A_c$ of 53.93 Btu/deg.F-$ft^2$ and a DHC/$A_c$ of 56.76 directly from Appendix A. These numbers also are recorded on Worksheet 3. Finally, the worksheet is completed by locating and recording the values of F, G, $U_c$, and alpha specified for direct gain system number 6442 in Appendix A. The aperture size, 791 $ft^2$, is also recorded to facilitate analysis of mixed systems.

In some instances a building might employ two different system types; Worksheet 3 allows for this possibility. To analyze a mixed system, repeat the above procedure for the second system and enter the component areas in the indicated blanks. The mixed system parameters are then calculated using the weighting procedure indicated on the worksheet.

5.3.5 Base temperature. Worksheet 4 for the base temperature is divided into two parts. The first part is used to calculate the base temperature when a constant thermostat setting is employed during the heating season. The second part is used to calculate the base temperature when a night time setback is employed in the building. For this example we shall adopt a setback strategy.

The daytime setting shall be 70deg.F and is assumed to be in effect from 5 a.m. to 10 p.m. for a duration of 17 hours. The night time setpoint shall be 60deg.F and has a duration of 7 hours. After entering these values on the worksheet, the indicated formulas are used to calculate the average setpoint of:

$$T_{ave} = 67.1\text{deg.F} \quad .$$

This number is entered on the worksheet and the time constant is calculated next. Based on previously recorded values for DHC, NLC, $U_{\lceil c \rceil}$, and $A_{\lceil c \rceil}$, the time constant is:

[tau] = 30.9 hr .

Using this number in the following equation on the worksheet we obtain an effective thermostat setpoint of:

$T_{\lceil e \rceil}$ = 67.5deg.F .

Finally, the base temperature is calculated from the last equation on the worksheet. The internal heat generation rate ($Q_{\lceil int \rceil}$) is taken to be the product of 20,000 Btu per person per day (a typical value) and 14, the probable number of occupants of a quadruplex (assuming an average family size of 3.5 persons). Using these assumptions, we obtain a base temperature of:

$T_{\lceil b \rceil}$ = 59.5 = 60deg.F ,

and enter it on the worksheet.

5.3.6 Weather parameters. We begin filling out Worksheet 5, as indicated in the example, by entering the state and city in which the building is located. Then we turn to the weather tables presented in Appendix B and locate the column for a base temperature of 60deg.F and record the ANNUAL DD given in that column on the worksheet.

Next, record the parameters that characterize the direct gain system. The number of glazings is two, the azimuth is 15 degrees, and the tilt is zero.

The value of the south/vertical transmitted radiation to degree day ratio is obtained from the column marked TB60 (indicating a base temperature of 60deg.F) and the row labeled VT2/DD (indicating a double glazed system ). The value found in the weather tables is:

$(VT2/DD)_{\lceil o \rceil}$ = 27.60 .

The subscript o indicates a south/vertical orientation.

Similarly, from the same column and the row marked PARAMETER A, we obtain:

$a_{\lceil o \rceil}$ = 0.637 ,

for a south/vertical orientation.

To correct for the azimuth of 15 degrees east, one simply records the value of A1 through A5 and B1 through B5 from the TB60 column and uses the referenced equations to obtain:

VT2/DD = 27.51 ,

and:

a = 0.616 ,

where the subscript i has been dropped because only a single system is present. As a general rule, the corrections for azimuth do not become significant until the departure from due south approaches +/-30 degrees.

If two systems having either different numbers of glazings or different orientations are employed it will be necessary to determine the weather parameters for the second system using the blanks provided. Then the weather parameters for the two systems are area weighted using the formula provided on the worksheet.

5.3.7 Auxiliary heat requirements. The auxiliary heat requirements of the building are calculated using Worksheet 6 which is reproduced for the example calculation. The scaled solar load ratio (SLR*) is computed from parameters previously recorded on other worksheets and found to be 0.64. Using this value and the city parameter (a) from Worksheet 5, the annual heat to load ratio is read from the nomograph in figure 23 as 0.37. Finally, using the formula at the bottom of the worksheet, calculate an annual auxiliary heat requirement of 32.6 MMBtu for the four-plex unit. Dividing this figure by the floor space of 6800 $ft^2$ and the annual heating degree days of 2778 yields an auxiliary heating factor of 1.73 Btu/$ft^2$-DD.

5.3.8 Distribution of the solar aperture. In general, the total solar aperture of a multi-family unit should be distributed in a manner that provides greater solar gains to the sections of the unit that experience the greater loads. We can accomplish this by performing the calculations presented herein once for each unique thermal zone within a unit. The worksheets are set up to allow this procedure by entering appropriate values for the heated floorspace and using the specialized definition of total perimeter ($P_t$) that excludes partitions between distinct thermal zones. However, in many cases the much simpler procedure described below is adequate.

On Worksheet 2 we determined that the four-plex unit has a total NLC of 28,248 Btu/DD. Each of the four sections, therefore has, on the average, a NLC of 7,062 Btu/DD, or one fourth of the total value. The average NLC value must be adjusted to account for the different loss characteristics of the two unique thermal zones that exist in the four-plex units. The two outer sections will have a larger loss coefficient than the two interior sections which have two shared or common side walls. It is assumed that a negligible amount of heat is transferred through these common walls because only small temperature differences are likely to exist from one side to the other. The exterior side walls on the end sections, however, lose heat to ambient conditions that may be quite cold.

We can easily calculate the loss characteristics of the end walls using the equations on Worksheet 2. The end wall area i:s

$$A_w = 18 \times 23 = 414 \ ft^2 \quad .$$

Note that we have assumed that there are no windows on the end walls. The load coefficient of the wall is therefore:

$$LC_w = 24 \ A_w/RWALL = 24 \times 414/21 = 473 \ Btu/DD$$

Having obtained the end wall loss coefficient, the net load coefficient for an interior zone ($NLC_{i}$) is given by:

$$NLC_{i} = (NLC - 2\ L_{w})/NZONE \quad , \qquad \text{(Equation 5.21)}$$

where NZONE is the number of zones, four in this case, for a row type building.

The net load coefficient of an exterior zone ($NLC_{e}$) is then given by:

$$NLC_{e} = NLC_{i} + L_{w} \quad . \qquad \text{(Equation 5.22)}$$

Carrying out the computation yields:

$$NLC_{i} = 6{,}825 \text{ Btu/DD} \quad ,$$

$$NLC_{e} = 7{,}299 \text{ Btu/DD} \quad .$$

Equating the LCRs of interior and exterior sections to the original LCR of the complete unit yields the following simple equations for determining $A_{ci}$ and $A_{ce}$, the solar collection areas for the two sections:

$$A_{ci} = A_{c}(NLC_{i}/NLC) \quad , \qquad \text{(Equation 5.23)}$$

$$A_{ce} = A_{c}(NLC_{e}/NLC) \quad . \qquad \text{(Equation 5.24)}$$

Evaluation of these equations for the four-plex unit yields:

$$A_{ci} = 191 \text{ ft}^2 \quad ,$$

$$A_{ce} = 204 \text{ ft}^2 \quad .$$

Note that the aperture sizes differ by only 7 percent and the sizing could be performed with reasonable accuracy (for this example) by simply distributing the total aperture area uniformly among the sections. In that case:

$$A_{ci} = A_{ce} = 198 \text{ ft}^2 \quad ,$$

is the aperture size for interior and exterior sections.

5.3.9 System efficiencies. System efficiencies for the reference month are evaluated using Worksheet 7 in the example. The total effective load coefficient and the solar heating fraction are evaluated using parameters available on other worksheets, and recorded. Then the total efficiency is calculated from the equation provided on Worksheet 7. The result is:

$$e_{t} = 0.86 \quad .$$

Since the delivery efficiency of all direct gain systems is unity, the utilization efficiency has the same value as $e_{t}$, or:

$$e_{u} = 0.86 \quad .$$

This result indicates that 14 percent of the solar energy absorbed in the building during the harshest winter month (February for Norfolk at a base temperature of 60deg.F) must be ventilated to avoid driving the room air temperature more than 10deg.F above the thermostat setpoint.

5.3.10 Average maximum temperature. The average daily maximum temperature during the reference month is determined by the equations provided on Worksheet 8 which is reproduced in the examples.

The first equation gives the solar energy delivered to the living space during February which is the reference month. All quantities in the equation are available from previous worksheets except the monthly degree days (DD) which is obtained from Appendix B. Next, the excess solar energy is determined by taking the product of $Q_{D}$ and the compliment of the utilization efficiency. The excess solar energy is 1.69 MMBtu. The average temperature in the living space, assuming the excess solar energy is ventilated, is $\bar{T}$ which is found to have a value of 70.7 for this example. When a night time setback is employed, the effective thermostat setpoint ($T_{e}$) is used for $T_{set}$ in the equation for $\bar{T}$. Finally, the temperature increment without ventilation ([W-DELTA]$T_{I}$) is computed to be 1.3deg.F which is added to $\bar{T}$ to obtain an average daily maximum temperature of 72deg.F, which is well within the comfort range.

5.3.11 Incremental cooling load. The incremental cooling load is determined by filling out Worksheets 9 and 10 which are reproduced in the examples. First read the TOTAL ANNUAL TRANSMITTED RADIATION from the row marked DUE SOUTH AND VERTICAL in the weather table for Norfolk. Since the system is double glazed, select the quantity:

$$(QTA2)_{o} = 232{,}584 \text{ Btu/ft}^{2} \quad .$$

Then read and record C1 through C5 from the row marked AZIMUTH AND TILT COEF. and record them on the worksheet. Finally, using equation 5.15 as indicated, calculate the transmitted solar radiation corrected for azimuth and tilt. The result is:

$$QTA2 = 231{,}210 \text{ Btu/ft}^{2} \quad .$$

The last equation on the worksheet yields:

$$Q_{D} = 177.4 \times 10^{6} \text{ Btu} \quad ,$$

for the delivered solar energy.

We begin filling out Worksheet 10 by selecting a maximum temperature of 80deg.F. In this case $T_{set}$ is 70deg.F which is the same value used for the auxiliary heat consumption analysis. Therefore, we may use the annual heat to load ratio and the auxiliary heat requirement that were previously recorded on Worksheet 6. Enter these numbers and calculate the annual solar heating fraction using the indicated equation. Then calculate the actual indoor temperature from the equation provided on Worksheet 10. The result is:

$$T_{act} = 75.8\text{deg.F}$$

Next, the actual annual heating degree days is determined from Worksheet 4 by employing $T_{act}$ in place of the daytime thermostat setpoint to obtain the base temperature:

$$T_b = 65.8 \text{deg.F} \quad .$$

Referring to the weather table for Norfolk and interpolating between base temperatures of 65deg.F and 70deg.F, we obtain:

$$DD_{act} = 3{,}827 \quad .$$

Now the actual annual heat load is calculated from the equation provided on Worksheet 9. The result is:

$$Q_{act} = 133.5 \times 10^{6} \text{ Btu} \quad .$$

Then the incremental cooling load is calculated from the final equation on the worksheet and found to be:

$$Q_I = 76.5 \times 10^{6} \text{ Btu} \quad .$$

This is quite a large number and points out the necessity for shading the solar aperture during the cooling season. Since our system has movable insulation, the means for providing the required shading is already in place.

5.3.12 Refining the design. The first refinement one might consider to the four-plex family housing unit would be to increase the building mass. This could moss easily be accomplished by employing massive partitioning walls between the individual sections. The addition of more mass would increase the DHC and EHC of the unit and lead to a higher utilization efficiency thereby reducing the auxiliary heat requirements.

Additionally, the increase in utilization efficiency might lead one to consider reducing the size of the solar apertures. This strategy could reduce the incremental cooling load thereby improving building comfort and convenience. Alternately, covers or shading devices could be employed to reduce $Q_D$ during the cooling season.

The quantitative effect of any design refinements on building performance can be determined by entering the change on the appropriate worksheet and working forward from that point.

# 6. NOTES

6.1 Intended use. In this handbook, the basic concepts of passive solar design have been outlined and the general climatic considerations that relate to its applicability in various regions of the continental United States have been discussed. Even in those regions where solar availability is low, building performance can always be improved by cost free measures such as proper building orientation and window distribution. The use of passive solar design can significantly reduce energy consumed for space heating both in existing buildings that may be retrofit and in new construction.

Guidelines for schematic design have been presented that should also prove useful for initial screening of building designs submitted in response to a turn key procurement action. More detailed design analysis procedures were provided for use in the design process or for final evaluation of candidate designs. Design refinement was discussed in terms of the efficiencies of a passive solar system, and finally example calculations were presented for a four-plex family housing unit to illustrate use of the procedures.

6.2 Data requirements. When this handbook is used in an acquisition and data are required to be delivered, the data requirements shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (CDRL), incorporated into the contract. When the provisions of DOD FAR Supplement, Part 27, Sub-Part 27.410-6 (DD Form 1423) are invoked and the DD Form 1423 is not used, the data shall be delivered by !he contractor in accordance with the contractor purchase order requirements.

6.3 Subject term (key word) listing.

Solar design procedures
Passive solar design procedures
Heating systems

# APPENDIX A

## SYSTEM PERFORMANCE CORRELATION PARAMETERS

### Direct Gain Systems

SYSTEM NUMBERING CONVENTION

First digit: Mass-area to glazing-area ratio ($A_m/A_c$) (3, 6, or 9)
Second digit: Thermal storage mass thickness (THICK) (2, 4, or 6)
Third digit: R-value of night insulation (0, 4, or 9)
Fourth digit: Number of glazings (NGL) (1, 2, or 3)

| System Number | F | G | $U_c$ | [alpha] | $DHC/A_c$ | $EHC/A_c$ | $e_r$ |
|---|---|---|---|---|---|---|---|
| 3201 | 0.458 | 22.73 | 1.10 | 0.94 | 14.94 | 14.49 | 1. |
| 3202 | 0.576 | 10.49 | 0.49 | 0.94 | 14.94 | 14.49 | 1. |
| 3203 | 0.661 | 6.65 | 0.31 | 0.94 | 14.94 | 14.49 | 1. |
| 3241 | 0.608 | 9.77 | 0.61 | 0.94 | 14.94 | 14.49 | 1. |
| 3242 | 0.623 | 5.21 | 0.35 | 0.94 | 14.94 | 14.49 | 1. |
| 3243 | 0.669 | 3.53 | 0.28 | 0.94 | 14.94 | 14.49 | 1. |
| 3291 | 0.637 | 8.33 | 0.53 | 0.94 | 14.94 | 14.49 | 1. |
| 3292 | 0.651 | 3.77 | 0.27 | 0.94 | 14.94 | 14.49 | 1. |
| 3293 | 0.685 | 2.33 | 0.19 | 0.94 | 14.94 | 14.49 | 1. |
| 3401 | 0.754 | 24.89 | 1.10 | 0.94 | 28.38 | 27.85 | 1. |
| 3402 | 0.838 | 10.73 | 0.49 | 0.94 | 28.38 | 27.85 | 1. |
| 3403 | 0.886 | 6.17 | 0.31 | 0.94 | 28.38 | 27.85 | 1. |
| 3441 | 0.822 | 10.25 | 0.61 | 0.94 | 28.38 | 27.85 | 1. |
| 3442 | 0.834 | 4.97 | 0.35 | 0.94 | 28.38 | 27.85 | 1. |
| 3443 | 0.875 | 3.05 | 0.28 | 0.94 | 28.38 | 27.85 | 1. |
| 3491 | 0.832 | 8.57 | 0.53 | 0.94 | 28.38 | 27.85 | 1. |
| 3492 | 0.852 | 3.48 | 0.27 | 0.94 | 28.38 | 27.85 | 1. |
| 3493 | 0.882 | 1.80 | 0.19 | 0.94 | 28.38 | 27.85 | 1. |
| 3601 | 0.826 | 25.13 | 1.10 | 0.94 | 35.79 | 36.73 | 1. |
| 3602 | 0.894 | 10.49 | 0.49 | 0.94 | 35.79 | 36.73 | 1. |
| 3603 | 0.943 | 5.93 | 0.31 | 0.94 | 35.79 | 36.73 | 1. |
| 3641 | 0.870 | 10.01 | 0.61 | 0.94 | 35.79 | 36.73 | 1. |
| 3642 | 0.870 | 4.49 | 0.35 | 0.94 | 35.79 | 36.73 | 1. |
| 3643 | 0.910 | 2.57 | 0.28 | 0.94 | 35.79 | 36.73 | 1. |
| 3691 | 0.865 | 8.09 | 0.53 | 0.94 | 35.79 | 36.73 | 1. |
| 3692 | 0.889 | 3.00 | 0.27 | 0.94 | 35.79 | 36.73 | 1. |
| 3693 | 0.916 | 1.32 | 0.19 | 0.94 | 35.79 | 36.73 | 1. |
| 6201 | 0.719 | 25.06 | 1.10 | 0.97 | 29.88 | 28.05 | 1. |
| 6202 | 0.812 | 10.90 | 0.49 | 0.97 | 29.88 | 28.05 | 1. |
| 6203 | 0.867 | 6.34 | 0.31 | 0.97 | 29.88 | 28.05 | 1. |
| 6241 | 0.786 | 10.18 | 0.61 | 0.97 | 29.88 | 28.05 | 1. |
| 6242 | 0.810 | 5.14 | 0.35 | 0.97 | 29.88 | 28.05 | 1. |
| 6243 | 0.857 | 3.22 | 0.28 | 0.97 | 29.88 | 28.05 | 1. |

Direct Gain Systems - Continued

SYSTEM NUMBERING CONVENTION

First digit: Mass-area to glazing-area ratio ($A_m/A_c$) (3, 6, or 9)
Second digit: Thermal storage mass thickness (THICK) (2, 4, or 6)
Third digit: R-value of night insulation (0, 4, or 9)
Fourth digit: Number of glazings (NGL) (1, 2, or 3)

| System Number | F | G | $U_c$ | [alpha] | $DHC/A_c$ | $EHC/A_c$ | $e_r$ |
|---|---|---|---|---|---|---|---|
| 6291 | 0.796 | 8.50 | 0.53 | 0.97 | 29.88 | 28.05 | 1. |
| 6292 | 0.832 | 3.70 | 0.27 | 0.97 | 29.88 | 28.05 | 1. |
| 6293 | 0.866 | 2.02 | 0.19 | 0.97 | 29.88 | 28.05 | 1. |
| 6401 | 1.013 | 26.74 | 1.10 | 0.97 | 56.76 | 53.93 | 1. |
| 6402 | 1.024 | 10.66 | 0.49 | 0.97 | 56.76 | 53.93 | 1. |
| 6403 | 1.062 | 5.86 | 0.31 | 0.97 | 56.76 | 53.93 | 1. |
| 6441 | 0.964 | 10.18 | 0.61 | 0.97 | 56.76 | 53.93 | 1. |
| 6442 | 0.966 | 4.42 | 0.35 | 0.97 | 56.76 | 53.93 | 1. |
| 6443 | 1.015 | 2.50 | 0.28 | 0.97 | 56.76 | 53.93 | 1. |
| 6491 | 0.967 | 8.26 | 0.53 | 0.97 | 56.76 | 53.93 | 1. |
| 6492 | 0.964 | 2.74 | 0.27 | 0.97 | 56.76 | 53.93 | 1. |
| 6493 | 1.020 | 1.30 | 0.19 | 0.97 | 56.76 | 53.93 | 1. |
| 6601 | 1.089 | 26.98 | 1.10 | 0.97 | 71.58 | 71.11 | 1. |
| 6602 | 1.079 | 10.42 | 0.49 | 0.97 | 71.58 | 71.11 | 1. |
| 6603 | 1.095 | 5.38 | 0.31 | 0.97 | 71.58 | 71.11 | 1. |
| 6641 | 1.013 | 9.94 | 0.61 | 0.97 | 71.58 | 71.11 | 1. |
| 6642 | 1.019 | 4.18 | 0.35 | 0.97 | 71.58 | 71.11 | 1. |
| 6643 | 1.046 | 2.02 | 0.28 | 0.97 | 71.58 | 71.11 | 1. |
| 6691 | 1.005 | 8.02 | 0.53 | 0.97 | 71.58 | 71.11 | 1. |
| 6692 | 0.997 | 2.26 | 0.27 | 0.97 | 71.58 | 71.11 | 1. |
| 6693 | 1.051 | 0.82 | 0.19 | 0.97 | 71.58 | 71.11 | 1. |
| 9201 | 0.906 | 26.43 | 1.10 | 0.98 | 44.82 | 40.75 | 1. |
| 9202 | 0.943 | 10.83 | 0.49 | 0.98 | 44.82 | 40.75 | 1. |
| 9203 | 0.983 | 6.03 | 0.31 | 0.98 | 44.82 | 40.75 | 1. |
| 9241 | 0.896 | 10.35 | 0.61 | 0.98 | 44.82 | 40.75 | 1. |
| 9242 | 0.909 | 4.83 | 0.35 | 0.98 | 44.82 | 40.75 | 1. |
| 9243 | 0.962 | 2.91 | 0.28 | 0.98 | 44.82 | 40.75 | 1. |
| 9291 | 0.889 | 8.43 | 0.53 | 0.98 | 44.82 | 40.75 | 1. |
| 9292 | 0.926 | 3.39 | 0.27 | 0.98 | 44.82 | 40.75 | 1. |
| 9293 | 0.967 | 1.71 | 0.19 | 0.98 | 44.82 | 40.75 | 1. |
| 9401 | 1.191 | 28.11 | 1.10 | 0.98 | 85.14 | 78.34 | 1. |
| 9402 | 1.131 | 10.59 | 0.49 | 0.98 | 85.14 | 78.34 | 1. |
| 9403 | 1.149 | 5.55 | 0.31 | 0.98 | 85.14 | 78.34 | 1. |
| 9441 | 1.050 | 10.11 | 0.61 | 0.98 | 85.14 | 78.34 | 1. |
| 9442 | 1.063 | 4.35 | 0.35 | 0.98 | 85.14 | 78.34 | 1. |
| 9443 | 1.095 | 2.19 | 0.28 | 0.98 | 85.14 | 78.34 | 1. |

Direct Gain Systems - Continued

SYSTEM NUMBERING CONVENTION

First digit: Mass-area to glazing-area ratio ($A_m/A_c$) (3, 6, or 9)
Second digit: Thermal storage mass thickness (THICK) (2, 4, or 6)
Third digit: R-value of night insulation (0, 4, or 9)
Fourth digit: Number of glazings (NGL) (1, 2, or 3)

| System Number | F | G | $U_c$ | [alpha] | $DHC/A_c$ | $EHC/A_c$ | $e_c$ |
|---|---|---|---|---|---|---|---|
| 9491 | 1.041 | 8.19 | 0.53 | 0.98 | 85.14 | 78.34 | 1. |
| 9492 | 1.059 | 2.67 | 0.27 | 0.98 | 85.14 | 78.34 | 1. |
| 9493 | 1.097 | 0.99 | 0.19 | 0.98 | 85.14 | 78.34 | 1. |
| 9601 | 1.268 | 28.35 | 1.10 | 0.98 | 107.37 | 103.29 | 1. |
| 9602 | 1.200 | 10.59 | 0.49 | 0.98 | 107.37 | 103.29 | 1. |
| 9603 | 1.220 | 5.55 | 0.31 | 0.98 | 107.37 | 103.29 | 1. |
| 9641 | 1.113 | 10.11 | 0.61 | 0.98 | 107.37 | 103.29 | 1. |
| 9642 | 1.093 | 3.87 | 0.35 | 0.98 | 107.37 | 103.29 | 1. |
| 9643 | 1.143 | 1.95 | 0.28 | 0.98 | 107.37 | 103.29 | 1. |
| 9691 | 1.088 | 7.95 | 0.53 | 0.98 | 107.37 | 103.29 | 1. |
| 9692 | 1.088 | 2.19 | 0.27 | 0.98 | 107.37 | 103.29 | 1. |
| 9693 | 1.088 | 2.19 | 0.27 | 0.98 | 107.37 | 103.29 | 1. |

Radiant Panels

SYSTEM NUMBERING CONVENTION

First digit: Mass-area to glazing-area ratio ($A_m/A_c$) (3, 6, or 9)
Second digit: Thermal storage mass thickness (THICK) (4-inch only)
Third digit: Number of glazings (NGL) (2 only)

| System Number | F | G | $U_c$ | [alpha] | $DHC/A_c$ | $EHC/A_c$ | $e_r$ |
|---|---|---|---|---|---|---|---|
| 342 | 0.605 | 3.84 | 0.31 | 0.95 | 28.38 | 27.85 | 0. |
| 642 | 0.734 | 3.60 | 0.31 | 0.95 | 56.76 | 53.93 | 0. |
| 942 | 0.812 | 3.36 | 0.31 | 0.95 | 85.14 | 78.34 | 0. |

Thermosiphoning Air Panels
(Frontflow Systems with RTAP = 11)

SYSTEM NUMBERING CONVENTION

First digit: Mass-area to glazing-area ratio (3, 6, or 9)
Second digit: Thermal storage mass thickness (THICK) (2, 4, or 6)
Third digit: Number of glazings (NGL) (1 or 2)

| System Number | F | G | U[c] | [alpha] | DHC/A[c] | e[d] |
|---|---|---|---|---|---|---|
| 321 | 0.277 | 1.63 | 0.068 | 0.95 | 14.94 | 0.36 |
| 322 | 0.336 | 1.54 | 0.064 | 0.95 | 14.94 | 0.58 |
| 341 | 0.330 | 1.63 | 0.068 | 0.95 | 28.38 | 0.36 |
| 342 | 0.398 | 1.54 | 0.064 | 0.95 | 28.38 | 0.58 |
| 361 | 0.341 | 1.63 | 0.068 | 0.95 | 35.79 | 0.36 |
| 362 | 0.411 | 1.54 | 0.064 | 0.95 | 35.79 | 0.58 |
| 621 | 0.477 | 1.63 | 0.068 | 0.95 | 29.88 | 0.36 |
| 622 | 0.573 | 1.54 | 0.064 | 0.95 | 29.88 | 0.58 |
| 641 | 0.563 | 1.63 | 0.068 | 0.95 | 56.76 | 0.36 |
| 642 | 0.673 | 1.54 | 0.064 | 0.95 | 56.76 | 0.58 |
| 661 | 0.585 | 1.63 | 0.068 | 0.95 | 71.58 | 0.36 |
| 662 | 0.699 | 1.54 | 0.064 | 0.95 | 71.58 | 0.58 |
| 921 | 0.649 | 1.63 | 0.068 | 0.95 | 44.82 | 0.36 |
| 922 | 0.744 | 1.54 | 0.064 | 0.95 | 44.82 | 0.58 |
| 941 | 0.756 | 1.63 | 0.068 | 0.95 | 85.14 | 0.36 |
| 942 | 0.896 | 1.54 | 0.064 | 0.95 | 85.14 | 0.58 |
| 961 | 0.787 | 1.63 | 0.068 | 0.95 | 107.37 | 0.36 |
| 962 | 0.932 | 1.54 | 0.064 | 0.95 | 107.37 | 0.58 |

## Unvented Trombe Walls

SYSTEM NUMBERING CONVENTION

First digit: Mass thickness (1, 2, 3, or 4 implies 6-inch, 9-inch, 12-inch, or 18-inch, respectively)
Second digit: [rho]ck product (1, 2, or 3 implies 7.5, 15, or 30, respectively)
Third digit: R-value of night insulation (0 or 9)
Fourth digit: Number of glazings (NGL) (1, 2, or 3)
Fifth digit: Wall surface (1 or 2 implies flat black surface or selective surface, respectively)

| System Number | F | G | U┌c┐ | [alpha] | e┌d┐ |
|---|---|---|---|---|---|
| 11021 | 0.240 | 2.86 | 0.19 | 0.95 | 0.51 |
| 12021 | 0.551 | 5.04 | 0.24 | 0.95 | 0.64 |
| 13021 | 0.616 | 6.00 | 0.27 | 0.95 | 0.72 |
| 21021 | 0.208 | 2.14 | 0.16 | 0.95 | 0.43 |
| 22021 | 0.291 | 3.10 | 0.21 | 0.95 | 0.56 |
| 23021 | 0.343 | 3.82 | 0.25 | 0.95 | 0.67 |
| 31021 | 0.466 | 1.66 | 0.14 | 0.95 | 0.38 |
| 32021 | 0.496 | 3.60 | 0.19 | 0.95 | 0.51 |
| 33011 | 0.484 | 7.44 | 0.29 | 0.95 | 0.52 |
| 33012 | 0.166 | 3.12 | 0.23 | 0.90 | 0.62 |
| 33021 | 0.644 | 4.80 | 0.24 | 0.95 | 0.64 |
| 33022 | 0.802 | 2.16 | 0.20 | 0.90 | 0.72 |
| 33031 | 0.761 | 3.36 | 0.20 | 0.95 | 0.78 |
| 33911 | 0.611 | 3.12 | 0.20 | 0.95 | 0.52 |
| 33912 | 0.812 | 0.72 | 0.15 | 0.90 | 0.62 |
| 33921 | 0.755 | 1.68 | 0.15 | 0.95 | 0.64 |
| 33922 | 0.877 | 0.48 | 0.13 | 0.90 | 0.72 |
| 33931 | 0.539 | 0.02 | 0.13 | 0.95 | 0.78 |
| 41021 | 0.126 | 1.18 | 0.11 | 0.95 | 0.29 |
| 42021 | 0.406 | 2.88 | 0.16 | 0.95 | 0.43 |
| 43021 | 0.570 | 3.84 | 0.21 | 0.95 | 0.56 |

## Vented Trombe Walls

SYSTEM NUMBERING CONVENTION

First digit: Mass thickness (1, 2, 3, or 4 implies 6-inch, 9-inch, 12-inch, or 18-inch, respectively)
Second digit: [rho]ck product (1, 2, or 3 implies 7.5, 15, or 30, respectively)
Third digit: R-value of night insulation (0 or 9)
Fourth digit: Number of glazings (NGL) (1, 2, or 3)
Fifth digit: Wall surface (1 or 2 implies flat black surface or selective surface, respectively)

| System Number | F | G | U┌c┐ | [alpha] | e┌d┐ |
|---|---|---|---|---|---|
| 11021 | 0.292 | 3.10 | 0.19 | 0.95 | 0.72 |
| 12021 | 0.605 | 5.28 | 0.24 | 0.95 | 0.74 |
| 13021 | 0.629 | 6.00 | 0.27 | 0.95 | 0.76 |
| 21021 | 0.280 | 2.38 | 0.16 | 0.95 | 0.69 |
| 22021 | 0.654 | 4.78 | 0.21 | 0.95 | 0.72 |
| 23021 | 0.725 | 5.74 | 0.25 | 0.95 | 0.74 |
| 31021 | 0.259 | 2.14 | 0.14 | 0.95 | 0.67 |
| 32021 | 0.638 | 4.32 | 0.19 | 0.95 | 0.70 |
| 33011 | 0.545 | 7.92 | 0.29 | 0.95 | 0.57 |
| 33012 | 0.809 | 3.60 | 0.23 | 0.90 | 0.70 |
| 33021 | 0.741 | 5.28 | 0.24 | 0.95 | 0.72 |
| 33022 | 0.900 | 2.64 | 0.20 | 0.90 | 0.79 |
| 33031 | 0.872 | 3.84 | 0.20 | 0.95 | 0.80 |
| 33911 | 0.728 | 4.08 | 0.20 | 0.95 | 0.57 |
| 33912 | 0.924 | 1.44 | 0.15 | 0.90 | 0.70 |
| 33921 | 0.861 | 2.16 | 0.15 | 0.95 | 0.72 |
| 33922 | 0.983 | 0.96 | 0.13 | 0.90 | 0.79 |
| 33931 | 0.595 | 0.22 | 0.13 | 0.95 | 0.80 |
| 41021 | 0.215 | 1.66 | 0.11 | 0.95 | 0.65 |
| 42021 | 0.570 | 3.60 | 0.16 | 0.95 | 0.67 |
| 43021 | 0.709 | 4.56 | 0.21 | 0.95 | 0.70 |

## Water Walls

SYSTEM NUMBERING CONVENTION

First digit: Wall thickness (1, 2, 3, 4, 5, or 6 implies 3-inch, 6-inch, 9-inch, 12-inch, 18-inch, or 24-inch, respectively)
Second digit: R-value of night insulation (0 or 9)
Third digit: Number of glazings (NGL) (1, 2, or 3)
Fourth digit: Wall surface (1 or 2 implies flat black surface or selective surface, respectively)

| System Number | F | G | U[c] | [alpha] | e[d] |
|---|---|---|---|---|---|
| 1021 | 0.684 | 6.94 | 0.31 | 0.95 | 0.83 |
| 2021 | 0.833 | 6.48 | 0.31 | 0.95 | 0.83 |
| 3011 | 0.735 | 10.80 | 0.41 | 0.95 | 0.73 |
| 3012 | 0.904 | 3.36 | 0.30 | 0.90 | 0.80 |
| 3021 | 0.885 | 6.24 | 0.31 | 0.95 | 0.83 |
| 3022 | 0.973 | 2.40 | 0.24 | 0.90 | 0.86 |
| 3031 | 0.981 | 4.06 | 0.25 | 0.95 | 0.98 |
| 3911 | 0.873 | 3.84 | 0.25 | 0.95 | 0.73 |
| 3912 | 0.960 | 0.48 | 0.17 | 0.90 | 0.80 |
| 3921 | 0.981 | 1.92 | 0.18 | 0.95 | 0.83 |
| 3922 | 0.992 | 0.00 | 0.14 | 0.90 | 0.86 |
| 3931 | 1.039 | 0.94 | 0.15 | 0.95 | 0.98 |
| 4021 | 0.907 | 6.00 | 0.31 | 0.95 | 0.83 |
| 5021 | 0.931 | 5.74 | 0.31 | 0.95 | 0.83 |
| 6021 | 0.954 | 5.74 | 0.31 | 0.95 | 0.83 |

## Concrete Block Walls

SYSTEM NUMBERING CONVENTION

First digit: Unfilled or filled (1 implies unfilled blocks and 2 implies filled blocks)
Second digit: R-value of night insulation (0 or 9)
Third digit: Number of glazings (NGL) (1 or 2)

| System Number | F | G | U[c] | [alpha] | e[d] |
|---|---|---|---|---|---|
| 101 | 0.454 | 6.04 | 0.42 | 0.95 | 0.55 |
| 102 | 0.500 | 3.88 | 0.28 | 0.95 | 0.55 |
| 191 | 0.563 | 3.16 | 0.13 | 0.95 | 0.55 |
| 192 | 0.607 | 1.96 | 0.11 | 0.95 | 0.55 |
| 201 | 0.575 | 6.76 | 0.47 | 0.95 | 0.59 |
| 202 | 0.630 | 4.36 | 0.31 | 0.95 | 0.59 |
| 291 | 0.737 | 3.64 | 0.14 | 0.95 | 0.59 |
| 292 | 0.749 | 1.96 | 0.12 | 0.95 | 0.59 |

Sunspaces

SYSTEM NUMBERING CONVENTION

First digit: Sunspace type (1 or 2 implies attached or semi-enclosed, respectively)
Second digit: Glazing tilt from vertical (1 or 2 implies 0 degrees or 40 degrees, respectively)
Third digit: Common wall (1 or 2 implies masonry or insulated, respectively)
Fourth digit: R-value of night insulation (0 or 9)

| System Number | F | G | U[c] | [alpha] | e[d] |
|---|---|---|---|---|---|
| 1210 | 0.551 | 5.76 | 0.27 | 0.96 | 0.70 |
| 1219 | 0.673 | 3.12 | 0.21 | 0.96 | 0.70 |
| 1220 | 0.516 | 7.20 | 0.04 | 0.94 | 0.53 |
| 1229 | 0.659 | 4.08 | 0.04 | 0.94 | 0.53 |
| 2110 | 0.786 | 6.96 | 0.38 | 0.95 | 0.71 |
| 2119 | 0.886 | 4.32 | 0.28 | 0.95 | 0.71 |
| 2120 | 0.580 | 5.28 | 0.08 | 0.94 | 0.54 |
| 2129 | 0.750 | 3.84 | 0.08 | 0.94 | 0.54 |
| 2210 | 0.699 | 6.96 | 0.36 | 0.96 | 0.68 |
| 2219 | 0.826 | 3.36 | 0.26 | 0.96 | 0.68 |
| 2220 | 0.607 | 6.48 | 0.07 | 0.94 | 0.50 |
| 2229 | 0.772 | 3.12 | 0.07 | 0.94 | 0.50 |

## WEATHER PARAMETERS

BIRMINGHAM, ALABAMA — ELEVATION = 630 — LAT = 33.6

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 976.38 | 184.18 | 115.04 | 79.15 | 57.93 | 43.80 | 34.11 | 27.59 | 19.94 |
| VT2/DD | 831.23 | 156.80 | 97.94 | 67.38 | 49.31 | 37.29 | 29.04 | 23.49 | 16.98 |
| VT3/DD | 721.52 | 136.11 | 85.01 | 58.49 | 42.81 | 32.37 | 25.21 | 20.39 | 14.74 |
| MONTHLY DD | 23 | 121 | 194 | 282 | 385 | 509 | 654 | 808 | 1118 |
| ANNUAL DD | 54 | 314 | 581 | 977 | 1504 | 2174 | 3019 | 4077 | 6849 |
| PARAMETER A | .179 | .658 | .681 | .642 | .590 | .568 | .568 | .591 | .622 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .1719 | .0429 | .0440 | .0487 | .0540 | .0563 | .0564 | .0547 | .0548 |
| A2 | -.2003 | .0246 | .0918 | .1859 | .2918 | .3755 | .4420 | .5079 | .7050 |
| A3 | -.0228 | -.0836 | -.1625 | -.2819 | -.4180 | -.5272 | -.6160 | -.7059 | -.9853 |
| A4 | -.0601 | .0376 | .0870 | .1586 | .2404 | .3073 | .3620 | .4167 | .5781 |
| A5 | -.1798 | -.0373 | -.0370 | -.0428 | -.0507 | -.0595 | -.0689 | -.0797 | -.1144 |
| B1 | -.0445 | -.0445 | -.0445 | -.0445 | -.0445 | -.0445 | -.0445 | -.0445 | -.0445 |
| B2 | -.9584 | -.9584 | -.9584 | -.9584 | -.9584 | -.9584 | -.9584 | -.9584 | -.9584 |
| B3 | .5777 | .5777 | .5777 | .5777 | .5777 | .5777 | .5777 | .5777 | .5777 |
| B4 | .9117 | .9117 | .9117 | .9117 | .9117 | .9117 | .9116 | .9116 | .9117 |
| B5 | -1.2260 | -1.2261 | -1.2260 | -1.2260 | -1.2260 | -1.2260 | -1.2260 | -1.2260 | -1.2260 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 265272 QTA2 = 220764 QTA3 = 189712
AZIMUTH AND TILT COEF. C1 = -.0170 C2 = -.2050 C3 = -.4159 C4 = 1.7706 C5 = -1.1628

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 43 | 46 | 53 | 62 | 70 | 75 | 79 | 77 | 72 | 62 | 53 | 44 |
| QHOR: | 710 | 943 | 1284 | 1633 | 1914 | 1864 | 1796 | 1660 | 1481 | 1217 | 841 | 641 |

MOBILE, ALABAMA — ELEVATION = 220 — LAT = 30.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 1863.20 | 538.38 | 239.86 | 134.50 | 84.03 | 57.44 | 42.50 | 27.39 |
| VT2/DD | NA | 1583.23 | 457.48 | 203.81 | 114.29 | 71.40 | 48.81 | 36.11 | 23.27 |
| VT3/DD | NA | 1374.00 | 397.02 | 176.88 | 99.18 | 61.97 | 42.36 | 31.34 | 20.20 |
| MONTHLY DD | 0 | 13 | 44 | 99 | 177 | 283 | 414 | 559 | 867 |
| ANNUAL DD | 0 | 31 | 132 | 326 | 642 | 1130 | 1795 | 2658 | 5184 |
| PARAMETER A | NA | .702 | .664 | .567 | .483 | .466 | .477 | .493 | .557 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0000 | -.0060 | -.0088 | -.0120 | -.0139 | -.0135 | -.0111 | -.0005 |
| A2 | NA | .3814 | .3263 | .3541 | .4269 | .4776 | .5399 | .6155 | .7940 |
| A3 | NA | -.4803 | -.4196 | -.4599 | -.5605 | -.6366 | -.7243 | -.8270 | -1.0796 |
| A4 | NA | .2349 | .2047 | .2232 | .2733 | .3136 | .3613 | .4190 | .5543 |
| A5 | NA | .0053 | -.0001 | -.0021 | -.0078 | -.0184 | -.0276 | -.0365 | -.0577 |
| B1 | NA | -.0081 | -.0081 | -.0081 | -.0081 | -.0081 | -.0081 | -.0081 | -.0081 |
| B2 | NA | -.9077 | -.9077 | -.9077 | -.9077 | -.9077 | -.9077 | -.9077 | -.9077 |
| B3 | NA | .5141 | .5142 | .5142 | .5141 | .5141 | .5141 | .5141 | .5141 |
| B4 | NA | 1.0145 | 1.0144 | 1.0144 | 1.0144 | 1.0144 | 1.0145 | 1.0145 | 1.0144 |
| B5 | NA | -1.2019 | -1.2019 | -1.2019 | -1.2019 | -1.2019 | -1.2019 | -1.2019 | -1.2019 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 267445 QTA2 = 222797 QTA3 = 191687
AZIMUTH AND TILT COEF. C1 = .0301 C2 = -.1798 C3 = -.3900 C4 = 1.7247 C5 = -1.0617

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 52 | 52 | 59 | 64 | 74 | 78 | 79 | 79 | 76 | 68 | 58 | 53 |
| QHOR: | 843 | 1089 | 1464 | 1696 | 1853 | 1794 | 1731 | 1586 | 1475 | 1323 | 933 | 757 |

MONTGOMERY, ALABAMA — ELEVATION = 203 — LAT = 32.3

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 371.03 | 199.56 | 115.75 | 74.56 | 52.93 | 40.13 | 32.04 | 22.62 |
| VT2/DD | NA | 316.52 | 170.24 | 98.47 | 63.43 | 45.03 | 34.14 | 27.26 | 19.24 |
| VT3/DD | NA | 274.88 | 147.85 | 85.48 | 55.06 | 39.08 | 29.63 | 23.66 | 16.70 |
| MONTHLY DD | 8 | 68 | 127 | 205 | 318 | 448 | 591 | 741 | 1049 |
| ANNUAL DD | 19 | 185 | 379 | 695 | 1155 | 1774 | 2572 | 3546 | 6202 |
| PARAMETER A | NA | .428 | .374 | .419 | .468 | .510 | .537 | .550 | .590 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.1373 | -.1652 | .1489 | .1270 | .1100 | .0982 | .0890 | .0679 |
| A2 | NA | .4976 | .6239 | .1030 | .1649 | .2192 | .2899 | .3923 | .6379 |
| A3 | NA | -.4841 | -.6160 | -.1237 | -.2002 | -.2692 | -.3639 | -.5037 | -.8520 |
| A4 | NA | .2692 | .3501 | .1693 | .2073 | .2458 | .3040 | .3887 | .5819 |
| A5 | NA | .1118 | .1279 | -.0444 | -.0436 | -.0467 | -.0573 | -.0738 | -.1124 |
| B1 | NA | .0575 | .0575 | -.0241 | -.0241 | -.0241 | -.0241 | -.0241 | -.0241 |
| B2 | NA | -1.0340 | -1.0340 | -.9219 | -.9219 | -.9219 | -.9219 | -.9219 | -.9219 |
| B3 | NA | .6305 | .6305 | .4981 | .4981 | .4980 | .4980 | .4981 | .4981 |
| B4 | NA | .8497 | .8497 | .9378 | .9378 | .9378 | .9378 | .9378 | .9378 |
| B5 | NA | -1.2590 | -1.2590 | -1.2456 | -1.2456 | -1.2457 | -1.2456 | -1.2456 | -1.2456 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 268541 QTA2 = 223433 QTA3 = 192017
AZIMUTH AND TILT COEF. C1 = .0006 C2 = -.1783 C3 = -.4647 C4 = 1.8211 C5 = -1.1514

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 46 | 48 | 57 | 65 | 71 | 78 | 79 | 80 | 75 | 64 | 54 | 46 |
| QHOR: | 756 | 926 | 1345 | 1723 | 1883 | 1969 | 1876 | 1723 | 1534 | 1203 | 905 | 730 |

PHOENIX, ARIZONA — ELEVATION = 1112 — LAT = 33.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | NA | 1425.49 | 562.22 | 293.33 | 176.30 | 118.82 | 85.84 | 64.94 | 42.15 |
| VT2/DD | NA | 1219.26 | 480.88 | 250.89 | 150.80 | 101.63 | 73.42 | 55.54 | 36.05 |
| VT3/DD | NA | 1059.44 | 417.85 | 218.01 | 131.03 | 88.31 | 63.80 | 48.26 | 31.33 |
| MONTHLY DD | 1 | 26 | 66 | 126 | 209 | 310 | 429 | 567 | 874 |
| ANNUAL DD | 1 | 43 | 140 | 328 | 634 | 1090 | 1713 | 2503 | 4544 |
| PARAMETER A | NA | .508 | .594 | .594 | .573 | .556 | .531 | .514 | .488 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0377 | -.0388 | -.0372 | -.0343 | -.0313 | -.0299 | -.0284 | -.0251 |
| A2 | NA | .1179 | .2200 | .3588 | .4854 | .6118 | .7523 | .8935 | 1.2002 |
| A3 | NA | -.0995 | -.2095 | -.3666 | -.5172 | -.6769 | -.8587 | -1.0471 | -1.4688 |
| A4 | NA | .0961 | .1693 | .2706 | .3655 | .4640 | .5748 | .6858 | .9244 |
| A5 | NA | .0141 | .0156 | .0135 | .0069 | -.0069 | -.0252 | -.0463 | -.0972 |
| B1 | NA | .0249 | .0249 | .0249 | .0249 | .0249 | .0249 | .0249 | .0249 |
| B2 | NA | -1.1544 | -1.1544 | -1.1544 | -1.1544 | -1.1544 | -1.1544 | -1.1544 | -1.1544 |
| B3 | NA | .7236 | .7236 | .7237 | .7237 | .7237 | .7237 | .7237 | .7236 |
| B4 | NA | .7977 | .7977 | .7977 | .7977 | .7977 | .7977 | .7977 | .7977 |
| B5 | NA | -1.3211 | -1.3210 | -1.3210 | -1.3210 | -1.3210 | -1.3210 | -1.3210 | -1.3211 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 377059 — QTA2 = 313598 — QTA3 = 269197

AZIMUTH AND TILT COEF. — C1 = .0268 — C2 = -.1794 — C3 = -.5866 — C4 = 1.9450 — C5 = -1.3422

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 52 | 54 | 61 | 68 | 78 | 88 | 92 | 90 | 85 | 72 | 60 | 51 |
| QHOR: | 1025 | 1402 | 1849 | 2330 | 2708 | 2696 | 2428 | 2290 | 2031 | 1571 | 1207 | 920 |

PRESCOTT, ARIZONA — ELEVATION = 5023 — LAT = 34.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M= 4) |
| VT1/DD | 533.11 | 173.78 | 117.35 | 85.99 | 66.71 | 53.84 | 44.95 | 38.47 | 31.50 |
| VT2/DD | 456.61 | 148.85 | 100.52 | 73.65 | 57.14 | 46.11 | 38.50 | 32.95 | 25.39 |
| VT3/DD | 396.89 | 129.38 | 87.37 | 64.01 | 49.66 | 40.08 | 33.46 | 28.64 | 21.41 |
| MONTHLY DD | 78 | 238 | 352 | 481 | 620 | 768 | 920 | 1075 | 886 |
| ANNUAL DD | 179 | 784 | 1304 | 1975 | 2801 | 3783 | 4937 | 6261 | 9332 |
| PARAMETER A | .751 | .584 | .536 | .498 | .463 | .436 | .415 | .400 | .343 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0055 | -.0020 | .0034 | .0098 | .0171 | .0244 | .0314 | .0386 | -.1797 |
| A2 | .2413 | .6056 | .8188 | 1.0620 | 1.3367 | 1.6143 | 1.8697 | 2.1141 | -6.3069 |
| A3 | -.2371 | -.6339 | -.9000 | -1.2170 | -1.5710 | -1.9282 | -2.2571 | -2.5817 | 8.3292 |
| A4 | .1417 | .3664 | .5108 | .6803 | .8695 | 1.0605 | 1.2363 | 1.4101 | -4.2555 |
| A5 | .0275 | .0471 | .0330 | .0080 | -.0151 | -.0363 | -.0547 | -.0808 | .5901 |
| B1 | -.0079 | -.0079 | -.0079 | -.0079 | -.0079 | -.0079 | -.0079 | -.0079 | .0759 |
| B2 | -1.2022 | -1.2022 | -1.2023 | -1.2023 | -1.2023 | -1.2023 | -1.2022 | -1.2022 | .6718 |
| B3 | .7491 | .7491 | .7491 | .7492 | .7491 | .7492 | .7491 | .7491 | -1.7396 |
| B4 | .7470 | .7470 | .7470 | .7470 | .7470 | .7470 | .7470 | .7470 | 2.7328 |
| B5 | -1.3476 | -1.3476 | -1.3476 | -1.3476 | -1.3476 | -1.3476 | -1.3476 | -1.3476 | -1.5482 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 385714 — QTA2 = 321257 — QTA3 = 275902

AZIMUTH AND TILT COEF. — C1 = .0378 — C2 = -.1548 — C3 = -.6027 — C4 = 1.8583 — C5 = -1.3820

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 36 | 38 | 46 | 50 | 60 | 72 | 75 | 71 | 68 | 57 | 44 | 35 |
| QHOR: | 1044 | 1318 | 1819 | 2316 | 2623 | 2761 | 2269 | 2051 | 1928 | 1570 | 1140 | 931 |

TUCSON, ARIZONA — ELEVATION = 2556 — LAT = 32.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M= 2) | (M= 2) | (M= 1) | (M= 1) |
| VT1/DD | NA | 1309.57 | 592.71 | 318.25 | 191.14 | 127.55 | 92.13 | 69.24 | 45.07 |
| VT2/DD | NA | 1120.40 | 507.09 | 272.28 | 163.53 | 107.96 | 77.98 | 59.12 | 38.49 |
| VT3/DD | NA | 973.71 | 440.70 | 236.63 | 142.12 | 93.59 | 67.60 | 51.37 | 33.44 |
| MONTHLY DD | 3 | 31 | 68 | 127 | 211 | 289 | 400 | 577 | 886 |
| ANNUAL DD | 5 | 69 | 185 | 416 | 794 | 1330 | 2025 | 2879 | 5152 |
| PARAMETER A | NA | .645 | .510 | .422 | .403 | .401 | .373 | .364 | .376 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0178 | .0264 | .0358 | .0398 | -.0233 | -.0197 | .0271 | .0332 |
| A2 | NA | .4491 | .6493 | .8979 | 1.0423 | -.4393 | -.2420 | 1.2912 | 1.6468 |
| A3 | NA | -.5059 | -.7196 | -1.0019 | -1.1890 | .3507 | .0681 | -1.7162 | -2.2131 |
| A4 | NA | .2814 | .4009 | .5597 | .6640 | -.2081 | -.0603 | .9499 | 1.2077 |
| A5 | NA | .0175 | .0353 | .0428 | .0275 | -.1298 | -.1665 | -.1626 | -.2132 |
| B1 | NA | -.0049 | -.0049 | -.0049 | -.0049 | .0142 | .0142 | .0015 | .0015 |
| B2 | NA | -1.1887 | -1.1887 | -1.1887 | -1.1887 | -.8480 | -.8480 | -1.1138 | -1.1138 |
| B3 | NA | .7300 | .7300 | .7300 | .7300 | .2412 | .2412 | .6298 | .6298 |
| B4 | NA | .8442 | .8442 | .8442 | .8442 | 1.2516 | 1.2516 | .9238 | .9238 |
| B5 | NA | -1.3533 | -1.3533 | -1.3533 | -1.3533 | -1.4306 | -1.4306 | -1.3634 | -1.3634 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 372002 — QTA2 = 309460 — QTA3 = 265702

AZIMUTH AND TILT COEF. — C1 = .0379 — C2 = -.1607 — C3 = -.6371 — C4 = 1.9989 — C5 = -1.3575

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 51 | 51 | 59 | 67 | 73 | 84 | 85 | 83 | 79 | 69 | 57 | 51 |
| QHOR: | 1083 | 1416 | 1873 | 2386 | 2691 | 2719 | 2307 | 2178 | 1954 | 1634 | 1207 | 1012 |

WINSLOW, ARIZONA — ELEVATION = 4882 — LAT = 35.0

| SOUTH-VERT. | TB30 (M=12) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 610.64 | 160.36 | 107.84 | 79.45 | 62.19 | 50.91 | 43.02 | 37.24 | 29.35 |
| VT2/DD | 523.30 | 137.42 | 92.42 | 68.09 | 53.30 | 43.63 | 36.87 | 31.91 | 25.15 |
| VT3/DD | 454.88 | 119.45 | 80.33 | 59.19 | 46.33 | 37.93 | 32.05 | 27.74 | 21.86 |
| MONTHLY DD | 70 | 268 | 398 | 541 | 691 | 844 | 998 | 1153 | 1463 |
| ANNUAL DD | 217 | 913 | 1476 | 2180 | 3029 | 4014 | 5147 | 6429 | 9413 |
| PARAMETER A | .372 | .483 | .482 | .465 | .448 | .428 | .412 | .396 | .339 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0869 | .0694 | .0721 | .0769 | .0819 | .0869 | .0907 | .0953 | .1192 |
| A2 | .7940 | .7700 | .8998 | 1.0757 | 1.2741 | 1.4987 | 1.7301 | 1.9838 | 2.7808 |
| A3 | -.7536 | -.7985 | -.9646 | -1.1832 | -1.4335 | -1.7240 | -2.0336 | -2.3778 | -3.4503 |
| A4 | .4309 | .4422 | .5297 | .6464 | .7809 | .9369 | 1.1022 | 1.2860 | 1.8642 |
| A5 | .1183 | .0700 | .0609 | .0527 | .0397 | .0191 | -.0095 | -.0439 | -.1460 |
| B1 | -.0130 | -.0130 | -.0130 | -.0130 | -.0130 | -.0130 | -.0130 | -.0130 | -.0130 |
| B2 | -1.2315 | -1.2315 | -1.2315 | -1.2315 | -1.2315 | -1.2315 | -1.2315 | -1.2315 | -1.2315 |
| B3 | .7824 | .7824 | .7824 | .7824 | .7824 | .7824 | .7824 | .7824 | .7824 |
| B4 | .7369 | .7369 | .7369 | .7369 | .7369 | .7369 | .7369 | .7369 | .7369 |
| B5 | -1.3494 | -1.3494 | -1.3494 | -1.3494 | -1.3493 | -1.3494 | -1.3494 | -1.3494 | -1.3494 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 389291 — QTA2 = 324229 — QTA3 = 278408

AZIMUTH AND TILT COEF. — C1 = .0556 — C2 = -.2014 — C3 = -.5588 — C4 = 1.8641 — C5 = -1.3937

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 34 | 36 | 45 | 52 | 63 | 72 | 78 | 74 | 69 | 55 | 43 | 32 |
| QHOR: | 1020 | 1329 | 1756 | 2345 | 2625 | 2726 | 2382 | 2131 | 1931 | 1521 | 1107 | 950 |

YUMA, ARIZONA — ELEVATION = 207 — LAT = 32.7

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | NA | 2412.82 | 807.75 | 367.48 | 193.30 | 119.58 | 83.27 | 50.19 |
| VT2/DD | NA | NA | 2064.05 | 690.99 | 314.36 | 165.02 | 102.09 | 71.09 | 42.85 |
| VT3/DD | NA | NA | 1793.66 | 600.47 | 273.18 | 143.37 | 88.69 | 61.76 | 37.22 |
| MONTHLY DD | 0 | 4 | 16 | 48 | 106 | 200 | 324 | 465 | 771 |
| ANNUAL DD | 0 | 8 | 36 | 119 | 308 | 654 | 1171 | 1870 | 3801 |
| PARAMETER A | NA | NA | .196 | .362 | .446 | .567 | .617 | .611 | .551 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | .0007 | .0036 | .0071 | .0153 | .0189 | .0227 | .0318 |
| A2 | NA | NA | .6003 | .4205 | .4447 | .2406 | .3675 | .5024 | .8731 |
| A3 | NA | NA | -.5490 | -.3997 | -.4581 | -.3386 | -.5047 | -.6855 | -1.1985 |
| A4 | NA | NA | .4319 | .3057 | .3270 | .1856 | .2789 | .3798 | .6595 |
| A5 | NA | NA | .0441 | .0225 | .0046 | -.0445 | -.0600 | -.0793 | -.1413 |
| B1 | NA | NA | -.0074 | -.0074 | -.0074 | -.0092 | -.0092 | -.0092 | -.0092 |
| B2 | NA | NA | -1.1756 | -1.1756 | -1.1756 | -1.1073 | -1.1073 | -1.1073 | -1.1073 |
| B3 | NA | NA | .7259 | .7259 | .7259 | .6344 | .6344 | .6344 | .6344 |
| B4 | NA | NA | .8267 | .8267 | .8267 | .9261 | .9261 | .9261 | .9261 |
| B5 | NA | NA | -1.3306 | -1.3305 | -1.3306 | -1.3500 | -1.3500 | -1.3500 | -1.3501 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 381823 — QTA2 = 317478 — QTA3 = 272506

AZIMUTH AND TILT COEF. — C1 = .0116 — C2 = -.1436 — C3 = -.6535 — C4 = 2.0058 — C5 = -1.3550

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 55 | 60 | 64 | 71 | 80 | 86 | 92 | 92 | 87 | 74 | 63 | 56 |
| QHOR: | 1071 | 1498 | 1940 | 2421 | 2737 | 2824 | 2529 | 2327 | 2070 | 1603 | 1217 | 986 |

FORT SMITH, ARKANSAS — ELEVATION = 463 — LAT = 35.3

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 744.93 | 148.36 | 91.65 | 64.14 | 48.50 | 38.68 | 32.02 | 27.28 | 20.95 |
| VT2/DD | 636.56 | 126.78 | 78.32 | 54.81 | 41.45 | 33.05 | 27.36 | 23.31 | 17.91 |
| VT3/DD | 552.98 | 110.13 | 68.04 | 47.61 | 36.01 | 28.71 | 23.77 | 20.25 | 15.56 |
| MONTHLY DD | 38 | 188 | 305 | 436 | 577 | 723 | 873 | 1025 | 1335 |
| ANNUAL DD | 104 | 512 | 908 | 1425 | 2074 | 2844 | 3734 | 4770 | 7453 |
| PARAMETER A | .324 | .598 | .606 | .597 | .578 | .563 | .554 | .552 | .569 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0381 | .0166 | .0149 | .0144 | .0154 | .0173 | .0193 | .0204 | .0187 |
| A2 | .5304 | .3119 | .3550 | .4047 | .4700 | .5397 | .6136 | .6948 | .9119 |
| A3 | -.5156 | -.3123 | -.3546 | -.4041 | -.4727 | -.5505 | -.6388 | -.7468 | -1.0688 |
| A4 | .3256 | .1979 | .2273 | .2610 | .3065 | .3569 | .4121 | .4758 | .6526 |
| A5 | .1039 | .0506 | .0565 | .0630 | .0688 | .0712 | .0691 | .0587 | .0082 |
| B1 | -.0184 | -.0184 | -.0184 | -.0184 | -.0184 | -.0184 | -.0184 | -.0184 | -.0184 |
| B2 | -1.1013 | -1.1013 | -1.1013 | -1.1013 | -1.1013 | -1.1013 | -1.1013 | -1.1013 | -1.1013 |
| B3 | .6859 | .6860 | .6859 | .6859 | .6859 | .6859 | .6859 | .6859 | .6859 |
| B4 | .7916 | .7916 | .7916 | .7916 | .7916 | .7916 | .7916 | .7916 | .7916 |
| B5 | -1.2873 | -1.2873 | -1.2873 | -1.2873 | -1.2873 | -1.2873 | -1.2872 | -1.2873 | -1.2873 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 293307 — QTA2 = 244328 — QTA3 = 209951

AZIMUTH AND TILT COEF. — C1 = -.0245 — C2 = -.2424 — C3 = -.4149 — C4 = 1.7591 — C5 = -1.2331

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 36 | 42 | 49 | 63 | 70 | 76 | 81 | 79 | 74 | 61 | 49 | 41 |
| QHOR: | 729 | 1014 | 1322 | 1696 | 1949 | 2019 | 2031 | 1872 | 1550 | 1183 | 872 | 713 |

LITTLE ROCK, ARKANSAS — ELEVATION = 266 — LAT = 34.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 817.22 | 192.15 | 116.58 | 78.27 | 56.62 | 43.64 | 35.27 | 29.42 | 22.02 |
| VT2/DD | 697.10 | 163.90 | 99.44 | 66.77 | 48.30 | 37.22 | 30.08 | 25.09 | 18.78 |
| VT3/DD | 605.37 | 142.33 | 86.36 | 57.98 | 41.94 | 32.32 | 26.13 | 21.79 | 16.31 |
| MONTHLY DD | 33 | 141 | 232 | 345 | 477 | 620 | 767 | 919 | 1228 |
| ANNUAL DD | 58 | 361 | 683 | 1141 | 1738 | 2455 | 3316 | 4346 | 7010 |
| PARAMETER A | .690 | .644 | .597 | .552 | .520 | .502 | .497 | .508 | .537 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0295 | -.0490 | -.0536 | -.0584 | -.0608 | -.0609 | -.0583 | -.0532 | -.0411 |
| A2 | .0744 | .1644 | .2398 | .3284 | .4110 | .4842 | .5584 | .6322 | .8358 |
| A3 | -.0944 | -.2041 | -.2901 | -.3869 | -.4785 | -.5635 | -.6554 | -.7552 | -1.0488 |
| A4 | .0460 | .1059 | .1583 | .2182 | .2753 | .3286 | .3865 | .4484 | .6200 |
| A5 | .0071 | .0135 | .0187 | .0278 | .0344 | .0360 | .0315 | .0189 | -.0270 |
| B1 | -.0379 | -.0379 | -.0379 | -.0379 | -.0379 | -.0379 | -.0379 | -.0379 | -.0379 |
| B2 | -1.0327 | -1.0327 | -1.0327 | -1.0327 | -1.0327 | -1.0327 | -1.0327 | -1.0327 | -1.0327 |
| B3 | .6204 | .6204 | .6204 | .6204 | .6204 | .6204 | .6204 | .6204 | .6204 |
| B4 | .8546 | .8545 | .8546 | .8546 | .8546 | .8545 | .8546 | .8545 | .8546 |
| B5 | -1.2710 | -1.2709 | -1.2710 | -1.2710 | -1.2710 | -1.2709 | -1.2710 | -1.2710 | -1.2710 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 287021 — QTA2 = 239109 — QTA3 = 205527

AZIMUTH AND TILT COEF. — C1 = -.0545 — C2 = -.2231 — C3 = -.4217 — C4 = 1.7532 — C5 = -1.2047

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 40 | 43 | 52 | 63 | 71 | 78 | 79 | 80 | 73 | 63 | 50 | 43 |
| QHOR: | 772 | 991 | 1279 | 1617 | 1967 | 2045 | 1991 | 1798 | 1517 | 1243 | 847 | 705 |

ARCATA, CALIFORNIA — ELEVATION = 226 — LAT = 41.0

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | NA | 762.45 | 276.29 | 123.52 | 66.10 | 42.45 | 30.89 | 24.27 | 16.99 |
| VT2/DD | NA | 650.85 | 235.85 | 105.60 | 56.51 | 36.29 | 26.41 | 20.75 | 14.52 |
| VT3/DD | NA | 565.10 | 204.78 | 91.72 | 49.08 | 31.52 | 22.94 | 18.02 | 12.61 |
| MONTHLY DD | 0 | 25 | 69 | 142 | 266 | 413 | 568 | 723 | 1033 |
| ANNUAL DD | 1 | 71 | 279 | 792 | 1794 | 3318 | 5091 | 6908 | 10555 |
| PARAMETER A | NA | .673 | .674 | .634 | .669 | .661 | .592 | .532 | .457 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0109 | -.0136 | -.1111 | -.1207 | -.1464 | -.1925 | -.2347 | -.2975 |
| A2 | NA | .1799 | .4199 | .8350 | .9546 | 1.1880 | 1.5322 | 1.8336 | 2.2748 |
| A3 | NA | -.2113 | -.5021 | -.8970 | -1.0785 | -1.4154 | -1.8536 | -2.2193 | -2.7416 |
| A4 | NA | .1090 | .2946 | .5978 | .7155 | .9275 | 1.2104 | 1.4494 | 1.7932 |
| A5 | NA | .0207 | .0046 | .0348 | -.0071 | -.0665 | -.1011 | -.1156 | -.1254 |
| B1 | NA | .0179 | .0179 | .0482 | .0482 | .0482 | .0482 | .0482 | .0482 |
| B2 | NA | -1.0316 | -1.0316 | -1.0918 | -1.0919 | -1.0919 | -1.0919 | -1.0919 | -1.0919 |
| B3 | NA | .6913 | .6913 | .7536 | .7536 | .7536 | .7537 | .7537 | .7536 |
| B4 | NA | .7164 | .7164 | .6383 | .6383 | .6383 | .6383 | .6383 | .6383 |
| B5 | NA | -1.1481 | -1.1482 | -1.1439 | -1.1440 | -1.1439 | -1.1439 | -1.1439 | -1.1439 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 256991 — QTA2 = 214291 — QTA3 = 184258

AZIMUTH AND TILT COEF. — C1 = -.1083 — C2 = -.2981 — C3 = -.2423 — C4 = 1.5907 — C5 = -1.1414

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 46 | 47 | 47 | 48 | 52 | 54 | 55 | 56 | 55 | 53 | 50 | 46 |
| QHOR: | 545 | 794 | 1047 | 1644 | 1874 | 1883 | 1798 | 1560 | 1344 | 968 | 546 | 465 |

BAKERSFIELD, CALIFORNIA — ELEVATION = 492 — LAT = 35.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | NA | 984.79 | 335.69 | 159.03 | 90.08 | 59.33 | 43.64 | 34.32 | 24.00 |
| VT2/DD | NA | 841.91 | 286.98 | 135.96 | 77.01 | 50.72 | 37.31 | 29.34 | 20.52 |
| VT3/DD | NA | 731.29 | 249.28 | 118.10 | 66.89 | 44.06 | 32.41 | 25.48 | 17.82 |
| MONTHLY DD | 1 | 25 | 74 | 156 | 275 | 417 | 567 | 721 | 1031 |
| ANNUAL DD | 1 | 55 | 199 | 489 | 974 | 1661 | 2528 | 3576 | 6185 |
| PARAMETER A | NA | .491 | .531 | .555 | .642 | .728 | .765 | .783 | .789 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0626 | -.0566 | -.0478 | -.0346 | -.0253 | -.0201 | -.0165 | -.0115 |
| A2 | NA | .1308 | .2067 | .2578 | .2796 | .3249 | .4148 | .5175 | .7283 |
| A3 | NA | -.1689 | -.2545 | -.3122 | -.3441 | -.4161 | -.5498 | -.7000 | -1.0085 |
| A4 | NA | .1251 | .1858 | .2288 | .2454 | .2816 | .3542 | .4365 | .6062 |
| A5 | NA | -.0249 | -.0306 | -.0361 | -.0428 | -.0589 | -.0839 | -.1099 | -.1633 |
| B1 | NA | -.0154 | -.0154 | -.0154 | -.0154 | -.0154 | -.0154 | -.0154 | -.0154 |
| B2 | NA | -1.1376 | -1.1376 | -1.1376 | -1.1376 | -1.1376 | -1.1376 | -1.1376 | -1.1376 |
| B3 | NA | .7532 | .7532 | .7532 | .7532 | .7532 | .7532 | .7532 | .7532 |
| B4 | NA | .7764 | .7764 | .7764 | .7764 | .7764 | .7764 | .7764 | .7764 |
| B5 | NA | -1.2308 | -1.2309 | -1.2308 | -1.2308 | -1.2308 | -1.2308 | -1.2308 | -1.2309 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 341443 — QTA2 = 283234 — QTA3 = 242759

AZIMUTH AND TILT COEF. — C1 = -.0253 — C2 = -.0981 — C3 = -.6830 — C4 = 2.0210 — C5 = -1.3427

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 45 | 51 | 57 | 62 | 69 | 78 | 83 | 82 | 76 | 66 | 56 | 46 |
| QHOR: | 782 | 1132 | 1648 | 2164 | 2507 | 2762 | 2713 | 2413 | 2003 | 1470 | 988 | 676 |

CHINA LAKE, CALIFORNIA — ELEVATION = 2234 — LAT = 35.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | NA | 533.27 | 251.86 | 147.62 | 98.07 | 70.87 | 54.72 | 44.52 | 32.41 |
| VT2/DD | NA | 457.08 | 215.88 | 126.53 | 84.06 | 60.74 | 46.90 | 38.16 | 27.78 |
| VT3/DD | NA | 397.29 | 187.64 | 109.97 | 73.06 | 52.80 | 40.77 | 33.17 | 24.14 |
| MONTHLY DD | 6 | 69 | 147 | 250 | 377 | 521 | 675 | 830 | 1140 |
| ANNUAL DD | 12 | 168 | 388 | 740 | 1245 | 1915 | 2751 | 3735 | 6127 |
| PARAMETER A | NA | .415 | .563 | .623 | .640 | .633 | .607 | .575 | .523 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0110 | .0066 | .0048 | .0036 | .0029 | .0023 | .0020 | .0015 |
| A2 | NA | .2647 | .2505 | .3021 | .4120 | .5591 | .7317 | .9139 | 1.2853 |
| A3 | NA | -.1845 | -.1945 | -.2667 | -.4119 | -.6011 | -.8139 | -1.0367 | -1.5131 |
| A4 | NA | .1672 | .1623 | .2029 | .2865 | .3953 | .5192 | .6495 | .9221 |
| A5 | NA | .0751 | .0559 | .0440 | .0266 | .0095 | -.0030 | -.0147 | -.0553 |
| B1 | NA | .0033 | .0033 | .0033 | .0033 | .0033 | .0033 | .0033 | .0033 |
| B2 | NA | -1.2520 | -1.2520 | -1.2520 | -1.2520 | -1.2520 | -1.2520 | -1.2520 | -1.2520 |
| B3 | NA | .8178 | .8177 | .8178 | .8178 | .8178 | .8178 | .8178 | .8177 |
| B4 | NA | .7328 | .7328 | .7328 | .7328 | .7328 | .7328 | .7328 | .7328 |
| B5 | NA | -1.3191 | -1.3191 | -1.3191 | -1.3191 | -1.3191 | -1.3191 | -1.3191 | -1.3191 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 374583 — QTA2 = 311531 — QTA3 = 267275

AZIMUTH AND TILT COEF. — C1 = .0013 — C2 = -.2062 — C3 = -.5767 — C4 = 1.9426 — C5 = -1.3888

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 45 | 50 | 58 | 60 | 74 | 85 | 90 | 86 | 80 | 65 | 53 | 43 |
| QHOR: | 891 | 1294 | 1691 | 2256 | 2561 | 2756 | 2636 | 2412 | 2010 | 1470 | 1027 | 845 |

DAGGETT, CALIFORNIA — ELEVATION = 1929 — LAT = 34.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | NA | 839.32 | 364.59 | 202.64 | 127.15 | 87.64 | 64.97 | 51.10 | 35.53 |
| VT2/DD | NA | 717.93 | 312.32 | 173.58 | 108.92 | 75.08 | 55.66 | 43.77 | 30.43 |
| VT3/DD | NA | 623.86 | 271.43 | 150.86 | 94.66 | 65.25 | 48.37 | 38.04 | 26.45 |
| MONTHLY DD | 3 | 44 | 99 | 178 | 284 | 412 | 556 | 706 | 1016 |
| ANNUAL DD | 6 | 101 | 252 | 516 | 950 | 1585 | 2405 | 3393 | 5846 |
| PARAMETER A | NA | .254 | .403 | .508 | .594 | .614 | .606 | .585 | .532 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0936 | -.0672 | -.0570 | -.0527 | -.0535 | -.0552 | -.0572 | -.0616 |
| A2 | NA | -.1497 | .2110 | .2690 | .3782 | .5443 | .7275 | .9238 | 1.3754 |
| A3 | NA | .0656 | -.1611 | -.2437 | -.3919 | -.6124 | -.8547 | -1.1177 | -1.7359 |
| A4 | NA | -.1418 | .1736 | .2105 | .2884 | .4111 | .5466 | .6934 | 1.0351 |
| A5 | NA | -.0435 | .0299 | .0205 | .0041 | -.0196 | -.0446 | -.0742 | -.1496 |
| B1 | NA | .0065 | .0357 | .0357 | .0357 | .0357 | .0357 | .0357 | .0357 |
| B2 | NA | -1.1856 | -1.2292 | -1.2292 | -1.2292 | -1.2292 | -1.2292 | -1.2292 | -1.2292 |
| B3 | NA | .7320 | .7950 | .7950 | .7950 | .7950 | .7950 | .7950 | .7950 |
| B4 | NA | .8468 | .7594 | .7594 | .7594 | .7593 | .7594 | .7594 | .7594 |
| B5 | NA | -1.3303 | -1.3151 | -1.3151 | -1.3151 | -1.3151 | -1.3151 | -1.3152 | -1.3151 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 375300 — QTA2 = 312128 — QTA3 = 267824

AZIMUTH AND TILT COEF. — C1 = .0145 — C2 = -.1935 — C3 = -.5929 — C4 = 1.9615 — C5 = -1.3828

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 47 | 53 | 57 | 62 | 73 | 79 | 89 | 85 | 79 | 66 | 56 | 47 |
| QHOR: | 964 | 1305 | 1749 | 2268 | 2617 | 2748 | 2640 | 2370 | 2017 | 1518 | 1072 | 860 |

EL TORO, CALIFORNIA — ELEVATION = 381 — LAT = 33.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M= 5) | (M= 5) |
| VT1/DD | NA | NA | 2671.76 | 746.45 | 313.87 | 163.00 | 102.14 | 67.15 | 35.15 |
| VT2/DD | NA | NA | 2282.38 | 637.67 | 268.13 | 139.47 | 87.40 | 54.20 | 28.38 |
| VT3/DD | NA | NA | 1982.91 | 554.00 | 232.95 | 121.19 | 75.94 | 45.82 | 23.99 |
| MONTHLY DD | 0 | 1 | 14 | 49 | 116 | 209 | 334 | 309 | 590 |
| ANNUAL DD | 0 | 2 | 31 | 153 | 482 | 1149 | 2196 | 3558 | 6800 |
| PARAMETER A | NA | NA | .420 | .517 | .492 | .386 | .324 | .433 | .504 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | .0084 | .0014 | -.0204 | -.0941 | -.1435 | .2893 | .2266 |
| A2 | NA | NA | -.0292 | .2419 | .8524 | 1.9676 | 2.8167 | -4.8995 | -3.7764 |
| A3 | NA | NA | .0238 | -.2939 | -1.0814 | -2.4043 | -3.4833 | 6.5202 | 4.9481 |
| A4 | NA | NA | -.0157 | .1729 | .6095 | 1.4083 | 2.0324 | -3.4731 | -2.5977 |
| A5 | NA | NA | .0026 | -.0041 | -.0482 | -.0817 | -.1285 | .2575 | .0945 |
| B1 | NA | NA | -.0283 | -.0283 | -.0283 | -.0182 | -.0182 | -.2783 | -.2783 |
| B2 | NA | NA | -1.1296 | -1.1297 | -1.1297 | -1.1864 | -1.1864 | .8918 | .8918 |
| B3 | NA | NA | .6766 | .6766 | .6766 | .7583 | .7583 | -1.8295 | -1.8295 |
| B4 | NA | NA | .8880 | .8880 | .8880 | .8051 | .8052 | 3.0757 | 3.0756 |
| B5 | NA | NA | -1.3301 | -1.3301 | -1.3301 | -1.3046 | -1.3046 | -1.0375 | -1.0374 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 337351 — QTA2 = 280994 — QTA3 = 241414

AZIMUTH AND TILT COEF. — C1 = -.1197 — C2 = -.3156 — C3 = -.3884 — C4 = 1.8600 — C5 = -1.2915

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 54 | 56 | 56 | 58 | 61 | 63 | 69 | 70 | 70 | 62 | 59 | 54 |
| QHOR: | 993 | 1233 | 1627 | 1923 | 2114 | 2225 | 2370 | 2144 | 1720 | 1375 | 1039 | 873 |

FRESNO, CALIFORNIA — ELEVATION = 328 — LAT = 36.8

| SOUTH-VERT. | TB30 (M=12) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | 324.60 | 144.13 | 79.68 | 50.41 | 36.24 | 28.17 | 23.03 | 16.88 |
| VT2/DD | NA | 277.06 | 123.03 | 68.01 | 43.03 | 30.93 | 24.04 | 19.66 | 14.41 |
| VT3/DD | NA | 240.56 | 106.82 | 59.05 | 37.36 | 26.86 | 20.88 | 17.07 | 12.51 |
| MONTHLY DD | 1 | 60 | 136 | 246 | 389 | 540 | 695 | 850 | 1160 |
| ANNUAL DD | 2 | 127 | 343 | 741 | 1356 | 2171 | 3172 | 4343 | 7116 |
| PARAMETER A | NA | .650 | .715 | .787 | .868 | .919 | .953 | .976 | .990 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0087 | .0094 | .0125 | .0160 | .0193 | .0217 | .0235 | .0265 |
| A2 | NA | .0873 | .0868 | .1062 | .1427 | .1933 | .2477 | .3031 | .4279 |
| A3 | NA | -.0645 | -.0692 | -.1052 | -.1646 | -.2431 | -.3266 | -.4122 | -.6067 |
| A4 | NA | .0981 | .1015 | .1246 | .1595 | .2060 | .2547 | .3037 | .4155 |
| A5 | NA | -.0086 | -.0141 | -.0285 | -.0451 | -.0648 | -.0847 | -.1048 | -.1519 |
| B1 | NA | -.0540 | -.0540 | -.0540 | -.0540 | -.0540 | -.0540 | -.0540 | -.0540 |
| B2 | NA | -1.0399 | -1.0399 | -1.0399 | -1.0399 | -1.0399 | -1.0399 | -1.0399 | -1.0399 |
| B3 | NA | .6858 | .6858 | .6858 | .6858 | .6858 | .6858 | .6858 | .6858 |
| B4 | NA | .7490 | .7489 | .7489 | .7489 | .7489 | .7489 | .7489 | .7489 |
| B5 | NA | -1.1593 | -1.1593 | -1.1593 | -1.1593 | -1.1593 | -1.1592 | -1.1593 | -1.1593 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 332506 — QTA2 = 275526 — QTA3 = 236027

AZIMUTH AND TILT COEF. — C1 = -.0296 — C2 = -.0510 — C3 = -.7110 — C4 = 2.0150 — C5 = -1.3551

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 43 | 49 | 55 | 59 | 68 | 76 | 81 | 78 | 72 | 63 | 51 | 42 |
| QHOR: | 669 | 1033 | 1590 | 2116 | 2502 | 2720 | 2708 | 2399 | 2024 | 1455 | 911 | 570 |

LOS ANGELES, CALIFORNIA — ELEVATION = 105 — LAT = 33.9

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M= 3) | TB70 (M= 4) | TB80 (M= 5) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | NA | NA | 1366.86 | 452.04 | 198.15 | 113.84 | 75.26 | 38.84 |
| VT2/DD | NA | NA | NA | 1169.57 | 386.79 | 169.55 | 94.86 | 61.11 | 31.33 |
| VT3/DD | NA | NA | NA | 1016.27 | 336.09 | 147.33 | 81.68 | 51.78 | 26.48 |
| MONTHLY DD | 0 | 1 | 6 | 25 | 74 | 169 | 288 | 328 | 539 |
| ANNUAL DD | 0 | 1 | 7 | 45 | 240 | 818 | 1851 | 3300 | 6793 |
| PARAMETER A | NA | NA | NA | .742 | .632 | .418 | .359 | .350 | .362 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | NA | .0064 | .0198 | .0119 | .1719 | .0110 | .3939 |
| A2 | NA | NA | NA | .1822 | .6147 | 1.5103 | -1.1159 | -3.8450 | -5.6262 |
| A3 | NA | NA | NA | -.2137 | -.6587 | -1.7128 | 1.0635 | 4.9619 | 7.5059 |
| A4 | NA | NA | NA | .1457 | .4473 | 1.0934 | -.7835 | -2.7267 | -4.0269 |
| A5 | NA | NA | NA | -.0165 | .0088 | -.0122 | -.0926 | .2816 | .3383 |
| B1 | NA | NA | NA | -.0325 | -.0325 | -.0325 | -.1130 | -.1048 | -.2943 |
| B2 | NA | NA | NA | -1.1809 | -1.1809 | -1.1809 | -.4665 | .2276 | .9025 |
| B3 | NA | NA | NA | .7501 | .7502 | .7501 | -.2104 | -1.1320 | -1.8509 |
| B4 | NA | NA | NA | .7940 | .7940 | .7940 | 1.7020 | 2.4436 | 3.0884 |
| B5 | NA | NA | NA | -1.2992 | -1.2992 | -1.2991 | -1.3865 | -1.3456 | -1.0532 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 334081 — QTA2 = 278374 — QTA3 = 239221

AZIMUTH AND TILT COEF. — C1 = -.1143 — C2 = -.3072 — C3 = -.3894 — C4 = 1.8284 — C5 = -1.2782

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 56 | 55 | 55 | 59 | 62 | 64 | 67 | 69 | 67 | 63 | 59 | 56 |
| QHOR: | 943 | 1230 | 1642 | 1909 | 2133 | 2127 | 2294 | 2123 | 1761 | 1305 | 998 | 853 |

MOUNT SHASTA, CALIFORNIA — ELEVATION = 3586 — LAT = 41.3

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 668.00 | 99.18 | 60.06 | 42.37 | 32.70 | 26.63 | 22.45 | 19.41 | 15.27 |
| VT2/DD | 571.01 | 84.78 | 51.34 | 36.22 | 27.96 | 22.76 | 19.19 | 16.59 | 13.06 |
| VT3/DD | 495.97 | 73.63 | 44.60 | 31.46 | 24.28 | 19.77 | 16.67 | 14.41 | 11.34 |
| MONTHLY DD | 33 | 224 | 370 | 524 | 679 | 834 | 989 | 1144 | 1454 |
| ANNUAL DD | 70 | 656 | 1299 | 2170 | 3216 | 4434 | 5809 | 7314 | 10627 |
| PARAMETER A | .426 | .768 | .802 | .792 | .774 | .769 | .767 | .758 | .723 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.1112 | -.0575 | -.0635 | -.0716 | -.0772 | -.0786 | -.0786 | -.0789 | -.0817 |
| A2 | .1134 | .0471 | .1120 | .2203 | .3133 | .4013 | .4897 | .5867 | .8038 |
| A3 | -.0914 | -.0670 | -.1606 | -.2804 | -.3956 | -.5130 | -.6366 | -.7741 | -1.0829 |
| A4 | .1142 | .0667 | .1265 | .2048 | .2796 | .3527 | .4285 | .5129 | .7043 |
| A5 | .0008 | -.0210 | -.0293 | -.0383 | -.0487 | -.0655 | -.0874 | -.1133 | -.1727 |
| B1 | .0318 | .0318 | .0318 | .0318 | .0318 | .0318 | .0318 | .0318 | .0318 |
| B2 | -1.0813 | -1.0813 | -1.0813 | -1.0813 | -1.0813 | -1.0813 | -1.0813 | -1.0813 | -1.0813 |
| B3 | .7077 | .7076 | .7076 | .7076 | .7077 | .7076 | .7077 | .7076 | .7076 |
| B4 | .6799 | .6799 | .6799 | .6799 | .6799 | .6799 | .6799 | .6799 | .6799 |
| B5 | -1.2063 | -1.2062 | -1.2063 | -1.2063 | -1.2063 | -1.2062 | -1.2063 | -1.2063 | -1.2063 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 322519 — QTA2 = 268219 — QTA3 = 230094

AZIMUTH AND TILT COEF. — C1 = -.0114 — C2 = -.2205 — C3 = -.4899 — C4 = 1.7953 — C5 = -1.3471

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 33 | 38 | 44 | 46 | 55 | 63 | 71 | 68 | 63 | 49 | 42 | 35 |
| QHOR: | 569 | 799 | 1309 | 1779 | 2199 | 2481 | 2602 | 2234 | 1786 | 1168 | 599 | 528 |

OAKLAND, CALIFORNIA — ELEVATION = 7 — LAT = 37.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | NA | 645.84 | 215.94 | 105.21 | 64.07 | 45.17 | 34.86 | 23.93 |
| VT2/DD | NA | NA | 551.56 | 184.41 | 89.85 | 54.71 | 38.58 | 29.77 | 20.43 |
| VT3/DD | NA | NA | 479.02 | 160.16 | 78.03 | 47.52 | 33.51 | 25.85 | 17.75 |
| MONTHLY DD | 0 | 4 | 37 | 110 | 225 | 369 | 524 | 679 | 989 |
| ANNUAL DD | 0 | 6 | 60 | 245 | 741 | 1734 | 3215 | 4918 | 8520 |
| PARAMETER A | NA | NA | .600 | .814 | .899 | .874 | .819 | .713 | .539 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | .0460 | .0508 | .0608 | .0654 | .0636 | .0662 | .0763 |
| A2 | NA | NA | -.0969 | -.0516 | .1326 | .3982 | .7052 | 1.0686 | 1.7529 |
| A3 | NA | NA | .0582 | .0116 | -.2093 | -.5709 | -1.0103 | -1.5190 | -2.4389 |
| A4 | NA | NA | -.0317 | .0032 | .1438 | .3651 | .6348 | .9531 | 1.5387 |
| A5 | NA | NA | -.0471 | -.0468 | -.0612 | -.1164 | -.1981 | -.2833 | -.4070 |
| B1 | NA | NA | -.0825 | -.0825 | -.0825 | -.0825 | -.0825 | -.0825 | -.0825 |
| B2 | NA | NA | -1.0789 | -1.0789 | -1.0789 | -1.0789 | -1.0789 | -1.0789 | -1.0789 |
| B3 | NA | NA | .6893 | .6893 | .6893 | .6893 | .6893 | .6893 | .6893 |
| B4 | NA | NA | .7903 | .7903 | .7903 | .7903 | .7903 | .7903 | .7903 |
| B5 | NA | NA | -1.2231 | -1.2231 | -1.2231 | -1.2231 | -1.2231 | -1.2231 | -1.2231 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 313023 — QTA2 = 260250 — QTA3 = 223289

AZIMUTH AND TILT COEF. — C1 = -.1003 — C2 = -.2861 — C3 = -.4195 — C4 = 1.8449 — C5 = -1.2944

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 48 | 52 | 52 | 54 | 58 | 60 | 61 | 63 | 63 | 60 | 54 | 49 |
| QHOR: | 665 | 1002 | 1359 | 1974 | 2209 | 2348 | 2286 | 2087 | 1679 | 1190 | 786 | 643 |

POINT MUGU, CALIFORNIA — ELEVATION = 13 — LAT = 34.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M= 3) | (M= 3) | (M= 3) | (M= 5) | (M= 5) |
| VT1/DD | NA | NA | 2549.57 | 724.92 | 311.54 | 151.88 | 91.56 | 56.68 | 30.58 |
| VT2/DD | NA | NA | 2182.62 | 620.59 | 259.10 | 126.32 | 76.15 | 45.72 | 24.67 |
| VT3/DD | NA | NA | 1896.71 | 539.29 | 222.84 | 108.64 | 65.49 | 38.63 | 20.85 |
| MONTHLY DD | 0 | 1 | 13 | 47 | 103 | 210 | 349 | 363 | 673 |
| ANNUAL DD | 0 | 3 | 38 | 177 | 524 | 1237 | 2430 | 4006 | 7568 |
| PARAMETER A | NA | NA | .460 | .545 | .515 | .528 | .433 | .527 | .537 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | -.0272 | -.0206 | -.0268 | -.0484 | -.0983 | .1294 | .0973 |
| A2 | NA | NA | .8697 | .9373 | -1.4775 | -.9736 | -.6432 | -3.8500 | -3.5354 |
| A3 | NA | NA | -.9472 | -1.0368 | 1.6150 | .9862 | .5316 | 5.1133 | 4.6610 |
| A4 | NA | NA | .5661 | .6139 | -.8885 | -.5502 | -.3051 | -2.5533 | -2.2981 |
| A5 | NA | NA | .0532 | .0449 | -.1395 | -.1396 | -.1566 | .0839 | .0249 |
| B1 | NA | NA | -.0063 | -.0063 | -.0121 | -.0121 | -.0121 | -.1801 | -.1801 |
| B2 | NA | NA | -1.2047 | -1.2047 | -.3867 | -.3867 | -.3867 | .9472 | .9472 |
| B3 | NA | NA | .7735 | .7734 | -.3150 | -.3150 | -.3150 | -1.9257 | -1.9258 |
| B4 | NA | NA | .7851 | .7852 | 1.7196 | 1.7195 | 1.7196 | 3.0157 | 3.0158 |
| B5 | NA | NA | -1.3111 | -1.3111 | -1.3741 | -1.3740 | -1.3741 | -1.0416 | -1.0416 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 330564 — QTA2 = 275614 — QTA3 = 236916

AZIMUTH AND TILT COEF. — C1 = -.0993 — C2 = -.3222 — C3 = -.3542 — C4 = 1.7759 — C5 = -1.2672

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 54 | 54 | 53 | 57 | 58 | 61 | 64 | 65 | 65 | 62 | 57 | 55 |
| QHOR: | 918 | 1224 | 1636 | 2028 | 2074 | 2033 | 2206 | 1896 | 1601 | 1291 | 1017 | 849 |

RED BLUFF, CALIFORNIA — ELEVATION = 354 — LAT = 40.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) |
| VT1/DD | NA | 264.27 | 132.71 | 78.03 | 52.77 | 39.12 | 30.75 | 24.81 | 17.89 |
| VT2/DD | NA | 226.03 | 113.51 | 66.74 | 45.13 | 33.46 | 26.30 | 21.24 | 15.32 |
| VT3/DD | NA | 196.33 | 98.59 | 57.97 | 39.20 | 29.07 | 22.84 | 18.46 | 13.31 |
| MONTHLY DD | 5 | 81 | 162 | 276 | 408 | 550 | 700 | 802 | 1112 |
| ANNUAL DD | 5 | 137 | 378 | 817 | 1455 | 2277 | 3277 | 4453 | 7254 |
| PARAMETER A | NA | .714 | .767 | .762 | .740 | .737 | .749 | .790 | .837 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0037 | -.0036 | -.0006 | .0022 | .0049 | .0073 | .0304 | .0314 |
| A2 | NA | -.0101 | .0288 | .1144 | .2131 | .3027 | .3803 | .5203 | .6258 |
| A3 | NA | -.0038 | -.0567 | -.1550 | -.2718 | -.3845 | -.4869 | -.6155 | -.7831 |
| A4 | NA | -.0076 | .0229 | .0885 | .1630 | .2321 | .2932 | .4201 | .5110 |
| A5 | NA | -.0103 | -.0186 | -.0236 | -.0303 | -.0409 | -.0535 | -.0482 | -.0877 |
| B1 | NA | -.0352 | -.0352 | -.0352 | -.0352 | -.0352 | -.0352 | -.0456 | -.0456 |
| B2 | NA | -1.1386 | -1.1386 | -1.1386 | -1.1386 | -1.1386 | -1.1386 | -1.1735 | -1.1736 |
| B3 | NA | .7692 | .7691 | .7691 | .7691 | .7691 | .7691 | .8157 | .8157 |
| B4 | NA | .7118 | .7119 | .7118 | .7119 | .7119 | .7118 | .6443 | .6443 |
| B5 | NA | -1.2027 | -1.2027 | -1.2027 | -1.2027 | -1.2027 | -1.2027 | -1.1953 | -1.1953 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 328888 — QTA2 = 273310 — QTA3 = 234377

AZIMUTH AND TILT COEF. — C1 = -.0210 — C2 = -.1954 — C3 = -.5323 — C4 = 1.8505 — C5 = -1.3437

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 42 | 49 | 50 | 57 | 67 | 77 | 82 | 80 | 73 | 63 | 51 | 44 |
| QHOR: | 569 | 866 | 1318 | 1953 | 2338 | 2542 | 2686 | 2350 | 1855 | 1251 | 736 | 492 |

SAN DIEGO CA TMY — ELEVATION = 30 — LAT = 32.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 5) |
| VT1/DD | NA | NA | NA | 1949.55 | 549.07 | 216.38 | 112.92 | 74.14 | 38.34 |
| VT2/DD | NA | NA | NA | 1663.20 | 468.42 | 184.60 | 96.34 | 63.25 | 31.00 |
| VT3/DD | NA | NA | NA | 1444.62 | 406.86 | 160.34 | 83.68 | 54.94 | 26.25 |
| MONTHLY DD | 0 | 0 | 2 | 17 | 60 | 152 | 291 | 444 | 514 |
| ANNUAL DD | 0 | 0 | 3 | 31 | 159 | 572 | 1460 | 2826 | 6281 |
| PARAMETER A | NA | NA | NA | .376 | .601 | .536 | .458 | .385 | .434 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | NA | -.0014 | -.0284 | -.0757 | -.1202 | -.1734 | .0947 |
| A2 | NA | NA | NA | -.1340 | .1497 | .6549 | 1.2936 | 2.0243 | -4.3534 |
| A3 | NA | NA | NA | .0863 | -.2366 | -.8528 | -1.6906 | -2.6346 | 5.7182 |
| A4 | NA | NA | NA | -.0473 | .1568 | .5436 | 1.0312 | 1.5700 | -2.9249 |
| A5 | NA | NA | NA | -.0570 | -.0625 | -.0944 | -.1497 | -.1789 | .0932 |
| B1 | NA | NA | NA | -.0177 | -.0177 | -.0177 | -.0177 | -.0177 | -.2223 |
| B2 | NA | NA | NA | -1.0743 | -1.0743 | -1.0743 | -1.0743 | -1.0743 | .8596 |
| B3 | NA | NA | NA | .6272 | .6272 | .6272 | .6272 | .6272 | -1.7581 |
| B4 | NA | NA | NA | .9253 | .9253 | .9253 | .9253 | .9253 | 3.0159 |
| B5 | NA | NA | NA | -1.3064 | -1.3064 | -1.3064 | -1.3064 | -1.3064 | -1.0003 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 326323 QTA2 = 271836 QTA3 = 233615
AZIMUTH AND TILT COEF. C1 = -.1403 C2 = -.3271 C3 = -.3550 C4 = 1.8486 C5 = -1.2694

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 55 | 57 | 58 | 60 | 63 | 64 | 68 | 70 | 70 | 66 | 61 | 57 |
| QHOR: | 959 | 1280 | 1617 | 1920 | 1996 | 2003 | 2191 | 2106 | 1694 | 1385 | 1064 | 882 |

SAN FRANCISCO, CALIFORNIA — ELEVATION = 16 — LAT = 37.6

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | NA | 566.75 | 212.87 | 107.91 | 66.89 | 47.18 | 36.29 | 24.82 |
| VT2/DD | NA | NA | 484.11 | 181.83 | 92.17 | 57.14 | 40.30 | 31.00 | 21.20 |
| VT3/DD | NA | NA | 420.45 | 157.92 | 80.05 | 49.63 | 35.00 | 26.92 | 18.41 |
| MONTHLY DD | 0 | 5 | 43 | 114 | 226 | 364 | 516 | 671 | 981 |
| ANNUAL DD | 0 | 11 | 90 | 331 | 982 | 2175 | 3703 | 5395 | 8974 |
| PARAMETER A | NA | NA | .681 | .829 | .864 | .816 | .710 | .611 | .469 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | .0208 | .0266 | .0344 | .0399 | .0453 | .0506 | .0612 |
| A2 | NA | NA | -.0630 | .0949 | .3746 | .6838 | 1.0556 | 1.4418 | 2.1527 |
| A3 | NA | NA | .0241 | -.1636 | -.5456 | -.9905 | -1.5160 | -2.0471 | -2.9991 |
| A4 | NA | NA | -.0185 | .1003 | .3322 | .6044 | .9296 | 1.2611 | 1.8615 |
| A5 | NA | NA | -.0362 | -.0465 | -.1050 | -.1907 | -.2829 | -.3633 | -.4863 |
| B1 | NA | NA | -.0665 | -.0665 | -.0665 | -.0665 | -.0665 | -.0665 | -.0665 |
| B2 | NA | NA | -1.0915 | -1.0915 | -1.0915 | -1.0915 | -1.0915 | -1.0915 | -1.0915 |
| B3 | NA | NA | .6990 | .6990 | .6990 | .6990 | .6990 | .6990 | .6990 |
| B4 | NA | NA | .7935 | .7935 | .7935 | .7935 | .7936 | .7935 | .7935 |
| B5 | NA | NA | -1.2317 | -1.2317 | -1.2317 | -1.2317 | -1.2317 | -1.2317 | -1.2317 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 325986 QTA2 = 271087 QTA3 = 232596
AZIMUTH AND TILT COEF. C1 = -.0768 C2 = -.2904 C3 = -.4324 C4 = 1.8576 C5 = -1.3182

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 48 | 51 | 51 | 54 | 55 | 58 | 60 | 61 | 62 | 59 | 53 | 48 |
| QHOR: | 679 | 1077 | 1417 | 1946 | 2249 | 2440 | 2427 | 2098 | 1777 | 1225 | 894 | 616 |

SANTA MARIA, CALIFORNIA — ELEVATION = 236 — LAT = 34.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 6) | (M= 6) |
| VT1/DD | NA | 820.17 | 400.35 | 226.71 | 134.32 | 86.50 | 61.48 | 46.38 | 26.73 |
| T2/DD | NA | 700.70 | 342.04 | 193.69 | 114.75 | 73.90 | 52.53 | 37.38 | 21.54 |
| VT3/DD | NA | 608.65 | 297.10 | 168.24 | 99.68 | 64.19 | 45.62 | 31.63 | 18.23 |
| MONTHLY DD | 2 | 38 | 77 | 136 | 230 | 358 | 503 | 407 | 707 |
| ANNUAL DD | 3 | 72 | 192 | 467 | 1113 | 2253 | 3700 | 5350 | 8902 |
| PARAMETER A | NA | .515 | .720 | .750 | .720 | .579 | .418 | .400 | .474 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0179 | -.0090 | -.0114 | -.0246 | -.0583 | -.1078 | .1208 | .0882 |
| A2 | NA | .0126 | .1430 | .3660 | .8201 | 1.5203 | 2.4448 | -6.1518 | -4.8643 |
| A3 | NA | -.0614 | -.1998 | -.4958 | -1.1367 | -2.0997 | -3.3200 | 8.6883 | 6.8033 |
| A4 | NA | .0187 | .1182 | .2939 | .6663 | 1.2372 | 1.9705 | -5.0303 | -3.9337 |
| A5 | NA | -.0316 | -.0275 | -.0584 | -.1494 | -.2658 | -.3709 | .9835 | .6931 |
| B1 | NA | -.0144 | -.0144 | -.0144 | -.0144 | -.0144 | -.0144 | -.2136 | -.2136 |
| B2 | NA | -1.1221 | -1.1221 | -1.1221 | -1.1221 | -1.1221 | -1.1221 | 1.3694 | 1.3695 |
| B3 | NA | .7156 | .7156 | .7156 | .7156 | .7156 | .7156 | -2.4938 | -2.4940 |
| B4 | NA | .8408 | .8408 | .8408 | .8408 | .8408 | .8408 | 3.7916 | 3.7917 |
| B5 | NA | -1.2919 | -1.2918 | -1.2919 | -1.2919 | -1.2918 | -1.2918 | -.9217 | -.9219 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 325546 QTA2 = 270853 QTA3 = 232533
AZIMUTH AND TILT COEF. C1 = -.1077 C2 = -.2901 C3 = -.4187 C4 = 1.8874 C5 = -1.3046

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 48 | 51 | 52 | 54 | 56 | 56 | 60 | 60 | 60 | 58 | 55 | 51 |
| QHOR: | 843 | 1101 | 1549 | 1920 | 2044 | 2394 | 2369 | 2109 | 1689 | 1366 | 958 | 802 |

SUNNYVALE, CALIFORNIA — ELEVATION = 39 — LAT = 37.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | NA | NA | 614.36 | 270.05 | 130.86 | 75.13 | 51.26 | 38.74 | 26.02 |
| VT2/DD | NA | NA | 525.69 | 231.07 | 111.97 | 64.29 | 43.87 | 33.15 | 22.27 |
| VT3/DD | NA | NA | 456.68 | 200.74 | 97.27 | 55.85 | 38.11 | 28.80 | 19.34 |
| MONTHLY DD | 0 | 11 | 40 | 91 | 188 | 327 | 479 | 634 | 944 |
| ANNUAL DD | 0 | 18 | 97 | 323 | 831 | 1730 | 3034 | 4612 | 8136 |
| PARAMETER A | NA | NA | .871 | .717 | .647 | .697 | .717 | .665 | .521 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | .0289 | .0473 | .0523 | .0407 | .0295 | .0213 | .0096 |
| A2 | NA | NA | .1509 | .3921 | .6099 | .7058 | .8955 | 1.2265 | 2.0052 |
| A3 | NA | NA | -.1590 | -.4318 | -.7034 | -.8637 | -1.1592 | -1.6368 | -2.6912 |
| A4 | NA | NA | .1083 | .2843 | .4529 | .5465 | .7231 | 1.0138 | 1.6668 |
| A5 | NA | NA | .0035 | -.0011 | -.0237 | -.0688 | -.1405 | -.2308 | -.3768 |
| B1 | NA | NA | -.0381 | -.0381 | -.0381 | -.0381 | -.0381 | -.0381 | -.0381 |
| B2 | NA | NA | -1.1628 | -1.1628 | -1.1628 | -1.1628 | -1.1628 | -1.1628 | -1.1628 |
| B3 | NA | NA | .7857 | .7858 | .7858 | .7858 | .7858 | .7858 | .7858 |
| B4 | NA | NA | .7158 | .7158 | .7158 | .7158 | .7158 | .7158 | .7158 |
| B5 | NA | NA | -1.2246 | -1.2246 | -1.2246 | -1.2246 | -1.2246 | -1.2246 | -1.2246 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 323128 — QTA2 = 268567 — QTA3 = 230386

AZIMUTH AND TILT COEF. — C1 = -.0780 — C2 = -.2648 — C3 = -.4592 — C4 = 1.8779 — C5 = -1.3070

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 49 | 51 | 53 | 57 | 59 | 64 | 64 | 65 | 63 | 61 | 53 | 49 |
| QHOR: | 737 | 1043 | 1467 | 1896 | 2301 | 2433 | 2447 | 2197 | 1751 | 1239 | 844 | 634 |

COLORADO SPRINGS, COLORADO — ELEVATION = 6171 — LAT = 38.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 2) | (M= 2) | (M= 2) | (M= 3) | (M= 3) | (M= 4) |
| VT1/DD | 293.83 | 123.39 | 91.14 | 71.04 | 56.98 | 47.23 | 40.59 | 34.63 | 26.82 |
| VT2/DD | 251.68 | 105.69 | 78.06 | 60.39 | 48.44 | 40.15 | 33.90 | 28.92 | 21.88 |
| VT3/DD | 218.74 | 91.86 | 67.85 | 52.39 | 42.02 | 34.83 | 29.19 | 24.91 | 18.60 |
| MONTHLY DD | 147 | 350 | 474 | 522 | 651 | 786 | 901 | 1056 | 1013 |
| ANNUAL DD | 459 | 1414 | 2097 | 2932 | 3934 | 5097 | 6440 | 7936 | 11244 |
| PARAMETER A | .494 | .337 | .311 | .309 | .314 | .314 | .326 | .340 | .336 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0451 | .0870 | .1031 | .0304 | .0412 | .0528 | .1015 | .1119 | -.3218 |
| A2 | .6498 | 1.1919 | 1.4119 | .0613 | .2634 | .4796 | -2.0843 | -1.7046 | -5.0829 |
| A3 | -.6326 | -1.2172 | -1.4723 | -.4395 | -.6783 | -.9405 | 1.9826 | 1.5413 | 6.2182 |
| A4 | .4195 | .7798 | .9304 | .0530 | .2072 | .3749 | -.9970 | -.7300 | -3.2101 |
| A5 | .1149 | .1680 | .1755 | -.1988 | -.2061 | -.2180 | -.3976 | -.3962 | -.0474 |
| B1 | -.0269 | -.0269 | -.0269 | -.0129 | -.0129 | -.0129 | -.0223 | -.0223 | .1189 |
| B2 | -1.1664 | -1.1664 | -1.1665 | -.9266 | -.9266 | -.9266 | -.3737 | -.3737 | .3681 |
| B3 | .7373 | .7373 | .7373 | .4096 | .4096 | .4096 | -.2979 | -.2979 | -1.2709 |
| B4 | .6658 | .6659 | .6659 | .9832 | .9832 | .9832 | 1.5143 | 1.5143 | 2.3201 |
| B5 | -1.3518 | -1.3519 | -1.3518 | -1.4009 | -1.4009 | -1.4009 | -1.4664 | -1.4664 | -1.4699 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 389705 — QTA2 = 325747 — QTA3 = 280111

AZIMUTH AND TILT COEF. — C1 = .0510 — C2 = -.3640 — C3 = -.3178 — C4 = 1.6205 — C5 = -1.3902

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 30 | 32 | 35 | 46 | 55 | 65 | 70 | 69 | 62 | 52 | 37 | 33 |
| QHOR: | 884 | 1164 | 1590 | 1956 | 2146 | 2344 | 2177 | 2022 | 1779 | 1389 | 972 | 760 |

DENVER, COLORADO — ELEVATION = 5331 — LAT = 39.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) |
| VT1/DD | 213.04 | 103.97 | 78.45 | 61.97 | 49.91 | 41.50 | 35.41 | 30.88 | 24.58 |
| VT2/DD | 182.55 | 89.10 | 67.22 | 52.68 | 42.43 | 35.28 | 30.11 | 26.25 | 20.90 |
| VT3/DD | 158.67 | 77.44 | 58.43 | 45.70 | 36.80 | 30.60 | 26.11 | 22.77 | 18.13 |
| MONTHLY DD | 193 | 396 | 525 | 545 | 677 | 814 | 954 | 1094 | 1374 |
| ANNUAL DD | 568 | 1510 | 2209 | 3059 | 4059 | 5223 | 6542 | 8004 | 11262 |
| PARAMETER A | .492 | .428 | .417 | .418 | .430 | .438 | .438 | .430 | .375 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0459 | .0864 | .1028 | .0336 | .0438 | .0536 | .0634 | .0741 | .1059 |
| A2 | .4113 | .6545 | .7883 | -.3182 | -.1620 | .0157 | .2016 | .4021 | .9085 |
| A3 | -.3867 | -.6345 | -.7878 | .0130 | -.1582 | -.3669 | -.5935 | -.8479 | -1.5254 |
| A4 | .2766 | .4408 | .5374 | -.0971 | .0126 | .1428 | .2821 | .4364 | .8402 |
| A5 | .0877 | .1158 | .1152 | -.2401 | -.2361 | -.2414 | -.2522 | -.2705 | -.3389 |
| B1 | -.0366 | -.0366 | -.0366 | -.0178 | -.0178 | -.0178 | -.0178 | -.0178 | -.0178 |
| B2 | -1.1883 | -1.1883 | -1.1883 | -.9252 | -.9253 | -.9253 | -.9252 | -.9253 | -.9252 |
| B3 | .7562 | .7562 | .7562 | .4242 | .4242 | .4242 | .4242 | .4243 | .4242 |
| B4 | .6544 | .6544 | .6545 | .9707 | .9707 | .9707 | .9707 | .9707 | .9706 |
| B5 | -1.3439 | -1.3440 | -1.3440 | -1.3722 | -1.3722 | -1.3722 | -1.3722 | -1.3722 | -1.3721 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 386992 — QTA2 = 323451 — QTA3 = 278106

AZIMUTH AND TILT COEF. — C1 = .0505 — C2 = -.3776 — C3 = -.3051 — C4 = 1.6205 — C5 = -1.3879

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 29 | 30 | 38 | 48 | 57 | 64 | 72 | 70 | 62 | 49 | 38 | 30 |
| QHOR: | 834 | 1080 | 1609 | 1910 | 2206 | 2345 | 2325 | 2015 | 1777 | 1339 | 881 | 744 |

EAGLE, COLORADO — ELEVATION = 6512 — LAT = 39.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 92.08 | 53.69 | 43.30 | 36.08 | 30.92 | 27.06 | 24.05 | 21.64 | 18.03 |
| VT2/DD | 78.81 | 46.07 | 37.06 | 30.88 | 26.47 | 23.16 | 20.58 | 18.52 | 15.43 |
| VT3/DD | 68.48 | 40.05 | 32.20 | 26.83 | 23.00 | 20.12 | 17.88 | 16.09 | 13.41 |
| MONTHLY DD | 364 | 670 | 774 | 929 | 1084 | 1239 | 1394 | 1549 | 1859 |
| ANNUAL DD | 1251 | 2666 | 3622 | 4729 | 5976 | 7352 | 8839 | 10421 | 13824 |
| PARAMETER A | .509 | .569 | .586 | .598 | .603 | .597 | .579 | .552 | .479 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0472 | .0118 | -.0398 | -.0367 | -.0340 | -.0315 | -.0293 | -.0272 | -.0230 |
| A2 | .0595 | .7273 | .3750 | .4863 | .6058 | .7437 | .9075 | 1.1031 | 1.5882 |
| A3 | -.0928 | -.6846 | -.4486 | -.5912 | -.7497 | -.9359 | -1.1580 | -1.4214 | -2.0628 |
| A4 | .1643 | .4138 | .3826 | .4663 | .5587 | .6682 | .8007 | .9597 | 1.3530 |
| A5 | -.0451 | .1136 | -.0425 | -.0543 | -.0710 | -.0930 | -.1204 | -.1513 | -.2165 |
| B1 | .0385 | .0182 | .0385 | .0385 | .0385 | .0385 | .0385 | .0385 | .0385 |
| B2 | -1.1306 | -1.2569 | -1.1306 | -1.1306 | -1.1306 | -1.1306 | -1.1306 | -1.1306 | -1.1306 |
| B3 | .7257 | .8581 | .7257 | .7257 | .7258 | .7258 | .7257 | .7257 | .7257 |
| B4 | .6679 | .5936 | .6679 | .6679 | .6679 | .6679 | .6679 | .6679 | .6679 |
| B5 | -1.3018 | -1.3062 | -1.3018 | -1.3018 | -1.3018 | -1.3018 | -1.3019 | -1.3018 | -1.3019 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 373103 — QTA2 = 311455 — QTA3 = 267655

AZIMUTH AND TILT COEF. — C1 = .0727 — C2 = -.3201 — C3 = -.3715 — C4 = 1.6770 — C5 = -1.3689

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 22 | 31 | 42 | 51 | 59 | 65 | 64 | 54 | 42 | 31 | 18 |
| QHOR: | 744 | 1120 | 1479 | 2004 | 2269 | 2510 | 2334 | 2115 | 1761 | 1296 | 914 | 705 |

GRAND JUNCTION, COLORADO — ELEVATION = 4839 — LAT = 39.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 164.23 | 69.32 | 52.97 | 42.81 | 35.92 | 30.94 | 27.17 | 24.22 | 19.90 |
| VT2/DD | 140.54 | 59.31 | 45.33 | 36.63 | 30.74 | 26.48 | 23.25 | 20.73 | 17.03 |
| VT3/DD | 122.11 | 51.54 | 39.38 | 31.83 | 26.71 | 23.00 | 20.20 | 18.01 | 14.80 |
| MONTHLY DD | 211 | 499 | 653 | 808 | 963 | 1118 | 1273 | 1428 | 1738 |
| ANNUAL DD | 470 | 1397 | 2076 | 2890 | 3820 | 4870 | 6040 | 7347 | 10373 |
| PARAMETER A | .650 | .703 | .693 | .677 | .657 | .639 | .624 | .614 | .592 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0341 | .0241 | .0222 | .0210 | .0203 | .0197 | .0194 | .0193 | .0207 |
| A2 | -.0233 | .1090 | .1897 | .2797 | .3765 | .4788 | .5827 | .6881 | .9360 |
| A3 | -.0155 | -.1330 | -.2169 | -.3182 | -.4315 | -.5543 | -.6834 | -.8198 | -1.1589 |
| A4 | .0350 | .1221 | .1795 | .2452 | .3176 | .3951 | .4757 | .5593 | .7641 |
| A5 | -.0385 | -.0140 | -.0077 | -.0063 | -.0080 | -.0125 | -.0208 | -.0341 | -.0819 |
| B1 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 |
| B2 | -1.1306 | -1.1306 | -1.1306 | -1.1306 | -1.1306 | -1.1306 | -1.1306 | -1.1306 | -1.1306 |
| B3 | .7119 | .7119 | .7119 | .7119 | .7119 | .7119 | .7119 | .7119 | .7119 |
| B4 | .6905 | .6905 | .6905 | .6905 | .6905 | .6905 | .6904 | .6905 | .6905 |
| B5 | -1.3112 | -1.3112 | -1.3112 | -1.3112 | -1.3112 | -1.3111 | -1.3112 | -1.3112 | -1.3112 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 374957 — QTA2 = 312580 — QTA3 = 268426

AZIMUTH AND TILT COEF. — C1 = .0234 — C2 = -.2936 — C3 = -.4211 — C4 = 1.7365 — C5 = -1.3783

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 23 | 32 | 39 | 50 | 63 | 72 | 79 | 76 | 66 | 52 | 39 | 29 |
| QHOR: | 777 | 1103 | 1523 | 1959 | 2397 | 2582 | 2508 | 2199 | 1821 | 1328 | 924 | 731 |

PUEBLO, COLORADO — ELEVATION = 4721 — LAT = 38.3

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 169.14 | 88.77 | 69.00 | 55.80 | 46.50 | 39.70 | 34.51 | 30.50 | 24.74 |
| VT2/DD | 144.83 | 76.01 | 59.08 | 47.78 | 39.82 | 33.99 | 29.54 | 26.11 | 21.19 |
| VT3/DD | 125.86 | 66.06 | 51.35 | 41.52 | 34.60 | 29.54 | 25.68 | 22.69 | 18.41 |
| MONTHLY DD | 240 | 458 | 589 | 729 | 875 | 1025 | 1179 | 1334 | 1644 |
| ANNUAL DD | 640 | 1449 | 2035 | 2755 | 3614 | 4613 | 5774 | 7107 | 10155 |
| PARAMETER A | .583 | .584 | .578 | .565 | .555 | .541 | .528 | .512 | .447 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0650 | .0702 | .0746 | .0800 | .0852 | .0914 | .0972 | .1042 | .1300 |
| A2 | .5422 | .5485 | .5883 | .6583 | .7484 | .8646 | .9954 | 1.1564 | 1.6634 |
| A3 | -.5582 | -.5657 | -.6136 | -.7010 | -.8157 | -.9641 | -1.1345 | -1.3470 | -2.0126 |
| A4 | .3591 | .3645 | .3935 | .4452 | .5124 | .5997 | .7001 | .8259 | 1.2240 |
| A5 | .0590 | .0611 | .0600 | .0559 | .0486 | .0383 | .0235 | .0025 | -.0619 |
| B1 | -.0262 | -.0262 | -.0262 | -.0262 | -.0262 | -.0262 | -.0262 | -.0262 | -.0262 |
| B2 | -1.1626 | -1.1626 | -1.1626 | -1.1626 | -1.1626 | -1.1626 | -1.1626 | -1.1626 | -1.1626 |
| B3 | .7257 | .7257 | .7258 | .7258 | .7257 | .7258 | .7257 | .7257 | .7258 |
| B4 | .6979 | .6979 | .6979 | .6979 | .6979 | .6979 | .6979 | .6979 | .6979 |
| B5 | -1.3490 | -1.3490 | -1.3491 | -1.3490 | -1.3491 | -1.3490 | -1.3491 | -1.3491 | -1.3490 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 383915 — QTA2 = 320503 — QTA3 = 275441

AZIMUTH AND TILT COEF. — C1 = .0563 — C2 = -.3342 — C3 = -.3646 — C4 = 1.6799 — C5 = -1.3866

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 26 | 34 | 38 | 50 | 62 | 71 | 75 | 74 | 65 | 56 | 42 | 34 |
| QHOR: | 869 | 1174 | 1612 | 1939 | 2225 | 2502 | 2312 | 2068 | 1742 | 1383 | 960 | 800 |

HARTFORD, CONNECTICUT — ELEVATION = 180 — LAT = 41.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 83.09 | 34.75 | 25.39 | 19.73 | 16.04 | 13.48 | 11.61 | 10.20 | 8.20 |
| VT2/DD | 71.01 | 29.70 | 21.70 | 16.87 | 13.71 | 11.52 | 9.92 | 8.72 | 7.01 |
| VT3/DD | 61.67 | 25.79 | 18.84 | 14.65 | 11.90 | 10.01 | 8.62 | 7.57 | 6.08 |
| MONTHLY DD | 156 | 373 | 510 | 657 | 808 | 961 | 1116 | 1270 | 1580 |
| ANNUAL DD | 591 | 1549 | 2262 | 3115 | 4106 | 5232 | 6506 | 7927 | 11171 |
| PARAMETER A | .446 | .636 | .693 | .753 | .807 | .851 | .888 | .921 | .961 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0655 | -.0366 | -.0297 | -.0239 | -.0196 | -.0163 | -.0138 | -.0119 | -.0089 |
| A2 | .3403 | .3318 | .3456 | .3518 | .3622 | .3783 | .3965 | .4172 | .4813 |
| A3 | -.3975 | -.3769 | -.3877 | -.3955 | -.4118 | -.4362 | -.4639 | -.4958 | -.5911 |
| A4 | .3665 | .3033 | .2995 | .2957 | .2994 | .3098 | .3230 | .3392 | .3911 |
| A5 | -.0967 | -.0480 | -.0351 | -.0293 | -.0289 | -.0312 | -.0349 | -.0400 | -.0554 |
| B1 | .0019 | .0019 | .0019 | .0019 | .0019 | .0019 | .0019 | .0019 | .0019 |
| B2 | -1.0835 | -1.0835 | -1.0835 | -1.0835 | -1.0835 | -1.0835 | -1.0835 | -1.0835 | -1.0835 |
| B3 | .7642 | .7642 | .7642 | .7642 | .7642 | .7642 | .7642 | .7642 | .7642 |
| B4 | .6338 | .6337 | .6337 | .6337 | .6337 | .6337 | .6337 | .6337 | .6337 |
| B5 | -1.1120 | -1.1119 | -1.1119 | -1.1120 | -1.1120 | -1.1119 | -1.1119 | -1.1120 | -1.1119 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 236215 — QTA2 = 197248 — QTA3 = 169727

AZIMUTH AND TILT COEF. — C1 = .0092 — C2 = -.3189 — C3 = -.2118 — C4 = 1.5188 — C5 = -1.1223

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 25 | 27 | 35 | 49 | 58 | 69 | 73 | 70 | 62 | 51 | 41 | 29 |
| QHOR: | 492 | 784 | 992 | 1304 | 1679 | 1681 | 1717 | 1421 | 1148 | 863 | 493 | 355 |

WILMINGTON, DELAWARE — ELEVATION = 79 — LAT = 39.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 163.17 | 62.45 | 44.50 | 34.07 | 27.50 | 23.01 | 19.79 | 17.36 | 13.93 |
| VT2/DD | 139.44 | 53.37 | 38.03 | 29.11 | 23.50 | 19.67 | 16.91 | 14.83 | 11.91 |
| VT3/DD | 121.11 | 46.35 | 33.03 | 25.28 | 20.41 | 17.08 | 14.69 | 12.88 | 10.34 |
| MONTHLY DD | 134 | 350 | 492 | 642 | 796 | 951 | 1106 | 1261 | 1571 |
| ANNUAL DD | 257 | 902 | 1493 | 2239 | 3105 | 4094 | 5211 | 6493 | 9608 |
| PARAMETER A | .549 | .626 | .630 | .616 | .601 | .594 | .592 | .598 | .618 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0637 | .0655 | .0712 | .0772 | .0816 | .0835 | .0838 | .0818 | .0758 |
| A2 | .2411 | .2384 | .3073 | .3951 | .4830 | .5687 | .6546 | .7323 | .8826 |
| A3 | -.2115 | -.2263 | -.3053 | -.4063 | -.5101 | -.6162 | -.7253 | -.8271 | -1.0367 |
| A4 | .1557 | .1572 | .2048 | .2661 | .3281 | .3904 | .4538 | .5125 | .6343 |
| A5 | .0393 | .0323 | .0348 | .0367 | .0367 | .0329 | .0272 | .0198 | -.0064 |
| B1 | -.0361 | -.0361 | -.0361 | -.0361 | -.0361 | -.0361 | -.0361 | -.0361 | -.0361 |
| B2 | -1.0858 | -1.0858 | -1.0858 | -1.0858 | -1.0858 | -1.0858 | -1.0858 | -1.0858 | -1.0858 |
| B3 | .7083 | .7083 | .7083 | .7083 | .7083 | .7083 | .7083 | .7083 | .7083 |
| B4 | .7220 | .7220 | .7220 | .7220 | .7220 | .7221 | .7220 | .7220 | .7220 |
| B5 | -1.2076 | -1.2075 | -1.2076 | -1.2075 | -1.2076 | -1.2076 | -1.2076 | -1.2075 | -1.2075 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 264220 — QTA2 = 220473 — QTA3 = 189602

AZIMUTH AND TILT COEF. — C1 = -.0050 — C2 = -.3291 — C3 = -.2455 — C4 = 1.5886 — C5 = -1.1719

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 29 | 32 | 42 | 52 | 60 | 71 | 75 | 74 | 67 | 57 | 45 | 36 |
| QHOR: | 585 | 829 | 1112 | 1488 | 1667 | 1864 | 1860 | 1646 | 1335 | 1012 | 635 | 499 |

WASHINGTON, D.C. — ELEVATION = 289 — LAT = 38.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) |
| VT1/DD | 160.14 | 68.86 | 49.64 | 37.84 | 30.41 | 25.31 | 21.63 | 18.81 | 14.44 |
| VT2/DD | 136.84 | 58.84 | 42.42 | 32.33 | 25.98 | 21.63 | 18.48 | 16.09 | 12.35 |
| VT3/DD | 118.84 | 51.10 | 36.84 | 28.08 | 22.56 | 18.79 | 16.05 | 13.98 | 10.73 |
| MONTHLY DD | 144 | 334 | 464 | 608 | 757 | 909 | 1064 | 1026 | 1336 |
| ANNUAL DD | 264 | 894 | 1430 | 2113 | 2930 | 3887 | 5004 | 6284 | 9372 |
| PARAMETER A | .560 | .594 | .557 | .539 | .536 | .541 | .554 | .569 | .627 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0575 | -.0929 | -.1106 | -.1209 | -.1247 | -.1247 | -.1222 | .0683 | .0597 |
| A2 | .2861 | .3463 | .4192 | .4987 | .5733 | .6424 | .7086 | .9458 | 1.0488 |
| A3 | -.2592 | -.3434 | -.4274 | -.5212 | -.6154 | -.7073 | -.8000 | -1.0588 | -1.2412 |
| A4 | .1695 | .2093 | .2544 | .3055 | .3570 | .4080 | .4606 | .6562 | .7553 |
| A5 | .0611 | .0613 | .0682 | .0720 | .0699 | .0636 | .0525 | .0072 | -.0376 |
| A1 | .0543 | .0543 | .0543 | .0543 | .0543 | .0543 | .0543 | -.0160 | -.0160 |
| B2 | -1.0893 | -1.0893 | -1.0893 | -1.0893 | -1.0893 | -1.0893 | -1.0893 | -1.1356 | -1.1356 |
| B3 | .7192 | .7192 | .7192 | .7192 | .7192 | .7193 | .7192 | .7807 | .7807 |
| B4 | .7408 | .7408 | .7409 | .7408 | .7408 | .7408 | .7409 | .6713 | .6713 |
| B5 | -1.2365 | -1.2364 | -1.2364 | -1.2364 | -1.2364 | -1.2364 | -1.2365 | -1.2044 | -1.2045 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 261459 — QTA2 = 217987 — QTA3 = 187386

AZIMUTH AND TILT COEF. — C1 = .0183 — C2 = -.2857 — C3 = -.2975 — C4 = 1.6289 — C5 = -1.1923

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 30 | 33 | 43 | 54 | 63 | 69 | 75 | 74 | 69 | 56 | 46 | 36 |
| QHOR: | 608 | 813 | 1180 | 1482 | 1711 | 1892 | 1716 | 1700 | 1313 | 983 | 676 | 489 |

APALACHICOLA, FLORIDA — ELEVATION = 20 — LAT = 29.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 1411.91 | 576.32 | 285.04 | 160.41 | 99.62 | 66.60 | 47.90 | 30.18 |
| VT2/DD | NA | 1200.17 | 489.89 | 242.29 | 136.35 | 84.68 | 56.61 | 40.72 | 25.66 |
| VT3/DD | NA | 1041.68 | 425.20 | 210.30 | 118.35 | 73.50 | 49.13 | 35.34 | 22.27 |
| MONTHLY DD | 1 | 18 | 44 | 89 | 157 | 253 | 379 | 527 | 836 |
| ANNUAL DD | 1 | 37 | 112 | 265 | 524 | 932 | 1534 | 2342 | 4620 |
| PARAMETER A | NA | .718 | .675 | .577 | .520 | .515 | .531 | .545 | .577 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0172 | .0209 | .0280 | .0331 | .0337 | .0327 | .0317 | .0281 |
| A2 | NA | .1080 | .0961 | .1238 | .1694 | .2265 | .2944 | .3931 | .6608 |
| A3 | NA | -.1585 | -.1627 | -.2168 | -.2894 | -.3687 | -.4569 | -.5908 | -.9759 |
| A4 | NA | .1242 | .1359 | .1776 | .2243 | .2667 | .3127 | .3837 | .5839 |
| A5 | NA | -.0441 | -.0670 | -.0929 | -.1129 | -.1218 | -.1257 | -.1367 | -.1796 |
| B1 | NA | -.0320 | -.0320 | -.0320 | -.0320 | -.0320 | -.0320 | -.0320 | -.0320 |
| B2 | NA | -.9322 | -.9322 | -.9322 | -.9322 | -.9322 | -.9322 | -.9322 | -.9322 |
| B3 | NA | .5253 | .5253 | .5253 | .5253 | .5253 | .5253 | .5253 | .5253 |
| B4 | NA | 1.0234 | 1.0235 | 1.0234 | 1.0234 | 1.0234 | 1.0234 | 1.0234 | 1.0234 |
| B5 | NA | -1.2507 | -1.2507 | -1.2507 | -1.2507 | -1.2506 | -1.2507 | -1.2506 | -1.2506 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 283099 — QTA2 = 235429 — QTA3 = 202310

AZIMUTH AND TILT COEF. — C1 = .0103 — C2 = -.1238 — C3 = -.5285 — C4 = 1.9163 — C5 = -1.1730

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 53 | 52 | 60 | 69 | 74 | 80 | 81 | 81 | 79 | 69 | 59 | 55 |
| QHOR: | 863 | 1182 | 1458 | 1979 | 2134 | 1916 | 1875 | 1784 | 1556 | 1443 | 1047 | 832 |

DAYTONA BEACH, FLORIDA — ELEVATION = 39 — LAT = 29.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 1490.07 | 620.98 | 323.74 | 194.83 | 124.31 | 83.85 | 59.83 | 36.13 |
| VT2/DD | NA | 1267.19 | 528.09 | 275.31 | 165.69 | 105.72 | 71.31 | 50.88 | 30.73 |
| VT3/DD | NA | 1100.12 | 458.47 | 239.02 | 143.85 | 91.78 | 61.91 | 44.17 | 26.68 |
| MONTHLY DD | 0 | 18 | 44 | 85 | 141 | 221 | 328 | 460 | 761 |
| ANNUAL DD | 0 | 26 | 65 | 151 | 298 | 570 | 1009 | 1652 | 4003 |
| PARAMETER A | NA | .302 | .461 | .623 | .726 | .772 | .744 | .689 | .671 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0254 | .0154 | .0161 | .0193 | .0271 | .0386 | .0520 | .0684 |
| A2 | NA | .4324 | .2414 | .2090 | .2146 | .2546 | .3439 | .4634 | .8007 |
| A3 | NA | -.5186 | -.2919 | -.2558 | -.2671 | -.3248 | -.4477 | -.6121 | -1.0874 |
| A4 | NA | .2360 | .1321 | .1143 | .1211 | .1519 | .2139 | .2968 | .5275 |
| A5 | NA | .0376 | .0201 | .0170 | .0131 | .0063 | -.0018 | -.0119 | -.0358 |
| B1 | NA | -.0360 | -.0360 | -.0360 | -.0360 | -.0360 | -.0360 | -.0360 | -.0360 |
| B2 | NA | -.9655 | -.9655 | -.9655 | -.9655 | -.9655 | -.9655 | -.9655 | -.9655 |
| B3 | NA | .5374 | .5374 | .5374 | .5374 | .5374 | .5375 | .5375 | .5375 |
| B4 | NA | 1.0469 | 1.0469 | 1.0469 | 1.0469 | 1.0469 | 1.0469 | 1.0469 | 1.0469 |
| B5 | NA | -1.2670 | -1.2670 | -1.2670 | -1.2670 | -1.2671 | -1.2670 | -1.2670 | -1.2670 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 278952 — QTA2 = 232386 — QTA3 = 199929

AZIMUTH AND TILT COEF. — C1 = .0313 — C2 = -.1754 — C3 = -.4271 — C4 = 1.7868 — C5 = -1.0886

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 55 | 58 | 64 | 69 | 74 | 77 | 79 | 79 | 78 | 71 | 64 | 62 |
| QHOR: | 939 | 1198 | 1605 | 1891 | 1931 | 1790 | 1755 | 1674 | 1465 | 1284 | 1039 | 873 |

JACKSONVILLE, FLORIDA — ELEVATION = 30 — LAT = 30.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 642.69 | 325.39 | 197.17 | 127.07 | 85.11 | 60.47 | 45.55 | 29.72 |
| VT2/DD | NA | 546.75 | 276.81 | 167.74 | 108.10 | 72.41 | 51.45 | 38.75 | 25.29 |
| VT3/DD | NA | 474.64 | 240.30 | 145.61 | 93.84 | 62.86 | 44.66 | 33.64 | 21.95 |
| MONTHLY DD | 3 | 40 | 80 | 131 | 204 | 304 | 428 | 568 | 871 |
| ANNUAL DD | 3 | 85 | 187 | 354 | 615 | 1004 | 1561 | 2321 | 4693 |
| PARAMETER A | NA | .696 | .633 | .581 | .572 | .566 | .559 | .556 | .617 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0220 | .0244 | .0283 | .0310 | .0325 | .0350 | .0388 | .0439 |
| A2 | NA | .0050 | .0560 | .1153 | .1761 | .2457 | .3166 | .4075 | .6487 |
| A3 | NA | -.0069 | -.0687 | -.1413 | -.2161 | -.3042 | -.3952 | -.5183 | -.8680 |
| A4 | NA | .0191 | .0498 | .0899 | .1326 | .1817 | .2333 | .3015 | .4779 |
| A5 | NA | -.0117 | -.0108 | -.0125 | -.0151 | -.0190 | -.0244 | -.0359 | -.0694 |
| B1 | NA | -.0449 | -.0449 | -.0449 | -.0449 | -.0449 | -.0449 | -.0449 | -.0449 |
| B2 | NA | -.9591 | -.9591 | -.9591 | -.9591 | -.9591 | -.9591 | -.9591 | -.9591 |
| B3 | NA | .5433 | .5433 | .5433 | .5433 | .5433 | .5433 | .5433 | .5433 |
| B4 | NA | .9989 | .9989 | .9989 | .9989 | .9989 | .9989 | .9989 | .9989 |
| B5 | NA | -1.2353 | -1.2352 | -1.2352 | -1.2353 | -1.2352 | -1.2352 | -1.2352 | -1.2352 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 274221 — QTA2 = 228286 — QTA3 = 196299

AZIMUTH AND TILT COEF. — C1 = .0087 — C2 = -.1608 — C3 = -.4468 — C4 = 1.7977 — C5 = -1.0939

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 51 | 54 | 62 | 70 | 75 | 78 | 79 | 80 | 77 | 68 | 60 | 54 |
| QHOR: | 875 | 1146 | 1550 | 1896 | 1980 | 1882 | 1805 | 1726 | 1402 | 1223 | 949 | 803 |

MIAMI, FLORIDA — ELEVATION = 7 — LAT = 25.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | NA | NA | NA | NA | 1061.19 | 506.28 | 283.78 | 180.63 | 74.62 |
| VT2/DD | NA | NA | NA | NA | 901.70 | 430.18 | 241.13 | 153.49 | 63.40 |
| VT3/DD | NA | NA | NA | NA | 782.79 | 373.46 | 209.33 | 133.25 | 55.04 |
| MONTHLY DD | 0 | 1 | 3 | 11 | 29 | 60 | 107 | 168 | 407 |
| ANNUAL DD | 0 | 1 | 5 | 21 | 59 | 133 | 264 | 507 | 2067 |
| PARAMETER A | NA | NA | NA | NA | .365 | .361 | .454 | .535 | .526 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | NA | NA | .0769 | .0762 | .0591 | .0552 | .0794 |
| A2 | NA | NA | NA | NA | .3697 | .4049 | .3587 | .4267 | 1.1039 |
| A3 | NA | NA | NA | NA | -.4200 | -.4630 | -.4192 | -.5374 | -1.4634 |
| A4 | NA | NA | NA | NA | .3209 | .3566 | .3202 | .3748 | .8415 |
| A5 | NA | NA | NA | NA | .0169 | .0143 | .0031 | -.0285 | -.0623 |
| B1 | NA | NA | NA | NA | .0022 | .0022 | .0022 | .0022 | .0022 |
| B2 | NA | NA | NA | NA | -.9100 | -.9100 | -.9100 | -.9100 | -.9100 |
| B3 | NA | NA | NA | NA | .4721 | .4721 | .4721 | .4721 | .4721 |
| B4 | NA | NA | NA | NA | 1.0518 | 1.0518 | 1.0518 | 1.0518 | 1.0518 |
| B5 | NA | NA | NA | NA | -1.2849 | -1.2850 | -1.2850 | -1.2849 | -1.2850 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 276305 QTA2 = 230029 QTA3 = 197908
AZIMUTH AND TILT COEF. C1 = .0626 C2 = -.1094 C3 = -.4800 C4 = 1.8167 C5 =-1.0490

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 67 | 69 | 72 | 74 | 77 | 80 | 80 | 82 | 81 | 77 | 73 | 66 |
| QHOR: | 1044 | 1341 | 1592 | 1902 | 1794 | 1674 | 1748 | 1692 | 1496 | 1285 | 1184 | 1030 |

ORLANDO, FLORIDA — ELEVATION = 118 — LAT = 28.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | NA | 1806.72 | 671.66 | 331.06 | 184.24 | 114.47 | 77.53 | 43.76 |
| VT2/DD | NA | NA | 1535.75 | 570.93 | 281.41 | 156.61 | 97.30 | 65.91 | 37.19 |
| VT3/DD | NA | NA | 1333.20 | 495.63 | 244.29 | 135.96 | 84.47 | 57.21 | 32.29 |
| MONTHLY DD | 0 | 3 | 16 | 43 | 88 | 158 | 255 | 376 | 666 |
| ANNUAL DD | 0 | 5 | 27 | 80 | 193 | 413 | 796 | 1389 | 3507 |
| PARAMETER A | NA | NA | .326 | .532 | .564 | .601 | .586 | .578 | .592 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | -.0422 | -.0235 | -.0212 | -.0171 | -.0127 | -.0075 | .0061 |
| A2 | NA | NA | -.1503 | -.0388 | .0395 | .1238 | .2616 | .4394 | .8579 |
| A3 | NA | NA | .1215 | .0094 | -.0882 | -.1931 | -.3739 | -.6134 | -1.1863 |
| A4 | NA | NA | -.0797 | -.0108 | .0436 | .1015 | .1986 | .3221 | .5972 |
| A5 | NA | NA | -.0371 | -.0251 | -.0285 | -.0315 | -.0419 | -.0558 | -.0700 |
| B1 | NA | NA | -.0095 | -.0095 | -.0095 | -.0095 | -.0095 | -.0095 | -.0095 |
| B2 | NA | NA | -.9462 | -.9462 | -.9462 | -.9462 | -.9462 | -.9462 | -.9462 |
| B3 | NA | NA | .5087 | .5087 | .5087 | .5087 | .5087 | .5087 | .5087 |
| B4 | NA | NA | 1.0621 | 1.0621 | 1.0621 | 1.0621 | 1.0621 | 1.0621 | 1.0621 |
| B5 | NA | NA | -1.2665 | -1.2665 | -1.2665 | -1.2665 | -1.2665 | -1.2665 | -1.2665 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 283403 QTA2 = 236198 QTA3 = 203267
AZIMUTH AND TILT COEF. C1 = .0304 C2 = -.1557 C3 = -.4514 C4 = 1.7975 C5 =-1.0778

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 58 | 63 | 67 | 70 | 76 | 79 | 80 | 80 | 78 | 74 | 68 | 59 |
| QHOR: | 1008 | 1260 | 1575 | 1913 | 2013 | 1812 | 1793 | 1670 | 1478 | 1313 | 1125 | 910 |

TALLAHASSEE, FLORIDA — ELEVATION = 69 — LAT = 30.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 466.66 | 268.80 | 168.71 | 109.67 | 75.66 | 55.17 | 42.08 | 27.73 |
| VT2/DD | NA | 396.65 | 228.99 | 143.40 | 93.22 | 64.31 | 46.90 | 35.77 | 23.57 |
| VT3/DD | NA | 344.27 | 198.82 | 124.46 | 80.91 | 55.82 | 40.70 | 31.05 | 20.46 |
| MONTHLY DD | 14 | 53 | 92 | 148 | 227 | 329 | 452 | 592 | 899 |
| ANNUAL DD | 23 | 143 | 295 | 523 | 855 | 1323 | 1958 | 2793 | 5287 |
| PARAMETER A | NA | .489 | .505 | .491 | .495 | .502 | .501 | .509 | .575 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0051 | .0238 | .0031 | .0055 | .0069 | .0085 | .0112 | .0175 |
| A2 | NA | -.0311 | .4239 | .2265 | .2833 | .3266 | .3919 | .4908 | .7255 |
| A3 | NA | -.0086 | -.4813 | -.3248 | -.3938 | -.4498 | -.5400 | -.6798 | -1.0078 |
| A4 | NA | .0147 | .3008 | .2020 | .2436 | .2745 | .3220 | .3941 | .5547 |
| A5 | NA | -.0360 | -.0086 | -.0480 | -.0507 | -.0539 | -.0617 | -.0745 | -.0911 |
| B1 | NA | -.0156 | -.0232 | -.0156 | -.0156 | -.0156 | -.0156 | -.0156 | -.0156 |
| B2 | NA | -.9258 | -1.0062 | -.9258 | -.9258 | -.9258 | -.9258 | -.9258 | -.9258 |
| B3 | NA | .5201 | .6112 | .5201 | .5201 | .5201 | .5201 | .5201 | .5201 |
| B4 | NA | 1.0203 | .9328 | 1.0203 | 1.0202 | 1.0202 | 1.0202 | 1.0202 | 1.0202 |
| B5 | NA | -1.2241 | -1.2195 | -1.2241 | -1.2240 | -1.2240 | -1.2240 | -1.2241 | -1.2240 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 273514 QTA2 = 227749 QTA3 = 195879
AZIMUTH AND TILT COEF. C1 = .0137 C2 = -.1726 C3 = -.4304 C4 = 1.7838 C5 =-1.0852

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 51 | 51 | 60 | 67 | 72 | 77 | 79 | 78 | 77 | 69 | 57 | 51 |
| QHOR: | 870 | 1177 | 1459 | 1822 | 1901 | 1890 | 1761 | 1731 | 1488 | 1251 | 993 | 799 |

TAMPA, FLORIDA — ELEVATION = 10 — LAT = 28.0

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 2) | TB65 (M= 2) | TB70 (M= 2) | TB80 (M= 2) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | NA | 1695.93 | 745.93 | 398.56 | 222.07 | 123.74 | 78.63 | 41.98 |
| VT2/DD | NA | NA | 1442.03 | 634.26 | 338.89 | 186.61 | 103.98 | 66.07 | 35.28 |
| VT3/DD | NA | NA | 1252.05 | 550.70 | 294.24 | 161.42 | 89.94 | 57.15 | 30.52 |
| MONTHLY DD | 0 | 6 | 18 | 41 | 77 | 107 | 192 | 302 | 565 |
| ANNUAL DD | 0 | 9 | 36 | 101 | 232 | 474 | 874 | 1477 | 3612 |
| PARAMETER A | NA | NA | .380 | .374 | .369 | .409 | .522 | .560 | .615 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | .0093 | .0071 | .0068 | -.1084 | -.0855 | -.0805 | -.0635 |
| A2 | NA | NA | .2798 | .3060 | .4095 | -.9739 | -.6250 | -.4347 | -.0315 |
| A3 | NA | NA | -.3233 | -.3553 | -.4921 | 1.0076 | .6090 | .3754 | -.1320 |
| A4 | NA | NA | .1218 | .1309 | .2010 | -.4284 | -.2435 | -.1293 | .1042 |
| A5 | NA | NA | .0624 | .0707 | .0650 | -.2264 | -.1820 | -.1723 | -.1439 |
| B1 | NA | NA | .0069 | .0069 | .0069 | .0455 | .0456 | .0456 | .0456 |
| B2 | NA | NA | -.9751 | -.9751 | -.9751 | -.6072 | -.6072 | -.6072 | -.6072 |
| B3 | NA | NA | .5195 | .5195 | .5194 | .0769 | .0769 | .0769 | .0769 |
| B4 | NA | NA | 1.0868 | 1.0868 | 1.0868 | 1.4135 | 1.4135 | 1.4135 | 1.4135 |
| B5 | NA | NA | -1.3087 | -1.3087 | -1.3087 | -1.2636 | -1.2637 | -1.2637 | -1.2637 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 284283 QTA2 = 236840 QTA3 = 203785
AZIMUTH AND TILT COEF. C1 = .0492 C2 = -.1420 C3 = -.4766 C4 = 1.8242 C5 = -1.0800

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 59 | 59 | 66 | 69 | 76 | 79 | 80 | 81 | 79 | 72 | 66 | 60 |
| QHOR: | 1042 | 1190 | 1658 | 1898 | 2006 | 1859 | 1813 | 1664 | 1522 | 1343 | 1135 | 956 |

WEST PALM BEACH, FLORIDA — ELEVATION = 20 — LAT = 26.7

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | NA | NA | NA | 1183.58 | 521.58 | 271.07 | 150.92 | 60.51 |
| VT2/DD | NA | NA | NA | NA | 1004.30 | 442.57 | 230.01 | 128.06 | 51.35 |
| VT3/DD | NA | NA | NA | NA | 871.62 | 384.11 | 199.63 | 111.14 | 44.56 |
| MONTHLY DD | 0 | 0 | 1 | 7 | 23 | 52 | 99 | 178 | 445 |
| ANNUAL DD | 0 | 0 | 1 | 12 | 44 | 123 | 281 | 600 | 2293 |
| PARAMETER A | NA | NA | NA | NA | .317 | .681 | .705 | .645 | .609 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | NA | NA | .0696 | .0304 | .0268 | .0249 | .0159 |
| A2 | NA | NA | NA | NA | .4888 | .2190 | .2672 | .3972 | .7796 |
| A3 | NA | NA | NA | NA | -.5920 | -.2749 | -.3485 | -.5200 | -1.0409 |
| A4 | NA | NA | NA | NA | .3119 | .1525 | .1957 | .2902 | .5517 |
| A5 | NA | NA | NA | NA | .0189 | -.0043 | -.0182 | -.0272 | -.0401 |
| B1 | NA | NA | NA | NA | .0246 | .0246 | .0246 | .0246 | .0246 |
| B2 | NA | NA | NA | NA | -.8754 | -.8754 | -.8754 | -.8754 | -.8754 |
| B3 | NA | NA | NA | NA | .4202 | .4201 | .4202 | .4202 | .4201 |
| B4 | NA | NA | NA | NA | 1.1149 | 1.1149 | 1.1149 | 1.1149 | 1.1149 |
| B5 | NA | NA | NA | NA | -1.2570 | -1.2571 | -1.2570 | -1.2570 | -1.2570 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 263327 QTA2 = 219275 QTA3 = 188669
AZIMUTH AND TILT COEF. C1 = .0552 C2 = -.0987 C3 = -.4875 C4 = 1.8292 C5 = -1.0233

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 65 | 67 | 70 | 74 | 78 | 80 | 81 | 82 | 80 | 76 | 72 | 68 |
| QHOR: | 982 | 1207 | 1553 | 1844 | 1844 | 1732 | 1734 | 1651 | 1394 | 1269 | 1067 | 962 |

ATLANTA, GEORGIA — ELEVATION = 1033 — LAT = 33.7

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 1037.30 | 187.47 | 108.15 | 69.67 | 48.80 | 36.80 | 29.31 | 24.33 | 18.17 |
| VT2/DD | 883.06 | 159.60 | 92.07 | 59.31 | 41.55 | 31.32 | 24.95 | 20.72 | 15.46 |
| VT3/DD | 766.54 | 138.54 | 79.92 | 51.48 | 36.06 | 27.19 | 21.66 | 17.98 | 13.42 |
| MONTHLY DD | 21 | 119 | 205 | 319 | 455 | 604 | 758 | 913 | 1223 |
| ANNUAL DD | 50 | 332 | 639 | 1079 | 1657 | 2392 | 3310 | 4417 | 7333 |
| PARAMETER A | .753 | .664 | .619 | .588 | .593 | .615 | .640 | .662 | .707 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0277 | -.0427 | -.0526 | -.0620 | -.0658 | -.0663 | -.0654 | -.0639 | -.0588 |
| A2 | -.0196 | .0507 | .1143 | .1934 | .2395 | .2720 | .3166 | .3783 | .5625 |
| A3 | -.0011 | -.0817 | -.1598 | -.2549 | -.3099 | -.3510 | -.4136 | -.5029 | -.7756 |
| A4 | .0313 | .0942 | .1501 | .2155 | .2521 | .2783 | .3166 | .3694 | .5203 |
| A5 | -.0358 | -.0393 | -.0460 | -.0510 | -.0530 | -.0567 | -.0665 | -.0813 | -.1128 |
| B1 | .0279 | .0279 | .0279 | .0279 | .0279 | .0279 | .0279 | .0279 | .0279 |
| B2 | -.9408 | -.9408 | -.9408 | -.9408 | -.9408 | -.9408 | -.9408 | -.9408 | -.9408 |
| B3 | .5415 | .5415 | .5415 | .5415 | .5415 | .5415 | .5415 | .5415 | .5415 |
| B4 | .8948 | .8948 | .8948 | .8948 | .8948 | .8948 | .8948 | .8948 | .8948 |
| B5 | -1.2264 | -1.2264 | -1.2264 | -1.2264 | -1.2263 | -1.2264 | -1.2264 | -1.2264 | -1.2264 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 270595 QTA2 = 225194 QTA3 = 193508
AZIMUTH AND TILT COEF. C1 = -.0107 C2 = -.1937 C3 = -.4441 C4 = 1.7889 C5 = -1.1750

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 40 | 43 | 50 | 63 | 68 | 73 | 76 | 76 | 72 | 61 | 51 | 43 |
| QHOR: | 695 | 931 | 1328 | 1661 | 1979 | 1890 | 1884 | 1783 | 1347 | 1254 | 887 | 690 |

AUGUSTA, GEORGIA — ELEVATION = 148 — LAT = 33.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 2) | (M= 2) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 1219.46 | 258.96 | 153.70 | 96.80 | 65.61 | 47.73 | 36.59 | 29.23 | 20.73 |
| VT2/DD | 1031.33 | 219.01 | 129.99 | 82.36 | 55.83 | 40.61 | 31.13 | 24.87 | 17.64 |
| VT3/DD | 893.78 | 189.90 | 112.65 | 71.48 | 48.45 | 35.24 | 27.02 | 21.58 | 15.31 |
| MONTHLY DD | 20 | 92 | 156 | 228 | 337 | 463 | 604 | 756 | 1066 |
| ANNUAL DD | 55 | 314 | 576 | 952 | 1458 | 2115 | 2938 | 3957 | 6730 |
| PARAMETER A | .549 | .537 | .494 | .519 | .562 | .597 | .620 | .645 | .689 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0451 | .0551 | .0642 | .0048 | .0060 | .0065 | .0067 | .0065 | .0063 |
| A2 | -.3724 | -.3792 | -.4009 | .1998 | .2157 | .2419 | .2816 | .3343 | .5177 |
| A3 | .3742 | .3769 | .3959 | -.3552 | -.3680 | -.3977 | -.4487 | -.5181 | -.7723 |
| A4 | -.2790 | -.2738 | -.2852 | .3061 | .3084 | .3227 | .3505 | .3872 | .5203 |
| A5 | -.0332 | -.0403 | -.0455 | -.1537 | -.1455 | -.1423 | -.1440 | -.1469 | -.1657 |
| B1 | -.0274 | -.0274 | -.0274 | -.0049 | -.0049 | -.0049 | -.0049 | -.0049 | -.0049 |
| B2 | -.7643 | -.7643 | -.7643 | -.9219 | -.9219 | -.9219 | -.9218 | -.9219 | -.9218 |
| B3 | .2692 | .2692 | .2692 | .5415 | .5415 | .5415 | .5414 | .5415 | .5415 |
| B4 | 1.1842 | 1.1842 | 1.1842 | .9094 | .9094 | .9094 | .9094 | .9094 | .9094 |
| B5 | -1.2892 | -1.2892 | -1.2892 | -1.2045 | -1.2045 | -1.2045 | -1.2045 | -1.2045 | -1.2045 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 273830 — QTA2 = 228165 — QTA3 = 196198

AZIMUTH AND TILT COEF. — C1 = -.0019 — C2 = -.2310 — C3 = -.3800 — C4 = 1.7315 — C5 = -1.1513

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 45 | 45 | 52 | 64 | 71 | 76 | 78 | 78 | 72 | 61 | 53 | 47 |
| QHOR: | 718 | 1001 | 1342 | 1665 | 1916 | 1894 | 1814 | 1666 | 1376 | 1223 | 924 | 704 |

MACON, GEORGIA — ELEVATION = 361 — LAT = 32.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 1530.47 | 268.68 | 146.34 | 90.98 | 62.38 | 45.52 | 35.02 | 28.17 | 20.23 |
| VT2/DD | 1302.74 | 228.70 | 124.56 | 77.44 | 53.10 | 38.75 | 29.81 | 23.98 | 17.22 |
| VT3/DD | 1130.89 | 198.53 | 108.13 | 67.23 | 46.09 | 33.64 | 25.88 | 20.82 | 14.95 |
| MONTHLY DD | 15 | 83 | 152 | 245 | 357 | 489 | 636 | 790 | 1100 |
| ANNUAL DD | 26 | 208 | 430 | 775 | 1244 | 1859 | 2643 | 3624 | 6303 |
| PARAMETER A | .601 | .717 | .744 | .732 | .734 | .756 | .769 | .771 | .787 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0213 | -.0254 | -.0269 | -.0297 | -.0312 | -.0310 | -.0310 | -.0311 | -.0291 |
| A2 | .0816 | .0617 | .0646 | .0930 | .1384 | .1815 | .2347 | .3032 | .4817 |
| A3 | -.1120 | -.0990 | -.1081 | -.1491 | -.2102 | -.2671 | -.3373 | -.4298 | -.6819 |
| A4 | .0833 | .0820 | .0894 | .1151 | .1501 | .1821 | .2229 | .2766 | .4163 |
| A5 | -.0193 | -.0319 | -.0380 | -.0445 | -.0496 | -.0534 | -.0587 | -.0672 | -.0949 |
| B1 | .0095 | .0095 | .0095 | .0095 | .0095 | .0095 | .0095 | .0095 | .0095 |
| B2 | -.9561 | -.9561 | -.9561 | -.9561 | -.9561 | -.9561 | -.9561 | -.9561 | -.9561 |
| B3 | .5511 | .5511 | .5511 | .5511 | .5511 | .5511 | .5511 | .5512 | .5512 |
| B4 | .9340 | .9340 | .9340 | .9339 | .9339 | .9339 | .9340 | .9339 | .9339 |
| B5 | -1.2484 | -1.2484 | -1.2484 | -1.2484 | -1.2484 | -1.2484 | -1.2485 | -1.2484 | -1.2484 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 275785 — QTA2 = 229589 — QTA3 = 197331

AZIMUTH AND TILT COEF. — C1 = -.0105 — C2 = -.1984 — C3 = -.4385 — C4 = 1.7788 — C5 = -1.1625

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 44 | 48 | 56 | 64 | 72 | 78 | 79 | 78 | 73 | 63 | 53 | 48 |
| QHOR: | 705 | 1009 | 1369 | 1806 | 1900 | 1966 | 1788 | 1731 | 1435 | 1231 | 936 | 760 |

SAVANNAH, GEORGIA — ELEVATION = 52 — LAT = 32.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 484.15 | 240.02 | 144.15 | 93.22 | 64.31 | 47.45 | 36.64 | 24.73 |
| VT2/DD | NA | 412.35 | 204.43 | 122.77 | 79.40 | 54.77 | 40.41 | 31.20 | 21.06 |
| VT3/DD | NA | 358.03 | 177.50 | 106.60 | 68.94 | 47.56 | 35.09 | 27.09 | 18.29 |
| MONTHLY DD | 5 | 49 | 98 | 163 | 253 | 366 | 497 | 643 | 953 |
| ANNUAL DD | 12 | 155 | 328 | 599 | 995 | 1530 | 2227 | 3129 | 5743 |
| PARAMETER A | NA | .624 | .597 | .556 | .536 | .546 | .559 | .582 | .648 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0599 | -.0685 | -.0761 | -.0784 | -.0753 | -.0718 | -.0665 | -.0526 |
| A2 | NA | .1110 | .2023 | .2607 | .3086 | .3416 | .3928 | .4679 | .6842 |
| A3 | NA | -.2071 | -.3156 | -.3864 | -.4460 | -.4879 | -.5560 | -.6574 | -.9571 |
| A4 | NA | .1232 | .1833 | .2258 | .2603 | .2828 | .3178 | .3689 | .5178 |
| A5 | NA | -.0647 | -.0613 | -.0622 | -.0638 | -.0650 | -.0683 | -.0735 | -.0905 |
| B1 | NA | .0382 | .0382 | .0382 | .0382 | .0382 | .0382 | .0382 | .0382 |
| B2 | NA | -1.0090 | -1.0090 | -1.0090 | -1.0090 | -1.0090 | -1.0090 | -1.0090 | -1.0090 |
| B3 | NA | .5940 | .5941 | .5940 | .5940 | .5941 | .5940 | .5940 | .5940 |
| B4 | NA | .9683 | .9683 | .9682 | .9683 | .9682 | .9682 | .9683 | .9682 |
| B5 | NA | -1.2565 | -1.2565 | -1.2564 | -1.2564 | -1.2564 | -1.2564 | -1.2565 | -1.2564 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 271750 — QTA2 = 226572 — QTA3 = 194916

AZIMUTH AND TILT COEF. — C1 = .0341 — C2 = -.2492 — C3 = -.3775 — C4 = 1.7564 — C5 = -1.1460

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 49 | 49 | 57 | 65 | 71 | 77 | 78 | 79 | 75 | 67 | 56 | 49 |
| QHOR: | 758 | 1069 | 1421 | 1789 | 1815 | 1873 | 1683 | 1610 | 1322 | 1219 | 917 | 796 |

BOISE, IDAHO — ELEVATION = 2867 — LAT = 43.6

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 266.16 | 70.98 | 46.61 | 34.19 | 26.96 | 22.25 | 18.95 | 16.50 | 13.10 |
| VT2/DD | 227.91 | 60.78 | 39.95 | 29.31 | 23.11 | 19.08 | 16.24 | 14.14 | 11.23 |
| VT3/DD | 198.02 | 52.81 | 34.72 | 25.47 | 20.08 | 16.58 | 14.11 | 12.29 | 9.76 |
| MONTHLY DD | 78 | 293 | 424 | 578 | 733 | 888 | 1043 | 1198 | 1508 |
| ANNUAL DD | 180 | 973 | 1651 | 2494 | 3503 | 4667 | 5981 | 7429 | 10631 |
| PARAMETER A | .670 | .720 | .755 | .784 | .810 | .832 | .855 | .872 | .881 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0879 | .0951 | -.0668 | -.0623 | -.0585 | -.0556 | -.0533 | -.0517 | -.0506 |
| A2 | .0296 | .1238 | .2845 | .3366 | .3934 | .4466 | .4960 | .5473 | .6706 |
| A3 | -.0761 | -.1722 | -.2654 | -.3305 | -.4036 | -.4766 | -.5489 | -.6266 | -.8103 |
| A4 | .0265 | .1015 | .2212 | .2604 | .3028 | .3436 | .3830 | .4257 | .5297 |
| A5 | -.0275 | -.0294 | .0130 | .0075 | .0003 | -.0097 | -.0225 | -.0385 | -.0759 |
| B1 | -.0377 | -.0377 | .0389 | .0389 | .0389 | .0389 | .0389 | .0389 | .0389 |
| B2 | -1.1587 | -1.1587 | -1.1990 | -1.1991 | -1.1991 | -1.1991 | -1.1991 | -1.1990 | -1.1991 |
| B3 | .7989 | .7988 | .8424 | .8424 | .8425 | .8424 | .8425 | .8424 | .8424 |
| B4 | .6012 | .6012 | .5368 | .5368 | .5368 | .5368 | .5368 | .5368 | .5368 |
| B5 | -1.1894 | -1.1894 | -1.1849 | -1.1849 | -1.1848 | -1.1848 | -1.1849 | -1.1849 | -1.1849 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 336744 — QTA2 = 280651 — QTA3 = 241023

AZIMUTH AND TILT COEF. — C1 = .0108 — C2 = -.2363 — C3 = -.4488 — C4 = 1.6951 — C5 = -1.3457

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 30 | 37 | 40 | 47 | 58 | 66 | 74 | 72 | 64 | 51 | 40 | 31 |
| QHOR: | 496 | 880 | 1261 | 1856 | 2244 | 2506 | 2636 | 2229 | 1715 | 1139 | 606 | 436 |

LEWISTON, IDAHO — ELEVATION = 1437 — LAT = 46.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 108.71 | 45.15 | 31.18 | 22.16 | 16.85 | 13.59 | 11.39 | 9.80 | 7.66 |
| VT2/DD | 92.80 | 38.54 | 26.62 | 18.97 | 14.42 | 11.63 | 9.75 | 8.39 | 6.56 |
| VT3/DD | 80.57 | 33.46 | 23.11 | 16.48 | 12.53 | 10.10 | 8.47 | 7.29 | 5.70 |
| MONTHLY DD | 117 | 281 | 407 | 492 | 647 | 802 | 957 | 1112 | 1422 |
| ANNUAL DD | 212 | 774 | 1368 | 2175 | 3169 | 4353 | 5701 | 7186 | 10452 |
| PARAMETER A | .364 | .745 | .772 | .812 | .871 | .930 | .981 | 1.022 | 1.072 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.1240 | -.0686 | -.0774 | .0430 | .0358 | .0304 | .0266 | .0239 | .0203 |
| A2 | -.2581 | -.0094 | .0569 | .3668 | .3744 | .3783 | .3842 | .3949 | .4328 |
| A3 | .1930 | -.0182 | -.0807 | -.3433 | -.3597 | -.3745 | -.3927 | -.4174 | -.4859 |
| A4 | -.0775 | .0338 | .0747 | .1925 | .2064 | .2189 | .2326 | .2495 | .2938 |
| A5 | -.1108 | -.0385 | .0286 | .0744 | .0650 | .0535 | .0411 | .0282 | .0023 |
| B1 | .0847 | .0847 | .0847 | .0139 | .0139 | .0139 | .0139 | .0139 | .0139 |
| B2 | -1.0085 | -1.0085 | -1.0085 | -1.1317 | -1.1317 | -1.1317 | -1.1317 | -1.1317 | -1.1317 |
| B3 | .6987 | .6986 | .6986 | .8282 | .8282 | .8282 | .8282 | .8282 | .8282 |
| B4 | .6211 | .6211 | .6211 | .5370 | .5370 | .5370 | .5370 | .5370 | .5370 |
| B5 | -1.0751 | -1.0752 | -1.0752 | -1.0948 | -1.0948 | -1.0948 | -1.0948 | -1.0948 | -1.0948 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 263355 — QTA2 = 219543 — QTA3 = 188727

AZIMUTH AND TILT COEF. — C1 = .0142 — C2 = -.2602 — C3 = -.3425 — C4 = 1.6196 — C5 = -1.2342

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 32 | 39 | 41 | 49 | 59 | 66 | 75 | 71 | 61 | 50 | 40 | 34 |
| QHOR: | 361 | 619 | 1026 | 1391 | 1844 | 1999 | 2343 | 1886 | 1413 | 835 | 394 | 275 |

POCATELLO, IDAHO — ELEVATION = 4478 — LAT = 42.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 88.98 | 45.62 | 34.04 | 27.06 | 22.44 | 19.17 | 16.73 | 14.85 | 12.11 |
| VT2/DD | 76.19 | 39.08 | 29.17 | 23.18 | 19.23 | 16.43 | 14.34 | 12.72 | 10.38 |
| VT3/DD | 66.20 | 33.96 | 25.34 | 20.14 | 16.71 | 14.27 | 12.46 | 11.05 | 9.02 |
| MONTHLY DD | 278 | 447 | 599 | 754 | 909 | 1064 | 1219 | 1374 | 1684 |
| ANNUAL DD | 636 | 1740 | 2587 | 3583 | 4711 | 5969 | 7352 | 8847 | 12104 |
| PARAMETER A | .563 | .728 | .807 | .850 | .877 | .896 | .911 | .921 | .918 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0312 | -.0457 | -.0457 | -.0450 | -.0439 | -.0432 | -.0405 | -.0389 | -.0367 |
| A2 | .0535 | .2396 | .2905 | .3464 | .4004 | .4520 | .5014 | .5536 | .6757 |
| A3 | -.0550 | -.2609 | -.3293 | -.4020 | -.4730 | -.5428 | -.6119 | -.6868 | -.8627 |
| A4 | -.0097 | .2009 | .2356 | .2751 | .3146 | .3533 | .3919 | .4342 | .5357 |
| A5 | .0201 | -.0238 | -.0302 | -.0367 | -.0442 | -.0530 | -.0638 | -.0772 | -.1102 |
| B1 | .0135 | .0113 | .0113 | .0113 | .0113 | .0113 | .0113 | .0113 | .0113 |
| B2 | -1.1576 | -1.1760 | -1.1760 | -1.1760 | -1.1760 | -1.1760 | -1.1760 | -1.1760 | -1.1760 |
| B3 | .7658 | .8167 | .8168 | .8168 | .8168 | .8168 | .8168 | .8167 | .8168 |
| B4 | .6288 | .5532 | .5532 | .5532 | .5532 | .5532 | .5532 | .5532 | .5532 |
| B5 | -1.2291 | -1.1885 | -1.1885 | -1.1884 | -1.1885 | -1.1885 | -1.1885 | -1.1885 | -1.1884 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 348164 — QTA2 = 290185 — QTA3 = 249205

AZIMUTH AND TILT COEF. — C1 = .0048 — C2 = -.2279 — C3 = -.4555 — C4 = 1.6850 — C5 = -1.3620

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 22 | 29 | 38 | 42 | 55 | 63 | 72 | 70 | 59 | 47 | 36 | 25 |
| QHOR: | 575 | 936 | 1382 | 1815 | 2249 | 2423 | 2672 | 2213 | 1758 | 1196 | 691 | 458 |

CHICAGO, ILLINOIS — ELEVATION = 623 — LAT = 41.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 91.16 | 39.95 | 29.06 | 22.65 | 18.51 | 15.62 | 13.48 | 11.86 | 9.56 |
| VT2/DD | 77.92 | 34.18 | 24.86 | 19.38 | 15.84 | 13.37 | 11.54 | 10.15 | 8.18 |
| VT3/DD | 67.68 | 29.69 | 21.60 | 16.83 | 13.76 | 11.61 | 10.02 | 8.82 | 7.10 |
| MONTHLY DD | 213 | 382 | 525 | 674 | 825 | 977 | 1132 | 1287 | 1597 |
| ANNUAL DD | 624 | 1581 | 2284 | 3100 | 4026 | 5076 | 6272 | 7622 | 10768 |
| PARAMETER A | .432 | .546 | .618 | .677 | .724 | .768 | .809 | .848 | .909 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.1014 | .0649 | .0583 | .0536 | .0501 | .0474 | .0454 | .0440 | .0424 |
| A2 | .3012 | .5024 | .4799 | .4707 | .4771 | .4874 | .4995 | .5128 | .5549 |
| A3 | -.2926 | -.5212 | -.5044 | -.5038 | -.5228 | -.5462 | -.5711 | -.5967 | -.6700 |
| A4 | .1937 | .3547 | .3376 | .3315 | .3382 | .3488 | .3616 | .3761 | .4200 |
| A5 | .0330 | -.0056 | -.0054 | -.0080 | -.0130 | -.0189 | -.0251 | -.0318 | -.0513 |
| B1 | .0383 | -.0078 | -.0078 | -.0078 | -.0078 | -.0078 | -.0078 | -.0078 | -.0078 |
| B2 | -1.0799 | -1.1246 | -1.1246 | -1.1246 | -1.1246 | -1.1246 | -1.1246 | -1.1246 | -1.1246 |
| B3 | .7087 | .7798 | .7798 | .7798 | .7798 | .7798 | .7798 | .7798 | .7798 |
| B4 | .6758 | .6070 | .6070 | .6070 | .6070 | .6070 | .6070 | .6070 | .6070 |
| B5 | -1.1935 | -1.1578 | -1.1578 | -1.1578 | -1.1578 | -1.1578 | -1.1578 | -1.1578 | -1.1578 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 267580 — QTA2 = 223141 — QTA3 = 191797

AZIMUTH AND TILT COEF. — C1 = .0413 — C2 = -.3014 — C3 = -.3070 — C4 = 1.6098 — C5 = -1.2171

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 25 | 26 | 34 | 48 | 60 | 71 | 75 | 73 | 66 | 55 | 42 | 28 |
| QHOR: | 503 | 802 | 1118 | 1411 | 1771 | 1955 | 1992 | 1792 | 1322 | 927 | 575 | 383 |

MOLINE, ILLINOIS — ELEVATION = 591 — LAT = 41.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 60.64 | 34.72 | 27.65 | 22.83 | 19.38 | 16.83 | 14.87 | 13.32 | 11.02 |
| VT2/DD | 51.85 | 29.68 | 23.65 | 19.52 | 16.57 | 14.39 | 12.71 | 11.39 | 9.42 |
| VT3/DD | 45.04 | 25.78 | 20.54 | 16.96 | 14.39 | 12.50 | 11.04 | 9.89 | 8.18 |
| MONTHLY DD | 326 | 570 | 716 | 867 | 1022 | 1177 | 1332 | 1487 | 1797 |
| ANNUAL DD | 739 | 1722 | 2411 | 3208 | 4126 | 5182 | 6381 | 7735 | 10897 |
| PARAMETER A | .715 | .733 | .724 | .729 | .742 | .760 | .775 | .792 | .812 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0193 | -.0106 | -.0055 | -.0008 | .0038 | .0084 | .0127 | .0164 | .0214 |
| A2 | .0906 | .1603 | .2062 | .2445 | .2829 | .3248 | .3732 | .4215 | .5381 |
| A3 | -.0898 | -.1729 | -.2226 | -.2652 | -.3112 | -.3646 | -.4284 | -.4932 | -.6546 |
| A4 | .0911 | .1403 | .1709 | .1963 | .2226 | .2527 | .2889 | .3261 | .4208 |
| A5 | -.0161 | -.0172 | -.0144 | -.0122 | -.0123 | -.0150 | -.0198 | -.0259 | -.0468 |
| B1 | .0093 | .0093 | .0093 | .0093 | .0093 | .0093 | .0093 | .0093 | .0093 |
| B2 | -1.0890 | -1.0890 | -1.0890 | -1.0890 | -1.0890 | -1.0890 | -1.0890 | -1.0890 | -1.0890 |
| B3 | .7150 | .7150 | .7150 | .7150 | .7150 | .7150 | .7151 | .7151 | .7151 |
| B4 | .6635 | .6634 | .6635 | .6635 | .6634 | .6635 | .6634 | .6634 | .6634 |
| B5 | -1.1948 | -1.1948 | -1.1949 | -1.1948 | -1.1948 | -1.1948 | -1.1948 | -1.1948 | -1.1948 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 274671 — QTA2 = 229286 — QTA3 = 197172

AZIMUTH AND TILT COEF. — C1 = .0431 — C2 = -.3213 — C3 = -.2755 — C4 = 1.5642 — C5 = -1.2057

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 22 | 25 | 36 | 51 | 61 | 71 | 73 | 72 | 64 | 53 | 40 | 29 |
| QHOR: | 505 | 811 | 1138 | 1473 | 1712 | 1984 | 1914 | 1679 | 1350 | 1003 | 612 | 481 |

SPRINGFIELD, ILLINOIS — ELEVATION = 614 — LAT = 39.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 100.24 | 50.00 | 35.89 | 27.51 | 22.12 | 18.47 | 15.86 | 13.89 | 11.13 |
| VT2/DD | 85.70 | 42.75 | 30.69 | 23.52 | 18.91 | 15.79 | 13.56 | 11.88 | 9.52 |
| VT3/DD | 74.44 | 37.13 | 26.65 | 20.43 | 16.42 | 13.72 | 11.77 | 10.31 | 8.27 |
| MONTHLY DD | 232 | 347 | 484 | 631 | 785 | 940 | 1095 | 1250 | 1560 |
| ANNUAL DD | 504 | 1321 | 1917 | 2635 | 3487 | 4479 | 5605 | 6876 | 9904 |
| PARAMETER A | .507 | .525 | .616 | .685 | .739 | .778 | .805 | .831 | .878 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0476 | .0472 | .0370 | .0311 | .0279 | .0264 | .0259 | .0254 | .0246 |
| A2 | .2249 | .2928 | .2865 | .2899 | .3043 | .3346 | .3738 | .4115 | .4921 |
| A3 | -.2182 | -.3222 | -.3161 | -.3221 | -.3438 | -.3862 | -.4404 | -.4931 | -.6122 |
| A4 | .0736 | .3150 | .2936 | .2872 | .2937 | .3154 | .3460 | .3760 | .4432 |
| A5 | .0773 | -.0837 | -.0683 | -.0606 | -.0588 | -.0613 | -.0666 | -.0726 | -.0918 |
| B1 | .0073 | -.0257 | -.0257 | -.0257 | -.0257 | -.0257 | -.0257 | -.0257 | -.0257 |
| B2 | -1.1005 | -1.0831 | -1.0831 | -1.0831 | -1.0831 | -1.0831 | -1.0831 | -1.0831 | -1.0831 |
| B3 | .7126 | .7222 | .7222 | .7222 | .7222 | .7222 | .7222 | .7222 | .7222 |
| B4 | .7132 | .6481 | .6481 | .6480 | .6481 | .6481 | .6481 | .6481 | .6481 |
| B5 | -1.2330 | -1.1647 | -1.1647 | -1.1647 | -1.1647 | -1.1648 | -1.1648 | -1.1647 | -1.1647 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 275387 — QTA2 = 229442 — QTA3 = 197126

AZIMUTH AND TILT COEF. — C1 = -.0070 — C2 = -.2654 — C3 = -.3687 — C4 = 1.6755 — C5 = -1.2278

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 27 | 30 | 42 | 53 | 64 | 73 | 75 | 75 | 67 | 55 | 41 | 29 |
| QHOR: | 596 | 869 | 1154 | 1525 | 1768 | 2085 | 2010 | 1861 | 1387 | 1059 | 622 | 452 |

EVANSVILLE, INDIANA — ELEVATION = 387 — LAT = 38.1

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 203.65 | 69.92 | 46.19 | 33.84 | 26.43 | 21.55 | 18.11 | 15.56 | 12.14 |
| VT2/DD | 173.70 | 59.71 | 39.44 | 28.90 | 22.57 | 18.40 | 15.47 | 13.29 | 10.36 |
| VT3/DD | 150.80 | 51.85 | 34.25 | 25.09 | 19.60 | 15.98 | 13.43 | 11.54 | 9.00 |
| MONTHLY DD | 97 | 245 | 370 | 505 | 647 | 793 | 944 | 1099 | 1408 |
| ANNUAL DD | 249 | 910 | 1453 | 2111 | 2885 | 3784 | 4845 | 6073 | 9052 |
| PARAMETER A | .403 | .424 | .505 | .551 | .582 | .617 | .662 | .707 | .777 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.1532 | .1403 | .1117 | .0986 | .0904 | .0829 | .0751 | .0684 | .0592 |
| A2 | .2373 | .4905 | .4575 | .4677 | .4858 | .4944 | .4967 | .5104 | .5808 |
| A3 | -.2270 | -.5349 | -.5089 | -.5278 | -.5531 | -.5677 | -.5785 | -.6068 | -.7244 |
| A4 | .1842 | .3404 | .3254 | .3383 | .3566 | .3682 | .3759 | .3928 | .4619 |
| A5 | .0435 | -.0074 | -.0117 | -.0147 | -.0171 | -.0201 | -.0257 | -.0347 | -.0632 |
| B1 | .0619 | -.0188 | -.0188 | -.0188 | -.0188 | -.0188 | -.0188 | -.0188 | -.0188 |
| B2 | -.9932 | -1.0476 | -1.0476 | -1.0476 | -1.0476 | -1.0476 | -1.0476 | -1.0476 | -1.0476 |
| B3 | .6301 | .7056 | .7056 | .7056 | .7056 | .7056 | .7055 | .7056 | .7056 |
| B4 | .7635 | .7089 | .7089 | .7089 | .7089 | .7089 | .7089 | .7089 | .7089 |
| B5 | -1.1885 | -1.1577 | -1.1578 | -1.1578 | -1.1578 | -1.1578 | -1.1578 | -1.1577 | -1.1578 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 258260 — QTA2 = 215074 — QTA3 = 184801
AZIMUTH AND TILT COEF. — C1 = .0157 — C2 = -.2558 — C3 = -.3510 — C4 = 1.6748 — C5 = -1.1714

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 32 | 33 | 44 | 56 | 66 | 74 | 77 | 76 | 67 | 58 | 44 | 34 |
| QHOR: | 571 | 793 | 1106 | 1494 | 1744 | 1925 | 1900 | 1724 | 1378 | 1051 | 668 | 481 |

FORT WAYNE, INDIANA — ELEVATION = 827 — LAT = 41.0

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 53.50 | 28.15 | 22.22 | 18.30 | 15.55 | 12.99 | 11.06 | 9.61 | 7.62 |
| VT2/DD | 45.66 | 24.03 | 18.96 | 15.62 | 13.27 | 11.08 | 9.43 | 8.20 | 6.50 |
| VT3/DD | 39.64 | 20.86 | 16.46 | 13.56 | 11.52 | 9.62 | 8.19 | 7.12 | 5.64 |
| MONTHLY DD | 299 | 569 | 721 | 876 | 1031 | 877 | 1031 | 1186 | 1496 |
| ANNUAL DD | 645 | 1649 | 2341 | 3141 | 4061 | 5121 | 6340 | 7731 | 10983 |
| PARAMETER A | .807 | .678 | .643 | .637 | .648 | .719 | .789 | .853 | .947 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0006 | -.0013 | -.0039 | -.0054 | -.0059 | -.0905 | -.0798 | -.0712 | -.0601 |
| A2 | .1903 | .3542 | .4222 | .4607 | .4836 | .3651 | .3654 | .3557 | .3855 |
| A3 | -.1940 | -.3614 | -.4328 | -.4765 | -.5076 | -.4459 | -.4407 | -.4462 | -.4998 |
| A4 | .0987 | .1851 | .2254 | .2518 | .2723 | .3279 | .3188 | .3171 | .3423 |
| A5 | .0375 | .0712 | .0813 | .0831 | .0784 | -.0679 | -.0669 | -.0683 | -.0796 |
| B1 | .0159 | .0159 | .0159 | .0159 | .0159 | .0587 | .0587 | .0587 | .0587 |
| B2 | -1.0225 | -1.0225 | -1.0224 | -1.0225 | -1.0225 | -.9801 | -.9800 | -.9801 | -.9800 |
| B3 | .6940 | .6940 | .6940 | .6940 | .6940 | .6804 | .6804 | .6804 | .6804 |
| B4 | .7182 | .7183 | .7183 | .7183 | .7183 | .6881 | .6881 | .6881 | .6881 |
| B5 | -1.1325 | -1.1325 | -1.1325 | -1.1325 | -1.1325 | -1.0649 | -1.0649 | -1.0649 | -1.0649 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 231389 — QTA2 = 192744 — QTA3 = 165682
AZIMUTH AND TILT COEF. — C1 = .0289 — C2 = -.2343 — C3 = -.3114 — C4 = 1.5947 — C5 = -1.1008

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 21 | 28 | 34 | 50 | 60 | 70 | 72 | 70 | 63 | 53 | 41 | 31 |
| QHOR: | 469 | 693 | 960 | 1382 | 1668 | 1849 | 1748 | 1608 | 1206 | 899 | 527 | 350 |

INDIANAPOLIS, INDIANA — ELEVATION = 807 — LAT = 39.7

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 63.94 | 34.47 | 26.94 | 20.79 | 16.64 | 13.85 | 11.87 | 10.38 | 8.30 |
| VT2/DD | 54.58 | 29.42 | 22.99 | 17.74 | 14.20 | 11.82 | 10.13 | 8.86 | 7.08 |
| VT3/DD | 47.38 | 25.54 | 19.96 | 15.40 | 12.32 | 10.26 | 8.79 | 7.69 | 6.15 |
| MONTHLY DD | 260 | 483 | 618 | 618 | 772 | 927 | 1082 | 1237 | 1547 |
| ANNUAL DD | 538 | 1392 | 2032 | 2807 | 3703 | 4713 | 5867 | 7185 | 10338 |
| PARAMETER A | .658 | .595 | .594 | .665 | .733 | .785 | .833 | .879 | .956 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0030 | -.0109 | -.0192 | -.0594 | -.0565 | -.0548 | -.0532 | -.0514 | -.0485 |
| A2 | .1649 | .3402 | .3958 | .3601 | .3538 | .3576 | .3672 | .3792 | .4219 |
| A3 | -.1761 | -.3747 | -.4396 | -.4444 | -.4398 | -.4484 | -.4654 | -.4864 | -.5568 |
| A4 | .0659 | .1654 | .2024 | .2564 | .2547 | .2611 | .2726 | .2866 | .3306 |
| A5 | .0399 | .0569 | .0581 | -.0330 | -.0341 | -.0373 | -.0421 | -.0484 | -.0669 |
| B1 | .0461 | .0461 | .0461 | .0626 | .0626 | .0626 | .0626 | .0626 | .0626 |
| B2 | -1.0318 | -1.0318 | -1.0318 | -1.0190 | -1.0190 | -1.0190 | -1.0190 | -1.0190 | -1.0190 |
| B3 | .7009 | .7010 | .7009 | .7072 | .7072 | .7072 | .7072 | .7072 | .7072 |
| B4 | .7289 | .7288 | .7288 | .7038 | .7039 | .7039 | .7039 | .7038 | .7038 |
| B5 | -1.1383 | -1.1383 | -1.1383 | -1.0975 | -1.0975 | -1.0975 | -1.0975 | -1.0975 | -1.0975 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 241904 — QTA2 = 201465 — QTA3 = 173135
AZIMUTH AND TILT COEF. — C1 = .0114 — C2 = -.2439 — C3 = -.3295 — C4 = 1.6238 — C5 = -1.1276

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 25 | 30 | 39 | 51 | 61 | 71 | 74 | 74 | 65 | 55 | 42 | 30 |
| QHOR: | 488 | 699 | 1065 | 1371 | 1740 | 1873 | 1751 | 1616 | 1317 | 1020 | 593 | 385 |

SOUTH BEND, INDIANA — ELEVATION = 774 — LAT = 41.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 57.74 | 28.13 | 21.55 | 17.36 | 14.53 | 12.49 | 10.87 | 9.52 | 7.62 |
| VT2/DD | 49.28 | 24.01 | 18.39 | 14.82 | 12.40 | 10.66 | 9.28 | 8.12 | 6.51 |
| VT3/DD | 42.79 | 20.85 | 15.97 | 12.86 | 10.76 | 9.25 | 8.05 | 7.05 | 5.65 |
| MONTHLY DD | 239 | 490 | 640 | 794 | 949 | 1104 | 1092 | 1247 | 1557 |
| ANNUAL DD | 585 | 1564 | 2279 | 3125 | 4098 | 5206 | 6464 | 7884 | 11140 |
| PARAMETER A | .652 | .658 | .683 | .711 | .742 | .775 | .817 | .872 | .952 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0738 | .0722 | .0682 | .0644 | .0609 | .0577 | .0179 | .0172 | .0171 |
| A2 | .1810 | .2979 | .3192 | .3376 | .3549 | .3693 | .3519 | .3545 | .3873 |
| A3 | -.1739 | -.3083 | -.3363 | -.3646 | -.3927 | -.4172 | -.4369 | -.4473 | -.5069 |
| A4 | .1009 | .1790 | .1984 | .2182 | .2374 | .2541 | .3271 | .3296 | .3615 |
| A5 | .0241 | .0252 | .0209 | .0135 | .0057 | -.0016 | -.0771 | -.0808 | -.0979 |
| B1 | -.0406 | -.0406 | -.0406 | -.0406 | -.0406 | -.0406 | -.0188 | -.0188 | -.0188 |
| B2 | -1.0144 | -1.0143 | -1.0143 | -1.0144 | -1.0143 | -1.0143 | -1.0001 | -1.0001 | -1.0001 |
| B3 | .6759 | .6759 | .6759 | .6759 | .6758 | .6758 | .6880 | .6879 | .6880 |
| B4 | .6980 | .6980 | .6980 | .6980 | .6980 | .6980 | .6565 | .6566 | .6566 |
| B5 | -1.1252 | -1.1252 | -1.1252 | -1.1252 | -1.1252 | -1.1252 | -1.0797 | -1.0797 | -1.0797 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 241738 — QTA2 = 201190 — QTA3 = 172799
AZIMUTH AND TILT COEF. — C1 = .0146 — C2 = -.2343 — C3 = -.3603 — C4 = 1.6652 — C5 =-1.1821

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 24 | 27 | 34 | 46 | 61 | 67 | 72 | 70 | 64 | 53 | 41 | 29 |
| QHOR: | 398 | 649 | 981 | 1353 | 1698 | 1951 | 1916 | 1783 | 1359 | 897 | 520 | 348 |

BURLINGTON, IOWA — ELEVATION = 702 — LAT = 40.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) |
| VT1/DD | 68.74 | 41.05 | 33.08 | 27.52 | 23.52 | 20.53 | 18.21 | 16.12 | 12.86 |
| VT2/DD | 58.81 | 35.12 | 28.30 | 23.54 | 20.12 | 17.57 | 15.58 | 13.81 | 11.01 |
| VT3/DD | 51.10 | 30.51 | 24.59 | 20.45 | 17.48 | 15.26 | 13.54 | 12.00 | 9.57 |
| MONTHLY DD | 364 | 609 | 756 | 909 | 1063 | 1218 | 1373 | 1222 | 1532 |
| ANNUAL DD | 661 | 1635 | 2326 | 3129 | 4035 | 5061 | 6232 | 7563 | 10707 |
| PARAMETER A | .663 | .678 | .649 | .626 | .617 | .622 | .629 | .656 | .722 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0216 | .0301 | .0335 | .0362 | .0379 | .0390 | .0404 | -.0051 | -.0015 |
| A2 | .1497 | .2271 | .2958 | .3650 | .4254 | .4812 | .5462 | .6946 | .7728 |
| A3 | -.1318 | -.2268 | -.3026 | -.3798 | -.4504 | -.5217 | -.6083 | -.7541 | -.8920 |
| A4 | .1051 | .1556 | .2033 | .2524 | .2969 | .3406 | .3925 | .5454 | .6143 |
| A5 | .0178 | .0207 | .0240 | .0262 | .0253 | .0195 | .0105 | -.0230 | -.0549 |
| B1 | -.0372 | -.0372 | -.0372 | -.0372 | -.0372 | -.0372 | -.0372 | -.0176 | -.0176 |
| B2 | -1.1354 | -1.1354 | -1.1354 | -1.1354 | -1.1354 | -1.1354 | -1.1354 | -1.1674 | -1.1674 |
| B3 | .7479 | .7479 | .7479 | .7479 | .7479 | .7479 | .7479 | .7952 | .7952 |
| B4 | .6780 | .6780 | .6780 | .6780 | .6780 | .6780 | .6780 | .6106 | .6107 |
| B5 | -1.2367 | -1.2367 | -1.2366 | -1.2367 | -1.2367 | -1.2367 | -1.2367 | -1.2070 | -1.2070 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 295976 — QTA2 = 246856 — QTA3 = 212158
AZIMUTH AND TILT COEF. — C1 = -.0169 — C2 = -.3221 — C3 = -.3190 — C4 = 1.6438 — C5 =-1.2548

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 26 | 37 | 53 | 60 | 71 | 74 | 73 | 65 | 54 | 41 | 30 |
| QHOR: | 611 | 860 | 1213 | 1562 | 1909 | 2125 | 2162 | 1890 | 1450 | 1087 | 649 | 462 |

DES MOINES, IOWA — ELEVATION = 965 — LAT = 41.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) |
| VT1/DD | 58.00 | 35.29 | 28.94 | 24.46 | 21.18 | 18.67 | 16.70 | 15.10 | 12.46 |
| VT2/DD | 49.65 | 30.20 | 24.77 | 20.94 | 18.13 | 15.98 | 14.29 | 12.93 | 10.67 |
| VT3/DD | 43.14 | 26.24 | 21.52 | 18.19 | 15.75 | 13.89 | 12.42 | 11.23 | 9.27 |
| MONTHLY DD | 422 | 694 | 846 | 1001 | 1155 | 1310 | 1465 | 1621 | 1586 |
| ANNUAL DD | 877 | 1909 | 2619 | 3444 | 4384 | 5453 | 6678 | 8067 | 11275 |
| PARAMETER A | .637 | .678 | .666 | .656 | .654 | .660 | .674 | .688 | .717 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0204 | -.0287 | -.0336 | -.0372 | -.0390 | -.0392 | -.0380 | -.0365 | .1155 |
| A2 | .1850 | .2586 | .3103 | .3604 | .4097 | .4605 | .5152 | .5778 | .8209 |
| A3 | -.1599 | -.2435 | -.2992 | -.3556 | -.4149 | -.4803 | -.5550 | -.6428 | -.9987 |
| A4 | .1050 | .1590 | .1952 | .2309 | .2669 | .3052 | .3478 | .3975 | .5990 |
| A5 | .0296 | .0305 | .0334 | .0346 | .0331 | .0285 | .0202 | .0085 | -.0622 |
| B1 | .0285 | .0285 | .0285 | .0285 | .0285 | .0285 | .0285 | .0285 | -.0424 |
| B2 | -1.1366 | -1.1366 | -1.1366 | -1.1366 | -1.1366 | -1.1366 | -1.1366 | -1.1366 | -1.1705 |
| B3 | .7435 | .7435 | .7435 | .7435 | .7435 | .7435 | .7435 | .7435 | .8121 |
| B4 | .6505 | .6504 | .6505 | .6505 | .6505 | .6504 | .6505 | .6504 | .5962 |
| B5 | -1.2366 | -1.2366 | -1.2366 | -1.2366 | -1.2366 | -1.2366 | -1.2366 | -1.2366 | -1.2003 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 294691 — QTA2 = 245879 — QTA3 = 211347
AZIMUTH AND TILT COEF. — C1 = .0241 — C2 = -.2860 — C3 = -.3427 — C4 = 1.6119 — C5 =-1.2661

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 17 | 23 | 36 | 50 | 60 | 70 | 74 | 72 | 63 | 53 | 39 | 28 |
| QHOR: | 579 | 883 | 1204 | 1557 | 1866 | 2140 | 2094 | 1798 | 1442 | 1034 | 604 | 461 |

MASON CITY, IOWA — ELEVATION = 1224 — LAT = 43.2

| SOUTH-VERT. | TB30 (M=12) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 54.27 | 30.14 | 24.22 | 20.23 | 17.37 | 15.22 | 13.54 | 12.20 | 10.18 |
| VT2/DD | 46.52 | 25.83 | 20.76 | 17.34 | 14.89 | 13.04 | 11.61 | 10.45 | 8.72 |
| VT3/DD | 40.43 | 22.45 | 18.04 | 15.07 | 12.94 | 11.34 | 10.09 | 9.09 | 7.58 |
| MONTHLY DD | 351 | 632 | 786 | 941 | 1096 | 1251 | 1406 | 1561 | 1871 |
| ANNUAL DD | 1317 | 2652 | 3492 | 4428 | 5473 | 6635 | 7930 | 9372 | 12651 |
| PARAMETER A | .440 | .603 | .659 | .696 | .732 | .764 | .796 | .826 | .864 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .2603 | .1875 | .1718 | .1627 | .1541 | .1466 | .1395 | .1332 | .1256 |
| A2 | .5265 | .4576 | .4593 | .4752 | .4931 | .5135 | .5334 | .5570 | .6368 |
| A3 | -.4792 | -.4340 | -.4439 | -.4691 | -.4982 | -.5310 | -.5637 | -.6032 | -.7277 |
| A4 | .3918 | .3439 | .3456 | .3579 | .3718 | .3877 | .4035 | .4233 | .4919 |
| A5 | .0106 | .0071 | .0060 | .0038 | .0001 | -.0044 | -.0095 | -.0174 | -.0425 |
| B1 | -.0753 | -.0753 | -.0753 | -.0753 | -.0753 | -.0753 | -.0753 | -.0753 | -.0753 |
| B2 | -1.1923 | -1.1923 | -1.1923 | -1.1923 | -1.1923 | -1.1923 | -1.1923 | -1.1923 | -1.1923 |
| B3 | .8289 | .8289 | .8289 | .8289 | .8289 | .8289 | .8289 | .8289 | .8289 |
| B4 | .5370 | .5370 | .5370 | .5370 | .5370 | .5370 | .5370 | .5370 | .5370 |
| B5 | -1.1996 | -1.1997 | -1.1996 | -1.1996 | -1.1996 | -1.1996 | -1.1996 | -1.1996 | -1.1996 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 302928 — QTA2 = 253120 — QTA3 = 217709

AZIMUTH AND TILT COEF. — C1 = .0085 — C2 = -.3431 — C3 = -.2704 — C4 = 1.5556 — C5 = -1.2773

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 17 | 16 | 29 | 45 | 57 | 69 | 72 | 69 | 61 | 49 | 35 | 19 |
| QHOR: | 553 | 851 | 1232 | 1448 | 1926 | 2143 | 2128 | 1797 | 1429 | 986 | 580 | 412 |

SIOUX CITY, IOWA — ELEVATION = 1102 — LAT = 42.4

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 58.26 | 36.63 | 30.25 | 25.73 | 22.39 | 19.74 | 17.29 | 15.37 | 12.58 |
| VT2/DD | 49.91 | 31.37 | 25.91 | 22.04 | 19.18 | 16.92 | 14.81 | 13.17 | 10.78 |
| VT3/DD | 43.37 | 27.26 | 22.52 | 19.15 | 16.66 | 14.70 | 12.87 | 11.45 | 9.37 |
| MONTHLY DD | 458 | 728 | 882 | 1037 | 1192 | 1090 | 1244 | 1399 | 1709 |
| ANNUAL DD | 1092 | 2217 | 2947 | 3786 | 4736 | 5800 | 6992 | 8333 | 11462 |
| PARAMETER A | .471 | .508 | .514 | .519 | .526 | .541 | .587 | .629 | .690 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0686 | -.0729 | -.0770 | -.0818 | -.0855 | .0281 | .0214 | .0159 | .0073 |
| A2 | .2755 | .4112 | .4834 | .5495 | .6084 | .6822 | .6859 | .7004 | .7812 |
| A3 | -.2228 | -.3673 | -.4441 | -.5183 | -.5888 | -.6573 | -.6825 | -.7213 | -.8620 |
| A4 | .1232 | .2178 | .2668 | .3135 | .3576 | .5228 | .5266 | .5397 | .6094 |
| A5 | .0781 | .0869 | .0924 | .0941 | .0917 | .0254 | .0150 | .0025 | -.0299 |
| B1 | .0407 | .0407 | .0407 | .0407 | .0407 | .0031 | .0031 | .0031 | .0031 |
| B2 | -1.1690 | -1.1689 | -1.1690 | -1.1690 | -1.1690 | -1.1748 | -1.1748 | -1.1748 | -1.1748 |
| B3 | .7804 | .7804 | .7804 | .7804 | .7804 | .8047 | .8047 | .8047 | .8046 |
| B4 | .6123 | .6123 | .6123 | .6123 | .6123 | .5548 | .5548 | .5548 | .5548 |
| B5 | -1.2385 | -1.2385 | -1.2385 | -1.2385 | -1.2385 | -1.2015 | -1.2015 | -1.2016 | -1.2016 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 304290 — QTA2 = 254147 — QTA3 = 218547

AZIMUTH AND TILT COEF. — C1 = -.0181 — C2 = -.3391 — C3 = -.2799 — C4 = 1.5669 — C5 = -1.2655

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 16 | 22 | 34 | 49 | 62 | 70 | 76 | 73 | 63 | 53 | 36 | 24 |
| QHOR: | 600 | 818 | 1251 | 1612 | 1906 | 2131 | 2105 | 1867 | 1281 | 1060 | 624 | 475 |

DODGE CITY, KANSAS — ELEVATION = 2582 — LAT = 37.8

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 177.61 | 81.93 | 61.60 | 48.78 | 40.06 | 33.86 | 29.32 | 25.86 | 20.92 |
| VT2/DD | 151.93 | 70.08 | 52.69 | 41.73 | 34.26 | 28.96 | 25.08 | 22.12 | 17.89 |
| VT3/DD | 132.00 | 60.89 | 45.78 | 36.26 | 29.77 | 25.17 | 21.79 | 19.22 | 15.54 |
| MONTHLY DD | 191 | 414 | 551 | 695 | 847 | 1002 | 1157 | 1312 | 1622 |
| ANNUAL DD | 424 | 1254 | 1860 | 2580 | 3419 | 4392 | 5506 | 6775 | 9773 |
| PARAMETER A | .683 | .611 | .572 | .541 | .522 | .514 | .516 | .521 | .512 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0843 | .1247 | .1450 | .1619 | .1741 | .1799 | .1799 | .1773 | .1767 |
| A2 | .1954 | .3275 | .4036 | .4896 | .5853 | .6741 | .7597 | .8566 | 1.1491 |
| A3 | -.2313 | -.3557 | -.4322 | -.5297 | -.6438 | -.7528 | -.8654 | -.9994 | -1.4118 |
| A4 | .1678 | .2572 | .3115 | .3761 | .4488 | .5161 | .5827 | .6603 | .8983 |
| A5 | -.0165 | .0007 | .0059 | .0037 | -.0025 | -.0094 | -.0217 | -.0406 | -.1033 |
| B1 | -.0758 | -.0758 | -.0758 | -.0758 | -.0758 | -.0758 | -.0758 | -.0758 | -.0758 |
| B2 | -1.1336 | -1.1336 | -1.1336 | -1.1336 | -1.1336 | -1.1336 | -1.1336 | -1.1336 | -1.1336 |
| B3 | .7171 | .7171 | .7171 | .7171 | .7171 | .7171 | .7171 | .7171 | .7171 |
| B4 | .7375 | .7375 | .7375 | .7375 | .7375 | .7375 | .7375 | .7375 | .7375 |
| B5 | -1.3058 | -1.3058 | -1.3058 | -1.3058 | -1.3058 | -1.3057 | -1.3058 | -1.3058 | -1.3058 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 346492 — QTA2 = 288809 — QTA3 = 248071

AZIMUTH AND TILT COEF. — C1 = -.0282 — C2 = -.2826 — C3 = -.4008 — C4 = 1.7513 — C5 = -1.3575

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 27 | 34 | 39 | 53 | 65 | 75 | 76 | 77 | 65 | 56 | 42 | 32 |
| QHOR: | 811 | 1092 | 1482 | 1908 | 2074 | 2337 | 2304 | 2115 | 1723 | 1304 | 871 | 717 |

GOODLAND, KANSAS — ELEVATION = 3688 — LAT = 39.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 195.73 | 90.15 | 66.06 | 51.37 | 41.91 | 35.40 | 30.63 | 27.00 | 21.82 |
| VT2/DD | 167.68 | 77.24 | 56.70 | 44.08 | 35.97 | 30.38 | 26.29 | 23.17 | 18.73 |
| VT3/DD | 145.74 | 67.13 | 49.29 | 38.33 | 31.27 | 26.41 | 22.86 | 20.14 | 16.28 |
| MONTHLY DD | 192 | 416 | 534 | 687 | 842 | 997 | 1152 | 1307 | 1617 |
| ANNUAL DD | 550 | 1546 | 2267 | 3123 | 4115 | 5235 | 6499 | 7915 | 11090 |
| PARAMETER A | .573 | .413 | .422 | .440 | .444 | .441 | .436 | .431 | .396 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0691 | .1232 | .0220 | .0283 | .0338 | .0381 | .0407 | .0414 | .0414 |
| A2 | .3236 | .7208 | 1.1681 | 1.2272 | 1.3399 | 1.4890 | 1.6492 | 1.8133 | 2.3129 |
| A3 | -.3610 | -.7861 | -1.0939 | -1.1852 | -1.3388 | -1.5340 | -1.7414 | -1.9598 | -2.6086 |
| A4 | .1662 | .3979 | .6662 | .7197 | .8107 | .9266 | 1.0506 | 1.1817 | 1.5741 |
| A5 | .0471 | .0941 | .1696 | .1528 | .1339 | .1154 | .0976 | .0739 | .0084 |
| B1 | -.0497 | -.0497 | -.0228 | -.0228 | -.0228 | -.0228 | -.0228 | -.0228 | -.0228 |
| B2 | -1.1933 | -1.1933 | -1.2603 | -1.2603 | -1.2603 | -1.2602 | -1.2603 | -1.2603 | -1.2603 |
| B3 | .7657 | .7657 | .8398 | .8398 | .8398 | .8398 | .8398 | .8398 | .8398 |
| B4 | .6801 | .6801 | .5985 | .5985 | .5986 | .5986 | .5985 | .5985 | .5985 |
| B5 | -1.3260 | -1.3260 | -1.3054 | -1.3054 | -1.3055 | -1.3055 | -1.3054 | -1.3054 | -1.3054 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 361783 QTA2 = 301995 QTA3 = 259503
AZIMUTH AND TILT COEF. C1 = -.0312 C2 = -.3623 C3 = -.3387 C4 = 1.6668 C5 =-1.3630

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 27 | 32 | 37 | 48 | 56 | 69 | 74 | 74 | 63 | 52 | 37 | 27 |
| QHOR: | 806 | 1045 | 1408 | 1913 | 2086 | 2343 | 2347 | 2125 | 1641 | 1275 | 813 | 693 |

TOPEKA, KANSAS — ELEVATION = 886 — LAT = 39.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 117.30 | 62.44 | 48.17 | 38.00 | 30.63 | 25.53 | 21.88 | 19.14 | 15.31 |
| VT2/DD | 100.35 | 53.42 | 41.21 | 32.54 | 26.23 | 21.86 | 18.73 | 16.39 | 13.11 |
| VT3/DD | 87.18 | 46.41 | 35.80 | 28.27 | 22.79 | 18.99 | 16.28 | 14.24 | 11.39 |
| MONTHLY DD | 248 | 466 | 605 | 624 | 774 | 929 | 1084 | 1239 | 1549 |
| ANNUAL DD | 573 | 1386 | 1967 | 2665 | 3477 | 4405 | 5458 | 6673 | 9599 |
| PARAMETER A | .593 | .514 | .485 | .501 | .547 | .590 | .625 | .655 | .696 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0556 | -.0831 | -.0932 | .0337 | .0292 | .0263 | .0249 | .0245 | .0246 |
| A2 | .1604 | .3724 | .4606 | .6179 | .6084 | .6104 | .6315 | .6729 | .7987 |
| A3 | -.1647 | -.3717 | -.4590 | -.6187 | -.6168 | -.6306 | -.6692 | -.7356 | -.9277 |
| A4 | .0841 | .2137 | .2677 | .4480 | .4397 | .4417 | .4596 | .4941 | .5989 |
| A5 | .0392 | .0708 | .0837 | -.0035 | -.0030 | -.0058 | -.0128 | -.0244 | -.0573 |
| B1 | .0178 | .0178 | .0178 | -.0201 | -.0201 | -.0201 | -.0201 | -.0201 | -.0201 |
| B2 | -1.1270 | -1.1270 | -1.1270 | -1.1528 | -1.1528 | -1.1528 | -1.1528 | -1.1528 | -1.1528 |
| B3 | .7151 | .7150 | .7151 | .7609 | .7609 | .7609 | .7608 | .7609 | .7609 |
| B4 | .7111 | .7111 | .7111 | .6460 | .6461 | .6461 | .6461 | .6461 | .6460 |
| B5 | -1.2731 | -1.2732 | -1.2732 | -1.2248 | -1.2248 | -1.2248 | -1.2248 | -1.2248 | -1.2248 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 308146 QTA2 = 256995 QTA3 = 220856
AZIMUTH AND TILT COEF. C1 = -.0154 C2 = -.2875 C3 = -.3558 C4 = 1.6591 C5 =-1.2708

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 25 | 31 | 40 | 56 | 66 | 73 | 77 | 79 | 67 | 57 | 44 | 30 |
| QHOR: | 705 | 940 | 1280 | 1639 | 1975 | 2088 | 2159 | 1904 | 1484 | 1139 | 802 | 565 |

LEXINGTON, KENTUCKY — ELEVATION = 988 — LAT = 38.0

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) |
| VT1/DD | 113.84 | 55.16 | 40.87 | 31.62 | 25.48 | 21.19 | 18.07 | 15.28 | 11.65 |
| VT2/DD | 97.11 | 47.05 | 34.87 | 26.97 | 21.73 | 18.07 | 15.42 | 13.04 | 9.94 |
| VT3/DD | 84.31 | 40.85 | 30.27 | 23.42 | 18.87 | 15.69 | 13.38 | 11.32 | 8.63 |
| MONTHLY DD | 166 | 343 | 464 | 599 | 744 | 894 | 1048 | 993 | 1303 |
| ANNUAL DD | 355 | 954 | 1454 | 2089 | 2862 | 3781 | 4862 | 6109 | 9178 |
| PARAMETER A | .451 | .566 | .586 | .595 | .600 | .610 | .628 | .687 | .787 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0534 | .0436 | .0428 | .0422 | .0418 | .0408 | .0393 | -.0055 | -.0041 |
| A2 | .3465 | .2827 | .3135 | .3549 | .3986 | .4405 | .4800 | .5279 | .5746 |
| A3 | -.3011 | -.2611 | -.3040 | -.3571 | -.4144 | -.4740 | -.5357 | -.6510 | -.7427 |
| A4 | .1822 | .1565 | .1835 | .2165 | .2526 | .2904 | .3296 | .4195 | .4713 |
| A5 | .1169 | .0860 | .0810 | .0778 | .0723 | .0618 | .0458 | -.0543 | -.0844 |
| B1 | -.0288 | -.0288 | -.0288 | -.0288 | -.0288 | -.0288 | -.0288 | -.0092 | -.0092 |
| B2 | -1.0028 | -1.0028 | -1.0028 | -1.0028 | -1.0028 | -1.0028 | -1.0028 | -1.0152 | -1.0152 |
| B3 | .6511 | .6511 | .6511 | .6511 | .6511 | .6511 | .6511 | .6890 | .6890 |
| B4 | .7624 | .7623 | .7623 | .7623 | .7623 | .7623 | .7623 | .7209 | .7209 |
| B5 | -1.1860 | -1.1859 | -1.1859 | -1.1859 | -1.1859 | -1.1860 | -1.1859 | -1.1366 | -1.1366 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 251362 QTA2 = 209159 QTA3 = 179667
AZIMUTH AND TILT COEF. C1 = -.0191 C2 = -.2150 C3 = -.3901 C4 = 1.6968 C5 =-1.1640

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 31 | 34 | 43 | 57 | 62 | 72 | 75 | 73 | 69 | 57 | 45 | 37 |
| QHOR: | 547 | 761 | 1101 | 1510 | 1755 | 1924 | 1858 | 1736 | 1365 | 1078 | 632 | 444 |

LOUISVILLE, KENTUCKY — ELEVATION = 489 — LAT = 38.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=.1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 136.73 | 61.61 | 44.89 | 34.38 | 27.46 | 22.71 | 19.24 | 16.67 | 13.16 |
| VT2/DD | 116.67 | 52.57 | 38.30 | 29.34 | 23.43 | 19.38 | 16.42 | 14.23 | 11.23 |
| VT3/DD | 101.29 | 45.65 | 33.25 | 25.47 | 20.35 | 16.82 | 14.25 | 12.35 | 9.75 |
| MONTHLY DD | 142 | 314 | 432 | 563 | 705 | 853 | 1007 | 1162 | 1472 |
| ANNUAL DD | 263 | 871 | 1394 | 2044 | 2814 | 3716 | 4756 | 5966 | 8930 |
| PARAMETER A | .631 | .664 | .636 | .624 | .622 | .628 | .640 | .654 | .686 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0221 | .0336 | .0355 | .0349 | .0339 | .0329 | .0321 | .0313 | .0295 |
| A2 | .1588 | .2316 | .2908 | .3437 | .3885 | .4272 | .4667 | .5132 | .6342 |
| A3 | -.1605 | -.2511 | -.3209 | -.3843 | -.4399 | -.4915 | -.5469 | -.6150 | -.7979 |
| A4 | .1289 | .1825 | .2272 | .2675 | .3030 | .3353 | .3697 | .4110 | .5181 |
| A5 | .0128 | .0145 | .0156 | .0149 | .0123 | .0065 | -.0020 | -.0142 | -.0493 |
| B1 | -.0206 | -.0206 | -.0206 | -.0206 | -.0206 | -.0206 | -.0206 | -.0206 | -.0206 |
| B2 | -1.0199 | -1.0199 | -1.0199 | -1.0199 | -1.0199 | -1.0199 | -1.0199 | -1.0199 | -1.0199 |
| B3 | .6739 | .6739 | .6739 | .6739 | .6739 | .6739 | .6739 | .6739 | .6739 |
| B4 | .7571 | .7572 | .7572 | .7571 | .7571 | .7571 | .7571 | .7572 | .7572 |
| B5 | -1.1838 | -1.1838 | -1.1839 | -1.1838 | -1.1838 | -1.1838 | -1.1838 | -1.1838 | -1.1838 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 252591 — QTA2 = 210277 — QTA3 = 180660
AZIMUTH AND TILT COEF. — C1 = -.0108 — C2 = -.2505 — C3 = -.3469 — C4 = 1.6789 — C5 = -1.1611

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 32 | 33 | 44 | 56 | 66 | 73 | 76 | 75 | 69 | 57 | 46 | 39 |
| QHOR: | 557 | 796 | 1148 | 1539 | 1699 | 1886 | 1794 | 1695 | 1386 | 1036 | 629 | 474 |

BATON ROUGE, LOUISIANA — ELEVATION = 75 — LAT = 30.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 636.82 | 382.41 | 204.32 | 155.64 | 75.14 | 53.20 | 39.96 | 26.07 |
| VT2/DD | NA | 543.05 | 326.11 | 173.67 | 98.29 | 63.87 | 45.22 | 33.97 | 22.16 |
| VT3/DD | NA | 471.63 | 283.22 | 150.74 | 85.31 | 55.43 | 39.25 | 29.48 | 19.23 |
| MONTHLY DD | 14 | 39 | 66 | 113 | 199 | 307 | 433 | 577 | 884 |
| ANNUAL DD | 14 | 72 | 167 | 359 | 690 | 1169 | 1813 | 2643 | 5099 |
| PARAMETER A | NA | .497 | .474 | .480 | .491 | .498 | .505 | .517 | .596 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0931 | .1433 | -.0778 | -.0641 | -.0561 | -.0481 | -.0391 | -.0175 |
| A2 | NA | .2243 | .4529 | .0838 | .1731 | .2340 | .3121 | .4104 | .6217 |
| A3 | NA | -.2116 | -.4545 | -.1397 | -.2367 | -.3082 | -.4076 | -.5387 | -.8405 |
| A4 | NA | .0809 | .2036 | .1299 | .1832 | .2246 | .2814 | .3532 | .5047 |
| A5 | NA | .0656 | .0978 | -.0562 | -.0469 | -.0460 | -.0509 | -.0604 | -.0872 |
| B1 | NA | -.0806 | -.0806 | -.0025 | -.0025 | -.0025 | -.0025 | -.0025 | -.0025 |
| B2 | NA | -1.0487 | -1.0487 | -.9155 | -.9155 | -.9155 | -.9155 | -.9155 | -.9155 |
| B3 | NA | .6280 | .6280 | .4913 | .4913 | .4913 | .4913 | .4913 | .4913 |
| B4 | NA | .9179 | .9179 | 1.0107 | 1.0108 | 1.0108 | 1.0108 | 1.0108 | 1.0108 |
| B5 | NA | -1.2642 | -1.2642 | -1.2336 | -1.2336 | -1.2337 | -1.2336 | -1.2336 | -1.2336 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 257715 — QTA2 = 214430 — QTA3 = 184339
AZIMUTH AND TILT COEF. — C1 = .0299 — C2 = -.1411 — C3 = -.4761 — C4 = 1.8309 — C5 = -1.1012

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 51 | 52 | 60 | 68 | 73 | 79 | 80 | 80 | 76 | 69 | 58 | 51 |
| QHOR: | 790 | 1037 | 1316 | 1757 | 1920 | 1764 | 1748 | 1698 | 1451 | 1226 | 919 | 761 |

LAKE CHARLES, LOUISIANA — ELEVATION = 10 — LAT = 30.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 852.26 | 357.16 | 170.23 | 97.97 | 64.63 | 46.79 | 35.42 | 23.18 |
| VT2/DD | NA | 725.88 | 303.38 | 144.60 | 83.22 | 54.90 | 39.75 | 30.09 | 19.69 |
| VT3/DD | NA | 630.24 | 263.28 | 125.49 | 72.22 | 47.65 | 34.49 | 26.11 | 17.09 |
| MONTHLY DD | 6 | 27 | 57 | 120 | 209 | 317 | 438 | 578 | 884 |
| ANNUAL DD | 7 | 64 | 155 | 329 | 629 | 1088 | 1700 | 2497 | 4883 |
| PARAMETER A | NA | .407 | .535 | .607 | .661 | .652 | .646 | .650 | .701 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .2289 | -.0609 | -.0477 | -.0386 | -.0334 | -.0272 | -.0208 | -.0085 |
| A2 | NA | .4980 | .0558 | .0741 | .1072 | .1787 | .2526 | .3288 | .5182 |
| A3 | NA | -.4804 | -.1065 | -.1261 | -.1692 | -.2648 | -.3616 | -.4615 | -.7196 |
| A4 | NA | .2914 | .0911 | .0959 | .1156 | .1660 | .2191 | .2747 | .4131 |
| A5 | NA | .1096 | -.0614 | -.0543 | -.0546 | -.0619 | -.0683 | -.0746 | -.0914 |
| B1 | NA | -.0987 | -.0060 | -.0060 | -.0060 | -.0060 | -.0060 | -.0060 | -.0060 |
| B2 | NA | -.9870 | -.8863 | -.8863 | -.8863 | -.8863 | -.8863 | -.8863 | -.8863 |
| B3 | NA | .5873 | .4882 | .4882 | .4882 | .4882 | .4882 | .4882 | .4882 |
| B4 | NA | .9272 | 1.0149 | 1.0150 | 1.0150 | 1.0149 | 1.0150 | 1.0150 | 1.0149 |
| B5 | NA | -1.2415 | -1.1995 | -1.1995 | -1.1995 | -1.1995 | -1.1996 | -1.1995 | -1.1995 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 249261 — QTA2 = 207312 — QTA3 = 178216
AZIMUTH AND TILT COEF. — C1 = .0267 — C2 = -.0845 — C3 = -.5126 — C4 = 1.8353 — C5 = -1.0595

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 51 | 54 | 60 | 67 | 74 | 79 | 81 | 80 | 77 | 67 | 61 | 51 |
| QHOR: | 729 | 1045 | 1296 | 1589 | 1871 | 2013 | 1774 | 1569 | 1468 | 1246 | 886 | 736 |

NEW ORLEANS, LOUISIANA — ELEVATION = 10 — LAT = 30.0

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 963.99 | 439.33 | 229.37 | 137.65 | 91.60 | 63.96 | 46.83 | 29.44 |
| VT2/DD | NA | 819.69 | 373.56 | 195.04 | 117.04 | 77.89 | 54.38 | 39.82 | 25.04 |
| VT3/DD | NA | 711.52 | 324.27 | 169.30 | 101.60 | 67.61 | 47.21 | 34.56 | 21.73 |
| MONTHLY DD | 2 | 25 | 54 | 104 | 173 | 260 | 372 | 508 | 808 |
| ANNUAL DD | 2 | 45 | 124 | 280 | 544 | 940 | 1526 | 2323 | 4698 |
| PARAMETER A | NA | .518 | .606 | .628 | .594 | .566 | .560 | .565 | .594 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0036 | .0030 | .0116 | .0216 | .0317 | .0421 | .0508 | .0654 |
| A2 | NA | -.0906 | -.0240 | .0538 | .1464 | .2432 | .3464 | .4550 | .7372 |
| A3 | NA | .0808 | .0067 | -.0836 | -.1951 | -.3172 | -.4548 | -.6052 | -1.0139 |
| A4 | NA | -.0398 | .0112 | .0715 | .1425 | .2136 | .2876 | .3675 | .5828 |
| A5 | NA | -.0270 | -.0288 | -.0330 | -.0392 | -.0463 | -.0563 | -.0705 | -.1161 |
| B1 | NA | -.0577 | -.0577 | -.0577 | -.0577 | -.0577 | -.0577 | -.0577 | -.0577 |
| B2 | NA | -.9371 | -.9371 | -.9371 | -.9371 | -.9371 | -.9371 | -.9371 | -.9371 |
| B3 | NA | .5243 | .5243 | .5243 | .5243 | .5243 | .5243 | .5243 | .5243 |
| B4 | NA | 1.0097 | 1.0097 | 1.0096 | 1.0097 | 1.0097 | 1.0097 | 1.0097 | 1.0097 |
| B5 | NA | -1.2285 | -1.2285 | -1.2284 | -1.2285 | -1.2285 | -1.2285 | -1.2284 | -1.2285 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 268094 — QTA2 = 223086 — QTA3 = 191787
AZIMUTH AND TILT COEF. — C1 = .0188 — C2 = -.1506 — C3 = -.4857 — C4 = 1.8632 — C5 = -1.1251

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 53 | 54 | 60 | 69 | 74 | 78 | 80 | 81 | 74 | 71 | 60 | 55 |
| QHOR: | 818 | 1082 | 1423 | 1699 | 1958 | 1893 | 1780 | 1731 | 1537 | 1374 | 950 | 806 |

SHREVEPORT, LOUISIANA — ELEVATION = 259 — LAT = 32.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 553.93 | 260.07 | 143.07 | 86.78 | 60.14 | 45.03 | 35.39 | 24.52 |
| VT2/DD | NA | 472.66 | 221.91 | 122.08 | 73.86 | 51.18 | 38.32 | 30.12 | 20.87 |
| VT3/DD | NA | 410.51 | 192.73 | 106.03 | 64.11 | 44.43 | 33.27 | 26.15 | 18.12 |
| MONTHLY DD | 2 | 48 | 103 | 187 | 284 | 410 | 548 | 697 | 1006 |
| ANNUAL DD | 3 | 111 | 293 | 627 | 1104 | 1709 | 2466 | 3393 | 5918 |
| PARAMETER A | NA | .580 | .505 | .448 | .472 | .479 | .495 | .516 | .564 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0405 | -.0518 | -.0609 | .0541 | .0533 | .0510 | .0480 | .0422 |
| A2 | NA | .2368 | .4174 | .6216 | .2833 | .3357 | .3982 | .4740 | .7047 |
| A3 | NA | -.2243 | -.4269 | -.6600 | -.4082 | -.4715 | -.5507 | -.6485 | -.9625 |
| A4 | NA | .1518 | .2822 | .4278 | .2525 | .2900 | .3339 | .3869 | .5557 |
| A5 | NA | .0405 | .0450 | .0497 | -.0717 | -.0720 | -.0738 | -.0765 | -.0983 |
| B1 | NA | -.0076 | -.0076 | -.0076 | -.0437 | -.0437 | -.0437 | -.0437 | -.0437 |
| B2 | NA | -1.0389 | -1.0389 | -1.0389 | -.9446 | -.9446 | -.9446 | -.9446 | -.9446 |
| B3 | NA | .6308 | .6308 | .6308 | .5258 | .5258 | .5258 | .5258 | .5258 |
| B4 | NA | .8380 | .8380 | .8380 | .9363 | .9363 | .9363 | .9363 | .9363 |
| B5 | NA | -1.2670 | -1.2670 | -1.2670 | -1.2563 | -1.2563 | -1.2563 | -1.2563 | -1.2563 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 277362 — QTA2 = 230686 — QTA3 = 198185
AZIMUTH AND TILT COEF. — C1 = -.0280 — C2 = -.1261 — C3 = -.5261 — C4 = 1.8371 — C5 = -1.1774

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 47 | 50 | 57 | 66 | 73 | 78 | 82 | 81 | 76 | 65 | 53 | 46 |
| QHOR: | 777 | 1027 | 1411 | 1550 | 1919 | 2098 | 2043 | 1877 | 1502 | 1255 | 914 | 756 |

BANGOR, MAINE — ELEVATION = 203 — LAT = 44.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 62.25 | 33.47 | 26.71 | 22.20 | 18.89 | 16.25 | 14.26 | 12.70 | 10.42 |
| VT2/DD | 53.02 | 28.68 | 22.89 | 19.02 | 16.20 | 13.93 | 12.23 | 10.89 | 8.94 |
| VT3/DD | 46.01 | 24.92 | 19.89 | 16.53 | 14.08 | 12.11 | 10.62 | 9.46 | 7.77 |
| MONTHLY DD | 385 | 607 | 761 | 916 | 954 | 1109 | 1264 | 1419 | 1729 |
| ANNUAL DD | 1109 | 2370 | 3232 | 4229 | 5381 | 6692 | 8167 | 9780 | 13255 |
| PARAMETER A | .290 | .394 | .437 | .473 | .513 | .565 | .609 | .642 | .664 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0672 | .0906 | .0801 | .0709 | -.0217 | -.0216 | -.0224 | -.0240 | -.0288 |
| A2 | -.6687 | .9005 | .8902 | .8981 | .9701 | .9458 | .9396 | .9597 | 1.0819 |
| A3 | .4352 | -.8232 | -.8306 | -.8597 | -.8631 | -.8766 | -.9065 | -.9623 | -1.1541 |
| A4 | -.4090 | .4724 | .4715 | .4865 | .6305 | .6246 | .6323 | .6590 | .7690 |
| A5 | -.1472 | .1843 | .1732 | .1589 | .1501 | .1225 | .0966 | .0723 | .0311 |
| B1 | .0321 | -.0023 | -.0023 | -.0023 | .0228 | .0228 | .0228 | .0228 | .0228 |
| B2 | -.9553 | -1.1854 | -1.1854 | -1.1854 | -1.2002 | -1.2002 | -1.2002 | -1.2002 | -1.2001 |
| B3 | .5492 | .8291 | .8291 | .8291 | .8487 | .8487 | .8487 | .8487 | .8487 |
| B4 | .8278 | .5690 | .5690 | .5690 | .5104 | .5104 | .5104 | .5104 | .5104 |
| B5 | -1.2321 | -1.1921 | -1.1921 | -1.1921 | -1.1755 | -1.1756 | -1.1756 | -1.1756 | -1.1755 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 267176 — QTA2 = 223456 — QTA3 = 192363
AZIMUTH AND TILT COEF. — C1 = -.0142 — C2 = -.3645 — C3 = -.1894 — C4 = 1.4786 — C5 = -1.1996

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 16 | 27 | 41 | 52 | 62 | 67 | 66 | 58 | 46 | 38 | 24 |
| QHOR: | 463 | 777 | 1000 | 1467 | 1740 | 1851 | 1887 | 1633 | 1209 | 884 | 418 | 390 |

CARIBOU, MAINE — ELEVATION = 623 — LAT = 46.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 30.10 | 19.22 | 15.84 | 13.47 | 11.72 | 10.36 | 9.29 | 8.42 | 7.09 |
| VT2/DD | 25.74 | 16.47 | 13.57 | 11.54 | 10.04 | 8.88 | 7.96 | 7.22 | 6.08 |
| VT3/DD | 22.36 | 14.31 | 11.80 | 10.03 | 8.72 | 7.72 | 6.92 | 6.27 | 5.28 |
| MONTHLY DD | 560 | 725 | 879 | 1034 | 1189 | 1344 | 1499 | 1654 | 1964 |
| ANNUAL DD | 1804 | 3285 | 4256 | 5369 | 6614 | 8011 | 9562 | 11228 | 14762 |
| PARAMETER A | .580 | .674 | .740 | .793 | .838 | .879 | .915 | .939 | .951 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0620 | .0423 | .0417 | .0407 | .0395 | .0379 | .0364 | .0353 | .0346 |
| A2 | .1112 | .4036 | .4054 | .4129 | .4246 | .4384 | .4569 | .4855 | .5720 |
| A3 | -.1125 | -.3509 | -.3662 | -.3856 | -.4090 | -.4358 | -.4692 | -.5149 | -.6400 |
| A4 | .1611 | .3015 | .3033 | .3097 | .3196 | .3319 | .3491 | .3747 | .4484 |
| A5 | -.0613 | .0460 | .0390 | .0330 | .0269 | .0194 | .0102 | -.0001 | -.0216 |
| B1 | .0489 | .0141 | .0141 | .0141 | .0141 | .0141 | .0141 | .0141 | .0141 |
| B2 | -1.0812 | -1.1578 | -1.1578 | -1.1578 | -1.1578 | -1.1578 | -1.1578 | -1.1578 | -1.1578 |
| B3 | .7505 | .8430 | .8430 | .8430 | .8430 | .8430 | .8429 | .8430 | .8430 |
| B4 | .5493 | .4755 | .4755 | .4755 | .4755 | .4755 | .4755 | .4755 | .4755 |
| B5 | -1.1375 | -1.1410 | -1.1410 | -1.1410 | -1.1410 | -1.1410 | -1.1410 | -1.1410 | -1.1410 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 254829 — QTA2 = 213316 — QTA3 = 183741

AZIMUTH AND TILT COEF. — C1 = .0461 — C2 = -.3488 — C3 = -.1789 — C4 = 1.4228 — C5 = -1.1933

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 12 | 13 | 25 | 36 | 51 | 60 | 64 | 61 | 54 | 43 | 31 | 16 |
| QHOR: | 410 | 736 | 1171 | 1425 | 1617 | 1815 | 1746 | 1468 | 1028 | 687 | 378 | 308 |

PORTLAND, MAINE — ELEVATION = 62 — LAT = 43.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 64.80 | 33.88 | 26.38 | 21.44 | 17.82 | 15.21 | 13.27 | 11.77 | 9.59 |
| VT2/DD | 55.44 | 28.98 | 22.57 | 18.35 | 15.27 | 13.03 | 11.37 | 10.08 | 8.22 |
| VT3/DD | 48.16 | 25.18 | 19.61 | 15.94 | 13.27 | 11.33 | 9.88 | 8.76 | 7.14 |
| MONTHLY DD | 271 | 519 | 667 | 820 | 904 | 1059 | 1214 | 1369 | 1679 |
| ANNUAL DD | 774 | 1831 | 2627 | 3583 | 4696 | 5975 | 7421 | 8997 | 12465 |
| PARAMETER A | .385 | .501 | .544 | .575 | .621 | .663 | .701 | .726 | .738 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .1505 | .1219 | .1166 | .1143 | -.1041 | -.0905 | -.0792 | -.0708 | -.0601 |
| A2 | .2482 | .3455 | .4036 | .4681 | .7696 | .7861 | .8082 | .8471 | .9823 |
| A3 | -.2127 | -.3280 | -.3986 | -.4795 | -.7473 | -.7895 | -.8377 | -.9033 | -1.0993 |
| A4 | .1950 | .2522 | .2914 | .3372 | .4968 | .5168 | .5405 | .5757 | .6864 |
| A5 | .0259 | .0330 | .0336 | .0314 | .0917 | .0758 | .0597 | .0444 | .0142 |
| B1 | -.0695 | -.0695 | -.0695 | -.0695 | .0137 | .0137 | .0137 | .0137 | .0137 |
| B2 | -1.1214 | -1.1214 | -1.1214 | -1.1214 | -1.2016 | -1.2016 | -1.2016 | -1.2016 | -1.2016 |
| B3 | .7598 | .7598 | .7597 | .7598 | .8542 | .8542 | .8542 | .8542 | .8542 |
| B4 | .6294 | .6294 | .6294 | .6294 | .5509 | .5509 | .5509 | .5509 | .5509 |
| B5 | -1.1787 | -1.1787 | -1.1787 | -1.1787 | -1.1726 | -1.1726 | -1.1727 | -1.1726 | -1.1726 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 244177 — QTA2 = 204136 — QTA3 = 175706

AZIMUTH AND TILT COEF. — C1 = .0171 — C2 = -.3600 — C3 = -.1835 — C4 = 1.4876 — C5 = -1.1647

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 23 | 24 | 34 | 42 | 52 | 63 | 68 | 66 | 59 | 49 | 39 | 25 |
| QHOR: | 439 | 680 | 1011 | 1250 | 1575 | 1711 | 1779 | 1488 | 1186 | 857 | 479 | 368 |

BALTIMORE, MARYLAND — ELEVATION = 154 — LAT = 39.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 174.04 | 68.94 | 48.71 | 36.98 | 29.68 | 24.09 | 20.07 | 17.20 | 13.37 |
| VT2/DD | 148.73 | 58.91 | 41.62 | 31.61 | 25.36 | 20.60 | 17.16 | 14.71 | 11.43 |
| VT3/DD | 129.17 | 51.17 | 36.15 | 27.45 | 22.03 | 17.89 | 14.91 | 12.77 | 9.93 |
| MONTHLY DD | 128 | 323 | 457 | 602 | 750 | 773 | 928 | 1083 | 1393 |
| ANNUAL DD | 271 | 911 | 1479 | 2193 | 3036 | 4016 | 5136 | 6417 | 9503 |
| PARAMETER A | .463 | .587 | .603 | .593 | .581 | .607 | .641 | .675 | .726 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0786 | .0752 | .0770 | .0808 | .0830 | -.1298 | -.1215 | -.1137 | -.1028 |
| A2 | .3347 | .3233 | .3693 | .4392 | .5284 | .6683 | .6996 | .7260 | .8148 |
| A3 | -.3344 | -.3470 | -.4022 | -.4846 | -.5931 | -.7550 | -.8025 | -.8460 | -.9866 |
| A4 | .1506 | .1650 | .2006 | .2498 | .3128 | .4748 | .5010 | .5249 | .6048 |
| A5 | .0843 | .0588 | .0573 | .0581 | .0567 | -.0129 | -.0189 | -.0269 | -.0543 |
| B1 | -.0406 | -.0406 | -.0406 | -.0406 | -.0406 | .0410 | .0410 | .0410 | .0410 |
| B2 | -1.0932 | -1.0932 | -1.0932 | -1.0932 | -1.0932 | -1.1174 | -1.1174 | -1.1174 | -1.1174 |
| B3 | .7171 | .7171 | .7171 | .7171 | .7171 | .7602 | .7602 | .7602 | .7602 |
| B4 | .7363 | .7363 | .7363 | .7363 | .7363 | .6740 | .6739 | .6740 | .6739 |
| B5 | -1.2173 | -1.2173 | -1.2174 | -1.2174 | -1.2173 | -1.1764 | -1.1764 | -1.1764 | -1.1763 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 268723 — QTA2 = 224187 — QTA3 = 192782

AZIMUTH AND TILT COEF. — C1 = -.0188 — C2 = -.3188 — C3 = -.2738 — C4 = 1.5998 — C5 = -1.1757

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 30 | 34 | 42 | 51 | 61 | 72 | 76 | 74 | 68 | 57 | 46 | 35 |
| QHOR: | 597 | 824 | 1230 | 1493 | 1728 | 1940 | 1835 | 1586 | 1352 | 1053 | 674 | 490 |

PATUXENT RIVER, MARYLAND — ELEVATION = 46 — LAT = 38.3

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 297.37 | 95.17 | 63.98 | 46.20 | 35.63 | 28.88 | 24.15 | 20.72 | 16.14 |
| VT2/DD | 253.91 | 81.27 | 54.63 | 39.45 | 30.42 | 24.66 | 20.62 | 17.69 | 13.78 |
| VT3/DD | 220.50 | 70.57 | 47.44 | 34.26 | 26.42 | 21.42 | 17.91 | 15.37 | 11.96 |
| MONTHLY DD | 76 | 237 | 353 | 489 | 634 | 782 | 936 | 1091 | 1401 |
| ANNUAL DD | 97 | 495 | 925 | 1512 | 2237 | 3098 | 4139 | 5363 | 8367 |
| PARAMETER A | .451 | .659 | .662 | .626 | .606 | .591 | .594 | .606 | .628 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0031 | .0171 | .0212 | .0252 | .0277 | .0301 | .0310 | .0301 | .0271 |
| A2 | .0356 | .0996 | .1741 | .2683 | .3501 | .4449 | .5346 | .6164 | .7936 |
| A3 | -.0381 | -.1032 | -.1865 | -.2876 | -.3783 | -.4925 | -.6047 | -.7123 | -.9556 |
| A4 | .0282 | .0865 | .1388 | .2016 | .2565 | .3229 | .3864 | .4468 | .5837 |
| A5 | .0006 | .0023 | .0059 | .0148 | .0204 | .0196 | .0162 | .0087 | -.0163 |
| B1 | -.0181 | -.0181 | -.0181 | -.0181 | -.0181 | -.0181 | -.0181 | -.0181 | -.0181 |
| B2 | -1.0579 | -1.0579 | -1.0579 | -1.0579 | -1.0579 | -1.0579 | -1.0579 | -1.0579 | -1.0579 |
| B3 | .6729 | .6729 | .6729 | .6729 | .6729 | .6729 | .6729 | .6729 | .6729 |
| B4 | .7663 | .7663 | .7663 | .7663 | .7663 | .7663 | .7663 | .7663 | .7663 |
| B5 | -1.2124 | -1.2124 | -1.2124 | -1.2124 | -1.2124 | -1.2124 | -1.2123 | -1.2124 | -1.2124 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 270660 — QTA2 = 225690 — QTA3 = 194035

AZIMUTH AND TILT COEF. — C1 = -.0052 — C2 = -.3040 — C3 = -.2834 — C4 = 1.6231 — C5 = -1.1652

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 34 | 38 | 46 | 54 | 64 | 73 | 77 | 76 | 71 | 60 | 48 | 39 |
| QHOR: | 629 | 906 | 1145 | 1562 | 1666 | 2007 | 1897 | 1694 | 1372 | 1037 | 712 | 567 |

BOSTON, MASSACHUSETTS — ELEVATION = 16 — LAT = 42.4

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 126.94 | 48.07 | 33.95 | 26.19 | 21.27 | 17.86 | 15.38 | 13.51 | 10.86 |
| VT2/DD | 108.50 | 41.09 | 29.02 | 22.38 | 18.18 | 15.27 | 13.15 | 11.55 | 9.28 |
| VT3/DD | 94.22 | 35.68 | 25.20 | 19.44 | 15.79 | 13.26 | 11.42 | 10.03 | 8.06 |
| MONTHLY DD | 135 | 357 | 506 | 656 | 808 | 962 | 1117 | 1272 | 1582 |
| ANNUAL DD | 261 | 1040 | 1717 | 2537 | 3508 | 4643 | 5949 | 7410 | 10728 |
| PARAMETER A | .720 | .690 | .686 | .691 | .697 | .706 | .718 | .731 | .737 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .1207 | .2140 | .2413 | .2575 | .2679 | .2743 | .2784 | .2809 | .2923 |
| A2 | .0407 | .2330 | .2939 | .3565 | .4266 | .4961 | .5604 | .6175 | .7559 |
| A3 | -.0888 | -.2992 | -.3640 | -.4380 | -.5250 | -.6134 | -.6964 | -.7713 | -.9592 |
| A4 | .0490 | .1814 | .2210 | .2658 | .3184 | .3717 | .4212 | .4658 | .5771 |
| A5 | -.0396 | -.0309 | -.0253 | -.0270 | -.0327 | -.0401 | -.0476 | -.0551 | -.0792 |
| B1 | -.2002 | -.2002 | -.2002 | -.2002 | -.2002 | -.2002 | -.2002 | -.2002 | -.2002 |
| B2 | -1.0800 | -1.0800 | -1.0800 | -1.0800 | -1.0800 | -1.0800 | -1.0800 | -1.0800 | -1.0800 |
| B3 | .7408 | .7407 | .7407 | .7408 | .7408 | .7407 | .7407 | .7407 | .7407 |
| B4 | .6577 | .6577 | .6577 | .6577 | .6577 | .6577 | .6577 | .6577 | .6577 |
| B5 | -1.1650 | -1.1650 | -1.1651 | -1.1651 | -1.1650 | -1.1651 | -1.1651 | -1.1651 | -1.1651 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 243348 — QTA2 = 203130 — QTA3 = 174713

AZIMUTH AND TILT COEF. — C1 = -.0039 — C2 = -.3052 — C3 = -.2438 — C4 = 1.5616 — C5 = -1.1892

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 28 | 34 | 36 | 47 | 56 | 67 | 72 | 71 | 62 | 53 | 44 | 32 |
| QHOR: | 454 | 675 | 1029 | 1282 | 1620 | 1910 | 1725 | 1478 | 1288 | 835 | 502 | 385 |

ALPENA, MICHIGAN — ELEVATION = 689 — LAT = 45.1

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 35.63 | 16.82 | 12.81 | 10.34 | 8.67 | 7.47 | 6.56 | 5.84 | 4.80 |
| VT2/DD | 30.42 | 14.35 | 10.93 | 8.82 | 7.40 | 6.37 | 5.59 | 4.98 | 4.09 |
| VT3/DD | 26.41 | 12.45 | 9.49 | 7.66 | 6.42 | 5.53 | 4.85 | 4.33 | 3.55 |
| MONTHLY DD | 364 | 495 | 650 | 805 | 960 | 1115 | 1270 | 1425 | 1735 |
| ANNUAL DD | 1118 | 2433 | 3313 | 4337 | 5495 | 6777 | 8206 | 9780 | 13228 |
| PARAMETER A | .477 | .786 | .907 | .998 | 1.069 | 1.126 | 1.176 | 1.218 | 1.274 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0416 | -.0913 | -.0735 | -.0627 | -.0556 | -.0505 | -.0464 | -.0433 | -.0394 |
| A2 | .3542 | .1441 | .1308 | .1283 | .1334 | .1415 | .1507 | .1617 | .1908 |
| A3 | -.3739 | -.2104 | -.1905 | -.1872 | -.1948 | -.2062 | -.2195 | -.2356 | -.2790 |
| A4 | .2124 | .1899 | .1695 | .1628 | .1643 | .1689 | .1751 | .1834 | .2085 |
| A5 | .0154 | -.0991 | -.0860 | -.0805 | -.0787 | -.0783 | -.0788 | -.0805 | -.0884 |
| B1 | .0131 | .0532 | .0532 | .0532 | .0532 | .0532 | .0532 | .0532 | .0532 |
| B2 | -1.0169 | -.9744 | -.9744 | -.9744 | -.9744 | -.9744 | -.9744 | -.9744 | -.9745 |
| B3 | .7119 | .6958 | .6958 | .6958 | .6958 | .6958 | .6958 | .6958 | .6958 |
| B4 | .6257 | .6044 | .6044 | .6044 | .6044 | .6044 | .6044 | .6044 | .6044 |
| B5 | -1.0842 | -1.0288 | -1.0289 | -1.0289 | -1.0289 | -1.0289 | -1.0289 | -1.0289 | -1.0289 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 236263 — QTA2 = 196800 — QTA3 = 169126

AZIMUTH AND TILT COEF. — C1 = .0182 — C2 = -.2352 — C3 = -.3533 — C4 = 1.6042 — C5 = -1.1796

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 19 | 17 | 28 | 41 | 51 | 64 | 67 | 68 | 56 | 49 | 36 | 24 |
| QHOR: | 367 | 598 | 1064 | 1415 | 1821 | 1883 | 1938 | 1577 | 1153 | 722 | 393 | 247 |

DETROIT, MICHIGAN — ELEVATION = 627 — LAT = 42.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 95.96 | 36.39 | 25.53 | 19.45 | 15.61 | 12.96 | 11.06 | 9.64 | 7.68 |
| VT2/DD | 81.38 | 31.07 | 21.80 | 16.61 | 13.32 | 11.06 | 9.44 | 8.23 | 6.56 |
| VT3/DD | 70.56 | 26.97 | 18.92 | 14.42 | 11.57 | 9.60 | 8.20 | 7.15 | 5.69 |
| MONTHLY DD | 185 | 321 | 458 | 601 | 749 | 903 | 1058 | 1213 | 1523 |
| ANNUAL DD | 482 | 1429 | 2116 | 2923 | 3849 | 4915 | 6115 | 7469 | 10636 |
| PARAMETER A | .283 | .448 | .552 | .630 | .700 | .767 | .825 | .880 | .969 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0047 | -.0932 | -.0699 | -.0568 | -.0473 | -.0398 | -.0341 | -.0297 | -.0240 |
| A2 | -1.0572 | .5695 | .4865 | .4483 | .4213 | .4023 | .3935 | .3892 | .4048 |
| A3 | 1.0485 | -.7125 | -.6032 | -.5525 | -.5188 | -.4972 | -.4895 | -.4885 | -.5216 |
| A4 | -.5056 | .3788 | .3301 | .3103 | .2981 | .2920 | .2932 | .2971 | .3235 |
| A5 | -.1716 | -.0446 | -.0360 | -.0333 | -.0337 | -.0365 | -.0412 | -.0466 | -.0632 |
| B1 | .0086 | .0369 | .0369 | .0369 | .0369 | .0369 | .0369 | .0369 | .0369 |
| B2 | -.7547 | -1.0292 | -1.0292 | -1.0292 | -1.0292 | -1.0292 | -1.0292 | -1.0292 | -1.0292 |
| B3 | .3607 | .7276 | .7276 | .7276 | .7276 | .7276 | .7276 | .7276 | .7276 |
| B4 | .9113 | .6423 | .6423 | .6423 | .6423 | .6423 | .6423 | .6423 | .6423 |
| B5 | -1.1367 | -1.0791 | -1.0791 | -1.0791 | -1.0791 | -1.0791 | -1.0790 | -1.0791 | -1.0791 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 239317 — QTA2 = 199365 — QTA3 = 171348

AZIMUTH AND TILT COEF. — C1 = .0255 — C2 = -.2569 — C3 = -.3119 — C4 = 1.6053 — C5 = -1.1476

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 26 | 26 | 35 | 49 | 61 | 69 | 74 | 71 | 67 | 56 | 42 | 30 |
| QHOR: | 424 | 690 | 969 | 1384 | 1732 | 1898 | 1891 | 1551 | 1297 | 833 | 491 | 338 |

FLINT, MICHIGAN — ELEVATION = 764 — LAT = 43.0

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 48.49 | 26.05 | 20.48 | 16.06 | 13.09 | 11.04 | 9.54 | 8.41 | 6.79 |
| VT2/DD | 41.41 | 22.25 | 17.50 | 13.72 | 11.18 | 9.43 | 8.15 | 7.18 | 5.80 |
| VT3/DD | 35.96 | 19.32 | 15.19 | 11.91 | 9.71 | 8.19 | 7.08 | 6.23 | 5.03 |
| MONTHLY DD | 303 | 564 | 718 | 680 | 835 | 990 | 1145 | 1300 | 1610 |
| ANNUAL DD | 816 | 1908 | 2681 | 3583 | 4617 | 5782 | 7101 | 8584 | 11941 |
| PARAMETER A | .590 | .573 | .564 | .631 | .698 | .759 | .817 | .871 | .944 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0046 | -.0328 | -.0460 | -.1141 | -.1057 | -.0983 | -.0911 | -.0845 | -.0759 |
| A2 | .3773 | .4751 | .5262 | .5154 | .4881 | .4719 | .4612 | .4577 | .4824 |
| A3 | -.3741 | -.4671 | -.5186 | -.5475 | -.5250 | -.5158 | -.5135 | -.5205 | -.5728 |
| A4 | .1951 | .2567 | .2890 | .3596 | .3424 | .3346 | .3317 | .3348 | .3663 |
| A5 | .0683 | .0895 | .0983 | .0199 | .0158 | .0098 | .0023 | -.0066 | -.0278 |
| B1 | .0299 | .0299 | .0299 | .0563 | .0563 | .0563 | .0563 | .0563 | .0563 |
| B2 | -1.0444 | -1.0444 | -1.0444 | -1.0458 | -1.0458 | -1.0458 | -1.0458 | -1.0458 | -1.0458 |
| B3 | .7152 | .7152 | .7152 | .7393 | .7394 | .7394 | .7393 | .7393 | .7394 |
| B4 | .6618 | .6618 | .6618 | .6205 | .6205 | .6205 | .6205 | .6205 | .6205 |
| B5 | -1.1232 | -1.1231 | -1.1231 | -1.0862 | -1.0862 | -1.0861 | -1.0861 | -1.0861 | -1.0861 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 226423 — QTA2 = 188692 — QTA3 = 162232

AZIMUTH AND TILT COEF. — C1 = .0136 — C2 = -.2530 — C3 = -.2909 — C4 = 1.5772 — C5 = -1.1172

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 21 | 24 | 31 | 46 | 54 | 67 | 70 | 68 | 62 | 52 | 38 | 28 |
| QHOR: | 411 | 647 | 999 | 1313 | 1698 | 1831 | 1764 | 1523 | 1184 | 808 | 372 | 306 |

GRAND RAPIDS, MICHIGAN — ELEVATION = 804 — LAT = 42.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 59.48 | 26.42 | 19.30 | 15.20 | 12.54 | 10.67 | 9.28 | 8.22 | 6.68 |
| VT2/DD | 50.79 | 22.56 | 16.48 | 12.98 | 10.71 | 9.11 | 7.93 | 7.02 | 5.71 |
| VT3/DD | 44.10 | 19.58 | 14.31 | 11.27 | 9.29 | 7.91 | 6.88 | 6.09 | 4.96 |
| MONTHLY DD | 221 | 420 | 575 | 730 | 885 | 1040 | 1195 | 1350 | 1660 |
| ANNUAL DD | 654 | 1793 | 2571 | 3469 | 4501 | 5654 | 6947 | 8393 | 11691 |
| PARAMETER A | .516 | .634 | .728 | .798 | .861 | .915 | .967 | 1.013 | 1.076 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .1876 | -.1232 | -.1050 | -.0941 | -.0856 | -.0794 | -.0740 | -.0696 | -.0643 |
| A2 | .3337 | .3248 | .3029 | .2964 | .2918 | .2905 | .2916 | .2980 | .3340 |
| A3 | -.3626 | -.4192 | -.3901 | -.3815 | -.3760 | -.3756 | -.3794 | -.3915 | -.4497 |
| A4 | .1937 | .2715 | .2527 | .2470 | .2438 | .2444 | .2479 | .2565 | .2947 |
| A5 | -.0156 | -.0664 | -.0588 | -.0556 | -.0542 | -.0548 | -.0573 | -.0621 | -.0793 |
| B1 | -.0409 | .0715 | .0715 | .0715 | .0715 | .0715 | .0715 | .0715 | .0715 |
| B2 | -1.0328 | -1.0229 | -1.0229 | -1.0229 | -1.0229 | -1.0229 | -1.0229 | -1.0229 | -1.0229 |
| B3 | .6918 | .7168 | .7168 | .7168 | .7168 | .7168 | .7168 | .7168 | .7168 |
| B4 | .6612 | .6227 | .6227 | .6227 | .6227 | .6227 | .6227 | .6227 | .6227 |
| B5 | -1.1184 | -1.0846 | -1.0846 | -1.0846 | -1.0846 | -1.0846 | -1.0846 | -1.0846 | -1.0846 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 242968 — QTA2 = 202220 — QTA3 = 173676

AZIMUTH AND TILT COEF. — C1 = .0178 — C2 = -.2213 — C3 = -.3910 — C4 = 1.6545 — C5 = -1.1923

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 24 | 23 | 33 | 46 | 59 | 67 | 71 | 68 | 60 | 53 | 39 | 26 |
| QHOR: | 369 | 724 | 973 | 1468 | 1741 | 1966 | 1970 | 1681 | 1238 | 877 | 466 | 313 |

SAULT STE. MARIE, MICHIGAN — ELEVATION = 725 — LAT = 46.5

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 21.63 | 14.11 | 12.00 | 10.45 | 9.24 | 8.29 | 7.52 | 6.87 | 5.87 |
| VT2/DD | 18.50 | 12.07 | 10.26 | 8.93 | 7.90 | 7.09 | 6.43 | 5.88 | 5.02 |
| VT3/DD | 16.06 | 10.48 | 8.92 | 7.76 | 6.87 | 6.16 | 5.58 | 5.11 | 4.36 |
| MONTHLY DD | 576 | 883 | 1038 | 1193 | 1348 | 1503 | 1658 | 1813 | 2123 |
| ANNUAL DD | 1687 | 3170 | 4119 | 5200 | 6444 | 7847 | 9407 | 11082 | 14621 |
| PARAMETER A | .762 | .824 | .847 | .875 | .910 | .944 | .975 | .996 | 1.006 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0607 | .0661 | .0687 | .0693 | .0685 | .0673 | .0661 | .0657 | .0675 |
| A2 | .1741 | .2037 | .2234 | .2410 | .2570 | .2742 | .2950 | .3226 | .3949 |
| A3 | -.2281 | -.2588 | -.2799 | -.2999 | -.3189 | -.3408 | -.3691 | -.4076 | -.5076 |
| A4 | .1058 | .1300 | .1462 | .1622 | .1779 | .1950 | .2155 | .2418 | .3075 |
| A5 | -.0267 | -.0242 | -.0232 | -.0235 | -.0249 | -.0276 | -.0325 | -.0395 | -.0572 |
| B1 | -.0567 | -.0567 | -.0567 | -.0567 | -.0567 | -.0567 | -.0567 | -.0567 | -.0567 |
| B2 | -1.0798 | -1.0798 | -1.0798 | -1.0798 | -1.0798 | -1.0798 | -1.0798 | -1.0798 | -1.0798 |
| B3 | .7656 | .7656 | .7656 | .7656 | .7656 | .7656 | .7656 | .7656 | .7656 |
| B4 | .5853 | .5853 | .5853 | .5853 | .5853 | .5853 | .5853 | .5853 | .5853 |
| B5 | -1.1149 | -1.1148 | -1.1149 | -1.1149 | -1.1149 | -1.1148 | -1.1148 | -1.1149 | -1.1149 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 236448 — QTA2 = 197299 — QTA3 = 169700

AZIMUTH AND TILT COEF. — C1 = .0101 — C2 = -.2990 — C3 = -.2694 — C4 = 1.5480 — C5 = -1.1912

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 11 | 14 | 23 | 37 | 50 | 57 | 63 | 62 | 55 | 45 | 34 | 19 |
| QHOR: | 325 | 606 | 1057 | 1418 | 1695 | 1867 | 1910 | 1532 | 1040 | 661 | 339 | 265 |

TRAVERSE CITY, MICHIGAN — ELEVATION = 630 — LAT = 44.7

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 36.89 | 18.77 | 14.89 | 12.33 | 10.52 | 9.18 | 8.14 | 7.31 | 6.08 |
| VT2/DD | 31.50 | 16.03 | 12.71 | 10.53 | 8.99 | 7.84 | 6.95 | 6.24 | 5.19 |
| VT3/DD | 27.35 | 13.92 | 11.04 | 9.14 | 7.80 | 6.81 | 6.04 | 5.42 | 4.51 |
| MONTHLY DD | 302 | 593 | 748 | 903 | 1058 | 1213 | 1368 | 1523 | 1833 |
| ANNUAL DD | 883 | 2161 | 3016 | 4003 | 5115 | 6357 | 7743 | 9277 | 12668 |
| PARAMETER A | .650 | .734 | .756 | .790 | .823 | .857 | .891 | .925 | .969 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0133 | .0161 | .0170 | .0167 | .0159 | .0146 | .0133 | .0120 | .0100 |
| A2 | .3264 | .2992 | .3083 | .3108 | .3170 | .3276 | .3396 | .3522 | .3944 |
| A3 | -.3240 | -.3096 | -.3233 | -.3306 | -.3436 | -.3630 | -.3848 | -.4080 | -.4768 |
| A4 | .1856 | .1835 | .1931 | .1989 | .2085 | .2224 | .2377 | .2540 | .3002 |
| A5 | .0310 | .0177 | .0161 | .0130 | .0082 | .0014 | -.0064 | -.0151 | -.0358 |
| B1 | .0110 | .0110 | .0110 | .0110 | .0110 | .0110 | .0110 | .0110 | .0110 |
| B2 | -1.0243 | -1.0243 | -1.0243 | -1.0243 | -1.0243 | -1.0243 | -1.0243 | -1.0243 | -1.0243 |
| B3 | .7076 | .7076 | .7076 | .7076 | .7076 | .7076 | .7076 | .7076 | .7076 |
| B4 | .6234 | .6234 | .6234 | .6234 | .6234 | .6234 | .6234 | .6234 | .6234 |
| B5 | -1.0943 | -1.0943 | -1.0943 | -1.0943 | -1.0943 | -1.0943 | -1.0943 | -1.0943 | -1.0943 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 226231 — QTA2 = 188351 — QTA3 = 161837

AZIMUTH AND TILT COEF. — C1 = .0128 — C2 = -.2269 — C3 = -.3422 — C4 = 1.6223 — C5 = -1.1644

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 21 | 29 | 42 | 54 | 63 | 70 | 66 | 59 | 50 | 37 | 26 |
| QHOR: | 310 | 529 | 949 | 1374 | 1718 | 1908 | 1939 | 1584 | 1166 | 759 | 346 | 280 |

DULUTH, MINNESOTA — ELEVATION = 1417 — LAT = 46.8

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 25.32 | 17.92 | 15.61 | 13.67 | 11.98 | 10.66 | 9.60 | 8.73 | 7.40 |
| VT2/DD | 21.70 | 15.36 | 13.38 | 11.73 | 10.28 | 9.14 | 8.24 | 7.49 | 6.35 |
| VT3/DD | 18.86 | 13.35 | 11.62 | 10.19 | 8.93 | 7.95 | 7.16 | 6.51 | 5.52 |
| MONTHLY DD | 740 | 1045 | 1200 | 1098 | 1253 | 1408 | 1563 | 1718 | 2028 |
| ANNUAL DD | 2107 | 3716 | 4704 | 5823 | 7081 | 8474 | 10013 | 11669 | 15196 |
| PARAMETER A | .640 | .610 | .611 | .638 | .689 | .735 | .775 | .805 | .827 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0406 | .0383 | .0351 | -.1374 | -.1261 | -.1170 | -.1097 | -.1047 | -.1019 |
| A2 | .2359 | .3803 | .4387 | .6797 | .6716 | .6707 | .6776 | .6992 | .7862 |
| A3 | -.2381 | -.3616 | -.4179 | -.5412 | -.5584 | -.5814 | -.6123 | -.6583 | -.7922 |
| A4 | .1457 | .2308 | .2694 | .4191 | .4228 | .4310 | .4448 | .4690 | .5477 |
| A5 | .0183 | .0523 | .0609 | .1575 | .1393 | .1224 | .1057 | .0896 | .0618 |
| B1 | .0137 | .0137 | .0137 | .0755 | .0755 | .0755 | .0755 | .0755 | .0755 |
| B2 | -1.1712 | -1.1712 | -1.1712 | -1.2280 | -1.2280 | -1.2280 | -1.2280 | -1.2280 | -1.2280 |
| B3 | .8235 | .8235 | .8235 | .8835 | .8835 | .8835 | .8835 | .8835 | .8835 |
| B4 | .5257 | .5257 | .5257 | .4472 | .4472 | .4471 | .4472 | .4471 | .4472 |
| B5 | -1.1807 | -1.1807 | -1.1807 | -1.1806 | -1.1806 | -1.1805 | -1.1806 | -1.1806 | -1.1806 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 251930 — QTA2 = 211002 — QTA3 = 181791

AZIMUTH AND TILT COEF. — C1 = .0147 — C2 = -.3968 — C3 = -.1366 — C4 = 1.4154 — C5 = -1.1950

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 6 | 13 | 22 | 36 | 49 | 58 | 65 | 63 | 55 | 45 | 28 | 14 |
| QHOR: | 413 | 670 | 1013 | 1324 | 1557 | 1765 | 1830 | 1510 | 1050 | 723 | 369 | 296 |

INTERNATIONAL FALLS, MINNESOTA — ELEVATION = 1184 — LAT = 48.6

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 19.05 | 14.15 | 12.42 | 10.86 | 9.63 | 8.65 | 7.84 | 7.17 | 6.13 |
| VT2/DD | 16.35 | 12.14 | 10.65 | 9.32 | 8.26 | 7.42 | 6.72 | 6.15 | 5.26 |
| VT3/DD | 14.21 | 10.55 | 9.26 | 8.10 | 7.18 | 6.45 | 5.84 | 5.35 | 4.57 |
| MONTHLY DD | 895 | 1205 | 1051 | 1202 | 1354 | 1509 | 1664 | 1819 | 2129 |
| ANNUAL DD | 2711 | 4331 | 5304 | 6402 | 7645 | 9040 | 10578 | 12229 | 15757 |
| PARAMETER A | .622 | .659 | .690 | .751 | .811 | .868 | .917 | .956 | .999 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0246 | .0276 | -.0075 | -.0069 | -.0070 | -.0073 | -.0077 | -.0081 | -.0091 |
| A2 | .3728 | .4315 | .3945 | .3880 | .3838 | .3843 | .3914 | .4072 | .4615 |
| A3 | -.3199 | -.3724 | -.3479 | -.3504 | -.3561 | -.3672 | -.3864 | -.4159 | -.5005 |
| A4 | .2064 | .2383 | .3145 | .3041 | .2975 | .2962 | .3015 | .3147 | .3606 |
| A5 | .0717 | .0867 | .0244 | .0233 | .0205 | .0162 | .0102 | .0027 | -.0148 |
| B1 | -.0022 | -.0022 | .0118 | .0118 | .0118 | .0118 | .0118 | .0118 | .0118 |
| B2 | -1.2227 | -1.2227 | -1.2032 | -1.2032 | -1.2032 | -1.2032 | -1.2032 | -1.2032 | -1.2032 |
| B3 | .8770 | .8770 | .8737 | .8737 | .8737 | .8737 | .8738 | .8737 | .8738 |
| B4 | .4587 | .4587 | .4240 | .4240 | .4240 | .4239 | .4240 | .4239 | .4239 |
| B5 | -1.1779 | -1.1778 | -1.1445 | -1.1444 | -1.1444 | -1.1444 | -1.1445 | -1.1444 | -1.1444 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 266962 — QTA2 = 223550 — QTA3 = 192572
AZIMUTH AND TILT COEF. — C1 = -.0056 — C2 = -.3520 — C3 = -.1984 — C4 = 1.4214 — C5 = -1.2271

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 1 | 7 | 18 | 37 | 52 | 60 | 65 | 63 | 51 | 44 | 27 | 11 |
| QHOR: | 344 | 688 | 993 | 1415 | 1790 | 1882 | 1955 | 1645 | 1083 | 734 | 341 | 266 |

MINNEAPOLIS-ST. PAUL, MINNESOTA — ELEVATION = 837 — LAT = 44.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 34.40 | 21.09 | 17.18 | 14.48 | 12.51 | 11.01 | 9.84 | 8.89 | 7.45 |
| VT2/DD | 29.48 | 18.06 | 14.71 | 12.40 | 10.71 | 9.43 | 8.42 | 7.61 | 6.38 |
| VT3/DD | 25.62 | 15.69 | 12.78 | 10.77 | 9.31 | 8.19 | 7.32 | 6.61 | 5.54 |
| MONTHLY DD | 611 | 676 | 830 | 984 | 1139 | 1294 | 1449 | 1604 | 1914 |
| ANNUAL DD | 1578 | 2910 | 3731 | 4660 | 5706 | 6874 | 8179 | 9622 | 12877 |
| PARAMETER A | .524 | .646 | .710 | .769 | .824 | .874 | .919 | .959 | 1.015 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0347 | -.0062 | -.0029 | -.0002 | .0018 | .0034 | .0046 | .0055 | .0065 |
| A2 | .3586 | .2286 | .2416 | .2502 | .2589 | .2714 | .2874 | .3060 | .3564 |
| A3 | -.2816 | -.2785 | -.2857 | -.2918 | -.3016 | -.3181 | -.3398 | -.3661 | -.4395 |
| A4 | .1494 | .2576 | .2535 | .2502 | .2503 | .2562 | .2669 | .2812 | .3246 |
| A5 | .1165 | -.0879 | -.0737 | -.0642 | -.0590 | -.0570 | -.0575 | -.0603 | -.0730 |
| B1 | .0127 | .0069 | .0069 | .0069 | .0069 | .0069 | .0069 | .0069 | .0069 |
| B2 | -1.1787 | -1.1277 | -1.1277 | -1.1277 | -1.1277 | -1.1277 | -1.1277 | -1.1277 | -1.1277 |
| B3 | .8086 | .7975 | .7975 | .7975 | .7975 | .7975 | .7975 | .7975 | .7975 |
| B4 | .5615 | .5297 | .5297 | .5297 | .5297 | .5297 | .5297 | .5297 | .5297 |
| B5 | -1.2117 | -1.1361 | -1.1361 | -1.1361 | -1.1361 | -1.1361 | -1.1361 | -1.1361 | -1.1360 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 274061 — QTA2 = 229062 — QTA3 = 197098
AZIMUTH AND TILT COEF. — C1 = .0177 — C2 = -.3695 — C3 = -.2190 — C4 = 1.5129 — C5 = -1.2341

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 10 | 17 | 27 | 47 | 57 | 69 | 73 | 70 | 61 | 50 | 33 | 18 |
| QHOR: | 461 | 771 | 1140 | 1400 | 1759 | 1910 | 1958 | 1685 | 1246 | 874 | 468 | 338 |

ROCHESTER, MINNESOTA — ELEVATION = 1319 — LAT = 43.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 37.52 | 24.29 | 20.20 | 17.02 | 14.70 | 12.93 | 11.54 | 10.42 | 8.72 |
| VT2/DD | 32.13 | 20.80 | 17.31 | 14.58 | 12.59 | 11.08 | 9.89 | 8.93 | 7.47 |
| VT3/DD | 27.92 | 18.07 | 15.04 | 12.67 | 10.94 | 9.62 | 8.59 | 7.76 | 6.49 |
| MONTHLY DD | 551 | 851 | 823 | 977 | 1132 | 1287 | 1442 | 1597 | 1907 |
| ANNUAL DD | 1513 | 2843 | 3699 | 4656 | 5720 | 6909 | 8248 | 9762 | 13136 |
| PARAMETER A | .591 | .578 | .600 | .646 | .687 | .727 | .766 | .803 | .841 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0478 | .0519 | -.1185 | -.1073 | -.0984 | -.0911 | -.0852 | -.0803 | -.0765 |
| A2 | .2110 | .3283 | .5130 | .5146 | .5215 | .5325 | .5463 | .5650 | .6460 |
| A3 | -.1698 | -.2700 | -.5110 | -.5159 | -.5309 | -.5530 | -.5797 | -.6143 | -.7387 |
| A4 | .1449 | .2142 | .3288 | .3323 | .3417 | .3555 | .3723 | .3938 | .4705 |
| A5 | .0385 | .0643 | .0381 | .0373 | .0324 | .0253 | .0167 | .0060 | -.0216 |
| B1 | .0102 | .0102 | .0700 | .0700 | .0700 | .0700 | .0700 | .0700 | .0700 |
| B2 | -1.1373 | -1.1373 | -1.1720 | -1.1720 | -1.1720 | -1.1720 | -1.1720 | -1.1720 | -1.1720 |
| B3 | .7654 | .7654 | .8317 | .8318 | .8317 | .8318 | .8318 | .8318 | .8318 |
| B4 | .5882 | .5882 | .5411 | .5411 | .5411 | .5411 | .5411 | .5411 | .5411 |
| B5 | -1.2018 | -1.2018 | -1.1704 | -1.1704 | -1.1704 | -1.1704 | -1.1704 | -1.1704 | -1.1704 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 265526 — QTA2 = 221894 — QTA3 = 190907
AZIMUTH AND TILT COEF. — C1 = .0254 — C2 = -.3569 — C3 = -.2192 — C4 = 1.5159 — C5 = -1.2220

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 12 | 19 | 27 | 46 | 57 | 66 | 70 | 67 | 57 | 49 | 33 | 18 |
| QHOR: | 477 | 771 | 1073 | 1421 | 1629 | 1894 | 1930 | 1648 | 1190 | 821 | 486 | 379 |

JACKSON, MISSISSIPPI — ELEVATION = 331 — LAT = 32.3

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | 406.53 | 202.20 | 113.76 | 72.43 | 50.86 | 38.37 | 30.45 | 21.44 |
| VT2/DD | NA | 346.98 | 172.03 | 96.79 | 61.62 | 43.27 | 32.64 | 25.91 | 18.24 |
| VT3/DD | NA | 301.36 | 149.32 | 84.01 | 53.49 | 37.56 | 28.33 | 22.49 | 15.84 |
| MONTHLY DD | 8 | 64 | 111 | 197 | 310 | 441 | 585 | 737 | 1047 |
| ANNUAL DD | 18 | 195 | 413 | 757 | 1238 | 1851 | 2600 | 3528 | 6096 |
| PARAMETER A | NA | .423 | .507 | .592 | .626 | .638 | .644 | .654 | .704 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.1314 | .0782 | .0623 | .0555 | .0519 | .0491 | .0461 | .0395 |
| A2 | NA | .6214 | .1448 | .1791 | .2220 | .2681 | .3217 | .3825 | .5353 |
| A3 | NA | -.5891 | -.2661 | -.2995 | -.3500 | -.4076 | -.4768 | -.5574 | -.7700 |
| A4 | NA | .3844 | .1399 | .1611 | .1914 | .2251 | .2650 | .3116 | .4327 |
| A5 | NA | .1295 | -.0744 | -.0680 | -.0671 | -.0687 | -.0722 | -.0780 | -.1001 |
| B1 | NA | .0258 | -.0398 | -.0398 | -.0398 | -.0398 | -.0398 | -.0398 | -.0398 |
| B2 | NA | -1.0579 | -.9459 | -.9459 | -.9459 | -.9459 | -.9459 | -.9459 | -.9459 |
| B3 | NA | .6546 | .5445 | .5445 | .5444 | .5445 | .5445 | .5445 | .5445 |
| B4 | NA | .8432 | .9589 | .9589 | .9589 | .9589 | .9589 | .9589 | .9589 |
| B5 | NA | -1.2755 | -1.2445 | -1.2445 | -1.2445 | -1.2445 | -1.2444 | -1.2445 | -1.2445 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 276008 — QTA2 = 229661 — QTA3 = 197360
AZIMUTH AND TILT COEF. — C1 = -.0097 — C2 = -.1880 — C3 = -.4569 — C4 = 1.8177 — C5 = -1.1697

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 46 | 49 | 55 | 65 | 72 | 78 | 80 | 79 | 75 | 65 | 54 | 46 |
| QHOR: | 731 | 1067 | 1376 | 1731 | 1948 | 1921 | 1860 | 1801 | 1535 | 1287 | 890 | 735 |

MERIDIAN, MISSISSIPPI — ELEVATION = 308 — LAT = 32.3

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 1818.97 | 291.61 | 168.85 | 100.17 | 65.57 | 46.94 | 35.82 | 28.71 | 20.45 |
| VT2/DD | 1534.40 | 245.99 | 142.43 | 85.19 | 55.77 | 39.92 | 30.46 | 24.41 | 17.39 |
| VT3/DD | 1328.76 | 213.02 | 123.35 | 73.94 | 48.40 | 34.65 | 26.44 | 21.19 | 15.10 |
| MONTHLY DD | 12 | 74 | 128 | 220 | 336 | 469 | 615 | 768 | 1078 |
| ANNUAL DD | 30 | 243 | 474 | 825 | 1309 | 1950 | 2763 | 3747 | 6402 |
| PARAMETER A | .391 | .534 | .465 | .503 | .563 | .604 | .624 | .630 | .659 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0372 | -.0224 | -.0298 | .0100 | .0056 | .0016 | -.0020 | -.0057 | -.0119 |
| A2 | -.6353 | -.5640 | -.6074 | .3082 | .3093 | .3233 | .3613 | .4294 | .6033 |
| A3 | .6619 | .5654 | .6012 | -.4058 | -.4111 | -.4335 | -.4894 | -.5857 | -.8344 |
| A4 | -.4311 | -.3772 | -.4065 | .2666 | .2646 | .2769 | .3110 | .3677 | .5054 |
| A5 | -.0828 | -.0889 | -.1006 | -.0359 | -.0383 | -.0436 | -.0534 | -.0656 | -.0940 |
| B1 | .0389 | .0389 | .0389 | .0214 | .0214 | .0214 | .0214 | .0214 | .0214 |
| B2 | -.6891 | -.6892 | -.6892 | -.9233 | -.9233 | -.9233 | -.9233 | -.9233 | -.9234 |
| B3 | .2072 | .2072 | .2072 | .5290 | .5290 | .5290 | .5290 | .5290 | .5290 |
| B4 | 1.2607 | 1.2607 | 1.2607 | .9562 | .9562 | .9562 | .9562 | .9562 | .9562 |
| B5 | -1.2467 | -1.2467 | -1.2467 | -1.2288 | -1.2288 | -1.2288 | -1.2288 | -1.2288 | -1.2288 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 262790 — QTA2 = 218513 — QTA3 = 187738
AZIMUTH AND TILT COEF. — C1 = .0128 — C2 = -.1471 — C3 = -.4867 — C4 = 1.8288 — C5 = -1.1317

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 45 | 47 | 55 | 65 | 71 | 78 | 80 | 79 | 74 | 62 | 53 | 47 |
| QHOR: | 728 | 996 | 1312 | 1721 | 1831 | 1957 | 1879 | 1815 | 1470 | 1203 | 873 | 698 |

COLUMBIA, MISSOURI — ELEVATION = 886 — LAT = 38.8

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 133.67 | 62.99 | 47.29 | 35.52 | 28.14 | 23.22 | 19.72 | 17.12 | 13.55 |
| VT2/DD | 114.29 | 53.85 | 40.43 | 30.40 | 24.08 | 19.87 | 16.88 | 14.65 | 11.60 |
| VT3/DD | 99.27 | 46.77 | 35.12 | 26.41 | 20.92 | 17.27 | 14.66 | 12.73 | 10.07 |
| MONTHLY DD | 170 | 361 | 481 | 567 | 716 | 867 | 1021 | 1176 | 1486 |
| ANNUAL DD | 437 | 1185 | 1750 | 2437 | 3243 | 4178 | 5263 | 6520 | 9548 |
| PARAMETER A | .466 | .465 | .465 | .525 | .572 | .608 | .646 | .681 | .730 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0336 | .0559 | .0668 | .0929 | .0899 | .0880 | .0853 | .0825 | .0789 |
| A2 | .2676 | .4044 | .4653 | .5925 | .5942 | .6099 | .6254 | .6511 | .7575 |
| A3 | -.2897 | -.4362 | -.5042 | -.6029 | -.6187 | -.6505 | -.6835 | -.7319 | -.9072 |
| A4 | .1446 | .2377 | .2785 | .4610 | .4603 | .4710 | .4817 | .5016 | .5875 |
| A5 | .0202 | .0250 | .0256 | .0125 | .0050 | -.0036 | -.0130 | -.0258 | -.0643 |
| B1 | -.0359 | -.0359 | -.0359 | -.0441 | -.0441 | -.0441 | -.0441 | -.0441 | -.0441 |
| B2 | -1.1360 | -1.1360 | -1.1360 | -1.1645 | -1.1645 | -1.1645 | -1.1645 | -1.1645 | -1.1645 |
| B3 | .7560 | .7559 | .7559 | .8089 | .8088 | .8089 | .8089 | .8088 | .8089 |
| B4 | .7578 | .7578 | .7578 | .6755 | .6755 | .6755 | .6755 | .6755 | .6755 |
| B5 | -1.2303 | -1.2303 | -1.2303 | -1.2061 | -1.2061 | -1.2061 | -1.2061 | -1.2061 | -1.2061 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 281039 — QTA2 = 234096 — QTA3 = 201080
AZIMUTH AND TILT COEF. — C1 = -.0054 — C2 = -.2539 — C3 = -.3695 — C4 = 1.7232 — C5 = -1.2628

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 31 | 32 | 40 | 55 | 65 | 73 | 76 | 75 | 66 | 56 | 45 | 32 |
| QHOR: | 610 | 808 | 1160 | 1553 | 1986 | 1996 | 2110 | 1866 | 1446 | 1097 | 710 | 510 |

SPRINGFIELD, MISSOURI — ELEVATION = 1270 — LAT = 37.2

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 317.02 | 104.58 | 69.95 | 51.34 | 40.09 | 32.64 | 27.34 | 23.47 | 18.30 |
| VT2/DD | 271.43 | 89.31 | 59.73 | 43.84 | 34.23 | 27.87 | 23.34 | 20.05 | 15.63 |
| VT3/DD | 235.85 | 77.56 | 51.88 | 38.07 | 29.73 | 24.20 | 20.27 | 17.41 | 13.57 |
| MONTHLY DD | 82 | 246 | 368 | 502 | 643 | 789 | 942 | 1097 | 1407 |
| ANNUAL DD | 258 | 889 | 1403 | 2054 | 2833 | 3741 | 4790 | 6016 | 9025 |
| PARAMETER A | .356 | .404 | .463 | .477 | .482 | .486 | .493 | .506 | .518 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0327 | .0061 | .0049 | .0047 | .0044 | .0039 | .0039 | .0047 | .0095 |
| A2 | 1.0569 | .4271 | .4156 | .4658 | .5352 | .6089 | .6864 | .7663 | 1.0067 |
| A3 | -.9508 | -.4909 | -.4825 | -.5460 | -.6326 | -.7247 | -.8266 | -.9368 | -1.2786 |
| A4 | .6098 | .3751 | .3605 | .3966 | .4470 | .5002 | .5565 | .6143 | .7992 |
| A5 | .1827 | .0011 | -.0025 | -.0056 | -.0085 | -.0110 | -.0172 | -.0270 | -.0685 |
| B1 | -.0493 | -.0469 | -.0469 | -.0469 | -.0469 | -.0469 | -.0469 | -.0469 | -.0469 |
| B2 | -1.1727 | -1.0616 | -1.0616 | -1.0616 | -1.0616 | -1.0616 | -1.0616 | -1.0616 | -1.0616 |
| B3 | .7756 | .6645 | .6645 | .6645 | .6645 | .6645 | .6645 | .6645 | .6645 |
| B4 | .6910 | .7808 | .7808 | .7808 | .7808 | .7808 | .7808 | .7808 | .7808 |
| B5 | -1.2618 | -1.2611 | -1.2611 | -1.2611 | -1.2611 | -1.2611 | -1.2611 | -1.2611 | -1.2611 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 287976 — QTA2 = 239841 — QTA3 = 206019
AZIMUTH AND TILT COEF. — C1 = -.0424 — C2 = -.2531 — C3 = -.4050 — C4 = 1.7284 — C5 = -1.2426

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 34 | 36 | 42 | 55 | 65 | 72 | 77 | 75 | 68 | 56 | 47 | 35 |
| QHOR: | 690 | 900 | 1243 | 1625 | 1869 | 2060 | 2105 | 1956 | 1483 | 1007 | 790 | 617 |

ST. LOUIS, MISSOURI — ELEVATION = 564 — LAT = 38.8

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 179.56 | 64.37 | 45.41 | 34.17 | 27.05 | 22.23 | 18.84 | 16.34 | 12.92 |
| VT2/DD | 153.42 | 55.04 | 38.83 | 29.22 | 23.13 | 19.01 | 16.11 | 13.97 | 11.05 |
| VT3/DD | 133.25 | 47.81 | 33.73 | 25.38 | 20.09 | 16.51 | 13.99 | 12.14 | 9.59 |
| MONTHLY DD | 139 | 297 | 421 | 559 | 707 | 860 | 1015 | 1170 | 1480 |
| ANNUAL DD | 385 | 1068 | 1617 | 2290 | 3093 | 4020 | 5069 | 6257 | 9181 |
| PARAMETER A | .196 | .510 | .575 | .626 | .663 | .695 | .722 | .748 | .805 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0490 | .0902 | .0825 | .0789 | .0786 | .0782 | .0780 | .0775 | .0753 |
| A2 | .7140 | .4463 | .4572 | .4554 | .4608 | .4712 | .4925 | .5196 | .5892 |
| A3 | -.6085 | -.4048 | -.4333 | -.4429 | -.4595 | -.4830 | -.5203 | -.5660 | -.6847 |
| A4 | .3303 | .3478 | .3571 | .3574 | .3642 | .3751 | .3944 | .4184 | .4813 |
| A5 | .2316 | .0123 | .0078 | .0038 | -.0016 | -.0084 | -.0168 | -.0267 | -.0546 |
| B1 | -.0523 | -.0838 | -.0838 | -.0838 | -.0838 | -.0838 | -.0838 | -.0838 | -.0838 |
| B2 | -1.0761 | -1.0984 | -1.0984 | -1.0984 | -1.0984 | -1.0984 | -1.0984 | -1.0984 | -1.0984 |
| B3 | .6852 | .7240 | .7240 | .7240 | .7240 | .7240 | .7240 | .7240 | .7240 |
| B4 | .7408 | .6684 | .6684 | .6684 | .6684 | .6684 | .6684 | .6684 | .6684 |
| B5 | -1.2289 | -1.1894 | -1.1894 | -1.1893 | -1.1894 | -1.1894 | -1.1893 | -1.1893 | -1.1893 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 282726 — QTA2 = 235480 — QTA3 = 202275
AZIMUTH AND TILT COEF. — C1 = -.0246 — C2 = -.2614 — C3 = -.3767 — C4 = 1.7012 — C5 = -1.2279

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 32 | 33 | 41 | 56 | 66 | 74 | 78 | 76 | 69 | 58 | 43 | 32 |
| QHOR: | 665 | 866 | 1223 | 1578 | 1862 | 2130 | 2119 | 1884 | 1403 | 1063 | 701 | 492 |

BILLINGS, MONTANA — ELEVATION = 3570 — LAT = 45.8

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 65.77 | 39.09 | 31.41 | 25.93 | 22.02 | 19.13 | 16.90 | 15.14 | 12.53 |
| VT2/DD | 56.49 | 33.57 | 26.98 | 22.27 | 18.91 | 16.43 | 14.52 | 13.01 | 10.76 |
| VT3/DD | 49.11 | 29.19 | 23.45 | 19.36 | 16.44 | 14.28 | 12.62 | 11.31 | 9.36 |
| MONTHLY DD | 343 | 577 | 718 | 869 | 1024 | 1179 | 1334 | 1489 | 1799 |
| ANNUAL DD | 1011 | 2078 | 2844 | 3781 | 4865 | 6096 | 7464 | 8960 | 12234 |
| PARAMETER A | .558 | .641 | .652 | .664 | .681 | .700 | .718 | .731 | .734 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0232 | -.0066 | -.0003 | .0052 | .0096 | .0130 | .0155 | .0175 | .0211 |
| A2 | .4369 | .5529 | .6261 | .6848 | .7303 | .7722 | .8166 | .8661 | 1.0005 |
| A3 | -.3250 | -.4508 | -.5298 | -.5969 | -.6551 | -.7156 | -.7829 | -.8581 | -1.0497 |
| A4 | .2406 | .3145 | .3616 | .4013 | .4356 | .4716 | .5119 | .5574 | .6746 |
| A5 | .1219 | .1293 | .1343 | .1357 | .1315 | .1209 | .1064 | .0895 | .0538 |
| B1 | -.0098 | -.0098 | -.0098 | -.0098 | -.0098 | -.0098 | -.0098 | -.0098 | -.0098 |
| B2 | -1.2784 | -1.2784 | -1.2784 | -1.2784 | -1.2784 | -1.2784 | -1.2784 | -1.2784 | -1.2784 |
| B3 | .9134 | .9134 | .9134 | .9134 | .9134 | .9134 | .9134 | .9134 | .9134 |
| B4 | .4570 | .4570 | .4570 | .4570 | .4570 | .4570 | .4570 | .4570 | .4570 |
| B5 | -1.2176 | -1.2176 | -1.2176 | -1.2176 | -1.2177 | -1.2176 | -1.2176 | -1.2176 | -1.2176 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 325458 — QTA2 = 272347 — QTA3 = 234387
AZIMUTH AND TILT COEF. — C1 = .0190 — C2 = -.3867 — C3 = -.2307 — C4 = 1.5110 — C5 = -1.3074

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 23 | 27 | 33 | 42 | 56 | 63 | 72 | 72 | 59 | 51 | 36 | 21 |
| QHOR: | 496 | 757 | 1145 | 1508 | 1863 | 2281 | 2333 | 2065 | 1473 | 1006 | 570 | 420 |

CUT BANK, MONTANA — ELEVATION = 3839 — LAT = 48.6

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 42.60 | 28.48 | 23.81 | 20.02 | 17.16 | 14.99 | 13.30 | 11.95 | 9.94 |
| VT2/DD | 36.58 | 24.48 | 20.46 | 17.21 | 14.75 | 12.88 | 11.43 | 10.27 | 8.54 |
| VT3/DD | 31.80 | 21.29 | 17.79 | 14.96 | 12.82 | 11.20 | 9.94 | 8.93 | 7.43 |
| MONTHLY DD | 514 | 642 | 768 | 913 | 1065 | 1219 | 1374 | 1529 | 1839 |
| ANNUAL DD | 1571 | 2884 | 3810 | 4914 | 6180 | 7597 | 9135 | 10772 | 14257 |
| PARAMETER A | .588 | .669 | .696 | .741 | .786 | .825 | .853 | .868 | .870 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0005 | .0125 | .0121 | .0108 | .0095 | .0083 | .0075 | .0070 | .0068 |
| A2 | .1881 | .4810 | .5378 | .5655 | .5882 | .6151 | .6525 | .7018 | .8250 |
| A3 | -.1771 | -.3681 | -.4362 | -.4831 | -.5272 | -.5770 | -.6382 | -.7124 | -.8844 |
| A4 | .1138 | .2863 | .3236 | .3456 | .3664 | .3916 | .4249 | .4670 | .5682 |
| A5 | .0352 | .1006 | .1008 | .0923 | .0810 | .0679 | .0538 | .0395 | .0125 |
| B1 | .0029 | -.0007 | -.0007 | -.0007 | -.0007 | -.0007 | -.0007 | -.0007 | -.0007 |
| B2 | -1.2598 | -1.3062 | -1.3062 | -1.3062 | -1.3062 | -1.3062 | -1.3062 | -1.3062 | -1.3062 |
| B3 | .8996 | .9511 | .9511 | .9511 | .9511 | .9511 | .9511 | .9511 | .9511 |
| B4 | .4547 | .3932 | .3932 | .3933 | .3933 | .3932 | .3932 | .3933 | .3933 |
| B5 | -1.2103 | -1.1940 | -1.1940 | -1.1941 | -1.1941 | -1.1940 | -1.1941 | -1.1941 | -1.1941 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 318994 — QTA2 = 267446 — QTA3 = 230418
AZIMUTH AND TILT COEF. — C1 = .0064 — C2 = -.4133 — C3 = -.1864 — C4 = 1.4216 — C5 = -1.2990

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 15 | 21 | 29 | 38 | 49 | 58 | 64 | 63 | 52 | 46 | 29 | 20 |
| QHOR: | 414 | 686 | 1124 | 1490 | 1863 | 2019 | 2330 | 1922 | 1349 | 894 | 476 | 322 |

DILLON, MONTANA — ELEVATION = 5210 — LAT = 45.3

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 78.75 | 42.72 | 33.99 | 27.95 | 23.71 | 20.59 | 18.19 | 16.29 | 13.48 |
| VT2/DD | 67.56 | 36.65 | 29.20 | 24.01 | 20.36 | 17.68 | 15.62 | 14.00 | 11.58 |
| VT3/DD | 58.72 | 31.86 | 25.39 | 20.87 | 17.71 | 15.37 | 13.58 | 12.17 | 10.07 |
| MONTHLY DD | 328 | 605 | 713 | 867 | 1022 | 1177 | 1332 | 1487 | 1797 |
| ANNUAL DD | 1030 | 2374 | 3311 | 4404 | 5655 | 7058 | 8581 | 10195 | 13644 |
| PARAMETER A | .577 | .600 | .623 | .649 | .667 | .680 | .684 | .679 | .648 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0615 | -.0564 | .0752 | .0747 | .0753 | .0764 | .0786 | .0821 | .0918 |
| A2 | .3567 | .4773 | .7300 | .7832 | .8444 | .9125 | .9960 | 1.0959 | 1.3404 |
| A3 | -.3549 | -.4668 | -.6436 | -.7190 | -.8051 | -.9037 | -1.0220 | -1.1588 | -1.4822 |
| A4 | .2073 | .2802 | .4340 | .4769 | .5268 | .5841 | .6539 | .7355 | .9308 |
| A5 | .0428 | .0620 | .1352 | .1239 | .1109 | .0933 | .0732 | .0530 | .0126 |
| B1 | .0304 | .0304 | -.0158 | -.0158 | -.0158 | -.0158 | -.0158 | -.0158 | -.0158 |
| B2 | -1.2332 | -1.2332 | -1.2863 | -1.2863 | -1.2863 | -1.2863 | -1.2863 | -1.2863 | -1.2863 |
| B3 | .8526 | .8526 | .9186 | .9186 | .9186 | .9186 | .9186 | .9186 | .9186 |
| B4 | .5382 | .5382 | .4692 | .4692 | .4692 | .4692 | .4692 | .4692 | .4692 |
| B5 | -1.2354 | -1.2354 | -1.2270 | -1.2270 | -1.2270 | -1.2270 | -1.2270 | -1.2270 | -1.2270 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 332749 — QTA2 = 278271 — QTA3 = 239391
AZIMUTH AND TILT COEF. — C1 = .0620 — C2 = -.3724 — C3 = -.2626 — C4 = 1.5403 — C5 = -1.3243

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 26 | 29 | 40 | 50 | 58 | 65 | 64 | 53 | 44 | 34 | 22 |
| QHOR: | 527 | 797 | 1264 | 1570 | 2064 | 2203 | 2401 | 2038 | 1521 | 970 | 585 | 452 |

GLASGOW, MONTANA — ELEVATION = 2297 — LAT = 48.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 34.73 | 22.37 | 18.81 | 16.22 | 14.26 | 12.72 | 11.48 | 10.46 | 8.89 |
| VT2/DD | 29.77 | 19.18 | 16.12 | 13.90 | 12.22 | 10.90 | 9.84 | 8.97 | 7.62 |
| VT3/DD | 25.87 | 16.67 | 14.01 | 12.08 | 10.62 | 9.48 | 8.55 | 7.79 | 6.62 |
| MONTHLY DD | 526 | 817 | 971 | 1127 | 1282 | 1437 | 1592 | 1747 | 2057 |
| ANNUAL DD | 1864 | 3285 | 4180 | 5188 | 6329 | 7589 | 8984 | 10508 | 13825 |
| PARAMETER A | .733 | .719 | .730 | .751 | .777 | .805 | .833 | .858 | .886 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0275 | -.0276 | -.0272 | -.0267 | -.0260 | -.0255 | -.0248 | -.0242 | -.0235 |
| A2 | .2300 | .2690 | .2905 | .3103 | .3294 | .3496 | .3720 | .3983 | .4730 |
| A3 | -.2562 | -.3033 | -.3274 | -.3498 | -.3717 | -.3960 | -.4247 | -.4603 | -.5632 |
| A4 | .1729 | .2055 | .2224 | .2378 | .2526 | .2684 | .2864 | .3079 | .3700 |
| A5 | -.0236 | -.0295 | -.0304 | -.0308 | -.0313 | -.0325 | -.0353 | -.0400 | -.0555 |
| B1 | .0348 | .0348 | .0348 | .0348 | .0348 | .0348 | .0348 | .0348 | .0348 |
| B2 | -1.1869 | -1.1869 | -1.1869 | -1.1869 | -1.1869 | -1.1869 | -1.1869 | -1.1869 | -1.1869 |
| B3 | .8389 | .8389 | .8389 | .8389 | .8389 | .8389 | .8389 | .8389 | .8389 |
| B4 | .4912 | .4913 | .4912 | .4913 | .4913 | .4912 | .4912 | .4912 | .4913 |
| B5 | -1.1670 | -1.1670 | -1.1670 | -1.1670 | -1.1671 | -1.1670 | -1.1670 | -1.1670 | -1.1671 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 307828 — QTA2 = 258007 — QTA3 = 222288
AZIMUTH AND TILT COEF. — C1 = .0304 — C2 = -.4065 — C3 = -.1726 — C4 = 1.4195 — C5 = -1.2703

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 13 | 15 | 26 | 38 | 55 | 65 | 72 | 68 | 58 | 45 | 27 | 18 |
| QHOR: | 393 | 694 | 1127 | 1449 | 1904 | 2009 | 2200 | 1820 | 1324 | 887 | 491 | 328 |

GREAT FALLS, MONTANA — ELEVATION = 3661 — LAT = 47.5

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 52.28 | 34.61 | 28.54 | 23.87 | 20.33 | 17.64 | 15.58 | 13.94 | 11.53 |
| VT2/DD | 44.83 | 29.68 | 24.48 | 20.47 | 17.43 | 15.13 | 13.36 | 11.96 | 9.89 |
| VT3/DD | 38.97 | 25.80 | 21.28 | 17.79 | 15.15 | 13.15 | 11.61 | 10.39 | 8.59 |
| MONTHLY DD | 394 | 595 | 722 | 864 | 1014 | 1168 | 1323 | 1478 | 1788 |
| ANNUAL DD | 1126 | 2183 | 2940 | 3877 | 4994 | 6272 | 7697 | 9239 | 12598 |
| PARAMETER A | .798 | .812 | .797 | .781 | .779 | .784 | .791 | .794 | .781 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0708 | -.0578 | -.0524 | -.0482 | -.0436 | -.0390 | -.0348 | -.0313 | -.0259 |
| A2 | .2332 | .3271 | .3885 | .4496 | .5000 | .5451 | .5924 | .6470 | .7853 |
| A3 | -.1891 | -.2896 | -.3562 | -.4239 | -.4841 | -.5433 | -.6087 | -.6845 | -.8717 |
| A4 | .1097 | .1748 | .2179 | .2616 | .3009 | .3392 | .3811 | .4293 | .5479 |
| A5 | .0658 | .0680 | .0693 | .0697 | .0661 | .0583 | .0473 | .0343 | .0054 |
| B1 | .0224 | .0224 | .0224 | .0224 | .0224 | .0224 | .0224 | .0224 | .0224 |
| B2 | -1.2032 | -1.2032 | -1.2032 | -1.2032 | -1.2032 | -1.2032 | -1.2032 | -1.2032 | -1.2032 |
| B3 | .8509 | .8509 | .8509 | .8509 | .8509 | .8509 | .8509 | .8509 | .8509 |
| B4 | .4948 | .4949 | .4949 | .4948 | .4949 | .4949 | .4949 | .4949 | .4948 |
| B5 | -1.2043 | -1.2043 | -1.2043 | -1.2043 | -1.2043 | -1.2043 | -1.2043 | -1.2043 | -1.2043 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 312480 — QTA2 = 261571 — QTA3 = 225209

AZIMUTH AND TILT COEF. — C1 = .0431 — C2 = -.3796 — C3 = -.2111 — C4 = 1.4754 — C5 = -1.2967

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 22 | 26 | 32 | 42 | 53 | 62 | 71 | 66 | 57 | 44 | 36 | 29 |
| QHOR: | 420 | 717 | 1155 | 1515 | 1805 | 2088 | 2375 | 1931 | 1352 | 906 | 504 | 354 |

HELENA, MONTANA — ELEVATION = 3898 — LAT = 46.6

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 47.13 | 28.35 | 22.93 | 19.21 | 16.52 | 14.50 | 12.91 | 11.64 | 9.60 |
| VT2/DD | 40.37 | 24.29 | 19.64 | 16.46 | 14.15 | 12.42 | 11.06 | 9.97 | 8.23 |
| VT3/DD | 35.08 | 21.10 | 17.07 | 14.30 | 12.30 | 10.79 | 9.61 | 8.66 | 7.15 |
| MONTHLY DD | 389 | 646 | 798 | 953 | 1108 | 1263 | 1418 | 1573 | 1778 |
| ANNUAL DD | 1058 | 2253 | 3124 | 4154 | 5334 | 6673 | 8148 | 9725 | 13118 |
| PARAMETER A | .656 | .755 | .783 | .807 | .830 | .852 | .868 | .877 | .887 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0276 | .0262 | .0252 | .0243 | .0236 | .0230 | .0226 | .0227 | .0186 |
| A2 | .0973 | .1857 | .2334 | .2801 | .3236 | .3667 | .4122 | .4618 | .7086 |
| A3 | -.1137 | -.2055 | -.2597 | -.3137 | -.3656 | -.4204 | -.4807 | -.5476 | -.7857 |
| A4 | .0776 | .1387 | .1737 | .2083 | .2414 | .2760 | .3141 | .3563 | .5167 |
| A5 | -.0088 | -.0056 | -.0069 | -.0089 | -.0121 | -.0183 | -.0273 | -.0385 | -.0184 |
| B1 | -.0033 | -.0033 | -.0033 | -.0033 | -.0033 | -.0033 | -.0033 | -.0033 | -.0009 |
| B2 | -1.1561 | -1.1561 | -1.1561 | -1.1561 | -1.1561 | -1.1561 | -1.1561 | -1.1561 | -1.2253 |
| B3 | .8058 | .8059 | .8059 | .8059 | .8059 | .8059 | .8059 | .8058 | .8795 |
| B4 | .5367 | .5367 | .5367 | .5367 | .5367 | .5367 | .5367 | .5367 | .4664 |
| B5 | -1.1690 | -1.1690 | -1.1690 | -1.1690 | -1.1690 | -1.1690 | -1.1690 | -1.1690 | -1.1684 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 302571 — QTA2 = 253030 — QTA3 = 217741

AZIMUTH AND TILT COEF. — C1 = .0260 — C2 = -.3607 — C3 = -.2433 — C4 = 1.5198 — C5 = -1.2899

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 19 | 27 | 32 | 41 | 53 | 60 | 70 | 66 | 54 | 46 | 34 | 22 |
| QHOR: | 416 | 688 | 1111 | 1437 | 1873 | 2017 | 2337 | 1944 | 1465 | 928 | 522 | 352 |

LEWISTOWN, MONTANA — ELEVATION = 4147 — LAT = 47.1

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 50.09 | 31.43 | 25.38 | 21.00 | 17.88 | 15.55 | 13.76 | 12.34 | 10.23 |
| VT2/DD | 42.96 | 26.96 | 21.77 | 18.01 | 15.33 | 13.34 | 11.80 | 10.59 | 8.78 |
| VT3/DD | 37.34 | 23.43 | 18.92 | 15.66 | 13.33 | 11.59 | 10.26 | 9.20 | 7.63 |
| MONTHLY DD | 370 | 590 | 730 | 883 | 1037 | 1192 | 1347 | 1502 | 1812 |
| ANNUAL DD | 1063 | 2249 | 3136 | 4207 | 5440 | 6832 | 8344 | 9954 | 13394 |
| PARAMETER A | .819 | .810 | .806 | .816 | .832 | .848 | .856 | .856 | .836 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0766 | .0914 | .0958 | .0969 | .0962 | .0949 | .0942 | .0944 | .0971 |
| A2 | .2326 | .3497 | .4084 | .4543 | .4947 | .5381 | .5890 | .6481 | .7862 |
| A3 | -.1908 | -.3266 | -.3981 | -.4584 | -.5145 | -.5761 | -.6478 | -.7295 | -.9149 |
| A4 | .1429 | .2222 | .2642 | .2989 | .3311 | .3666 | .4084 | .4567 | .5681 |
| A5 | .0548 | .0544 | .0514 | .0453 | .0373 | .0275 | .0160 | .0037 | -.0211 |
| B1 | -.0206 | -.0206 | -.0206 | -.0206 | -.0206 | -.0206 | -.0206 | -.0206 | -.0206 |
| B2 | -1.2104 | -1.2104 | -1.2104 | -1.2104 | -1.2104 | -1.2104 | -1.2104 | -1.2104 | -1.2104 |
| B3 | .8547 | .8547 | .8547 | .8548 | .8547 | .8547 | .8547 | .8547 | .8547 |
| B4 | .4979 | .4979 | .4979 | .4979 | .4979 | .4979 | .4979 | .4979 | .4979 |
| B5 | -1.1940 | -1.1940 | -1.1940 | -1.1940 | -1.1940 | -1.1940 | -1.1940 | -1.1939 | -1.1940 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 300335 — QTA2 = 251370 — QTA3 = 216400

AZIMUTH AND TILT COEF. — C1 = .0626 — C2 = -.3630 — C3 = -.2343 — C4 = 1.4800 — C5 = -1.2803

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 21 | 23 | 30 | 39 | 50 | 58 | 67 | 64 | 54 | 46 | 34 | 28 |
| QHOR: | 384 | 654 | 1115 | 1437 | 1776 | 2009 | 2308 | 1877 | 1364 | 929 | 508 | 371 |

MILES CITY, MONTANA — ELEVATION = 2635 — LAT = 46.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 42.82 | 28.32 | 23.82 | 20.51 | 18.00 | 16.03 | 14.46 | 13.16 | 11.16 |
| VT2/DD | 36.74 | 24.30 | 20.44 | 17.60 | 15.44 | 13.76 | 12.40 | 11.29 | 9.58 |
| VT3/DD | 31.94 | 21.12 | 17.77 | 15.30 | 13.42 | 11.96 | 10.78 | 9.82 | 8.32 |
| MONTHLY DD | 532 | 804 | 956 | 1110 | 1265 | 1420 | 1575 | 1730 | 2040 |
| ANNUAL DD | 1529 | 2800 | 3655 | 4630 | 5717 | 6923 | 8259 | 9715 | 12940 |
| PARAMETER A | .654 | .693 | .700 | .705 | .712 | .721 | .733 | .745 | .754 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0869 | .0855 | .0856 | .0852 | .0842 | .0822 | .0795 | .0769 | .0736 |
| A2 | .2404 | .3230 | .3783 | .4326 | .4853 | .5354 | .5835 | .6326 | .7472 |
| A3 | -.2071 | -.3062 | -.3686 | -.4309 | -.4928 | -.5539 | -.6152 | -.6801 | -.8349 |
| A4 | .1178 | .1776 | .2155 | .2534 | .2912 | .3287 | .3663 | .4060 | .5004 |
| A5 | .0421 | .0391 | .0397 | .0393 | .0379 | .0344 | .0289 | .0210 | -.0009 |
| B1 | -.0065 | -.0065 | -.0065 | -.0065 | -.0065 | -.0065 | -.0065 | -.0065 | -.0065 |
| B2 | -1.2335 | -1.2335 | -1.2335 | -1.2335 | -1.2335 | -1.2335 | -1.2335 | -1.2335 | -1.2335 |
| B3 | .8646 | .8646 | .8647 | .8646 | .8646 | .8647 | .8646 | .8646 | .8646 |
| B4 | .5060 | .5060 | .5060 | .5060 | .5060 | .5060 | .5060 | .5060 | .5060 |
| B5 | -1.2140 | -1.2140 | -1.2140 | -1.2140 | -1.2140 | -1.2140 | -1.2140 | -1.2140 | -1.2140 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 325433 — QTA2 = 272494 — QTA3 = 234589

AZIMUTH AND TILT COEF. — C1 = .0331 — C2 = -.4029 — C3 = -.2084 — C4 = 1.4771 — C5 = -1.3071

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 14 | 18 | 31 | 42 | 54 | 66 | 74 | 74 | 59 | 48 | 32 | 21 |
| QHOR: | 460 | 749 | 1141 | 1488 | 1890 | 2153 | 2300 | 2001 | 1485 | 978 | 573 | 386 |

MISSOULA, MONTANA — ELEVATION = 3189 — LAT = 46.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 48.22 | 21.16 | 15.56 | 12.30 | 10.17 | 8.67 | 7.56 | 6.70 | 5.45 |
| VT2/DD | 41.17 | 18.06 | 13.28 | 10.50 | 8.68 | 7.40 | 6.45 | 5.72 | 4.66 |
| VT3/DD | 35.74 | 15.68 | 11.53 | 9.12 | 7.54 | 6.43 | 5.60 | 4.96 | 4.04 |
| MONTHLY DD | 231 | 431 | 586 | 741 | 896 | 1051 | 1206 | 1361 | 1671 |
| ANNUAL DD | 547 | 1770 | 2681 | 3765 | 5012 | 6409 | 7925 | 9541 | 12977 |
| PARAMETER A | .702 | .867 | .950 | 1.018 | 1.076 | 1.126 | 1.164 | 1.191 | 1.220 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0660 | .0745 | .0662 | .0608 | .0567 | .0536 | .0517 | .0508 | .0507 |
| A2 | .0480 | .0944 | .1146 | .1315 | .1458 | .1601 | .1764 | .1951 | .2352 |
| A3 | -.0354 | -.1155 | -.1386 | -.1598 | -.1795 | -.2006 | -.2255 | -.2540 | -.3144 |
| A4 | .0031 | .1155 | .1287 | .1409 | .1519 | .1639 | .1785 | .1959 | .2337 |
| A5 | .0318 | -.0407 | -.0398 | -.0409 | -.0435 | -.0476 | -.0535 | -.0605 | -.0759 |
| B1 | .0101 | -.0754 | -.0754 | -.0754 | -.0754 | -.0754 | -.0754 | -.0754 | -.0754 |
| B2 | -1.0107 | -.9996 | -.9996 | -.9996 | -.9996 | -.9996 | -.9996 | -.9995 | -.9996 |
| B3 | .7003 | .7169 | .7168 | .7168 | .7168 | .7168 | .7168 | .7168 | .7168 |
| B4 | .6127 | .5644 | .5644 | .5644 | .5644 | .5644 | .5644 | .5644 | .5644 |
| B5 | -1.0783 | -1.0278 | -1.0278 | -1.0278 | -1.0279 | -1.0279 | -1.0278 | -1.0279 | -1.0279 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 255076 — QTA2 = 212669 — QTA3 = 182836

AZIMUTH AND TILT COEF. — C1 = .0184 — C2 = -.2265 — C3 = -.3640 — C4 = 1.6089 — C5 = -1.2390

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 23 | 31 | 34 | 43 | 52 | 59 | 67 | 65 | 54 | 42 | 34 | 26 |
| QHOR: | 313 | 586 | 976 | 1338 | 1716 | 1981 | 2312 | 1875 | 1348 | 804 | 389 | 260 |

GRAND ISLAND, NEBRASKA — ELEVATION = 1857 — LAT = 41.0

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 82.08 | 48.03 | 38.94 | 32.52 | 27.84 | 24.32 | 21.59 | 19.41 | 16.15 |
| VT2/DD | 70.31 | 41.14 | 33.35 | 27.86 | 23.85 | 20.83 | 18.49 | 16.63 | 13.83 |
| VT3/DD | 61.10 | 35.75 | 28.99 | 24.21 | 20.73 | 18.10 | 16.07 | 14.45 | 12.02 |
| MONTHLY DD | 363 | 620 | 765 | 916 | 1070 | 1225 | 1380 | 1535 | 1845 |
| ANNUAL DD | 911 | 1989 | 2717 | 3565 | 4535 | 5616 | 6829 | 8189 | 11307 |
| PARAMETER A | .510 | .529 | .539 | .545 | .550 | .553 | .560 | .567 | .557 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0586 | .0782 | .0822 | .0847 | .0860 | .0864 | .0853 | .0834 | .0824 |
| A2 | .1525 | .3400 | .4106 | .4823 | .5573 | .6353 | .7156 | .8055 | 1.0592 |
| A3 | -.1001 | -.2850 | -.3616 | -.4455 | -.5367 | -.6337 | -.7398 | -.8629 | -1.2098 |
| A4 | .1324 | .2536 | .3005 | .3504 | .4043 | .4615 | .5224 | .5920 | .7923 |
| A5 | .0098 | .0289 | .0320 | .0307 | .0266 | .0206 | .0100 | -.0050 | -.0498 |
| B1 | -.0438 | -.0438 | -.0438 | -.0438 | -.0438 | -.0438 | -.0438 | -.0438 | -.0438 |
| B2 | -1.1710 | -1.1710 | -1.1710 | -1.1710 | -1.1710 | -1.1710 | -1.1710 | -1.1710 | -1.1710 |
| B3 | .7477 | .7477 | .7477 | .7477 | .7477 | .7477 | .7477 | .7477 | .7477 |
| B4 | .6393 | .6394 | .6394 | .6394 | .6394 | .6394 | .6394 | .6394 | .6393 |
| B5 | -1.2747 | -1.2748 | -1.2748 | -1.2748 | -1.2748 | -1.2748 | -1.2748 | -1.2748 | -1.2747 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 323891 — QTA2 = 270409 — QTA3 = 232417

AZIMUTH AND TILT COEF. — C1 = -.0207 — C2 = -.3303 — C3 = -.3305 — C4 = 1.6264 — C5 = -1.3235

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 24 | 35 | 48 | 61 | 70 | 76 | 73 | 63 | 53 | 39 | 25 |
| QHOR: | 654 | 930 | 1280 | 1715 | 1993 | 2183 | 2182 | 1928 | 1464 | 1124 | 699 | 564 |

NORTH PLATTE, NEBRASKA — ELEVATION = 2785 — LAT = 41.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 85.52 | 50.72 | 41.05 | 34.26 | 29.35 | 25.65 | 22.78 | 20.48 | 17.05 |
| VT2/DD | 73.25 | 43.44 | 35.16 | 29.34 | 25.13 | 21.97 | 19.51 | 17.54 | 14.60 |
| VT3/DD | 63.65 | 37.75 | 30.55 | 25.50 | 21.84 | 19.09 | 16.95 | 15.24 | 12.69 |
| MONTHLY DD | 368 | 621 | 767 | 920 | 1073 | 1228 | 1383 | 1538 | 1848 |
| ANNUAL DD | 972 | 2168 | 2958 | 3871 | 4900 | 6048 | 7336 | 8768 | 11987 |
| PARAMETER A | .755 | .623 | .586 | .563 | .552 | .551 | .553 | .553 | .527 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0443 | -.0621 | -.0669 | -.0696 | -.0704 | -.0696 | -.0684 | -.0675 | -.0695 |
| A2 | .2154 | .4131 | .5062 | .5949 | .6757 | .7501 | .8318 | .9299 | 1.2239 |
| A3 | -.2391 | -.4540 | -.5579 | -.6585 | -.7523 | -.8439 | -.9509 | -1.0837 | -1.4826 |
| A4 | .1323 | .2612 | .3248 | .3868 | .4451 | .5021 | .5683 | .6496 | .8912 |
| A5 | .0187 | .0343 | .0381 | .0400 | .0392 | .0333 | .0208 | .0021 | -.0515 |
| B1 | .0092 | .0092 | .0092 | .0092 | .0092 | .0092 | .0092 | .0092 | .0092 |
| B2 | -1.1660 | -1.1660 | -1.1660 | -1.1660 | -1.1660 | -1.1660 | -1.1660 | -1.1660 | -1.1660 |
| B3 | .7662 | .7661 | .7662 | .7661 | .7661 | .7662 | .7662 | .7662 | .7662 |
| B4 | .6449 | .6449 | .6449 | .6449 | .6449 | .6449 | .6449 | .6449 | .6449 |
| B5 | -1.2778 | -1.2778 | -1.2778 | -1.2778 | -1.2778 | -1.2778 | -1.2778 | -1.2778 | -1.2778 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 343538 — QTA2 = 286992 — QTA3 = 246740

AZIMUTH AND TILT COEF. — C1 = -.0215 — C2 = -.3646 — C3 = -.2949 — C4 = 1.5991 — C5 = -1.3261

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 26 | 32 | 45 | 60 | 67 | 73 | 71 | 58 | 50 | 34 | 26 |
| QHOR: | 699 | 925 | 1341 | 1701 | 2034 | 2320 | 2227 | 1996 | 1578 | 1191 | 768 | 589 |

OMAHA, NEBRASKA — ELEVATION = 1325 — LAT = 41.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) |
| VT1/DD | 79.21 | 47.05 | 37.96 | 31.55 | 26.96 | 23.54 | 20.89 | 18.41 | 14.87 |
| VT2/DD | 67.79 | 40.26 | 32.48 | 27.00 | 23.07 | 20.14 | 17.87 | 15.78 | 12.74 |
| VT3/DD | 58.89 | 34.98 | 28.22 | 23.46 | 20.05 | 17.50 | 15.53 | 13.71 | 11.07 |
| MONTHLY DD | 363 | 611 | 757 | 911 | 1066 | 1221 | 1376 | 1301 | 1611 |
| ANNUAL DD | 826 | 1753 | 2397 | 3161 | 4051 | 5064 | 6197 | 7485 | 10562 |
| PARAMETER A | .429 | .473 | .487 | .502 | .513 | .521 | .531 | .570 | .627 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0643 | .0563 | .0521 | .0471 | .0421 | .0382 | .0349 | -.0020 | -.0047 |
| A2 | .1793 | .2584 | .3176 | .3714 | .4246 | .4867 | .5531 | .8543 | .9546 |
| A3 | -.1248 | -.2137 | -.2742 | -.3312 | -.3917 | -.4672 | -.5512 | -.8812 | -1.0570 |
| A4 | .1530 | .2108 | .2524 | .2911 | .3320 | .3818 | .4351 | .5850 | .6798 |
| A5 | .0533 | .0529 | .0574 | .0595 | .0575 | .0513 | .0430 | .0350 | -.0088 |
| B1 | .0109 | .0109 | .0109 | .0109 | .0109 | .0109 | .0109 | .0216 | .0216 |
| B2 | -1.1209 | -1.1210 | -1.1209 | -1.1209 | -1.1209 | -1.1209 | -1.1209 | -1.1916 | -1.1916 |
| B3 | .7381 | .7381 | .7381 | .7381 | .7381 | .7381 | .7381 | .8302 | .8302 |
| B4 | .6413 | .6413 | .6413 | .6413 | .6413 | .6413 | .6413 | .5773 | .5774 |
| B5 | -1.2523 | -1.2523 | -1.2523 | -1.2523 | -1.2523 | -1.2523 | -1.2523 | -1.2247 | -1.2247 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 308652 — QTA2 = 257857 — QTA3 = 221771

AZIMUTH AND TILT COEF. — C1 = .0218 — C2 = -.3111 — C3 = -.2855 — C4 = 1.5735 — C5 = -1.2742

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 25 | 39 | 54 | 65 | 72 | 76 | 75 | 63 | 55 | 40 | 28 |
| QHOR: | 662 | 931 | 1185 | 1510 | 2002 | 2182 | 2063 | 1872 | 1394 | 1010 | 683 | 526 |

SCOTTSBLUFF, NEBRASKA — ELEVATION = 3957 — LAT = 41.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 105.47 | 58.51 | 46.28 | 37.89 | 31.94 | 27.37 | 23.81 | 21.07 | 17.12 |
| VT2/DD | 90.36 | 50.13 | 39.65 | 32.46 | 27.36 | 23.49 | 20.44 | 18.08 | 14.70 |
| VT3/DD | 78.53 | 43.57 | 34.46 | 28.21 | 23.78 | 20.42 | 17.77 | 15.72 | 12.78 |
| MONTHLY DD | 294 | 530 | 670 | 818 | 970 | 1036 | 1191 | 1346 | 1656 |
| ANNUAL DD | 861 | 2011 | 2806 | 3749 | 4813 | 6000 | 7328 | 8792 | 12031 |
| PARAMETER A | .692 | .586 | .553 | .534 | .522 | .518 | .524 | .529 | .512 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0125 | .0244 | .0293 | .0333 | .0365 | .0585 | .0596 | .0608 | .0662 |
| A2 | .1738 | .4488 | .5752 | .6881 | .7978 | 1.2392 | 1.3198 | 1.4061 | 1.6814 |
| A3 | -.2059 | -.5034 | -.6386 | -.7618 | -.8897 | -1.2464 | -1.3600 | -1.4853 | -1.8607 |
| A4 | .1354 | .3226 | .4084 | .4865 | .5665 | .8027 | .8706 | .9456 | 1.1745 |
| A5 | -.0031 | .0100 | .0174 | .0219 | .0192 | .0944 | .0777 | .0560 | .0025 |
| B1 | -.0195 | -.0195 | -.0195 | -.0195 | -.0195 | -.0244 | -.0244 | -.0244 | -.0244 |
| B2 | -1.1751 | -1.1751 | -1.1751 | -1.1751 | -1.1751 | -1.2556 | -1.2556 | -1.2556 | -1.2556 |
| B3 | .7752 | .7752 | .7752 | .7752 | .7752 | .8632 | .8632 | .8632 | .8632 |
| B4 | .6209 | .6208 | .6208 | .6208 | .6208 | .5404 | .5404 | .5404 | .5404 |
| B5 | -1.2768 | -1.2768 | -1.2768 | -1.2768 | -1.2767 | -1.2634 | -1.2633 | -1.2634 | -1.2634 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 339089 — QTA2 = 283282 — QTA3 = 243534

AZIMUTH AND TILT COEF. — C1 = .0048 — C2 = -.3818 — C3 = -.2798 — C4 = 1.5940 — C5 = -1.3381

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 23 | 29 | 34 | 44 | 56 | 66 | 72 | 72 | 59 | 46 | 35 | 26 |
| QHOR: | 667 | 946 | 1275 | 1648 | 1921 | 2236 | 2273 | 2001 | 1645 | 1092 | 714 | 552 |

ELKO, NEVADA — ELEVATION = 5075 — LAT = 40.8

| SOUTH-VERT. | TB30 (M=12) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 113.38 | 59.25 | 45.75 | 37.18 | 31.31 | 27.04 | 23.80 | 21.25 | 17.50 |
| VT2/DD | 97.29 | 50.85 | 39.26 | 31.91 | 26.87 | 23.21 | 20.42 | 18.24 | 15.02 |
| VT3/DD | 84.58 | 44.20 | 34.13 | 27.74 | 23.36 | 20.17 | 17.75 | 15.85 | 13.06 |
| MONTHLY DD | 271 | 519 | 672 | 827 | 982 | 1137 | 1292 | 1447 | 1757 |
| ANNUAL DD | 681 | 1829 | 2693 | 3708 | 4872 | 6164 | 7570 | 9073 | 12321 |
| PARAMETER A | .766 | .794 | .786 | .773 | .758 | .738 | .715 | .687 | .623 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0048 | .0181 | .0254 | .0325 | .0394 | .0459 | .0522 | .0586 | .0717 |
| A2 | .1670 | .3734 | .4863 | .5987 | .7167 | .8421 | .9794 | 1.1308 | 1.4783 |
| A3 | -.1284 | -.3533 | -.4859 | -.6218 | -.7702 | -.9314 | -1.1108 | -1.3092 | -1.7628 |
| A4 | .0900 | .2214 | .2957 | .3717 | .4546 | .5451 | .6463 | .7588 | 1.0180 |
| A5 | .0430 | .0506 | .0492 | .0443 | .0343 | .0201 | .0018 | -.0191 | -.0660 |
| B1 | -.0166 | -.0166 | -.0166 | -.0166 | -.0166 | -.0166 | -.0166 | -.0166 | -.0166 |
| B2 | -1.2535 | -1.2535 | -1.2535 | -1.2535 | -1.2535 | -1.2535 | -1.2535 | -1.2535 | -1.2535 |
| B3 | .8504 | .8503 | .8504 | .8504 | .8503 | .8503 | .8504 | .8503 | .8503 |
| B4 | .5711 | .5711 | .5711 | .5711 | .5711 | .5711 | .5710 | .5711 | .5711 |
| B5 | -1.2706 | -1.2706 | -1.2706 | -1.2707 | -1.2706 | -1.2706 | -1.2706 | -1.2706 | -1.2706 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 376783 — QTA2 = 314220 — QTA3 = 269870
AZIMUTH AND TILT COEF. — C1 = .0427 — C2 = -.2528 — C3 = -.4448 — C4 = 1.6982 — C5 = -1.3871

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 26 | 31 | 37 | 43 | 54 | 62 | 73 | 67 | 58 | 46 | 35 | 23 |
| QHOR: | 721 | 1114 | 1434 | 1895 | 2298 | 2586 | 2606 | 2360 | 1922 | 1309 | 800 | 616 |

ELY, NEVADA — ELEVATION = 6253 — LAT = 39.3

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 122.10 | 64.20 | 50.45 | 41.27 | 34.86 | 30.16 | 26.59 | 23.77 | 19.61 |
| VT2/DD | 104.52 | 54.96 | 43.19 | 35.33 | 29.84 | 25.82 | 22.76 | 20.35 | 16.79 |
| VT3/DD | 90.82 | 47.76 | 37.53 | 30.70 | 25.93 | 22.44 | 19.78 | 17.68 | 14.59 |
| MONTHLY DD | 285 | 541 | 689 | 842 | 997 | 1152 | 1307 | 1462 | 1772 |
| ANNUAL DD | 929 | 2202 | 3081 | 4107 | 5295 | 6622 | 8079 | 9642 | 13008 |
| PARAMETER A | .620 | .641 | .634 | .624 | .613 | .597 | .573 | .543 | .469 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .1402 | .1472 | .1533 | .1592 | .1653 | .1730 | .1838 | .1985 | .2396 |
| A2 | .2962 | .4979 | .6177 | .7443 | .8808 | 1.0332 | 1.2121 | 1.4223 | 1.9443 |
| A3 | -.3848 | -.6266 | -.7791 | -.9433 | -1.1230 | -1.3258 | -1.5650 | -1.8848 | -2.5332 |
| A4 | .1473 | .2787 | .3598 | .4483 | .5469 | .6590 | .7916 | .9466 | 1.3273 |
| A5 | -.0173 | -.0229 | -.0323 | -.0452 | -.0618 | -.0823 | -.1069 | -.1343 | -.1936 |
| B1 | -.0494 | -.0494 | -.0494 | -.0494 | -.0494 | -.0494 | -.0494 | -.0494 | -.0494 |
| B2 | -1.1627 | -1.1627 | -1.1627 | -1.1627 | -1.1627 | -1.1627 | -1.1627 | -1.1627 | -1.1627 |
| B3 | .7557 | .7557 | .7557 | .7557 | .7557 | .7557 | .7557 | .7557 | .7557 |
| B4 | .7022 | .7022 | .7022 | .7022 | .7022 | .7022 | .7022 | .7022 | .7022 |
| B5 | -1.2929 | -1.2928 | -1.2928 | -1.2928 | -1.2928 | -1.2928 | -1.2929 | -1.2928 | -1.2928 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 385856 — QTA2 = 321819 — QTA3 = 276464
AZIMUTH AND TILT COEF. — C1 = .0716 — C2 = -.2616 — C3 = -.4361 — C4 = 1.6828 — C5 = -1.3759

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 22 | 29 | 34 | 41 | 50 | 58 | 68 | 66 | 58 | 45 | 33 | 24 |
| QHOR: | 809 | 1142 | 1646 | 1952 | 2262 | 2495 | 2491 | 2217 | 1890 | 1450 | 920 | 722 |

LAS VEGAS, NEVADA — ELEVATION = 2178 — LAT = 36.1

| SOUTH-VERT. | TB30 (M= 2) | TB40 (M= 1) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | 814.03 | 333.02 | 172.77 | 108.35 | 76.32 | 58.40 | 47.28 | 34.23 |
| VT2/DD | NA | 696.84 | 285.47 | 148.11 | 92.88 | 65.42 | 50.07 | 40.53 | 29.35 |
| VT3/DD | NA | 605.63 | 248.14 | 128.74 | 80.73 | 56.87 | 43.52 | 35.23 | 25.51 |
| MONTHLY DD | 2 | 52 | 116 | 223 | 355 | 504 | 659 | 814 | 1124 |
| ANNUAL DD | 6 | 131 | 332 | 664 | 1161 | 1831 | 2658 | 3625 | 5957 |
| PARAMETER A | NA | .414 | .435 | .538 | .590 | .615 | .617 | .608 | .577 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0064 | -.0411 | -.0335 | -.0317 | -.0310 | -.0313 | -.0319 | -.0335 |
| A2 | NA | .1472 | .4032 | .3518 | .4041 | .5101 | .6462 | .7991 | 1.1315 |
| A3 | NA | -.1577 | -.3605 | -.3246 | -.4031 | -.5493 | -.7293 | -.9290 | -1.3692 |
| A4 | NA | .0813 | .2596 | .2282 | .2678 | .3457 | .4434 | .5524 | .7929 |
| A5 | NA | .0143 | .0350 | .0254 | .0132 | -.0050 | -.0228 | -.0411 | -.0851 |
| B1 | NA | .0127 | .0236 | .0236 | .0236 | .0236 | .0236 | .0236 | .0236 |
| B2 | NA | -1.1942 | -1.2441 | -1.2441 | -1.2441 | -1.2441 | -1.2441 | -1.2441 | -1.2441 |
| B3 | NA | .7305 | .8022 | .8022 | .8022 | .8022 | .8022 | .8022 | .8022 |
| B4 | NA | .7886 | .7135 | .7136 | .7135 | .7135 | .7135 | .7135 | .7135 |
| B5 | NA | -1.3450 | -1.3197 | -1.3197 | -1.3197 | -1.3197 | -1.3197 | -1.3197 | -1.3197 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 405194 — QTA2 = 337375 — QTA3 = 289592
AZIMUTH AND TILT COEF. — C1 = .0187 — C2 = -.2297 — C3 = -.5440 — C4 = 1.8642 — C5 = -1.4054

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 44 | 49 | 57 | 62 | 74 | 84 | 91 | 87 | 80 | 68 | 53 | 43 |
| QHOR: | 1005 | 1398 | 1893 | 2389 | 2653 | 2781 | 2550 | 2366 | 2066 | 1519 | 1092 | 859 |

LOVELOCK, NEVADA — ELEVATION = 3904 — LAT = 40.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 199.48 | 92.24 | 69.20 | 54.25 | 44.09 | 37.00 | 31.86 | 27.95 | 22.44 |
| VT2/DD | 170.81 | 78.98 | 59.26 | 46.45 | 37.75 | 31.68 | 27.28 | 23.93 | 19.22 |
| VT3/DD | 148.44 | 68.64 | 51.50 | 40.37 | 32.81 | 27.53 | 23.71 | 20.80 | 16.70 |
| MONTHLY DD | 177 | 383 | 510 | 651 | 801 | 954 | 1108 | 1263 | 1573 |
| ANNUAL DD | 463 | 1322 | 1986 | 2818 | 3811 | 4953 | 6232 | 7627 | 10722 |
| PARAMETER A | .616 | .677 | .681 | .668 | .653 | .638 | .623 | .603 | .550 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0331 | .0517 | .0591 | .0665 | .0730 | .0783 | .0828 | .0873 | .0982 |
| A2 | .0159 | .1598 | .2601 | .3833 | .5157 | .6516 | .7922 | .9451 | 1.3164 |
| A3 | -.0556 | -.2077 | -.3282 | -.4809 | -.6459 | -.8176 | -.9995 | -1.2012 | -1.6963 |
| A4 | .0349 | .1352 | .2067 | .2943 | .3875 | .4836 | .5850 | .6975 | .9750 |
| A5 | -.0294 | -.0277 | -.0345 | -.0450 | -.0560 | -.0687 | -.0854 | -.1069 | -.1634 |
| B1 | -.0195 | -.0195 | -.0195 | -.0195 | -.0195 | -.0195 | -.0195 | -.0195 | -.0195 |
| B2 | -1.1603 | -1.1603 | -1.1603 | -1.1603 | -1.1603 | -1.1603 | -1.1603 | -1.1603 | -1.1603 |
| B3 | .7307 | .7307 | .7307 | .7307 | .7306 | .7307 | .7307 | .7307 | .7307 |
| B4 | .6753 | .6753 | .6753 | .6753 | .6754 | .6753 | .6753 | .6753 | .6753 |
| B5 | -1.2922 | -1.2921 | -1.2921 | -1.2921 | -1.2922 | -1.2921 | -1.2921 | -1.2921 | -1.2921 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 405973 — QTA2 = 338297 — QTA3 = 290416
AZIMUTH AND TILT COEF. — C1 = .0331 — C2 = -.2060 — C3 = -.5192 — C4 = 1.7491 — C5 = -1.4134

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 29 | 35 | 42 | 48 | 58 | 67 | 77 | 73 | 63 | 50 | 39 | 30 |
| QHOR: | 793 | 1179 | 1636 | 2190 | 2522 | 2802 | 2784 | 2496 | 2050 | 1448 | 892 | 705 |

RENO, NEVADA — ELEVATION = 4400 — LAT = 39.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 295.82 | 107.17 | 75.52 | 56.83 | 45.16 | 37.26 | 31.69 | 27.57 | 21.88 |
| VT2/DD | 253.79 | 91.94 | 64.79 | 48.76 | 38.74 | 31.97 | 27.19 | 23.65 | 18.77 |
| VT3/DD | 220.61 | 79.92 | 56.32 | 42.38 | 33.68 | 27.79 | 23.64 | 20.56 | 16.32 |
| MONTHLY DD | 111 | 307 | 435 | 578 | 728 | 882 | 1037 | 1192 | 1502 |
| ANNUAL DD | 296 | 1162 | 1874 | 2771 | 3831 | 5052 | 6416 | 7893 | 11110 |
| PARAMETER A | .840 | .800 | .769 | .750 | .731 | .710 | .682 | .648 | .569 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0117 | -.0201 | -.0247 | -.0283 | -.0315 | -.0345 | -.0377 | -.0412 | -.0488 |
| A2 | .2052 | .4174 | .5525 | .6837 | .8156 | .9559 | 1.1188 | 1.3083 | 1.7640 |
| A3 | -.1839 | -.4276 | -.5963 | -.7643 | -.9345 | -1.1177 | -1.3323 | -1.5819 | -2.1786 |
| A4 | .1191 | .2556 | .3493 | .4421 | .5359 | .6372 | .7565 | .8960 | 1.2309 |
| A5 | .0260 | .0230 | .0112 | -.0029 | -.0176 | -.0353 | -.0578 | -.0846 | -.1453 |
| B1 | .0352 | .0352 | .0352 | .0352 | .0352 | .0352 | .0352 | .0352 | .0352 |
| B2 | -1.2504 | -1.2504 | -1.2504 | -1.2504 | -1.2504 | -1.2504 | -1.2504 | -1.2504 | -1.2504 |
| B3 | .8360 | .8360 | .8360 | .8360 | .8360 | .8360 | .8360 | .8360 | .8360 |
| B4 | .6114 | .6114 | .6114 | .6114 | .6114 | .6114 | .6114 | .6114 | .6113 |
| B5 | -1.2847 | -1.2847 | -1.2847 | -1.2847 | -1.2847 | -1.2847 | -1.2847 | -1.2847 | -1.2847 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 396079 — QTA2 = 330088 — QTA3 = 283405
AZIMUTH AND TILT COEF. — C1 = .0266 — C2 = -.2316 — C3 = -.4916 — C4 = 1.7538 — C5 = -1.4065

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 33 | 36 | 42 | 46 | 54 | 65 | 71 | 68 | 60 | 48 | 38 | 31 |
| QHOR: | 846 | 1130 | 1682 | 2072 | 2454 | 2726 | 2661 | 2429 | 2023 | 1424 | 904 | 679 |

TONOPAH, NEVADA — ELEVATION = 5423 — LAT = 38.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 318.84 | 122.82 | 90.06 | 68.73 | 54.52 | 45.18 | 38.57 | 33.65 | 26.81 |
| VT2/DD | 273.21 | 105.24 | 77.18 | 58.98 | 46.79 | 38.77 | 33.10 | 28.88 | 23.01 |
| VT3/DD | 237.49 | 91.48 | 67.09 | 51.28 | 40.68 | 33.71 | 28.78 | 25.11 | 20.00 |
| MONTHLY DD | 140 | 362 | 494 | 595 | 750 | 905 | 1060 | 1215 | 1525 |
| ANNUAL DD | 323 | 1166 | 1836 | 2664 | 3649 | 4783 | 6060 | 7472 | 10631 |
| PARAMETER A | .599 | .642 | .595 | .570 | .558 | .539 | .519 | .496 | .426 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0584 | .0625 | .0713 | -.0636 | -.0627 | -.0626 | -.0626 | -.0629 | -.0669 |
| A2 | .0648 | .3606 | .5445 | .9512 | 1.1124 | 1.2921 | 1.4870 | 1.7146 | 2.3749 |
| A3 | -.1214 | -.4375 | -.6393 | -1.0466 | -1.2416 | -1.4628 | -1.7090 | -2.0051 | -2.8665 |
| A4 | .0605 | .2404 | .3543 | .5932 | .7019 | .8246 | .9608 | 1.1242 | 1.6005 |
| A5 | -.0242 | -.0072 | .0015 | .0147 | .0067 | -.0049 | -.0222 | -.0494 | -.1296 |
| B1 | -.0113 | -.0113 | -.0113 | .0370 | .0370 | .0370 | .0370 | .0370 | .0370 |
| B2 | -1.2091 | -1.2091 | -1.2091 | -1.2718 | -1.2718 | -1.2718 | -1.2718 | -1.2718 | -1.2718 |
| B3 | .7440 | .7440 | .7440 | .8288 | .8289 | .8289 | .8288 | .8288 | .8289 |
| B4 | .7115 | .7115 | .7115 | .6380 | .6380 | .6380 | .6380 | .6380 | .6380 |
| B5 | -1.3533 | -1.3534 | -1.3533 | -1.3250 | -1.3251 | -1.3251 | -1.3251 | -1.3251 | -1.3251 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 422366 — QTA2 = 352173 — QTA3 = 302419
AZIMUTH AND TILT COEF. — C1 = .0414 — C2 = -.2475 — C3 = -.4996 — C4 = 1.7671 — C5 = -1.4292

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 29 | 37 | 42 | 47 | 57 | 68 | 74 | 72 | 63 | 50 | 40 | 30 |
| QHOR: | 948 | 1274 | 1738 | 2277 | 2620 | 2746 | 2678 | 2428 | 2056 | 1545 | 1065 | 818 |

WINNEMUCCA, NEVADA — ELEVATION = 4341 — LAT = 40.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 220.03 | 85.28 | 61.24 | 46.97 | 37.97 | 31.84 | 27.42 | 24.07 | 19.35 |
| VT2/DD | 188.49 | 73.05 | 52.46 | 40.24 | 32.52 | 27.28 | 23.49 | 20.62 | 16.58 |
| VT3/DD | 163.81 | 63.49 | 45.59 | 34.97 | 28.27 | 23.71 | 20.41 | 17.92 | 14.40 |
| MONTHLY DD | 139 | 359 | 499 | 651 | 805 | 960 | 1115 | 1270 | 1580 |
| ANNUAL DD | 467 | 1466 | 2228 | 3154 | 4236 | 5464 | 6811 | 8258 | 11416 |
| PARAMETER A | .638 | .701 | .704 | .704 | .699 | .689 | .672 | .650 | .598 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0408 | .0390 | .0414 | .0428 | .0445 | .0464 | .0486 | .0511 | .0569 |
| A2 | .1549 | .3634 | .4672 | .5510 | .6403 | .7437 | .8631 | .9955 | 1.3062 |
| A3 | -.2295 | -.4604 | -.5770 | -.6731 | -.7823 | -.9148 | -1.0719 | -1.2484 | -1.6643 |
| A4 | .1148 | .2472 | .3134 | .3686 | .4306 | .5054 | .5939 | .6934 | .9287 |
| A5 | -.0472 | -.0405 | -.0382 | -.0387 | -.0449 | -.0571 | -.0744 | -.0956 | -.1465 |
| B1 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 |
| B2 | -1.1834 | -1.1834 | -1.1834 | -1.1834 | -1.1834 | -1.1834 | -1.1834 | -1.1834 | -1.1834 |
| B3 | .7689 | .7689 | .7689 | .7689 | .7689 | .7689 | .7689 | .7689 | .7689 |
| B4 | .6520 | .6520 | .6520 | .6520 | .6520 | .6520 | .6520 | .6520 | .6520 |
| B5 | -1.2657 | -1.2657 | -1.2657 | -1.2657 | -1.2657 | -1.2657 | -1.2658 | -1.2657 | -1.2657 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 380423 — QTA2 = 317174 — QTA3 = 272363

AZIMUTH AND TILT COEF. — C1 = .0428 — C2 = -.2466 — C3 = -.4591 — C4 = 1.7064 — C5 = -1.3864

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 29 | 35 | 38 | 43 | 56 | 66 | 74 | 70 | 60 | 48 | 39 | 28 |
| QHOR: | 690 | 1060 | 1473 | 1996 | 2339 | 2677 | 2631 | 2342 | 1941 | 1319 | 814 | 656 |

YUCCA FLATS, NEVADA — ELEVATION = 3927 — LAT = 36.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 394.34 | 134.40 | 93.26 | 69.49 | 54.39 | 44.44 | 37.54 | 32.49 | 25.60 |
| VT2/DD | 338.15 | 115.25 | 79.97 | 59.59 | 46.64 | 38.11 | 32.19 | 27.86 | 21.95 |
| VT3/DD | 293.94 | 100.18 | 69.51 | 51.80 | 40.55 | 33.13 | 27.98 | 24.22 | 19.08 |
| MONTHLY DD | 95 | 279 | 402 | 539 | 688 | 843 | 998 | 1153 | 1463 |
| ANNUAL DD | 252 | 906 | 1452 | 2152 | 3018 | 4043 | 5202 | 6486 | 9384 |
| PARAMETER A | .770 | .754 | .744 | .734 | .714 | .689 | .661 | .629 | .554 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0115 | .0188 | .0135 | .0155 | .0178 | .0202 | .0227 | .0251 | .0302 |
| A2 | .4298 | .4691 | .5471 | .6453 | .7605 | .8926 | 1.0408 | 1.2107 | 1.6516 |
| A3 | -.4597 | -.4985 | -.5984 | -.7255 | -.8746 | -1.0468 | -1.2410 | -1.4652 | -2.0531 |
| A4 | .2644 | .2892 | .3428 | .4103 | .4897 | .5817 | .6859 | .8067 | 1.1246 |
| A5 | .0197 | .0215 | .0138 | .0038 | -.0079 | -.0224 | -.0394 | -.0605 | -.1200 |
| B1 | .0104 | .0104 | .0104 | .0104 | .0104 | .0104 | .0104 | .0104 | .0104 |
| B2 | -1.2526 | -1.2526 | -1.2525 | -1.2526 | -1.2526 | -1.2525 | -1.2526 | -1.2525 | -1.2525 |
| B3 | .8197 | .8197 | .8197 | .8197 | .8197 | .8197 | .8197 | .8197 | .8197 |
| B4 | .6872 | .6872 | .6872 | .6872 | .6872 | .6872 | .6872 | .6872 | .6872 |
| B5 | -1.3154 | -1.3154 | -1.3154 | -1.3154 | -1.3154 | -1.3154 | -1.3154 | -1.3154 | -1.3154 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 400968 — QTA2 = 333927 — QTA3 = 286642

AZIMUTH AND TILT COEF. — C1 = .0306 — C2 = -.2115 — C3 = -.5494 — C4 = 1.8360 — C5 = -1.4082

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 36 | 38 | 43 | 52 | 61 | 73 | 79 | 76 | 68 | 55 | 45 | 32 |
| QHOR: | 945 | 1291 | 1773 | 2161 | 2559 | 2771 | 2705 | 2382 | 2085 | 1563 | 1028 | 815 |

CONCORD, NEW HAMPSHIRE — ELEVATION = 344 — LAT = 43.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 45.43 | 23.55 | 18.45 | 15.10 | 12.76 | 11.03 | 9.71 | 8.67 | 7.14 |
| VT2/DD | 38.84 | 20.13 | 15.78 | 12.91 | 10.91 | 9.43 | 8.30 | 7.41 | 6.10 |
| VT3/DD | 33.73 | 17.49 | 13.70 | 11.21 | 9.48 | 8.19 | 7.21 | 6.44 | 5.30 |
| MONTHLY DD | 276 | 532 | 680 | 830 | 983 | 1137 | 1292 | 1447 | 1757 |
| ANNUAL DD | 962 | 2149 | 2960 | 3909 | 4991 | 6213 | 7582 | 9092 | 12439 |
| PARAMETER A | .585 | .743 | .806 | .855 | .893 | .929 | .960 | .986 | 1.009 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0436 | -.0242 | -.0188 | -.0150 | -.0121 | -.0098 | -.0080 | -.0065 | -.0041 |
| A2 | .2490 | .2742 | .2819 | .2941 | .3110 | .3278 | .3476 | .3724 | .4442 |
| A3 | -.3041 | -.3251 | -.3319 | -.3468 | -.3689 | -.3921 | -.4199 | -.4555 | -.5575 |
| A4 | .2295 | .2347 | .2385 | .2481 | .2622 | .2764 | .2933 | .3144 | .3750 |
| A5 | -.0630 | -.0456 | -.0421 | -.0422 | -.0443 | -.0474 | -.0516 | -.0573 | -.0737 |
| B1 | -.0001 | -.0001 | -.0001 | -.0001 | -.0001 | -.0001 | -.0001 | -.0001 | -.0001 |
| B2 | -1.0874 | -1.0874 | -1.0874 | -1.0874 | -1.0874 | -1.0874 | -1.0874 | -1.0874 | -1.0874 |
| B3 | .7676 | .7676 | .7676 | .7676 | .7676 | .7676 | .7676 | .7676 | .7676 |
| B4 | .6042 | .6042 | .6042 | .6042 | .6042 | .6042 | .6042 | .6042 | .6042 |
| B5 | -1.1053 | -1.1053 | -1.1053 | -1.1053 | -1.1054 | -1.1053 | -1.1053 | -1.1053 | -1.1053 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 233141 — QTA2 = 194711 — QTA3 = 167543

AZIMUTH AND TILT COEF. — C1 = .0206 — C2 = -.3168 — C3 = -.2224 — C4 = 1.5143 — C5 = -1.1470

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 24 | 31 | 45 | 57 | 65 | 70 | 67 | 58 | 49 | 38 | 23 |
| QHOR: | 453 | 715 | 966 | 1296 | 1648 | 1749 | 1649 | 1423 | 1074 | 816 | 465 | 336 |

LAKEHURST, NEW JERSEY — ELEVATION = 121 — LAT = 40.0

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 151.55 | 62.03 | 44.41 | 34.19 | 27.55 | 21.89 | 18.10 | 15.42 | 11.89 |
| VT2/DD | 129.48 | 53.00 | 37.94 | 29.21 | 23.54 | 18.70 | 15.47 | 13.17 | 10.16 |
| VT3/DD | 112.45 | 46.03 | 32.95 | 25.37 | 20.44 | 16.24 | 13.43 | 11.44 | 8.82 |
| MONTHLY DD | 144 | 353 | 493 | 640 | 585 | 736 | 890 | 1045 | 1355 |
| ANNUAL DD | 303 | 986 | 1584 | 2334 | 3232 | 4285 | 5497 | 6857 | 10033 |
| PARAMETER A | .510 | .585 | .582 | .570 | .575 | .648 | .702 | .746 | .796 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0432 | .0540 | .0622 | .0684 | -.0737 | -.0615 | -.0538 | -.0487 | -.0435 |
| A2 | .3238 | .3713 | .4543 | .5459 | .6152 | .6005 | .6056 | .6186 | .6920 |
| A3 | -.2895 | -.3544 | -.4459 | -.5542 | -.7143 | -.7082 | -.7245 | -.7502 | -.8641 |
| A4 | .1424 | .1840 | .2419 | .3095 | .4892 | .4806 | .4880 | .5013 | .5648 |
| A5 | .0930 | .0862 | .0898 | .0872 | -.0627 | -.0655 | -.0704 | -.0762 | -.0952 |
| B1 | -.0188 | -.0188 | -.0188 | -.0188 | .0351 | .0351 | .0351 | .0351 | .0351 |
| B2 | -1.0806 | -1.0806 | -1.0806 | -1.0806 | -1.0743 | -1.0743 | -1.0743 | -1.0743 | -1.0743 |
| B3 | .7081 | .7081 | .7081 | .7081 | .7382 | .7382 | .7382 | .7382 | .7382 |
| B4 | .7254 | .7254 | .7254 | .7254 | .6712 | .6711 | .6711 | .6711 | .6711 |
| B5 | -1.1975 | -1.1975 | -1.1975 | -1.1975 | -1.1328 | -1.1327 | -1.1327 | -1.1327 | -1.1327 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 259427 — QTA2 = 216569 — QTA3 = 186313
AZIMUTH AND TILT COEF. — C1 = .0138 — C2 = -.3217 — C3 = -.2356 — C4 = 1.5494 — C5 = -1.1410

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 29 | 32 | 40 | 49 | 59 | 70 | 74 | 72 | 65 | 56 | 46 | 36 |
| QHOR: | 594 | 810 | 1141 | 1458 | 1777 | 1776 | 1752 | 1593 | 1261 | 963 | 661 | 447 |

NEWARK, NEW JERSEY — ELEVATION = 30 — LAT = 40.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) |
| VT1/DD | 208.63 | 69.18 | 47.38 | 35.34 | 28.02 | 23.18 | 19.74 | 17.19 | 13.45 |
| VT2/DD | 178.35 | 59.14 | 40.50 | 30.21 | 23.96 | 19.82 | 16.87 | 14.69 | 11.50 |
| VT3/DD | 154.90 | 51.37 | 35.17 | 26.24 | 20.81 | 17.21 | 14.66 | 12.76 | 9.99 |
| MONTHLY DD | 99 | 298 | 434 | 583 | 735 | 888 | 1043 | 1198 | 1378 |
| ANNUAL DD | 185 | 823 | 1400 | 2125 | 2982 | 3972 | 5105 | 6421 | 9575 |
| PARAMETER A | .530 | .524 | .531 | .533 | .536 | .549 | .566 | .591 | .646 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0079 | -.0118 | -.0182 | -.0234 | -.0261 | -.0273 | -.0283 | -.0290 | -.0388 |
| A2 | .2488 | .3268 | .4292 | .5210 | .5951 | .6591 | .7178 | .7635 | .9535 |
| A3 | -.2489 | -.3507 | -.4647 | -.5636 | -.6499 | -.7331 | -.8141 | -.8816 | -1.1022 |
| A4 | .1368 | .1812 | .2435 | .2991 | .3488 | .3981 | .4476 | .4902 | .6803 |
| A5 | .0379 | .0439 | .0552 | .0667 | .0691 | .0621 | .0505 | .0365 | -.0234 |
| B1 | .0206 | .0206 | .0206 | .0206 | .0206 | .0206 | .0206 | .0206 | .0240 |
| B2 | -1.1013 | -1.1013 | -1.1013 | -1.1012 | -1.1013 | -1.1013 | -1.1012 | -1.1013 | -1.1312 |
| B3 | .7459 | .7459 | .7459 | .7458 | .7459 | .7459 | .7459 | .7459 | .7818 |
| B4 | .6977 | .6976 | .6977 | .6977 | .6976 | .6976 | .6976 | .6977 | .6413 |
| B5 | -1.1892 | -1.1892 | -1.1892 | -1.1893 | -1.1892 | -1.1892 | -1.1892 | -1.1892 | -1.1664 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 257955 — QTA2 = 215193 — QTA3 = 185041
AZIMUTH AND TILT COEF. — C1 = -.0029 — C2 = -.3094 — C3 = -.2657 — C4 = 1.5823 — C5 = -1.1690

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 31 | 33 | 40 | 52 | 62 | 72 | 75 | 73 | 67 | 57 | 46 | 35 |
| QHOR: | 549 | 794 | 1143 | 1461 | 1799 | 1825 | 1769 | 1559 | 1299 | 949 | 577 | 476 |

ALBUQUERQUE, NEW MEXICO — ELEVATION = 5312 — LAT = 35.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 727.92 | 187.50 | 116.19 | 81.13 | 61.62 | 49.55 | 41.42 | 35.58 | 27.75 |
| VT2/DD | 623.13 | 160.23 | 99.29 | 69.33 | 52.66 | 42.34 | 35.39 | 30.40 | 23.71 |
| VT3/DD | 541.54 | 139.20 | 86.26 | 60.23 | 45.75 | 36.79 | 30.75 | 26.41 | 20.60 |
| MONTHLY DD | 59 | 209 | 337 | 482 | 635 | 789 | 944 | 1099 | 1409 |
| ANNUAL DD | 179 | 753 | 1257 | 1925 | 2734 | 3677 | 4784 | 6074 | 9108 |
| PARAMETER A | .420 | .416 | .468 | .501 | .508 | .503 | .501 | .503 | .469 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0543 | .0095 | .0075 | .0059 | .0050 | .0044 | .0044 | .0052 | .0102 |
| A2 | .8541 | .5942 | .5490 | .5665 | .6496 | .7647 | .8901 | 1.0279 | 1.4787 |
| A3 | -.8331 | -.7137 | -.6598 | -.6871 | -.8005 | -.9548 | -1.1269 | -1.3218 | -1.9594 |
| A4 | .6177 | .3785 | .3554 | .3782 | .4494 | .5440 | .6478 | .7629 | 1.1316 |
| A5 | .1115 | -.0165 | -.0168 | -.0249 | -.0413 | -.0606 | -.0841 | -.1138 | -.2090 |
| B1 | .0342 | .0189 | .0189 | .0189 | .0189 | .0189 | .0189 | .0189 | .0189 |
| B2 | -1.1590 | -1.1094 | -1.1095 | -1.1094 | -1.1094 | -1.1095 | -1.1094 | -1.1094 | -1.1094 |
| B3 | .7315 | .6633 | .6633 | .6633 | .6633 | .6633 | .6633 | .6633 | .6633 |
| B4 | .7190 | .8164 | .8164 | .8164 | .8164 | .8164 | .8164 | .8164 | .8164 |
| B5 | -1.3414 | -1.3401 | -1.3401 | -1.3401 | -1.3401 | -1.3401 | -1.3401 | -1.3401 | -1.3402 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 394526 — QTA2 = 328454 — QTA3 = 281992
AZIMUTH AND TILT COEF. — C1 = .0531 — C2 = -.2322 — C3 = -.5058 — C4 = 1.8563 — C5 = -1.3877

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 34 | 38 | 44 | 54 | 65 | 73 | 77 | 75 | 67 | 57 | 43 | 35 |
| QHOR: | 979 | 1345 | 1744 | 2289 | 2583 | 2653 | 2485 | 2308 | 1955 | 1596 | 1170 | 950 |

CLAYTON, NEW MEXICO — ELEVATION = 4970 — LAT = 36.4

| SOUTH-VERT. | TB30 (M=12) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 330.72 | 143.08 | 102.34 | 77.07 | 60.82 | 49.80 | 41.99 | 36.29 | 28.53 |
| VT2/DD | 283.39 | 122.60 | 87.70 | 66.04 | 52.12 | 42.67 | 35.98 | 31.09 | 24.45 |
| VT3/DD | 246.34 | 106.57 | 76.23 | 57.40 | 45.30 | 37.09 | 31.28 | 27.03 | 21.25 |
| MONTHLY DD | 125 | 289 | 404 | 537 | 680 | 831 | 985 | 1140 | 1450 |
| ANNUAL DD | 362 | 1023 | 1561 | 2241 | 3062 | 4036 | 5191 | 6533 | 9701 |
| PARAMETER A | .502 | .448 | .445 | .437 | .430 | .423 | .419 | .412 | .351 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0099 | .0164 | .0198 | .0245 | .0293 | .0336 | .0376 | .0412 | .0565 |
| A2 | .8240 | .9644 | 1.0279 | 1.1186 | 1.2347 | 1.3808 | 1.5654 | 1.7784 | 2.5891 |
| A3 | -.8385 | -.9693 | -1.0465 | -1.1591 | -1.3077 | -1.5051 | -1.7574 | -2.0469 | -3.1125 |
| A4 | .4919 | .5733 | .6205 | .6891 | .7783 | .8941 | 1.0406 | 1.2088 | 1.8326 |
| A5 | .0886 | .1101 | .1061 | .0988 | .0866 | .0644 | .0359 | .0049 | -.0893 |
| B1 | -.0035 | -.0035 | -.0035 | -.0035 | -.0035 | -.0035 | -.0035 | -.0035 | -.0035 |
| B2 | -1.1936 | -1.1936 | -1.1936 | -1.1936 | -1.1936 | -1.1936 | -1.1936 | -1.1936 | -1.1936 |
| B3 | .7618 | .7618 | .7618 | .7618 | .7618 | .7618 | .7618 | .7618 | .7618 |
| B4 | .6747 | .6747 | .6747 | .6747 | .6747 | .6747 | .6747 | .6747 | .6747 |
| B5 | -1.3429 | -1.3429 | -1.3429 | -1.3429 | -1.3429 | -1.3429 | -1.3429 | -1.3429 | -1.3429 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 387230 — QTA2 = 323041 — QTA3 = 277587

AZIMUTH AND TILT COEF. — C1 = .0338 — C2 = -.2928 — C3 = -.4199 — C4 = 1.7181 — C5 = -1.3864

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 33 | 36 | 42 | 53 | 61 | 70 | 74 | 73 | 65 | 55 | 42 | 33 |
| QHOR: | 972 | 1243 | 1725 | 2076 | 2264 | 2296 | 2323 | 2107 | 1779 | 1485 | 1037 | 861 |

LOS ALAMOS, NEW MEXICO — ELEVATION = 7380 — LAT = 35.8

| SOUTH-VERT. | TB30 (M=12) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M=11) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 217.86 | 93.09 | 69.00 | 54.45 | 44.93 | 38.27 | 32.67 | 28.49 | 22.27 |
| VT2/DD | 186.62 | 79.74 | 59.11 | 46.64 | 38.48 | 32.71 | 27.92 | 24.35 | 18.99 |
| VT3/DD | 162.19 | 69.31 | 51.37 | 40.54 | 33.45 | 28.42 | 24.26 | 21.16 | 16.49 |
| MONTHLY DD | 183 | 428 | 577 | 731 | 886 | 903 | 1058 | 1213 | 1246 |
| ANNUAL DD | 363 | 1241 | 1937 | 2790 | 3789 | 4953 | 6297 | 7809 | 11184 |
| PARAMETER A | .595 | .526 | .481 | .438 | .407 | .385 | .393 | .386 | .349 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0415 | -.0337 | -.0231 | -.0133 | -.0049 | .2371 | .2347 | .2424 | -.3778 |
| A2 | .3259 | .5814 | .7956 | 1.0708 | 1.3697 | 1.2926 | 1.4863 | 1.7509 | 1.8983 |
| A3 | -.2670 | -.5250 | -.7774 | -1.1163 | -1.4931 | -1.7108 | -1.9614 | -2.3143 | -2.6190 |
| A4 | .1853 | .3447 | .4905 | .6842 | .8977 | .8886 | 1.0325 | 1.2313 | 1.5627 |
| A5 | .0768 | .1021 | .0986 | .0832 | .0613 | -.1187 | -.1377 | -.1713 | -.3484 |
| B1 | .0383 | .0383 | .0383 | .0383 | .0383 | -.0199 | -.0199 | -.0199 | .1488 |
| B2 | -1.1982 | -1.1982 | -1.1982 | -1.1982 | -1.1982 | -1.1242 | -1.1242 | -1.1242 | -1.0068 |
| B3 | .7586 | .7586 | .7586 | .7586 | .7587 | .6897 | .6897 | .6897 | .5457 |
| B4 | .7138 | .7138 | .7138 | .7138 | .7138 | .8073 | .8073 | .8074 | .8743 |
| B5 | -1.3178 | -1.3177 | -1.3178 | -1.3177 | -1.3177 | -1.3081 | -1.3081 | -1.3081 | -1.3118 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 342227 — QTA2 = 284968 — QTA3 = 244705

AZIMUTH AND TILT COEF. — C1 = .1024 — C2 = -.2314 — C3 = -.4776 — C4 = 1.7964 — C5 = -1.3387

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 30 | 32 | 41 | 49 | 54 | 67 | 71 | 65 | 60 | 53 | 38 | 26 |
| QHOR: | 889 | 1191 | 1558 | 2141 | 2150 | 2272 | 2080 | 1974 | 1777 | 1410 | 796 | 898 |

ROSWELL, NEW MEXICO — ELEVATION = 3619 — LAT = 33.4

| SOUTH-VERT. | TB30 (M=12) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 853.90 | 217.54 | 138.53 | 97.57 | 73.62 | 58.25 | 47.75 | 40.29 | 30.61 |
| VT2/DD | 730.88 | 186.20 | 118.57 | 83.52 | 63.02 | 49.85 | 40.87 | 34.48 | 26.20 |
| VT3/DD | 635.21 | 161.83 | 103.05 | 72.58 | 54.77 | 43.33 | 35.52 | 29.97 | 22.77 |
| MONTHLY DD | 46 | 182 | 285 | 405 | 536 | 678 | 827 | 980 | 1290 |
| ANNUAL DD | 110 | 553 | 949 | 1488 | 2171 | 2990 | 3960 | 5101 | 7865 |
| PARAMETER A | .660 | .584 | .582 | .584 | .573 | .552 | .533 | .518 | .464 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0223 | .0347 | .0365 | .0385 | .0425 | .0477 | .0523 | .0560 | .0663 |
| A2 | .3584 | .5374 | .5845 | .6631 | .7804 | .9270 | 1.0816 | 1.2475 | 1.7588 |
| A3 | -.3716 | -.5743 | -.6321 | -.7367 | -.8905 | -1.0807 | -1.2853 | -1.5113 | -2.2201 |
| A4 | .2402 | .3658 | .4005 | .4598 | .5466 | .6535 | .7674 | .8923 | 1.2859 |
| A5 | .0160 | .0139 | .0101 | -.0009 | -.0148 | -.0297 | -.0479 | -.0722 | -.1588 |
| B1 | -.0306 | -.0306 | -.0306 | -.0306 | -.0306 | -.0306 | -.0306 | -.0306 | -.0306 |
| B2 | -1.1869 | -1.1869 | -1.1869 | -1.1869 | -1.1869 | -1.1869 | -1.1869 | -1.1869 | -1.1869 |
| B3 | .7315 | .7315 | .7315 | .7315 | .7315 | .7315 | .7315 | .7315 | .7315 |
| B4 | .7936 | .7936 | .7936 | .7936 | .7935 | .7936 | .7936 | .7935 | .7935 |
| B5 | -1.3433 | -1.3433 | -1.3434 | -1.3433 | -1.3433 | -1.3433 | -1.3433 | -1.3433 | -1.3433 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 372331 — QTA2 = 309904 — QTA3 = 266109

AZIMUTH AND TILT COEF. — C1 = .0005 — C2 = -.2095 — C3 = -.5640 — C4 = 1.9251 — C5 = -1.3598

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 39 | 43 | 51 | 59 | 69 | 77 | 78 | 79 | 69 | 59 | 49 | 38 |
| QHOR: | 1058 | 1382 | 1834 | 2219 | 2449 | 2586 | 2490 | 2195 | 1921 | 1479 | 1160 | 947 |

TRUTH OR CONSEQUENCES, NEW MEXICO — ELEVATION = 4859 — LAT = 33.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 491.46 | 200.02 | 133.58 | 95.63 | 72.38 | 57.41 | 47.30 | 40.16 | 30.84 |
| VT2/DD | 419.74 | 170.83 | 114.09 | 81.68 | 61.81 | 49.03 | 40.39 | 34.30 | 26.34 |
| VT3/DD | 364.69 | 148.43 | 99.12 | 70.96 | 53.71 | 42.60 | 35.10 | 29.80 | 22.89 |
| MONTHLY DD | 84 | 206 | 309 | 431 | 570 | 718 | 872 | 1026 | 1336 |
| ANNUAL DD | 124 | 511 | 883 | 1394 | 2062 | 2888 | 3878 | 5050 | 7916 |
| PARAMETER A | .658 | .727 | .700 | .674 | .650 | .618 | .584 | .562 | .500 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0005 | .0138 | .0189 | .0232 | .0269 | .0309 | .0349 | .0381 | .0487 |
| A2 | -.0283 | .0878 | .1513 | .2182 | .3115 | .4431 | .6087 | .7855 | 1.2873 |
| A3 | .0128 | -.1421 | -.2180 | -.3000 | -.4203 | -.5950 | -.8174 | -1.0586 | -1.7668 |
| A4 | -.0041 | .1009 | .1500 | .2013 | .2730 | .3750 | .5028 | .6387 | 1.0401 |
| A5 | -.0151 | -.0354 | -.0389 | -.0442 | -.0559 | -.0753 | -.1004 | -.1285 | -.2289 |
| B1 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 |
| B2 | -1.1041 | -1.1042 | -1.1042 | -1.1042 | -1.1042 | -1.1041 | -1.1041 | -1.1042 | -1.1042 |
| B3 | .6229 | .6229 | .6230 | .6229 | .6229 | .6229 | .6229 | .6229 | .6229 |
| B4 | .8873 | .8873 | .8873 | .8873 | .8873 | .8873 | .8873 | .8873 | .8873 |
| B5 | -1.3745 | -1.3745 | -1.3745 | -1.3745 | -1.3745 | -1.3745 | -1.3745 | -1.3745 | -1.3745 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 386862 — QTA2 = 321982 — QTA3 = 276433

AZIMUTH AND TILT COEF. — C1 = .0565 — C2 = -.2267 — C3 = -.5685 — C4 = 1.9430 — C5 = -1.3932

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 36 | 43 | 50 | 60 | 67 | 77 | 78 | 75 | 72 | 58 | 48 | 39 |
| QHOR: | 1066 | 1429 | 1850 | 2347 | 2570 | 2684 | 2382 | 2227 | 1965 | 1522 | 1256 | 1029 |

TUCUMCARI, NEW MEXICO — ELEVATION = 4039 — LAT = 35.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 2) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 2) |
| VT1/DD | 707.95 | 220.65 | 141.31 | 99.78 | 75.18 | 59.50 | 48.90 | 41.45 | 31.99 |
| VT2/DD | 600.17 | 187.07 | 120.76 | 85.26 | 64.24 | 50.84 | 41.79 | 35.42 | 27.12 |
| VT3/DD | 520.35 | 162.19 | 104.92 | 74.08 | 55.82 | 44.17 | 36.31 | 30.77 | 23.51 |
| MONTHLY DD | 50 | 161 | 298 | 421 | 559 | 707 | 860 | 1015 | 1111 |
| ANNUAL DD | 177 | 693 | 1146 | 1735 | 2466 | 3339 | 4366 | 5573 | 8502 |
| PARAMETER A | .216 | .293 | .346 | .372 | .383 | .384 | .386 | .386 | .347 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0964 | -.0754 | .0042 | -.0002 | -.0034 | -.0058 | -.0076 | -.0091 | -.0799 |
| A2 | -1.5724 | -.8493 | .6704 | .7248 | .8210 | .9526 | 1.1111 | 1.2913 | .7580 |
| A3 | 1.3452 | .6698 | -.7790 | -.8549 | -.9845 | -1.1603 | -1.3757 | -1.6223 | -1.3021 |
| A4 | -.9882 | -.5291 | .5337 | .5753 | .6511 | .7549 | .8810 | 1.0251 | .6889 |
| A5 | -.4003 | -.2658 | .0042 | -.0088 | -.0252 | -.0450 | -.0709 | -.1007 | -.3466 |
| B1 | .0317 | .0317 | .0121 | .0121 | .0121 | .0121 | .0121 | .0121 | .0317 |
| B2 | -.8596 | -.8596 | -1.0963 | -1.0963 | -1.0963 | -1.0963 | -1.0963 | -1.0963 | -.8596 |
| B3 | .2951 | .2951 | .6389 | .6389 | .6389 | .6389 | .6389 | .6389 | .2951 |
| B4 | 1.1321 | 1.1322 | .8093 | .8093 | .8093 | .8093 | .8092 | .8093 | 1.1322 |
| B5 | -1.4105 | -1.4106 | -1.3679 | -1.3679 | -1.3679 | -1.3679 | -1.3679 | -1.3679 | -1.4106 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 382497 — QTA2 = 318684 — QTA3 = 273696

AZIMUTH AND TILT COEF. — C1 = .0099 — C2 = -.2789 — C3 = -.4751 — C4 = 1.8214 — C5 = -1.3923

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 37 | 40 | 46 | 56 | 65 | 75 | 78 | 77 | 69 | 59 | 46 | 37 |
| QHOR: | 1011 | 1267 | 1742 | 2187 | 2265 | 2460 | 2383 | 2186 | 1893 | 1449 | 1072 | 930 |

ALBANY, NEW YORK — ELEVATION = 292 — LAT = 42.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 68.58 | 36.44 | 28.73 | 23.48 | 19.07 | 16.05 | 13.86 | 12.19 | 9.83 |
| VT2/DD | 58.71 | 31.19 | 24.60 | 20.09 | 16.32 | 13.73 | 11.86 | 10.43 | 8.41 |
| VT3/DD | 51.01 | 27.10 | 21.37 | 17.45 | 14.17 | 11.93 | 10.30 | 9.06 | 7.31 |
| MONTHLY DD | 307 | 578 | 733 | 670 | 824 | 979 | 1134 | 1289 | 1599 |
| ANNUAL DD | 773 | 1868 | 2645 | 3528 | 4519 | 5633 | 6886 | 8305 | 11586 |
| PARAMETER A | .549 | .557 | .544 | .555 | .620 | .674 | .724 | .770 | .829 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0058 | .0147 | .0193 | -.0019 | .0009 | .0028 | .0040 | .0048 | .0056 |
| A2 | .4414 | .5550 | .6486 | .5903 | .5785 | .5769 | .5787 | .5879 | .6517 |
| A3 | -.3952 | -.5196 | -.6227 | -.6560 | -.6525 | -.6608 | -.6737 | -.6972 | -.8025 |
| A4 | .2144 | .2654 | .3167 | .4550 | .4393 | .4348 | .4356 | .4445 | .5016 |
| A5 | .1089 | .1320 | .1432 | -.0431 | -.0402 | -.0408 | -.0444 | -.0514 | -.0745 |
| B1 | .0061 | .0061 | .0061 | .0143 | .0143 | .0143 | .0143 | .0143 | .0143 |
| B2 | -1.1572 | -1.1572 | -1.1572 | -1.1203 | -1.1203 | -1.1203 | -1.1203 | -1.1203 | -1.1203 |
| B3 | .7982 | .7983 | .7982 | .7906 | .7906 | .7906 | .7906 | .7905 | .7906 |
| B4 | .6327 | .6327 | .6327 | .5976 | .5976 | .5976 | .5976 | .5976 | .5976 |
| B5 | -1.2069 | -1.2069 | -1.2070 | -1.1403 | -1.1403 | -1.1403 | -1.1403 | -1.1403 | -1.1403 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 264255 — QTA2 = 220452 — QTA3 = 189523

AZIMUTH AND TILT COEF. — C1 = .0310 — C2 = -.2823 — C3 = -.2990 — C4 = 1.5752 — C5 = -1.2016

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 21 | 23 | 33 | 47 | 56 | 68 | 72 | 69 | 63 | 55 | 39 | 28 |
| QHOR: | 508 | 789 | 1076 | 1484 | 1870 | 1938 | 1928 | 1687 | 1223 | 902 | 519 | 400 |

BINGHAMTON, NEW YORK — ELEVATION = 1637 — LAT = 42.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 36.23 | 18.47 | 14.17 | 11.43 | 9.54 | 8.14 | 7.07 | 6.25 | 5.08 |
| VT2/DD | 30.86 | 15.72 | 12.06 | 9.73 | 8.12 | 6.93 | 6.02 | 5.32 | 4.32 |
| VT3/DD | 26.79 | 13.63 | 10.46 | 8.44 | 7.04 | 6.01 | 5.22 | 4.62 | 3.75 |
| MONTHLY DD | 335 | 453 | 590 | 731 | 876 | 1027 | 1182 | 1337 | 1647 |
| ANNUAL DD | 923 | 2172 | 3011 | 3950 | 5008 | 6199 | 7549 | 9071 | 12503 |
| PARAMETER A | .545 | .679 | .754 | .808 | .861 | .917 | .974 | 1.028 | 1.104 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0506 | -.1120 | -.1029 | -.0970 | -.0913 | -.0852 | -.0791 | -.0736 | -.0666 |
| A2 | .2675 | .1921 | .1980 | .2039 | .2079 | .2098 | .2123 | .2178 | .2459 |
| A3 | -.2587 | -.2770 | -.2764 | -.2797 | -.2828 | -.2844 | -.2881 | -.2968 | -.3400 |
| A4 | .1629 | .2473 | .2428 | .2424 | .2413 | .2386 | .2369 | .2386 | .2602 |
| A5 | .0402 | -.1279 | -.1140 | -.1064 | -.1007 | -.0957 | -.0922 | -.0907 | -.0960 |
| B1 | .0555 | .0859 | .0859 | .0859 | .0859 | .0859 | .0859 | .0859 | .0859 |
| B2 | -.9215 | -.8787 | -.8787 | -.8787 | -.8787 | -.8787 | -.8787 | -.8787 | -.8787 |
| B3 | .6072 | .6048 | .6048 | .6048 | .6048 | .6048 | .6048 | .6048 | .6048 |
| B4 | .7162 | .6892 | .6891 | .6891 | .6891 | .6891 | .6891 | .6891 | .6891 |
| B5 | -1.0690 | -.9882 | -.9882 | -.9882 | -.9882 | -.9882 | -.9882 | -.9882 | -.9882 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 203903 QTA2 = 169748 QTA3 = 145904

AZIMUTH AND TILT COEF. C1 = .0254 C2 = -.1900 C3 = -.3300 C4 = 1.5741 C5 =-1.0651

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 22 | 28 | 43 | 56 | 65 | 69 | 66 | 60 | 50 | 37 | 26 |
| QHOR: | 382 | 594 | 870 | 1261 | 1489 | 1673 | 1650 | 1449 | 1149 | 725 | 413 | 280 |

BUFFALO, NEW YORK — ELEVATION = 705 — LAT = 42.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 44.73 | 22.08 | 16.44 | 12.59 | 10.16 | 8.49 | 7.29 | 6.38 | 5.11 |
| VT2/DD | 38.07 | 18.80 | 14.00 | 10.72 | 8.65 | 7.23 | 6.20 | 5.43 | 4.35 |
| VT3/DD | 33.03 | 16.31 | 12.14 | 9.30 | 7.50 | 6.27 | 5.38 | 4.71 | 3.77 |
| MONTHLY DD | 229 | 463 | 484 | 631 | 783 | 936 | 1091 | 1246 | 1556 |
| ANNUAL DD | 661 | 1684 | 2433 | 3321 | 4346 | 5515 | 6830 | 8306 | 11679 |
| PARAMETER A | .540 | .586 | .642 | .732 | .807 | .874 | .934 | .989 | 1.074 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0296 | -.0573 | .0402 | .0309 | .0252 | .0210 | .0176 | .0149 | .0109 |
| A2 | .3405 | .3639 | .3476 | .3116 | .2896 | .2769 | .2708 | .2692 | .2806 |
| A3 | -.3521 | -.3920 | -.4017 | -.3648 | -.3442 | -.3348 | -.3336 | -.3380 | -.3655 |
| A4 | .1755 | .2162 | .2710 | .2481 | .2357 | .2306 | .2306 | .2339 | .2523 |
| A5 | .0601 | .0398 | -.0272 | -.0296 | -.0332 | -.0378 | -.0433 | -.0492 | -.0634 |
| B1 | .0706 | .0706 | .0259 | .0259 | .0259 | .0259 | .0259 | .0259 | .0259 |
| B2 | -.8883 | -.8883 | -.8881 | -.8881 | -.8881 | -.8881 | -.8881 | -.8881 | -.8881 |
| B3 | .6106 | .6106 | .6253 | .6253 | .6253 | .6253 | .6253 | .6253 | .6253 |
| B4 | .7130 | .7130 | .6852 | .6852 | .6852 | .6851 | .6851 | .6851 | .6851 |
| B5 | -1.0120 | -1.0120 | -.9822 | -.9822 | -.9822 | -.9822 | -.9822 | -.9822 | -.9822 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 203843 QTA2 = 169379 QTA3 = 145445

AZIMUTH AND TILT COEF. C1 = .0116 C2 = -.1584 C3 = -.3865 C4 = 1.6530 C5 =-1.0812

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 25 | 25 | 33 | 46 | 54 | 66 | 71 | 68 | 61 | 51 | 40 | 29 |
| QHOR: | 341 | 527 | 891 | 1281 | 1681 | 1799 | 1769 | 1485 | 1180 | 724 | 350 | 267 |

MASSENA, NEW YORK — ELEVATION = 207 — LAT = 44.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 32.49 | 20.29 | 16.95 | 14.55 | 12.75 | 11.34 | 10.11 | 9.05 | 7.50 |
| VT2/DD | 27.79 | 17.35 | 14.50 | 12.44 | 10.90 | 9.70 | 8.65 | 7.75 | 6.42 |
| VT3/DD | 24.14 | 15.07 | 12.59 | 10.81 | 9.47 | 8.42 | 7.51 | 6.73 | 5.57 |
| MONTHLY DD | 448 | 781 | 935 | 1089 | 1244 | 1398 | 1336 | 1491 | 1801 |
| ANNUAL DD | 1395 | 2746 | 3631 | 4640 | 5772 | 7030 | 8436 | 9985 | 13397 |
| PARAMETER A | .708 | .707 | .721 | .741 | .763 | .787 | .823 | .865 | .916 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0875 | .0898 | .0877 | .0843 | .0805 | .0764 | -.1015 | -.0950 | -.0882 |
| A2 | .1781 | .2674 | .2978 | .3236 | .3491 | .3750 | .4976 | .5051 | .5539 |
| A3 | -.1740 | -.2597 | -.2920 | -.3238 | -.3584 | -.3957 | -.5364 | -.5589 | -.6455 |
| A4 | .1104 | .1678 | .1889 | .2091 | .2305 | .2537 | .3526 | .3650 | .4159 |
| A5 | .0122 | .0221 | .0238 | .0217 | .0170 | .0103 | .0045 | -.0068 | -.0337 |
| B1 | -.0158 | -.0158 | -.0158 | -.0158 | -.0158 | -.0158 | .0805 | .0805 | .0805 |
| B2 | -1.0848 | -1.0848 | -1.0848 | -1.0848 | -1.0848 | -1.0848 | -1.1248 | -1.1248 | -1.1248 |
| B3 | .7346 | .7346 | .7346 | .7346 | .7346 | .7346 | .8001 | .8001 | .8001 |
| B4 | .6052 | .6052 | .6052 | .6052 | .6052 | .6052 | .5399 | .5399 | .5399 |
| B5 | -1.1485 | -1.1485 | -1.1485 | -1.1485 | -1.1485 | -1.1485 | -1.1287 | -1.1287 | -1.1287 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 259809 QTA2 = 216723 QTA3 = 186342

AZIMUTH AND TILT COEF. C1 = .0132 C2 = -.2560 C3 = -.3348 C4 = 1.5799 C5 =-1.2176

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 14 | 20 | 25 | 42 | 53 | 64 | 69 | 65 | 58 | 47 | 34 | 21 |
| QHOR: | 403 | 669 | 1083 | 1522 | 1831 | 2022 | 1980 | 1697 | 1263 | 812 | 434 | 327 |

NEW YORK (LA GUARDIA), NEW YORK — ELEVATION = 52 — LAT = 40.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) |
| VT1/DD | 193.36 | 66.65 | 45.23 | 33.57 | 26.61 | 21.98 | 18.69 | 16.07 | 12.35 |
| VT2/DD | 165.21 | 56.95 | 38.65 | 28.68 | 22.73 | 18.78 | 15.97 | 13.75 | 10.57 |
| VT3/DD | 143.47 | 49.45 | 33.56 | 24.91 | 19.74 | 16.31 | 13.87 | 11.94 | 9.18 |
| MONTHLY DD | 100 | 290 | 427 | 576 | 726 | 879 | 1034 | 1033 | 1341 |
| ANNUAL DD | 204 | 782 | 1328 | 2029 | 2861 | 3849 | 4998 | 6316 | 9495 |
| PARAMETER A | .640 | .557 | .538 | .542 | .538 | .546 | .557 | .585 | .661 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0469 | .0684 | .0738 | .0752 | .0779 | .0779 | .0774 | .0199 | .0208 |
| A2 | .2046 | .3590 | .4429 | .5103 | .5944 | .6622 | .7355 | .9914 | 1.0036 |
| A3 | -.2061 | -.3698 | -.4591 | -.5354 | -.6324 | -.7163 | -.8134 | -1.0992 | -1.1546 |
| A4 | .1331 | .2360 | .2915 | .3378 | .3968 | .4477 | .5070 | .6614 | .6963 |
| A5 | .0265 | .0410 | .0495 | .0528 | .0551 | .0517 | .0421 | .0424 | .0086 |
| B1 | -.0331 | -.0331 | -.0331 | -.0331 | -.0331 | -.0331 | -.0331 | -.0121 | -.0121 |
| B2 | -1.0800 | -1.0800 | -1.0800 | -1.0800 | -1.0800 | -1.0800 | -1.0800 | -1.1401 | -1.1401 |
| B3 | .7280 | .7279 | .7279 | .7279 | .7279 | .7279 | .7279 | .8061 | .8061 |
| B4 | .7081 | .7081 | .7081 | .7081 | .7081 | .7081 | .7081 | .6462 | .6462 |
| B5 | -1.1736 | -1.1736 | -1.1736 | -1.1736 | -1.1736 | -1.1736 | -1.1736 | -1.1582 | -1.1582 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 241010 — QTA2 = 201255 — QTA3 = 173178

AZIMUTH AND TILT COEF. — C1 = .0224 — C2 = -.3712 — C3 = -.1597 — C4 = 1.5321 — C5 = -1.1270

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 31 | 33 | 40 | 50 | 59 | 70 | 76 | 74 | 68 | 58 | 48 | 36 |
| QHOR: | 531 | 793 | 1069 | 1422 | 1545 | 1677 | 1615 | 1426 | 1206 | 904 | 559 | 433 |

NEW YORK (CENTRAL PARK), NEW YORK — ELEVATION = 187 — LAT = 40.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 231.35 | 69.98 | 45.25 | 32.77 | 25.61 | 20.52 | 16.85 | 14.29 | 10.96 |
| VT2/DD | 197.93 | 59.87 | 38.71 | 28.04 | 21.91 | 17.56 | 14.42 | 12.23 | 9.38 |
| VT3/DD | 171.92 | 52.00 | 33.62 | 24.35 | 19.03 | 15.25 | 12.52 | 10.62 | 8.15 |
| MONTHLY DD | 79 | 260 | 402 | 555 | 710 | 711 | 866 | 1021 | 1331 |
| ANNUAL DD | 196 | 781 | 1330 | 2041 | 2908 | 3914 | 5085 | 6473 | 9768 |
| PARAMETER A | .325 | .448 | .459 | .465 | .487 | .547 | .622 | .689 | .771 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .2016 | .2075 | .2458 | .2885 | .3114 | .0831 | .0864 | .0868 | .0886 |
| A2 | .7682 | .6303 | .6848 | .7333 | .7663 | .8152 | .7817 | .7698 | .8259 |
| A3 | -.6616 | -.6053 | -.6662 | -.7200 | -.7726 | -.8871 | -.8772 | -.8895 | -1.0006 |
| A4 | .3912 | .3640 | .4025 | .4315 | .4562 | .5336 | .5235 | .5277 | .5872 |
| A5 | .2068 | .1251 | .1302 | .1361 | .1260 | .0173 | -.0019 | -.0203 | -.0532 |
| B1 | -.1092 | -.1092 | -.1092 | -.1092 | -.1092 | -.0363 | -.0363 | -.0363 | -.0363 |
| B2 | -1.1468 | -1.1468 | -1.1468 | -1.1468 | -1.1468 | -1.1650 | -1.1649 | -1.1650 | -1.1649 |
| B3 | .8010 | .8010 | .8010 | .8010 | .8010 | .8336 | .8335 | .8336 | .8335 |
| B4 | .6799 | .6799 | .6799 | .6799 | .6799 | .6492 | .6492 | .6492 | .6492 |
| B5 | -1.2024 | -1.2024 | -1.2024 | -1.2024 | -1.2024 | -1.1640 | -1.1640 | -1.1640 | -1.1640 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 237904 — QTA2 = 198407 — QTA3 = 170587

AZIMUTH AND TILT COEF. — C1 = .0560 — C2 = -.3376 — C3 = -.2214 — C4 = 1.5814 — C5 = -1.1662

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 32 | 32 | 39 | 52 | 59 | 67 | 73 | 74 | 66 | 57 | 47 | 37 |
| QHOR: | 466 | 727 | 1035 | 1352 | 1657 | 1720 | 1625 | 1502 | 1189 | 906 | 524 | 379 |

ROCHESTER, NEW YORK — ELEVATION = 554 — LAT = 43.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 39.16 | 19.88 | 15.52 | 12.63 | 10.29 | 8.68 | 7.51 | 6.61 | 5.34 |
| VT2/DD | 33.35 | 16.93 | 13.22 | 10.77 | 8.77 | 7.40 | 6.40 | 5.64 | 4.55 |
| VT3/DD | 28.94 | 14.69 | 11.47 | 9.35 | 7.61 | 6.42 | 5.56 | 4.89 | 3.95 |
| MONTHLY DD | 274 | 540 | 691 | 681 | 836 | 991 | 1146 | 1301 | 1611 |
| ANNUAL DD | 741 | 1873 | 2656 | 3565 | 4608 | 5781 | 7110 | 8583 | 11912 |
| PARAMETER A | .577 | .644 | .676 | .719 | .807 | .879 | .942 | .997 | 1.077 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0731 | -.0619 | -.0573 | .0275 | .0248 | .0234 | .0227 | .0224 | .0228 |
| A2 | .1853 | .2068 | .2168 | .3497 | .3214 | .3068 | .2995 | .2973 | .3104 |
| A3 | -.1939 | -.2278 | -.2420 | -.3929 | -.3670 | -.3563 | -.3540 | -.3577 | -.3877 |
| A4 | .1629 | .1769 | .1851 | .2863 | .2668 | .2583 | .2558 | .2574 | .2756 |
| A5 | -.0062 | -.0087 | -.0104 | -.0355 | -.0369 | -.0396 | -.0432 | -.0477 | -.0605 |
| B1 | -.0238 | -.0238 | -.0238 | -.0628 | -.0628 | -.0628 | -.0628 | -.0628 | -.0628 |
| B2 | -.9112 | -.9112 | -.9112 | -.9583 | -.9583 | -.9583 | -.9583 | -.9583 | -.9583 |
| B3 | .6093 | .6093 | .6093 | .6749 | .6748 | .6748 | .6748 | .6748 | .6748 |
| B4 | .7106 | .7106 | .7106 | .6459 | .6459 | .6459 | .6459 | .6459 | .6459 |
| B5 | -1.0511 | -1.0511 | -1.0511 | -1.0243 | -1.0244 | -1.0244 | -1.0244 | -1.0244 | -1.0244 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 213006 — QTA2 = 177157 — QTA3 = 152172

AZIMUTH AND TILT COEF. — C1 = -.0115 — C2 = -.2019 — C3 = -.3521 — C4 = 1.6364 — C5 = -1.1125

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 22 | 22 | 31 | 46 | 55 | 67 | 71 | 68 | 62 | 51 | 40 | 28 |
| QHOR: | 343 | 564 | 907 | 1353 | 1608 | 1810 | 1839 | 1524 | 1180 | 721 | 408 | 266 |

SYRACUSE, NEW YORK — ELEVATION = 407 — LAT = 43.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 39.09 | 20.90 | 16.60 | 13.75 | 11.67 | 9.85 | 8.49 | 7.44 | 5.97 |
| VT2/DD | 33.33 | 17.81 | 14.15 | 11.72 | 9.95 | 8.39 | 7.23 | 6.34 | 5.09 |
| VT3/DD | 28.92 | 15.46 | 12.28 | 10.18 | 8.64 | 7.29 | 6.28 | 5.51 | 4.42 |
| MONTHLY DD | 315 | 589 | 741 | 894 | 801 | 950 | 1102 | 1256 | 1566 |
| ANNUAL DD | 793 | 1894 | 2641 | 3513 | 4512 | 5669 | 6983 | 8449 | 11793 |
| PARAMETER A | .492 | .578 | .611 | .643 | .678 | .755 | .825 | .887 | .977 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0184 | -.0196 | -.0208 | -.0209 | -.0580 | -.0506 | -.0445 | -.0396 | -.0334 |
| A2 | .3342 | .3531 | .3611 | .3650 | .3637 | .3434 | .3314 | .3279 | .3470 |
| A3 | -.3343 | -.3693 | -.3824 | -.3934 | -.4148 | -.3995 | -.3934 | -.3976 | -.4393 |
| A4 | .1660 | .1954 | .2088 | .2210 | .3052 | .2919 | .2851 | .2852 | .3080 |
| A5 | .0721 | .0578 | .0518 | .0432 | -.0390 | -.0422 | -.0460 | -.0513 | -.0667 |
| B1 | -.0063 | -.0063 | -.0063 | -.0063 | .0115 | .0115 | .0115 | .0115 | .0115 |
| B2 | -.9528 | -.9528 | -.9528 | -.9528 | -.9490 | -.9490 | -.9490 | -.9490 | -.9490 |
| B3 | .6510 | .6510 | .6510 | .6510 | .6635 | .6635 | .6635 | .6635 | .6635 |
| B4 | .6935 | .6935 | .6935 | .6935 | .6529 | .6529 | .6529 | .6529 | .6529 |
| B5 | -1.0677 | -1.0676 | -1.0676 | -1.0677 | -1.0270 | -1.0271 | -1.0271 | -1.0270 | -1.0270 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 211744 — QTA2 = 176235 — QTA3 = 151435

AZIMUTH AND TILT COEF. — C1 = -.0261 — C2 = -.2099 — C3 = -.3345 — C4 = 1.5985 — C5 = -1.0974

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 21 | 23 | 32 | 47 | 57 | 66 | 70 | 69 | 62 | 50 | 40 | 29 |
| QHOR: | 380 | 530 | 870 | 1339 | 1573 | 1736 | 1757 | 1553 | 1144 | 738 | 395 | 290 |

ASHEVILLE, NORTH CAROLINA — ELEVATION = 2169 — LAT = 35.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) |
| VT1/DD | 532.54 | 149.37 | 93.59 | 64.46 | 47.73 | 37.47 | 30.71 | 26.01 | 19.91 |
| VT2/DD | 450.93 | 126.48 | 79.25 | 54.58 | 40.42 | 31.73 | 26.00 | 22.02 | 16.86 |
| VT3/DD | 390.86 | 109.63 | 68.69 | 47.31 | 35.03 | 27.50 | 22.54 | 19.09 | 14.61 |
| MONTHLY DD | 45 | 159 | 254 | 369 | 498 | 635 | 775 | 915 | 1195 |
| ANNUAL DD | 156 | 655 | 1095 | 1668 | 2419 | 3372 | 4536 | 5936 | 9202 |
| PARAMETER A | .496 | .441 | .449 | .474 | .486 | .494 | .505 | .517 | .469 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0438 | -.0609 | -.0638 | -.0630 | -.0650 | -.0683 | -.0706 | -.0721 | -.0862 |
| A2 | -.6194 | -.4459 | -.3824 | -.3175 | -.2469 | -.1571 | -.0352 | .1188 | .5346 |
| A3 | .5593 | .3511 | .2830 | .2150 | .1322 | .0211 | -.1324 | -.3302 | -.8954 |
| A4 | -.3924 | -.2720 | -.2269 | -.1807 | -.1270 | -.0574 | .0364 | .1548 | .4780 |
| A5 | -.1268 | -.1283 | -.1237 | -.1182 | -.1187 | -.1228 | -.1294 | -.1386 | -.1769 |
| B1 | .0267 | .0267 | .0267 | .0267 | .0267 | .0267 | .0267 | .0267 | .0267 |
| B2 | -.8004 | -.8004 | -.8004 | -.8004 | -.8004 | -.8004 | -.8004 | -.8004 | -.8004 |
| B3 | .3294 | .3294 | .3294 | .3294 | .3294 | .3294 | .3294 | .3294 | .3294 |
| B4 | 1.1329 | 1.1328 | 1.1329 | 1.1329 | 1.1329 | 1.1329 | 1.1329 | 1.1329 | 1.1329 |
| B5 | -1.2786 | -1.2785 | -1.2786 | -1.2786 | -1.2786 | -1.2786 | -1.2786 | -1.2786 | -1.2786 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 277780 — QTA2 = 231614 — QTA3 = 199158

AZIMUTH AND TILT COEF. — C1 = -.0128 — C2 = -.3038 — C3 = -.3116 — C4 = 1.6831 — C5 = -1.1941

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 40 | 37 | 43 | 56 | 64 | 69 | 71 | 70 | 63 | 55 | 44 | 40 |
| QHOR: | 709 | 966 | 1343 | 1686 | 1827 | 1830 | 1774 | 1582 | 1356 | 1148 | 851 | 655 |

CAPE HATTERAS, NORTH CAROLINA — ELEVATION = 7 — LAT = 35.3

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 416.09 | 207.51 | 121.35 | 80.97 | 57.82 | 43.09 | 34.08 | 23.99 |
| VT2/DD | NA | 352.52 | 175.81 | 102.81 | 68.60 | 48.99 | 36.74 | 29.06 | 20.46 |
| VT3/DD | NA | 305.63 | 152.43 | 89.14 | 59.48 | 42.47 | 31.91 | 25.23 | 17.77 |
| MONTHLY DD | 9 | 57 | 114 | 195 | 292 | 408 | 583 | 738 | 1048 |
| ANNUAL DD | 15 | 152 | 355 | 700 | 1212 | 1881 | 2739 | 3787 | 6603 |
| PARAMETER A | NA | .529 | .533 | .458 | .389 | .383 | .408 | .434 | .489 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0324 | .0396 | .0614 | .0957 | .1160 | -.0114 | .0018 | .0185 |
| A2 | NA | -.4642 | -.4445 | -.4719 | -.4292 | -.2916 | .6428 | .7539 | .9908 |
| A3 | NA | .3138 | .2819 | .2718 | .1766 | .0083 | -.7153 | -.8784 | -1.2371 |
| A4 | NA | -.3536 | -.3317 | -.3575 | -.3339 | -.2328 | .6197 | .7028 | .8807 |
| A5 | NA | -.1185 | -.1237 | -.1406 | -.1575 | -.1616 | -.0382 | -.0620 | -.1149 |
| B1 | NA | -.0516 | -.0516 | -.0516 | -.0516 | -.0516 | -.0118 | -.0118 | -.0118 |
| B2 | NA | -.8319 | -.8319 | -.8319 | -.8319 | -.8319 | -1.0059 | -1.0059 | -1.0059 |
| B3 | NA | .3978 | .3978 | .3978 | .3978 | .3978 | .5975 | .5975 | .5976 |
| B4 | NA | 1.1301 | 1.1301 | 1.1301 | 1.1301 | 1.1301 | .8397 | .8397 | .8397 |
| B5 | NA | -1.2625 | -1.2626 | -1.2626 | -1.2626 | -1.2626 | -1.2575 | -1.2575 | -1.2574 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 283396 — QTA2 = 236025 — QTA3 = 202827

AZIMUTH AND TILT COEF. — C1 = .0086 — C2 = -.2553 — C3 = -.3715 — C4 = 1.7536 — C5 = -1.2141

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 46 | 45 | 51 | 60 | 67 | 75 | 78 | 77 | 73 | 65 | 55 | 47 |
| QHOR: | 719 | 971 | 1274 | 1739 | 1961 | 2048 | 1898 | 1685 | 1506 | 1171 | 898 | 637 |

CHARLOTTE, NORTH CAROLINA — ELEVATION = 768 — LAT = 35.2

| SOUTH-VERT. | TB30 (M= 2) | TB40 (M= 2) | TB45 (M= 2) | TB50 (M= 2) | TB55 (M= 2) | TB60 (M= 2) | TB65 (M= 2) | TB70 (M= 2) | TB80 (M= 2) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 637.55 | 164.48 | 106.47 | 75.45 | 55.38 | 42.47 | 33.94 | 28.00 | 20.67 |
| VT2/DD | 539.46 | 139.18 | 90.09 | 63.84 | 46.86 | 35.94 | 28.72 | 23.69 | 17.49 |
| VT3/DD | 467.52 | 120.62 | 78.08 | 55.33 | 40.61 | 31.15 | 24.89 | 20.53 | 15.16 |
| MONTHLY DD | 35 | 134 | 207 | 293 | 399 | 520 | 650 | 789 | 1068 |
| ANNUAL DD | 103 | 464 | 798 | 1265 | 1875 | 2641 | 3574 | 4708 | 7644 |
| PARAMETER A | .547 | .539 | .509 | .475 | .468 | .468 | .483 | .519 | .578 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0530 | -.0642 | -.0745 | -.0856 | -.0915 | -.0961 | -.0968 | -.0925 | -.0873 |
| A2 | -.6365 | -.6295 | -.6425 | -.6453 | -.5951 | -.5242 | -.4246 | -.2913 | .0267 |
| A3 | .6197 | .6066 | .6152 | .6106 | .5506 | .4670 | .3521 | .1986 | -.2000 |
| A4 | -.3038 | -.2910 | -.2883 | -.2754 | -.2330 | -.1768 | -.1052 | -.0173 | .2095 |
| A5 | -.1702 | -.1766 | -.1866 | -.1986 | -.2010 | -.2020 | -.1984 | -.1900 | -.1978 |
| B1 | .0524 | .0524 | .0524 | .0524 | .0524 | .0524 | .0524 | .0524 | .0524 |
| B2 | -.7450 | -.7450 | -.7450 | -.7450 | -.7450 | -.7450 | -.7450 | -.7450 | -.7450 |
| B3 | .2628 | .2628 | .2628 | .2628 | .2628 | .2628 | .2628 | .2628 | .2628 |
| B4 | 1.1155 | 1.1155 | 1.1155 | 1.1155 | 1.1155 | 1.1155 | 1.1155 | 1.1154 | 1.1155 |
| B5 | -1.2534 | -1.2534 | -1.2534 | -1.2535 | -1.2535 | -1.2535 | -1.2534 | -1.2534 | -1.2535 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 284778 — QTA2 = 237355 — QTA3 = 204057

AZIMUTH AND TILT COEF. — C1 = -.0023 — C2 = -.2818 — C3 = -.3425 — C4 = 1.7068 — C5 = -1.1967

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 39 | 41 | 49 | 60 | 69 | 74 | 76 | 76 | 72 | 60 | 49 | 42 |
| QHOR: | 766 | 904 | 1343 | 1643 | 1825 | 1994 | 1864 | 1768 | 1450 | 1224 | 875 | 634 |

CHERRY POINT, NORTH CAROLINA — ELEVATION = 36 — LAT = 34.9

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | 374.01 | 198.25 | 120.04 | 81.13 | 59.43 | 45.69 | 36.53 | 25.85 |
| VT2/DD | NA | 319.08 | 169.14 | 102.41 | 69.22 | 50.70 | 38.98 | 31.17 | 22.05 |
| VT3/DD | NA | 277.10 | 146.88 | 88.93 | 60.11 | 44.03 | 33.85 | 27.06 | 19.15 |
| MONTHLY DD | 12 | 73 | 138 | 228 | 337 | 460 | 598 | 748 | 1057 |
| ANNUAL DD | 23 | 184 | 412 | 764 | 1260 | 1899 | 2708 | 3732 | 6532 |
| PARAMETER A | NA | .621 | .561 | .520 | .485 | .463 | .455 | .467 | .502 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0419 | .0662 | .0832 | .0981 | .1097 | .1183 | .1214 | .1230 |
| A2 | NA | .2496 | .3005 | .3612 | .4566 | .5576 | .6709 | .7908 | 1.0721 |
| A3 | NA | -.2594 | -.3305 | -.4082 | -.5235 | -.6507 | -.7982 | -.9631 | -1.3641 |
| A4 | NA | .1976 | .2360 | .2774 | .3413 | .4113 | .4907 | .5782 | .7909 |
| A5 | NA | .0059 | .0016 | .0016 | .0037 | .0010 | -.0057 | -.0198 | -.0618 |
| B1 | NA | -.0571 | -.0571 | -.0571 | -.0571 | -.0571 | -.0571 | -.0571 | -.0571 |
| B2 | NA | -1.0478 | -1.0478 | -1.0478 | -1.0478 | -1.0478 | -1.0478 | -1.0478 | -1.0478 |
| B3 | NA | .6382 | .6382 | .6382 | .6381 | .6382 | .6382 | .6382 | .6382 |
| B4 | NA | .8595 | .8595 | .8595 | .8595 | .8595 | .8595 | .8595 | .8595 |
| B5 | NA | -1.2627 | -1.2626 | -1.2627 | -1.2627 | -1.2627 | -1.2627 | -1.2627 | -1.2627 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 289407 — QTA2 = 241299 — QTA3 = 207484

AZIMUTH AND TILT COEF. — C1 = .0102 — C2 = -.2834 — C3 = -.3330 — C4 = 1.6988 — C5 = -1.1849

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 45 | 45 | 52 | 61 | 69 | 75 | 78 | 77 | 74 | 64 | 54 | 47 |
| QHOR: | 789 | 1048 | 1448 | 1732 | 1928 | 1997 | 1867 | 1662 | 1398 | 1125 | 893 | 732 |

GREENSBORO, NORTH CAROLINA — ELEVATION = 886 — LAT = 36.1

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 2) | TB65 (M= 2) | TB70 (M= 2) | TB80 (M= 2) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 606.77 | 162.51 | 100.18 | 68.84 | 51.36 | 40.37 | 32.48 | 27.17 | 20.47 |
| VT2/DD | 518.02 | 138.74 | 85.53 | 58.77 | 43.85 | 34.18 | 27.50 | 23.00 | 17.33 |
| VT3/DD | 449.91 | 120.50 | 74.28 | 51.04 | 38.09 | 29.63 | 23.84 | 19.94 | 15.02 |
| MONTHLY DD | 46 | 172 | 280 | 407 | 545 | 576 | 716 | 856 | 1136 |
| ANNUAL DD | 92 | 515 | 929 | 1487 | 2183 | 3022 | 4023 | 5215 | 8231 |
| PARAMETER A | .564 | .513 | .455 | .443 | .450 | .470 | .509 | .539 | .564 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0303 | -.0677 | -.0848 | -.0946 | -.1003 | -.0047 | -.0126 | -.0201 | -.0368 |
| A2 | .0598 | .3408 | .4400 | .5099 | .5685 | -.4310 | -.3038 | -.1729 | .1393 |
| A3 | -.0817 | -.3409 | -.4311 | -.4999 | -.5713 | .2500 | .1138 | -.0370 | -.4318 |
| A4 | .0537 | .2427 | .3109 | .3618 | .4104 | -.1720 | -.0831 | .0111 | .2467 |
| A5 | .0012 | .0579 | .0796 | .0884 | .0827 | -.2262 | -.2155 | -.2116 | -.2269 |
| B1 | .0633 | .0633 | .0633 | .0633 | .0633 | .0376 | .0376 | .0376 | .0376 |
| B2 | -1.0544 | -1.0544 | -1.0544 | -1.0544 | -1.0544 | -.7843 | -.7843 | -.7843 | -.7843 |
| B3 | .6400 | .6400 | .6400 | .6400 | .6400 | .3283 | .3283 | .3283 | .3283 |
| B4 | .8034 | .8034 | .8034 | .8034 | .8034 | 1.1089 | 1.1089 | 1.1089 | 1.1089 |
| B5 | -1.2795 | -1.2794 | -1.2794 | -1.2795 | -1.2795 | -1.2476 | -1.2476 | -1.2476 | -1.2476 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 290432 — QTA2 = 242227 — QTA3 = 208282

AZIMUTH AND TILT COEF. — C1 = -.0121 — C2 = -.3077 — C3 = -.3185 — C4 = 1.6775 — C5 = -1.2116

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 37 | 39 | 46 | 59 | 66 | 73 | 75 | 75 | 69 | 58 | 49 | 40 |
| QHOR: | 750 | 953 | 1350 | 1775 | 1785 | 2009 | 1845 | 1691 | 1376 | 1193 | 854 | 668 |

RALEIGH-DURHAM, NORTH CAROLINA — ELEVATION = 440 — LAT = 35.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 2) | (M= 2) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 599.43 | 152.80 | 100.23 | 63.98 | 45.05 | 33.90 | 26.93 | 22.27 | 16.47 |
| VT2/DD | 507.57 | 129.39 | 84.87 | 54.48 | 38.37 | 28.87 | 22.94 | 18.96 | 14.03 |
| VT3/DD | 440.03 | 112.17 | 73.57 | 47.29 | 33.30 | 25.06 | 19.91 | 16.46 | 12.18 |
| MONTHLY DD | 37 | 144 | 220 | 306 | 434 | 577 | 727 | 879 | 1188 |
| ANNUAL DD | 84 | 468 | 841 | 1346 | 1981 | 2780 | 3753 | 4910 | 7904 |
| PARAMETER A | .539 | .542 | .436 | .504 | .555 | .599 | .627 | .648 | .693 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0731 | -.0795 | -.1019 | .0906 | .0800 | .0727 | .0684 | .0648 | .0566 |
| A2 | -.3654 | -.3509 | -.4299 | .3593 | .3662 | .3900 | .4395 | .5017 | .6540 |
| A3 | .3990 | .3757 | .4575 | -.4746 | -.4850 | -.5186 | -.5877 | -.6750 | -.8945 |
| A4 | -.2266 | -.2140 | -.2586 | .2594 | .2653 | .2835 | .3203 | .3668 | .4855 |
| A5 | -.0233 | -.0264 | -.0346 | -.0363 | -.0380 | -.0420 | -.0492 | -.0585 | -.0863 |
| B1 | .0346 | .0346 | .0346 | -.0306 | -.0306 | -.0306 | -.0306 | -.0306 | -.0306 |
| B2 | -.7727 | -.7727 | -.7727 | -.9700 | -.9700 | -.9700 | -.9700 | -.9700 | -.9700 |
| B3 | .3505 | .3505 | .3505 | .6290 | .6290 | .6290 | .6290 | .6290 | .6290 |
| B4 | 1.0960 | 1.0960 | 1.0961 | .8657 | .8656 | .8656 | .8656 | .8656 | .8656 |
| B5 | -1.1827 | -1.1827 | -1.1827 | -1.1407 | -1.1406 | -1.1406 | -1.1406 | -1.1406 | -1.1407 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 260975 QTA2 = 217348 QTA3 = 186833
AZIMUTH AND TILT COEF. C1 = -.0065 C2 = -.2162 C3 = -.3516 C4 = 1.6793 C5 =-1.1075

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 41 | 41 | 48 | 58 | 66 | 74 | 76 | 75 | 70 | 57 | 50 | 41 |
| QHOR: | 650 | 943 | 1265 | 1659 | 1756 | 1865 | 1832 | 1673 | 1358 | 1096 | 847 | 636 |

BISMARK, NORTH DAKOTA — ELEVATION = 1647 — LAT = 46.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 37.81 | 24.92 | 21.16 | 18.38 | 16.16 | 14.41 | 13.01 | 11.85 | 10.07 |
| VT2/DD | 32.40 | 21.35 | 18.13 | 15.75 | 13.87 | 12.37 | 11.16 | 10.17 | 8.64 |
| VT3/DD | 28.15 | 18.55 | 15.76 | 13.68 | 12.05 | 10.75 | 9.70 | 8.84 | 7.51 |
| MONTHLY DD | 573 | 869 | 1023 | 1178 | 1280 | 1435 | 1590 | 1745 | 2055 |
| ANNUAL DD | 1955 | 3413 | 4330 | 5365 | 6522 | 7789 | 9166 | 10680 | 14025 |
| PARAMETER A | .513 | .564 | .585 | .611 | .642 | .670 | .694 | .717 | .742 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0405 | .0457 | .0475 | .0483 | -.0899 | -.0820 | -.0752 | -.0692 | -.0609 |
| A2 | .2773 | .3684 | .4105 | .4444 | .6745 | .6937 | .7180 | .7464 | .8358 |
| A3 | -.2852 | -.3779 | -.4214 | -.4581 | -.5591 | -.5963 | -.6405 | -.6918 | -.8335 |
| A4 | .1645 | .2264 | .2567 | .2834 | .4304 | .4517 | .4773 | .5071 | .5929 |
| A5 | -.0044 | .0042 | .0071 | .0079 | .1295 | .1165 | .1026 | .0862 | .0501 |
| B1 | -.0260 | -.0260 | -.0260 | -.0260 | .0264 | .0264 | .0264 | .0264 | .0264 |
| B2 | -1.1645 | -1.1645 | -1.1645 | -1.1645 | -1.2259 | -1.2259 | -1.2259 | -1.2259 | -1.2259 |
| B3 | .8123 | .8123 | .8123 | .8123 | .8804 | .8804 | .8804 | .8804 | .8804 |
| B4 | .5224 | .5223 | .5224 | .5223 | .4391 | .4390 | .4391 | .4391 | .4390 |
| B5 | -1.1847 | -1.1846 | -1.1847 | -1.1846 | -1.1902 | -1.1901 | -1.1902 | -1.1902 | -1.1902 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 308278 QTA2 = 258078 QTA3 = 222207
AZIMUTH AND TILT COEF. C1 = .0165 C2 = -.3878 C3 = -.1867 C4 = 1.4661 C5 =-1.2829

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 12 | 14 | 27 | 40 | 55 | 63 | 70 | 72 | 55 | 44 | 28 | 13 |
| QHOR: | 473 | 783 | 1123 | 1459 | 1861 | 2081 | 2188 | 1888 | 1321 | 877 | 509 | 399 |

FARGO, NORTH DAKOTA — ELEVATION = 899 — LAT = 46.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 23.83 | 17.32 | 15.22 | 13.57 | 12.24 | 11.15 | 10.24 | 9.46 | 8.22 |
| VT2/DD | 20.43 | 14.85 | 13.04 | 11.63 | 10.49 | 9.56 | 8.78 | 8.11 | 7.05 |
| VT3/DD | 17.75 | 12.90 | 11.34 | 10.11 | 9.12 | 8.31 | 7.63 | 7.05 | 6.13 |
| MONTHLY DD | 815 | 1121 | 1276 | 1431 | 1586 | 1741 | 1896 | 2051 | 2361 |
| ANNUAL DD | 2229 | 3734 | 4643 | 5650 | 6775 | 8027 | 9408 | 10905 | 14213 |
| PARAMETER A | .644 | .678 | .692 | .712 | .739 | .769 | .799 | .824 | .854 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0287 | -.0330 | -.0345 | -.0347 | -.0340 | -.0329 | -.0317 | -.0309 | -.0306 |
| A2 | .2372 | .3119 | .3473 | .3746 | .3978 | .4183 | .4397 | .4661 | .5444 |
| A3 | -.2215 | -.2993 | -.3379 | -.3701 | -.4009 | -.4302 | -.4624 | -.5018 | -.6152 |
| A4 | .1085 | .1545 | .1778 | .1979 | .2177 | .2371 | .2580 | .2830 | .3529 |
| A5 | .0399 | .0475 | .0494 | .0487 | .0449 | .0396 | .0326 | .0242 | .0023 |
| B1 | .0358 | .0358 | .0358 | .0358 | .0358 | .0358 | .0358 | .0358 | .0358 |
| B2 | -1.1942 | -1.1942 | -1.1942 | -1.1942 | -1.1942 | -1.1942 | -1.1942 | -1.1942 | -1.1942 |
| B3 | .8396 | .8396 | .8395 | .8396 | .8396 | .8396 | .8396 | .8396 | .8396 |
| B4 | .5228 | .5228 | .5228 | .5228 | .5228 | .5228 | .5228 | .5228 | .5228 |
| B5 | -1.1857 | -1.1856 | -1.1857 | -1.1856 | -1.1856 | -1.1856 | -1.1856 | -1.1857 | -1.1857 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 294869 QTA2 = 246700 QTA3 = 212380
AZIMUTH AND TILT COEF. C1 = .0091 C2 = -.3542 C3 = -.2276 C4 = 1.4775 C5 =-1.2531

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 3 | 11 | 25 | 41 | 56 | 65 | 70 | 68 | 59 | 48 | 29 | 12 |
| QHOR: | 421 | 745 | 1139 | 1577 | 1891 | 1976 | 2163 | 1803 | 1273 | 890 | 460 | 351 |

MINOT, NORTH DAKOTA — ELEVATION = 1713 — LAT = 48.3

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 26.04 | 18.09 | 15.62 | 13.74 | 12.26 | 11.07 | 10.09 | 9.27 | 7.98 |
| VT2/DD | 22.34 | 15.52 | 13.40 | 11.79 | 10.52 | 9.50 | 8.66 | 7.96 | 6.84 |
| VT3/DD | 19.42 | 13.49 | 11.65 | 10.24 | 9.14 | 8.26 | 7.53 | 6.91 | 5.95 |
| MONTHLY DD | 679 | 978 | 1133 | 1288 | 1443 | 1598 | 1753 | 1908 | 2218 |
| ANNUAL DD | 2013 | 3486 | 4426 | 5477 | 6641 | 7939 | 9373 | 10926 | 14308 |
| PARAMETER A | .696 | .731 | .755 | .777 | .803 | .830 | .858 | .881 | .906 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0698 | .0701 | .0689 | .0674 | .0655 | .0634 | .0613 | .0595 | .0579 |
| A2 | .2003 | .2715 | .3033 | .3347 | .3633 | .3911 | .4179 | .4474 | .5264 |
| A3 | -.1923 | -.2666 | -.3026 | -.3396 | -.3747 | -.4103 | -.4468 | -.4885 | -.5995 |
| A4 | .1138 | .1530 | .1723 | .1926 | .2123 | .2328 | .2543 | .2788 | .3442 |
| A5 | .0230 | .0322 | .0342 | .0347 | .0340 | .0316 | .0270 | .0204 | .0027 |
| B1 | -.0112 | -.0112 | -.0112 | -.0112 | -.0112 | -.0112 | -.0112 | -.0112 | -.0112 |
| B2 | -1.2178 | -1.2178 | -1.2178 | -1.2178 | -1.2178 | -1.2178 | -1.2178 | -1.2178 | -1.2178 |
| B3 | .8694 | .8694 | .8695 | .8695 | .8695 | .8695 | .8695 | .8695 | .8695 |
| B4 | .4797 | .4797 | .4797 | .4797 | .4797 | .4797 | .4797 | .4797 | .4797 |
| B5 | -1.1841 | -1.1841 | -1.1841 | -1.1841 | -1.1841 | -1.1841 | -1.1841 | -1.1841 | -1.1841 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 294301 — QTA2 = 246584 — QTA3 = 212431
AZIMUTH AND TILT COEF. — C1 = .0426 — C2 = -.3724 — C3 = -.1974 — C4 = 1.4105 — C5 = -1.2506

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 8 | 13 | 26 | 39 | 54 | 63 | 68 | 68 | 56 | 45 | 28 | 15 |
| QHOR: | 364 | 677 | 1032 | 1417 | 1967 | 2011 | 2083 | 1700 | 1240 | 881 | 441 | 316 |

AKRON-CANTON, OHIO — ELEVATION = 1237 — LAT = 40.9

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 67.23 | 30.80 | 23.23 | 17.95 | 14.56 | 12.17 | 10.40 | 9.06 | 7.21 |
| VT2/DD | 57.38 | 26.29 | 19.83 | 15.32 | 12.43 | 10.39 | 8.87 | 7.73 | 6.15 |
| VT3/DD | 49.82 | 22.82 | 17.21 | 13.30 | 10.79 | 9.02 | 7.70 | 6.71 | 5.34 |
| MONTHLY DD | 222 | 484 | 471 | 610 | 751 | 899 | 1053 | 1208 | 1518 |
| ANNUAL DD | 560 | 1516 | 2204 | 3019 | 3977 | 5092 | 6358 | 7774 | 11071 |
| PARAMETER A | .499 | .563 | .604 | .686 | .760 | .825 | .884 | .933 | 1.007 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0835 | .0663 | -.0548 | -.0491 | -.0448 | -.0414 | -.0388 | -.0368 | -.0345 |
| A2 | .3636 | .3950 | .3508 | .3412 | .3358 | .3372 | .3440 | .3553 | .3958 |
| A3 | -.3640 | -.4065 | -.4156 | -.4048 | -.4007 | -.4070 | -.4218 | -.4428 | -.5103 |
| A4 | .1684 | .1955 | .3066 | .2909 | .2818 | .2805 | .2856 | .2955 | .3330 |
| A5 | .0878 | .0832 | -.0607 | -.0523 | -.0478 | -.0472 | -.0499 | -.0545 | -.0702 |
| B1 | .0085 | .0085 | .0538 | .0538 | .0538 | .0538 | .0538 | .0538 | .0538 |
| B2 | -1.0302 | -1.0302 | -1.0038 | -1.0038 | -1.0038 | -1.0038 | -1.0038 | -1.0038 | -1.0038 |
| B3 | .6935 | .6935 | .6941 | .6941 | .6942 | .6941 | .6941 | .6941 | .6942 |
| B4 | .7177 | .7177 | .6767 | .6767 | .6766 | .6767 | .6767 | .6767 | .6767 |
| B5 | -1.1433 | -1.1433 | -1.0815 | -1.0815 | -1.0815 | -1.0815 | -1.0815 | -1.0815 | -1.0815 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 229591 — QTA2 = 191089 — QTA3 = 164169
AZIMUTH AND TILT COEF. — C1 = .0278 — C2 = -.2117 — C3 = -.3570 — C4 = 1.6358 — C5 = -1.1220

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 24 | 27 | 36 | 48 | 58 | 67 | 72 | 69 | 62 | 53 | 41 | 31 |
| QHOR: | 431 | 664 | 928 | 1403 | 1711 | 1877 | 1872 | 1553 | 1179 | 910 | 528 | 326 |

CINCINNATI, OHIO — ELEVATION = 889 — LAT = 39.1

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 82.90 | 40.15 | 30.20 | 23.75 | 19.43 | 16.35 | 14.09 | 12.37 | 9.95 |
| VT2/DD | 70.69 | 34.24 | 25.75 | 20.25 | 16.57 | 13.94 | 12.01 | 10.55 | 8.48 |
| VT3/DD | 61.37 | 29.72 | 22.36 | 17.58 | 14.38 | 12.10 | 10.43 | 9.16 | 7.36 |
| MONTHLY DD | 190 | 392 | 521 | 662 | 810 | 962 | 1117 | 1272 | 1582 |
| ANNUAL DD | 329 | 1055 | 1634 | 2335 | 3162 | 4126 | 5250 | 6563 | 9680 |
| PARAMETER A | .734 | .869 | .817 | .784 | .764 | .762 | .775 | .795 | .831 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0686 | .0920 | .1117 | .1240 | .1314 | .1331 | .1308 | .1264 | .1190 |
| A2 | .1362 | .2047 | .2616 | .3072 | .3464 | .3758 | .4020 | .4316 | .5091 |
| A3 | -.1451 | -.2354 | -.3031 | -.3574 | -.4053 | -.4438 | -.4816 | -.5262 | -.6443 |
| A4 | .0815 | .1283 | .1659 | .1966 | .2243 | .2477 | .2715 | .2998 | .3725 |
| A5 | .0142 | .0120 | .0140 | .0150 | .0144 | .0108 | .0038 | -.0061 | -.0320 |
| B1 | -.0656 | -.0656 | -.0656 | -.0656 | -.0656 | -.0656 | -.0656 | -.0656 | -.0656 |
| B2 | -.9917 | -.9917 | -.9917 | -.9917 | -.9917 | -.9918 | -.9917 | -.9917 | -.9917 |
| B3 | .6558 | .6559 | .6559 | .6559 | .6559 | .6559 | .6559 | .6559 | .6559 |
| B4 | .7585 | .7585 | .7585 | .7585 | .7585 | .7584 | .7585 | .7585 | .7585 |
| B5 | -1.1280 | -1.1280 | -1.1279 | -1.1280 | -1.1280 | -1.1280 | -1.1280 | -1.1280 | -1.1280 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 236072 — QTA2 = 196528 — QTA3 = 168869
AZIMUTH AND TILT COEF. — C1 = .0244 — C2 = -.2208 — C3 = -.3424 — C4 = 1.6367 — C5 = -1.1058

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 28 | 32 | 40 | 52 | 63 | 73 | 74 | 74 | 65 | 56 | 43 | 38 |
| QHOR: | 481 | 758 | 1024 | 1370 | 1755 | 1901 | 1757 | 1616 | 1205 | 965 | 563 | 451 |

COLUMBUS, OHIO — ELEVATION = 833 — LAT = 40.0

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 98.46 | 40.68 | 29.89 | 23.32 | 19.01 | 16.01 | 13.46 | 11.60 | 9.10 |
| VT2/DD | 83.97 | 34.69 | 25.49 | 19.89 | 16.21 | 13.65 | 11.49 | 9.90 | 7.76 |
| VT3/DD | 72.89 | 30.11 | 22.13 | 17.27 | 14.07 | 11.85 | 9.98 | 8.60 | 6.74 |
| MONTHLY DD | 158 | 382 | 520 | 667 | 818 | 971 | 968 | 1123 | 1433 |
| ANNUAL DD | 388 | 1216 | 1832 | 2576 | 3462 | 4507 | 5722 | 7112 | 10324 |
| PARAMETER A | .630 | .615 | .605 | .611 | .628 | .654 | .716 | .772 | .846 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0391 | .0526 | .0544 | .0534 | .0506 | .0464 | -.0554 | -.0516 | -.0479 |
| A2 | .2416 | .3190 | .3499 | .3755 | .3970 | .4178 | .5096 | .5081 | .5502 |
| A3 | -.2278 | -.3192 | -.3532 | -.3854 | -.4165 | -.4505 | -.5655 | -.5793 | -.6616 |
| A4 | .1356 | .1898 | .2130 | .2348 | .2550 | .2760 | .3701 | .3757 | .4213 |
| A5 | .0554 | .0596 | .0612 | .0588 | .0530 | .0440 | -.0074 | -.0179 | -.0434 |
| B1 | .0233 | .0233 | .0233 | .0233 | .0233 | .0233 | .0701 | .0701 | .0701 |
| B2 | -.9886 | -.9886 | -.9886 | -.9886 | -.9886 | -.9886 | -1.0203 | -1.0203 | -1.0203 |
| B3 | .6488 | .6488 | .6488 | .6488 | .6488 | .6488 | .6963 | .6963 | .6963 |
| B4 | .7487 | .7487 | .7487 | .7487 | .7487 | .7487 | .6911 | .6911 | .6912 |
| B5 | -1.1370 | -1.1370 | -1.1369 | -1.1369 | -1.1370 | -1.1370 | -1.1041 | -1.1041 | -1.1041 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 233881 — QTA2 = 194826 — QTA3 = 167455

AZIMUTH AND TILT COEF. — C1 = .0425 — C2 = -.2383 — C3 = -.3152 — C4 = 1.6129 — C5 = -1.1093

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 28 | 31 | 37 | 51 | 60 | 70 | 73 | 71 | 65 | 53 | 44 | 33 |
| QHOR: | 467 | 659 | 981 | 1312 | 1642 | 1875 | 1862 | 1610 | 1235 | 941 | 569 | 383 |

DAYTON, OHIO — ELEVATION = 1004 — LAT = 39.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 94.93 | 37.76 | 27.27 | 21.05 | 16.93 | 14.08 | 12.02 | 10.48 | 8.35 |
| VT2/DD | 80.98 | 32.21 | 23.26 | 17.95 | 14.45 | 12.01 | 10.25 | 8.94 | 7.12 |
| VT3/DD | 70.31 | 27.96 | 20.19 | 15.58 | 12.54 | 10.42 | 8.90 | 7.76 | 6.18 |
| MONTHLY DD | 186 | 337 | 467 | 605 | 751 | 904 | 1059 | 1214 | 1524 |
| ANNUAL DD | 472 | 1315 | 1935 | 2678 | 3559 | 4572 | 5729 | 7063 | 10245 |
| PARAMETER A | .427 | .656 | .708 | .747 | .789 | .828 | .869 | .914 | .988 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .1274 | -.0733 | -.0642 | -.0578 | -.0522 | -.0479 | -.0443 | -.0411 | -.0369 |
| A2 | .2647 | .2466 | .2624 | .2770 | .2884 | .2986 | .3090 | .3207 | .3626 |
| A3 | -.2472 | -.2745 | -.2938 | -.3134 | -.3318 | -.3498 | -.3689 | -.3907 | -.4616 |
| A4 | .1060 | .2562 | .2633 | .2718 | .2786 | .2856 | .2931 | .3016 | .3369 |
| A5 | .0931 | -.0653 | -.0601 | -.0581 | -.0583 | -.0602 | -.0630 | -.0667 | -.0813 |
| B1 | -.0134 | .0570 | .0570 | .0570 | .0570 | .0570 | .0570 | .0570 | .0570 |
| B2 | -1.0056 | -.9888 | -.9888 | -.9888 | -.9888 | -.9888 | -.9888 | -.9888 | -.9888 |
| B3 | .6595 | .6634 | .6634 | .6634 | .6634 | .6634 | .6634 | .6634 | .6634 |
| B4 | .7510 | .6973 | .6973 | .6973 | .6973 | .6974 | .6974 | .6974 | .6973 |
| B5 | -1.1525 | -1.0905 | -1.0905 | -1.0905 | -1.0905 | -1.0905 | -1.0905 | -1.0905 | -1.0905 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 242634 — QTA2 = 202038 — QTA3 = 173613

AZIMUTH AND TILT COEF. — C1 = .0255 — C2 = -.2396 — C3 = -.3369 — C4 = 1.6397 — C5 = -1.1378

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 29 | 31 | 37 | 51 | 62 | 71 | 73 | 73 | 65 | 55 | 42 | 30 |
| QHOR: | 523 | 734 | 1035 | 1395 | 1738 | 1890 | 1818 | 1680 | 1286 | 967 | 563 | 382 |

TOLEDO, OHIO — ELEVATION = 692 — LAT = 41.6

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 69.51 | 29.37 | 21.75 | 17.08 | 13.90 | 11.68 | 10.07 | 8.85 | 7.12 |
| VT2/DD | 59.32 | 25.07 | 18.56 | 14.57 | 11.86 | 9.97 | 8.59 | 7.55 | 6.08 |
| VT3/DD | 51.49 | 21.76 | 16.11 | 12.65 | 10.29 | 8.65 | 7.46 | 6.55 | 5.28 |
| MONTHLY DD | 163 | 385 | 520 | 662 | 814 | 968 | 1123 | 1278 | 1588 |
| ANNUAL DD | 624 | 1644 | 2373 | 3242 | 4235 | 5364 | 6637 | 8071 | 11349 |
| PARAMETER A | .533 | .701 | .761 | .821 | .882 | .934 | .978 | 1.019 | 1.076 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.1598 | -.1267 | -.1151 | -.1032 | -.0918 | -.0830 | -.0758 | -.0698 | -.0621 |
| A2 | .2899 | .2382 | .2424 | .2440 | .2451 | .2527 | .2634 | .2773 | .3223 |
| A3 | -.4219 | -.3433 | -.3400 | -.3365 | -.3357 | -.3452 | -.3597 | -.3799 | -.4465 |
| A4 | .2687 | .2288 | .2295 | .2285 | .2281 | .2340 | .2430 | .2553 | .2960 |
| A5 | -.1190 | -.0942 | -.0855 | -.0790 | -.0753 | -.0749 | -.0760 | -.0791 | -.0917 |
| B1 | .0542 | .0542 | .0542 | .0542 | .0542 | .0542 | .0542 | .0542 | .0542 |
| B2 | -1.0108 | -1.0108 | -1.0108 | -1.0108 | -1.0108 | -1.0108 | -1.0108 | -1.0108 | -1.0108 |
| B3 | .7142 | .7142 | .7142 | .7142 | .7142 | .7142 | .7142 | .7142 | .7142 |
| B4 | .6652 | .6651 | .6652 | .6652 | .6652 | .6652 | .6651 | .6651 | .6652 |
| B5 | -1.0697 | -1.0697 | -1.0696 | -1.0697 | -1.0697 | -1.0697 | -1.0696 | -1.0697 | -1.0697 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 241051 — QTA2 = 200914 — QTA3 = 172717

AZIMUTH AND TILT COEF. — C1 = .0118 — C2 = -.2769 — C3 = -.2898 — C4 = 1.5896 — C5 = -1.1382

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 25 | 26 | 34 | 49 | 57 | 68 | 71 | 69 | 62 | 52 | 41 | 28 |
| QHOR: | 441 | 714 | 987 | 1348 | 1687 | 1898 | 1824 | 1588 | 1283 | 942 | 514 | 338 |

YOUNGSTOWN, OHIO — ELEVATION = 1184 — LAT = 41.3

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 2) | (M= 2) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 49.87 | 27.11 | 21.16 | 16.10 | 12.83 | 10.63 | 9.04 | 7.87 | 6.25 |
| VT2/DD | 42.11 | 22.89 | 17.87 | 13.72 | 10.94 | 9.06 | 7.71 | 6.71 | 5.32 |
| VT3/DD | 36.47 | 19.82 | 15.47 | 11.91 | 9.49 | 7.86 | 6.69 | 5.82 | 4.62 |
| MONTHLY DD | 230 | 424 | 543 | 584 | 732 | 884 | 1039 | 1194 | 1504 |
| ANNUAL DD | 679 | 1688 | 2396 | 3256 | 4271 | 5423 | 6727 | 8209 | 11550 |
| PARAMETER A | .533 | .490 | .519 | .620 | .717 | .796 | .864 | .926 | 1.007 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0044 | -.0082 | -.0132 | .0103 | .0061 | .0034 | .0015 | -.0000 | -.0023 |
| A2 | -.7560 | -.7733 | -.6949 | .4671 | .4118 | .3838 | .3691 | .3639 | .3876 |
| A3 | .6896 | .6890 | .6072 | -.5642 | -.5046 | -.4773 | -.4661 | -.4669 | -.5131 |
| A4 | -.1858 | -.1454 | -.1057 | .3497 | .3161 | .3011 | .2949 | .2958 | .3248 |
| A5 | -.3124 | -.3546 | -.3393 | -.0383 | -.0415 | -.0457 | -.0502 | -.0560 | -.0730 |
| B1 | .0671 | .0671 | .0671 | .0468 | .0468 | .0468 | .0468 | .0468 | .0468 |
| B2 | -.5390 | -.5390 | -.5390 | -.9349 | -.9349 | -.9349 | -.9349 | -.9349 | -.9349 |
| B3 | .2150 | .2150 | .2150 | .6428 | .6428 | .6428 | .6428 | .6428 | .6428 |
| B4 | .9612 | .9612 | .9612 | .6850 | .6850 | .6850 | .6850 | .6850 | .6850 |
| B5 | -.9696 | -.9696 | -.9696 | -1.0345 | -1.0345 | -1.0345 | -1.0345 | -1.0345 | -1.0345 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 212638 — QTA2 = 176851 — QTA3 = 151911

AZIMUTH AND TILT COEF. — C1 = .0394 — C2 = -.1648 — C3 = -.3926 — C4 = 1.6310 — C5 = -1.0921

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 24 | 26 | 34 | 48 | 55 | 66 | 69 | 67 | 64 | 51 | 40 | 31 |
| QHOR: | 403 | 537 | 911 | 1260 | 1654 | 1714 | 1760 | 1527 | 1244 | 820 | 468 | 298 |

OKLAHOMA CITY, OKLAHOMA — ELEVATION = 1302 — LAT = 35.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) |
| VT1/DD | 272.48 | 120.99 | 85.01 | 62.84 | 48.82 | 39.50 | 33.07 | 28.41 | 21.71 |
| VT2/DD | 232.71 | 103.33 | 72.60 | 53.67 | 41.69 | 33.74 | 28.24 | 24.26 | 18.56 |
| VT3/DD | 202.14 | 89.76 | 63.07 | 46.62 | 36.22 | 29.31 | 24.53 | 21.07 | 16.13 |
| MONTHLY DD | 115 | 258 | 367 | 497 | 639 | 790 | 944 | 1099 | 1274 |
| ANNUAL DD | 208 | 688 | 1111 | 1652 | 2322 | 3145 | 4120 | 5246 | 8017 |
| PARAMETER A | .553 | .476 | .459 | .452 | .453 | .469 | .481 | .483 | .504 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0592 | .1010 | .1071 | .1082 | .1058 | .0983 | .0916 | .0867 | -.0505 |
| A2 | .2782 | .5019 | .5570 | .5945 | .6330 | .6680 | .7343 | .8466 | 1.2710 |
| A3 | -.2473 | -.4835 | -.5404 | -.5805 | -.6273 | -.6817 | -.7802 | -.9396 | -1.5516 |
| A4 | .1568 | .2935 | .3279 | .3531 | .3822 | .4146 | .4713 | .5621 | .9133 |
| A5 | .0737 | .1054 | .1133 | .1165 | .1145 | .1019 | .0845 | .0633 | -.0512 |
| B1 | -.0338 | -.0338 | -.0338 | -.0338 | -.0338 | -.0338 | -.0338 | -.0338 | .0090 |
| B2 | -1.0753 | -1.0753 | -1.0754 | -1.0753 | -1.0753 | -1.0753 | -1.0753 | -1.0754 | -1.1201 |
| B3 | .6408 | .6408 | .6408 | .6408 | .6408 | .6408 | .6408 | .6408 | .7247 |
| B4 | .8164 | .8164 | .8163 | .8164 | .8164 | .8164 | .8163 | .8164 | .7473 |
| B5 | -1.3126 | -1.3126 | -1.3126 | -1.3126 | -1.3126 | -1.3127 | -1.3126 | -1.3126 | -1.2698 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 308846 — QTA2 = 257271 — QTA3 = 221049

AZIMUTH AND TILT COEF. — C1 = -.0204 — C2 = -.2465 — C3 = -.4196 — C4 = 1.7540 — C5 = -1.2575

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 34 | 39 | 47 | 60 | 67 | 75 | 80 | 79 | 73 | 61 | 49 | 38 |
| QHOR: | 812 | 1015 | 1366 | 1780 | 1874 | 2121 | 2123 | 2005 | 1606 | 1264 | 911 | 702 |

TULSA, OKLAHOMA — ELEVATION = 676 — LAT = 36.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) |
| VT1/DD | 378.67 | 119.22 | 79.39 | 58.01 | 45.14 | 36.57 | 30.60 | 26.24 | 19.83 |
| VT2/DD | 323.62 | 101.89 | 67.85 | 49.58 | 38.57 | 31.26 | 26.15 | 22.43 | 16.96 |
| VT3/DD | 281.12 | 88.51 | 58.94 | 43.07 | 33.51 | 27.15 | 22.72 | 19.48 | 14.73 |
| MONTHLY DD | 75 | 238 | 358 | 489 | 629 | 776 | 928 | 1082 | 1264 |
| ANNUAL DD | 179 | 658 | 1079 | 1618 | 2270 | 3050 | 3964 | 5022 | 7674 |
| PARAMETER A | .360 | .468 | .495 | .491 | .474 | .467 | .468 | .475 | .527 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.1908 | -.1458 | -.1407 | -.1461 | -.1548 | -.1592 | -.1602 | -.1597 | -.0320 |
| A2 | .4466 | .4649 | .5020 | .5764 | .6726 | .7620 | .8407 | .9238 | 1.1005 |
| A3 | -.4113 | -.4559 | -.4957 | -.5751 | -.6817 | -.7868 | -.8856 | -.9977 | -1.2653 |
| A4 | .2142 | .2489 | .2772 | .3263 | .3891 | .4496 | .5066 | .5710 | .7798 |
| A5 | .1437 | .1114 | .1111 | .1175 | .1246 | .1270 | .1238 | .1136 | -.0001 |
| B1 | .0570 | .0570 | .0570 | .0570 | .0570 | .0570 | .0570 | .0570 | .0165 |
| B2 | -1.0988 | -1.0988 | -1.0988 | -1.0988 | -1.0988 | -1.0988 | -1.0988 | -1.0988 | -1.1118 |
| B3 | .6905 | .6905 | .6906 | .6905 | .6905 | .6905 | .6905 | .6905 | .7187 |
| B4 | .7686 | .7686 | .7686 | .7686 | .7686 | .7686 | .7686 | .7686 | .7261 |
| B5 | -1.2781 | -1.2781 | -1.2781 | -1.2781 | -1.2781 | -1.2781 | -1.2781 | -1.2781 | -1.2424 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 288791 — QTA2 = 240634 — QTA3 = 206804

AZIMUTH AND TILT COEF. — C1 = -.0106 — C2 = -.2486 — C3 = -.3782 — C4 = 1.7026 — C5 = -1.2063

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 35 | 40 | 48 | 60 | 69 | 77 | 82 | 80 | 72 | 64 | 49 | 39 |
| QHOR: | 730 | 936 | 1328 | 1576 | 1853 | 2032 | 2051 | 1906 | 1442 | 1151 | 850 | 642 |

ASTORIA, OREGON — ELEVATION = 23 — LAT = 46.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | NA | 145.53 | 69.35 | 38.49 | 23.77 | 17.02 | 13.26 | 10.86 | 7.97 |
| VT2/DD | NA | 124.33 | 59.25 | 32.88 | 20.31 | 14.54 | 11.33 | 9.28 | 6.81 |
| VT3/DD | NA | 107.96 | 51.45 | 28.55 | 17.63 | 12.63 | 9.84 | 8.06 | 5.91 |
| MONTHLY DD | 2 | 64 | 134 | 242 | 391 | 546 | 701 | 856 | 1166 |
| ANNUAL DD | 5 | 192 | 529 | 1212 | 2271 | 3671 | 5330 | 7104 | 10722 |
| PARAMETER A | NA | .712 | .791 | .847 | .907 | .975 | 1.023 | 1.035 | 1.018 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0151 | -.0155 | -.0187 | -.0200 | -.0211 | -.0238 | -.0281 | -.0366 |
| A2 | NA | .2201 | .2879 | .3930 | .4355 | .4482 | .4723 | .5156 | .6032 |
| A3 | NA | -.1825 | -.2650 | -.3911 | -.4536 | -.4867 | -.5336 | -.5998 | -.7216 |
| A4 | NA | .1201 | .1789 | .2638 | .3020 | .3210 | .3502 | .3933 | .4743 |
| A5 | NA | .0562 | .0482 | .0412 | .0301 | .0143 | -.0038 | -.0206 | -.0435 |
| B1 | NA | .0174 | .0174 | .0174 | .0174 | .0174 | .0174 | .0174 | .0174 |
| B2 | NA | -1.0476 | -1.0475 | -1.0476 | -1.0475 | -1.0476 | -1.0476 | -1.0476 | -1.0476 |
| B3 | NA | .7572 | .7572 | .7572 | .7572 | .7572 | .7572 | .7572 | .7572 |
| B4 | NA | .5669 | .5669 | .5669 | .5669 | .5669 | .5669 | .5669 | .5669 |
| B5 | NA | -1.0500 | -1.0500 | -1.0499 | -1.0500 | -1.0500 | -1.0500 | -1.0500 | -1.0499 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 212013 QTA2 = 177007 QTA3 = 152367
AZIMUTH AND TILT COEF. C1 = -.0909 C2 = -.2904 C3 = -.1898 C4 = 1.4838 C5 = -1.0830

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 41 | 43 | 44 | 46 | 52 | 56 | 60 | 60 | 57 | 53 | 47 | 42 |
| QHOR: | 316 | 515 | 844 | 1160 | 1572 | 1607 | 1774 | 1467 | 1186 | 663 | 368 | 258 |

MEDFORD, OREGON — ELEVATION = 1299 — LAT = 42.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 450.83 | 54.18 | 30.52 | 20.34 | 15.16 | 12.08 | 10.04 | 8.59 | 6.66 |
| VT2/DD | 384.32 | 46.19 | 26.01 | 17.34 | 12.92 | 10.30 | 8.56 | 7.32 | 5.68 |
| VT3/DD | 333.53 | 40.09 | 22.58 | 15.05 | 11.21 | 8.94 | 7.42 | 6.35 | 4.93 |
| MONTHLY DD | 20 | 170 | 302 | 453 | 607 | 762 | 917 | 1072 | 1382 |
| ANNUAL DD | 64 | 543 | 1120 | 1933 | 2954 | 4159 | 5516 | 6996 | 10233 |
| PARAMETER A | .674 | 1.093 | 1.174 | 1.223 | 1.251 | 1.278 | 1.303 | 1.321 | 1.340 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .1396 | .0582 | .0504 | .0472 | .0463 | .0456 | .0450 | .0449 | .0458 |
| A2 | .1736 | .0580 | .0650 | .0816 | .1016 | .1214 | .1401 | .1595 | .2013 |
| A3 | -.2149 | -.0760 | -.0889 | -.1145 | -.1447 | -.1749 | -.2038 | -.2344 | -.3005 |
| A4 | .1899 | .0744 | .0849 | .1040 | .1258 | .1464 | .1654 | .1852 | .2276 |
| A5 | -.0592 | -.0300 | -.0365 | -.0454 | -.0548 | -.0637 | -.0722 | -.0814 | -.1014 |
| B1 | -.1507 | -.1507 | -.1507 | -.1507 | -.1507 | -.1507 | -.1507 | -.1507 | -.1507 |
| B2 | -.9562 | -.9562 | -.9562 | -.9562 | -.9562 | -.9562 | -.9562 | -.9562 | -.9562 |
| B3 | .6857 | .6857 | .6857 | .6856 | .6857 | .6857 | .6857 | .6857 | .6857 |
| B4 | .6676 | .6677 | .6676 | .6676 | .6677 | .6676 | .6677 | .6676 | .6676 |
| B5 | -1.0325 | -1.0325 | -1.0325 | -1.0325 | -1.0325 | -1.0325 | -1.0325 | -1.0325 | -1.0325 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 270789 QTA2 = 224611 QTA3 = 192526
AZIMUTH AND TILT COEF. C1 = -.0725 C2 = -.1407 C3 = -.5304 C4 = 1.8685 C5 = -1.2955

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 37 | 39 | 43 | 49 | 54 | 65 | 71 | 69 | 64 | 53 | 43 | 35 |
| QHOR: | 398 | 717 | 1135 | 1590 | 2036 | 2330 | 2528 | 2140 | 1603 | 980 | 517 | 289 |

NORTH BEND, OREGON — ELEVATION = 16 — LAT = 43.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | NA | 484.67 | 182.34 | 88.83 | 49.12 | 31.47 | 23.08 | 18.23 | 12.83 |
| VT2/DD | NA | 414.18 | 155.84 | 75.92 | 41.97 | 26.89 | 19.73 | 15.58 | 10.96 |
| VT3/DD | NA | 359.66 | 135.34 | 65.93 | 36.45 | 23.35 | 17.13 | 13.53 | 9.52 |
| MONTHLY DD | 0 | 28 | 94 | 193 | 273 | 427 | 582 | 737 | 1047 |
| ANNUAL DD | 0 | 83 | 293 | 791 | 1720 | 3120 | 4808 | 6613 | 10263 |
| PARAMETER A | NA | .544 | .722 | .730 | .831 | .946 | .962 | .941 | .889 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0025 | -.0337 | -.0556 | -.0516 | -.0516 | -.0588 | -.0678 | -.0824 |
| A2 | NA | .1107 | .2915 | .4462 | .4712 | .4854 | .5696 | .6659 | .8118 |
| A3 | NA | -.1643 | -.2989 | -.4745 | -.5634 | -.6078 | -.7379 | -.8759 | -1.0752 |
| A4 | NA | .1396 | .1935 | .3172 | .4112 | .4363 | .5253 | .6225 | .7650 |
| A5 | NA | -.0634 | .0311 | .0253 | -.0608 | -.0861 | -.1232 | -.1558 | -.1956 |
| B1 | NA | .0087 | .0141 | .0141 | .0087 | .0087 | .0087 | .0087 | .0087 |
| B2 | NA | -1.0643 | -1.0742 | -1.0742 | -1.0643 | -1.0643 | -1.0643 | -1.0643 | -1.0643 |
| B3 | NA | .7606 | .7425 | .7425 | .7606 | .7606 | .7606 | .7606 | .7606 |
| B4 | NA | .6054 | .6380 | .6380 | .6054 | .6054 | .6054 | .6054 | .6054 |
| B5 | NA | -1.0906 | -1.1350 | -1.1350 | -1.0906 | -1.0906 | -1.0906 | -1.0906 | -1.0906 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 268903 QTA2 = 224232 QTA3 = 192763
AZIMUTH AND TILT COEF. C1 = -.1144 C2 = -.3551 C3 = -.2234 C4 = 1.6083 C5 = -1.2039

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 45 | 46 | 46 | 48 | 53 | 56 | 58 | 58 | 58 | 53 | 51 | 46 |
| QHOR: | 461 | 715 | 1120 | 1511 | 1877 | 1943 | 2044 | 1869 | 1358 | 915 | 505 | 368 |

PORTLAND, OREGON — ELEVATION = 39 — LAT = 45.6

| SOUTH-VERT. | TB30 (M=12) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | 86.76 | 40.13 | 23.50 | 16.14 | 12.23 | 9.85 | 8.24 | 6.21 |
| VT2/DD | NA | 73.66 | 34.07 | 19.95 | 13.70 | 10.38 | 8.36 | 7.00 | 5.27 |
| VT3/DD | NA | 63.87 | 29.54 | 17.30 | 11.88 | 9.00 | 7.25 | 6.07 | 4.57 |
| MONTHLY DD | 7 | 90 | 195 | 333 | 485 | 640 | 795 | 950 | 1260 |
| ANNUAL DD | 12 | 251 | 639 | 1313 | 2255 | 3465 | 4910 | 6511 | 9965 |
| PARAMETER A | NA | .787 | .941 | 1.007 | 1.062 | 1.123 | 1.184 | 1.224 | 1.255 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0693 | .0549 | .0519 | .0493 | .0451 | .0406 | .0373 | .0333 |
| A2 | NA | -.1538 | -.1075 | -.0835 | -.0569 | -.0303 | -.0041 | .0218 | .0711 |
| A3 | NA | .0815 | .0404 | .0094 | -.0229 | -.0529 | -.0827 | -.1153 | -.1841 |
| A4 | NA | -.0180 | .0119 | .0402 | .0659 | .0866 | .1049 | .1256 | .1715 |
| A5 | NA | -.1165 | -.1074 | -.1167 | -.1221 | -.1227 | -.1223 | -.1257 | -.1403 |
| B1 | NA | -.0695 | -.0695 | -.0695 | -.0695 | -.0695 | -.0695 | -.0695 | -.0695 |
| B2 | NA | -.7663 | -.7663 | -.7663 | -.7663 | -.7663 | -.7663 | -.7663 | -.7663 |
| B3 | NA | .5429 | .5430 | .5430 | .5430 | .5430 | .5429 | .5429 | .5430 |
| B4 | NA | .7249 | .7249 | .7249 | .7249 | .7249 | .7249 | .7249 | .7249 |
| B5 | NA | -.9026 | -.9026 | -.9026 | -.9027 | -.9026 | -.9026 | -.9027 | -.9026 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 224971 — QTA2 = 187385 — QTA3 = 161087
AZIMUTH AND TILT COEF. — C1 = -.0835 — C2 = -.2131 — C3 = -.3272 — C4 = 1.6087 — C5 = -1.1420

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 39 | 42 | 45 | 49 | 56 | 63 | 68 | 64 | 62 | 53 | 46 | 40 |
| QHOR: | 294 | 534 | 897 | 1311 | 1645 | 1863 | 2085 | 1627 | 1266 | 742 | 383 | 253 |

REDMOND, OREGON — ELEVATION = 3084 — LAT = 44.3

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 163.17 | 73.66 | 48.98 | 35.41 | 27.48 | 22.38 | 18.88 | 16.33 | 12.85 |
| VT2/DD | 139.62 | 63.13 | 41.98 | 30.35 | 23.55 | 19.18 | 16.18 | 13.99 | 11.01 |
| VT3/DD | 121.29 | 54.86 | 36.48 | 26.37 | 20.46 | 16.67 | 14.06 | 12.16 | 9.57 |
| MONTHLY DD | 117 | 254 | 382 | 528 | 681 | 836 | 991 | 1146 | 1456 |
| ANNUAL DD | 290 | 1115 | 1862 | 2859 | 4065 | 5430 | 6922 | 8507 | 11875 |
| PARAMETER A | .771 | .796 | .838 | .845 | .846 | .843 | .834 | .821 | .784 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0495 | .0363 | .0386 | .0415 | .0428 | .0432 | .0431 | .0431 | .0433 |
| A2 | .0400 | .4056 | .4533 | .5180 | .5869 | .6589 | .7388 | .8238 | 1.0014 |
| A3 | -.0800 | -.3835 | -.4510 | -.5372 | -.6323 | -.7337 | -.8464 | -.9654 | -1.2097 |
| A4 | .0366 | .2866 | .3278 | .3807 | .4376 | .4980 | .5653 | .6369 | .7852 |
| A5 | -.0279 | .0418 | .0303 | .0189 | .0043 | -.0132 | -.0331 | -.0537 | -.0934 |
| B1 | .0713 | .0212 | .0212 | .0212 | .0212 | .0212 | .0212 | .0212 | .0212 |
| B2 | -1.1210 | -1.1878 | -1.1878 | -1.1878 | -1.1878 | -1.1878 | -1.1878 | -1.1878 | -1.1878 |
| B3 | .7698 | .8419 | .8419 | .8419 | .8419 | .8419 | .8419 | .8419 | .8419 |
| B4 | .6060 | .5251 | .5251 | .5251 | .5251 | .5250 | .5251 | .5251 | .5251 |
| B5 | -1.1703 | -1.1736 | -1.1736 | -1.1736 | -1.1736 | -1.1735 | -1.1736 | -1.1736 | -1.1736 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 307375 — QTA2 = 256263 — QTA3 = 220163
AZIMUTH AND TILT COEF. — C1 = .0556 — C2 = -.2552 — C3 = -.3921 — C4 = 1.6563 — C5 = -1.3054

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 33 | 35 | 38 | 43 | 50 | 60 | 67 | 61 | 57 | 48 | 40 | 33 |
| QHOR: | 471 | 767 | 1193 | 1654 | 2047 | 2343 | 2387 | 2057 | 1569 | 986 | 569 | 415 |

SALEM, OREGON — ELEVATION = 200 — LAT = 44.9

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 653.01 | 130.67 | 61.21 | 31.38 | 19.80 | 14.39 | 11.29 | 9.29 | 6.86 |
| VT2/DD | 556.39 | 111.34 | 52.12 | 26.72 | 16.86 | 12.25 | 9.61 | 7.91 | 5.84 |
| VT3/DD | 482.84 | 96.62 | 45.22 | 23.18 | 14.63 | 10.63 | 8.34 | 6.86 | 5.07 |
| MONTHLY DD | 16 | 81 | 133 | 259 | 411 | 565 | 720 | 875 | 1185 |
| ANNUAL DD | 31 | 260 | 650 | 1391 | 2474 | 3790 | 5277 | 6886 | 10331 |
| PARAMETER A | .221 | .880 | .954 | 1.049 | 1.117 | 1.162 | 1.195 | 1.214 | 1.228 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.1210 | -.0310 | .0297 | .0255 | .0236 | .0222 | .0209 | .0199 | .0187 |
| A2 | .0925 | .1244 | .1140 | .1271 | .1361 | .1514 | .1709 | .1936 | .2396 |
| A3 | -.0056 | -.1244 | -.1672 | -.1825 | -.1973 | -.2209 | -.2507 | -.2851 | -.3551 |
| A4 | -.0999 | .0649 | .1524 | .1605 | .1704 | .1863 | .2055 | .2276 | .2727 |
| A5 | .1619 | .0250 | -.0670 | -.0664 | -.0712 | -.0779 | -.0860 | -.0952 | -.1139 |
| B1 | .0038 | .0038 | -.0439 | -.0439 | -.0439 | -.0439 | -.0439 | -.0439 | -.0439 |
| B2 | -.9309 | -.9309 | -.8907 | -.8907 | -.8907 | -.8907 | -.8907 | -.8907 | -.8907 |
| B3 | .6384 | .6384 | .6395 | .6394 | .6394 | .6394 | .6394 | .6394 | .6395 |
| B4 | .6950 | .6950 | .6550 | .6550 | .6550 | .6550 | .6550 | .6550 | .6550 |
| B5 | -1.0362 | -1.0362 | -.9668 | -.9668 | -.9669 | -.9668 | -.9668 | -.9668 | -.9668 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 233243 — QTA2 = 194065 — QTA3 = 166711
AZIMUTH AND TILT COEF. — C1 = -.0567 — C2 = -.1852 — C3 = -.3823 — C4 = 1.6635 — C5 = -1.1674

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 40 | 42 | 44 | 48 | 54 | 60 | 65 | 65 | 60 | 51 | 45 | 41 |
| QHOR: | 336 | 590 | 881 | 1386 | 1714 | 1838 | 2280 | 1820 | 1314 | 748 | 395 | 271 |

ALLENTOWN, PENNSYLVANIA — ELEVATION = 384 — LAT = 40.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 97.72 | 44.12 | 33.01 | 25.72 | 20.50 | 17.02 | 14.53 | 12.67 | 10.09 |
| VT2/DD | 83.49 | 37.69 | 28.20 | 21.97 | 17.52 | 14.54 | 12.41 | 10.83 | 8.62 |
| VT3/DD | 72.51 | 32.73 | 24.49 | 19.08 | 15.21 | 12.62 | 10.78 | 9.40 | 7.49 |
| MONTHLY DD | 201 | 445 | 594 | 598 | 750 | 903 | 1058 | 1213 | 1523 |
| ANNUAL DD | 426 | 1357 | 2032 | 2807 | 3705 | 4759 | 5976 | 7373 | 10633 |
| PARAMETER A | .518 | .507 | .505 | .531 | .591 | .651 | .705 | .754 | .811 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0293 | .0358 | .0361 | -.0387 | -.0351 | -.0328 | -.0321 | -.0321 | -.0349 |
| A2 | .3234 | .4532 | .5359 | .5529 | .5432 | .5374 | .5425 | .5524 | .6296 |
| A3 | -.2916 | -.4439 | -.5395 | -.5888 | -.5888 | -.5949 | -.6143 | -.6401 | -.7672 |
| A4 | .1287 | .2040 | .2591 | .4242 | .4152 | .4114 | .4175 | .4285 | .4978 |
| A5 | .1081 | .1206 | .1238 | -.0143 | -.0158 | -.0203 | -.0270 | -.0355 | -.0630 |
| B1 | .0244 | .0244 | .0244 | .0485 | .0485 | .0485 | .0485 | .0485 | .0485 |
| B2 | -1.0765 | -1.0765 | -1.0765 | -1.0657 | -1.0657 | -1.0657 | -1.0657 | -1.0657 | -1.0657 |
| B3 | .7202 | .7202 | .7202 | .7312 | .7312 | .7312 | .7312 | .7312 | .7312 |
| B4 | .7145 | .7145 | .7146 | .6597 | .6597 | .6597 | .6597 | .6597 | .6598 |
| B5 | -1.1821 | -1.1821 | -1.1821 | -1.1273 | -1.1273 | -1.1273 | -1.1273 | -1.1273 | -1.1273 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 244077 QTA2 = 203460 QTA3 = 174899

AZIMUTH AND TILT COEF. C1 = .0013 C2 = -.2765 C3 = -.2962 C4 = 1.5873 C5 =-1.1410

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 25 | 28 | 38 | 50 | 60 | 69 | 71 | 71 | 64 | 53 | 44 | 30 |
| QHOR: | 537 | 739 | 1066 | 1366 | 1666 | 1838 | 1783 | 1542 | 1216 | 946 | 559 | 425 |

ERIE, PENNSYLVANIA — ELEVATION = 738 — LAT = 42.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 58.62 | 27.59 | 20.76 | 16.15 | 12.86 | 10.66 | 9.08 | 7.91 | 6.29 |
| VT2/DD | 49.97 | 23.51 | 17.70 | 13.78 | 10.98 | 9.10 | 7.75 | 6.76 | 5.37 |
| VT3/DD | 43.37 | 20.41 | 15.36 | 11.97 | 9.53 | 7.90 | 6.73 | 5.86 | 4.66 |
| MONTHLY DD | 206 | 438 | 582 | 590 | 741 | 894 | 1049 | 1204 | 1514 |
| ANNUAL DD | 535 | 1530 | 2254 | 3111 | 4099 | 5234 | 6532 | 8014 | 11435 |
| PARAMETER A | .548 | .600 | .613 | .655 | .726 | .794 | .860 | .923 | 1.012 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0281 | -.0377 | -.0386 | -.0749 | -.0650 | -.0572 | -.0507 | -.0454 | -.0392 |
| A2 | .2177 | .3117 | .3561 | .5850 | .5422 | .5068 | .4787 | .4580 | .4626 |
| A3 | -.2142 | -.3274 | -.3782 | -.6455 | -.6032 | -.5694 | -.5452 | -.5313 | -.5625 |
| A4 | .1742 | .2476 | .2781 | .3377 | .3186 | .3040 | .2946 | .2911 | .3170 |
| A5 | .0119 | .0093 | .0116 | .0396 | .0322 | .0245 | .0154 | .0045 | -.0226 |
| B1 | .0111 | .0111 | .0111 | .0282 | .0282 | .0282 | .0282 | .0282 | .0282 |
| B2 | -.9476 | -.9475 | -.9475 | -1.0231 | -1.0231 | -1.0231 | -1.0231 | -1.0231 | -1.0231 |
| B3 | .6418 | .6418 | .6418 | .7308 | .7308 | .7308 | .7308 | .7308 | .7309 |
| B4 | .7019 | .7020 | .7020 | .6654 | .6654 | .6654 | .6654 | .6654 | .6654 |
| B5 | -1.0692 | -1.0693 | -1.0693 | -1.0652 | -1.0653 | -1.0653 | -1.0652 | -1.0653 | -1.0653 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 218491 QTA2 = 181618 QTA3 = 155952

AZIMUTH AND TILT COEF. C1 = -.0175 C2 = -.1914 C3 = -.3759 C4 = 1.6709 C5 =-1.1181

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 26 | 26 | 34 | 45 | 58 | 64 | 69 | 68 | 62 | 52 | 42 | 31 |
| QHOR: | 375 | 586 | 890 | 1421 | 1744 | 1846 | 1792 | 1557 | 1250 | 852 | 409 | 286 |

HARRISBURG, PENNSYLVANIA — ELEVATION = 348 — LAT = 40.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 156.79 | 53.15 | 37.38 | 28.54 | 23.02 | 19.27 | 16.56 | 14.52 | 11.64 |
| VT2/DD | 133.91 | 45.39 | 31.93 | 24.37 | 19.66 | 16.45 | 14.14 | 12.40 | 9.94 |
| VT3/DD | 116.28 | 39.41 | 27.72 | 21.16 | 17.07 | 14.29 | 12.28 | 10.77 | 8.63 |
| MONTHLY DD | 116 | 343 | 488 | 639 | 792 | 946 | 1101 | 1256 | 1566 |
| ANNUAL DD | 237 | 985 | 1635 | 2415 | 3290 | 4274 | 5410 | 6734 | 9877 |
| PARAMETER A | .518 | .643 | .652 | .633 | .613 | .607 | .622 | .651 | .686 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .1093 | .0841 | .0889 | .0975 | .1046 | .1079 | .1057 | .1008 | .0947 |
| A2 | .3533 | .3095 | .3627 | .4439 | .5248 | .5870 | .6216 | .6488 | .7564 |
| A3 | -.3349 | -.3078 | -.3703 | -.4661 | -.5622 | -.6387 | -.6882 | -.7350 | -.9011 |
| A4 | .1733 | .1568 | .1946 | .2505 | .3064 | .3519 | .3830 | .4130 | .5133 |
| A5 | .0727 | .0573 | .0579 | .0587 | .0589 | .0564 | .0482 | .0341 | -.0011 |
| B1 | -.0438 | -.0438 | -.0438 | -.0438 | -.0438 | -.0438 | -.0438 | -.0438 | -.0438 |
| B2 | -1.0637 | -1.0637 | -1.0637 | -1.0637 | -1.0637 | -1.0637 | -1.0637 | -1.0637 | -1.0637 |
| B3 | .7061 | .7061 | .7061 | .7061 | .7061 | .7061 | .7060 | .7061 | .7061 |
| B4 | .7294 | .7294 | .7294 | .7294 | .7294 | .7294 | .7294 | .7294 | .7293 |
| B5 | -1.1731 | -1.1731 | -1.1731 | -1.1731 | -1.1731 | -1.1730 | -1.1731 | -1.1731 | -1.1730 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 242941 QTA2 = 202451 QTA3 = 174011

AZIMUTH AND TILT COEF. C1 = .0014 C2 = -.2682 C3 = -.3071 C4 = 1.6091 C5 =-1.1397

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 29 | 31 | 40 | 52 | 62 | 71 | 75 | 72 | 65 | 55 | 43 | 35 |
| QHOR: | 512 | 756 | 1060 | 1439 | 1660 | 1816 | 1798 | 1517 | 1246 | 943 | 582 | 454 |

PHILADELPHIA, PENNSYLVANIA — ELEVATION = 30 — LAT = 39.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 189.86 | 63.54 | 44.27 | 33.40 | 26.61 | 22.06 | 18.78 | 16.34 | 12.98 |
| VT2/DD | 162.13 | 54.26 | 37.81 | 28.52 | 22.73 | 18.83 | 16.04 | 13.96 | 11.08 |
| VT3/DD | 140.79 | 47.11 | 32.83 | 24.77 | 19.73 | 16.36 | 13.92 | 12.12 | 9.62 |
| MONTHLY DD | 103 | 308 | 441 | 585 | 734 | 886 | 1041 | 1196 | 1506 |
| ANNUAL DD | 209 | 865 | 1449 | 2171 | 3013 | 3982 | 5112 | 6412 | 9534 |
| PARAMETER A | .565 | .670 | .648 | .633 | .622 | .617 | .626 | .643 | .674 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0506 | -.0228 | -.0177 | -.0131 | -.0093 | -.0060 | -.0032 | -.0014 | .0002 |
| A2 | .2373 | .1852 | .2522 | .3294 | .4115 | .4881 | .5508 | .6017 | .7291 |
| A3 | -.2480 | -.2167 | -.2959 | -.3879 | -.4873 | -.5806 | -.6591 | -.7269 | -.9075 |
| A4 | .1445 | .1284 | .1776 | .2341 | .2950 | .3529 | .4015 | .4429 | .5504 |
| A5 | .0278 | .0038 | .0023 | -.0004 | -.0046 | -.0094 | -.0152 | -.0233 | -.0514 |
| B1 | .0036 | .0036 | .0036 | .0036 | .0036 | .0036 | .0036 | .0036 | .0036 |
| B2 | -1.0542 | -1.0542 | -1.0542 | -1.0542 | -1.0542 | -1.0542 | -1.0542 | -1.0542 | -1.0542 |
| B3 | .7018 | .7018 | .7018 | .7018 | .7018 | .7018 | .7018 | .7018 | .7018 |
| B4 | .7248 | .7249 | .7249 | .7249 | .7248 | .7249 | .7248 | .7249 | .7249 |
| B5 | -1.1683 | -1.1684 | -1.1684 | -1.1684 | -1.1684 | -1.1684 | -1.1684 | -1.1684 | -1.1684 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 254166 QTA2 = 212049 QTA3 = 182360
AZIMUTH AND TILT COEF. C1 = .0070 C2 = -.3179 C3 = -.2415 C4 = 1.5751 C5 = -1.1533

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 31 | 33 | 42 | 50 | 62 | 71 | 76 | 74 | 68 | 56 | 45 | 35 |
| QHOR: | 551 | 781 | 1109 | 1419 | 1743 | 1813 | 1701 | 1580 | 1306 | 935 | 635 | 482 |

PITTSBURGH, PENNSYLVANIA — ELEVATION = 1224 — LAT = 40.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 66.60 | 33.42 | 25.69 | 19.45 | 15.30 | 12.54 | 10.58 | 9.15 | 7.20 |
| VT2/DD | 56.83 | 28.52 | 21.92 | 16.57 | 13.04 | 10.68 | 9.02 | 7.80 | 6.14 |
| VT3/DD | 49.34 | 24.76 | 19.03 | 14.38 | 11.31 | 9.27 | 7.83 | 6.77 | 5.33 |
| MONTHLY DD | 230 | 458 | 596 | 539 | 685 | 836 | 991 | 1146 | 1456 |
| ANNUAL DD | 552 | 1453 | 2118 | 2899 | 3812 | 4881 | 6120 | 7539 | 10841 |
| PARAMETER A | .598 | .575 | .542 | .603 | .669 | .735 | .802 | .867 | .960 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0817 | -.0942 | -.1016 | .0428 | .0376 | .0332 | .0292 | .0259 | .0222 |
| A2 | .4448 | .5587 | .6321 | .3747 | .3566 | .3430 | .3333 | .3305 | .3610 |
| A3 | -.4083 | -.5215 | -.5940 | -.4486 | -.4283 | -.4149 | -.4076 | -.4109 | -.4679 |
| A4 | .2370 | .2930 | .3351 | .3706 | .3485 | .3318 | .3195 | .3145 | .3404 |
| A5 | .1087 | .1370 | .1512 | -.0862 | -.0789 | -.0742 | -.0718 | -.0728 | -.0865 |
| B1 | .0466 | .0466 | .0466 | -.0069 | -.0069 | -.0069 | -.0069 | -.0069 | -.0069 |
| B2 | -1.0106 | -1.0106 | -1.0106 | -.9373 | -.9373 | -.9373 | -.9373 | -.9373 | -.9373 |
| B3 | .6724 | .6724 | .6724 | .6395 | .6395 | .6395 | .6395 | .6395 | .6394 |
| B4 | .7219 | .7219 | .7219 | .7092 | .7092 | .7092 | .7092 | .7092 | .7092 |
| B5 | -1.1324 | -1.1325 | -1.1324 | -1.0455 | -1.0455 | -1.0455 | -1.0455 | -1.0455 | -1.0455 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 219177 QTA2 = 182367 QTA3 = 156679
AZIMUTH AND TILT COEF. C1 = .0175 C2 = -.2096 C3 = -.3327 C4 = 1.6309 C5 = -1.0926

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 26 | 30 | 35 | 48 | 61 | 67 | 71 | 70 | 65 | 52 | 41 | 33 |
| QHOR: | 449 | 588 | 899 | 1370 | 1624 | 1753 | 1768 | 1541 | 1230 | 869 | 525 | 336 |

WILKES-BARRE, PENNSYLVANIA — ELEVATION = 948 — LAT = 41.3

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 69.91 | 32.30 | 24.41 | 19.44 | 16.14 | 13.80 | 12.05 | 10.70 | 8.73 |
| VT2/DD | 59.59 | 27.53 | 20.81 | 16.57 | 13.76 | 11.76 | 10.27 | 9.12 | 7.44 |
| VT3/DD | 51.71 | 23.89 | 18.06 | 14.38 | 11.94 | 10.21 | 8.92 | 7.91 | 6.46 |
| MONTHLY DD | 211 | 457 | 604 | 759 | 914 | 1069 | 1224 | 1379 | 1689 |
| ANNUAL DD | 494 | 1468 | 2180 | 3032 | 4019 | 5134 | 6407 | 7853 | 11158 |
| PARAMETER A | .692 | .614 | .618 | .636 | .660 | .689 | .723 | .756 | .792 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0374 | .0512 | .0512 | .0487 | .0454 | .0418 | .0380 | .0347 | .0305 |
| A2 | .0204 | .1336 | .1834 | .2270 | .2640 | .2945 | .3232 | .3568 | .4548 |
| A3 | -.0593 | -.1919 | -.2455 | -.2940 | -.3368 | -.3745 | -.4137 | -.4617 | -.6026 |
| A4 | .0829 | .1726 | .2021 | .2269 | .2492 | .2694 | .2911 | .3189 | .4042 |
| A5 | -.0627 | -.0689 | -.0617 | -.0558 | -.0527 | -.0527 | -.0567 | -.0643 | -.0888 |
| B1 | -.0253 | -.0253 | -.0253 | -.0253 | -.0253 | -.0253 | -.0253 | -.0253 | -.0253 |
| B2 | -.9511 | -.9511 | -.9511 | -.9511 | -.9511 | -.9511 | -.9511 | -.9511 | -.9511 |
| B3 | .6335 | .6334 | .6335 | .6335 | .6335 | .6334 | .6335 | .6334 | .6334 |
| B4 | .7276 | .7277 | .7276 | .7277 | .7277 | .7277 | .7277 | .7277 | .7277 |
| B5 | -1.0864 | -1.0864 | -1.0864 | -1.0864 | -1.0864 | -1.0864 | -1.0864 | -1.0864 | -1.0864 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 226513 QTA2 = 188707 QTA3 = 162200
AZIMUTH AND TILT COEF. C1 = -.0177 C2 = -.2483 C3 = -.2960 C4 = 1.5912 C5 = -1.1103

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 25 | 26 | 35 | 48 | 59 | 67 | 73 | 69 | 62 | 52 | 41 | 29 |
| QHOR: | 460 | 677 | 933 | 1381 | 1632 | 1799 | 1706 | 1516 | 1108 | 906 | 490 | 384 |

PROVIDENCE, RHODE ISLAND — ELEVATION = 62 — LAT = 41.7

| SOUTH-VERT. | TB30 (M=12) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 138.70 | 53.05 | 37.29 | 28.17 | 22.27 | 18.33 | 15.53 | 13.47 | 10.65 |
| VT2/DD | 118.72 | 45.41 | 31.92 | 24.11 | 19.06 | 15.69 | 13.29 | 11.53 | 9.11 |
| VT3/DD | 103.13 | 39.45 | 27.72 | 20.94 | 16.56 | 13.63 | 11.55 | 10.02 | 7.92 |
| MONTHLY DD | 114 | 297 | 422 | 559 | 707 | 859 | 1014 | 1169 | 1479 |
| ANNUAL DD | 401 | 1218 | 1899 | 2733 | 3729 | 4864 | 6147 | 7594 | 10902 |
| PARAMETER A | .241 | .440 | .509 | .568 | .622 | .662 | .699 | .735 | .778 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0907 | -.0433 | -.0369 | -.0339 | -.0317 | -.0303 | -.0286 | -.0267 | -.0234 |
| A2 | .8106 | .6519 | .6773 | .6921 | .6992 | .7161 | .7290 | .7444 | .8224 |
| A3 | -.7212 | -.6585 | -.7035 | -.7327 | -.7529 | -.7833 | -.8116 | -.8457 | -.9742 |
| A4 | .6292 | .4669 | .4726 | .4790 | .4847 | .4995 | .5133 | .5300 | .5998 |
| A5 | .0483 | .0311 | .0330 | .0310 | .0253 | .0184 | .0087 | -.0035 | -.0333 |
| B1 | .0157 | .0157 | .0157 | .0157 | .0157 | .0157 | .0157 | .0157 | .0157 |
| B2 | -1.1516 | -1.1516 | -1.1516 | -1.1516 | -1.1516 | -1.1516 | -1.1516 | -1.1516 | -1.1516 |
| B3 | .8100 | .8100 | .8100 | .8100 | .8100 | .8100 | .8100 | .8100 | .8100 |
| B4 | .6159 | .6159 | .6159 | .6159 | .6159 | .6159 | .6158 | .6159 | .6159 |
| B5 | -1.1608 | -1.1608 | -1.1608 | -1.1608 | -1.1608 | -1.1608 | -1.1607 | -1.1608 | -1.1608 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 250294 — QTA2 = 208990 — QTA3 = 179770

AZIMUTH AND TILT COEF. — C1 = .0155 — C2 = -.3250 — C3 = -.2398 — C4 = 1.5463 — C5 = -1.1685

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 28 | 29 | 36 | 45 | 57 | 66 | 74 | 70 | 63 | 52 | 43 | 32 |
| QHOR: | 510 | 719 | 1056 | 1352 | 1766 | 1792 | 1740 | 1510 | 1205 | 925 | 558 | 396 |

CHARLESTON, SOUTH CAROLINA — ELEVATION = 39 — LAT = 32.9

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | 467.31 | 245.97 | 141.53 | 89.98 | 61.42 | 44.75 | 34.64 | 23.64 |
| VT2/DD | NA | 398.41 | 209.70 | 120.66 | 76.72 | 52.36 | 38.16 | 29.54 | 20.15 |
| VT3/DD | NA | 345.96 | 182.09 | 104.78 | 66.62 | 45.47 | 33.13 | 25.65 | 17.50 |
| MONTHLY DD | 9 | 49 | 93 | 162 | 255 | 374 | 513 | 663 | 971 |
| ANNUAL DD | 14 | 148 | 324 | 627 | 1065 | 1652 | 2406 | 3362 | 6061 |
| PARAMETER A | NA | .578 | .573 | .556 | .543 | .554 | .579 | .604 | .643 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0155 | .0207 | .0244 | .0280 | .0301 | .0313 | .0317 | .0323 |
| A2 | NA | .1367 | .2049 | .2684 | .3346 | .3844 | .4339 | .5043 | .7471 |
| A3 | NA | -.1719 | -.2496 | -.3250 | -.4075 | -.4725 | -.5390 | -.6366 | -.9802 |
| A4 | NA | .1417 | .1913 | .2387 | .2882 | .3236 | .3574 | .4062 | .5750 |
| A5 | NA | -.0451 | -.0466 | -.0505 | -.0560 | -.0595 | -.0623 | -.0683 | -.0903 |
| B1 | NA | .0240 | .0240 | .0240 | .0240 | .0240 | .0240 | .0240 | .0240 |
| B2 | NA | -1.0501 | -1.0501 | -1.0501 | -1.0501 | -1.0501 | -1.0501 | -1.0501 | -1.0501 |
| B3 | NA | .6427 | .6427 | .6427 | .6426 | .6427 | .6427 | .6427 | .6427 |
| B4 | NA | .9291 | .9291 | .9291 | .9291 | .9291 | .9291 | .9291 | .9291 |
| B5 | NA | -1.2509 | -1.2509 | -1.2509 | -1.2509 | -1.2509 | -1.2509 | -1.2509 | -1.2509 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 272020 — QTA2 = 226798 — QTA3 = 195077

AZIMUTH AND TILT COEF. — C1 = .0623 — C2 = -.2953 — C3 = -.3090 — C4 = 1.7349 — C5 = -1.1526

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 48 | 48 | 56 | 64 | 71 | 75 | 78 | 78 | 74 | 64 | 56 | 49 |
| QHOR: | 714 | 1037 | 1368 | 1754 | 1866 | 1778 | 1737 | 1593 | 1408 | 1138 | 1000 | 693 |

COLUMBIA, SOUTH CAROLINA — ELEVATION = 226 — LAT = 33.9

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 1015.30 | 216.39 | 121.37 | 78.63 | 56.49 | 43.01 | 33.98 | 27.71 | 20.03 |
| VT2/DD | 864.66 | 184.28 | 103.37 | 66.96 | 48.11 | 36.63 | 28.94 | 23.60 | 17.05 |
| VT3/DD | 750.59 | 159.97 | 89.73 | 58.13 | 41.76 | 31.80 | 25.12 | 20.49 | 14.80 |
| MONTHLY DD | 22 | 103 | 183 | 283 | 394 | 517 | 655 | 803 | 1111 |
| ANNUAL DD | 42 | 289 | 554 | 942 | 1461 | 2123 | 2942 | 3946 | 6596 |
| PARAMETER A | .836 | .820 | .795 | .751 | .723 | .706 | .704 | .715 | .749 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0224 | .0358 | .0400 | .0460 | .0481 | .0475 | .0444 | .0401 | .0313 |
| A2 | -.0614 | .0539 | .0814 | .0998 | .1248 | .1613 | .2127 | .2770 | .4484 |
| A3 | .0320 | -.1169 | -.1502 | -.1755 | -.2095 | -.2592 | -.3287 | -.4163 | -.6552 |
| A4 | -.0004 | .1143 | .1399 | .1630 | .1893 | .2219 | .2626 | .3107 | .4377 |
| A5 | -.0431 | -.0641 | -.0668 | -.0726 | -.0785 | -.0848 | -.0913 | -.0987 | -.1205 |
| B1 | -.0056 | -.0056 | -.0056 | -.0056 | -.0056 | -.0056 | -.0056 | -.0056 | -.0056 |
| B2 | -.9650 | -.9650 | -.9650 | -.9650 | -.9650 | -.9650 | -.9650 | -.9650 | -.9650 |
| B3 | .5756 | .5756 | .5756 | .5755 | .5756 | .5756 | .5756 | .5756 | .5756 |
| B4 | .8888 | .8888 | .8888 | .8888 | .8888 | .8888 | .8888 | .8888 | .8888 |
| B5 | -1.2327 | -1.2327 | -1.2327 | -1.2327 | -1.2327 | -1.2327 | -1.2327 | -1.2327 | -1.2327 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 280242 — QTA2 = 233439 — QTA3 = 200669

AZIMUTH AND TILT COEF. — C1 = .0089 — C2 = -.2418 — C3 = -.3966 — C4 = 1.7513 — C5 = -1.1852

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 44 | 44 | 54 | 64 | 71 | 77 | 80 | 79 | 72 | 64 | 52 | 46 |
| QHOR: | 688 | 1029 | 1366 | 1722 | 1860 | 1966 | 1875 | 1730 | 1442 | 1187 | 904 | 710 |

GREENVILLE, SOUTH CAROLINA — ELEVATION = 971 — LAT = 34.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 655.06 | 188.26 | 120.45 | 83.55 | 60.48 | 44.43 | 34.55 | 28.17 | 20.53 |
| VT2/DD | 558.87 | 159.48 | 102.04 | 70.78 | 51.23 | 37.96 | 29.52 | 24.07 | 17.54 |
| VT3/DD | 485.34 | 138.26 | 88.46 | 61.36 | 44.42 | 32.97 | 25.64 | 20.90 | 15.23 |
| MONTHLY DD | 42 | 128 | 200 | 288 | 397 | 528 | 679 | 833 | 1143 |
| ANNUAL DD | 86 | 381 | 683 | 1110 | 1720 | 2518 | 3496 | 4659 | 7637 |
| PARAMETER A | .232 | .409 | .413 | .404 | .429 | .496 | .547 | .572 | .608 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0863 | .0379 | .0382 | .0411 | .0401 | .0364 | .0315 | .0284 | .0230 |
| A2 | .7008 | -.5964 | -.5488 | -.5104 | -.4176 | .6739 | .7169 | .8080 | 1.0196 |
| A3 | -.6302 | .5029 | .4450 | .3950 | .2956 | -.7102 | -.7965 | -.9359 | -1.2547 |
| A4 | .5470 | -.4716 | -.4383 | -.4089 | -.3313 | .5492 | .5882 | .6636 | .8355 |
| A5 | .1005 | -.0833 | -.0798 | -.0801 | -.0787 | -.0080 | -.0302 | -.0516 | -.0970 |
| B1 | .0148 | -.0104 | -.0104 | -.0104 | -.0104 | -.0099 | -.0099 | -.0099 | -.0099 |
| B2 | -1.0343 | -.8265 | -.8265 | -.8265 | -.8265 | -1.0800 | -1.0800 | -1.0800 | -1.0800 |
| B3 | .6287 | .3516 | .3516 | .3516 | .3516 | .6857 | .6857 | .6857 | .6856 |
| B4 | .8354 | 1.1391 | 1.1391 | 1.1391 | 1.1391 | .7639 | .7638 | .7638 | .7639 |
| B5 | -1.2692 | -1.3007 | -1.3008 | -1.3007 | -1.3008 | -1.2470 | -1.2469 | -1.2469 | -1.2470 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 286542 — QTA2 = 238827 — QTA3 = 205319
AZIMUTH AND TILT COEF. — C1 = -.0083 — C2 = -.2888 — C3 = -.3399 — C4 = 1.7146 — C5 = -1.2027

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 40 | 41 | 50 | 60 | 65 | 74 | 75 | 76 | 71 | 59 | 51 | 43 |
| QHOR: | 766 | 961 | 1346 | 1694 | 1866 | 2015 | 1776 | 1775 | 1474 | 1191 | 914 | 625 |

HURON, SOUTH DAKOTA — ELEVATION = 1289 — LAT = 44.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 31.11 | 19.62 | 16.34 | 13.98 | 12.20 | 10.83 | 9.74 | 8.84 | 7.47 |
| VT2/DD | 26.64 | 16.80 | 13.99 | 11.97 | 10.45 | 9.27 | 8.34 | 7.57 | 6.39 |
| VT3/DD | 23.14 | 14.59 | 12.15 | 10.40 | 9.08 | 8.06 | 7.24 | 6.58 | 5.56 |
| MONTHLY DD | 479 | 760 | 913 | 1067 | 1222 | 1377 | 1532 | 1687 | 1997 |
| ANNUAL DD | 1831 | 3149 | 4011 | 4985 | 6072 | 7273 | 8588 | 10028 | 13240 |
| PARAMETER A | .616 | .740 | .803 | .856 | .904 | .944 | .978 | 1.008 | 1.051 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0033 | .0015 | .0034 | .0052 | .0069 | .0085 | .0099 | .0112 | .0134 |
| A2 | .1864 | .2071 | .2121 | .2211 | .2352 | .2543 | .2755 | .2985 | .3537 |
| A3 | -.2187 | -.2346 | -.2398 | -.2522 | -.2726 | -.2998 | -.3298 | -.3628 | -.4435 |
| A4 | .2559 | .2450 | .2387 | .2385 | .2437 | .2542 | .2674 | .2830 | .3253 |
| A5 | -.0815 | -.0628 | -.0566 | -.0538 | -.0535 | -.0548 | -.0572 | -.0608 | -.0737 |
| B1 | -.0174 | -.0174 | -.0174 | -.0174 | -.0174 | -.0174 | -.0174 | -.0174 | -.0174 |
| B2 | -1.1331 | -1.1331 | -1.1331 | -1.1331 | -1.1331 | -1.1331 | -1.1331 | -1.1331 | -1.1331 |
| B3 | .7941 | .7941 | .7941 | .7941 | .7941 | .7941 | .7941 | .7941 | .7941 |
| B4 | .5341 | .5341 | .5341 | .5341 | .5341 | .5341 | .5341 | .5341 | .5341 |
| B5 | -1.1492 | -1.1492 | -1.1491 | -1.1491 | -1.1492 | -1.1492 | -1.1491 | -1.1491 | -1.1492 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 293341 — QTA2 = 244942 — QTA3 = 210614
AZIMUTH AND TILT COEF. — C1 = .0149 — C2 = -.3003 — C3 = -.3193 — C4 = 1.5676 — C5 = -1.2750

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 11 | 16 | 26 | 45 | 57 | 66 | 74 | 73 | 60 | 47 | 32 | 15 |
| QHOR: | 475 | 784 | 1142 | 1454 | 1843 | 2127 | 2230 | 1864 | 1395 | 951 | 569 | 348 |

PIERRE, SOUTH DAKOTA — ELEVATION = 1726 — LAT = 44.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) |
| VT1/DD | 53.46 | 32.59 | 27.03 | 23.08 | 20.14 | 17.86 | 16.04 | 14.57 | 12.15 |
| VT2/DD | 45.83 | 27.94 | 23.17 | 19.78 | 17.26 | 15.31 | 13.75 | 12.49 | 10.43 |
| VT3/DD | 39.83 | 24.28 | 20.14 | 17.19 | 15.00 | 13.31 | 11.95 | 10.85 | 9.07 |
| MONTHLY DD | 457 | 750 | 905 | 1059 | 1214 | 1369 | 1524 | 1679 | 1823 |
| ANNUAL DD | 1257 | 2496 | 3299 | 4212 | 5243 | 6395 | 7667 | 9072 | 12220 |
| PARAMETER A | .505 | .579 | .593 | .607 | .626 | .645 | .665 | .682 | .714 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0028 | .0012 | .0027 | .0038 | .0045 | .0049 | .0051 | .0052 | -.0051 |
| A2 | .2699 | .3501 | .4007 | .4513 | .4992 | .5471 | .5964 | .6481 | .8575 |
| A3 | -.2423 | -.3377 | -.3950 | -.4543 | -.5146 | -.5773 | -.6437 | -.7150 | -.9310 |
| A4 | .1283 | .1850 | .2187 | .2532 | .2879 | .3241 | .3625 | .4040 | .6014 |
| A5 | .0380 | .0377 | .0388 | .0384 | .0354 | .0302 | .0231 | .0140 | .0129 |
| B1 | .0204 | .0204 | .0204 | .0204 | .0204 | .0204 | .0204 | .0204 | .0241 |
| B2 | -1.2036 | -1.2036 | -1.2036 | -1.2036 | -1.2036 | -1.2036 | -1.2036 | -1.2036 | -1.2363 |
| B3 | .8209 | .8209 | .8209 | .8209 | .8209 | .8209 | .8209 | .8209 | .8730 |
| B4 | .5718 | .5718 | .5718 | .5718 | .5718 | .5718 | .5718 | .5718 | .4994 |
| B5 | -1.2271 | -1.2271 | -1.2272 | -1.2272 | -1.2272 | -1.2272 | -1.2272 | -1.2272 | -1.2124 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 324109 — QTA2 = 270968 — QTA3 = 233082
AZIMUTH AND TILT COEF. — C1 = .0247 — C2 = -.3563 — C3 = -.2705 — C4 = 1.5373 — C5 = -1.3048

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 15 | 20 | 31 | 46 | 58 | 69 | 76 | 74 | 62 | 51 | 34 | 21 |
| QHOR: | 528 | 764 | 1226 | 1496 | 1999 | 2215 | 2256 | 2002 | 1498 | 1049 | 654 | 445 |

RAPID CITY, SOUTH DAKOTA — ELEVATION = 3169 — LAT = 44.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 88.36 | 47.96 | 37.96 | 31.00 | 25.90 | 22.22 | 19.46 | 17.30 | 14.16 |
| VT2/DD | 75.76 | 41.12 | 32.55 | 26.61 | 22.23 | 19.08 | 16.71 | 14.85 | 12.16 |
| VT3/DD | 65.85 | 35.74 | 28.29 | 23.14 | 19.33 | 16.59 | 14.52 | 12.91 | 10.57 |
| MONTHLY DD | 293 | 539 | 681 | 780 | 934 | 1088 | 1243 | 1397 | 1707 |
| ANNUAL DD | 970 | 2159 | 2958 | 3903 | 4980 | 6185 | 7529 | 9009 | 12281 |
| PARAMETER A | .562 | .527 | .527 | .545 | .573 | .597 | .616 | .630 | .634 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0511 | .0614 | .0627 | -.1041 | -.0970 | -.0916 | -.0872 | -.0840 | -.0814 |
| A2 | .2798 | .4864 | .5684 | .8010 | .8394 | .8876 | .9415 | 1.0049 | 1.1799 |
| A3 | -.3127 | -.5213 | -.6097 | -.6877 | -.7547 | -.8336 | -.9200 | -1.0173 | -1.2669 |
| A4 | .1508 | .2788 | .3338 | .5369 | .5689 | .6094 | .6552 | .7086 | .8532 |
| A5 | -.0034 | .0156 | .0192 | .1379 | .1214 | .1036 | .0846 | .0652 | .0238 |
| B1 | .0208 | .0208 | .0208 | .0706 | .0706 | .0706 | .0706 | .0706 | .0706 |
| B2 | -1.2175 | -1.2175 | -1.2175 | -1.2551 | -1.2551 | -1.2551 | -1.2551 | -1.2551 | -1.2551 |
| B3 | .8350 | .8350 | .8350 | .8822 | .8821 | .8822 | .8822 | .8822 | .8822 |
| B4 | .5773 | .5772 | .5772 | .4914 | .4914 | .4914 | .4914 | .4914 | .4914 |
| B5 | -1.2345 | -1.2345 | -1.2345 | -1.2347 | -1.2347 | -1.2347 | -1.2347 | -1.2347 | -1.2347 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 327896 — QTA2 = 274283 — QTA3 = 235992

AZIMUTH AND TILT COEF. — C1 = .0624 — C2 = -.3894 — C3 = -.2368 — C4 = 1.5294 — C5 = -1.3157

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 23 | 26 | 32 | 43 | 55 | 65 | 72 | 73 | 58 | 49 | 33 | 24 |
| QHOR: | 556 | 762 | 1256 | 1596 | 1904 | 2168 | 2198 | 2008 | 1489 | 1038 | 657 | 462 |

SIOUX FALLS, SOUTH DAKOTA — ELEVATION = 1427 — LAT = 43.6

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 48.31 | 29.84 | 24.95 | 21.43 | 18.78 | 16.72 | 15.06 | 13.71 | 11.61 |
| VT2/DD | 41.39 | 25.56 | 21.37 | 18.36 | 16.09 | 14.32 | 12.91 | 11.74 | 9.95 |
| VT3/DD | 35.97 | 22.22 | 18.57 | 15.96 | 13.99 | 12.45 | 11.22 | 10.21 | 8.65 |
| MONTHLY DD | 488 | 790 | 945 | 1100 | 1255 | 1410 | 1565 | 1720 | 2030 |
| ANNUAL DD | 1327 | 2661 | 3500 | 4439 | 5487 | 6644 | 7924 | 9349 | 12570 |
| PARAMETER A | .675 | .688 | .691 | .699 | .713 | .725 | .734 | .745 | .752 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .1136 | .1328 | .1395 | .1418 | .1411 | .1402 | .1389 | .1367 | .1335 |
| A2 | .1611 | .2548 | .2972 | .3372 | .3800 | .4314 | .4881 | .5466 | .6842 |
| A3 | -.1624 | -.2633 | -.3099 | -.3577 | -.4121 | -.4785 | -.5520 | -.6286 | -.8120 |
| A4 | .1166 | .1766 | .2043 | .2317 | .2622 | .2999 | .3421 | .3863 | .4941 |
| A5 | -.0062 | .0023 | .0051 | .0048 | .0021 | -.0025 | -.0084 | -.0152 | -.0363 |
| B1 | -.0510 | -.0510 | -.0510 | -.0510 | -.0510 | -.0510 | -.0510 | -.0510 | -.0510 |
| B2 | -1.1748 | -1.1748 | -1.1747 | -1.1748 | -1.1748 | -1.1748 | -1.1747 | -1.1747 | -1.1748 |
| B3 | .7879 | .7879 | .7879 | .7879 | .7879 | .7879 | .7879 | .7879 | .7879 |
| B4 | .5939 | .5939 | .5939 | .5939 | .5939 | .5939 | .5939 | .5939 | .5939 |
| B5 | -1.2317 | -1.2317 | -1.2317 | -1.2317 | -1.2317 | -1.2317 | -1.2317 | -1.2317 | -1.2317 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 311037 — QTA2 = 260256 — QTA3 = 223974

AZIMUTH AND TILT COEF. — C1 = .0081 — C2 = -.3926 — C3 = -.2079 — C4 = 1.4967 — C5 = -1.2791

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 14 | 19 | 30 | 46 | 57 | 69 | 73 | 72 | 59 | 51 | 33 | 21 |
| QHOR: | 523 | 821 | 1189 | 1610 | 1807 | 2044 | 2065 | 1754 | 1363 | 1060 | 635 | 463 |

CHATTANOOGA, TENNESSEE — ELEVATION = 689 — LAT = 35.0

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 2) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 425.11 | 138.19 | 86.09 | 55.95 | 40.52 | 31.20 | 25.09 | 20.92 | 15.69 |
| VT2/DD | 359.45 | 116.85 | 73.46 | 47.73 | 34.57 | 26.62 | 21.41 | 17.85 | 13.39 |
| VT3/DD | 311.47 | 101.25 | 63.78 | 41.45 | 30.02 | 23.12 | 18.59 | 15.50 | 11.63 |
| MONTHLY DD | 49 | 150 | 226 | 348 | 481 | 624 | 776 | 931 | 1241 |
| ANNUAL DD | 101 | 510 | 925 | 1483 | 2154 | 2949 | 3895 | 5035 | 7960 |
| PARAMETER A | .583 | .454 | .433 | .508 | .545 | .573 | .602 | .637 | .685 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0210 | .0318 | -.0088 | -.0128 | -.0162 | -.0189 | -.0213 | -.0231 | -.0258 |
| A2 | -.4151 | -.5593 | .7099 | .6064 | .5941 | .6112 | .6345 | .6630 | .7988 |
| A3 | .4392 | .5984 | -.8031 | -.7000 | -.6970 | -.7275 | -.7672 | -.8175 | -1.0254 |
| A4 | -.2527 | -.3250 | .4994 | .4377 | .4366 | .4541 | .4755 | .5014 | .6129 |
| A5 | -.0595 | -.0827 | .0249 | .0073 | -.0031 | -.0110 | -.0198 | -.0313 | -.0623 |
| B1 | -.0143 | -.0143 | -.0019 | -.0019 | -.0019 | -.0019 | -.0019 | -.0019 | -.0019 |
| B2 | -.7284 | -.7284 | -1.0324 | -1.0324 | -1.0324 | -1.0324 | -1.0324 | -1.0324 | -1.0324 |
| B3 | .2697 | .2697 | .6855 | .6855 | .6855 | .6855 | .6855 | .6855 | .6855 |
| B4 | 1.1427 | 1.1427 | .7906 | .7905 | .7906 | .7906 | .7906 | .7906 | .7906 |
| B5 | -1.2259 | -1.2259 | -1.1902 | -1.1902 | -1.1903 | -1.1902 | -1.1902 | -1.1902 | -1.1902 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 253586 — QTA2 = 211303 — QTA3 = 181696

AZIMUTH AND TILT COEF. — C1 = -.0287 — C2 = -.2337 — C3 = -.3469 — C4 = 1.6763 — C5 = -1.1248

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 39 | 40 | 49 | 59 | 65 | 74 | 77 | 76 | 71 | 61 | 48 | 39 |
| QHOR: | 658 | 887 | 1138 | 1607 | 1685 | 1818 | 1700 | 1620 | 1324 | 1101 | 807 | 573 |

KNOXVILLE, TENNESSEE — ELEVATION = 981 — LAT = 35.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 230.40 | 95.06 | 67.23 | 49.61 | 38.19 | 30.36 | 25.02 | 21.23 | 16.27 |
| VT2/DD | 196.45 | 81.05 | 57.33 | 42.30 | 32.56 | 25.89 | 21.33 | 18.10 | 13.87 |
| VT3/DD | 170.56 | 70.37 | 49.77 | 36.72 | 28.27 | 22.48 | 18.52 | 15.71 | 12.04 |
| MONTHLY DD | 94 | 227 | 321 | 435 | 565 | 711 | 863 | 1017 | 1327 |
| ANNUAL DD | 162 | 584 | 974 | 1515 | 2196 | 3028 | 4004 | 5162 | 8108 |
| PARAMETER A | .741 | .676 | .614 | .577 | .550 | .541 | .540 | .560 | .610 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0072 | .0056 | .0018 | -.0023 | -.0059 | -.0086 | -.0106 | -.0116 | -.0109 |
| A2 | .0937 | .1931 | .2646 | .3479 | .4285 | .4969 | .5686 | .6282 | .7723 |
| A3 | -.0961 | -.2004 | -.2813 | -.3776 | -.4716 | -.5582 | -.6550 | -.7452 | -.9719 |
| A4 | .0533 | .1110 | .1574 | .2142 | .2725 | .3275 | .3883 | .4437 | .5786 |
| A5 | .0203 | .0415 | .0493 | .0542 | .0565 | .0509 | .0391 | .0202 | -.0309 |
| B1 | -.0130 | -.0130 | -.0130 | -.0130 | -.0130 | -.0130 | -.0130 | -.0130 | -.0130 |
| B2 | -1.0030 | -1.0030 | -1.0030 | -1.0030 | -1.0030 | -1.0030 | -1.0030 | -1.0030 | -1.0030 |
| B3 | .6281 | .6282 | .6282 | .6281 | .6281 | .6281 | .6282 | .6282 | .6281 |
| B4 | .8229 | .8229 | .8229 | .8229 | .8229 | .8229 | .8229 | .8229 | .8229 |
| B5 | -1.2165 | -1.2165 | -1.2165 | -1.2165 | -1.2165 | -1.2165 | -1.2165 | -1.2165 | -1.2166 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 260343 — QTA2 = 216726 — QTA3 = 186235

AZIMUTH AND TILT COEF. — C1 = -.0161 — C2 = -.2333 — C3 = -.3686 — C4 = 1.7174 — C5 = -1.1536

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 37 | 39 | 48 | 59 | 67 | 73 | 76 | 76 | 72 | 58 | 46 | 41 |
| QHOR: | 637 | 878 | 1201 | 1578 | 1817 | 1890 | 1857 | 1696 | 1378 | 1156 | 734 | 566 |

MEMPHIS,.TENNESSEE — ELEVATION = 285 — LAT = 35.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 1025.10 | 186.55 | 104.92 | 68.69 | 49.21 | 37.74 | 30.25 | 25.09 | 18.68 |
| VT2/DD | 867.80 | 158.92 | 89.38 | 58.51 | 41.92 | 32.15 | 25.77 | 21.38 | 15.91 |
| VT3/DD | 752.18 | 137.96 | 77.59 | 50.79 | 36.39 | 27.91 | 22.37 | 18.56 | 13.81 |
| MONTHLY DD | 23 | 121 | 216 | 330 | 460 | 600 | 749 | 903 | 1213 |
| ANNUAL DD | 65 | 372 | 700 | 1162 | 1767 | 2493 | 3358 | 4371 | 7010 |
| PARAMETER A | .489 | .558 | .538 | .523 | .526 | .534 | .551 | .567 | .618 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0328 | .0111 | .0105 | .0113 | .0124 | .0135 | .0145 | .0157 | .0157 |
| A2 | -.4932 | .2247 | .2685 | .3059 | .3266 | .3540 | .3888 | .4386 | .5699 |
| A3 | .5161 | -.2881 | -.3443 | -.3883 | -.4113 | -.4457 | -.4942 | -.5664 | -.7630 |
| A4 | -.4067 | .1834 | .2075 | .2335 | .2516 | .2763 | .3086 | .3536 | .4685 |
| A5 | -.0044 | -.0106 | -.0072 | -.0047 | -.0049 | -.0087 | -.0175 | -.0309 | -.0673 |
| B1 | -.0103 | -.0056 | -.0056 | -.0056 | -.0056 | -.0056 | -.0056 | -.0056 | -.0056 |
| B2 | -.7977 | -.9748 | -.9748 | -.9748 | -.9748 | -.9748 | -.9748 | -.9748 | -.9748 |
| B3 | .3192 | .5954 | .5954 | .5954 | .5954 | .5954 | .5954 | .5954 | .5954 |
| B4 | 1.1503 | .8706 | .8705 | .8705 | .8705 | .8705 | .8705 | .8705 | .8705 |
| B5 | -1.2888 | -1.2272 | -1.2272 | -1.2272 | -1.2272 | -1.2272 | -1.2272 | -1.2271 | -1.2272 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 272252 — QTA2 = 226527 — QTA3 = 194596

AZIMUTH AND TILT COEF. — C1 = -.0064 — C2 = -.1929 — C3 = -.4513 — C4 = 1.7793 — C5 = -1.1812

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 40 | 41 | 51 | 64 | 71 | 78 | 81 | 79 | 73 | 62 | 49 | 44 |
| QHOR: | 694. | 942 | 1255 | 1624 | 1987 | 2050 | 2030 | 1769 | 1349 | 1194 | 827 | 601 |

NASHVILLE, TENNESSEE — ELEVATION = 591 — LAT = 36.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 534.88 | 126.19 | 78.17 | 53.56 | 39.33 | 30.46 | 24.36 | 20.28 | 15.19 |
| VT2/DD | 456.28 | 107.65 | 66.80 | 45.77 | 33.60 | 25.99 | 20.78 | 17.30 | 12.96 |
| VT3/DD | 396.15 | 93.46 | 58.02 | 39.75 | 29.19 | 22.56 | 18.04 | 15.02 | 11.25 |
| MONTHLY DD | 35 | 149 | 240 | 350 | 477 | 616 | 770 | 925 | 1235 |
| ANNUAL DD | 99 | 500 | 874 | 1374 | 2018 | 2803 | 3742 | 4880 | 7756 |
| PARAMETER A | .319 | .411 | .483 | .533 | .560 | .579 | .605 | .627 | .675 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .1999 | .1314 | -.0205 | -.0288 | -.0357 | .0548 | .0467 | .0399 | .0303 |
| A2 | .3765 | .3486 | .6162 | .6165 | .6490 | .4751 | .5134 | .5644 | .6826 |
| A3 | -.4175 | -.4039 | -.6108 | -.6304 | -.6805 | -.5738 | -.6269 | -.6992 | -.8775 |
| A4 | .2449 | .2457 | .4061 | .4206 | .4546 | .3705 | .4055 | .4513 | .5571 |
| A5 | .0090 | -.0079 | .0674 | .0506 | .0391 | -.0332 | -.0410 | -.0522 | -.0848 |
| B1 | -.0083 | -.0083 | .0284 | .0284 | .0284 | -.0083 | -.0083 | -.0083 | -.0083 |
| B2 | -1.0362 | -1.0362 | -1.0991 | -1.0991 | -1.0991 | -1.0362 | -1.0362 | -1.0362 | -1.0362 |
| B3 | .6761 | .6761 | .7437 | .7437 | .7437 | .6761 | .6762 | .6761 | .6762 |
| B4 | .8184 | .8183 | .7475 | .7475 | .7475 | .8184 | .8183 | .8184 | .8184 |
| B5 | -1.2136 | -1.2136 | -1.2188 | -1.2188 | -1.2188 | -1.2136 | -1.2136 | -1.2136 | -1.2136 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 253081 — QTA2 = 210388 — QTA3 = 180633

AZIMUTH AND TILT COEF. — C1 = .0046 — C2 = -.2387 — C3 = -.3701 — C4 = 1.7787 — C5 = -1.1807

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 40 | 42 | 49 | 58 | 67 | 75 | 78 | 76 | 71 | 60 | 50 | 40 |
| QHOR: | 553 | 808 | 1180 | 1561 | 1720 | 2032 | 1919 | 1758 | 1418 | 1062 | 691 | 509 |

ABILENE, TEXAS — ELEVATION = 1752 — LAT = 32.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 799.56 | 238.83 | 149.15 | 102.28 | 74.61 | 57.39 | 46.06 | 38.23 | 28.35 |
| VT2/DD | 683.14 | 204.05 | 127.43 | 87.39 | 63.75 | 49.03 | 39.35 | 32.66 | 24.22 |
| VT3/DD | 593.53 | 177.29 | 110.72 | 75.93 | 55.39 | 42.60 | 34.19 | 28.38 | 21.04 |
| MONTHLY DD | 42 | 141 | 226 | 330 | 452 | 588 | 732 | 882 | 1189 |
| ANNUAL DD | 67 | 326 | 610 | 1024 | 1562 | 2224 | 3032 | 3989 | 6479 |
| PARAMETER A | .572 | .682 | .648 | .587 | .543 | .527 | .522 | .512 | .483 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0091 | .0023 | .0016 | .0017 | .0021 | .0024 | .0031 | .0049 | .0124 |
| A2 | .0601 | .2646 | .3658 | .4809 | .5896 | .6736 | .7609 | .8927 | 1.2718 |
| A3 | -.0333 | -.2641 | -.3685 | -.4839 | -.5983 | -.6952 | -.8089 | -.9881 | -1.5115 |
| A4 | .0520 | .2065 | .2807 | .3655 | .4462 | .5097 | .5788 | .6842 | .9811 |
| A5 | .0143 | .0146 | .0220 | .0321 | .0383 | .0372 | .0269 | .0068 | -.0470 |
| B1 | -.0394 | -.0394 | -.0394 | -.0394 | -.0394 | -.0394 | -.0394 | -.0394 | -.0394 |
| B2 | -1.0918 | -1.0918 | -1.0918 | -1.0918 | -1.0918 | -1.0918 | -1.0918 | -1.0918 | -1.0918 |
| B3 | .6483 | .6482 | .6483 | .6483 | .6483 | .6483 | .6483 | .6483 | .6483 |
| B4 | .8163 | .8163 | .8163 | .8163 | .8162 | .8163 | .8162 | .8162 | .8163 |
| B5 | -1.3270 | -1.3271 | -1.3271 | -1.3271 | -1.3271 | -1.3270 | -1.3270 | -1.3270 | -1.3271 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 315053 — QTA2 = 262355 — QTA3 = 225453

AZIMUTH AND TILT COEF. — C1 = -.0204 — C2 = -.1847 — C3 = -.5094 — C4 = 1.8380 — C5 = -1.2504

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 43 | 47 | 53 | 65 | 71 | 78 | 82 | 83 | 77 | 63 | 55 | 41 |
| QHOR: | 904 | 1205 | 1566 | 1916 | 2062 | 2216 | 2092 | 1954 | 1552 | 1347 | 1013 | 858 |

AMARILLO, TEXAS — ELEVATION = 3602 — LAT = 35.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) |
| VT1/DD | 555.18 | 171.19 | 113.92 | 82.11 | 62.80 | 50.12 | 41.38 | 35.17 | 27.04 |
| VT2/DD | 470.88 | 145.19 | 96.62 | 69.64 | 53.26 | 42.51 | 35.10 | 29.83 | 22.93 |
| VT3/DD | 408.29 | 125.89 | 83.78 | 60.38 | 46.19 | 36.86 | 30.43 | 25.86 | 19.88 |
| MONTHLY DD | 59 | 191 | 287 | 399 | 521 | 653 | 791 | 931 | 1211 |
| ANNUAL DD | 213 | 829 | 1333 | 1976 | 2756 | 3671 | 4732 | 5973 | 8937 |
| PARAMETER A | .526 | .426 | .429 | .444 | .455 | .461 | .469 | .478 | .456 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0104 | -.0109 | -.0071 | -.0036 | -.0005 | .0023 | .0047 | .0068 | .0110 |
| A2 | -.4770 | -.5273 | -.4318 | -.3258 | -.2171 | -.0896 | .0514 | .2059 | .6149 |
| A3 | .2922 | .2822 | .1715 | .0545 | -.0705 | -.2260 | -.3973 | -.5865 | -1.1400 |
| A4 | -.3004 | -.3289 | -.2638 | -.1902 | -.1124 | -.0181 | .0874 | .2051 | .5325 |
| A5 | -.1738 | -.2165 | -.2142 | -.2088 | -.2076 | -.2126 | -.2182 | -.2262 | -.2858 |
| B1 | -.0071 | -.0071 | -.0071 | -.0071 | -.0071 | -.0071 | -.0071 | -.0071 | -.0071 |
| B2 | -.8724 | -.8724 | -.8724 | -.8724 | -.8724 | -.8724 | -.8724 | -.8724 | -.8724 |
| B3 | .3553 | .3553 | .3553 | .3553 | .3553 | .3553 | .3553 | .3553 | .3553 |
| B4 | 1.1066 | 1.1066 | 1.1066 | 1.1066 | 1.1066 | 1.1066 | 1.1066 | 1.1066 | 1.1066 |
| B5 | -1.3814 | -1.3815 | -1.3814 | -1.3814 | -1.3814 | -1.3814 | -1.3814 | -1.3814 | -1.3814 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 369046 — QTA2 = 307509 — QTA3 = 264119

AZIMUTH AND TILT COEF. — C1 = .0036 — C2 = -.2686 — C3 = -.4656 — C4 = 1.8042 — C5 = -1.3706

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 35 | 36 | 46 | 55 | 65 | 73 | 77 | 75 | 68 | 58 | 44 | 35 |
| QHOR: | 999 | 1180 | 1740 | 2041 | 2242 | 2342 | 2360 | 2166 | 1768 | 1462 | 1037 | 873 |

AUSTIN, TEXAS — ELEVATION = 620 — LAT = 30.3

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 3) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 1212.90 | 447.52 | 210.35 | 122.10 | 82.28 | 60.35 | 46.82 | 31.48 |
| VT2/DD | NA | 1032.84 | 381.08 | 179.12 | 103.97 | 70.06 | 51.39 | 39.87 | 26.81 |
| VT3/DD | NA | 896.83 | 330.90 | 155.53 | 90.28 | 60.84 | 44.62 | 34.62 | 23.28 |
| MONTHLY DD | 1 | 24 | 65 | 138 | 237 | 352 | 480 | 619 | 920 |
| ANNUAL DD | 2 | 73 | 215 | 484 | 870 | 1378 | 2026 | 2847 | 5158 |
| PARAMETER A | NA | .498 | .439 | .412 | .413 | .415 | .423 | .429 | .440 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.1274 | -.1473 | -.1553 | -.1528 | -.1486 | -.1427 | -.1388 | -.1351 |
| A2 | NA | .5330 | .5615 | .5716 | .5758 | .6178 | .6780 | .7879 | 1.1156 |
| A3 | NA | -.6655 | -.6959 | -.7018 | -.7020 | -.7484 | -.8225 | -.9702 | -1.4199 |
| A4 | NA | .4008 | .4273 | .4381 | .4410 | .4692 | .5112 | .5904 | .8230 |
| A5 | NA | -.0165 | -.0140 | -.0098 | -.0067 | -.0034 | -.0046 | -.0137 | -.0375 |
| B1 | NA | .0039 | .0039 | .0039 | .0039 | .0039 | .0039 | .0039 | .0039 |
| B2 | NA | -.9787 | -.9787 | -.9787 | -.9787 | -.9787 | -.9787 | -.9787 | -.9787 |
| B3 | NA | .5434 | .5433 | .5434 | .5434 | .5434 | .5434 | .5434 | .5434 |
| B4 | NA | .9546 | .9546 | .9546 | .9546 | .9546 | .9546 | .9546 | .9546 |
| B5 | NA | -1.2944 | -1.2945 | -1.2945 | -1.2945 | -1.2944 | -1.2945 | -1.2945 | -1.2944 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 285473 — QTA2 = 237697 — QTA3 = 204387

AZIMUTH AND TILT COEF. — C1 = -.0485 — C2 = -.1326 — C3 = -.5253 — C4 = 1.8623 — C5 = -1.1605

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 50 | 53 | 57 | 69 | 74 | 80 | 83 | 83 | 78 | 68 | 57 | 51 |
| QHOR: | 889 | 1105 | 1487 | 1550 | 1845 | 2074 | 2131 | 1921 | 1602 | 1333 | 1019 | 877 |

BROWNSVILLE, TEXAS — ELEVATION = 20 — LAT = 25.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | NA | 1443.54 | 565.66 | 284.07 | 162.90 | 103.44 | 68.86 | 37.60 |
| VT2/DD | NA | NA | 1224.15 | 479.69 | 240.89 | 138.14 | 87.72 | 58.40 | 31.88 |
| VT3/DD | NA | NA | 1062.27 | 416.25 | 209.04 | 119.88 | 76.12 | 50.67 | 27.67 |
| MONTHLY DD | 0 | 5 | 17 | 43 | 86 | 149 | 235 | 353 | 646 |
| ANNUAL DD | 0 | 6 | 35 | 108 | 247 | 466 | 798 | 1295 | 3133 |
| PARAMETER A | NA | NA | .319 | .489 | .458 | .425 | .440 | .495 | .606 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | -.0515 | -.0261 | -.0162 | -.0109 | -.0032 | .0017 | .0008 |
| A2 | NA | NA | .1842 | .1804 | .2829 | .3931 | .4798 | .4897 | .6354 |
| A3 | NA | NA | -.2350 | -.2361 | -.3769 | -.5291 | -.6488 | -.6653 | -.8932 |
| A4 | NA | NA | .0522 | .0745 | .1426 | .2169 | .2816 | .2982 | .4378 |
| A5 | NA | NA | .0579 | .0328 | .0255 | .0165 | .0045 | -.0058 | -.0570 |
| B1 | NA | NA | .0431 | .0431 | .0431 | .0431 | .0431 | .0431 | .0431 |
| B2 | NA | NA | -.8560 | -.8560 | -.8560 | -.8560 | -.8560 | -.8560 | -.8560 |
| B3 | NA | NA | .4392 | .4392 | .4392 | .4392 | .4392 | .4392 | .4392 |
| B4 | NA | NA | 1.1288 | 1.1288 | 1.1288 | 1.1288 | 1.1289 | 1.1288 | 1.1288 |
| B5 | NA | NA | -1.2413 | -1.2413 | -1.2413 | -1.2413 | -1.2413 | -1.2413 | -1.2413 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 259302 QTA2 = 215094 QTA3 = 184702
AZIMUTH AND TILT COEF. C1 = .0406 C2 = .1124 C3 = -.7719 C4 = 2.0791 C5 = -1.0249

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 59 | 61 | 67 | 74 | 78 | 80 | 82 | 82 | 80 | 75 | 67 | 60 |
| QHOR: | 914 | 1168 | 1494 | 1900 | 1911 | 2078 | 2199 | 2116 | 1706 | 1387 | 1032 | 869 |

CORPUS CHRISTI, TEXAS — ELEVATION = 43 — LAT = 27.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | NA | 2083.58 | 778.93 | 353.09 | 189.78 | 115.01 | 78.47 | 57.19 | 34.35 |
| VT2/DD | NA | 1773.36 | 662.96 | 300.52 | 161.53 | 97.89 | 66.79 | 48.68 | 29.24 |
| VT3/DD | NA | 1539.77 | 575.63 | 260.93 | 140.25 | 84.99 | 57.99 | 42.27 | 25.39 |
| MONTHLY DD | 0 | 12 | 32 | 70 | 129 | 214 | 313 | 430 | 715 |
| ANNUAL DD | 0 | 28 | 81 | 185 | 364 | 648 | 1065 | 1647 | 3581 |
| PARAMETER A | NA | .325 | .402 | .524 | .574 | .591 | .553 | .523 | .581 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .1270 | .0954 | .0653 | .0547 | .0484 | .0483 | .0466 | .0267 |
| A2 | NA | .3269 | .3389 | .3176 | .3613 | .4362 | .5576 | .6850 | .8777 |
| A3 | NA | -.4354 | -.4521 | -.4238 | -.4800 | -.5758 | -.7310 | -.8961 | -1.1737 |
| A4 | NA | .1840 | .1923 | .1819 | .2059 | .2470 | .3136 | .3903 | .5451 |
| A5 | NA | -.0043 | -.0045 | -.0041 | -.0016 | .0021 | .0077 | .0082 | -.0233 |
| B1 | NA | -.0485 | -.0485 | -.0485 | -.0485 | -.0485 | -.0485 | -.0485 | -.0485 |
| B2 | NA | -.9877 | -.9877 | -.9877 | -.9877 | -.9877 | -.9877 | -.9877 | -.9877 |
| B3 | NA | .5720 | .5720 | .5720 | .5720 | .5720 | .5720 | .5720 | .5720 |
| B4 | NA | 1.0079 | 1.0079 | 1.0079 | 1.0079 | 1.0079 | 1.0079 | 1.0079 | 1.0079 |
| B5 | NA | -1.2598 | -1.2598 | -1.2599 | -1.2598 | -1.2598 | -1.2598 | -1.2599 | -1.2598 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 273265 QTA2 = 227083 QTA3 = 195124
AZIMUTH AND TILT COEF. C1 = -.0530 C2 = .0103 C3 = -.6912 C4 = 1.9937 C5 = -1.0936

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 56 | 58 | 65 | 72 | 78 | 81 | 83 | 83 | 81 | 73 | 67 | 57 |
| QHOR: | 931 | 1118 | 1518 | 1673 | 1879 | 2090 | 2221 | 2076 | 1746 | 1408 | 1109 | 817 |

DEL RIO, TEXAS — ELEVATION = 1027 — LAT = 29.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) |
| VT1/DD | NA | 979.82 | 464.75 | 250.21 | 147.89 | 96.96 | 69.16 | 52.41 | 34.72 |
| VT2/DD | NA | 826.15 | 391.86 | 210.97 | 124.69 | 81.75 | 58.31 | 44.19 | 29.27 |
| VT3/DD | NA | 715.37 | 339.32 | 182.68 | 107.98 | 70.79 | 50.49 | 38.27 | 25.35 |
| MONTHLY DD | 3 | 29 | 62 | 115 | 194 | 296 | 414 | 547 | 826 |
| ANNUAL DD | 5 | 66 | 168 | 364 | 672 | 1095 | 1656 | 2402 | 4591 |
| PARAMETER A | NA | .451 | .485 | .430 | .450 | .478 | .502 | .525 | .549 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .1406 | .1229 | .1375 | .1272 | .1169 | .1094 | .1026 | .0909 |
| A2 | NA | -.6875 | -.7144 | -.8485 | -.7892 | -.6824 | -.5517 | -.3987 | -.0627 |
| A3 | NA | .7192 | .7531 | .9009 | .8358 | .7147 | .5619 | .3822 | -.0262 |
| A4 | NA | -.4366 | -.4629 | -.5535 | -.5138 | -.4406 | -.3511 | -.2475 | -.0235 |
| A5 | NA | -.0992 | -.0929 | -.1045 | -.0999 | -.0947 | -.0908 | -.0850 | -.0719 |
| B1 | NA | -.1168 | -.1168 | -.1168 | -.1168 | -.1168 | -.1168 | -.1168 | -.1168 |
| B2 | NA | -.7169 | -.7169 | -.7169 | -.7169 | -.7169 | -.7169 | -.7169 | -.7169 |
| B3 | NA | .1393 | .1394 | .1393 | .1393 | .1393 | .1393 | .1393 | .1393 |
| B4 | NA | 1.3410 | 1.3409 | 1.3410 | 1.3409 | 1.3410 | 1.3410 | 1.3410 | 1.3410 |
| B5 | NA | -1.3656 | -1.3656 | -1.3657 | -1.3656 | -1.3657 | -1.3657 | -1.3656 | -1.3657 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 298537 QTA2 = 248774 QTA3 = 214003
AZIMUTH AND TILT COEF. C1 = -.1047 C2 = -.1751 C3 = -.4747 C4 = 1.8419 C5 = -1.1716

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 52 | 50 | 63 | 70 | 78 | 81 | 85 | 82 | 78 | 69 | 61 | 52 |
| QHOR: | 1018 | 1261 | 1640 | 1710 | 1784 | 1978 | 2166 | 1857 | 1578 | 1302 | 1095 | 947 |

EL PASO, TEXAS — ELEVATION = 3917 — LAT = 31.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 2410.57 | 431.50 | 247.38 | 158.85 | 109.62 | 80.66 | 62.30 | 50.41 | 36.30 |
| VT2/DD | 2055.82 | 368.00 | 210.98 | 135.47 | 93.49 | 68.79 | 53.13 | 42.99 | 30.96 |
| VT3/DD | 1785.69 | 319.65 | 183.25 | 117.67 | 81.20 | 59.75 | 46.15 | 37.34 | 26.89 |
| MONTHLY DD | 17 | 93 | 162 | 252 | 366 | 497 | 643 | 795 | 1104 |
| ANNUAL DD | 28 | 222 | 458 | 825 | 1334 | 2001 | 2826 | 3808 | 6326 |
| PARAMETER A | .594 | .551 | .582 | .560 | .558 | .545 | .532 | .520 | .494 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0088 | .0171 | .0254 | .0389 | .0489 | .0589 | .0679 | .0770 | .0943 |
| A2 | .0293 | .0566 | .1229 | .2075 | .2809 | .3786 | .4941 | .6379 | 1.0423 |
| A3 | -.0557 | -.1009 | -.1838 | -.2905 | -.3839 | -.5120 | -.6672 | -.8642 | -1.4391 |
| A4 | .0381 | .0700 | .1242 | .1944 | .2538 | .3321 | .4239 | .5376 | .8588 |
| A5 | -.0156 | -.0246 | -.0318 | -.0410 | -.0495 | -.0632 | -.0817 | -.1066 | -.1889 |
| B1 | -.0138 | -.0138 | -.0138 | -.0138 | -.0138 | -.0138 | -.0138 | -.0138 | -.0138 |
| B2 | -1.0479 | -1.0479 | -1.0479 | -1.0479 | -1.0479 | -1.0479 | -1.0479 | -1.0479 | -1.0479 |
| B3 | .5780 | .5779 | .5779 | .5779 | .5780 | .5780 | .5780 | .5780 | .5779 |
| B4 | .9303 | .9303 | .9303 | .9304 | .9303 | .9303 | .9303 | .9303 | .9303 |
| B5 | -1.3684 | -1.3683 | -1.3683 | -1.3684 | -1.3683 | -1.3684 | -1.3683 | -1.3683 | -1.3683 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 377967 — QTA2 = 314267 — QTA3 = 269783

AZIMUTH AND TILT COEF. — C1 = .0512 — C2 = -.1234 — C3 = -.6574 — C4 = 2.0038 — C5 = -1.3655

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 44 | 48 | 56 | 65 | 74 | 81 | 82 | 80 | 73 | 64 | 52 | 44 |
| QHOR: | 1102 | 1535 | 1908 | 2329 | 2632 | 2690 | 2480 | 2268 | 1937 | 1698 | 1252 | 1040 |

FORT WORTH, TEXAS — ELEVATION = 538 — LAT = 32.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 1407.21 | 281.07 | 163.72 | 103.83 | 72.00 | 53.11 | 41.26 | 33.53 | 24.17 |
| VT2/DD | 1199.90 | 239.66 | 139.60 | 88.53 | 61.39 | 45.28 | 35.18 | 28.59 | 20.61 |
| VT3/DD | 1042.01 | 208.13 | 121.23 | 76.88 | 53.32 | 39.32 | 30.55 | 24.83 | 17.89 |
| MONTHLY DD | 19 | 94 | 162 | 255 | 368 | 499 | 642 | 790 | 1097 |
| ANNUAL DD | 34 | 229 | 449 | 793 | 1257 | 1870 | 2643 | 3598 | 6093 |
| PARAMETER A | .540 | .603 | .594 | .593 | .597 | .610 | .615 | .612 | .593 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0050 | .0155 | .0181 | .0185 | .0179 | .0164 | .0151 | .0141 | .0142 |
| A2 | .0423 | .2034 | .2355 | .2670 | .3056 | .3443 | .4120 | .5228 | .8065 |
| A3 | -.1230 | -.2829 | -.3137 | -.3462 | -.3915 | -.4417 | -.5342 | -.6841 | -1.0635 |
| A4 | .0802 | .2066 | .2329 | .2568 | .2857 | .3137 | .3639 | .4454 | .6502 |
| A5 | -.0657 | -.0583 | -.0561 | -.0549 | -.0564 | -.0604 | -.0698 | -.0830 | -.1087 |
| B1 | -.0341 | -.0341 | -.0341 | -.0341 | -.0341 | -.0341 | -.0341 | -.0341 | -.0341 |
| B2 | -1.0367 | -1.0367 | -1.0367 | -1.0367 | -1.0367 | -1.0367 | -1.0367 | -1.0367 | -1.0367 |
| B3 | .6173 | .6173 | .6173 | .6173 | .6173 | .6173 | .6173 | .6173 | .6173 |
| B4 | .9032 | .9032 | .9032 | .9032 | .9032 | .9032 | .9032 | .9032 | .9032 |
| B5 | -1.2868 | -1.2868 | -1.2868 | -1.2867 | -1.2867 | -1.2868 | -1.2868 | -1.2868 | -1.2868 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 295886 — QTA2 = 246312 — QTA3 = 211661

AZIMUTH AND TILT COEF. — C1 = -.0247 — C2 = -.1754 — C3 = -.4977 — C4 = 1.8566 — C5 = -1.2424

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 44 | 49 | 53 | 63 | 70 | 80 | 86 | 83 | 74 | 67 | 56 | 46 |
| QHOR: | 778 | 1057 | 1464 | 1527 | 1867 | 2178 | 2216 | 2044 | 1690 | 1272 | 954 | 761 |

HOUSTON, TEXAS — ELEVATION = 108 — LAT = 30.0

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M= 1) |
| VT1/DD | NA | 722.10 | 355.13 | 191.73 | 112.79 | 75.11 | 53.65 | 40.66 | 26.00 |
| VT2/DD | NA | 614.48 | 302.19 | 163.15 | 95.98 | 63.92 | 45.65 | 34.60 | 22.07 |
| VT3/DD | NA | 533.39 | 262.32 | 141.62 | 83.32 | 55.48 | 39.63 | 30.03 | 19.15 |
| MONTHLY DD | 2 | 30 | 61 | 113 | 192 | 288 | 403 | 532 | 813 |
| ANNUAL DD | 2 | 52 | 146 | 314 | 589 | 1001 | 1580 | 2349 | 4612 |
| PARAMETER A | NA | .647 | .454 | .405 | .475 | .520 | .557 | .565 | .624 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0435 | .1029 | .1232 | .1023 | .0906 | .0815 | .0772 | -.0284 |
| A2 | NA | .1916 | .4208 | .5275 | .4820 | .5115 | .5611 | .6452 | .5254 |
| A3 | NA | -.2126 | -.4453 | -.5624 | -.5263 | -.5783 | -.6520 | -.7691 | -.7532 |
| A4 | NA | .1318 | .2692 | .3389 | .3177 | .3505 | .3960 | .4649 | .4628 |
| A5 | NA | .0021 | .0278 | .0322 | .0189 | .0039 | -.0092 | -.0233 | -.1210 |
| B1 | NA | -.0592 | -.0592 | -.0592 | -.0592 | -.0592 | -.0592 | -.0592 | -.0171 |
| B2 | NA | -.9441 | -.9441 | -.9441 | -.9441 | -.9441 | -.9441 | -.9441 | -.8500 |
| B3 | NA | .5564 | .5564 | .5564 | .5564 | .5564 | .5564 | .5564 | .4676 |
| B4 | NA | .9378 | .9378 | .9378 | .9378 | .9378 | .9378 | .9378 | 1.0151 |
| B5 | NA | -1.1896 | -1.1896 | -1.1896 | -1.1896 | -1.1895 | -1.1896 | -1.1896 | -1.1663 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 254511 — QTA2 = 211879 — QTA3 = 182253

AZIMUTH AND TILT COEF. — C1 = -.0096 — C2 = -.1062 — C3 = -.4837 — C4 = 1.8108 — C5 = -1.0600

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 53 | 53 | 60 | 68 | 75 | 81 | 82 | 81 | 78 | 70 | 63 | 53 |
| QHOR: | 777 | 1099 | 1349 | 1564 | 1814 | 1878 | 1852 | 1606 | 1500 | 1254 | 961 | 727 |

KINGSVILLE, TEXAS — ELEVATION = 56 — LAT = 27.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | NA | 1130.33 | 414.43 | 208.13 | 121.54 | 80.40 | 57.28 | 34.55 |
| VT2/DD | NA | NA | 958.87 | 351.57 | 176.56 | 103.10 | 68.20 | 48.59 | 29.31 |
| VT3/DD | NA | NA | 832.08 | 305.08 | 153.21 | 89.47 | 59.19 | 42.16 | 25.43 |
| MONTHLY DD | 0 | 8 | 23 | 62 | 123 | 210 | 318 | 446 | 740 |
| ANNUAL DD | 0 | 13 | 53 | 158 | 351 | 649 | 1066 | 1649 | 3571 |
| PARAMETER A | NA | NA | .621 | .695 | .643 | .610 | .579 | .562 | .594 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | .1195 | .1025 | .1176 | .1298 | .1401 | .1449 | .1282 |
| A2 | NA | NA | .0287 | .1061 | .1763 | .2122 | .2497 | .2992 | .4949 |
| A3 | NA | NA | -.0361 | -.1358 | -.2264 | -.2711 | -.3179 | -.3835 | -.6558 |
| A4 | NA | NA | .0639 | .1189 | .1807 | .2144 | .2461 | .2847 | .4215 |
| A5 | NA | NA | -.0240 | -.0292 | -.0399 | -.0456 | -.0496 | -.0551 | -.0699 |
| B1 | NA | NA | -.0882 | -.0882 | -.0882 | -.0882 | -.0882 | -.0882 | -.0882 |
| B2 | NA | NA | -.8444 | -.8444 | -.8444 | -.8444 | -.8444 | -.8444 | -.8444 |
| B3 | NA | NA | .3849 | .3849 | .3849 | .3849 | .3849 | .3849 | .3849 |
| B4 | NA | NA | 1.0917 | 1.0917 | 1.0917 | 1.0917 | 1.0917 | 1.0917 | 1.0917 |
| B5 | NA | NA | -1.2509 | -1.2509 | -1.2509 | -1.2509 | -1.2509 | -1.2509 | -1.2509 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 267215 QTA2 = 222179 QTA3 = 190999

AZIMUTH AND TILT COEF. C1 = -.0164 C2 = .0036 C3 = -.6516 C4 = 1.9385 C5 =-1.0583

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 56 | 59 | 67 | 73 | 78 | 82 | 84 | 84 | 81 | 72 | 63 | 59 |
| QHOR: | 923 | 1153 | 1435 | 1600 | 1872 | 2034 | 2139 | 1940 | 1701 | 1335 | 1071 | 858 |

LAREDO, TEXAS — ELEVATION = 518 — LAT = 27.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M=12) |
| VT1/DD | NA | NA | 1586.46 | 599.46 | 282.17 | 155.03 | 96.39 | 66.96 | 39.41 |
| VT2/DD | NA | NA | 1350.45 | 510.28 | 240.20 | 131.59 | 81.82 | 56.84 | 33.54 |
| VT3/DD | NA | NA | 1172.71 | 443.12 | 208.58 | 114.22 | 71.01 | 49.34 | 29.13 |
| MONTHLY DD | 0 | 4 | 17 | 46 | 97 | 184 | 295 | 425 | 693 |
| ANNUAL DD | 0 | 9 | 45 | 144 | 339 | 643 | 1082 | 1676 | 3503 |
| PARAMETER A | NA | NA | .394 | .392 | .372 | .383 | .410 | .433 | .475 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | NA | .1313 | .1611 | .1996 | -.1961 | -.1727 | -.1590 | .1630 |
| A2 | NA | NA | .2824 | .4178 | .5579 | .1753 | .2653 | .3627 | .9658 |
| A3 | NA | NA | -.3052 | -.4576 | -.6199 | -.1968 | -.3158 | -.4435 | -1.2058 |
| A4 | NA | NA | .2730 | .3675 | .4561 | .1345 | .1879 | .2489 | .7060 |
| A5 | NA | NA | -.0037 | .0054 | .0153 | .0056 | .0053 | .0045 | -.0190 |
| B1 | NA | NA | -.1119 | -.1119 | -.1119 | -.0109 | -.0109 | -.0109 | -.1119 |
| B2 | NA | NA | -.9725 | -.9725 | -.9725 | -.8945 | -.8945 | -.8945 | -.9725 |
| B3 | NA | NA | .5310 | .5310 | .5310 | .4038 | .4038 | .4038 | .5310 |
| B4 | NA | NA | .9889 | .9889 | .9889 | 1.1179 | 1.1179 | 1.1179 | .9889 |
| B5 | NA | NA | -1.3045 | -1.3045 | -1.3045 | -1.3264 | -1.3264 | -1.3264 | -1.3045 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 273824 QTA2 = 227630 QTA3 = 195639

AZIMUTH AND TILT COEF. C1 = -.0371 C2 = -.0042 C3 = -.6765 C4 = 1.9929 C5 =-1.1057

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 56 | 60 | 67 | 75 | 80 | 85 | 86 | 86 | 82 | 75 | 63 | 57 |
| QHOR: | 977 | 1210 | 1475 | 1740 | 2005 | 2081 | 2143 | 2025 | 1645 | 1309 | 1026 | 856 |

LUBBOCK, TEXAS — ELEVATION = 3241 — LAT = 33.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 678.16 | 199.53 | 125.28 | 88.27 | 67.15 | 53.54 | 44.38 | 37.86 | 29.26 |
| VT2/DD | 574.43 | 170.46 | 107.03 | 75.41 | 57.36 | 45.74 | 37.91 | 32.34 | 25.00 |
| VT3/DD | 498.00 | 148.11 | 92.99 | 65.52 | 49.84 | 39.74 | 32.94 | 28.10 | 21.72 |
| MONTHLY DD | 52 | 200 | 319 | 452 | 595 | 746 | 900 | 1055 | 1365 |
| ANNUAL DD | 141 | 608 | 1026 | 1568 | 2242 | 3055 | 4000 | 5125 | 7923 |
| PARAMETER A | .563 | .481 | .518 | .540 | .544 | .541 | .531 | .521 | .480 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0149 | -.0871 | -.0810 | -.0793 | -.0797 | -.0801 | -.0807 | -.0813 | -.0866 |
| A2 | -.5072 | .4654 | .4679 | .4789 | .5267 | .6093 | .7231 | .8670 | 1.3057 |
| A3 | .4392 | -.5176 | -.5265 | -.5456 | -.6155 | -.7261 | -.8827 | -1.0822 | -1.7006 |
| A4 | -.3020 | .3286 | .3327 | .3449 | .3842 | .4497 | .5383 | .6502 | .9966 |
| A5 | -.1043 | .0286 | .0225 | .0155 | .0056 | -.0103 | -.0298 | -.0546 | -.1376 |
| B1 | -.0009 | .0321 | .0321 | .0321 | .0321 | .0321 | .0321 | .0321 | .0321 |
| B2 | -.8527 | -1.1115 | -1.1115 | -1.1115 | -1.1115 | -1.1115 | -1.1115 | -1.1115 | -1.1115 |
| B3 | .2807 | .6343 | .6343 | .6343 | .6343 | .6343 | .6343 | .6343 | .6343 |
| B4 | 1.1958 | .8691 | .8692 | .8691 | .8691 | .8692 | .8691 | .8691 | .8691 |
| B5 | -1.4079 | -1.3693 | -1.3693 | -1.3693 | -1.3693 | -1.3693 | -1.3692 | -1.3693 | -1.3692 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 370525 QTA2 = 308417 QTA3 = 264818

AZIMUTH AND TILT COEF. C1 = .0027 C2 = -.2118 C3 = -.5594 C4 = 1.9166 C5 =-1.3614

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 35 | 41 | 48 | 59 | 69 | 76 | 79 | 77 | 72 | 60 | 48 | 41 |
| QHOR: | 1018 | 1320 | 1781 | 2255 | 2376 | 2605 | 2479 | 2274 | 1806 | 1520 | 1159 | 926 |

LUFKIN, TEXAS — ELEVATION = 315 — LAT = 31.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 373.52 | 201.46 | 128.30 | 87.44 | 64.00 | 49.42 | 39.25 | 26.76 |
| VT2/DD | NA | 317.70 | 171.35 | 109.13 | 74.37 | 54.44 | 42.04 | 33.38 | 22.76 |
| VT3/DD | NA | 275.77 | 148.73 | 94.72 | 64.56 | 47.25 | 36.49 | 28.98 | 19.76 |
| MONTHLY DD | 7 | 69 | 127 | 200 | 293 | 400 | 518 | 652 | 957 |
| ANNUAL DD | 15 | 166 | 329 | 580 | 952 | 1457 | 2095 | 2929 | 5390 |
| PARAMETER A | NA | .527 | .594 | .601 | .583 | .543 | .524 | .530 | .572 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0347 | -.0233 | -.0130 | -.0040 | .0036 | .0100 | .0148 | .0229 |
| A2 | NA | -.0087 | .0337 | .1215 | .2147 | .2999 | .3798 | .4714 | .7212 |
| A3 | NA | -.0315 | -.0802 | -.1890 | -.3034 | -.4086 | -.5101 | -.6347 | -.9889 |
| A4 | NA | .0443 | .0721 | .1377 | .2082 | .2759 | .3391 | .4100 | .5983 |
| A5 | NA | -.0499 | -.0485 | -.0540 | -.0592 | -.0658 | -.0737 | -.0861 | -.1204 |
| B1 | NA | -.0657 | -.0657 | -.0657 | -.0657 | -.0657 | -.0657 | -.0657 | -.0657 |
| B2 | NA | -.9196 | -.9196 | -.9196 | -.9196 | -.9196 | -.9196 | -.9196 | -.9196 |
| B3 | NA | .5022 | .5022 | .5022 | .5022 | .5022 | .5022 | .5022 | .5022 |
| B4 | NA | .9560 | .9560 | .9560 | .9560 | .9561 | .9560 | .9560 | .9560 |
| B5 | NA | -1.2425 | -1.2425 | -1.2425 | -1.2425 | -1.2425 | -1.2425 | -1.2425 | -1.2424 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 274869 — QTA2 = 228683 — QTA3 = 196542

AZIMUTH AND TILT COEF. — C1 = -.0447 — C2 = -.1143 — C3 = -.5323 — C4 = 1.8533 — C5 =-1.1556

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 49 | 52 | 58 | 67 | 74 | 79 | 81 | 81 | 77 | 67 | 57 | 51 |
| QHOR: | 832 | 1082 | 1399 | 1636 | 1822 | 2056 | 1986 | 1886 | 1558 | 1355 | 888 | 746 |

MIDLAND-ODESSA, TEXAS — ELEVATION = 2858 — LAT = 31.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 417.42 | 213.95 | 131.87 | 91.21 | 68.45 | 54.19 | 44.72 | 33.09 |
| VT2/DD | NA | 356.20 | 182.57 | 112.53 | 77.84 | 58.41 | 46.24 | 38.16 | 28.23 |
| VT3/DD | NA | 309.45 | 158.61 | 97.76 | 67.62 | 50.74 | 40.18 | 33.15 | 24.53 |
| MONTHLY DD | 7 | 94 | 184 | 299 | 432 | 576 | 727 | 881 | 1191 |
| ANNUAL DD | 22 | 255 | 542 | 953 | 1491 | 2148 | 2953 | 3935 | 6547 |
| PARAMETER A | NA | .511 | .566 | .578 | .569 | .560 | .555 | .559 | .542 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0984 | -.0932 | -.0967 | -.1031 | -.1091 | -.1140 | -.1172 | -.1274 |
| A2 | NA | .2317 | .2590 | .3045 | .3797 | .4644 | .5539 | .6584 | 1.0330 |
| A3 | NA | -.2848 | -.3200 | -.3766 | -.4708 | -.5788 | -.6958 | -.8400 | -1.3837 |
| A4 | NA | .1595 | .1826 | .2175 | .2728 | .3350 | .4016 | .4825 | .7833 |
| A5 | NA | -.0005 | -.0056 | -.0097 | -.0154 | -.0228 | -.0323 | -.0498 | -.1313 |
| B1 | NA | .0442 | .0442 | .0442 | .0442 | .0442 | .0442 | .0442 | .0442 |
| B2 | NA | -1.0791 | -1.0791 | -1.0791 | -1.0791 | -1.0791 | -1.0791 | -1.0791 | -1.0791 |
| B3 | NA | .5924 | .5924 | .5924 | .5925 | .5925 | .5924 | .5925 | .5924 |
| B4 | NA | .9285 | .9285 | .9285 | .9284 | .9285 | .9285 | .9285 | .9285 |
| B5 | NA | -1.3731 | -1.3730 | -1.3731 | -1.3730 | -1.3731 | -1.3731 | -1.3731 | -1.3731 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 364494 — QTA2 = 303376 — QTA3 = 260588

AZIMUTH AND TILT COEF. — C1 = -.0252 — C2 = -.1757 — C3 = -.5947 — C4 = 1.9519 — C5 =-1.3313

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 41 | 46 | 54 | 65 | 73 | 79 | 80 | 78 | 73 | 66 | 52 | 45 |
| QHOR: | 1068 | 1390 | 1925 | 2210 | 2433 | 2612 | 2400 | 2146 | 1817 | 1556 | 1205 | 1030 |

PORT ARTHUR, TEXAS — ELEVATION = 23 — LAT = 30.0

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 1329.84 | 532.18 | 270.32 | 147.41 | 86.87 | 57.87 | 41.79 | 26.51 |
| VT2/DD | NA | 1133.28 | 453.52 | 230.36 | 125.22 | 73.80 | 49.16 | 35.50 | 22.52 |
| VT3/DD | NA | 984.08 | 393.81 | 200.04 | 108.67 | 64.04 | 42.66 | 30.81 | 19.54 |
| MONTHLY DD | 0 | 18 | 45 | 89 | 151 | 257 | 385 | 533 | 841 |
| ANNUAL DD | 1 | 44 | 129 | 300 | 595 | 1025 | 1628 | 2439 | 4815 |
| PARAMETER A | NA | .545 | .455 | .351 | .367 | .471 | .537 | .579 | .632 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0020 | -.0088 | -.0016 | .1654 | .1324 | .1199 | .1141 | .1074 |
| A2 | NA | .4933 | .6336 | .8957 | .2441 | .2312 | .2778 | .3509 | .5752 |
| A3 | NA | -.5287 | -.6726 | -.9619 | -.3811 | -.3516 | -.4053 | -.4991 | -.8062 |
| A4 | NA | .2918 | .3652 | .5273 | .2846 | .2488 | .2648 | .3066 | .4587 |
| A5 | NA | .0485 | .0725 | .0914 | -.1284 | -.1023 | -.0908 | -.0885 | -.1021 |
| B1 | NA | -.0308 | -.0308 | -.0308 | -.0713 | -.0713 | -.0713 | -.0713 | -.0713 |
| B2 | NA | -1.0215 | -1.0215 | -1.0215 | -.8957 | -.8957 | -.8957 | -.8957 | -.8957 |
| B3 | NA | .6120 | .6120 | .6120 | .4815 | .4816 | .4816 | .4816 | .4816 |
| B4 | NA | .9328 | .9328 | .9328 | 1.0285 | 1.0284 | 1.0285 | 1.0285 | 1.0284 |
| B5 | NA | -1.2458 | -1.2458 | -1.2458 | -1.2172 | -1.2171 | -1.2172 | -1.2172 | -1.2172 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 260515 — QTA2 = 216787 — QTA3 = 186397

AZIMUTH AND TILT COEF. — C1 = .0044 — C2 = -.1074 — C3 = -.5130 — C4 = 1.8486 — C5 =-1.0899

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 52 | 53 | 60 | 68 | 74 | 79 | 81 | 81 | 77 | 68 | 58 | 54 |
| QHOR: | 787 | 1083 | 1395 | 1608 | 1850 | 2018 | 1835 | 1658 | 1518 | 1297 | 971 | 758 |

SAN ANGELO, TEXAS — ELEVATION = 1909 — LAT = 31.4

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 2423.74 | 444.15 | 246.08 | 148.99 | 98.64 | 71.29 | 54.76 | 44.10 | 31.39 |
| VT2/DD | 2070.55 | 379.43 | 209.76 | 127.00 | 84.08 | 60.77 | 46.67 | 37.59 | 26.76 |
| VT3/DD | 1798.99 | 329.66 | 182.19 | 110.31 | 73.03 | 52.78 | 40.54 | 32.65 | 23.24 |
| MONTHLY DD | 15 | 82 | 135 | 223 | 337 | 466 | 606 | 753 | 1058 |
| ANNUAL DD | 36 | 240 | 464 | 784 | 1229 | 1800 | 2512 | 3387 | 5795 |
| PARAMETER A | .119 | .363 | .383 | .444 | .474 | .487 | .494 | .503 | .511 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.3628 | -.1316 | .0225 | .0178 | .0161 | .0143 | .0111 | .0070 | .0014 |
| A2 | 1.7246 | .7733 | .3461 | .3829 | .4252 | .4874 | .5619 | .6537 | .9348 |
| A3 | -1.8124 | -.8351 | -.3671 | -.4207 | -.4768 | -.5579 | -.6560 | -.7800 | -1.1763 |
| A4 | .9361 | .4602 | .3460 | .3569 | .3808 | .4242 | .4794 | .5482 | .7633 |
| A5 | .3306 | .1088 | -.0330 | -.0305 | -.0308 | -.0349 | -.0416 | -.0514 | -.0913 |
| B1 | .0190 | .0190 | -.0174 | -.0174 | -.0174 | -.0174 | -.0174 | -.0174 | -.0174 |
| B2 | -1.1075 | -1.1075 | -1.0139 | -1.0139 | -1.0139 | -1.0139 | -1.0138 | -1.0138 | -1.0139 |
| B3 | .6698 | .6698 | .5414 | .5413 | .5414 | .5414 | .5413 | .5413 | .5414 |
| B4 | .8585 | .8585 | .9273 | .9273 | .9273 | .9273 | .9273 | .9273 | .9273 |
| B5 | -1.3460 | -1.3460 | -1.3437 | -1.3437 | -1.3436 | -1.3436 | -1.3436 | -1.3437 | -1.3436 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 318557 — QTA2 = 265267 — QTA3 = 227983
AZIMUTH AND TILT COEF. — C1 = -.0130 — C2 = -.1763 — C3 = -.5297 — C4 = 1.8735 — C5 = -1.2525

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 45 | 50 | 55 | 66 | 75 | 80 | 83 | 81 | 77 | 66 | 56 | 47 |
| QHOR: | 936 | 1222 | 1660 | 1903 | 2067 | 2174 | 2170 | 1959 | 1682 | 1319 | 1075 | 952 |

SAN ANTONIO, TEXAS — ELEVATION = 794 — LAT = 29.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | NA | 689.39 | 342.79 | 198.89 | 125.01 | 85.83 | 63.36 | 48.98 | 32.39 |
| VT2/DD | NA | 587.40 | 292.07 | 169.47 | 106.52 | 73.13 | 53.99 | 41.73 | 27.59 |
| VT3/DD | NA | 510.10 | 253.64 | 147.17 | 92.50 | 63.51 | 46.88 | 36.24 | 23.96 |
| MONTHLY DD | 3 | 41 | 83 | 143 | 227 | 331 | 448 | 580 | 877 |
| ANNUAL DD | 4 | 78 | 200 | 425 | 771 | 1242 | 1844 | 2609 | 4879 |
| PARAMETER A | NA | .692 | .696 | .571 | .495 | .471 | .460 | .452 | .459 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0485 | .0633 | .0919 | .1116 | .1179 | .1201 | .1202 | .1113 |
| A2 | NA | .0702 | .1959 | .3719 | .5045 | .6093 | .7251 | .8731 | 1.2344 |
| A3 | NA | -.0906 | -.2395 | -.4391 | -.5891 | -.7147 | -.8595 | -1.0554 | -1.5442 |
| A4 | NA | .0540 | .1477 | .2758 | .3714 | .4476 | .5333 | .6435 | .9074 |
| A5 | NA | -.0090 | -.0107 | -.0056 | -.0010 | -.0016 | -.0062 | -.0181 | -.0441 |
| B1 | NA | -.1015 | -.1015 | -.1015 | -.1015 | -.1015 | -.1015 | -.1015 | -.1015 |
| B2 | NA | -.9964 | -.9964 | -.9964 | -.9964 | -.9964 | -.9964 | -.9964 | -.9964 |
| B3 | NA | .5729 | .5730 | .5729 | .5729 | .5729 | .5729 | .5729 | .5729 |
| B4 | NA | .9230 | .9230 | .9229 | .9230 | .9230 | .9230 | .9229 | .9229 |
| B5 | NA | -1.2855 | -1.2855 | -1.2855 | -1.2855 | -1.2854 | -1.2854 | -1.2854 | -1.2854 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 280269 — QTA2 = 233238 — QTA3 = 200519
AZIMUTH AND TILT COEF. — C1 = -.0924 — C2 = -.1215 — C3 = -.5398 — C4 = 1.9101 — C5 = -1.1503

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 51 | 54 | 61 | 68 | 73 | 80 | 84 | 83 | 79 | 69 | 59 | 51 |
| QHOR: | 934 | 1131 | 1467 | 1559 | 1855 | 2080 | 2175 | 1890 | 1664 | 1324 | 991 | 854 |

SHERMAN, TEXAS — ELEVATION = 764 — LAT = 33.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 1663.85 | 251.15 | 138.18 | 87.93 | 62.16 | 47.38 | 37.95 | 31.37 | 23.13 |
| VT2/DD | 1419.62 | 214.28 | 117.90 | 75.02 | 53.03 | 40.42 | 32.38 | 26.77 | 19.74 |
| VT3/DD | 1232.91 | 186.10 | 102.39 | 65.15 | 46.06 | 35.11 | 28.12 | 23.25 | 17.14 |
| MONTHLY DD | 16 | 108 | 197 | 309 | 437 | 574 | 716 | 866 | 1175 |
| ANNUAL DD | 30 | 222 | 477 | 872 | 1407 | 2091 | 2920 | 3902 | 6435 |
| PARAMETER A | .491 | .728 | .694 | .648 | .599 | .571 | .550 | .539 | .549 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0550 | -.0464 | -.0659 | -.0832 | -.0975 | -.1068 | -.1145 | -.1206 | -.1238 |
| A2 | .2532 | .2047 | .2711 | .3348 | .3955 | .4552 | .5386 | .6466 | .8788 |
| A3 | -.3299 | -.2549 | -.3213 | -.3839 | -.4445 | -.5088 | -.6123 | -.7562 | -1.0793 |
| A4 | .2139 | .1663 | .2132 | .2599 | .3069 | .3530 | .4183 | .5022 | .6794 |
| A5 | -.0362 | -.0175 | -.0085 | -.0005 | .0049 | .0069 | .0011 | -.0115 | -.0426 |
| B1 | .0451 | .0451 | .0451 | .0451 | .0451 | .0451 | .0451 | .0451 | .0451 |
| B2 | -1.0327 | -1.0327 | -1.0327 | -1.0327 | -1.0327 | -1.0327 | -1.0327 | -1.0327 | -1.0327 |
| B3 | .6173 | .6173 | .6172 | .6173 | .6173 | .6172 | .6172 | .6173 | .6173 |
| B4 | .8355 | .8354 | .8355 | .8355 | .8355 | .8355 | .8355 | .8355 | .8354 |
| B5 | -1.2717 | -1.2717 | -1.2717 | -1.2717 | -1.2717 | -1.2717 | -1.2717 | -1.2717 | -1.2716 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 292410 — QTA2 = 243401 — QTA3 = 209133
AZIMUTH AND TILT COEF. — C1 = -.0181 — C2 = -.1871 — C3 = -.4729 — C4 = 1.7973 — C5 = -1.2103

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 42 | 47 | 51 | 64 | 71 | 79 | 83 | 83 | 77 | 65 | 53 | 45 |
| QHOR: | 759 | 1028 | 1465 | 1627 | 1902 | 2112 | 2066 | 1925 | 1652 | 1260 | 910 | 713 |

WACO, TEXAS — ELEVATION = 509 — LAT = 31.6

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | NA | 326.27 | 186.57 | 118.58 | 80.16 | 57.83 | 44.02 | 35.24 | 24.90 |
| VT2/DD | NA | 277.68 | 158.78 | 100.92 | 68.22 | 49.22 | 37.46 | 29.99 | 21.19 |
| VT3/DD | NA | 241.07 | 137.85 | 87.61 | 59.23 | 42.73 | 32.52 | 26.04 | 18.40 |
| MONTHLY DD | 13 | 79 | 138 | 217 | 321 | 445 | 585 | 731 | 1035 |
| ANNUAL DD | 25 | 196 | 399 | 714 | 1157 | 1729 | 2443 | 3300 | 5601 |
| PARAMETER A | NA | .664 | .610 | .552 | .552 | .557 | .571 | .573 | .598 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | .0688 | .0779 | .0888 | .0891 | .0880 | .0846 | .0827 | .0738 |
| A2 | NA | .1782 | .1883 | .2247 | .2465 | .2788 | .3181 | .3801 | .5616 |
| A3 | NA | -.2285 | -.2458 | -.2938 | -.3206 | -.3597 | -.4084 | -.4890 | -.7403 |
| A4 | NA | .1922 | .2184 | .2684 | .2929 | .3218 | .3528 | .4017 | .5336 |
| A5 | NA | -.0506 | -.0648 | -.0817 | -.0873 | -.0909 | -.0934 | -.0997 | -.1187 |
| B1 | NA | -.0738 | -.0738 | -.0738 | -.0738 | -.0738 | -.0738 | -.0738 | -.0738 |
| B2 | NA | -.9332 | -.9332 | -.9332 | -.9332 | -.9332 | -.9332 | -.9332 | -.9332 |
| B3 | NA | .4975 | .4976 | .4976 | .4975 | .4975 | .4976 | .4976 | .4976 |
| B4 | NA | .9297 | .9296 | .9296 | .9296 | .9296 | .9296 | .9296 | .9296 |
| B5 | NA | -1.2604 | -1.2604 | -1.2603 | -1.2604 | -1.2603 | -1.2603 | -1.2604 | -1.2603 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 285595 — QTA2 = 237614 — QTA3 = 204200
AZIMUTH AND TILT COEF. — C1 = -.0520 — C2 = -.1245 — C3 = -.5457 — C4 = 1.8687 — C5 =-1.1801

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 46 | 48 | 55 | 68 | 74 | 82 | 84 | 84 | 77 | 68 | 55 | 49 |
| QHOR: | 801 | 1119 | 1488 | 1654 | 1919 | 2128 | 2206 | 1938 | 1537 | 1235 | 952 | 810 |

WICHITA FALLS, TEXAS — ELEVATION = 1030 — LAT = 34.0

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 821.27 | 206.04 | 125.48 | 85.78 | 63.49 | 49.44 | 40.01 | 33.39 | 24.95 |
| VT2/DD | 702.01 | 175.75 | 107.03 | 73.17 | 54.16 | 42.17 | 34.13 | 28.48 | 21.28 |
| VT3/DD | 609.89 | 152.64 | 92.96 | 63.55 | 47.03 | 36.62 | 29.64 | 24.74 | 18.48 |
| MONTHLY DD | 39 | 148 | 244 | 356 | 481 | 618 | 764 | 915 | 1225 |
| ANNUAL DD | 102 | 463 | 786 | 1225 | 1793 | 2508 | 3378 | 4402 | 6994 |
| PARAMETER A | .543 | .410 | .445 | .459 | .455 | .478 | .503 | .516 | .522 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0371 | .0163 | .0123 | .0099 | .0080 | .0061 | .0043 | .0023 | -.0012 |
| A2 | .4692 | .3342 | .3631 | .3939 | .4420 | .4770 | .5380 | .6397 | .9262 |
| A3 | -.4926 | -.3787 | -.4073 | -.4392 | -.4935 | -.5441 | -.6341 | -.7778 | -1.1757 |
| A4 | .3084 | .2714 | .2901 | .3133 | .3512 | .3797 | .4281 | .5081 | .7309 |
| A5 | .0422 | -.0032 | .0004 | .0021 | .0016 | -.0066 | -.0203 | -.0379 | -.0792 |
| B1 | .0137 | -.0051 | -.0051 | -.0051 | -.0051 | -.0051 | -.0051 | -.0051 | -.0051 |
| B2 | -1.1104 | -1.0296 | -1.0296 | -1.0296 | -1.0296 | -1.0296 | -1.0296 | -1.0296 | -1.0296 |
| B3 | .6939 | .5867 | .5866 | .5866 | .5866 | .5866 | .5867 | .5866 | .5866 |
| B4 | .7799 | .8659 | .8659 | .8659 | .8659 | .8659 | .8659 | .8659 | .8659 |
| B5 | -1.2934 | -1.3049 | -1.3050 | -1.3050 | -1.3049 | -1.3050 | -1.3050 | -1.3050 | -1.3050 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 313769 — QTA2 = 261258 — QTA3 = 224470
AZIMUTH AND TILT COEF. — C1 = -.0162 — C2 = -.2091 — C3 = -.4753 — C4 = 1.8060 — C5 =-1.2500

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 40 | 43 | 51 | 63 | 69 | 79 | 84 | 82 | 74 | 66 | 51 | 41 |
| QHOR: | 846 | 1141 | 1561 | 1803 | 2092 | 2198 | 2115 | 1935 | 1617 | 1274 | 950 | 823 |

BRYCE CANYON, UTAH — ELEVATION = 7589 — LAT = 37.7

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 5) |
| VT1/DD | 122.18 | 68.37 | 54.76 | 45.58 | 39.02 | 34.11 | 30.30 | 27.26 | 22.11 |
| VT2/DD | 104.68 | 58.57 | 46.91 | 39.05 | 33.43 | 29.23 | 25.96 | 23.35 | 17.69 |
| VT3/DD | 90.99 | 50.91 | 40.78 | 33.94 | 29.06 | 25.40 | 22.57 | 20.30 | 14.85 |
| MONTHLY DD | 344 | 615 | 768 | 922 | 1077 | 1232 | 1387 | 1542 | 1057 |
| ANNUAL DD | 1352 | 2929 | 3969 | 5147 | 6450 | 7884 | 9431 | 11088 | 14616 |
| PARAMETER A | .533 | .494 | .474 | .454 | .429 | .397 | .357 | .310 | .348 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0380 | .0507 | .0562 | .0616 | .0680 | .0767 | .0889 | .1062 | -.0088 |
| A2 | .6295 | 1.0064 | 1.2122 | 1.4309 | 1.6898 | 2.0203 | 2.4588 | 3.0538 | -9.0433 |
| A3 | -.7364 | -1.1932 | -1.4561 | -1.7387 | -2.0753 | -2.5050 | -3.0721 | -3.8331 | 12.2737 |
| A4 | .3649 | .6140 | .7566 | .9095 | 1.0906 | 1.3213 | 1.6246 | 2.0308 | -6.4512 |
| A5 | .0028 | -.0138 | -.0327 | -.0544 | -.0807 | -.1133 | -.1528 | -.1969 | 1.1358 |
| B1 | .0044 | .0044 | .0044 | .0044 | .0044 | .0044 | .0044 | .0044 | .0868 |
| B2 | -1.2067 | -1.2067 | -1.2067 | -1.2067 | -1.2067 | -1.2067 | -1.2067 | -1.2067 | 1.4007 |
| B3 | .7453 | .7453 | .7453 | .7453 | .7453 | .7453 | .7453 | .7453 | -2.5107 |
| B4 | .7244 | .7244 | .7244 | .7244 | .7244 | .7244 | .7244 | .7244 | 3.3945 |
| B5 | -1.3460 | -1.3460 | -1.3460 | -1.3460 | -1.3460 | -1.3460 | -1.3460 | -1.3460 | -1.4186 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 402394 — QTA2 = 335723 — QTA3 = 288411
AZIMUTH AND TILT COEF. — C1 = .0623 — C2 = -.2410 — C3 = -.4918 — C4 = 1.7383 — C5 =-1.4163

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 23 | 28 | 37 | 45 | 56 | 63 | 58 | 51 | 41 | 29 | 21 |
| QHOR: | 921 | 1245 | 1693 | 2201 | 2434 | 2613 | 2426 | 2178 | 1961 | 1463 | 1027 | 841 |

CEDAR CITY, UTAH — ELEVATION = 5617 — LAT = 37.7

| SOUTH-VERT. | TB30 (M=12) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 251.94 | 103.10 | 73.92 | 56.28 | 45.06 | 37.54 | 32.17 | 28.14 | 22.51 |
| VT2/DD | 215.99 | 88.39 | 63.37 | 48.25 | 38.63 | 32.18 | 27.58 | 24.13 | 19.30 |
| VT3/DD | 187.74 | 76.83 | 55.08 | 41.94 | 33.58 | 27.97 | 23.97 | 20.97 | 16.78 |
| MONTHLY DD | 138 | 338 | 472 | 619 | 774 | 929 | 1084 | 1239 | 1549 |
| ANNUAL DD | 456 | 1364 | 2055 | 2890 | 3865 | 4984 | 6258 | 7679 | 10868 |
| PARAMETER A | .495 | .507 | .517 | .523 | .522 | .519 | .520 | .518 | .479 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.1104 | -.0853 | -.0784 | -.0738 | -.0711 | -.0695 | -.0675 | -.0658 | -.0667 |
| A2 | .5882 | .8468 | .9297 | 1.0318 | 1.1511 | 1.2825 | 1.3989 | 1.5325 | 1.9776 |
| A3 | -.6061 | -.8698 | -.9771 | -1.1137 | -1.2737 | -1.4513 | -1.6147 | -1.8065 | -2.4246 |
| A4 | .3602 | .5069 | .5632 | .6355 | .7210 | .8161 | .9038 | 1.0073 | 1.3446 |
| A5 | .0189 | .0474 | .0395 | .0262 | .0096 | -.0096 | -.0311 | -.0602 | -.1426 |
| B1 | .0380 | .0380 | .0380 | .0380 | .0380 | .0380 | .0380 | .0380 | .0380 |
| B2 | -1.2279 | -1.2279 | -1.2279 | -1.2279 | -1.2279 | -1.2279 | -1.2279 | -1.2279 | -1.2279 |
| B3 | .7970 | .7970 | .7970 | .7970 | .7970 | .7970 | .7970 | .7970 | .7970 |
| B4 | .6626 | .6626 | .6626 | .6626 | .6626 | .6626 | .6626 | .6626 | .6626 |
| B5 | -1.2980 | -1.2979 | -1.2979 | -1.2979 | -1.2979 | -1.2979 | -1.2979 | -1.2979 | -1.2979 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 385473 — QTA2 = 321141 — QTA3 = 275728

AZIMUTH AND TILT COEF. — C1 = .0403 — C2 = -.2003 — C3 = -.5336 — C4 = 1.7860 — C5 = -1.3965

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 29 | 33 | 38 | 47 | 57 | 68 | 73 | 71 | 65 | 50 | 38 | 30 |
| QHOR: | 906 | 1168 | 1570 | 2122 | 2513 | 2659 | 2517 | 2223 | 1993 | 1484 | 992 | 756 |

SALT LAKE CITY, UTAH — ELEVATION = 4226 — LAT = 40.8

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 133.39 | 60.13 | 44.20 | 34.59 | 28.34 | 23.99 | 20.80 | 18.36 | 14.87 |
| VT2/DD | 114.13 | 51.45 | 37.82 | 29.60 | 24.25 | 20.53 | 17.80 | 15.71 | 12.72 |
| VT3/DD | 99.16 | 44.70 | 32.86 | 25.72 | 21.07 | 17.84 | 15.46 | 13.65 | 11.05 |
| MONTHLY DD | 182 | 403 | 549 | 701 | 856 | 1011 | 1166 | 1321 | 1631 |
| ANNUAL DD | 395 | 1263 | 1957 | 2812 | 3814 | 4969 | 6251 | 7646 | 10748 |
| PARAMETER A | .568 | .732 | .776 | .804 | .823 | .834 | .838 | .837 | .820 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0088 | -.0057 | -.0043 | -.0033 | -.0024 | -.0014 | -.0006 | .0002 | .0017 |
| A2 | -.1312 | .0069 | .0751 | .1501 | .2248 | .3001 | .3781 | .4585 | .6295 |
| A3 | .0762 | -.0538 | -.1313 | -.2226 | -.3164 | -.4137 | -.5177 | -.6273 | -.8648 |
| A4 | -.0176 | .0688 | .1168 | .1720 | .2276 | .2845 | .3446 | .4076 | .5441 |
| A5 | -.0827 | -.0691 | -.0717 | -.0787 | -.0874 | -.0980 | -.1112 | -.1268 | -.1638 |
| B1 | -.0013 | -.0013 | -.0013 | -.0013 | -.0013 | -.0013 | -.0013 | -.0013 | -.0013 |
| B2 | -1.1304 | -1.1304 | -1.1304 | -1.1304 | -1.1304 | -1.1304 | -1.1304 | -1.1304 | -1.1304 |
| B3 | .7409 | .7408 | .7409 | .7409 | .7409 | .7409 | .7409 | .7409 | .7409 |
| B4 | .6648 | .6648 | .6648 | .6648 | .6648 | .6648 | .6648 | .6648 | .6647 |
| B5 | -1.2193 | -1.2194 | -1.2194 | -1.2194 | -1.2193 | -1.2194 | -1.2193 | -1.2193 | -1.2193 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 355426 — QTA2 = 295942 — QTA3 = 254000

AZIMUTH AND TILT COEF. — C1 = .0060 — C2 = -.2237 — C3 = -.4973 — C4 = 1.7652 — C5 = -1.3790

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 27 | 34 | 41 | 48 | 57 | 67 | 78 | 74 | 65 | 51 | 38 | 28 |
| QHOR: | 596 | 991 | 1518 | 1916 | 2312 | 2529 | 2628 | 2307 | 1863 | 1307 | 752 | 558 |

BURLINGTON, VERMONT — ELEVATION = 341 — LAT = 44.5

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 42.90 | 24.89 | 19.91 | 16.38 | 13.87 | 11.96 | 10.47 | 9.31 | 7.63 |
| VT2/DD | 36.70 | 21.30 | 17.04 | 14.01 | 11.86 | 10.23 | 8.96 | 7.97 | 6.52 |
| VT3/DD | 31.88 | 18.50 | 14.80 | 12.17 | 10.30 | 8.88 | 7.78 | 6.92 | 5.67 |
| MONTHLY DD | 395 | 680 | 655 | 797 | 941 | 1092 | 1246 | 1401 | 1711 |
| ANNUAL DD | 1180 | 2430 | 3260 | 4214 | 5310 | 6552 | 7945 | 9483 | 12912 |
| PARAMETER A | .468 | .563 | .621 | .678 | .735 | .789 | .839 | .881 | .936 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0137 | .0110 | .0442 | .0438 | .0428 | .0415 | .0402 | .0389 | .0372 |
| A2 | .5654 | .5290 | .5282 | .5131 | .5010 | .4945 | .4927 | .4979 | .5377 |
| A3 | -.5338 | -.5096 | -.5776 | -.5667 | -.5598 | -.5602 | -.5666 | -.5820 | -.6516 |
| A4 | .3187 | .3108 | .4026 | .3921 | .3845 | .3823 | .3848 | .3934 | .4361 |
| A5 | .0979 | .0812 | -.0256 | -.0266 | -.0287 | -.0327 | -.0384 | -.0457 | -.0672 |
| B1 | -.0039 | -.0039 | -.0154 | -.0154 | -.0154 | -.0154 | -.0154 | -.0154 | -.0154 |
| B2 | -1.1052 | -1.1052 | -1.1048 | -1.1048 | -1.1048 | -1.1048 | -1.1048 | -1.1048 | -1.1048 |
| B3 | .7547 | .7548 | .7850 | .7850 | .7850 | .7850 | .7850 | .7850 | .7851 |
| B4 | .6040 | .6040 | .5604 | .5604 | .5604 | .5604 | .5604 | .5604 | .5604 |
| B5 | -1.1649 | -1.1649 | -1.1165 | -1.1165 | -1.1165 | -1.1165 | -1.1165 | -1.1165 | -1.1165 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 254757 — QTA2 = 212455 — QTA3 = 182647

AZIMUTH AND TILT COEF. — C1 = .0167 — C2 = -.2834 — C3 = -.2984 — C4 = 1.5869 — C5 = -1.2017

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 18 | 20 | 27 | 41 | 54 | 64 | 70 | 67 | 58 | 49 | 38 | 24 |
| QHOR: | 420 | 706 | 1073 | 1423 | 1734 | 2045 | 1975 | 1651 | 1265 | 829 | 434 | 329 |

NORFOLK, VIRGINIA — ELEVATION = 30 — LAT = 36.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) |
| VT1/DD | 670.09 | 173.32 | 105.29 | 63.13 | 43.09 | 32.60 | 26.21 | 21.92 | 16.51 |
| VT2/DD | 572.63 | 148.12 | 89.98 | 53.45 | 36.48 | 27.60 | 22.19 | 18.56 | 13.98 |
| VT3/DD | 497.39 | 128.65 | 78.16 | 46.33 | 31.62 | 23.92 | 19.24 | 16.09 | 12.12 |
| MONTHLY DD | 41 | 159 | 261 | 297 | 435 | 575 | 715 | 855 | 1135 |
| ANNUAL DD | 48 | 368 | 764 | 1302 | 1971 | 2778 | 3736 | 4875 | 7798 |
| PARAMETER A | .340 | .509 | .346 | .463 | .571 | .637 | .671 | .695 | .750 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0094 | .1183 | .2165 | -.2242 | -.1770 | -.1572 | -.1499 | -.1451 | -.1326 |
| A2 | .0084 | .4235 | .8522 | -.7410 | -.5457 | -.4382 | -.3579 | -.2774 | -.0808 |
| A3 | -.0076 | -.4124 | -.8173 | .5844 | .4116 | .3078 | .2202 | .1277 | -.1089 |
| A4 | -.0053 | .1639 | .3538 | -.2244 | -.1411 | -.0848 | -.0322 | .0231 | .1559 |
| A5 | .0095 | .1354 | .2591 | -.3315 | -.2677 | -.2437 | -.2376 | -.2354 | -.2351 |
| B1 | -.0393 | -.0393 | -.0393 | .0885 | .0885 | .0885 | .0885 | .0885 | .0885 |
| B2 | -1.1089 | -1.1089 | -1.1089 | -.7389 | -.7389 | -.7389 | -.7389 | -.7389 | -.7389 |
| B3 | .7122 | .7122 | .7122 | .3318 | .3319 | .3319 | .3318 | .3318 | .3318 |
| B4 | .7817 | .7816 | .7817 | 1.0540 | 1.0540 | 1.0540 | 1.0540 | 1.0540 | 1.0540 |
| B5 | -1.2555 | -1.2555 | -1.2555 | -1.1589 | -1.1588 | -1.1588 | -1.1589 | -1.1589 | -1.1589 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 279113 — QTA2 = 232584 — QTA3 = 199876

AZIMUTH AND TILT COEF. — C1 = .0046 — C2 = -.2934 — C3 = -.3243 — C4 = 1.6957 — C5 = -1.1985

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 39 | 39 | 47 | 60 | 67 | 74 | 78 | 76 | 71 | 57 | 53 | 41 |
| QHOR: | 737 | 796 | 1240 | 1646 | 1912 | 2018 | 1905 | 1711 | 1490 | 1012 | 881 | 572 |

RICHMOND, VIRGINIA — ELEVATION = 164 — LAT = 37.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 462.79 | 114.75 | 72.25 | 51.06 | 38.75 | 31.08 | 25.87 | 22.11 | 17.12 |
| VT2/DD | 392.36 | 97.97 | 61.69 | 43.60 | 33.09 | 26.53 | 22.09 | 18.88 | 14.62 |
| VT3/DD | 340.22 | 85.08 | 53.57 | 37.86 | 28.73 | 23.04 | 19.18 | 16.39 | 12.69 |
| MONTHLY DD | 47 | 205 | 325 | 461 | 607 | 757 | 909 | 1063 | 1373 |
| ANNUAL DD | 115 | 595 | 1023 | 1587 | 2299 | 3154 | 4165 | 5354 | 8341 |
| PARAMETER A | .341 | .534 | .603 | .623 | .622 | .613 | .610 | .613 | .611 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.1393 | .1175 | .1006 | .0953 | .0932 | .0918 | .0887 | .0841 | .0767 |
| A2 | -.8262 | .3025 | .2945 | .3313 | .3872 | .4540 | .5231 | .6042 | .8413 |
| A3 | .6981 | -.2930 | -.2980 | -.3464 | -.4167 | -.4995 | -.5888 | -.6982 | -1.0256 |
| A4 | -.4589 | .1883 | .1889 | .2165 | .2560 | .3027 | .3520 | .4110 | .5874 |
| A5 | -.1989 | .0561 | .0450 | .0420 | .0399 | .0384 | .0341 | .0258 | -.0032 |
| B1 | .0517 | -.0251 | -.0251 | -.0251 | -.0251 | -.0251 | -.0251 | -.0251 | -.0251 |
| B2 | -.8165 | -1.0612 | -1.0612 | -1.0612 | -1.0612 | -1.0612 | -1.0612 | -1.0612 | -1.0612 |
| B3 | .3952 | .6763 | .6763 | .6763 | .6763 | .6763 | .6763 | .6763 | .6763 |
| B4 | 1.0516 | .7876 | .7876 | .7876 | .7876 | .7876 | .7876 | .7876 | .7876 |
| B5 | -1.2162 | -1.2233 | -1.2233 | -1.2233 | -1.2233 | -1.2233 | -1.2233 | -1.2233 | -1.2233 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 267831 — QTA2 = 223505 — QTA3 = 192257

AZIMUTH AND TILT COEF. — C1 = .0080 — C2 = -.3006 — C3 = -.2735 — C4 = 1.5953 — C5 = -1.1485

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 35 | 39 | 46 | 58 | 66 | 71 | 77 | 76 | 69 | 58 | 49 | 41 |
| QHOR: | 661 | 882 | 1236 | 1524 | 1685 | 1856 | 1772 | 1632 | 1402 | 995 | 743 | 569 |

ROANOKE, VIRGINIA — ELEVATION = 1175 — LAT = 37.3

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 2) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) |
| VT1/DD | 384.29 | 111.19 | 69.80 | 49.16 | 37.52 | 30.17 | 25.11 | 21.47 | 16.65 |
| VT2/DD | 325.87 | 94.83 | 59.53 | 41.92 | 32.00 | 25.73 | 21.41 | 18.31 | 14.20 |
| VT3/DD | 282.56 | 82.33 | 51.69 | 36.40 | 27.78 | 22.34 | 18.59 | 15.90 | 12.33 |
| MONTHLY DD | 61 | 207 | 329 | 467 | 612 | 761 | 915 | 1070 | 1380 |
| ANNUAL DD | 154 | 662 | 1118 | 1722 | 2484 | 3387 | 4451 | 5708 | 8795 |
| PARAMETER A | .433 | .556 | .604 | .617 | .623 | .621 | .626 | .640 | .647 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0461 | -.0692 | -.0709 | -.0756 | -.0807 | -.0870 | -.0913 | -.0930 | -.0972 |
| A2 | -.6152 | .2131 | .2211 | .2496 | .2901 | .3456 | .4021 | .4649 | .6770 |
| A3 | .5400 | -.2613 | -.2753 | -.3138 | -.3663 | -.4369 | -.5098 | -.5952 | -.8923 |
| A4 | -.3942 | .2146 | .2218 | .2464 | .2821 | .3317 | .3808 | .4328 | .6053 |
| A5 | -.1299 | -.0279 | -.0315 | -.0366 | -.0430 | -.0512 | -.0594 | -.0697 | -.1059 |
| B1 | .0003 | .0324 | .0324 | .0324 | .0324 | .0324 | .0324 | .0324 | .0324 |
| B2 | -.8194 | -.9990 | -.9990 | -.9990 | -.9990 | -.9990 | -.9990 | -.9990 | -.9990 |
| B3 | .3710 | .6175 | .6175 | .6175 | .6174 | .6175 | .6175 | .6175 | .6175 |
| B4 | 1.0423 | .7954 | .7954 | .7954 | .7954 | .7954 | .7954 | .7954 | .7954 |
| B5 | -1.2446 | -1.2157 | -1.2157 | -1.2157 | -1.2158 | -1.2157 | -1.2157 | -1.2157 | -1.2158 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 274142 — QTA2 = 228703 — QTA3 = 196694

AZIMUTH AND TILT COEF. — C1 = -.0268 — C2 = -.2964 — C3 = -.3020 — C4 = 1.6294 — C5 = -1.1782

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 35 | 38 | 44 | 56 | 64 | 72 | 75 | 73 | 69 | 56 | 47 | 39 |
| QHOR: | 660 | 904 | 1259 | 1578 | 1749 | 1953 | 1806 | 1588 | 1387 | 1086 | 750 | 581 |

OLYMPIA, WASHINGTON — ELEVATION = 200 — LAT = 47.0

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 515.23 | 82.50 | 37.58 | 21.13 | 14.38 | 10.89 | 8.76 | 7.33 | 5.53 |
| VT2/DD | 439.23 | 70.33 | 32.01 | 18.00 | 12.25 | 9.27 | 7.46 | 6.24 | 4.71 |
| VT3/DD | 381.21 | 61.04 | 27.77 | 15.62 | 10.63 | 8.05 | 6.48 | 5.42 | 4.08 |
| MONTHLY DD | 18 | 109 | 185 | 329 | 484 | 639 | 794 | 949 | 1259 |
| ANNUAL DD | 35 | 416 | 939 | 1793 | 2929 | 4301 | 5851 | 7507 | 11027 |
| PARAMETER A | .678 | .869 | .971 | 1.084 | 1.153 | 1.209 | 1.248 | 1.271 | 1.289 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0168 | -.0220 | -.0012 | -.0037 | -.0059 | -.0079 | -.0099 | -.0117 | -.0149 |
| A2 | .0047 | .1406 | .0822 | .0898 | .1036 | .1194 | .1380 | .1581 | .1985 |
| A3 | .0009 | -.1405 | -.1330 | -.1378 | -.1533 | -.1736 | -.1996 | -.2283 | -.2866 |
| A4 | -.0020 | .0797 | .1338 | .1312 | .1387 | .1497 | .1649 | .1828 | .2203 |
| A5 | .0070 | .0218 | -.0756 | -.0677 | -.0659 | -.0669 | -.0709 | -.0766 | -.0898 |
| B1 | .0301 | .0301 | .0134 | .0134 | .0134 | .0134 | .0134 | .0134 | .0134 |
| B2 | -.9500 | -.9500 | -.9066 | -.9066 | -.9066 | -.9066 | -.9066 | -.9066 | -.9066 |
| B3 | .6595 | .6595 | .6566 | .6566 | .6565 | .6566 | .6566 | .6566 | .6565 |
| B4 | .6533 | .6533 | .6177 | .6177 | .6177 | .6177 | .6177 | .6177 | .6177 |
| B5 | -1.0310 | -1.0310 | -.9576 | -.9576 | -.9576 | -.9576 | -.9576 | -.9576 | -.9576 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 217974 — QTA2 = 181716 — QTA3 = 156306
AZIMUTH AND TILT COEF. — C1 = -.0711 — C2 = -.2185 — C3 = -.2984 — C4 = 1.5596 — C5 = -1.1267

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 38 | 41 | 42 | 46 | 53 | 58 | 63 | 61 | 58 | 50 | 43 | 39 |
| QHOR: | 279 | 496 | 876 | 1283 | 1586 | 1754 | 2017 | 1689 | 1174 | 613 | 329 | 226 |

SEATTLE, WASHINGTON — ELEVATION = 400 — LAT = 47.4

| SOUTH-VERT. | TB30 (M=12) | TB40 (M=12) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | 81.39 | 40.94 | 24.11 | 15.97 | 11.91 | 9.50 | 7.90 | 5.91 |
| VT2/DD | NA | 69.50 | 34.84 | 20.52 | 13.64 | 10.17 | 8.11 | 6.75 | 5.05 |
| VT3/DD | NA | 60.35 | 30.23 | 17.80 | 11.84 | 8.83 | 7.05 | 5.86 | 4.38 |
| MONTHLY DD | 14 | 89 | 203 | 345 | 456 | 611 | 766 | 921 | 1231 |
| ANNUAL DD | 16 | 284 | 732 | 1500 | 2585 | 3957 | 5531 | 7223 | 10773 |
| PARAMETER A | NA | .782 | .890 | .954 | 1.039 | 1.121 | 1.179 | 1.212 | 1.235 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0226 | -.0415 | -.0414 | -.0248 | -.0230 | -.0227 | -.0234 | -.0260 |
| A2 | NA | .2407 | .0189 | .0600 | .2787 | .2735 | .2776 | .2914 | .3280 |
| A3 | NA | -.1809 | -.0879 | -.1312 | -.2629 | -.2711 | -.2892 | -.3171 | -.3779 |
| A4 | NA | .1706 | .0679 | .1006 | .2208 | .2234 | .2338 | .2519 | .2931 |
| A5 | NA | .0653 | -.0824 | -.0811 | .0266 | .0132 | -.0004 | -.0133 | -.0347 |
| B1 | NA | .0271 | .0391 | .0391 | .0271 | .0271 | .0271 | .0271 | .0271 |
| B2 | NA | -1.0026 | -.8681 | -.8681 | -1.0026 | -1.0026 | -1.0026 | -1.0026 | -1.0026 |
| B3 | NA | .7267 | .6176 | .6176 | .7267 | .7267 | .7267 | .7268 | .7267 |
| B4 | NA | .5384 | .6664 | .6664 | .5384 | .5384 | .5384 | .5384 | .5384 |
| B5 | NA | -1.0356 | -.9747 | -.9746 | -1.0357 | -1.0357 | -1.0356 | -1.0357 | -1.0357 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 219982 — QTA2 = 183366 — QTA3 = 157708
AZIMUTH AND TILT COEF. — C1 = -.0636 — C2 = -.2369 — C3 = -.2890 — C4 = 1.5810 — C5 = -1.1581

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 38 | 42 | 42 | 46 | 53 | 59 | 62 | 63 | 58 | 51 | 46 | 40 |
| QHOR: | 278 | 466 | 897 | 1294 | 1647 | 1766 | 1997 | 1679 | 1147 | 637 | 329 | 201 |

SPOKANE, WASHINGTON — ELEVATION = 2365 — LAT = 47.6

| SOUTH-VERT. | TB30 (M=12) | TB40 (M=12) | TB45 (M=12) | TB50 (M=12) | TB55 (M=12) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 64.12 | 24.41 | 17.33 | 13.41 | 10.93 | 9.23 | 7.99 | 7.04 | 5.69 |
| VT2/DD | 54.80 | 20.86 | 14.81 | 11.46 | 9.34 | 7.89 | 6.83 | 6.02 | 4.86 |
| VT3/DD | 47.59 | 18.11 | 12.86 | 9.95 | 8.12 | 6.85 | 5.93 | 5.22 | 4.22 |
| MONTHLY DD | 143 | 376 | 530 | 685 | 840 | 995 | 1150 | 1305 | 1615 |
| ANNUAL DD | 378 | 1338 | 2135 | 3113 | 4247 | 5540 | 6982 | 8536 | 11904 |
| PARAMETER A | .766 | .983 | 1.048 | 1.107 | 1.159 | 1.210 | 1.255 | 1.291 | 1.333 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0171 | .0051 | .0028 | .0017 | .0013 | .0011 | .0010 | .0009 | .0008 |
| A2 | .0392 | .0657 | .0786 | .0931 | .1079 | .1205 | .1330 | .1469 | .1810 |
| A3 | -.0542 | -.0861 | -.1038 | -.1235 | -.1435 | -.1611 | -.1793 | -.2003 | -.2521 |
| A4 | .0502 | .0779 | .0913 | .1052 | .1183 | .1292 | .1401 | .1527 | .1842 |
| A5 | -.0277 | -.0347 | -.0393 | -.0436 | -.0473 | -.0504 | -.0541 | -.0589 | -.0716 |
| B1 | .0264 | .0264 | .0264 | .0264 | .0264 | .0264 | .0264 | .0264 | .0264 |
| B2 | -1.0527 | -1.0527 | -1.0527 | -1.0527 | -1.0527 | -1.0527 | -1.0527 | -1.0527 | -1.0527 |
| B3 | .7594 | .7593 | .7594 | .7594 | .7594 | .7594 | .7594 | .7593 | .7594 |
| B4 | .5239 | .5239 | .5239 | .5238 | .5239 | .5238 | .5238 | .5239 | .5239 |
| B5 | -1.0526 | -1.0527 | -1.0526 | -1.0526 | -1.0527 | -1.0526 | -1.0526 | -1.0527 | -1.0526 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL — QTA1 = 283427 — QTA2 = 236570 — QTA3 = 203465
AZIMUTH AND TILT COEF. — C1 = .0359 — C2 = -.2567 — C3 = -.3634 — C4 = 1.5818 — C5 = -1.2799

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 28 | 33 | 37 | 45 | 56 | 62 | 68 | 68 | 59 | 46 | 35 | 27 |
| QHOR: | 313 | 578 | 1091 | 1521 | 1929 | 2110 | 2293 | 1942 | 1521 | 860 | 434 | 243 |

WHIDBEY ISLAND, WASHINGTON — ELEVATION = 56 — LAT = 48.3

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | NA | 97.08 | 42.85 | 25.17 | 17.35 | 13.00 | 9.59 | 7.60 | 5.37 |
| VT2/DD | NA | 82.72 | 36.51 | 21.44 | 14.79 | 11.04 | 8.15 | 6.46 | 4.57 |
| VT3/DD | NA | 71.78 | 31.68 | 18.61 | 12.83 | 9.58 | 7.07 | 5.60 | 3.96 |
| MONTHLY DD | 8 | 86 | 195 | 332 | 481 | 437 | 592 | 747 | 1057 |
| ANNUAL DD | 14 | 221 | 557 | 1231 | 2296 | 3739 | 5424 | 7203 | 10838 |
| PARAMETER A | NA | 1.099 | 1.153 | 1.123 | 1.116 | 1.171 | 1.289 | 1.350 | 1.402 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | NA | -.0189 | -.0152 | -.0195 | -.0233 | -.0838 | -.0735 | -.0694 | -.0671 |
| A2 | NA | .0293 | .0492 | .0853 | .1235 | -.0000 | .0295 | .0516 | .0802 |
| A3 | NA | -.0351 | -.0545 | -.0956 | -.1444 | -.0835 | -.1129 | -.1389 | -.1757 |
| A4 | NA | .0490 | .0603 | .0959 | .1315 | .1464 | .1540 | .1668 | .1892 |
| A5 | NA | -.0185 | -.0149 | -.0212 | -.0293 | -.1455 | -.1341 | -.1328 | -.1366 |
| B1 | NA | .0195 | .0195 | .0195 | .0195 | .0794 | .0794 | .0794 | .0794 |
| B2 | NA | -.9193 | -.9193 | -.9193 | -.9193 | -.7880 | -.7880 | -.7880 | -.7880 |
| B3 | NA | .6590 | .6590 | .6590 | .6591 | .5716 | .5716 | .5717 | .5716 |
| B4 | NA | .6158 | .6158 | .6158 | .6158 | .6470 | .6470 | .6470 | .6470 |
| B5 | NA | -.9770 | -.9770 | -.9770 | -.9770 | -.8769 | -.8769 | -.8769 | -.8770 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 229339 QTA2 = 191576 QTA3 = 164964
AZIMUTH AND TILT COEF. C1 = -.0707 C2 = -.3144 C3 = -.1899 C4 = 1.5023 C5 = -1.1387

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 39 | 42 | 43 | 48 | 51 | 56 | 57 | 61 | 61 | 51 | 44 | 45 |
| QHOR: | 266 | 536 | 962 | 1147 | 1720 | 1784 | 1786 | 1734 | 1323 | 615 | 347 | 206 |

YAKIMA, WASHINGTON — ELEVATION = 1066 — LAT = 46.6

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M= 1) | TB65 (M= 1) | TB70 (M= 1) | TB80 (M= 1) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 63.62 | 30.55 | 22.51 | 17.51 | 14.24 | 11.98 | 10.34 | 9.09 | 7.33 |
| VT2/DD | 54.33 | 26.09 | 19.22 | 14.95 | 12.16 | 10.23 | 8.83 | 7.77 | 6.26 |
| VT3/DD | 47.18 | 22.65 | 16.69 | 12.98 | 10.56 | 8.88 | 7.67 | 6.74 | 5.43 |
| MONTHLY DD | 184 | 383 | 520 | 668 | 822 | 977 | 1132 | 1287 | 1597 |
| ANNUAL DD | 304 | 1070 | 1737 | 2601 | 3657 | 4863 | 6219 | 7699 | 10970 |
| PARAMETER A | .610 | .886 | .952 | 1.011 | 1.059 | 1.099 | 1.135 | 1.163 | 1.195 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0170 | -.0092 | -.0042 | -.0003 | .0028 | .0049 | .0065 | .0078 | .0096 |
| A2 | -.0461 | -.0158 | .0095 | .0349 | .0612 | .0847 | .1068 | .1301 | .1830 |
| A3 | .0066 | -.0310 | -.0605 | -.0906 | -.1230 | -.1522 | -.1808 | -.2124 | -.2877 |
| A4 | -.0304 | .0030 | .0279 | .0517 | .1758 | .0971 | .1173 | .1388 | .1885 |
| A5 | -.0236 | -.0348 | -.0407 | -.0461 | -.0517 | -.0568 | -.0622 | -.0689 | -.0866 |
| B1 | -.0005 | -.0005 | -.0005 | -.0005 | -.0005 | -.0005 | -.0005 | -.0005 | -.0005 |
| B2 | -1.0361 | -1.0361 | -1.0361 | -1.0361 | -1.0361 | -1.0361 | -1.0361 | -1.0361 | -1.0361 |
| B3 | .7424 | .7424 | .7424 | .7424 | .7424 | .7424 | .7424 | .7424 | .7424 |
| B4 | .6068 | .6068 | .6068 | .6068 | .6068 | .6068 | .6068 | .6068 | .6068 |
| B5 | -1.0696 | -1.0696 | -1.0696 | -1.0696 | -1.0696 | -1.0696 | -1.0696 | -1.0696 | -1.0696 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 291377 QTA2 = 243071 QTA3 = 208984
AZIMUTH AND TILT COEF. C1 = .0323 C2 = -.2975 C3 = -.3294 C4 = 1.6141 C5 = -1.2710

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 28 | 36 | 40 | 48 | 59 | 65 | 71 | 69 | 60 | 50 | 40 | 30 |
| QHOR: | 331 | 687 | 1161 | 1609 | 1965 | 2273 | 2337 | 2014 | 1492 | 886 | 444 | 298 |

CHARLESTON, WEST VIRGINIA — ELEVATION = 951 — LAT = 38.4

| SOUTH-VERT. | TB30 (M= 1) | TB40 (M= 1) | TB45 (M= 1) | TB50 (M= 1) | TB55 (M= 1) | TB60 (M=12) | TB65 (M=12) | TB70 (M=12) | TB80 (M=12) |
|---|---|---|---|---|---|---|---|---|---|
| VT1/DD | 123.21 | 53.33 | 39.52 | 30.47 | 24.20 | 19.55 | 15.89 | 13.33 | 10.04 |
| VT2/DD | 104.98 | 45.44 | 33.68 | 25.96 | 20.62 | 16.65 | 13.53 | 11.36 | 8.55 |
| VT3/DD | 91.12 | 39.44 | 29.23 | 22.53 | 17.90 | 14.45 | 11.74 | 9.85 | 7.42 |
| MONTHLY DD | 133 | 308 | 415 | 539 | 678 | 645 | 794 | 946 | 1255 |
| ANNUAL DD | 289 | 907 | 1406 | 2034 | 2822 | 3768 | 4875 | 6159 | 9285 |
| PARAMETER A | .484 | .570 | .576 | .575 | .592 | .631 | .698 | .759 | .849 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0037 | -.0099 | -.0146 | -.0188 | -.0218 | -.0047 | -.0064 | -.0074 | -.0091 |
| A2 | .2807 | .2958 | .3552 | .4135 | .4471 | .3761 | .3742 | .3831 | .4332 |
| A3 | -.2509 | -.2863 | -.3622 | -.4349 | -.4826 | -.4703 | -.4759 | -.4959 | -.5802 |
| A4 | .1325 | .1604 | .2115 | .2616 | .2973 | .4002 | .3955 | .4008 | .4444 |
| A5 | .0951 | .0754 | .0684 | .0626 | .0522 | -.0970 | -.0983 | -.1022 | -.1199 |
| B1 | -.0019 | -.0019 | -.0019 | -.0019 | -.0019 | -.0104 | -.0104 | -.0104 | -.0104 |
| B2 | -.9511 | -.9511 | -.9511 | -.9511 | -.9511 | -.9181 | -.9181 | -.9181 | -.9181 |
| B3 | .6166 | .6165 | .6166 | .6166 | .6165 | .6123 | .6123 | .6122 | .6123 |
| B4 | .7718 | .7718 | .7718 | .7718 | .7718 | .7322 | .7322 | .7322 | .7322 |
| B5 | -1.1412 | -1.1412 | -1.1412 | -1.1412 | -1.1412 | -1.0766 | -1.0765 | -1.0765 | -1.0765 |

TOTAL ANNUAL TRANSMITTED RADIATION
DUE SOUTH AND VERTICAL QTA1 = 228831 QTA2 = 190489 QTA3 = 163704
AZIMUTH AND TILT COEF. C1 = -.0418 C2 = -.2327 C3 = -.3226 C4 = 1.6465 C5 = -1.1022

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 33 | 33 | 44 | 54 | 61 | 71 | 76 | 71 | 67 | 55 | 47 | 39 |
| QHOR: | 503 | 658 | 991 | 1389 | 1662 | 1843 | 1665 | 1503 | 1268 | 1005 | 595 | 400 |

EAU CLAIRE, WISCONSIN — ELEVATION = 896 — LAT = 44.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 32.05 | 18.31 | 14.81 | 12.41 | 10.68 | 9.37 | 8.35 | 7.53 | 6.29 |
| VT2/DD | 27.44 | 15.65 | 12.66 | 10.61 | 9.13 | 8.01 | 7.14 | 6.43 | 5.38 |
| VT3/DD | 23.84 | 13.59 | 10.99 | 9.22 | 7.93 | 6.96 | 6.20 | 5.59 | 4.67 |
| MONTHLY DD | 593 | 647 | 800 | 955 | 1110 | 1265 | 1420 | 1575 | 1885 |
| ANNUAL DD | 1592 | 2982 | 3847 | 4813 | 5883 | 7068 | 8390 | 9858 | 13166 |
| PARAMETER A | .535 | .735 | .807 | .871 | .926 | .976 | 1.023 | 1.065 | 1.125 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.0494 | .0030 | .0087 | .0119 | .0137 | .0145 | .0146 | .0145 | .0141 |
| A2 | .3501 | .1346 | .1460 | .1566 | .1681 | .1798 | .1923 | .2079 | .2523 |
| A3 | -.2615 | -.2422 | -.2443 | -.2496 | -.2588 | -.2698 | -.2831 | -.3022 | -.3623 |
| A4 | .1594 | .2094 | .2041 | .2019 | .2034 | .2068 | .2122 | .2216 | .2552 |
| A5 | .1150 | -.1398 | -.1229 | -.1112 | -.1033 | -.0976 | -.0939 | -.0925 | -.0978 |
| B1 | .0227 | .0132 | .0132 | .0132 | .0132 | .0132 | .0132 | .0132 | .0132 |
| B2 | -1.1424 | -1.0727 | -1.0727 | -1.0727 | -1.0727 | -1.0727 | -1.0727 | -1.0727 | -1.0727 |
| B3 | .7824 | .7708 | .7707 | .7707 | .7707 | .7707 | .7707 | .7707 | .7707 |
| B4 | .5833 | .5661 | .5661 | .5661 | .5661 | .5661 | .5661 | .5661 | .5661 |
| B5 | -1.1910 | -1.0924 | -1.0924 | -1.0924 | -1.0924 | -1.0924 | -1.0924 | -1.0924 | -1.0924 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 260623 — QTA2 = 217759 — QTA3 = 187372

AZIMUTH AND TILT COEF. — C1 = .0352 — C2 = -.3317 — C3 = -.2398 — C4 = 1.4977 — C5 = -1.1950

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 10 | 16 | 27 | 45 | 57 | 68 | 69 | 69 | 60 | 50 | 32 | 19 |
| QHOR: | 443 | 734 | 1091 | 1373 | 1706 | 1985 | 1867 | 1590 | 1201 | 815 | 439 | 312 |

GREEN BAY, WISCONSIN — ELEVATION = 702 — LAT = 44.5

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 38.83 | 24.64 | 20.55 | 17.13 | 14.62 | 12.74 | 11.28 | 10.13 | 8.40 |
| VT2/DD | 33.27 | 21.11 | 17.60 | 14.68 | 12.52 | 10.91 | 9.66 | 8.67 | 7.20 |
| VT3/DD | 28.91 | 18.35 | 15.30 | 12.75 | 10.88 | 9.48 | 8.40 | 7.54 | 6.25 |
| MONTHLY DD | 494 | 778 | 933 | 893 | 1046 | 1201 | 1356 | 1511 | 1821 |
| ANNUAL DD | 1274 | 2564 | 3420 | 4394 | 5502 | 6757 | 8145 | 9677 | 13058 |
| PARAMETER A | .606 | .623 | .642 | .697 | .754 | .805 | .847 | .880 | .912 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .1198 | .1231 | .1195 | -.1425 | -.1290 | -.1188 | -.1115 | -.1060 | -.1012 |
| A2 | .2338 | .3600 | .4099 | .3879 | .3986 | .4155 | .4380 | .4670 | .5525 |
| A3 | -.2111 | -.3465 | -.4013 | -.3903 | -.4111 | -.4404 | -.4764 | -.5213 | -.6465 |
| A4 | .1151 | .1959 | .2288 | .3188 | .3231 | .3344 | .3516 | .3753 | .4467 |
| A5 | .0465 | .0554 | .0590 | -.0133 | -.0139 | -.0170 | -.0220 | -.0291 | -.0490 |
| B1 | -.0128 | -.0128 | -.0128 | .0960 | .0960 | .0960 | .0960 | .0960 | .0960 |
| B2 | -1.1764 | -1.1764 | -1.1764 | -1.1549 | -1.1549 | -1.1549 | -1.1549 | -1.1549 | -1.1549 |
| B3 | .8214 | .8214 | .8214 | .8165 | .8165 | .8165 | .8165 | .8165 | .8165 |
| B4 | .5741 | .5741 | .5742 | .5309 | .5310 | .5309 | .5309 | .5310 | .5310 |
| B5 | -1.1970 | -1.1970 | -1.1970 | -1.1585 | -1.1585 | -1.1585 | -1.1585 | -1.1586 | -1.1586 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 267987 — QTA2 = 224010 — QTA3 = 192781

AZIMUTH AND TILT COEF. — C1 = .0354 — C2 = -.3578 — C3 = -.2145 — C4 = 1.4900 — C5 = -1.2010

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 14 | 19 | 30 | 44 | 54 | 64 | 69 | 67 | 58 | 50 | 35 | 21 |
| QHOR: | 437 | 729 | 1196 | 1416 | 1699 | 1856 | 1912 | 1598 | 1285 | 835 | 481 | 351 |

LA CROSSE, WISCONSIN — ELEVATION = 673 — LAT = 43.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 53.82 | 30.98 | 23.87 | 19.12 | 15.94 | 13.67 | 11.97 | 10.64 | 8.71 |
| VT2/DD | 46.10 | 26.53 | 20.43 | 16.37 | 13.65 | 11.71 | 10.25 | 9.11 | 7.46 |
| VT3/DD | 40.06 | 23.05 | 17.75 | 14.22 | 11.86 | 10.17 | 8.90 | 7.92 | 6.48 |
| MONTHLY DD | 396 | 688 | 624 | 779 | 934 | 1089 | 1244 | 1399 | 1709 |
| ANNUAL DD | 968 | 2236 | 3036 | 3938 | 4959 | 6117 | 7416 | 8859 | 12134 |
| PARAMETER A | .633 | .506 | .560 | .630 | .695 | .752 | .801 | .844 | .902 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0461 | .1001 | -.0286 | -.0177 | -.0108 | -.0061 | -.0027 | -.0001 | .0040 |
| A2 | .3002 | .5298 | .4201 | .4059 | .4012 | .4078 | .4219 | .4409 | .5035 |
| A3 | -.2504 | -.4466 | -.4258 | -.4155 | -.4191 | -.4371 | -.4638 | -.4969 | -.5953 |
| A4 | .1525 | .2572 | .3787 | .3549 | .3443 | .3457 | .3548 | .3693 | .4225 |
| A5 | .0752 | .1405 | -.0402 | -.0331 | -.0319 | -.0342 | -.0382 | -.0439 | -.0628 |
| B1 | -.0655 | -.0655 | -.0231 | -.0231 | -.0231 | -.0231 | -.0231 | -.0231 | -.0231 |
| B2 | -1.1720 | -1.1720 | -1.1422 | -1.1422 | -1.1422 | -1.1422 | -1.1422 | -1.1422 | -1.1422 |
| B3 | .8021 | .8021 | .8079 | .8079 | .8079 | .8079 | .8079 | .8079 | .8079 |
| B4 | .6090 | .6090 | .5631 | .5631 | .5631 | .5631 | .5631 | .5631 | .5631 |
| B5 | -1.2114 | -1.2113 | -1.1461 | -1.1461 | -1.1461 | -1.1461 | -1.1462 | -1.1461 | -1.1461 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 264949 — QTA2 = 221289 — QTA3 = 190353

AZIMUTH AND TILT COEF. — C1 = -.0002 — C2 = -.3638 — C3 = -.2190 — C4 = 1.5471 — C5 = -1.2170

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 17 | 22 | 30 | 47 | 57 | 69 | 71 | 69 | 63 | 52 | 35 | 24 |
| QHOR: | 496 | 733 | 1068 | 1522 | 1646 | 2010 | 1876 | 1638 | 1211 | 886 | 479 | 361 |

MADISON, WISCONSIN — ELEVATION = 860 — LAT = 43.1

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 48.61 | 29.89 | 24.63 | 20.39 | 16.95 | 14.51 | 12.68 | 11.26 | 9.20 |
| VT2/DD | 41.60 | 25.58 | 21.08 | 17.47 | 14.53 | 12.43 | 10.87 | 9.65 | 7.89 |
| VT3/DD | 36.14 | 22.22 | 18.31 | 15.18 | 12.62 | 10.80 | 9.44 | 8.39 | 6.85 |
| MONTHLY DD | 439 | 714 | 867 | 765 | 920 | 1075 | 1230 | 1385 | 1695 |
| ANNUAL DD | 1081 | 2359 | 3168 | 4074 | 5103 | 6261 | 7567 | 9029 | 12343 |
| PARAMETER A | .722 | .588 | .567 | .596 | .663 | .721 | .771 | .815 | .868 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0416 | .0720 | .0803 | -.0537 | -.0448 | -.0383 | -.0333 | -.0293 | -.0239 |
| A2 | .2472 | .3868 | .4432 | .7508 | .6996 | .6730 | .6634 | .6656 | .7219 |
| A3 | -.2145 | -.3405 | -.4004 | -.8151 | -.7700 | -.7519 | -.7534 | -.7693 | -.8663 |
| A4 | .1635 | .2551 | .2920 | .3934 | .3760 | .3719 | .3777 | .3908 | .4514 |
| A5 | .0510 | .0767 | .0805 | .0434 | .0324 | .0224 | .0126 | .0022 | -.0235 |
| B1 | -.0352 | -.0352 | -.0352 | .0129 | .0129 | .0129 | .0129 | .0129 | .0129 |
| B2 | -1.1337 | -1.1337 | -1.1337 | -1.2116 | -1.2116 | -1.2116 | -1.2116 | -1.2116 | -1.2116 |
| B3 | .7794 | .7795 | .7795 | .8900 | .8900 | .8901 | .8901 | .8901 | .8900 |
| B4 | .6354 | .6353 | .6354 | .5880 | .5880 | .5880 | .5880 | .5880 | .5880 |
| B5 | -1.2051 | -1.2051 | -1.2051 | -1.1674 | -1.1674 | -1.1674 | -1.1674 | -1.1674 | -1.1674 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 270444 QTA2 = 225882 QTA3 = 194314

AZIMUTH AND TILT COEF. C1 = .0163 C2 = -.3502 C3 = -.2176 C4 = 1.5432 C5 = -1.2122

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 17 | 21 | 28 | 47 | 58 | 67 | 71 | 68 | 62 | 50 | 36 | 25 |
| QHOR: | 520 | 804 | 1212 | 1383 | 1702 | 1874 | 1916 | 1750 | 1336 | 865 | 511 | 376 |

MILWAUKEE, WISCONSIN — ELEVATION = 692 — LAT = 42.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 69.12 | 32.18 | 24.57 | 19.76 | 16.51 | 14.16 | 12.37 | 10.99 | 8.98 |
| VT2/DD | 59.14 | 27.53 | 21.02 | 16.91 | 14.13 | 12.11 | 10.59 | 9.40 | 7.68 |
| VT3/DD | 51.38 | 23.92 | 18.26 | 14.69 | 12.27 | 10.52 | 9.20 | 8.17 | 6.67 |
| MONTHLY DD | 220 | 473 | 620 | 770 | 922 | 1076 | 1231 | 1386 | 1696 |
| ANNUAL DD | 748 | 1891 | 2693 | 3623 | 4673 | 5865 | 7212 | 8708 | 12081 |
| PARAMETER A | .448 | .598 | .655 | .709 | .754 | .795 | .834 | .868 | .906 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0175 | .0069 | .0034 | .0007 | -.0012 | -.0027 | -.0039 | -.0050 | -.0072 |
| A2 | .3690 | .4239 | .4409 | .4542 | .4696 | .4868 | .5033 | .5232 | .5941 |
| A3 | -.4050 | -.4558 | -.4795 | -.5028 | -.5295 | -.5587 | -.5876 | -.6213 | -.7312 |
| A4 | .2622 | .2977 | .3146 | .3299 | .3467 | .3648 | .3822 | .4026 | .4701 |
| A5 | -.0204 | -.0073 | -.0102 | -.0158 | -.0222 | -.0291 | -.0364 | -.0449 | -.0699 |
| B1 | .0264 | .0264 | .0264 | .0264 | .0264 | .0264 | .0264 | .0264 | .0264 |
| B2 | -1.1121 | -1.1121 | -1.1121 | -1.1121 | -1.1121 | -1.1121 | -1.1121 | -1.1121 | -1.1121 |
| B3 | .7744 | .7743 | .7743 | .7743 | .7743 | .7743 | .7743 | .7743 | .7743 |
| B4 | .5819 | .5820 | .5820 | .5820 | .5820 | .5820 | .5820 | .5820 | .5820 |
| B5 | -1.1475 | -1.1475 | -1.1475 | -1.1475 | -1.1475 | -1.1475 | -1.1475 | -1.1475 | -1.1475 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 265769 QTA2 = 221569 QTA3 = 190417

AZIMUTH AND TILT COEF. C1 = .0136 C2 = -.2813 C3 = -.3320 C4 = 1.6062 C5 = -1.2212

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 22 | 25 | 32 | 44 | 55 | 65 | 69 | 69 | 61 | 51 | 38 | 25 |
| QHOR: | 491 | 665 | 1122 | 1451 | 1746 | 2030 | 2017 | 1770 | 1325 | 884 | 551 | 377 |

CASPER, WYOMING — ELEVATION = 5289 — LAT = 42.9

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 144.62 | 69.23 | 53.10 | 42.29 | 34.66 | 29.34 | 25.41 | 22.41 | 18.12 |
| VT2/DD | 124.08 | 59.40 | 45.55 | 36.32 | 29.77 | 25.20 | 21.82 | 19.24 | 15.57 |
| VT3/DD | 107.87 | 51.64 | 39.60 | 31.58 | 25.88 | 21.91 | 18.97 | 16.73 | 13.53 |
| MONTHLY DD | 237 | 496 | 647 | 695 | 848 | 1002 | 1157 | 1312 | 1622 |
| ANNUAL DD | 850 | 2112 | 3003 | 4046 | 5212 | 6496 | 7892 | 9404 | 12686 |
| PARAMETER A | .588 | .561 | .541 | .538 | .551 | .557 | .562 | .563 | .546 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0472 | .0489 | .0502 | -.1371 | -.1323 | -.1289 | -.1259 | -.1235 | -.1229 |
| A2 | .5783 | .7753 | .8831 | 1.1575 | 1.2214 | 1.3027 | 1.3876 | 1.4837 | 1.7350 |
| A3 | -.5950 | -.8114 | -.9309 | -1.1876 | -1.2826 | -1.3974 | -1.5171 | -1.6509 | -1.9887 |
| A4 | .3501 | .4783 | .5486 | .7613 | .8111 | .8728 | .9375 | 1.0111 | 1.2030 |
| A5 | .0400 | .0482 | .0515 | .0739 | .0588 | .0436 | .0275 | .0098 | -.0304 |
| B1 | -.0140 | -.0140 | -.0140 | .0439 | .0439 | .0439 | .0439 | .0439 | .0439 |
| B2 | -1.2354 | -1.2354 | -1.2353 | -1.2759 | -1.2759 | -1.2759 | -1.2759 | -1.2759 | -1.2759 |
| B3 | .8138 | .8138 | .8138 | .8813 | .8813 | .8813 | .8813 | .8813 | .8813 |
| B4 | .5818 | .5818 | .5818 | .5087 | .5087 | .5087 | .5087 | .5087 | .5087 |
| B5 | -1.2895 | -1.2895 | -1.2895 | -1.2656 | -1.2656 | -1.2656 | -1.2656 | -1.2656 | -1.2656 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL QTA1 = 383547 QTA2 = 320620 QTA3 = 275659

AZIMUTH AND TILT COEF. C1 = .0230 C2 = -.3276 C3 = -.3474 C4 = 1.5916 C5 = -1.3893

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 24 | 28 | 31 | 38 | 51 | 62 | 72 | 71 | 56 | 47 | 33 | 27 |
| QHOR: | 678 | 1024 | 1452 | 1835 | 2230 | 2506 | 2573 | 2240 | 1698 | 1231 | 763 | 543 |

CHEYENNE, WYOMING — ELEVATION = 6142 — LAT = 41.2

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) | (M= 2) |
| VT1/DD | 154.61 | 78.71 | 59.73 | 47.66 | 39.46 | 33.65 | 29.33 | 25.99 | 21.18 |
| VT2/DD | 132.49 | 66.89 | 50.76 | 40.50 | 33.54 | 28.60 | 24.93 | 22.09 | 18.00 |
| VT3/DD | 115.16 | 58.01 | 44.02 | 35.12 | 29.08 | 24.80 | 21.62 | 19.16 | 15.61 |
| MONTHLY DD | 240 | 406 | 536 | 671 | 811 | 951 | 1091 | 1231 | 1511 |
| ANNUAL DD | 769 | 1859 | 2684 | 3678 | 4821 | 6120 | 7573 | 9141 | 12548 |
| PARAMETER A | .550 | .535 | .525 | .510 | .496 | .483 | .473 | .451 | .381 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0060 | -.0285 | -.0216 | -.0128 | -.0027 | .0082 | .0192 | .0312 | .0614 |
| A2 | .5197 | -.3609 | -.2468 | -.1243 | .0077 | .1518 | .3072 | .4865 | .9445 |
| A3 | -.5044 | .1012 | -.0383 | -.1883 | -.3483 | -.5226 | -.7134 | -.9453 | -1.5602 |
| A4 | .3370 | -.1028 | -.0187 | .0722 | .1699 | .2771 | .3946 | .5367 | .9130 |
| A5 | .0857 | -.2242 | -.2278 | -.2313 | -.2338 | -.2373 | -.2442 | -.2619 | -.3214 |
| B1 | -.0191 | -.0081 | -.0081 | -.0081 | -.0081 | -.0081 | -.0081 | -.0081 | -.0081 |
| B2 | -1.1763 | -.8855 | -.8854 | -.8854 | -.8854 | -.8855 | -.8855 | -.8854 | -.8854 |
| B3 | .7566 | .3963 | .3962 | .3962 | .3962 | .3962 | .3962 | .3962 | .3962 |
| B4 | .6188 | .9379 | .9379 | .9379 | .9379 | .9379 | .9378 | .9379 | .9379 |
| B5 | -1.3233 | -1.3561 | -1.3561 | -1.3561 | -1.3561 | -1.3561 | -1.3561 | -1.3561 | -1.3561 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 370909 — QTA2 = 310337 — QTA3 = 266981

AZIMUTH AND TILT COEF. — C1 = .0498 — C2 = -.3840 — C3 = -.2760 — C4 = 1.5473 — C5 = -1.3717

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 25 | 26 | 32 | 43 | 50 | 60 | 68 | 67 | 57 | 48 | 35 | 30 |
| QHOR: | 743 | 1015 | 1483 | 1765 | 1953 | 2182 | 2195 | 1975 | 1686 | 1220 | 845 | 674 |

ROCK SPRINGS, WYOMING — ELEVATION = 6745 — LAT = 41.6

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) | (M=12) |
| VT1/DD | 124.85 | 64.50 | 50.49 | 41.42 | 35.12 | 30.48 | 26.92 | 24.11 | 19.94 |
| VT2/DD | 107.08 | 55.42 | 43.38 | 35.59 | 30.17 | 26.18 | 23.13 | 20.71 | 17.13 |
| VT3/DD | 93.09 | 48.19 | 37.72 | 30.95 | 26.24 | 22.77 | 20.11 | 18.01 | 14.90 |
| MONTHLY DD | 293 | 554 | 708 | 863 | 1018 | 1173 | 1328 | 1483 | 1793 |
| ANNUAL DD | 1089 | 2546 | 3528 | 4645 | 5882 | 7245 | 8729 | 10317 | 13741 |
| PARAMETER A | .425 | .446 | .464 | .473 | .473 | .471 | .466 | .452 | .404 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | -.1588 | .0461 | .0438 | .0430 | .0434 | .0442 | .0455 | .0477 | .0559 |
| A2 | .5179 | 1.1718 | 1.2676 | 1.3842 | 1.5281 | 1.6793 | 1.8484 | 2.0589 | 2.6400 |
| A3 | -.5169 | -1.0462 | -1.1845 | -1.3500 | -1.5482 | -1.7569 | -1.9883 | -2.2688 | -3.0102 |
| A4 | .2809 | .6824 | .7542 | .8428 | .9504 | 1.0639 | 1.1908 | 1.3470 | 1.7676 |
| A5 | .0451 | .2009 | .1816 | .1585 | .1342 | .1084 | .0808 | .0516 | -.0052 |
| B1 | .0603 | .0094 | .0094 | .0094 | .0094 | .0094 | .0094 | .0094 | .0094 |
| B2 | -1.2331 | -1.3026 | -1.3026 | -1.3026 | -1.3026 | -1.3026 | -1.3026 | -1.3026 | -1.3026 |
| B3 | .8005 | .8890 | .8889 | .8890 | .8890 | .8889 | .8890 | .8889 | .8890 |
| B4 | .6197 | .5295 | .5295 | .5295 | .5295 | .5295 | .5295 | .5295 | .5295 |
| B5 | -1.3053 | -1.2975 | -1.2975 | -1.2975 | -1.2975 | -1.2975 | -1.2975 | -1.2975 | -1.2975 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 399262 — QTA2 = 333558 — QTA3 = 286689

AZIMUTH AND TILT COEF. — C1 = .0467 — C2 = -.3068 — C3 = -.3973 — C4 = 1.6346 — C5 = -1.4079

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 22 | 22 | 29 | 38 | 49 | 58 | 68 | 66 | 56 | 43 | 30 | 22 |
| QHOR: | 742 | 1072 | 1580 | 2021 | 2321 | 2558 | 2592 | 2237 | 1855 | 1328 | 826 | 640 |

SHERIDAN, WYOMING — ELEVATION = 3967 — LAT = 44.8

| | TB30 | TB40 | TB45 | TB50 | TB55 | TB60 | TB65 | TB70 | TB80 |
|---|---|---|---|---|---|---|---|---|---|
| SOUTH-VERT. | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M= 1) | (M=12) |
| VT1/DD | 64.19 | 37.78 | 30.51 | 25.46 | 21.81 | 19.08 | 16.96 | 15.26 | 12.62 |
| VT2/DD | 55.03 | 32.38 | 26.16 | 21.82 | 18.70 | 16.36 | 14.54 | 13.08 | 10.82 |
| VT3/DD | 47.82 | 28.14 | 22.73 | 18.96 | 16.25 | 14.22 | 12.64 | 11.37 | 9.41 |
| MONTHLY DD | 368 | 626 | 774 | 928 | 1083 | 1238 | 1393 | 1548 | 1628 |
| ANNUAL DD | 866 | 2051 | 2883 | 3858 | 4990 | 6277 | 7709 | 9256 | 12593 |
| PARAMETER A | .812 | .809 | .787 | .769 | .762 | .759 | .757 | .750 | .724 |
| AZIMUTH AND TILT COEF. | | | | | | | | | |
| A1 | .0045 | .0076 | .0094 | .0111 | .0122 | .0128 | .0132 | .0137 | .0317 |
| A2 | .1161 | .2404 | .3139 | .3911 | .4662 | .5392 | .6158 | .7016 | .9688 |
| A3 | -.1082 | -.2361 | -.3171 | -.4055 | -.4955 | -.5869 | -.6863 | -.7993 | -1.1192 |
| A4 | .0736 | .1642 | .2179 | .2745 | .3305 | .3862 | .4458 | .5132 | .7438 |
| A5 | .0172 | .0221 | .0223 | .0205 | .0160 | .0088 | -.0016 | -.0144 | -.0552 |
| B1 | -.0001 | -.0001 | -.0001 | -.0001 | -.0001 | -.0001 | -.0001 | -.0001 | -.0076 |
| B2 | -1.1912 | -1.1912 | -1.1912 | -1.1912 | -1.1912 | -1.1912 | -1.1912 | -1.1912 | -1.2166 |
| B3 | .8170 | .8171 | .8170 | .8170 | .8171 | .8170 | .8170 | .8170 | .8589 |
| B4 | .5522 | .5522 | .5522 | .5522 | .5522 | .5522 | .5522 | .5522 | .4997 |
| B5 | -1.2152 | -1.2152 | -1.2152 | -1.2152 | -1.2152 | -1.2152 | -1.2152 | -1.2152 | -1.1927 |

TOTAL ANNUAL TRANSMITTED RADIATION

DUE SOUTH AND VERTICAL — QTA1 = 318069 — QTA2 = 265990 — QTA3 = 228848

AZIMUTH AND TILT COEF. — C1 = .0255 — C2 = -.3554 — C3 = -.2704 — C4 = 1.5311 — C5 = -1.3015

| MONTH: | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAVE: | 20 | 29 | 33 | 43 | 53 | 61 | 69 | 70 | 57 | 47 | 34 | 27 |
| QHOR: | 509 | 783 | 1201 | 1508 | 1864 | 2061 | 2349 | 2007 | 1479 | 1003 | 625 | 427 |

# APPENDIX C
# BLANK WORKSHEETS

## WORKSHEET 1
## Schematic Design Parameters

### BUILDING SIZE

Heated floor space: $A_{f}$ = _____ $ft^2$

Ceiling height: h = _____ ft

Total external perimeter: $P_{t}$ = _____ $ft^2$

NOTE: Include external perimeter of each floor.

External surface area: $A_{e} = 2A_{f} + (P_{t}$ [multiplied by] h) = _____

External surface-area-to-floor-area ratio: $A_{e}/A_{f}$ = _____

### INSULATION LEVELS

Thermal resistance of the wall: $RWALL_{o}$ = _____ deg.F-$ft^2$

NOTE: $RWALL_{o}$ is obtained from the contour map in figure 13.

$$RWALL = \frac{1}{3}\left[\frac{A_{e}}{A_{f}}\right] \quad RWALL_{o} = _____ \text{ deg.F-ft}^2$$

Thermal resistance of the roof: RROOF = 1.5 RWALL = _____ deg.F-$ft^2$

Thermal resistance of perimeter insulation: RPERIM or RBASE = 0.75 RWALL = _____ deg.F-$ft^2$

### PASSIVE SYSTEM TYPE: _____

### SOLAR APERTURE SIZE (DUE SOUTH ORIENTATION): $\left[\frac{A_{c}}{A_{f}}\right]_{o}$ = _____

NOTE: $\left[\frac{A_{c}}{A_{f}}\right]_{o}$ is obtained from one of the contour maps in figures 14 throu Remember to convert from percent to fractional value befo recording the quantity.

$$A_{c} = \frac{A_{f}\left[\frac{A_{c}}{A_{f}}\right]_{o}\frac{A_{e}}{A_{f}}}{3} = _____ \text{ ft}^2$$

### BUILDING ORIENTATION (AZIMUTH)

[theta] = _____ degrees

NOTE: Azimuth is zero for due south and positive to the east.

# WORKSHEET 2
## Estimation of Net Load Coefficient

### SPECIFIED DESIGN PARAMETERS

Total external perimeter: $P_{t}$ = _____

Ground floor area: $A_{g}$ = _____

Ground floor perimeter: $P_{g}$ = _____

Roof area (horizontal projection): $A_{r}$ = _____

South wall area: $A_{s}$ = _____
NOTE: $A_{s}$ includes windows and solar apertures.

Ceiling height: h = _____

Nonsouth window fraction: NSF = _____

Number of glazings in nonsouth windows: $NGL_{n}$ = _____

Air changes per hour: ACH = _____

Air density ratio (see figure 24): ADR = _____

### CALCULATED DESIGN PARAMETERS

Nonsouth window area: $A_{n}$ = [$P_{t}$ [multiplied by] h) - $A_{s}$] NSF = _____

Wall area: $A_{w}$ = ($P_{t}$ [multiplied by] h) - $A_{c}$ - $A_{n}$ NSF = _____

NOTE: $A_{w}$ is the total area of all external walls
excluding windows and solar apertures.

### NET LOAD COEFFICIENTS

Walls: $LC_{w}$ = 24 $A_{w}$/RWALL = _____

Nonsouth windows: $LC_{n}$ = 26 $A_{n}$/$NGL_{n}$ = _____

Pick One:

- Perimeter (slab on grade): $LC_{p}$ = 100 $P_{g}$ /(RPERIM + 5) = _____
- Basement (heated): $LC_{b}$ = 256 $P_{g}$/(RBASE + 8) = _____
- Floor (over vented crawl space): $LC_{f}$ = 24 $A_{g}$/RFLOOR = _____

Roof: $LC_{r}$ = 24 $A_{r}$/RROOF = _____

Infiltration: $LC_{i}$ = 0.432
(ACH [multiplied by] ADR [multiplied by] h [multiplied by] $A_{f}$) = _____

TOTAL: NLC = $LC_{w}$ + $LC_{n}$ + ($LC_{p}$ or $LC_{b}$ or $LC_{f}$) + $LC_{r}$ + $LC_{i}$ = _____

WORKSHEET 3
System Parameters

THERMAL STORAGE

Effective heat capacity: $EHC/A_{c}$ = _____ Btu/deg.F-f
(Direct gain or radiant heat panel only)
Diurnal heat capacity per $ft^2$ of aperture: $DHC/A_{c}$ = _____ Btu/deg.F-f

FIRST SYSTEM

System type: _____
System number: _____

Scale factor: $F_{1}$ = _____

Effective aperture conductance (daily): $G_{1}$ = _____ Btu/deg.F-f

Steady-state aperture conductance (hourly): $U_{c1}$ = _____ Btu/deg.F-f

System solar absorptance: $[alpha]_{1}$ = _____

Collection aperture area: $A_{c1}$ = _____ $ft^2$

SECOND SYSTEM

System type: _____
System number: _____

Scale factor: $F_{2}$ = _____

Effective aperture conductance (daily): $G_{2}$ = _____ Btu/deg.F-f

Steady-state aperture conductance (hourly): $U_{c2}$ = _____ Btu/deg.F-f

System solar absorptance: $[alpha]_{2}$ = _____

Collection aperture area: $A_{c2}$ = _____ $ft^2$

FIRST SYSTEM AREA FRACTION $f_{1} = A_{c1}/(A_{c1} + A_{c2})$

SECOND SYSTEM AREA FRACTION $f_{2} = A_{c2}/(A_{c1} + A_{c2})$

MIXED SYSTEM PARAMETERS

Scale factor: $F = (f_{1}$ [multiplied by] $F_{1}) + (f_{2}$ [multiplied by] $F_{2})$ = _____

Effective aperture conductance (daily): $G = (f_{1}$ [multiplied by] $G_{1}) + (f_{2}$ [multiplied by] $G_{2})$ = _____ Btu/deg.F-f

Steady-state aperture conductance (hourly): $U_{c} = (f_{1}$ [multiplied by] $U_{c1}) + (f_{2}$ [multiplied by] $U_{c2})$ = _____ Btu/deg.F-f

System solar absorptance: $[alpha] = (f_{1}$ [multiplied by] $[alpha]_{1}) + (f_{2}$ [multiplied by] $[alpha]_{2})$ = _____

Collection aperture area: $A_{c} = A_{c1} + A_{c2}$ = _____ $ft^2$

WORKSHEET 4
Base Temperature

CONSTANT THERMOSTAT SETTING

Thermostat setpoint: $T_{set}$ = _____

Base temperature:

$$T_b = T_{set} - \frac{Q_{int}}{[NLC + (24 \text{ [multiplied by] } U_c \text{ [multiplied by] } A_c)]}$$

$T_b$ = _____

NIGHT TIME SETBACK

Daytime setpoint: $T_1$ = _____

Duration of daytime setpoint: $hr_1$ = _____

Night time setpoint: $T_2$ = _____

Duration of night time setpoint: $hr_2$ = _____

Average setpoint: $T_{ave} = T_1(hr_1/24) + T_2(hr_2/24)$ $T_{ave}$ = _____

Building time constant:

$$[tau] = \frac{24 \text{ HDC}}{[NLC + (24 \text{ [multiplied by] } U_c \text{ [multiplied by] } A_c)]}$$

[tau] = _____

Effective thermostat setpoint:

$$T_e = T_1 - e^{[-0.1[tau]/24]} (T_1 - T_{ave})$$

$T_e$ = _____

Base temperature:

$$T_b = T_e - \frac{Q_{int}}{[NLC + (24 \text{ [multiplied by] } U_c \text{ [multiplied by] } A_c)]}$$

$T_b$ = _____

WORKSHEET 5
Weather Parameters

LOCATION STATE: _____
CITY: _____

Annual heating degree days: $DD_{[a]}$ = _____

FIRST SYSTEM

Number of glazings: NGL = _____
Orientation: [theta] = _____ degrees
Tilt: [open phi] = _____ degrees

South-vertical radiation to degree day ratio: $(VTn/DD)_{[o]}$ = _____ $Btu/ft^{[2]}$-DD

South-vertical city parameter: $a_{[o]}$ = _____

Coefficients for azimuth/tilt convection:

A1 = _____ A2 = _____ A3 = _____ A4 = _____ A5 = _____

B1 = _____ B2 = _____ B3 = _____ B4 = _____ B5 = _____

Corrected city parameter:
(Use equation 5.16) $a_{[1]}$ = _____

Corrected radiation to degree day ratio:
(Use equation 5.17) $(VTn/DD)_{[1]}$ = _____ $Btu/ft^{[2]}$-DD

SECOND SYSTEM

Number of glazings: NGL = _____
Orientation: [theta] = _____ degrees
Tilt: [open phi] = _____ degrees

South-vertical radiation to degree day ratio: $(VTn/DD)_{[o]}$ = _____ $Btu/ft^{[2]}$-DD

South-vertical city parameter: $a_{[o]}$ = _____

Coefficients for azimuth/tilt convection:

A1 = _____ A2 = _____ A3 = _____ A4 = _____ A5 = _____

B1 = _____ B2 = _____ B3 = _____ B4 = _____ B5 = _____

Corrected city parameter:
(Use equation 5.16) $a_{[1]}$ = _____

Corrected radiation to degree day ratio:
(Use equation 5.17) $(VTn/DD)_{[1]}$ = _____ $Btu/ft^{[2]}$-DD

MIXED WEATHER PARAMETERS

Radiation degree day ratio:

$$VTn/DD = f_{[1]}(VTn/DD)_{[1]} + f_{[2]}(VTn/DD)_{[2]} = _____ \ Btu/$$

City parameter: $a = f_{[1]}a_{[1]} + f_{[2]}a_{[2]}$ = _____

WORKSHEET 6
Estimation of Auxiliary Heat Consumption

SCALED SOLAR LOAD RATIO

$$SLR^* = \frac{F\ (VTn/DD)\ [alpha]}{NLC/A_{[c]} + G}$$

SLR* = _____

NOTE: All parameters in this expression are defined and recorded on Worksheets 2, 3, and 4.

ANNUAL HEAT-TO-LOAD-RATIO

$(Q_{[A]}/Q_{[L]})_{[a]}$ = _____

NOTE: The yearly heat-to-load ratio is obtained from the nomogram in figure 23. Using the value of SLR* calculated above and the city parameter a from Worksheet 5, one simply reads the heat-to-load ratio off the vertical axis of the nomogram.

ANNUAL AUXILIARY HEAT REQUIREMENT

$Q_{[A]} = (Q_{[A]}/Q_{[L]})_{[a]}$ (NLC + G [multiplied by] $A_{[c]}$) $DD_{[a]}$ $Q_{[A]}$ = _____

WORKSHEET 7
System Efficiencies During Reference Month

TOTAL SYSTEM EFFICIENCY

Total effective load coefficient:

$$TLC_{\lceil e \rceil} = NLC + G \text{ [multiplied by] } A_{\lceil c \rceil} = _____ \text{ Btu/d}$$

Solar heating fraction: $SHF = 1 - e^{\lfloor -SLR^{*} \rfloor} = _____$

Total efficiency:

$$e_{\lceil t \rceil} = \frac{TLC_{\lceil e \rceil} \text{ [multiplied by] } SHF + (24\ U_{\lceil c \rceil} - G)\ A_{\lceil c \rceil}}{\text{[alpha] } (VTn/DD)\ A_{\lceil c \rceil}} = _____$$

(NOTE: $e_{\lceil t \rceil} = e_{\lceil d \rceil}$ [multiplied by] $e_{\lceil u \rceil}$)

DELIVERY EFFICIENCY $e_{\lceil d \rceil} = _____$

UTILIZATION EFFICIENCY $e_{\lceil u \rceil} = \dfrac{e_{\lceil t \rceil}}{e_{\lceil d \rceil}} = _____$

WORKSHEET 8
Average Maximum Temperature During Reference Month

Delivered solar energy: $Q_{D}$ = [alpha] [multiplied by] $A_{c}$ [multiplied by] $e_{d}$ [multiplied by] $\frac{VTn}{DD}$ [multiplied by] DD = _____ $\frac{Btu}{month}$

Excess solar energy: $Q_{E}$ = (1 - $e_{u}$) $Q_{D}$ = _____ $\frac{Btu}{month}$

Average temperature with ventilation (for night setback $T_{set}$ = $T_{e}$):

$\bar{T}$ = $T_{set}$ + [10 [multiplied by] SHF (1 - $e_{u}$) $_{L}$0.2$_{J}$] = _____ deg.F

Temperature increment without ventilation:

$$[W\text{-}DELTA]T_{I} = \frac{Q_{E}}{NDAY \text{ [multiplied by] } DHC} = _____ \text{ deg.F}$$

Average maximum temperature without ventilation: $\bar{T}_{max}$ = $\bar{T}$ + [W-DELTA]$T_{I}$ = _____ deg.F

WORKSHEET 9
Annual Delivered Solar Energy

FIRST SYSTEM

Transmitted solar radiation: $(QTAn)_{o}$ = _____ Btu/ft$^2$-yr

Coefficients for azimuth/tilt correction:

C1 = _____ C2 = _____ C3 = _____ C4 = _____ C5 = _____

Corrected transmitted solar radiation: $(QTAn)_{1}$ = _____ Btu/ft$^2$-yr
(Use equation 5.20)

SECOND SYSTEM

Transmitted solar radiation: $(QTAn)_{o}$ = _____ Btu/ft$^2$-yr

Coefficients for azimuth/tilt correction:

C1 = _____ C2 = _____ C3 = _____ C4 = _____ C5 = _____

Corrected transmitted solar radiation: $(QTAn)_{2}$ = _____ Btu/ft$^2$-yr
(Use equation 5.20)

ANNUAL DELIVERED SOLAR ENERGY

$(Q_{D})_{a}$ = [alpha] [multiplied by] $A_{c}$ [multiplied by] $e_{d}$ [multiplied by]
$[f_{1}(QTAn)_{1} + f_{2}(QTAn)_{2}]$ = _____ Btu/yr

WORKSHEET 10
Annual Incremental Cooling Load

ANNUAL HEAT TO LOAD RATIO

(Use Worksheets 4, 5, and 6 with $T_{set} = T_{max} - 10$)

$$\left[\frac{Q_A}{Q_L}\right]_a = _____$$

ANNUAL AUXILIARY HEAT REQUIRED

(From Worksheet 6 with $T_{set} = T_{max} - 10$) $Q_A = _____$ Btu

ANNUAL SOLAR HEATING FRACTION

$$SHF_a = 1 - \left[\frac{Q_A}{Q_L}\right]_a = _____$$

ANNUAL UTILIZATION EFFICIENCY

$$(e_u)_a = \frac{[TLC_e \text{ [multiplied by] } SHF_a + (24\ U_c - G)\ A_c] \text{ [multiplied by] } DD_a}{(Q_D)_a} = _____$$

Note: Use: $TLC_e$ from Worksheet 7
$U_c$, G, and $A_c$ from Worksheet 3
$DD_a$ from Worksheet 5
$(Q_D)a$ from Worksheet 9

ACTUAL INDOOR TEMPERATURE (ANNUAL AVERAGE)

(Use: $T_{set} = T_{max} - 10$)

$$T_{act} = T_{set} + 10\ SHF_a \text{ [multiplied by] } (1 - e_u)_{0.2} = ____ \text{ deg.F}$$

ACTUAL ANNUAL DEGREE DAYS

(Use Worksheet No. 4 with $T_{set} = T_{act}$ to determine $T_b$) $DD_{act} = _____$ deg.F-day

ACTUAL ANNUAL HEAT LOAD
$Q_{act} = (NLC + 24\ U_c \text{ [multiplied by] } A_c \text{ [multiplied by] } DD_{act} = ___$ Btu

INCREMENTAL COOLING LOAD $Q_I = Q_D + Q_A - Q_{act} = ___$ Btu

# APPENDIX D
# EXAMPLE WORKSHEETS

## WORKSHEET 1
## Schematic Design Parameters

### BUILDING SIZE

Heated floor space: $A_{f} = \underline{6800}$ $ft^2$

Ceiling height: $h = \underline{9}$ ft

Total external perimeter: $P_{t} = \underline{684}$ $ft^2$

NOTE: Include external perimeter of each floor.

External surface area: $A_{e} = 2A_{f} + (P_{t}$ [multiplied by] $h) = \underline{19,756}$ $ft^2$

External surface-area-to-floor-area ratio: $A_{e}/A_{f} = \underline{2.91}$

### INSULATION LEVELS

Thermal resistance of the wall: $RWALL_{o} = \underline{22}$ deg.F-$ft^2$-h

NOTE: $RWALL_{o}$ is obtained from the contour map in figure 13.

$$RWALL = \frac{1}{3}\left[\frac{A_{e}}{A_{f}}\right] \quad RWALL_{o} = \underline{21} \text{ deg.F-ft}^2\text{-h}$$

Thermal resistance of the roof: $RROOF = 1.5\ RWALL = \underline{32}$ deg.F-$ft^2$-h

Thermal resistance of perimeter insulation: $\left.\begin{matrix} RPERIM \\ \text{or} \\ RBASE \end{matrix}\right] = 0.75\ RWALL = \underline{16}$ deg.F-$ft^2$-h

PASSIVE SYSTEM TYPE: Direct gai

SOLAR APERTURE SIZE (DUE SOUTH ORIENTATION): $\left[\frac{A_{c}}{A_{f}}\right]_{o} = \underline{0.12}$

NOTE: $\left[\frac{A_{c}}{A_{f}}\right]_{o}$ is obtained from one of the contour maps in figures 14 through Remember to convert from percent to fractional value before recording the quantity.

$$A_{c} = \frac{\left| A_{f} \right|_{o} A_{f}}{3} = \frac{791}{} \text{ ft}^{2}$$

BUILDING ORIENTATION (AZIMUTH) [theta] = 15 degrees

NOTE: Azimuth is zero for due south and positive to the east.

## WORKSHEET 2
## Estimation of Net Load Coefficient

**SPECIFIED DESIGN PARAMETERS**

| | | |
|---|---|---|
| Total external perimeter: | $P_t$ = | 684 ft |
| Ground floor area: | $A_g$ = | 3,400 $ft^2$ |
| Ground floor perimeter: | $P_g$ = | 342 ft |
| Roof area (horizontal projection): | $A_r$ = | 3,400 $ft^2$ |
| South wall area: | $A_s$ = | 2,664 $ft^2$ |
| NOTE : As includes windows and solar apertures. | | |
| Ceiling height: | h = | 9 ft |
| Nonsouth window fraction: | NSF = | 0.05 |
| Number of glazings in nonsouth windows: | $NGL_n$ = | 2 |
| Air changes per hour: | ACH = | 0.6 |
| Air density ratio (see figure 24): | ADR = | 1.0 |

**CALCULATED DESIGN PARAMETERS**

| | | |
|---|---|---|
| Nonsouth window area: | $A_n$ = [(P t Ž- )As]‘NSF | 175 $ft^2$ |
| Wall area: | $A_w$ = ( $p_t$ • h ) - $_c$A _ $A_n$ | 5,190 ft |

NOTE : $A_w$ is the total area of all external walls excluding windows and solar apertures.

**NET LOAD COEFFICIENTS**

| | | | |
|---|---|---|---|
| Walls: | | $LC_w$ = 24 $A_w$/RWALL = | 5,931 Btu/DD |
| Nonsouth windows: | | $LC_n$ = 26 $A_n$/$NGL_n$ = | 2,275 Btu/DD |
| Pick One | (Perimeter (slab on grade): | $LC_p$ = 100$P_g$ /(PREIM + 5) | 1,629 Btu/DD |
| | Basement (heated): | $LC_b$ = 256 $P_g$/(RBASE + 8) | Btu/DD |
| | (Floor (over vented crawl space): | $LC_f$ = 24 Ag/RFLOOR | Btu/DD |
| Roof : | | $LC_r$ = 24 Ar/RROOF | 2,550 Btu/DD |
| Infiltration: | | $LC_i$ = 0.432 (ACH Ž ADR Ž h Ž $A_f$) | 15,863 Btu/DD |
| TOTAL: | | NLC = $LC_w$ + $LC_n$ + ($LC_p$ or $LC_b$ or $LC_f$) + $LC_r$ + $LC_i$ | 28,248 Btu/DD |

WORKSHEET 3
System Parameters

THERMAL STORAGE

Effective heat capacity: $EHC/A_c$ = 53.93 Btu/°F-ft$^2$

(Direct gain or radiant heat panel only)

Diurnal heat capacity per ft$^2$ of aperture: $DHC/A_c$ = 56.96 Btu/°F-ft$^2$

FIRST SYSTEM

System type: Direct gain

System number: 6442

Scale factor: $F_1$ = 0.966

Effective aperture conductance (daily): $F_1$ = 4.42 Btu/°F-ft$^2$-day

Steady-state aperture conductance (hourly): $u_{cl}$ = 0.35 Btu/°F-ft$^2$-hr

System solar absorptance: al = 0.97

Collection aperture area: $A_{cl}$ = 791 ft$^2$

SECOND SYSTEM

System type: _____

System number: _____

Scale factor: $F_2$ = _____

Effective aperture conductance (daily): $G_2$ = _____ Btu/°F-ft2-day

Steady-state aperture conductance (hourly): $u_{c2}$ = _____ Btu/°F-ft2-hr

System solar absorptance: $a_2$ = _____

Collection aperture area: $A_{c2}$ = _____ ft$^2$

FIRST SYSTEM AREA FRACTION $f_1 = A_{cl}/(A_{cl} + A_{c2})$

SECOND SYSTEM AREA FRACTION $f_2 = A_{c2}/(A_{cl} + A_{c2})$

MIXED SYSTEM PARAMETERS

Scale factor; $F = (f_l Ž F_l) + (f_2 • F_2)$ = _____

Effective aperture conductance (daily): $G = (f_l • G_l) + (f_2 Ž G$ _____ Btu/°F-ft$^2$-day

Steady-state aperture conductance(hourly): $U_c = (f_1 Ž U_{cl}) + f_2 • U_{c2})$ = _____ Btu/°F-ft$^2$-hr

System solar absorptance: $a = (f_l • a_1) + (f_2 Ž a_2)$ = _____

Collection aperture area: $A_c = A_{cl} + A_{c2}$ = _____ ft$^2$

WORKSHEET 4
Base Temperature

CONSTANT THERMOSTAT SETTING

Thermostat setpoint: $T_{set}$ = _____

Base temperature:

$$T_b = T_{set} - \frac{Q_{int}}{[NLC + (24 \text{ [multiplied by] } U_c \text{ [multiplied by] } A_c)]}$$

$T_b$ = _____

NIGHT TIME SETBACK

Daytime setpoint: $T_1$ = 70

Duration of daytime setpoint: $hr_1$ = 17

Night time setpoint: $T_2$ = 60

Duration of night time setpoint: $hr_2$ = 7

Average setpoint: $T_{ave} = T_1(hr_1/24) + T_2(hr_2/24)$ $T_{ave}$ = 67.

Building time constant:

$$[tau] = \frac{24 \text{ DHC}}{[NLC + (24 \text{ [multiplied by] } U_c \text{ [multiplied by] } A_c)]}$$

[tau] = 30.

Effective thermostat setpoint:

$$T_e = T_1 - e^{\lfloor -0.1[tau]/24 \rfloor} (T_1 - T_{ave})$$

$T_e$ = 67.

Base temperature:

$$T_b = T_e - \frac{Q_{int}}{[NLC + (24 \text{ [multiplied by] } U_c \text{ [multiplied by] } A_c)]}$$

$T_b$ = 60

WORKSHEET 5
Weather Parameters

LOCATION STATE : VIRGINIA

CITY : NORFOLK

Annual heating degree days: $DD_a$ = 2,778

FIRST SYSTEM

Number of glazings: NGL = 2

Orientation: $\theta$ = 15 degrees

Tilt: $\varphi$ = 0 degrees

South-vertical radiation to degree day ratio: $(VTn/DD)_1$ = 27.60 Btu/ft$^2$-D

South-vertical city parameter: $a_0$ = 0.637

Coefficients for azimuthl/tilt convection:

Al = -0.1572 A2 = -0.4382 A3 = 0.3078 A4 = -0.0848 AS = -0,2437

B1 = 0,0885 B2 = -0.7389 B3 = 0.3319 B4 = 1.054 B5 = -1.159

Corrected city parameter:
(Use equation 5.16) al = 0,616

Corrected radiation to degree day ratio:
(Use equation 5.17) $(VTn/DD)_l$ = 27.51 Btu/ft$^2$-I

SECOND SYSTEM

Number of glazings: NGL = _____

Orientation: $\theta$ = _____ degrees

Tilt: $\varphi$ = _____ degrees

South-vertical radiation to degree day ratio: $(VTn/DD)_1$= _____ Btu/ft$^2$-I

South-vertical city parameter: $a_0$ = _____

Coefficients for azimuth/tilt convection:

A1 = _____ A2 = _____ A3 = _____ A4 = _____ A5= _____

B1 = _____ B2 = _____ B3 = _____ B4 = _____ B5 = _____

Corrected city parameter:
(Use equation 5.16) $a_l$ = _____

Corrected radiation to degree day ratio:
(Use equation 5.17) $(VTn/DD)_l$ = _____ Btu/ft$^2$-I

MIXED WEATHER PARAMETERS

Radiation degree day ratio:

$VTn/DD = f_l(VTn/DD)l + f_2(VTn/DD)_2$ = _____ Btu/ft$^2$-I

City parameter: $a = f_1a_1 + f_2a_2$ = _____

WORKSHEET 6
Estimation of Auxiliary Heat Consumption

SCALED SOLAR LOAD RATIO

$$SLR^* = \frac{F\ (VTn/DD)\ [alpha]}{NLC/A_{[c]} + G}$$

SLR* = 0.64

NOTE: All parameters in this expression are defined and recorded on Worksheets 2, 3, and 4.

ANNUAL HEAT-TO-LOAD-RATIO

$(Q_{[A]}/Q_{[L]})_{[a]}$ = 0.37

NOTE: The yearly heat-to-load ratio is obtained from the nomogram in figure 23. Using the value of SLR* calculated above and the city parameter a from Worksheet 5, one simply reads the heat-to-load ratio off the vertical axis of the nomogram.

ANNUAL AUXILIARY HEAT REQUIREMENT

$Q_{[A]} = (Q_{[A]}/Q_{[L]})_{[a]}$ (NLC + G [multiplied by] $A_{[c]}$) $DD_{[a]}$ $Q_{[A]}$ = 32.6 x 10

WORKSHEET 7
System Efficiencies During Reference Month

TOTAL SYSTEM EFFICIENCY

Total effective load coefficient:

$$TLC_{e} = NLC + G \text{ [multiplied by] } A_{c} = \underline{31{,}744} \text{ Btu/d}$$

Solar heating fraction:

$$SHF = 1 - e^{-SLR^{*}} = \underline{0.47}$$

Total efficiency:

$$e_{t} = \frac{TLC \text{ [multiplied by] } SHF + (24\ U_{c} - G)\ A_{c}}{\text{[alpha] } (VTn/DD)\ A_{c}} = \underline{0.86}$$

(NOTE: $e_{t} = e_{d}$ [multiplied by] $e_{u}$)

DELIVERY EFFICIENCY $e_{d} = \underline{1.0}$

UTILIZATION EFFICIENCY $e_{u} \quad \frac{e_{t}}{e_{d}} = \underline{0.86}$

WORKSHEET 8
Average Maximum Temperature During Reference Month

Delivered solar energy:

$Q_{D}$ = [alpha] [multiplied by] $A_{c}$ [multiplied by] $e_{d}$ [multiplied by] $\frac{VTn}{DD}$ [multiplied by] DD = $\underline{12.1 \times 10^{6}}$ $\frac{Bt}{mon}$

Excess solar energy: $Q_{E}$ = (1 - $e_{u}$) $Q_{D}$ = $\underline{1.69 \times 10^{6}}$ $\frac{Bt}{mon}$

Average temperature with ventilation (for night setback $T_{set}$ = $T_{e}$):

$\bar{T}$ = $T_{set}$ + [10 [multiplied by] SHF (1 - $e_{u}$) $^{0.2}$] = 70.7

Temperature increment without ventilation:

$$[W\text{-}DELTA]T_{I} = \frac{Q_{E}}{NDAY \text{ [multiplied by] } DHC} = \underline{1.3} \text{ d}$$

Average maximum temperature without ventilation: $\bar{T}_{max}$ = $\bar{T}$ + $[W\text{-}DELTA]T_{I}$ = 72.0 d

WORKSHEET 9
Annual Delivered Solar Energy

FIRST SYSTEM

Transmitted solar radiation: $(QTAn)_{o}$ = 232,584 Btu/ft$^2$-yr

Coefficients for azimuth/tilt correction:

C1 = 0.046 C2 = -0.2934 C3 = -0.3243 C4 = 1.6957 C5 = -1.1985

Corrected transmitted solar radiation: $(QTAn)_{1}$ = 231,210 Btu/ft$^2$-yr
(Use equation 5.20)

SECOND SYSTEM

Transmitted solar radiation: $(QTAn)_{o}$ = _____ Btu/ft$^2$-yr

Coefficients for azimuth/tilt correction:

C1 = _____ C2 = _____ C3 = _____ C4 = _____ C5 = _____

Corrected transmitted solar radiation: $(QTAn)_{2}$ = _____ Btu/ft$^2$-yr
(Use equation 5.20)

ANNUAL DELIVERED SOLAR ENERGY

$(Q_{D})_{a}$ = [alpha] [multiplied by] $A_{c}$ [multiplied by] $e_{d}$ [multiplied by]
$[f_{1}\ (QTAn)_{1} + f_{2}(QTAn)_{2}]$ = 177.4 x 10$^6$ Btu/yr

WORKSHEET 10
Annual Incremental Cooling Load

ANNUAL HEAT TO LOAD RATIO

(Use Worksheets 4, 5, and 6 with $T_{set} = T_{max} - 10$)

$$\left[\frac{Q_A}{Q_L}\right]_a = \underline{0.37}$$

ANNUAL AUXILIARY HEAT REQUIRED

(From Worksheet 6 with $T_{set} = T_{max} - 10$)

$$Q_A = \underline{32.6 \times 10}$$

ANNUAL SOLAR HEATING FRACTION

$$SHF_a = 1 - \left[\frac{Q_A}{Q_L}\right]_a = \underline{0.63}$$

ANNUAL UTILIZATION EFFICIENCY

$(e_u)_a =$

$$\frac{[TLC_e \text{ [multiplied by] } SHF_a + (24\ U_c - G)\ A_c] \text{ [multiplied by] } DD_a}{(Q_D)_a} = \underline{0.}$$

Note: Use: $TLC_e$ from Worksheet 7

$U_c$, G, and $A_c$ from Worksheet 3

$DD_a$ from Worksheet 5

$(Q_D)_a$ from Worksheet 9

ACTUAL INDOOR TEMPERATURE (ANNUAL AVERAGE)

(Use: $T_{set} = T_{max} - 10$)

$$T_{act} = T_{set} + 10\ SHF_a \text{ [multiplied by] } (1 - e_u)^{0.2} = \underline{75.8}\ d$$

ACTUAL ANNUAL DEGREE DAYS

(Use Worksheet No. 4 with $T_{set} = T_{act}$ to determine $T_b$)

$$DD_{act} = \underline{3,827}\ d$$

ACTUAL ANNUAL HEAT LOAD

$$Q_{act} = (NLC + 24\ U_c \text{ [multiplied by] } A_c) \text{ [multiplied by] } DD_{act} = \underline{133.5 \times 1}$$

INCREMENTAL COOLING LOAD

$$Q_1 = Q_D + Q_A - Q_{act} = \underline{76.5 \times 10}$$

Custodians:

Army - CE
Navy - YD
Air Force - 04

Preparing Activity:

Navy - YD

(Project FACR-0166)