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IMPACT OF PERIMETER INSULATION ON HEAT FLOW THROUGH SLABS IN RESIDENTIAL BUILDINGS

Prepared for the California Energy Commission

by

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ABSTRACT

The "F2 factors" method for calculating heat flow through slab-on-grade is currently required in the demonstration of residential energy code compliance in California. In this study we confirm that this method overestimates slab-on-grade heat gain and calculates significantly higher cooling loads than in reality. The "F2 factors" method of calculation (Standard Method) was simulated with an unmodified version of DOE-2.1E. The results were compared to those obtained with a more accurate method incorporated in a modified version of DOE-2.1E (called the Simplified Method because it is a simplification, using regression analysis, of a "detailed" two-dimensional finite-difference calculation of slab heat transfer).

The differences in the DOE-2 simulation results between the Standard and Simplified Methods can be *clearly* explained by the differences in modeling techniques between the two Methods. In cooling, the results from the more accurate Simplified Method are consistently lower than those from "F2 factors;" the differences are inversely proportional to the amount of slab perimeter insulation.

This report documents the differences in calculation between the two methods. It also reports and discusses the results of simulation for a one-story house with a relatively large footprint in all California Climate Zones, and those for a two-story house (with a much smaller footprint) in Fresno (Climate Zone 13). The subject houses used in all DOE-2 simulation are typical of residential construction in California and closely match test houses that are used by the California Energy Commission staff in their studies.

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1. INTRODUCTION

The demonstration of compliance with residential energy code in California currently requires the calculation of heat flow through slab-on-grade using "F2" factors for slab perimeter. These factors represent U-values for construction at slab perimeter and vary with the amount of insulation and type of cover on top of the slab.

This method may overestimate heat gain through the slab edge and may result in significantly higher cooling loads than in reality. Indeed, California Energy Commission staff and members of the industry have repeatedly expressed such concerns. To lay this issue to rest, this report compares the results from calculations using the currently prescribed method with those using a more sophisticated method of calculation, both applied to the same subject buildings.

Heat flow through building foundations represents one of the more complicated aspects of building thermal simulation due to the large thermal mass, slow response, and multi-directional heat flow paths in the subsoil below the foundation. Simulating accurately such heat flow requires the use of two- or three-dimensional finite-element or finite-difference programs that model not only the foundation but also a large area of soil that extends down and away from the building.

The Simplified Method used in this study is "simplified" only relative to a full-scale finite-element or finite-difference method. It is based on 2DFD, a two-dimensional finite-difference model originally developed at the University of Minnesota Underground Space Center. The Simplified Method was developed as an extension to DOE-2.1E and verified using a "detailed" method [Bazjanac, Huang and Winkelmann 2000]; the Detailed Method was previously used to generate a library of "benchmark" hourly foundation heat flow files. Because of that, the calculation of heat flow through a slab is considerably more representative of heat flow in reality than the calculation currently prescribed for use in the demonstration of compliance with the residential energy code. All results reported here were obtained from simulation with DOE-2.

The prescribed computer program for use in residential energy code compliance in California is CALRES. That program requires less detailed building description as input than DOE-2, and also employs a different simulation concept. To avoid "comparison of apples and oranges" in this study, the calculation method currently prescribed for compliance—which involves F2 factors that represent the slab conductance and assumes that slab heat transfer occurs only from the perimeter region of the slab to the outside air—is simulated with an unmodified version of DOE-2 [York et al. 1984]. We call this the "Standard Method." In this method slab heat transfer is modeled with fictitious exterior walls that have an area and conductance consistent with the appropriate F2 factors for different perimeter insulation values. All subject buildings are described using appropriate values defined in the 1998 Residential ACM Manual [CEC 1998].

The building industry appears to resist changes in building modeling techniques if these changes adversely affect their ability to trade off some of the energy efficiency measures, allowing them to construct buildings in the way they prefer. To accept change, members of the industry must be convinced of the value of the change and must be able to clearly see and evaluate the effects of proposed change on their work. With this in mind, the two subject houses used in this study very closely resemble buildings that have been used in prior demonstrations—buildings that have been used as samples or as test cases.

The one-story house is the main subject of this study. Its performance is simulated with both the Simplified and the Standard Methods in all 16 California Climate zones, with construction types adjusted per energy code requirements for each climate zone. The conditioned area of this house is entirely slab-on-grade, which assures the greatest possible effect of heat flow through the slab on the overall energy consumption in the house. All building internal loads and schedules of operation are as defined by the energy code.

The two-story house is used to study the effects of a smaller building footprint on a house with a comparable conditioned floor area. The performance of this house is simulated only in Climate Zone 13 (Fresno); the construction type in the building description is that prescribed for that climate zone. All internal loads and schedules are the same as for the one-story house.

The first two sections (Sections *2. ONE-STORY HOUSE* and *3. TWO-STORY HOUSE*) describe in detail the two subject houses used in the study. This is followed by a description of the Simplified and

Standard Methods, including a description of all appropriate algorithms (Section *4. SIMULATION WITH DOE-2.1E*). This section also describes the methodology used in the simulation of the operation of roller shades. The last section (Section *5. DISCUSSION OF RESULTS*) provides an analysis of results of this study. The report concludes with four appendices that contain the listings of DOE-2 input files for the one- and two-story houses for the Simplified and the Standard Method.

2. ONE-STORY HOUSE

The California Energy Commission selected the "1809" house in Sacramento as the subject house in the comparison of performance in the calculation of heat flow through slabs on grade between the Standard Method and the Simplified Method of calculation. (These methods are described in Sections 4.2 and 4.3.) The "1809" house is based on a sample house provided to the Commission by ConSol and has 1,809 ft^2 of conditioned space. Since no DOE-2 description of the house was available, we defined a one-story house that approximates the "1809" house in floor size, exterior wall area, window area, and building and wall orientation.

2.1 The "CEC" House

The available documentation for the "1809" house consisted of its MICROPAS input definition. No drawings were available. The MICROPAS input provides (among other information) data on the conditioned floor area, areas and construction types for all walls that constitute the boundary of the conditioned area, areas and glass types for all windows, areas and U-values for all pertinent doors, overhang and fin location and sizes, and the definition of interior shading of windows. Table 1 shows the pertinent data for the "1809" house that was extracted from its MICROPAS definition. The "CEC" house in the table is the "1809" house as defined in DOE-2.

Table 1 – Comparison of critical area sizes in the "DOE-2" house and the "CEC" house

	"DOE-2" House	*"CEC" House*
Net conditioned area	1,809 ft^2	1,809 ft^2
Net unconditioned area	424 ft^2	
Total net area	2,233 ft^2	
Exterior wall area:	1,229 ft^2	1,180 ft^2
North-facing	368 ft^2	382 ft^2
East-facing	334 ft^2	307 ft^2
South-facing	195 ft^2	179 ft^2
West-facing	332 ft^2	312 ft^2
Window area:	371.52 ft^2	360.40 ft^2
North-facing	104.70 ft^2	108.50 ft^2
East-facing	54.25 ft^2	50.00 ft^2
South-facing	104.86 ft^2	100.90 ft^2
West-facing	107.71 ft^2	101.00 ft^2
Window-to-exterior wall surface ratio:	.302	.305
North-facing	.284	.284
East-facing	.162	.163
South-facing	.538	.564
West-facing	.324	.324
Window-to-conditioned floor area ratio	.205	.199

Several input topics, such as the different types of schedule and thermostat settings, are "hidden" from the MICROPAS input. Since they are defined in the residential energy code they are contained inside MICROPAS and are applied automatically when the simulation is executed.

2.2 The "DOE-2" House

An existing house in Sacramento is the basis for the definition of the "DOE-2" house. It is a one-story private house that was modeled with DOE-2 for another study [Huang and Warner 1996]. Like the "CEC" house, the private house has a garage attached to the front of the house and an attic over the entire building. The front of the house faces due south.

The DOE-2 description of this house is modified to match the size and characteristics of the "CEC" house as much as possible. The critical measures needed to achieve this match are described below.

2.2.1 Adjustment in Size

The private house has 1,584 ft^2 of conditioned space and a 424-ft^2 garage. The conditioned space in the "DOE-2" house is enlarged from 1,584 ft^2 to 1,809 ft^2 to match exactly the "CEC" house. The attic is also enlarged from 1,584 ft^2 to 1,809 ft^2. The orientation and the basic building and layout of the private house are preserved.

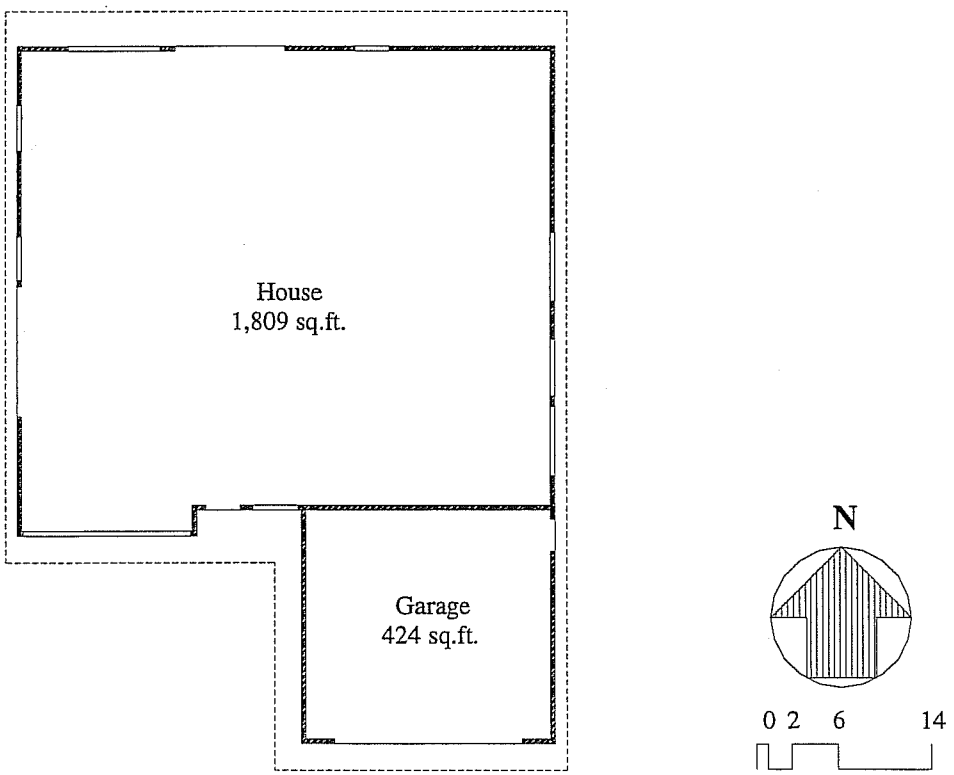
The small north-west facing wall in the private house is absorbed into the north- and west-facing walls. Its window is added to the west-facing wall.

2.2.2 Windows

The total window area in the private house is considerably smaller than that in the "CEC" house. The window-to-conditioned-floor-area is 0.20 in both the "CEC" and "DOE-2" houses, which exceeds the ratio defined in the prescriptive standard. To preserve the similarity in characteristics between the two houses, the window-to-external-wall-area ratios of the private house are adjusted in the "DOE-2" house to match as much as possible the corresponding ratios for the "CEC" house (Table 1). This is accomplished by determining the window-to-external-wall-area ratio of the "CEC" house and increasing the window area per respective orientation in the "DOE-2" to match the same ratio.

The window-to-conditioned-floor-area ratio is slightly higher in the "DOE-2" house because its exterior wall area is slightly larger than in the "CEC" house. Figure 1 shows the floor plan of the "DOE-2" house.

Figure 1 – Floor plan of the "DOE-2" house



2.2.3 Other Assumptions and Definitions

The exterior surface of all walls that form the exterior boundary of the conditioned space are defined as 5/8"-thick stucco. All wall constructions are as defined for the "CEC" house; wall insulation changes to match code requirements for each California climate zone. Exterior wall R-values are R-13 in Climate Zones 2-10 and R-19 in Climate Zones 1 and 11-16. The interior wall between the conditioned space and the garage is an R-13 wall in Climate Zones 2-10 and R-19 in Climate Zones 1 and 11-16.

Roof insulation also changes to match code requirements for each climate zone. It is R-30 in Climate Zones 2-10 and R-38 in Climate Zones 1 and 11-16. Because the ceiling of all conditioned space is also the floor of the attic, the roof insulation is applied instead to the ceiling construction. The roof construction itself is not insulated. Overhangs are the same as in the private house.

Internal loads are all defined as DOE-2 "source" loads. They vary from climate zone to climate zone per specifications defined in the 1998 Residential ACM Manual [CEC 1998].

As required by the 1998 Residential ACM Manual [CEC 1998], 80% of the conditioned floor area (i.e., slab on grade) is carpeted and 20% is uncarpeted. The garage is not conditioned and its floor is uncarpeted.

The house is naturally ventilated. When conditions allow natural ventilation, the house is ventilated at an assumed rate of 10 air-changes per hour. Natural ventilation stops when air-conditioning is operating. Since roller shades are extended only when air-conditioning is operating (see Section *4.1, Operation of Roller shades*), roller shades do not affect natural ventilation in this study.

The HVAC system consists of an air-conditioner and a gas-fired furnace, as observed in and modeled for the private house. It is adjusted to meet the pertinent requirements defined by the 1998 Residential ACM Manual [CEC 1998].

3. TWO-STORY HOUSE

One-story houses have a larger slab-area to house-volume *ratio* than multi-story houses of similar total floor area and volume. (For example, an eight-ft. high one-story house with a 20 ft. square footprint has a 400 ft^2 slab and a volume of 3,600 ft^3 with a slab-area to house volume ratio of 1:9 or 0.111; a two-story house with the same footprint has a volume of 7,200 ft^3 and the corresponding ratio of 1:18 or 0.055 – the former ratio is larger than the latter.) Because of the smaller slab area, the impact of slab foundation heat flow on the overall annual energy consumption may be smaller in multi-story houses. A typical two-story house provides an appropriate subject to study the impact of the Simplified Method on slab foundation heat flow in houses that have a smaller footprint (i.e., a smaller slab-area to house-volume ratio).
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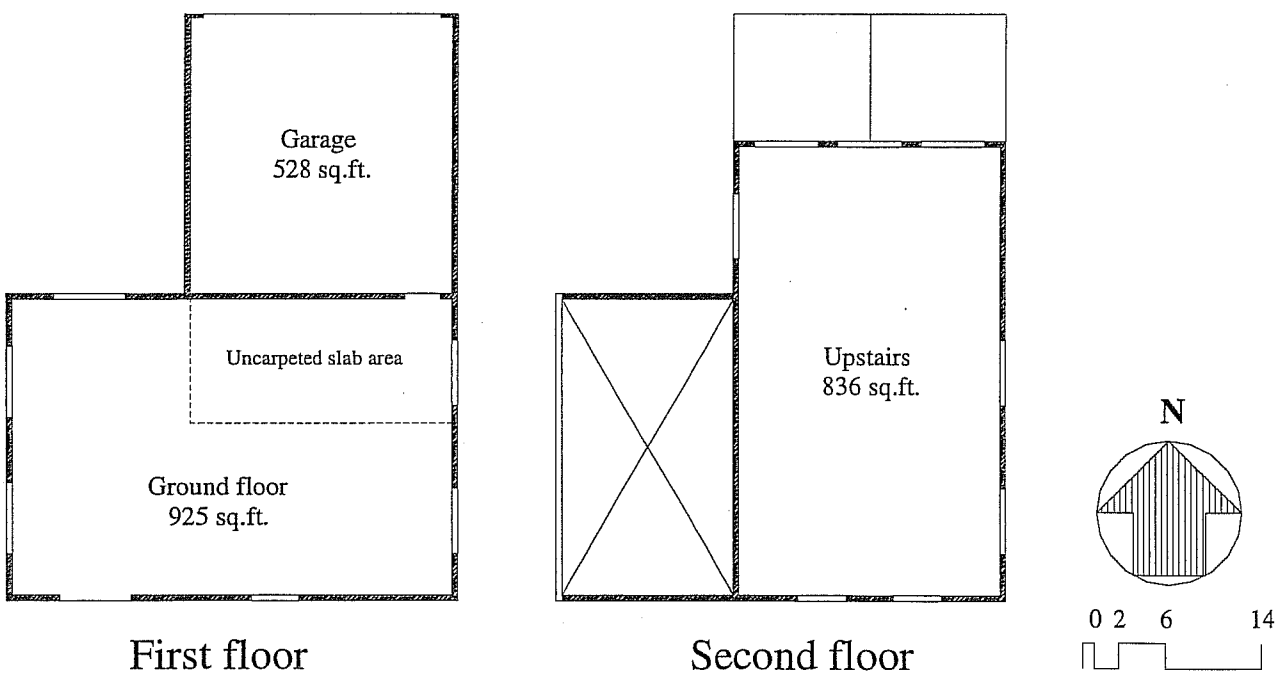
3.1 Description of the Two-Story House

The Energy Commission staff provided the description of the two-story house. The geometry of the house is well defined (Figure 2). The net conditioned area is 1,761 ft^2, which makes it only 48 ft^2 smaller than the one-story house.

Figure 2 – Floor plan of the two-story house



The window to floor-area ratio is the same in both houses: 20%. The distribution of windows is equal for all orientations: Each side if the house has the same glazing area. The total window area is 352.00 ft^2, compared to 371.52 ft^2 in the one-story house. The total exterior wall area is 1,949 ft^2, which is 63% more than the 1,229 ft^2 of exterior walls in the one-story-house (Table 2).

The living room portion on the ground floor of the house is a two-story space with a sloped ceiling and a shared interior wall with the quarters upstairs. The two-story house has the same construction and materials as the one-story. A portion of the upper level's floor (275 ft^2) is directly over the garage (a space that is not conditioned). That part of the floor has the same construction as the ceiling above the conditioned space in the one-story house that is directly below the unconditioned attic. The amount of insulation varies by climate zone the same way it varies in exterior walls (see Section *2.2.3 Other Assumptions and Definitions).*

3.2 Differences Relative to the One-story House

The slab-area to conditioned-area ratio will usually be smaller in multi-story than in one-story buildings. The reason is obvious: Any condition space on an upper floor cannot have a slab-on grade. If a two-story house has a two-story-high conditioned space, that space is defined as part of the lower floor. The ratio in the two-story house is 0.525; it is 1.00 in the one-story house.

Table 2 – Comparison of critical area sizes in the one- and two-story houses

	One-story House	*Two-story House*
Net conditioned area	1,809 ft^2	1,761 ft^2
Net unconditioned area	424 ft^2	528 ft^2
Total net area	2,233 ft^2	2,289 ft^2
Exterior wall area:	1,229 ft^2	1,949 ft^2
North-facing	368 ft^2	413 ft^2
East-facing	334 ft^2	504 ft^2
South-facing	195 ft^2	528 ft^2
West-facing	332 ft^2	504 ft^2
Window area:	371.52 ft^2	352.00 ft^2
North-facing	104.70 ft^2	88.00 ft^2
East-facing	54.25 ft^2	88.00 ft^2
South-facing	104.86 ft^2	88.00 ft^2
West-facing	107.71 ft^2	88.00 ft^2
Window-to-exterior wall surface ratio:	.302	.181
North-facing	.284	.213
East-facing	.162	.175
South-facing	.538	.167
West-facing	.324	.175
Window-to-conditioned floor area ratio	.205	.200

The two-story house has no attic. Most of the roof is situated directly above conditioned space; only a small part is over the garage. Unlike the one-story house, this building has no eaves or overhangs, and windows are not shaded from the outside at any time.

The floor plan shows a well-defined area (231 ft^2) that has no carpet on top of the slab. This constitutes 25% of the total slab area under conditioned space, which is more of the slab surface share than the 20% of uncarpeted slab in the one-story house. The total uncarpeted slab edge is only 11.5% of the total slab perimeter, compared to 20% in the one-story building.

Internal loads are defined per unit area of conditioned space, as in the one-story house. Because the floor of the two-story house is slightly smaller, its internal load is also slightly smaller. Since the kitchen is downstairs, two thirds of the internal load is assigned to the conditioned part of the ground floor. The remaining third is assigned to the second floor. HVAC equipment and system are the same as in the one-story house.

4. SIMULATION WITH DOE-2.1E

4.1 Operation of Roller Shades

Roller shades are fully extended (i.e., they actually cover the window) in the MICROPAS simulation of the "CEC" house only when air-conditioning is in operation. When air-conditioning is *not* operating, roller shades are *completely* retracted. This is as required by the code [CEC 1998].

A special two-run approach is used to match this behavior with DOE-2. First, a complete annual run with no roller shades in place at any time records which hours the air-conditioning is on. This information is then used in the second LOADS run to modify the window shading schedule: Roller shades are extended for all hours for which air-conditioning would be triggered without the roller shades in place. The second SYSTEMS run then properly calculates energy consumption with roller shades in place when needed. This may not perfectly match the modeling of roller shades as described in the Residential ACM Manual [CEC 1998], but is expected to be close enough to capture the differential energy use of slab edge modeling alternatives that is the subject of this study.

4.1.1 Glass and Shading

All glazing in the "DOE-2" house is the same as in the "CEC" house: Double-pane clear 1/8" glass with a ¼" air-gap. The window Shading Coefficient (SC) is 0.88; solar transmissivity is 0.705, and the Solar Heat Gain Coefficient (SHGC) is 0.760.

Solar gain through the window is always reduced by a shading factor of 0.968. This is necessary because of the effect of bug screens that are an always-present part of each window. When roller shades are extended the aggregate window shading factor is 0.595. This shading factor value also accounts for the presence of the bug screen. Both values are obtained from Equation 4.2 and from Tables 4-4 and 4-5 in Chapter 4 of the Residential ACM Manual [CEC 1998] which define solar heat gain coefficients for roller shades and bug screens as 0.47 and 0.76, respectively.

4.2 Standard Method

The regular version of DOE-2.1E (version 095) employs a model of the slab-on-grade that uses the concept of the "effective" U-value for slab construction that is applied to the slab surface area, multiplied by the differential between the zone and ground temperatures. The Standard Method instead considers the conductance of slab perimeter and the length of the wall that is exposed to outside air, and the differential between outside air and inside zone temperatures.

4.2.1 Definition of the Slab

In the Standard Method the heat transfer through a slab-on-grade (in Btu/hr) is defined as

```
Q = F2*(PERIM-EXPOSED)*(TOUTR - TZONER)          (1)
```

where F2 is the conductance per foot along the perimeter of the slab (in Btu/hr-ft-°F), PERIM-EXPOSED is the length of the slab perimeter that is exposed to outside air (in feet), TOUTR is the outside air temperature (in °R), and TZONER is the temperature of the zone that contains the slab (in °R) as calculated by the LOADS module.

The slab heat transfer in the regular version of DOE-2.1E (version 095) is calculated using

```
Q = (U-EFFECTIVE)*AREA*(TGNDR - TZONER)          (2)
```

where the input keyword U-EFFECTIVE is the effective U-value of the slab (in Btu/hr-ft^2-°F), AREA is the slab surface area (in ft^2), TZONER is the LOADS-calculated temperature of the zone containing the slab (in °R), and TGNDR is the ground temperature obtained from the weather file (in °R).

Since Eq. (1) uses ground temperature and Eq. (2) uses outside air temperature, the following approach is used to model Eq. (1) in DOE-2.1E for thermal zone HOUSE (see the listing of the DOE-2 input file for the Standard Method in Appendix A):

1. U-EFFECTIVE is set to zero.[1]
2. A resistance layer with an R-value of 1000 is added on the outside of the slab/ground layers.
3. Seven one-foot high vertical exterior walls are defined positioned along the perimeter of the building, each with a U-value equal to F2 in Eq. (1). The sum of the lengths of these walls equals the exposed perimeter length of the slab under the conditioned part of the building. Exterior walls are chosen because the heat transfer across exterior walls in DOE-2 is between outside air and zone air, as required by Eq. (1). The next section describes how the values of F2 are chosen.

Even though U-EFFECTIVE = 0 is used to turn off the normally-calculated heat transfer through the slab, it is still important to properly define the construction of the slab. This is because the weighting factors used in DOE-2 to determine zone heating and cooling loads from heat gains depend critically on the zone surfaces' heat capacity and conductance, which in turn depend on the layer-by-layer construction of the surfaces. The slab is particularly important to the weighting factors because it has a high heat capacity. In addition to the carpet and 4" concrete slab, the slab layer also includes 1 ft. of soil to account for the thermal capacitance of the ground, plus a resistance layer with a R-value of 1000 so that the slab behaves as an adiabatic surface in the weighting factor calculation.

Eighty percent of the slab in thermal zone HOUSE is carpeted, so for this zone two slabs are defined, one with a carpeted construction (1,447 ft^2) and one with an uncarpeted construction (362 ft^2). The uncarpeted construction consists of one foot of damp soil and four inches of heavy, construction-grade concrete. The carpeted construction adds a layer with a resistance of 2.08 h-ft^2-°F/Btu, representing a carpet with pad. Sensitivity analysis in previous work indicated that a 1-ft soil layer accounts for most of the active thermal mass of the soil beneath the slab.

A similar approach is used to model the slab under thermal zone GARAGE (see the listing of the DOE-2 input file for the Standard Method in Appendix A). Assumed to be uncarpeted, it has the same uncarpeted slab construction as thermal zone HOUSE.

4.2.2 The Selection of F2 Factors

F2 factors for the slab simulation with the Standard Method are as defined and applied in CALRES (version 1.35) for 16-inch insulation depth. (The source table was supplied by the California Energy Commission staff.) Slab F2 perimeter values for carpeted slab for R-0 (no insulation), R-5 and R-10 slab insulation are 0.72, 0.53 and 0.50 Btu/hr-ft-°F, respectively. For uncarpeted slab these values are 0.90, 0.58 and 0.53 Btu/hr-ft-°F, respectively. Eighty percent of the slab perimeter is assumed to be carpeted and 20% uncarpeted. To achieve this, all slab perimeter area under the south-facing entry wall is assumed not to be carpeted, as well as part of the slab perimeter under the east-facing wall. The rest of the slab perimeter is carpeted.

4.3 Simplified method

The Simplified Method divides the foundation into two regions. One is the perimeter region, which is coupled to the *previous two-weeks'* average outside air temperature, *monthly* ground temperature, and *annual* average air temperature. The other is the core region, which is coupled to the *monthly* ground temperature and *annual* average air temperature. For each foundation construction type, the Simplified Method provides a set of five *foundation conductances* that are derived from multi-linear regressions of daily heat flow [Bazjanac, Huang and Winkelmann 2000].

4.3.1 Slab Perimeter and Core

In the Simplified Method the heat transfer through a slab-on-grade (in Btu/hr) is given by

```
Q = PerimArea*[(PERIM-COND-WEEK)*(TAVWKR - TZONER) +
               (PERIM-COND-MONTH)*(TGNDR - TZONER) +
              (PERIM-COND-YEAR)*(TGDEEPR - TZONER)] +
```

[1] Since a value of 0.0 is not allowed in the DOE-2 input, a small value (0.0001) is used instead.

```
CoreArea*[(CORE-COND-MONTH)*(TGNDR - TZONER) +
          (CORE-COND-YEAR)*(TGDEEPR - TZONER)]        (3)
```

where

1. Q is the heat transfer from ground to room (Btu/hr).
2. PerimArea is the area of the perimeter region (ft^2). For slab-on-grade, PerimArea = (PERIM-EXPOSED)*PerimDepth, where PERIM-EXPOSED, an input value, is the length of the exposed perimeter (ft) and PerimDepth is the perimeter depth, equal to two feet.
3. PERIM-COND-WEEK, an input value, is the conductance of the perimeter region associated with heat transfer from outside air to zone air (Btu/hr-ft^2-°F).
4. PERIM-COND-MONTH, an input value, is the conductance of the perimeter region associated with heat transfer from shallow ground to zone air (Btu/hr-ft^2-°F).
5. PERIM-COND-YEAR, an input value, is the conductance of the perimeter region associated with heat transfer from deep ground to zone air (Btu/hr-ft^2-°F).
6. CoreArea is the area of the core region (ft^2). For slab-on-grade it is equal to total surface area minus PerimArea.
7. CORE-COND-MONTH, an input value, is the conductance of the core region associated with heat transfer from shallow ground to zone air (Btu/hr-ft^2-°F).
8. CORE-COND-YEAR, an input value, is the conductance of the core region associated with heat transfer from deep ground to zone air (Btu/hr-ft^2-°F).
9. TZONER is the zone's LOADS calculation temperature (°R).
10. TAVWKR is the previous week's average outside air temperature (°R).
11. TGNDR is the shallow-ground temperature, equal to the monthly average outside air temperature damped and delayed by three months (°R).
12. TGDEEPR is the deep ground temperature, equal to the annual average outside air temperature (°R).

As in the Standard Method, two slabs are defined for thermal zone HOUSE, one carpeted and one uncarpeted, with the same areas and constructions as those in the Standard Method (see the listing of the DOE-2 input file for the Simplified Method in Appendix B). Assuming that 80% of the slab perimeter is carpeted and 20% is not results in PERIM-EXPOSED values of 121.74 ft and 30.44 ft, respectively, for the carpeted and uncarpeted slabs.

4.3.2 Slab Insulation Levels

Insulation levels in the definition of carpeted and uncarpeted slabs in thermal zones HOUSE and GARAGE are reflected in the values of the conductances in Eq. (3). The values are obtained from Table 4 in the report that defines the Simplified Method of calculation [Bazjanac, Huang and Winkelmann 2000] for different of insulation depths and R-values. The correspondence between the variables in Eq. (3) and the column headings in that table is shown in Table 3.

Table 3 – Correspondence between DOE-2 variable names and table headings

DOE-2 Variable Name	*Variable Name in Table 4 [Bazjanac et al. 2000]*
PERIM-COND-WEEK	SPCW
PERIM-COND-MONTH	SPCM
PERIM-COND-YEAR	SPCY
CORE-COND-MONTH	SCCM
CORE-COND-YEAR	SCCY

5. DISCUSSION OF RESULTS

5.1 One-story House

The fundamental difference between the Standard Method and the Simplified Method is that the Standard Method models foundation heat flow to be between the thermal zone and the outside air, while the Simplified Method models a combination of foundation heat flows to three ground temperatures. The three ground temperatures are (1) a near-surface temperature equal to the previous two-weeks' average air temperature, (2) a monthly ground temperature at moderate depth (five feet below surface) that is dampened and delayed by three months relative to air temperatures, and (3) a constant deep ground temperature (10 ft. or more below surface) that is equivalent to the annual average air temperature.

The differences in the DOE-2 results between the Standard and Simplified Methods, as shown in Tables 3 and 4, can be explained by these differences in modeling techniques. In cooling, the Simplified Method results are in general 10-20% lower for the uninsulated slab, 5-10% lower for the slab with R-5 insulation, and 3-8% lower for the slab with R-10 insulation in all climates with significant cooling loads. The reasons for this reduction are: (a) the elimination of the transient hourly peak air temperatures, (b) the shifting of the peak medium depth ground temperatures from the summer to the late fall or early winter, and (c) the function of the constant deep ground temperature as a thermal sink in any climate where the annual air temperatures are significantly below the cooling thermostat setting. Conversely, the absence of a thermal sink in Climate Zone 15 (El Centro) results in Simplified Method results in cooling that are within 5% of the Standard Method.

In heating, the same three effects are present, but their impacts on the house heating energy use are different. In climates where the winter temperatures are below the heating set point all day, the first modeling difference (the elimination of the hourly minima) has very little impact on total heating. The second difference (dampening and time shift of minimum ground temperatures to the late spring) can reduce heating loads if they are shifted to times when heating is not needed. The third modeling difference (constant deep ground temperature) creates a steady heat drain from the foundation in climates where the annual air temperature is significantly below the heating set point. This is true for northern California, less so for southern California, and has no effect for hot inland climates, notably Climate Zone 15. Tables 3 and 4 show that the heating energy use computed using the Simplified Method is significantly larger than using the Standard Method for northern coastal climates (15-30% for uninsulated, 12-22% for insulated slabs), somewhat larger in southern coastal climates (6-17% for uninsulated, 3-12% for insulated slabs), and similar or slightly smaller in the Central Valley and desert climates (-3% to 6%). The largest relative increase in heating loads are in cool coastal climates such as Climate Zones 1 (Arcata, +27%), 3 (Oakland, +20%), and 5 (Santa Maria, +26%), while the largest relative decrease is in Climate Zone 15 (El Centro, -26%). They are all consistent with the known differences in modeling methodology.

Table 4 compares the annual site cooling and heating energy use calculated with the Simplified Method and with the Standard Method for different slab insulation levels and climate zones. The cooling energy shown is the electricity consumption of the air-conditioner. The heating energy is the natural gas use by the furnace[2]. Table 5 shows the difference in cooling and heating energy, expressed in percentage, as calculated by the Standard Method and the Simplified Method.

Table 4 shows that with the Simplified Method[3] increasing slab insulation increases cooling and decreases heating energy consumption. This is because insulation reduces the effect of thermal mass in the Simplified Method. With the Standard Method increasing slab insulation decreases both cooling and heating. With this method, which uses quick exterior walls with heat transfer to the outside air to represent slab heat transfer, the delay caused by thermal mass does not take place.

In comparison to the Standard Method, using the Simplified Method has a significant effect on cooling and almost double the effect on heating. With increased insulation cooling is higher with the Simplified Method and lower with the Standard Method. The latter case is, again, because the Standard Method's slab performance is more tied to the outside air temperature. Both methods show decreased

[2] By DOE-2 definition, fan energy is not included in the reported cooling or heating energy. It is typically less than 5% of the combined cooling and heating energy.

[3] With one exception: R-5 insulation in Climate Zone 15.

heating with increased insulation, but the rate of change for the Simplified Method for some climate zones is almost double that for the Standard Method.

Table 4 – Comparison of annual cooling and heating energy consumption calculated Using the Standard and Simplified Methods

Simulation parameters		*Standard method*		*Simplified method*	
Slab insulation	*California climate zone*	*Cooling (kWh)*	*Heating (MBtu)*	*Cooling (kWh)*	*Heating (MBtu)*
R-0	cz01	193	18.591	168	23.740
R-5	cz01	192	17.106	183	21.094
R-10	cz01	192	16.840	183	20.392
R-0	cz02	2039	16.715	1745	19.940
R-5	cz02	2003	15.482	1814	17.868
R-10	cz02	1998	15.266	1835	17.353
R-0	cz03	570	11.558	474	13.965
R-5	cz03	568	10.499	518	12.313
R-10	cz03	566	10.330	539	11.872
R-0	cz04	1701	11.167	1375	12.931
R-5	cz04	1673	10.210	1485	11.459
R-10	cz04	1673	10.043	1508	11.082
R-0	cz05	808	8.928	627	11.226
R-5	cz05	795	7.979	710	9.783
R-10	cz05	795	7.811	731	9.416
R-0	cz06	786	3.058	665	3.590
R-5	cz06	772	2.663	699	3.002
R-10	cz06	769	2.600	729	2.867
R-0	cz07	1124	2.273	944	2.827
R-5	cz07	1102	1.960	1017	2.372
R-10	cz07	1101	1.910	1039	2.263
R-0	cz08	2100	3.709	1879	3.959
R-5	cz08	2062	3.280	1959	3.377
R-10	cz08	2055	3.181	1986	3.257
R-0	cz09	2853	3.493	2533	4.063
R-5	cz09	2810	3.065	2639	3.518
R-10	cz09	2804	2.995	2675	3.398
R-0	cz10	3499	5.406	3135	5.711
R-5	cz10	3444	4.824	3242	4.969
R-10	cz10	3433	4.734	3268	4.794
R-0	cz11	3340	22.498	2996	22.808
R-5	cz11	3287	21.048	3059	20.888
R-10	cz11	3277	20.803	3082	20.440
R-0	cz12	2884	18.129	2565	19.262
R-5	cz12	2845	16.811	2643	17.408
R-10	cz12	2838	16.577	2674	16.943
R-0	cz13	4496	12.813	4074	12.431
R-5	cz13	4426	11.836	4134	11.049
R-10	cz13	4413	11.675	4152	10.714
R-0	cz14	3719	16.082	3302	16.416
R-5	cz14	3651	14.864	3347	14.663
R-10	cz14	3638	14.641	3362	14.239
R-0	cz15	7602	2.567	7242	1.779
R-5	cz15	7464	2.231	7231	1.530
R-10	cz15	7441	2.176	7238	1.465
R-0	cz16	1562	47.011	1249	52.652
R-5	cz16	1544	44.285	1305	48.631
R-10	cz16	1541	43.803	1328	47.598

Table 5 shows that the Simplified Method reduces both cooling and heating relative to the Standard Method except where the ground temperature is relatively high (in Climate Zone 15) or relatively low (in Climate Zone 16). The difference in cooling and heating between the two methods is much greater when the absolute values are very low, and much smaller when they are very high.

Table 5 – Difference in annual cooling and heating energy uses calculated using the Standard and Simplified Methods

Slab insulation	*California climate zone*	*Cooling (%)*	*Heating (%)*	*Slab insulation*	*California climate zone*	*Cooling (%)*	*Heating (%)*
R-0	cz01	-13.0	27.7	R-0	cz09	-11.2	16.3
R-5	cz01	-4.7	23.3	R-5	cz09	-6.1	14.8
R-10	cz01	-4.7	21.1	R-10	cz09	-4.6	13.5
R-0	cz02	-14.4	19.3	R-0	cz10	-10.4	5.6
R-5	cz02	-9.4	15.4	R-5	cz10	-5.9	3.0
R-10	cz02	-8.2	13.7	R-10	cz10	-4.8	1.3
R-0	cz03	-16.8	20.8	R-0	cz11	-10.3	1.4
R-5	cz03	-8.8	17.3	R-5	cz11	-6.9	-0.8
R-10	cz03	-4.8	14.9	R-10	cz11	-6.0	-1.7
R-0	cz04	-19.2	15.8	R-0	cz12	-11.1	6.2
R-5	cz04	-11.2	12.2	R-5	cz12	-7.1	3.6
R-10	cz04	-9.9	10.3	R-10	cz12	-5.8	2.2
R-0	cz05	-22.4	25.7	R-0	cz13	-9.4	-3.0
R-5	cz05	-10.7	22.6	R-5	cz13	-6.6	-6.6
R-10	cz05	-8.1	20.5	R-10	cz13	-5.9	-8.2
R-0	cz06	-15.4	17.4	R-0	cz14	-11.2	2.1
R-5	cz06	-9.5	12.7	R-5	cz14	-8.3	-1.4
R-10	cz06	-5.2	10.3	R-10	cz14	-7.6	-2.7
R-0	cz07	-16.0	24.4	R-0	cz15	-4.7	-30.7
R-5	cz07	-7.7	21.0	R-5	cz15	-3.1	-31.4
R-10	cz07	-5.6	18.5	R-10	cz15	-2.7	-32.7
R-0	cz08	-10.5	6.7	R-0	cz16	-20.0	12.0
R-5	cz08	-5.0	3.0	R-5	cz16	-15.5	9.8
R-10	cz08	-3.4	2.4	R-10	cz16	-13.8	8.7

Table 6 compares the savings or penalties in source heating and cooling energy use for R-5 and R-10 slab edge insulation relative to no insulation. The original cooling energy differences were calculated in kWh (as electricity); here they are converted to source energy *in MBtu* using a source multiplier of 3.00 (the conversion factor in the State of California) and added to the heating energy differences for a net change in total source energy. Whereas the Standard Method shows slab edge insulation to be beneficial for both heating and cooling, the Simplified Method shows insulation to be more effective in reducing heating energy use, but detrimental in raising cooling energy use, especially in mild cooling climates. With the Simplified Method, the benefits in lowering the heat gain through the near-surface portion of the slab are almost always overridden by the decreased thermal coupling to the medium depth and deep ground surfaces. Overall, the Simplified Method shows foundation insulation to be 30-50% more beneficial in cold locations with negligible cooling loads (Climate Zones 1 and 16), 30-50% less beneficial in northern coastal and Central Valley climates (Climate Zones 2 through 6, 11 through 14), and counterproductive, i.e., increases total energy costs, in southern coastal climates (Climate Zones 7 through 10) as compared to the Standard Method, that shows energy savings in all climates.

Table 6 – Net savings in annual source energy consumption from increase in slab insulation relative to no insulation

Simulation parameters		*Standard method*			*Simplified method*		
Slab insulation	*California climate zone*	*Source Cooling (MBtu)*	*Heating (MBtu)*	*Total Source (MBtu)*	*Source Cooling (MBtu)*	*Heating (MBtu)*	*Total Source (MBtu)*
R-5	cz01	-0.011	-1.485	**-1.496**	0.165	-2.646	**-2.481**
R-10	cz01	-0.011	-1.751	**-1.762**	0.165	-3.348	**-3.183**
R-5	cz02	-0.396	-1.233	**-1.629**	0.758	-2.072	**-1.314**
R-10	cz02	-0.451	-1.449	**-1.900**	0.989	-2.587	**-1.598**
R-5	cz03	-0.022	-1.059	**-1.081**	0.484	-1.652	**-1.168**
R-10	cz03	-0.044	-1.228	**-1.272**	0.714	-2.093	**-1.379**
R-5	cz04	-0.308	-0.957	**-1.265**	1.209	-1.472	**-0.263**
R-10	cz04	-0.308	-1.124	**-1.432**	1.462	-1.849	**-0.387**
R-5	cz05	-0.143	-0.949	**-1.092**	0.912	-1.443	**-0.531**
R-10	cz05	-0.143	-1.117	**-1.260**	1.143	-1.810	**-0.667**
R-5	cz06	-0.154	-0.395	**-0.549**	0.374	-0.588	**-0.214**
R-10	cz06	-0.187	-0.458	**-0.645**	0.703	-0.723	**-0.020**
R-5	cz07	-0.242	-0.313	**-0.555**	0.802	-0.455	**0.347**
R-10	cz07	-0.253	-0.363	**-0.616**	1.044	-0.564	**0.480**
R-5	cz08	-0.418	-0.429	**-0.847**	0.879	-0.582	**0.297**
R-10	cz08	-0.495	-0.528	**-1.023**	1.176	-0.702	**0.474**
R-5	cz09	-0.473	-0.428	**-0.901**	1.165	-0.545	**0.620**
R-10	cz09	-0.538	-0.498	**-1.036**	1.560	-0.665	**0.895**
R-5	cz10	-0.604	-0.582	**-1.186**	1.176	-0.742	**0.434**
R-10	cz10	-0.725	-0.672	**-1.397**	1.462	-0.917	**0.545**
R-5	cz11	-0.582	-1.450	**-2.032**	0.692	-1.920	**-1.228**
R-10	cz11	-0.692	-1.695	**-2.387**	0.945	-2.368	**-1.423**
R-5	cz12	-0.429	-1.318	**-1.747**	0.857	-1.854	**-0.997**
R-10	cz12	-0.505	-1.552	**-2.057**	1.198	-2.319	**-1.121**
R-5	cz13	-0.769	-0.977	**-1.746**	0.659	-1.382	**-0.723**
R-10	cz13	-0.912	-1.138	**-2.050**	0.857	-1.717	**-0.860**
R-5	cz14	-0.747	-1.218	**-1.965**	0.495	-1.753	**-1.258**
R-10	cz14	-0.890	-1.441	**-2.331**	0.659	-2.177	**-1.518**
R-5	cz15	-1.516	-0.336	**-1.852**	-0.121	-0.249	**-0.370**
R-10	cz15	-1.769	-0.391	**-2.160**	-0.044	-0.314	**-0.358**
R-5	cz16	-0.198	-2.726	**-2.924**	0.615	-4.021	**-3.406**
R-10	cz16	-0.231	-3.208	**-3.439**	0.868	-5.054	**-4.186**

Figure 3 shows the reductions in heating energy use as calculated by the Simplified and Standard Methods for R-5 and R-10 slab edge insulation. There is a clear linear relationship between the two, implying that the effect of the insulation is primarily to reduce the heat losses through to the near-surface ground and that the changes in conductance differ by 40% between the two methods. Figure 4 shows the change in cooling energy use calculated by the Simplified and Standard Methods for R-5 and R-10 slab edge insulation. Here the relationship between the two methods is complex and less prone to description. In many cases, the Simplified Method produces cooling energy penalties that are in reverse order to the energy savings shown by the Standard Method. However, there are also a few cases where the Simplified Method shows savings of 100-120 kWh (1.0-1.4 MBtu) when the Standard Method shows neither savings nor penalties.

Figure 5 gives a visual comparison of the effect of slab insulation on annual energy consumption in a one-story house for different climate zone as calculated by the Simplified and Standard Methods. The 12 bars for each climate zone represent the following types of annual consumption in MBtu, from left to right:

Simplified Method
Bar 1 = cooling, R-0
Bar 2 = cooling, R-5
Bar 3 = cooling, R-10
Bar 4 = heating, R-0
Bar 5 = heating, R-5
Bar 6 = heating, R-10

Standard Method
Bar 7 = cooling, R-0
Bar 8 = cooling, R-5
Bar 9 = cooling, R-10
Bar 10 = heating, R-0
Bar 11 = heating, R-5
Bar 12 = heating, R-10

Figure 3 - Savings in heating energy use as calculated by the Standard and Simplified Methods

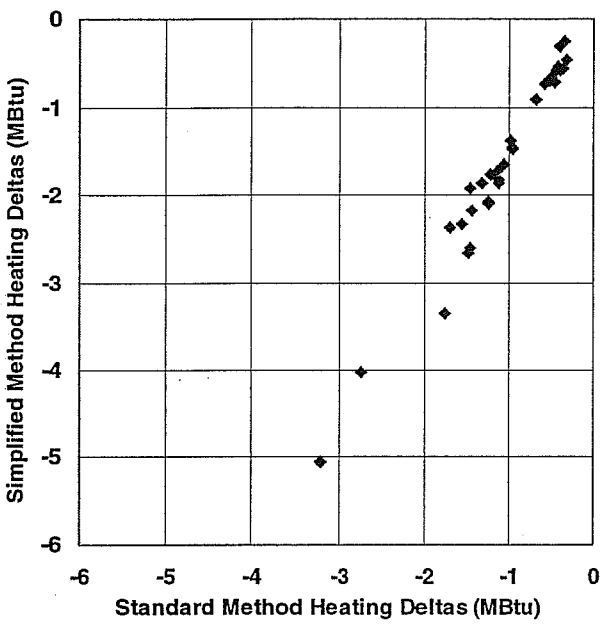


Figure 4 - Changes in cooling energy use as calculated by the Standard and Simplified Methods

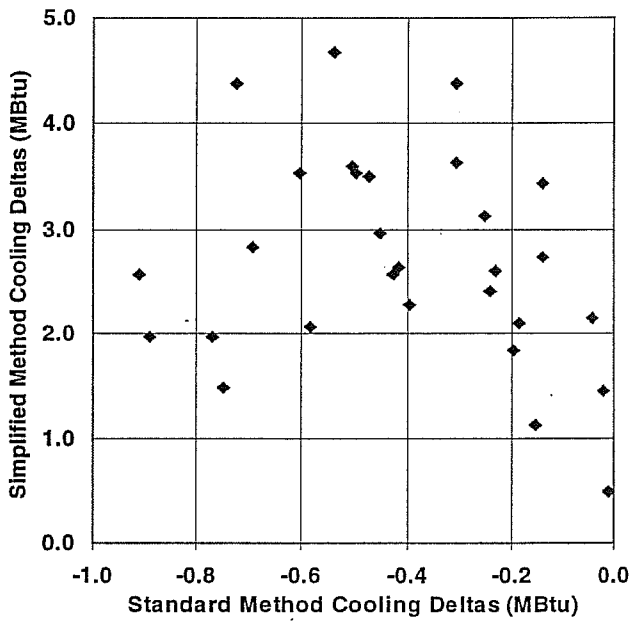
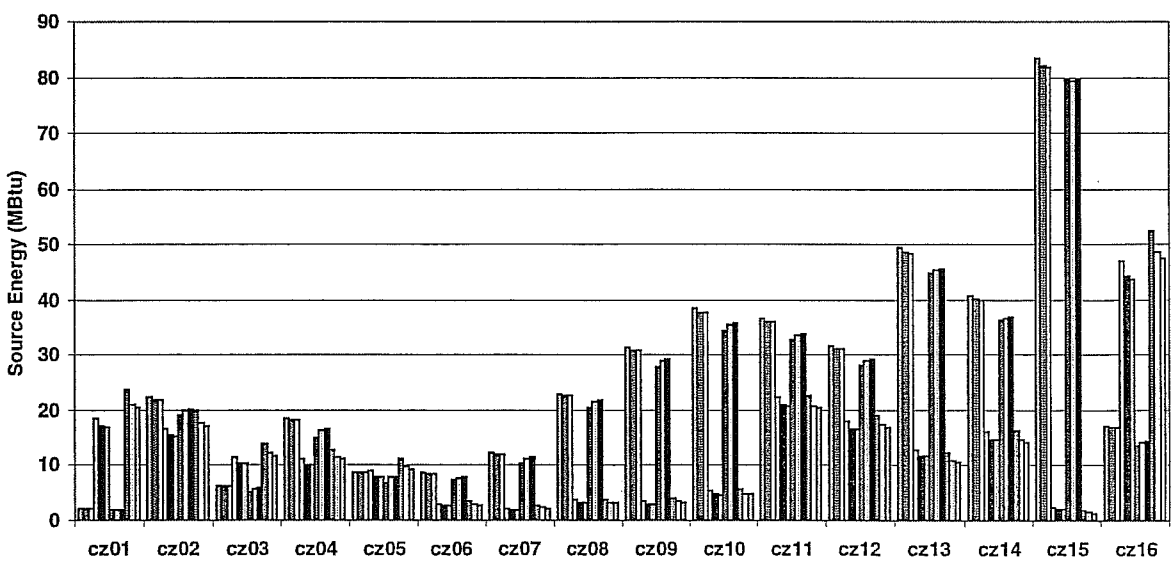


Figure 5 – Effect of slab insulation on annual energy consumption for the "DOE-2" house for different climate zones calculated by the Simplified and Standard Method



5.2 Two-story House

Although the two houses have roughly the same floor area, due to its compactness, the two-story house has a 10-15% lower heating gas use and a 10-15% higher cooling electricity use. As evident from the data shown in Table 7, the trends in energy usage from added foundation insulation are the same in the two prototypes: The Standard Method shows that insulation reduces both heating and cooling energy use, while the Simplified Method shows a larger benefit in heating (1.21 versus 0.84 MBtu), but a penalty in cooling (an increase of 87 kWh as compared to a saving of 48 kWh). All these values are proportionally smaller than for the one-story prototype, which has a larger foundation area (1.72 versus 1.14 MBtu, and 78 kWh increase versus 83 kWh decrease for the one- and two-story house, respectively).

Table 7 – Comparison of annual cooling and heating energy consumption for the Standard and Simplified Methods: One-story and two-story houses in Climate Zone 13 (Fresno)

Simulation parameters		*Standard method*		*Simplified method*	
House type	*Slab insulation*	*Cooling (kWh)*	*Heating (MBtu)*	*Cooling (kWh)*	*Heating (MBtu)*
One-story	R-0	4496	12.813	4074	12.431
	R-5	4426	11.836	4134	11.049
	R-10	4413	11.675	4152	10.714
Two-story	R-0	5000	11.112	4767	10.270
	R-5	4962	10.390	4835	9.278
	R-10	4952	10.272	4854	9.060

5.3 Roller Shades and Natural Ventilation

Given that the two-story house has no external shading, the perhaps lower-than-expected amount of energy consumption for cooling is rooted in the use of roller shades. Because the two-story house has no overhangs or eaves, all windows are fully exposed to solar radiation all the time the sun is up. This results in a higher solar load in the building and an earlier operation of air-conditioning than in the one-story house, and often keeps air-conditioning running longer in the simulation. Since the hours when air-conditioning is running determine when roller shades are in use in the second run that calculates the reported energy consumption (see Section *4.1 Operation of Roller shades*), windows in the two-story house may be actually shaded more than those in the one-story house.

Another factor offsets this effect on the operation of roller shades: The location and the effect of the conditioning control zone. The one-story house has only one conditioned zone, and that is naturally the control zone. The two-story house has two conditioned zones (the ground floor and the upstairs); the control zone is on the ground floor. Because this control zone has a substantially smaller area than the control zone in the one-story house, its internal loads are substantially smaller (see Section *3.2 Differences Relative to the One-story House*) and the resulting smaller cooling load may trigger air-conditioning later than in the one-story house.

Finally, we note that the calculated cooling may be higher than expected in actual houses. The examination of DOE-2 hourly results indicates two main reasons for this: (1) Natural ventilation is not used very much, and (2) there is little extended, continuous use of roller shades to reduce solar gain. In actual houses during the cooling season both natural ventilation and roller shades (or drapes, blinds, etc.) are likely to be in use more frequently and simultaneously. Exposed windows are often shaded while other windows are left open for natural ventilation as necessary. The automatic coupling of roller shade operation and air-conditioning in our modeling implies either a fairly sophisticated automated control system with sensors and motors, or a person present at all times to sense conditions and perform the action. Neither deployment seems feasible on large scale. Most occupants are likely to set their windows, shades and air-conditioning when they leave the house and leave them in that state until they return.

5.4 Conclusion

The results of this study show that the concerns with the method of calculation of heat flow using "F2 factors" are justified. This method of calculation of heat flow through slab-on-grade using "F2 factors" for slab perimeter appears to consistently overestimate cooling loads.

In this study, the method of calculation using "F2 factors" for slab perimeter, currently required in the demonstration of residential energy code compliance in California, is simulated with DOE-2.1E using its Standard Method of underground surface definition. The Simplified Method provides a more accurate calculation of heat flow through underground surfaces.

The differences in the DOE-2 simulation results between the Standard and Simplified Methods can be *clearly* explained by the differences in modeling techniques between the two Methods. In cooling, the results from the more accurate Simplified Method are consistently lower than those from "F2 factors." The differences are inversely proportional to the amount of slab perimeter insulation: they are 10-20% lower for the uninsulated slab, and 3-8% lower for the slab with R-10 insulation in all climates with significant cooling loads.

6. REFERENCES

Bazjanac, V., Y. J. Huang and F.C. Winkelmann 2000. *DOE-2 Modeling of Two-Dimensional Heat Flow in Underground Surfaces,* California Energy Commission, February 2000.

California Energy Commission 1998. *Low Rise Residential Alternative Calculation Approval Manual,* P400-98-003, November 1998.

Huang, Y.J. and J.F. Warner 1996. *Analysis of the Energy Performance of Cooling Retrofits in Sacramento Public Housing Using Monitored Data and Computer Simulations*, Final Report to the Research and Development Office, California Energy Commission, Contract 500-93-053, 1996.

D.A. York, C. Capiello and K.H. Olson, Eds. 1984. *DOE-2 Reference Manual*, LBL-8706, May 1984.

APPENDIX A: Listing of BDL File for One-story House, Standard Method

The listing below is the BDL file that describes the one-story house used as the subject of simulation in this study using F2 factors in the calculation of heat flow through slab-on-grade. The graphic and textual descriptions of the subject house are found in Section 2: ONE-STORY HOUSE.

This BDL file contains the input for the Standard Method and must be executed with the standard version of DOE-2.1E. Attempts to execute it with the special version of DOE-2.1E that contains the Simplified Method will fail.

```
$ --------------------- Set simulation conditions ----------------------
$ ##set1 run f00
$ ##set1 run f02
$ ##set1 run f04

$ ##set1 loc cz01
$ ##set1 loc cz02
$ ##set1 loc cz03
$ ##set1 loc cz04
$ ##set1 loc cz05
$ ##set1 loc cz06
$ ##set1 loc cz07
$ ##set1 loc cz08
$ ##set1 loc cz09
$ ##set1 loc cz10
$ ##set1 loc cz11
$ ##set1 loc cz12
$ ##set1 loc cz13
$ ##set1 loc cz14
$ ##set1 loc cz15
$ ##set1 loc cz16

$ ##set1 fndtn standard
$ ##set1 fndtn simplifd
$ ------------------------------------------------------------------------


$ INPUT LOADS ..
$ ABORT ERRORS ..
$ LIST WARNINGS ..


TITLE LINE-1 = *Typical One-story House*

##if #[run[] eqs f00 ]
      LINE-2 = *            No slab insulation*
##elseif #[run[] eqs f02 ]
      LINE-2 = *           Slab insulation R-5*
##elseif #[run[] eqs f04 ]
      LINE-2 = *           Slab insulation R-10*
##endif

##if #[fndtn[] eqs standard ]
      LINE-3 = *Slab: STANDARD calculation*
##elseif #[fndtn[] eqs simplifd ]
      LINE-3 = *Slab: SIMPLIFIED METHOD*
##endif

##if #[loc[] eqs cz01 ]
      LINE-4 = *              cz01 (Arcata)*
##elseif #[loc[] eqs cz02 ]
      LINE-4 = *            cz02 (Sta. Rosa)*
##elseif #[loc[] eqs cz03 ]
     LINE-4 = *             cz03 (Oakland)*
##elseif #[loc[] eqs cz04 ]
      LINE-4 = *            cz04 (Sunnyvale)*
##elseif #[loc[] eqs cz05 ]
      LINE-4 = *            cz05 (Sta. Maria)*
```

```
##elseif #[loc[] eqs cz06 ]
      LINE-4 = *            cz06 (Long Beach)*
##elseif #[loc[] eqs cz07 ]
      LINE-4 = *            cz07 (San Diego)*
##elseif #[loc[] eqs cz08 ]
      LINE-4 = *             cz08 (El Toro)*
##elseif #[loc[] eqs cz09 ]
      LINE-4 = *             cz09 (Pasadena)*
##elseif #[loc[] eqs cz10 ]
      LINE-4 = *            cz10 (Riverside)*
##elseif #[loc[] eqs cz11 ]
      LINE-4 = *            cz11 (Red Bluff)*
##elseif #[loc[] eqs cz12 ]
      LINE-4 = *            cz12 (Sacramento)*
##elseif #[loc[] eqs cz13 ]
      LINE-4 = *              cz13 (Fresno)*
##elseif #[loc[] eqs cz14 ]
      LINE-4 = *            cz14 (China Lake)*
##elseif #[loc[] eqs cz15 ]
      LINE-4 = *            cz15 (El Centro)*
##elseif #[loc[] eqs cz16 ]
      LINE-4 = *            cz16 (Mt. Shasta)*
##endif

      LINE-5 = *     input file: cec_house7_standard.inp* ..


RUN-PERIOD JAN 1, 1991 THRU DEC 31, 1991 ..


BUILDING-LOCATION
##if #[loc[] eqs cz01 ]
        LAT=40.8 LON=124.2  ALT=218
##elseif #[loc[] eqs cz02 ]
        LAT=38.4 LON=122.7  ALT=167
##elseif #[loc[] eqs cz03 ]
        LAT=37.7 LON=122.2  ALT=6
##elseif #[loc[] eqs cz04 ]
        LAT=37.4 LON=122.1  ALT=97
##elseif #[loc[] eqs cz05 ]
        LAT=34.9 LON=120.4  ALT=236
##elseif #[loc[] eqs cz06 ]
        LAT=33.8 LON=118.2  ALT=25
##elseif #[loc[] eqs cz07 ]
        LAT=32.7 LON=117.2  ALT=13
##elseif #[loc[] eqs cz08 ]
        LAT=33.6 LON=117.7  ALT=380
##elseif #[loc[] eqs cz09 ]
        LAT=34.2 LON=117.2  ALT=864
##elseif #[loc[] eqs cz10 ]
        LAT=34.1 LON=117.3  ALT=840
##elseif #[loc[] eqs cz11 ]
        LAT=40.2 LON=122.2  ALT=342
##elseif #[loc[] eqs cz12 ]
        LAT=38.5 LON=121.5  ALT=17
##elseif #[loc[] eqs cz13 ]
        LAT=36.8 LON=119.7  ALT=326
##elseif #[loc[] eqs cz14 ]
        LAT=35.7 LON=117.7  ALT=2220
##elseif #[loc[] eqs cz15 ]
        LAT=33.0 LON=115.6  ALT=-30
##elseif #[loc[] eqs cz16 ]
        LAT=41.3 LON=122.3  ALT=3535
##endif
                  HOL=YES  D-S=YES  AZ=0  T-Z=8 ..


$ --------------------------- Internal loads ---------------------------
I-GAIN-JAN=D-SCH  (1) (.029)                                    $ .024*1.19
                  (2) (.026)                                    $ .022*1.19
                (3,5) (.025)                                    $ .021*1.19
```

	(6)	(.031)	$ .026*1.19
	(7)	(.045)	$ .038*1.19
	(8)	(.070)	$ .059*1.19
	(9)	(.067)	$ .056*1.19
	(10)	(.071)	$ .060*1.19
	(11)	(.070)	$ .059*1.19
	(12)	(.055)	$ .046*1.19
	(13)	(.054)	$ .045*1.19
	(14)	(.036)	$ .030*1.19
	(15)	(.033)	$ .028*1.19
	(16)	(.037)	$ .031*1.19
	(17)	(.068)	$ .057*1.19
	(18,19)	(.076)	$ .064*1.19
	(20)	(.062)	$ .052*1.19
	(21)	(.060)	$ .050*1.19
	(22)	(.065)	$ .055*1.19
	(23)	(.052)	$ .044*1.19
	(24)	(.032) ..	$ .027*1.19
I-GAIN-FEB=D-SCH	(1)	(.027)	$ .024*1.11
	(2)	(.024)	$ .022*1.11
	(3,5)	(.023)	$ .021*1.11
	(6)	(.029)	$ .026*1.11
	(7)	(.042)	$ .038*1.11
	(8)	(.065)	$ .059*1.11
	(9)	(.062)	$ .056*1.11
	(10)	(.067)	$ .060*1.11
	(11)	(.065)	$ .059*1.11
	(12)	(.051)	$ .046*1.11
	(13)	(.050)	$ .045*1.11
	(14)	(.033)	$ .030*1.11
	(15)	(.031)	$ .028*1.11
	(16)	(.034)	$ .031*1.11
	(17)	(.063)	$ .057*1.11
	(18,19)	(.071)	$ .064*1.11
	(20)	(.058)	$ .052*1.11
	(21)	(.056)	$ .050*1.11
	(22)	(.061)	$ .055*1.11
	(23)	(.049)	$ .044*1.11
	(24)	(.030) ..	$ .027*1.11
I-GAIN-MAR=D-SCH	(1)	(.024)	$ .024*1.02
	(2)	(.022)	$ .022*1.02
	(3,5)	(.021)	$ .021*1.02
	(6)	(.026)	$ .026*1.02
	(7)	(.039)	$ .038*1.02
	(8)	(.060)	$ .059*1.02
	(9)	(.057)	$ .056*1.02
	(10)	(.061)	$ .060*1.02
	(11)	(.060)	$ .059*1.02
	(12)	(.047)	$ .046*1.02
	(13)	(.046)	$ .045*1.02
	(14)	(.031)	$ .030*1.02
	(15)	(.029)	$ .028*1.02
	(16)	(.032)	$ .031*1.02
	(17)	(.058)	$ .057*1.02
	(18,19)	(.065)	$ .064*1.02
	(20)	(.053)	$ .052*1.02
	(21)	(.051)	$ .050*1.02
	(22)	(.056)	$ .055*1.02
	(23)	(.045)	$ .044*1.02
	(24)	(.028) ..	$ .027*1.02
I-GAIN-APR=D-SCH	(1)	(.022)	$ .024*.93
	(2)	(.020)	$ .022*.93
	(3,5)	(.020)	$ .021*.93
	(6)	(.024)	$ .026*.93
	(7)	(.035)	$ .038*.93
	(8)	(.055)	$ .059*.93
	(9)	(.052)	$ .056*.93
	(10)	(.056)	$ .060*.93

	(11)	(.055)	$ .059*.93
	(12)	(.043)	$ .046*.93
	(13)	(.042)	$ .045*.93
	(14)	(.030)	$ .030*.93
	(15)	(.026)	$ .028*.93
	(16)	(.029)	$ .031*.93
	(17)	(.053)	$ .057*.93
	(18,19)	(.060)	$ .064*.93
	(20)	(.048)	$ .052*.93
	(21)	(.047)	$ .050*.93
	(22)	(.051)	$ .055*.93
	(23)	(.041)	$ .044*.93
	(24)	(.025) ..	$ .027*.93
I-GAIN-MAY=D-SCH	(1)	(.020)	$ .024*.84
	(2)	(.018)	$ .022*.84
	(3,5)	(.018)	$ .021*.84
	(6)	(.022)	$ .026*.84
	(7)	(.032)	$ .038*.84
	(8)	(.050)	$ .059*.84
	(9)	(.047)	$ .056*.84
	(10)	(.050)	$ .060*.84
	(11)	(.050)	$ .059*.84
	(12)	(.039)	$ .046*.84
	(13)	(.038)	$ .045*.84
	(14)	(.025)	$ .030*.84
	(15)	(.024)	$ .028*.84
	(16)	(.026)	$ .031*.84
	(17)	(.048)	$ .057*.84
	(18,19)	(.054)	$ .064*.84
	(20)	(.044)	$ .052*.84
	(21)	(.042)	$ .050*.84
	(22)	(.046)	$ .055*.84
	(23)	(.037)	$ .044*.84
	(24)	(.023) ..	$ .027*.84
I-GAIN-JUN=D-SCH	(1)	(.019)	$ .024*.80
	(2)	(.018)	$ .022*.80
	(3,5)	(.017)	$ .021*.80
	(6)	(.021)	$ .026*.80
	(7)	(.030)	$ .038*.80
	(8)	(.047)	$ .059*.80
	(9)	(.045)	$ .056*.80
	(10)	(.048)	$ .060*.80
	(11)	(.047)	$ .059*.80
	(12)	(.037)	$ .046*.80
	(13)	(.036)	$ .045*.80
	(14)	(.024)	$ .030*.80
	(15)	(.022)	$ .028*.80
	(16)	(.025)	$ .031*.80
	(17)	(.046)	$ .057*.80
	(18,19)	(.051)	$ .064*.80
	(20)	(.042)	$ .052*.80
	(21)	(.040)	$ .050*.80
	(22)	(.044)	$ .055*.80
	(23)	(.035)	$ .044*.80
	(24)	(.022) ..	$ .027*.80
I-GAIN-JUL=D-SCH	(1)	(.020)	$ .024*.82
	(2)	(.018)	$ .022*.82
	(3,5)	(.017)	$ .021*.82
	(6)	(.021)	$ .026*.82
	(7)	(.031)	$ .038*.82
	(8)	(.048)	$ .059*.82
	(9)	(.046)	$ .056*.82
	(10)	(.049)	$ .060*.82
	(11)	(.048)	$ .059*.82
	(12)	(.038)	$ .046*.82
	(13)	(.037)	$ .045*.82
	(14)	(.025)	$ .030*.82
	(15)	(.023)	$ .028*.82

	(16)	(.025)	$ .031*.82
	(17)	(.047)	$ .057*.82
	(18,19)	(.052)	$ .064*.82
	(20)	(.043)	$ .052*.82
	(21)	(.041)	$ .050*.82
	(22)	(.045)	$ .055*.82
	(23)	(.036)	$ .044*.82
	(24)	(.022) ..	$ .027*.82
I-GAIN-AUG=D-SCH	(1)	(.021)	$ .024*.88
	(2)	(.019)	$ .022*.88
	(3,5)	(.018)	$ .021*.88
	(6)	(.023)	$ .026*.88
	(7)	(.033)	$ .038*.88
	(8)	(.052)	$ .059*.88
	(9)	(.049)	$ .056*.88
	(10)	(.053)	$ .060*.88
	(11)	(.052)	$ .059*.88
	(12)	(.040)	$ .046*.88
	(13)	(.040)	$ .045*.88
	(14)	(.026)	$ .030*.88
	(15)	(.025)	$ .028*.88
	(16)	(.028)	$ .031*.88
	(17)	(.050)	$ .057*.88
	(18,19)	(.056)	$ .064*.88
	(20)	(.046)	$ .052*.88
	(21)	(.044)	$ .050*.88
	(22)	(.048)	$ .055*.88
	(23)	(.039)	$ .044*.88
	(24)	(.024) ..	$ .027*.88
I-GAIN-SEP=D-SCH	(1)	(.024)	$ .024*.98
	(2)	(.022)	$ .022*.98
	(3,5)	(.021)	$ .021*.98
	(6)	(.026)	$ .026*.98
	(7)	(.037)	$ .038*.98
	(8)	(.058)	$ .059*.98
	(9)	(.055)	$ .056*.98
	(10)	(.059)	$ .060*.98
	(11)	(.058)	$ .059*.98
	(12)	(.045)	$ .046*.98
	(13)	(.044)	$ .045*.98
	(14)	(.029)	$ .030*.98
	(15)	(.027)	$ .028*.98
	(16)	(.030)	$ .031*.98
	(17)	(.056)	$ .057*.98
	(18,19)	(.063)	$ .064*.98
	(20)	(.051)	$ .052*.98
	(21)	(.049)	$ .050*.98
	(22)	(.054)	$ .055*.98
	(23)	(.043)	$ .044*.98
	(24)	(.026) ..	$ .027*.98
I-GAIN-OCT=D-SCH	(1)	(.026)	$ .024*1.07
	(2)	(.024)	$ .022*1.07
	(3,5)	(.022)	$ .021*1.07
	(6)	(.028)	$ .026*1.07
	(7)	(.041)	$ .038*1.07
	(8)	(.069)	$ .059*1.07
	(9)	(.060)	$ .056*1.07
	(10)	(.064)	$ .060*1.07
	(11)	(.069)	$ .059*1.07
	(12)	(.049)	$ .046*1.07
	(13)	(.048)	$ .045*1.07
	(14)	(.032)	$ .030*1.07
	(15)	(.030)	$ .028*1.07
	(16)	(.033)	$ .031*1.07
	(17)	(.061)	$ .057*1.07
	(18,19)	(.068)	$ .064*1.07
	(20)	(.056)	$ .052*1.07
	(21)	(.054)	$ .050*1.07

```
                  (22) (.059)                                          $ .055*1.07
                  (23) (.047)                                          $ .044*1.07
                  (24) (.029) ..                                       $ .027*1.07

I-GAIN-NOV=D-SCH   (1) (.028)                                          $ .024*1.16
                   (2) (.026)                                          $ .022*1.16
                 (3,5) (.024)                                          $ .021*1.16
                   (6) (.030)                                          $ .026*1.16
                   (7) (.044)                                          $ .038*1.16
                   (8) (.068)                                          $ .059*1.16
                   (9) (.065)                                          $ .056*1.16
                  (10) (.070)                                          $ .060*1.16
                  (11) (.068)                                          $ .059*1.16
                  (12) (.053)                                          $ .046*1.16
                  (13) (.052)                                          $ .045*1.16
                  (14) (.035)                                          $ .030*1.16
                  (15) (.032)                                          $ .028*1.16
                  (16) (.036)                                          $ .031*1.16
                  (17) (.066)                                          $ .057*1.16
                (18,19) (.074)                                         $ .064*1.16
                  (20) (.060)                                          $ .052*1.16
                  (21) (.058)                                          $ .050*1.16
                  (22) (.064)                                          $ .055*1.16
                  (23) (.051)                                          $ .044*1.16
                  (24) (.031) ..                                       $ .027*1.16

I-GAIN-DEC=D-SCH   (1) (.030)                                          $ .024*1.27
                   (2) (.028)                                          $ .022*1.27
                 (3,5) (.027)                                          $ .021*1.27
                   (6) (.033)                                          $ .026*1.27
                   (7) (.048)                                          $ .038*1.27
                   (8) (.075)                                          $ .059*1.27
                   (9) (.071)                                          $ .056*1.27
                  (10) (.076)                                          $ .060*1.27
                  (11) (.075)                                          $ .059*1.27
                  (12) (.058)                                          $ .046*1.27
                  (13) (.057)                                          $ .045*1.27
                  (14) (.038)                                          $ .030*1.27
                  (15) (.036)                                          $ .028*1.27
                  (16) (.039)                                          $ .031*1.27
                  (17) (.072)                                          $ .057*1.27
                (18,19) (.081)                                         $ .064*1.27
                  (20) (.066)                                          $ .052*1.27
                  (21) (.064)                                          $ .050*1.27
                  (22) (.070)                                          $ .055*1.27
                  (23) (.056)                                          $ .044*1.27
                  (24) (.034) ..                                       $ .027*1.27

INT-LOADS=SCH  THRU JAN 31  (ALL) I-GAIN-JAN
               THRU FEB 28  (ALL) I-GAIN-FEB
               THRU MAR 31  (ALL) I-GAIN-MAR
               THRU APR 30  (ALL) I-GAIN-APR
               THRU MAY 31  (ALL) I-GAIN-MAY
               THRU JUN 30  (ALL) I-GAIN-JUN
               THRU JUL 31  (ALL) I-GAIN-JUL
               THRU AUG 31  (ALL) I-GAIN-AUG
               THRU SEP 30  (ALL) I-GAIN-SEP
               THRU OCT 31  (ALL) I-GAIN-OCT
               THRU NOV 30  (ALL) I-GAIN-NOV
               THRU DEC 31  (ALL) I-GAIN-DEC ..

MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.968) ..                   $ no roller shades
$ MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.595) ..                 $$ roller shades


$ ----------------------------- Materials -----------------------------
GYPBRD=MAT     COND=.1330  TH=.0417  DENS=50.00   S-H=0.20 ..
INS-R13=MAT    COND=.0224  TH=.2917  DENS=.71     S-H=.20 ..
STUCCO=MAT     COND=.4167  TH=.0729  DENS=166.00  S-H=.20 ..
WOOD=MAT       COND=.0667  TH=.2917  DENS=32.00   S-H=.33 ..
DAMPSOIL=MAT   COND=1.000  TH=1.000  DENS=115.00  S-H=.28 ..          $ typical damp soil
```

```
RUGNPAD=MAT   RES=2.08 ..                                          $ carpet and pad
CONCRETE=MAT  COND=.8000  TH=.3333  DENS=144.    S-H=.139 ..      $ 4" heavy concrete

$ ------------------------------ Layers -------------------------------
WOOD-FRM-R13=LA  MAT=(STUCCO,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
WOOD-FRM-R19=LA  MAT=(STUCCO,IN12,WOOD,GYPBRD)  I-F-R=0.68 ..
INT-WALL=LA      MAT=(GYPBRD,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
CEIL=LA          MAT=(PW04,AL33,GYPBRD)  I-F-R=.76 ..
ROOF-LA=LA       MAT=(AR02,AR01,PW04)  I-F-R=.76 ..
ROOF-R30=LA      MAT=(AR02,AR01,PW04,IN11,IN12)  I-F-R=.76 ..
ROOF-R38=LA      MAT=(AR02,AR01,PW04,IN12,IN12)  I-F-R=.76 ..
FSLABLDP=LA      MAT=(IN52,IN14,DAMPSOIL,CONCRETE,RUGNPAD)          $ slab, R-50, 1' dampsoil
                THICKNESS(1.0,.333,1.)  I-F-R=0.765 ..
BSLABLDP=LA     MAT=(IN52,IN14,DAMPSOIL,CONCRETE)                   $ slab, R-50, 1' dampsoil
                THICKNESS(1.0,.333)  I-F-R=0.765 ..


$ --------------------------- Construction ----------------------------
WALL1CON=CONS       LA=WOOD-FRM-R13  RO=3  ABS=0.7 ..
WALL2CON=CONS       LA=WOOD-FRM-R19  RO=3  ABS=0.7 ..
IWALL1CON=CONS      LA=INT-WALL  RO=3  ABS=0.7 ..
DOORCON=CONS        U=.33 ..
CEILCON=CONS        LA=CEIL ..
ROOFCON=CONS        LA=ROOF-LA ..
ROOF1CON=CONS       LA=ROOF-R30 ..
ROOF2CON=CONS       LA=ROOF-R38 ..
SLAB-CARP=CONS      LA=FSLABLDP ..
SLAB-NO-CARP=CONS   LA=BSLABLDP ..

##if #[run[] eqs f00 ]
       DEFINE  SPCW-CS=.0852  SPCM-CS=.0551  SPCY-CS=.0028          $ carpeted slab R-0
       SCCM-CS=.0418  SCCY-CS=.0224 ..
       DEFINE  SPCW-US=.1692  SPCM-US=.0737  SPCY-US=.0014          $ uncarpeted slab R-0
       SCCM-US=.0503  SCCY-US=.0238 ..
       SLAB-PERIM-CARP=CONS    U=.72 ..                             $ F2: carpeted R-0
       SLAB-PERIM-UNCARP=CONS    U=.90 ..                           $ F2: uncarpeted R-0
##elseif #[run[] eqs f02 ]
       DEFINE  SPCW-CS=.0291  SPCM-CS=.0685  SPCY-CS=.0100          $ carpeted slab R-5
       SCCM-CS=.0303  SCCY-CS=.0261 ..
       DEFINE  SPCW-US=.0600  SPCM-US=.0909  SPCY-US=.0086          $ uncarpeted slab R-5
       SCCM-US=.0366  SCCY-US=.0275 ..
       SLAB-PERIM-CARP=CONS    U=.53 ..                             $ F2: carpeted R-5
       SLAB-PERIM-UNCARP=CONS    U=.58 ..                           $ F2: uncarpeted R-5
##elseif #[run[] eqs f04 ]
       DEFINE  SPCW-CS=.0224  SPCM-CS=.0629  SPCY-CS=.0141          $ carpeted slab R-10
       SCCM-CS=.0255  SCCY-CS=.0278 ..
       DEFINE  SPCW-US=.0422  SPCM-US=.0912  SPCY-US=.0115          $ uncarpeted slab R-10
       SCCM-US=.0338  SCCY-US=.0284 ..
       SLAB-PERIM-CARP=CONS    U=.50 ..                             $ F2 carpeted R-10
       SLAB-PERIM-UNCARP=CONS    U=.53 ..                           $ F2 uncarpeted R-10
##endif

$ ------------------------------ Glazing ------------------------------
WINDOW2ATB=G-T  G-T-C=2000 ..

$ ------------------------- Shading from eaves -------------------------
SEAVE-1=B-S X=0  Y=-2.33  Z=7.95  H=2.48  W=14.58  AZ=180  TILT=20.00 ..
SEAVE-2=B-S LIKE SEAVE-1  X=14.58  Z=7.95  H=4.80  W=9.75 ..
SWEAVE=B-S  X=-1.00 Y=-2.33 Z=7.95  H=20.25 W=1.00  AZ=180 TILT=20.00 ..
SEEAVE=B-S LIKE SWEAVE  X=45.25  Y=7.48  Z=11.52  H=9.84 ..
NEAVE-1=B-S  X=46.25 Y=44.46  Z=7.98  H=3.07 W=47.25  AZ=0 TILT=12.00 ..
NEEAVE-1=B-S LIKE NEAVE-1  Y=22.76  Z=12.68  H=6.5 W=1.00  TILT=20.00 ..
NEEAVE-2=B-S  X=46.25 Y=41.46 Z=8.80  H=19.10 W=1.00  AZ=0 TILT=12.00 ..
NWEAVE-1=B-S LIKE NEEAVE-1  X=0 ..
NWEAVE-2=B-S LIKE NEEAVE-2  X=0 ..
GSEAVE-1=B-S X=21.87 Y=-20.33 Z=7.95 H=2.48 W=25.59 AZ=180 TILT=15.00 ..
GWEAVE=B-S  X=21.87 Y=-2.33 Z=7.95  H=2.48 W=15.67  AZ=270 TILT=15.00 ..
GEEAVE=B-S LIKE GWEAVE  X=47.58  Y=-18.00  W=25.48  AZ=90 ..

$ ------------------------- Space conditions -------------------------
SET FOR S-C  SOURCE-SCHEDULE=INT-LOADS  SOURCE-BTU/HR=47135  F-W=0    $ total internal gain:
```

```
            S-S=1.0  S-L=0 ..                                          $ 20,000 Btu/day +
                                                                       $ (1,809 sqft. X 15 Btu/d)=
                                                                       $ 47135 Btu/d

HOUSE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0005
              TEMPERATURE=(78)  ZONE-TYPE=CONDITIONED ..

ATTIC-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .00167  SOURCE-BTU/HR=0    $ 1ft2 vents/450ft2 fl.
              ZONE-TYPE=UNCONDITIONED ..                                  $ 0.75 discharge eff.
                                                                          $ (0.75/450 = .00167)

GARAGE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0015  SOURCE-BTU/HR=0    $ (E-L-F cond. space)X3
              ZONE-TYPE=UNCONDITIONED ..

$ ------------------------- Space descriptions -------------------------
SET FOR WI  G-T=WINDOW2ATB  FRAME-WIDTH 0.125 S-SCH=MULTIPLIERS ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
            H=8.0 ..


GARAGE=S  A=424  V=3390  S-C=GARAGE-SC ..
E-W  X=24.33  Y=-18.00  W=20.92  AZ=180 ..
  DOOR  X=2.42  H=7.00  W=16.00  CONS=DOORCON ..
E-W  X=45.25  Y=-18.00  W=20.25  AZ=90 ..
  DOOR  X=16.25  H=6.75  W=2.75  CONS=DOORCON ..
E-W  X=24.33  Y=2.25  W=20.25  AZ=270 ..
GCEILING=I-W  A=424  CONS=CEILCON  N-T=ATTIC ..
GSLAB-PERIM-S=E-W  AZ=180  W=20.92 ..
GSLAB-PERIM-E=E-W  X=45.25  Y=2.25  AZ=90  W=20.25 ..
GSLAB-PERIM-W=E-W  X=0  Y=37.25  AZ=270  W=20.25 ..
GSLAB-UNCARPETED=U-F  A=424  U-EFF=.0001  CONS=SLAB-NO-CARP ..


HOUSE=S  A=1809  V=14472  X=0  Y=0  S-C=HOUSE-SC ..
E-W  W=14.58  AZ=180 ..
  WI  X=.12  Y=1.58  H=6.00  W=14.33 ..
E-W  X=14.58  Y=2.25  W=9.25  AZ=180 ..
  DOOR  X=0.75  H=6.75  W=3.00  CONS=DOORCON ..
```

```
  WI  X=4.83  Y=1.67  H=4.92  W=3.83 ..
E-W  X=45.25  Y=2.25  W=39.21  AZ=90 ..
  WI  X=2.50  Y=2.83  H=3.92  W=6.92 ..
  WI  X=17.50  Y=2.83  H=3.92  W=6.92 ..
E-W  X=14.58  Y=0  W=2.00  AZ=90 ..
E-W  X=45.25  Y=41.46  W=45.30  AZ=0 ..
  WI  X=13.75  Y=5.33  H=1.83  W=2.92 ..
  WI  X=22.75  Y=.12  H=6.5  W=9.42 ..
  WI  X=33.5  Y=1.83  H=4.92  W=7.75 ..
E-W  X=0  Y=41.46  W=41.46  AZ=270 ..
  WI  X=4.71  Y=2.00  H=4.83  W=3.92 ..
  WI  X=16.13  Y=2.5  H=3.33  W=3.75 ..
  WI  X=20.46  Y=.12  H=6.83  W=11.17 ..
SET FOR I-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
..
I-W  A=167.36  N-T=GARAGE ..
SET FOR I-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
```

```
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
..
CEILING=I-W  A=1809  N-T=ATTIC ..
SET FOR E-W  H=1.00 ..
SLAB-PERIM-S1=E-W  CONS=SLAB-PERIM-CARP  AZ=180  W=14.58 ..
SLAB-PERIM-S3=E-W  CONS=SLAB-PERIM-UNCARP  X=14.58  Y=2.25  AZ=180  W=9.25 ..
SLAB-PERIM-E1=E-W  CONS=SLAB-PERIM-UNCARP  X=45.25  Y=2.25  AZ=90  W=21.19 ..
SLAB-PERIM-E2=E-W  CONS=SLAB-PERIM-CARP  X=45.25  Y=23.44  AZ=90  W=18.02 ..
SLAB-PERIM-E3=E-W  CONS=SLAB-PERIM-CARP  X=14.58  Y=0  AZ=90  W=2.00 ..
SLAB-PERIM-N1=E-W  CONS=SLAB-PERIM-CARP  X=45.25  Y=41.46  AZ=0  W=45.30 ..
SLAB-PERIM-W1=E-W  CONS=SLAB-PERIM-CARP  X=0  Y=41.46  AZ=270  W=41.46 ..
SLAB-CARPETED=U-F  A=1447  U-EFF=.0001  CONS=SLAB-CARP ..
SLAB-UNCARPETED=U-F  A=362  U-EFF=.0001  CONS=SLAB-NO-CARP ..


ATTIC=S  A=2233  V=6780  Z=8.80  S-C=ATTIC-SC ..
EGABLE=E-W  X=45.25  Y=8.75  H=4.59  W=17.5  AZ=90 ..
WGABLE=E-W LIKE EGABLE  X=0  Y=26.25  AZ=270 ..
SET FOR ROOF  CONS=ROOFCON  TILT=15.00 ..
SROOF-1=ROOF  X=0  Y=0  H=17.80  W=24.38  AZ=180  TILT=20.00 ..
SROOF-2=ROOF LIKE SROOF-1  X=24.33  Y=7.48  Z=2.723  H=9.84  W=20.92 ..
NROOF-1=ROOF  X=45.25  Y=41.46  H=19.10  W=45.25  AZ=0  TILT=12.00 ..
NROOF-2=ROOF LIKE NROOF-1  Y=22.76  Z=3.88  H=6.5  TILT=20.00 ..
GSROOF-1=ROOF  X=24.33  Y=-18.00  H=5.41  W=20.92  AZ=180  TILT=15.00 ..
GWROOF=ROOF  X=24.33  Y=7.48  H=10.80  W=20.25  AZ=270  TILT=15.00 ..
GEROOF=ROOF LIKE GWROOF  X=45.25  Y=-12.77  AZ=90 ..


LOADS-REPORT  SUMMARY=(LS-F) ..
$ LOADS-REPORT  SUMMARY=(LS-F)  HOURLY-DATA-SAVE = FORMATTED ..
$ LOADS-REPORT  VERIFICATION = (LV-I) ..
$ LOADS-REPORT  H-D-S=FORMATTED  R-F=HOURLY ..


END ..
COMPUTE LOADS ..


INPUT SYSTEMS ..

$ --------------------- Set simulation conditions ----------------------
##set1 accap   32000                                                  $ measured on site
##set1 accfm   1000                                                   $ measured on site
$ ##set1 vent    sg
$ ##set1 hrpt no
$ ##set1 hrpt yes

DEFINE  HEATSET=68  SETBACK=60  COOLSET=78
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
   VTYPE=-1                                                          $ enthalpic venting
##else
   VTYPE=0                                                           $ no venting
##endif
       FHIR=1.4286  MAXTEMP=120                                      $ assumed furnace input
       HCAPF=-50000                                                  $ 77% eff.+10% ductloss
##set1 sen_cap = #[accap[] * 0.75 ]
       CTCAP=accap[]  CSCAP=sen_cap[]  ACCFM=accfm[]  CBF=0.9 ..

$ ----------------------------- Schedules ------------------------------
HTSCH     SCHEDULE  THRU DEC 31 (ALL)  (1,6) (SETBACK)
```

```
                                        (7,23) (HEATSET)
                                          (24) (SETBACK)  ..
WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (1.0) ..                    $ natural vent. always
$ WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (0.0) ..                  $$ no natural vent.
VOPSCH    SCHEDULE  THRU DEC 31 (ALL) (1,24) (VTYPE) ..
CTSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (COOLSET) ..
VTSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (72) ..                     $ vent schedule 72 F

$ ------------------------------- Zones -------------------------------
ZC1                 ZONE-CONTROL
                              DESIGN-HEAT-T 68.
                              DESIGN-COOL-T 78.
                              COOL-TEMP-SCH CTSCH
                              HEAT-TEMP-SCH HTSCH
                              THERMOSTAT-TYPE TWO-POSITION ..
HOUSE               ZONE      ZONE-CONTROL ZC1 ..
ATTIC               ZONE      ZONE-TYPE UNCONDITIONED ..
GARAGE              ZONE      ZONE-TYPE UNCONDITIONED ..

$ ----------------------------- Systems -----------------------------
SYSCONTRL SYSTEM-CONTROL
                 MAX-SUPPLY-T MAXTEMP
                 MIN-SUPPLY-T 50
                   ..
SYSAIR    SYSTEM-AIR
                 SUPPLY-CFM ACCFM
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
                 NATURAL-VENT-SCH VOPSCH
                 VENT-TEMP-SCH VTSCH
                 OPEN-VENT-SCH WINDOPER
  ##if #[vent[] eqs sg]
                 HOR-VENT-FRAC 0.0
                 FRAC-VENT-AREA=.0242                                    $ 10% window area open
                 VENT-METHOD S-G                                         $ discharge coeff. 0.6
                 MAX-VENT-RATE 20
  ##endif
  ##if #[vent[] eqs ach]                                                 $ 10 ach when venting
                 NATURAL-VENT-AC 10
                 VENT-METHOD AIR-CHANGE
  ##endif
##endif
 ..

SYSEQP    SYSTEM-EQUIPMENT
                 COOLING-CAPACITY CTCAP
                 COOL-SH-CAP CSCAP
                 COIL-BF CBF
                 COMPRESSOR-TYPE SINGLE-SPEED
                 COOLING-EIR .39985
                 HEATING-CAPACITY HCAPF                                  $ furnace specs
                 FURNACE-AUX 0.
                 FURNACE-HIR FHIR ..                                     $ duct losses in FHIR

SUBR-FUNCTIONS  RESYS-5=*PRTAC* ..

RESIDEN  SYSTEM  SYSTEM-TYPE RESYS
                    Z-N=(HOUSE,GARAGE,ATTIC)
                 SYSTEM-CONTROL SYSCONTRL
                 SYSTEM-AIR SYSAIR
                 SYSTEM-EQUIPMENT SYSEQP
                 HEAT-SOURCE FURNACE ..


$ --------------------------- System reports ---------------------------
##if #[hrpt[] eqs yes]
HRSCH=SCH  THRU DEC 31 (ALL) (1,24) (1)  ..
RB-1=R-B  V-T=GLOBAL   V-L=(8) ..
RB-2=R-B  V-T=RESIDEN  V-L=(61,62) ..                                    $ part-loads
DUMP=H-R  R-SCH=HRSCH  R-B=(RB-1,RB-2) ..
##endif
```

```
SYSTEMS-REPORT
##if #[hrpt[] eqs yes]
                    HOURLY-DATA-SAVE=FORMATTED
##endif

$ S=(SS-A,SS-B,SS-C,SS-F,SS-H,SS-I) $ ..


END ..

FUNCTION  NAME=PRTAC ..
  $
  $ This function prints out whether the AC is on for each hour
  $
  ASSIGN IMO=IMO IDAY=IDAY IHR=IHR
         xQNOW=QNOW ..
      CALCULATE  ..
      IF (IMO.EQ.1.AND.IDAY.EQ.1.AND.IHR.EQ.1) REWIND 52
      WRITE(52,120) xQNOW
 120  FORMAT(E14.7)
      END
      END-FUNCTION ..

COMPUTE  SYSTEMS ..


$
$ SECOND SIMULATION WITH ADJUSTED ROLLER SHADE CONDITIONS PER AIR-CONDITIONING STATUS
$


$ --------------------- Set simulation conditions ----------------------
$ ##set1 run f00
$ ##set1 run f02
$ ##set1 run f04

$ ##set1 loc cz01
$ ##set1 loc cz02
$ ##set1 loc cz03
$ ##set1 loc cz04
$ ##set1 loc cz05
$ ##set1 loc cz06
$ ##set1 loc cz07
$ ##set1 loc cz08
$ ##set1 loc cz09
$ ##set1 loc cz10
$ ##set1 loc cz11
$ ##set1 loc cz12
$ ##set1 loc cz13
$ ##set1 loc cz14
$ ##set1 loc cz15
$ ##set1 loc cz16

$ ##set1 fndtn standard
$ ##set1 fndtn simplifd
$ ----------------------------------------------------------------------


INPUT LOADS ..
ABORT ERRORS ..
LIST WARNINGS ..



TITLE LINE-1 = *Typical One-story House*

##if #[run[] eqs f00 ]
      LINE-2 = *            No slab insulation*
##elseif #[run[] eqs f02 ]
      LINE-2 = *           Slab insulation R-5*
##elseif #[run[] eqs f04 ]
```

```
      LINE-2 = *            Slab insulation R-10*
##endif

##if #[fndtn[] eqs standard ]
      LINE-3 = *Slab: STANDARD calculation*
##elseif #[fndtn[] eqs simplifd ]
      LINE-3 = *Slab: SIMPLIFIED METHOD*
##endif

##if #[loc[] eqs cz01 ]
      LINE-4 = *               cz01 (Arcata)*
##elseif #[loc[] eqs cz02 ]
      LINE-4 = *             cz02 (Sta. Rosa)*
##elseif #[loc[] eqs cz03 ]
     LINE-4 = *              cz03 (Oakland)*
##elseif #[loc[] eqs cz04 ]
      LINE-4 = *             cz04 (Sunnyvale)*
##elseif #[loc[] eqs cz05 ]
      LINE-4 = *             cz05 (Sta. Maria)*
##elseif #[loc[] eqs cz06 ]
      LINE-4 = *             cz06 (Long Beach)*
##elseif #[loc[] eqs cz07 ]
      LINE-4 = *             cz07 (San Diego)*
##elseif #[loc[] eqs cz08 ]
      LINE-4 = *              cz08 (El Toro)*
##elseif #[loc[] eqs cz09 ]
      LINE-4 = *              cz09 (Pasadena)*
##elseif #[loc[] eqs cz10 ]
      LINE-4 = *             cz10 (Riverside)*
##elseif #[loc[] eqs cz11 ]
      LINE-4 = *             cz11 (Red Bluff)*
##elseif #[loc[] eqs cz12 ]
      LINE-4 = *             cz12 (Sacramento)*
##elseif #[loc[] eqs cz13 ]
      LINE-4 = *               cz13 (Fresno)*
##elseif #[loc[] eqs cz14 ]
      LINE-4 = *             cz14 (China Lake)*
##elseif #[loc[] eqs cz15 ]
      LINE-4 = *             cz15 (El Centro)*
##elseif #[loc[] eqs cz16 ]
      LINE-4 = *             cz16 (Mt. Shasta)*
##endif

      LINE-5 = *     input file: cec_house7_standard.inp* ..


RUN-PERIOD JAN 1, 1991 THRU DEC 31, 1991 ..


BUILDING-LOCATION
FUNCTION =(*SHADING*,*NONE*)                                        $ roller shade use
##if #[loc[] eqs cz01 ]
        LAT=40.8 LON=124.2  ALT=218
##elseif #[loc[] eqs cz02 ]
        LAT=38.4 LON=122.7  ALT=167
##elseif #[loc[] eqs cz03 ]
        LAT=37.7 LON=122.2  ALT=6
##elseif #[loc[] eqs cz04 ]
        LAT=37.4 LON=122.1  ALT=97
##elseif #[loc[] eqs cz05 ]
        LAT=34.9 LON=120.4  ALT=236
##elseif #[loc[] eqs cz06 ]
        LAT=33.8 LON=118.2  ALT=25
##elseif #[loc[] eqs cz07 ]
        LAT=32.7 LON=117.2  ALT=13
##elseif #[loc[] eqs cz08 ]
        LAT=33.6 LON=117.7  ALT=380
##elseif #[loc[] eqs cz09 ]
        LAT=34.2 LON=117.2  ALT=864
##elseif #[loc[] eqs cz10 ]
        LAT=34.1 LON=117.3  ALT=840
```

```
##elseif #[loc[] eqs cz11 ]
        LAT=40.2 LON=122.2  ALT=342
##elseif #[loc[] eqs cz12 ]
        LAT=38.5 LON=121.5  ALT=17
##elseif #[loc[] eqs cz13 ]
        LAT=36.8 LON=119.7  ALT=326
##elseif #[loc[] eqs cz14 ]
        LAT=35.7 LON=117.7  ALT=2220
##elseif #[loc[] eqs cz15 ]
        LAT=33.0 LON=115.6  ALT=-30
##elseif #[loc[] eqs cz16 ]
        LAT=41.3 LON=122.3  ALT=3535
##endif
                  HOL=YES  D-S=YES  AZ=0  T-Z=8 ..


$ -------------------------- Internal loads --------------------------
I-GAIN-JAN=D-SCH  (1) (.029)                                    $ .024*1.19
                  (2) (.026)                                    $ .022*1.19
                (3,5) (.025)                                    $ .021*1.19
                  (6) (.031)                                    $ .026*1.19
                  (7) (.045)                                    $ .038*1.19
                  (8) (.070)                                    $ .059*1.19
                  (9) (.067)                                    $ .056*1.19
                 (10) (.071)                                    $ .060*1.19
                 (11) (.070)                                    $ .059*1.19
                 (12) (.055)                                    $ .046*1.19
                 (13) (.054)                                    $ .045*1.19
                 (14) (.036)                                    $ .030*1.19
                 (15) (.033)                                    $ .028*1.19
                 (16) (.037)                                    $ .031*1.19
                 (17) (.068)                                    $ .057*1.19
               (18,19) (.076)                                   $ .064*1.19
                 (20) (.062)                                    $ .052*1.19
                 (21) (.060)                                    $ .050*1.19
                 (22) (.065)                                    $ .055*1.19
                 (23) (.052)                                    $ .044*1.19
                 (24) (.032) ..                                 $ .027*1.19

I-GAIN-FEB=D-SCH  (1) (.027)                                    $ .024*1.11
                  (2) (.024)                                    $ .022*1.11
                (3,5) (.023)                                    $ .021*1.11
                  (6) (.029)                                    $ .026*1.11
                  (7) (.042)                                    $ .038*1.11
                  (8) (.065)                                    $ .059*1.11
                  (9) (.062)                                    $ .056*1.11
                 (10) (.067)                                    $ .060*1.11
                 (11) (.065)                                    $ .059*1.11
                 (12) (.051)                                    $ .046*1.11
                 (13) (.050)                                    $ .045*1.11
                 (14) (.033)                                    $ .030*1.11
                 (15) (.031)                                    $ .028*1.11
                 (16) (.034)                                    $ .031*1.11
                 (17) (.063)                                    $ .057*1.11
               (18,19) (.071)                                   $ .064*1.11
                 (20) (.058)                                    $ .052*1.11
                 (21) (.056)                                    $ .050*1.11
                 (22) (.061)                                    $ .055*1.11
                 (23) (.049)                                    $ .044*1.11
                 (24) (.030) ..                                 $ .027*1.11

I-GAIN-MAR=D-SCH  (1) (.024)                                    $ .024*1.02
                  (2) (.022)                                    $ .022*1.02
                (3,5) (.021)                                    $ .021*1.02
                  (6) (.026)                                    $ .026*1.02
                  (7) (.039)                                    $ .038*1.02
                  (8) (.060)                                    $ .059*1.02
                  (9) (.057)                                    $ .056*1.02
                 (10) (.061)                                    $ .060*1.02
                 (11) (.060)                                    $ .059*1.02
                 (12) (.047)                                    $ .046*1.02
```

	(13)	(.046)	$ .045*1.02
	(14)	(.031)	$ .030*1.02
	(15)	(.029)	$ .028*1.02
	(16)	(.032)	$ .031*1.02
	(17)	(.058)	$ .057*1.02
	(18,19)	(.065)	$ .064*1.02
	(20)	(.053)	$ .052*1.02
	(21)	(.051)	$ .050*1.02
	(22)	(.056)	$ .055*1.02
	(23)	(.045)	$ .044*1.02
	(24)	(.028) ..	$ .027*1.02
I-GAIN-APR=D-SCH	(1)	(.022)	$ .024*.93
	(2)	(.020)	$ .022*.93
	(3,5)	(.020)	$ .021*.93
	(6)	(.024)	$ .026*.93
	(7)	(.035)	$ .038*.93
	(8)	(.055)	$ .059*.93
	(9)	(.052)	$ .056*.93
	(10)	(.056)	$ .060*.93
	(11)	(.055)	$ .059*.93
	(12)	(.043)	$ .046*.93
	(13)	(.042)	$ .045*.93
	(14)	(.030)	$ .030*.93
	(15)	(.026)	$ .028*.93
	(16)	(.029)	$ .031*.93
	(17)	(.053)	$ .057*.93
	(18,19)	(.060)	$ .064*.93
	(20)	(.048)	$ .052*.93
	(21)	(.047)	$ .050*.93
	(22)	(.051)	$ .055*.93
	(23)	(.041)	$ .044*.93
	(24)	(.025) ..	$ .027*.93
I-GAIN-MAY=D-SCH	(1)	(.020)	$ .024*.84
	(2)	(.018)	$ .022*.84
	(3,5)	(.018)	$ .021*.84
	(6)	(.022)	$ .026*.84
	(7)	(.032)	$ .038*.84
	(8)	(.050)	$ .059*.84
	(9)	(.047)	$ .056*.84
	(10)	(.050)	$ .060*.84
	(11)	(.050)	$ .059*.84
	(12)	(.039)	$ .046*.84
	(13)	(.038)	$ .045*.84
	(14)	(.025)	$ .030*.84
	(15)	(.024)	$ .028*.84
	(16)	(.026)	$ .031*.84
	(17)	(.048)	$ .057*.84
	(18,19)	(.054)	$ .064*.84
	(20)	(.044)	$ .052*.84
	(21)	(.042)	$ .050*.84
	(22)	(.046)	$ .055*.84
	(23)	(.037)	$ .044*.84
	(24)	(.023) ..	$ .027*.84
I-GAIN-JUN=D-SCH	(1)	(.019)	$ .024*.80
	(2)	(.018)	$ .022*.80
	(3,5)	(.017)	$ .021*.80
	(6)	(.021)	$ .026*.80
	(7)	(.030)	$ .038*.80
	(8)	(.047)	$ .059*.80
	(9)	(.045)	$ .056*.80
	(10)	(.048)	$ .060*.80
	(11)	(.047)	$ .059*.80
	(12)	(.037)	$ .046*.80
	(13)	(.036)	$ .045*.80
	(14)	(.024)	$ .030*.80
	(15)	(.022)	$ .028*.80
	(16)	(.025)	$ .031*.80
	(17)	(.046)	$ .057*.80

	(18,19)	(.051)	$ .064*.80
	(20)	(.042)	$ .052*.80
	(21)	(.040)	$ .050*.80
	(22)	(.044)	$ .055*.80
	(23)	(.035)	$ .044*.80
	(24)	(.022) ..	$ .027*.80
I-GAIN-JUL=D-SCH	(1)	(.020)	$ .024*.82
	(2)	(.018)	$ .022*.82
	(3,5)	(.017)	$ .021*.82
	(6)	(.021)	$ .026*.82
	(7)	(.031)	$ .038*.82
	(8)	(.048)	$ .059*.82
	(9)	(.046)	$ .056*.82
	(10)	(.049)	$ .060*.82
	(11)	(.048)	$ .059*.82
	(12)	(.038)	$ .046*.82
	(13)	(.037)	$ .045*.82
	(14)	(.025)	$ .030*.82
	(15)	(.023)	$ .028*.82
	(16)	(.025)	$ .031*.82
	(17)	(.047)	$ .057*.82
	(18,19)	(.052)	$ .064*.82
	(20)	(.043)	$ .052*.82
	(21)	(.041)	$ .050*.82
	(22)	(.045)	$ .055*.82
	(23)	(.036)	$ .044*.82
	(24)	(.022) ..	$ .027*.82
I-GAIN-AUG=D-SCH	(1)	(.021)	$ .024*.88
	(2)	(.019)	$ .022*.88
	(3,5)	(.018)	$ .021*.88
	(6)	(.023)	$ .026*.88
	(7)	(.033)	$ .038*.88
	(8)	(.052)	$ .059*.88
	(9)	(.049)	$ .056*.88
	(10)	(.053)	$ .060*.88
	(11)	(.052)	$ .059*.88
	(12)	(.040)	$ .046*.88
	(13)	(.040)	$ .045*.88
	(14)	(.026)	$ .030*.88
	(15)	(.025)	$ .028*.88
	(16)	(.028)	$ .031*.88
	(17)	(.050)	$ .057*.88
	(18,19)	(.056)	$ .064*.88
	(20)	(.046)	$ .052*.88
	(21)	(.044)	$ .050*.88
	(22)	(.048)	$ .055*.88
	(23)	(.039)	$ .044*.88
	(24)	(.024) ..	$ .027*.88
I-GAIN-SEP=D-SCH	(1)	(.024)	$ .024*.98
	(2)	(.022)	$ .022*.98
	(3,5)	(.021)	$ .021*.98
	(6)	(.026)	$ .026*.98
	(7)	(.037)	$ .038*.98
	(8)	(.058)	$ .059*.98
	(9)	(.055)	$ .056*.98
	(10)	(.059)	$ .060*.98
	(11)	(.058)	$ .059*.98
	(12)	(.045)	$ .046*.98
	(13)	(.044)	$ .045*.98
	(14)	(.029)	$ .030*.98
	(15)	(.027)	$ .028*.98
	(16)	(.030)	$ .031*.98
	(17)	(.056)	$ .057*.98
	(18,19)	(.063)	$ .064*.98
	(20)	(.051)	$ .052*.98
	(21)	(.049)	$ .050*.98
	(22)	(.054)	$ .055*.98
	(23)	(.043)	$ .044*.98

```
                 (24) (.026) ..                                    $ .027*.98

I-GAIN-OCT=D-SCH  (1) (.026)                                       $ .024*1.07
                  (2) (.024)                                       $ .022*1.07
                (3,5) (.022)                                       $ .021*1.07
                  (6) (.028)                                       $ .026*1.07
                  (7) (.041)                                       $ .038*1.07
                  (8) (.069)                                       $ .059*1.07
                  (9) (.060)                                       $ .056*1.07
                 (10) (.064)                                       $ .060*1.07
                 (11) (.069)                                       $ .059*1.07
                 (12) (.049)                                       $ .046*1.07
                 (13) (.048)                                       $ .045*1.07
                 (14) (.032)                                       $ .030*1.07
                 (15) (.030)                                       $ .028*1.07
                 (16) (.033)                                       $ .031*1.07
                 (17) (.061)                                       $ .057*1.07
               (18,19) (.068)                                      $ .064*1.07
                 (20) (.056)                                       $ .052*1.07
                 (21) (.054)                                       $ .050*1.07
                 (22) (.059)                                       $ .055*1.07
                 (23) (.047)                                       $ .044*1.07
                 (24) (.029) ..                                    $ .027*1.07

I-GAIN-NOV=D-SCH  (1) (.028)                                       $ .024*1.16
                  (2) (.026)                                       $ .022*1.16
                (3,5) (.024)                                       $ .021*1.16
                  (6) (.030)                                       $ .026*1.16
                  (7) (.044)                                       $ .038*1.16
                  (8) (.068)                                       $ .059*1.16
                  (9) (.065)                                       $ .056*1.16
                 (10) (.070)                                       $ .060*1.16
                 (11) (.068)                                       $ .059*1.16
                 (12) (.053)                                       $ .046*1.16
                 (13) (.052)                                       $ .045*1.16
                 (14) (.035)                                       $ .030*1.16
                 (15) (.032)                                       $ .028*1.16
                 (16) (.036)                                       $ .031*1.16
                 (17) (.066)                                       $ .057*1.16
               (18,19) (.074)                                      $ .064*1.16
                 (20) (.060)                                       $ .052*1.16
                 (21) (.058)                                       $ .050*1.16
                 (22) (.064)                                       $ .055*1.16
                 (23) (.051)                                       $ .044*1.16
                 (24) (.031) ..                                    $ .027*1.16

I-GAIN-DEC=D-SCH  (1) (.030)                                       $ .024*1.27
                  (2) (.028)                                       $ .022*1.27
                (3,5) (.027)                                       $ .021*1.27
                  (6) (.033)                                       $ .026*1.27
                  (7) (.048)                                       $ .038*1.27
                  (8) (.075)                                       $ .059*1.27
                  (9) (.071)                                       $ .056*1.27
                 (10) (.076)                                       $ .060*1.27
                 (11) (.075)                                       $ .059*1.27
                 (12) (.058)                                       $ .046*1.27
                 (13) (.057)                                       $ .045*1.27
                 (14) (.038)                                       $ .030*1.27
                 (15) (.036)                                       $ .028*1.27
                 (16) (.039)                                       $ .031*1.27
                 (17) (.072)                                       $ .057*1.27
               (18,19) (.081)                                      $ .064*1.27
                 (20) (.066)                                       $ .052*1.27
                 (21) (.064)                                       $ .050*1.27
                 (22) (.070)                                       $ .055*1.27
                 (23) (.056)                                       $ .044*1.27
                 (24) (.034) ..                                    $ .027*1.27

INT-LOADS=SCH  THRU JAN 31  (ALL) I-GAIN-JAN
               THRU FEB 28  (ALL) I-GAIN-FEB
               THRU MAR 31  (ALL) I-GAIN-MAR
```

```
                THRU APR 30  (ALL) I-GAIN-APR
                THRU MAY 31  (ALL) I-GAIN-MAY
                THRU JUN 30  (ALL) I-GAIN-JUN
                THRU JUL 31  (ALL) I-GAIN-JUL
                THRU AUG 31  (ALL) I-GAIN-AUG
                THRU SEP 30  (ALL) I-GAIN-SEP
                THRU OCT 31  (ALL) I-GAIN-OCT
                THRU NOV 30  (ALL) I-GAIN-NOV
                THRU DEC 31  (ALL) I-GAIN-DEC ..

MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.968) ..                    $ no roller shades
$ MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.595) ..                  $$ roller shades

$ ----------------------------- Materials ------------------------------
GYPBRD=MAT     COND=.1330  TH=.0417  DENS=50.00   S-H=0.20 ..
INS-R13=MAT    COND=.0224  TH=.2917  DENS=.71     S-H=.20 ..
STUCCO=MAT     COND=.4167  TH=.0729  DENS=166.00  S-H=.20 ..
WOOD=MAT       COND=.0667  TH=.2917  DENS=32.00   S-H=.33 ..
DAMPSOIL=MAT   COND=1.000  TH=1.000  DENS=115.00  S-H=.28 ..          $ typical damp soil
RUGNPAD=MAT    RES=2.08 ..                                            $ carpet and pad
CONCRETE=MAT   COND=.8000  TH=.3333  DENS=144.    S-H=.139 ..         $ 4" heavy concrete

$ ------------------------------ Layers -------------------------------
WOOD-FRM-R13=LA  MAT=(STUCCO,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
WOOD-FRM-R19=LA  MAT=(STUCCO,IN12,WOOD,GYPBRD)  I-F-R=0.68 ..
INT-WALL=LA      MAT=(GYPBRD,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
CEIL=LA          MAT=(PW04,AL33,GYPBRD)  I-F-R=.76 ..
ROOF-LA=LA       MAT=(AR02,AR01,PW04)  I-F-R=.76 ..
ROOF-R30=LA      MAT=(AR02,AR01,PW04,IN11,IN12)  I-F-R=.76 ..
ROOF-R38=LA      MAT=(AR02,AR01,PW04,IN12,IN12)  I-F-R=.76 ..
FSLABLDP=LA      MAT=(IN52,IN14,DAMPSOIL,CONCRETE,RUGNPAD)          $ slab, R-50, 1' dampsoil
                THICKNESS(1.0,.333,1.)  I-F-R=0.765 ..
BSLABLDP=LA     MAT=(IN52,IN14,DAMPSOIL,CONCRETE)                   $ slab, R-50, 1' dampsoil
                THICKNESS(1.0,.333)  I-F-R=0.765 ..

$ --------------------------- Construction ----------------------------
WALL1CON=CONS       LA=WOOD-FRM-R13  RO=3  ABS=0.7 ..
WALL2CON=CONS       LA=WOOD-FRM-R19  RO=3  ABS=0.7 ..
IWALL1CON=CONS      LA=INT-WALL  RO=3  ABS=0.7 ..
DOORCON=CONS        U=.33 ..
CEILCON=CONS        LA=CEIL ..
ROOFCON=CONS        LA=ROOF-LA ..
ROOF1CON=CONS       LA=ROOF-R30 ..
ROOF2CON=CONS       LA=ROOF-R38 ..
SLAB-CARP=CONS      LA=FSLABLDP ..
SLAB-NO-CARP=CONS   LA=BSLABLDP ..

##if #[run[] eqs f00 ]
       DEFINE  SPCW-CS=.0852  SPCM-CS=.0551  SPCY-CS=.0028            $ carpeted slab R-0
       SCCM-CS=.0418  SCCY-CS=.0224 ..
       DEFINE  SPCW-US=.1692  SPCM-US=.0737  SPCY-US=.0014            $ uncarpeted slab R-0
       SCCM-US=.0503  SCCY-US=.0238 ..
       SLAB-PERIM-CARP=CONS    U=.72 ..                               $ F2: carpeted R-0
       SLAB-PERIM-UNCARP=CONS    U=.90 ..                             $ F2: uncarpeted R-0
##elseif #[run[] eqs f02 ]
       DEFINE  SPCW-CS=.0291  SPCM-CS=.0685  SPCY-CS=.0100            $ carpeted slab R-5
       SCCM-CS=.0303  SCCY-CS=.0261 ..
       DEFINE  SPCW-US=.0600  SPCM-US=.0909  SPCY-US=.0086            $ uncarpeted slab R-5
       SCCM-US=.0366  SCCY-US=.0275 ..
       SLAB-PERIM-CARP=CONS    U=.53 ..                               $ F2: carpeted R-5
       SLAB-PERIM-UNCARP=CONS    U=.58 ..                             $ F2: uncarpeted R-5
##elseif #[run[] eqs f04 ]
       DEFINE  SPCW-CS=.0224  SPCM-CS=.0629  SPCY-CS=.0141            $ carpeted slab R-10
       SCCM-CS=.0255  SCCY-CS=.0278 ..
       DEFINE  SPCW-US=.0422  SPCM-US=.0912  SPCY-US=.0115            $ uncarpeted slab R-10
       SCCM-US=.0338  SCCY-US=.0284 ..
       SLAB-PERIM-CARP=CONS    U=.50 ..                               $ F2 carpeted R-10
       SLAB-PERIM-UNCARP=CONS    U=.53 ..                             $ F2 uncarpeted R-10
##endif

$ ----------------------------- Glazing -------------------------------
```

```
GARAGE=S  A=424  V=3390  S-C=GARAGE-SC ..
E-W  X=24.33  Y=-18.00  W=20.92  AZ=180 ..
  DOOR  X=2.42  H=7.00  W=16.00  CONS=DOORCON ..
E-W  X=45.25  Y=-18.00  W=20.25  AZ=90 ..
  DOOR  X=16.25  H=6.75  W=2.75  CONS=DOORCON ..
E-W  X=24.33  Y=2.25  W=20.25  AZ=270 ..
GCEILING=I-W  A=424  CONS=CEILCON  N-T=ATTIC ..
GSLAB-PERIM-S=E-W  AZ=180  W=20.92 ..
GSLAB-PERIM-E=E-W  X=45.25  Y=2.25  AZ=90  W=20.25 ..
GSLAB-PERIM-W=E-W  X=0  Y=37.25  AZ=270  W=20.25 ..
GSLAB-UNCARPETED=U-F  A=424  U-EFF=.0001  CONS=SLAB-NO-CARP ..


HOUSE=S  A=1809  V=14472  X=0  Y=0  S-C=HOUSE-SC ..
E-W  W=14.58  AZ=180 ..
  WI  X=.12  Y=1.58  H=6.00  W=14.33 ..
E-W  X=14.58  Y=2.25  W=9.25  AZ=180 ..
  DOOR  X=0.75  H=6.75  W=3.00  CONS=DOORCON ..
  WI  X=4.83  Y=1.67  H=4.92  W=3.83 ..
E-W  X=45.25  Y=2.25  W=39.21  AZ=90 ..
  WI  X=2.50  Y=2.83  H=3.92  W=6.92 ..
  WI  X=17.50  Y=2.83  H=3.92  W=6.92 ..
E-W  X=14.58  Y=0  W=2.00  AZ=90 ..
E-W  X=45.25  Y=41.46  W=45.30  AZ=0 ..
  WI  X=13.75  Y=5.33  H=1.83  W=2.92 ..
  WI  X=22.75  Y=.12  H=6.5  W=9.42 ..
  WI  X=33.5  Y=1.83  H=4.92  W=7.75 ..
E-W  X=0  Y=41.46  W=41.46  AZ=270 ..
  WI  X=4.71  Y=2.00  H=4.83  W=3.92 ..
  WI  X=16.13  Y=2.5  H=3.33  W=3.75 ..
  WI  X=20.46  Y=.12  H=6.83  W=11.17 ..
SET FOR I-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
..
I-W  A=167.36  N-T=GARAGE ..
SET FOR I-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
```

```
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
..
CEILING=I-W  A=1809  N-T=ATTIC ..
SET FOR E-W  H=1.00 ..
SLAB-PERIM-S1=E-W  CONS=SLAB-PERIM-CARP  AZ=180  W=14.58 ..
SLAB-PERIM-S3=E-W  CONS=SLAB-PERIM-UNCARP  X=14.58  Y=2.25  AZ=180  W=9.25 ..
SLAB-PERIM-E1=E-W  CONS=SLAB-PERIM-UNCARP  X=45.25  Y=2.25  AZ=90  W=21.19 ..
SLAB-PERIM-E2=E-W  CONS=SLAB-PERIM-CARP  X=45.25  Y=23.44  AZ=90  W=18.02 ..
SLAB-PERIM-E3=E-W  CONS=SLAB-PERIM-CARP  X=14.58  Y=0  AZ=90  W=2.00 ..
SLAB-PERIM-N1=E-W  CONS=SLAB-PERIM-CARP  X=45.25  Y=41.46  AZ=0  W=45.30 ..
SLAB-PERIM-W1=E-W  CONS=SLAB-PERIM-CARP  X=0  Y=41.46  AZ=270  W=41.46 ..
SLAB-CARPETED=U-F  A=1447  U-EFF=.0001  CONS=SLAB-CARP ..
SLAB-UNCARPETED=U-F  A=362  U-EFF=.0001  CONS=SLAB-NO-CARP ..


ATTIC=S  A=2233  V=6780  Z=8.80  S-C=ATTIC-SC ..
EGABLE=E-W  X=45.25  Y=8.75  H=4.59  W=17.5  AZ=90 ..
WGABLE=E-W LIKE EGABLE  X=0  Y=26.25  AZ=270 ..
SET FOR ROOF  CONS=ROOFCON  TILT=15.00 ..
SROOF-1=ROOF  X=0  Y=0  H=17.80  W=24.38  AZ=180  TILT=20.00 ..
SROOF-2=ROOF LIKE SROOF-1  X=24.33  Y=7.48  Z=2.723  H=9.84  W=20.92 ..
NROOF-1=ROOF  X=45.25  Y=41.46  H=19.10  W=45.25  AZ=0  TILT=12.00 ..
NROOF-2=ROOF LIKE NROOF-1  Y=22.76  Z=3.88  H=6.5  TILT=20.00 ..
GSROOF-1=ROOF  X=24.33  Y=-18.00  H=5.41  W=20.92  AZ=180  TILT=15.00 ..
GWROOF=ROOF  X=24.33  Y=7.48  H=10.80  W=20.25  AZ=270  TILT=15.00 ..
GEROOF=ROOF LIKE GWROOF  X=45.25  Y=-12.77  AZ=90 ..


LOADS-REPORT  SUMMARY=(LS-F) ..
$ LOADS-REPORT  SUMMARY=(LS-F)  HOURLY-DATA-SAVE = FORMATTED ..
$ LOADS-REPORT  VERIFICATION = (LV-I) ..
$ LOADS-REPORT  H-D-S=FORMATTED  R-F=HOURLY ..


END ..

FUNCTION  NAME=SHADING
          LEVEL=BUILDING    ..
  ASSIGN IMO=IMO IDAY=IDAY IHR=IHR DBT=DBT
         Y=SCHEDULE-NAME(MULTIPLIERS)  ..
CALCULATE   ..
      IF (IMO.EQ.1.AND.IDAY.EQ.1.AND.IHR.EQ.1) REWIND 52
```

```
      SC=0.968
      READ(52,1) xQNOW
    1 FORMAT(E14.7)
      IF (xQNOW.GT.0.0) SC=0.595
      Y=SC
      IF (IHR.EQ.15) PRINT 80,IMO,IDAY,IHR,DBT,xQNOW,Y
   80 FORMAT( ' SHADING POST ' ,3F4.0,F5.1,F10.2,F10.3)
      END
END-FUNCTION   ..

COMPUTE LOADS ..


INPUT SYSTEMS ..

$ --------------------- Set simulation conditions ----------------------
##set1 accap   32000                                                    $ measured on site
##set1 accfm   1000                                                     $ measured on site
$ ##set1 vent    sg
$ ##set1 hrpt no
$ ##set1 hrpt yes

DEFINE  HEATSET=68  SETBACK=60  COOLSET=78
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
   VTYPE=-1                                                            $ enthalpic venting
##else
   VTYPE=0                                                             $ no venting
##endif
        FHIR=1.4286  MAXTEMP=120                                       $ assumed furnace input
        HCAPF=-50000                                                   $ 77% eff.+10% ductloss
##set1 sen_cap = #[accap[] * 0.75 ]
        CTCAP=accap[]  CSCAP=sen_cap[]  ACCFM=accfm[]  CBF=0.9 ..

$ ----------------------------- Schedules ------------------------------
HTSCH      SCHEDULE  THRU DEC 31 (ALL)  (1,6) (SETBACK)
                                     (7,23) (HEATSET)
                                       (24) (SETBACK)  ..
WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (1.0) ..                  $ natural vent. always
$ WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (0.0) ..                $$ no natural vent.
VOPSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (VTYPE) ..
CTSCH      SCHEDULE  THRU DEC 31 (ALL) (1,24) (COOLSET) ..
VTSCH      SCHEDULE  THRU DEC 31 (ALL) (1,24) (72) ..                  $ vent schedule 72 F

$ ------------------------------- Zones --------------------------------
ZC1                ZONE-CONTROL
                             DESIGN-HEAT-T 68.
                             DESIGN-COOL-T 78.
                             COOL-TEMP-SCH CTSCH
                             HEAT-TEMP-SCH HTSCH
                             THERMOSTAT-TYPE TWO-POSITION ..
HOUSE              ZONE      ZONE-CONTROL ZC1 ..
ATTIC              ZONE      ZONE-TYPE UNCONDITIONED ..
GARAGE             ZONE      ZONE-TYPE UNCONDITIONED ..

$ ----------------------------- Systems ------------------------------
MAX-SUPPLY-T MAXTEMP
                 MIN-SUPPLY-T 50
                   ..
SYSAIR     SYSTEM-AIR
                 SUPPLY-CFM ACCFM
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
                 NATURAL-VENT-SCH VOPSCH
                 VENT-TEMP-SCH VTSCH
                 OPEN-VENT-SCH WINDOPER
  ##if #[vent[] eqs sg]
                 HOR-VENT-FRAC 0.0
                 FRAC-VENT-AREA=.0242                                  $ 10% window area open
                 VENT-METHOD S-G                                       $ discharge coeff. 0.6
                 MAX-VENT-RATE 20
  ##endif
  ##if #[vent[] eqs ach]                                               $ 10 ach when venting
```

```
                  NATURAL-VENT-AC 10
                  VENT-METHOD AIR-CHANGE
  ##endif
##endif
 ..

SYSEQP    SYSTEM-EQUIPMENT
                  COOLING-CAPACITY CTCAP
                  COOL-SH-CAP CSCAP
                  COIL-BF CBF
                  COMPRESSOR-TYPE SINGLE-SPEED
                  COOLING-EIR .39985
                  HEATING-CAPACITY HCAPF                          $ furnace specs
                  FURNACE-AUX 0.
                  FURNACE-HIR FHIR ..                             $ duct losses in FHIR


RESIDEN  SYSTEM  SYSTEM-TYPE RESYS
                    Z-N=(HOUSE,GARAGE,ATTIC)
                  SYSTEM-CONTROL SYSCONTRL
                  SYSTEM-AIR SYSAIR
                  SYSTEM-EQUIPMENT SYSEQP
                  HEAT-SOURCE FURNACE ..


$ -------------------------- System reports --------------------------
##if #[hrpt[] eqs yes]
HRSCH=SCH  THRU DEC 31 (ALL) (1,24) (1)  ..
RB-1=R-B  V-T=GLOBAL   V-L=(8) ..
RB-2=R-B  V-T=RESIDEN  V-L=(61,62) ..                             $ part-loads
DUMP=H-R  R-SCH=HRSCH  R-B=(RB-1,RB-2) ..
##endif

SYSTEMS-REPORT
##if #[hrpt[] eqs yes]
                 HOURLY-DATA-SAVE=FORMATTED
##endif

$ S=(SS-A,SS-B,SS-C,SS-F,SS-H,SS-I) ..
S=(SS-A,SS-H) ..
$ S=(SS-H) ..



END ..
COMPUTE  SYSTEMS ..


INPUT PLANT ..
PLANT-REPORT  S=(PS-B,PS-E,BEPS) ..
END ..

COMPUTE PLANT ..
STOP  ..
```

APPENDIX B: Listing of BDL File for the One-story House, Simplified Method

The listing below is the BDL file that describes the one-story house used as the subject of simulation in this study using a method of calculation of heat flow through slab-on-grade that is based on (and simplified relative to) the two-dimensional finite-difference method 2DFD. The graphic and textual descriptions of the subject house are found in Section 2: ONE-STORY HOUSE.

This BDL file contains the input for the Simplified Method and must be executed with the special version of DOE-2.1E that contains the Simplified Method. Attempts to execute it with the standard version of DOE-2.1E will fail.

```
$ --------------------- Set simulation conditions ----------------------
$ ##set1 run f00
$ ##set1 run f02
$ ##set1 run f04

$ ##set1 loc cz01
$ ##set1 loc cz02
$ ##set1 loc cz03
$ ##set1 loc cz04
$ ##set1 loc cz05
$ ##set1 loc cz06
$ ##set1 loc cz07
$ ##set1 loc cz08
$ ##set1 loc cz09
$ ##set1 loc cz10
$ ##set1 loc cz11
$ ##set1 loc cz12
$ ##set1 loc cz13
$ ##set1 loc cz14
$ ##set1 loc cz15
$ ##set1 loc cz16

$ ##set1 fndtn standard
$ ##set1 fndtn simplifd
$ ----------------------------------------------------------------------


INPUT LOADS ..
ABORT ERRORS ..
LIST WARNINGS ..


TITLE LINE-1 = *Typical One-story House*

##if #[run[] eqs f00 ]
      LINE-2 = *            No slab insulation*
##elseif #[run[] eqs f02 ]
      LINE-2 = *           Slab insulation R-5*
##elseif #[run[] eqs f04 ]
      LINE-2 = *           Slab insulation R-10*
##endif

##if #[fndtn[] eqs standard ]
      LINE-3 = *Slab: STANDARD calculation*
##elseif #[fndtn[] eqs simplifd ]
      LINE-3 = *Slab: SIMPLIFIED METHOD*
##endif

##if #[loc[] eqs cz01 ]
      LINE-4 = *              cz01 (Arcata)*
##elseif #[loc[] eqs cz02 ]
      LINE-4 = *            cz02 (Sta. Rosa)*
##elseif #[loc[] eqs cz03 ]
     LINE-4 = *             cz03 (Oakland)*
##elseif #[loc[] eqs cz04 ]
      LINE-4 = *            cz04 (Sunnyvale)*
```

```
##elseif #[loc[] eqs cz05 ]
      LINE-4 = *            cz05 (Sta. Maria)*
##elseif #[loc[] eqs cz06 ]
      LINE-4 = *            cz06 (Long Beach)*
##elseif #[loc[] eqs cz07 ]
      LINE-4 = *            cz07 (San Diego)*
##elseif #[loc[] eqs cz08 ]
      LINE-4 = *             cz08 (El Toro)*
##elseif #[loc[] eqs cz09 ]
      LINE-4 = *             cz09 (Pasadena)*
##elseif #[loc[] eqs cz10 ]
      LINE-4 = *            cz10 (Riverside)*
##elseif #[loc[] eqs cz11 ]
      LINE-4 = *            cz11 (Red Bluff)*
##elseif #[loc[] eqs cz12 ]
      LINE-4 = *            cz12 (Sacramento)*
##elseif #[loc[] eqs cz13 ]
      LINE-4 = *              cz13 (Fresno)*
##elseif #[loc[] eqs cz14 ]
      LINE-4 = *            cz14 (China Lake)*
##elseif #[loc[] eqs cz15 ]
      LINE-4 = *            cz15 (El Centro)*
##elseif #[loc[] eqs cz16 ]
      LINE-4 = *            cz16 (Mt. Shasta)*
##endif

      LINE-5 = *  input file: cec_house7_simp-method.inp* ..


RUN-PERIOD JAN 1, 1991 THRU DEC 31, 1991 ..


BUILDING-LOCATION
##if #[loc[] eqs cz01 ]
        LAT=40.8 LON=124.2  ALT=218
##elseif #[loc[] eqs cz02 ]
        LAT=38.4 LON=122.7  ALT=167
##elseif #[loc[] eqs cz03 ]
        LAT=37.7 LON=122.2  ALT=6
##elseif #[loc[] eqs cz04 ]
        LAT=37.4 LON=122.1  ALT=97
##elseif #[loc[] eqs cz05 ]
        LAT=34.9 LON=120.4  ALT=236
##elseif #[loc[] eqs cz06 ]
        LAT=33.8 LON=118.2  ALT=25
##elseif #[loc[] eqs cz07 ]
        LAT=32.7 LON=117.2  ALT=13
##elseif #[loc[] eqs cz08 ]
        LAT=33.6 LON=117.7  ALT=380
##elseif #[loc[] eqs cz09 ]
        LAT=34.2 LON=117.2  ALT=864
##elseif #[loc[] eqs cz10 ]
        LAT=34.1 LON=117.3  ALT=840
##elseif #[loc[] eqs cz11 ]
        LAT=40.2 LON=122.2  ALT=342
##elseif #[loc[] eqs cz12 ]
        LAT=38.5 LON=121.5  ALT=17
##elseif #[loc[] eqs cz13 ]
        LAT=36.8 LON=119.7  ALT=326
##elseif #[loc[] eqs cz14 ]
        LAT=35.7 LON=117.7  ALT=2220
##elseif #[loc[] eqs cz15 ]
        LAT=33.0 LON=115.6  ALT=-30
##elseif #[loc[] eqs cz16 ]
        LAT=41.3 LON=122.3  ALT=3535
##endif
                  HOL=YES  D-S=YES  AZ=0  T-Z=8 ..


$ -------------------------- Internal loads ---------------------------
I-GAIN-JAN=D-SCH  (1) (.029)                                    $ .024*1.19
```

	(2)	(.026)	$ .022*1.19
	(3,5)	(.025)	$ .021*1.19
	(6)	(.031)	$ .026*1.19
	(7)	(.045)	$ .038*1.19
	(8)	(.070)	$ .059*1.19
	(9)	(.067)	$ .056*1.19
	(10)	(.071)	$ .060*1.19
	(11)	(.070)	$ .059*1.19
	(12)	(.055)	$ .046*1.19
	(13)	(.054)	$ .045*1.19
	(14)	(.036)	$ .030*1.19
	(15)	(.033)	$ .028*1.19
	(16)	(.037)	$ .031*1.19
	(17)	(.068)	$ .057*1.19
	(18,19)	(.076)	$ .064*1.19
	(20)	(.062)	$ .052*1.19
	(21)	(.060)	$ .050*1.19
	(22)	(.065)	$ .055*1.19
	(23)	(.052)	$ .044*1.19
	(24)	(.032) ..	$ .027*1.19
I-GAIN-FEB=D-SCH	(1)	(.027)	$ .024*1.11
	(2)	(.024)	$ .022*1.11
	(3,5)	(.023)	$ .021*1.11
	(6)	(.029)	$ .026*1.11
	(7)	(.042)	$ .038*1.11
	(8)	(.065)	$ .059*1.11
	(9)	(.062)	$ .056*1.11
	(10)	(.067)	$ .060*1.11
	(11)	(.065)	$ .059*1.11
	(12)	(.051)	$ .046*1.11
	(13)	(.050)	$ .045*1.11
	(14)	(.033)	$ .030*1.11
	(15)	(.031)	$ .028*1.11
	(16)	(.034)	$ .031*1.11
	(17)	(.063)	$ .057*1.11
	(18,19)	(.071)	$ .064*1.11
	(20)	(.058)	$ .052*1.11
	(21)	(.056)	$ .050*1.11
	(22)	(.061)	$ .055*1.11
	(23)	(.049)	$ .044*1.11
	(24)	(.030) ..	$ .027*1.11
I-GAIN-MAR=D-SCH	(1)	(.024)	$ .024*1.02
	(2)	(.022)	$ .022*1.02
	(3,5)	(.021)	$ .021*1.02
	(6)	(.026)	$ .026*1.02
	(7)	(.039)	$ .038*1.02
	(8)	(.060)	$ .059*1.02
	(9)	(.057)	$ .056*1.02
	(10)	(.061)	$ .060*1.02
	(11)	(.060)	$ .059*1.02
	(12)	(.047)	$ .046*1.02
	(13)	(.046)	$ .045*1.02
	(14)	(.031)	$ .030*1.02
	(15)	(.029)	$ .028*1.02
	(16)	(.032)	$ .031*1.02
	(17)	(.058)	$ .057*1.02
	(18,19)	(.065)	$ .064*1.02
	(20)	(.053)	$ .052*1.02
	(21)	(.051)	$ .050*1.02
	(22)	(.056)	$ .055*1.02
	(23)	(.045)	$ .044*1.02
	(24)	(.028) ..	$ .027*1.02
I-GAIN-APR=D-SCH	(1)	(.022)	$ .024*.93
	(2)	(.020)	$ .022*.93
	(3,5)	(.020)	$ .021*.93
	(6)	(.024)	$ .026*.93
	(7)	(.035)	$ .038*.93
	(8)	(.055)	$ .059*.93

	(9)	(.052)	$ .056*.93
	(10)	(.056)	$ .060*.93
	(11)	(.055)	$ .059*.93
	(12)	(.043)	$ .046*.93
	(13)	(.042)	$ .045*.93
	(14)	(.030)	$ .030*.93
	(15)	(.026)	$ .028*.93
	(16)	(.029)	$ .031*.93
	(17)	(.053)	$ .057*.93
	(18,19)	(.060)	$ .064*.93
	(20)	(.048)	$ .052*.93
	(21)	(.047)	$ .050*.93
	(22)	(.051)	$ .055*.93
	(23)	(.041)	$ .044*.93
	(24)	(.025) ..	$ .027*.93
I-GAIN-MAY=D-SCH	(1)	(.020)	$ .024*.84
	(2)	(.018)	$ .022*.84
	(3,5)	(.018)	$ .021*.84
	(6)	(.022)	$ .026*.84
	(7)	(.032)	$ .038*.84
	(8)	(.050)	$ .059*.84
	(9)	(.047)	$ .056*.84
	(10)	(.050)	$ .060*.84
	(11)	(.050)	$ .059*.84
	(12)	(.039)	$ .046*.84
	(13)	(.038)	$ .045*.84
	(14)	(.025)	$ .030*.84
	(15)	(.024)	$ .028*.84
	(16)	(.026)	$ .031*.84
	(17)	(.048)	$ .057*.84
	(18,19)	(.054)	$ .064*.84
	(20)	(.044)	$ .052*.84
	(21)	(.042)	$ .050*.84
	(22)	(.046)	$ .055*.84
	(23)	(.037)	$ .044*.84
	(24)	(.023) ..	$ .027*.84
I-GAIN-JUN=D-SCH	(1)	(.019)	$ .024*.80
	(2)	(.018)	$ .022*.80
	(3,5)	(.017)	$ .021*.80
	(6)	(.021)	$ .026*.80
	(7)	(.030)	$ .038*.80
	(8)	(.047)	$ .059*.80
	(9)	(.045)	$ .056*.80
	(10)	(.048)	$ .060*.80
	(11)	(.047)	$ .059*.80
	(12)	(.037)	$ .046*.80
	(13)	(.036)	$ .045*.80
	(14)	(.024)	$ .030*.80
	(15)	(.022)	$ .028*.80
	(16)	(.025)	$ .031*.80
	(17)	(.046)	$ .057*.80
	(18,19)	(.051)	$ .064*.80
	(20)	(.042)	$ .052*.80
	(21)	(.040)	$ .050*.80
	(22)	(.044)	$ .055*.80
	(23)	(.035)	$ .044*.80
	(24)	(.022) ..	$ .027*.80
I-GAIN-JUL=D-SCH	(1)	(.020)	$ .024*.82
	(2)	(.018)	$ .022*.82
	(3,5)	(.017)	$ .021*.82
	(6)	(.021)	$ .026*.82
	(7)	(.031)	$ .038*.82
	(8)	(.048)	$ .059*.82
	(9)	(.046)	$ .056*.82
	(10)	(.049)	$ .060*.82
	(11)	(.048)	$ .059*.82
	(12)	(.038)	$ .046*.82
	(13)	(.037)	$ .045*.82

	(14)	(.025)	$ .030*.82
	(15)	(.023)	$ .028*.82
	(16)	(.025)	$ .031*.82
	(17)	(.047)	$ .057*.82
	(18,19)	(.052)	$ .064*.82
	(20)	(.043)	$ .052*.82
	(21)	(.041)	$ .050*.82
	(22)	(.045)	$ .055*.82
	(23)	(.036)	$ .044*.82
	(24)	(.022) ..	$ .027*.82
I-GAIN-AUG=D-SCH	(1)	(.021)	$ .024*.88
	(2)	(.019)	$ .022*.88
	(3,5)	(.018)	$ .021*.88
	(6)	(.023)	$ .026*.88
	(7)	(.033)	$ .038*.88
	(8)	(.052)	$ .059*.88
	(9)	(.049)	$ .056*.88
	(10)	(.053)	$ .060*.88
	(11)	(.052)	$ .059*.88
	(12)	(.040)	$ .046*.88
	(13)	(.040)	$ .045*.88
	(14)	(.026)	$ .030*.88
	(15)	(.025)	$ .028*.88
	(16)	(.028)	$ .031*.88
	(17)	(.050)	$ .057*.88
	(18,19)	(.056)	$ .064*.88
	(20)	(.046)	$ .052*.88
	(21)	(.044)	$ .050*.88
	(22)	(.048)	$ .055*.88
	(23)	(.039)	$ .044*.88
	(24)	(.024) ..	$ .027*.88
I-GAIN-SEP=D-SCH	(1)	(.024)	$ .024*.98
	(2)	(.022)	$ .022*.98
	(3,5)	(.021)	$ .021*.98
	(6)	(.026)	$ .026*.98
	(7)	(.037)	$ .038*.98
	(8)	(.058)	$ .059*.98
	(9)	(.055)	$ .056*.98
	(10)	(.059)	$ .060*.98
	(11)	(.058)	$ .059*.98
	(12)	(.045)	$ .046*.98
	(13)	(.044)	$ .045*.98
	(14)	(.029)	$ .030*.98
	(15)	(.027)	$ .028*.98
	(16)	(.030)	$ .031*.98
	(17)	(.056)	$ .057*.98
	(18,19)	(.063)	$ .064*.98
	(20)	(.051)	$ .052*.98
	(21)	(.049)	$ .050*.98
	(22)	(.054)	$ .055*.98
	(23)	(.043)	$ .044*.98
	(24)	(.026) ..	$ .027*.98
I-GAIN-OCT=D-SCH	(1)	(.026)	$ .024*1.07
	(2)	(.024)	$ .022*1.07
	(3,5)	(.022)	$ .021*1.07
	(6)	(.028)	$ .026*1.07
	(7)	(.041)	$ .038*1.07
	(8)	(.069)	$ .059*1.07
	(9)	(.060)	$ .056*1.07
	(10)	(.064)	$ .060*1.07
	(11)	(.069)	$ .059*1.07
	(12)	(.049)	$ .046*1.07
	(13)	(.048)	$ .045*1.07
	(14)	(.032)	$ .030*1.07
	(15)	(.030)	$ .028*1.07
	(16)	(.033)	$ .031*1.07
	(17)	(.061)	$ .057*1.07
	(18,19)	(.068)	$ .064*1.07

```
                  (20) (.056)                                          $ .052*1.07
                  (21) (.054)                                          $ .050*1.07
                  (22) (.059)                                          $ .055*1.07
                  (23) (.047)                                          $ .044*1.07
                  (24) (.029) ..                                       $ .027*1.07

 I-GAIN-NOV=D-SCH  (1) (.028)                                          $ .024*1.16
                   (2) (.026)                                          $ .022*1.16
                 (3,5) (.024)                                          $ .021*1.16
                   (6) (.030)                                          $ .026*1.16
                   (7) (.044)                                          $ .038*1.16
                   (8) (.068)                                          $ .059*1.16
                   (9) (.065)                                          $ .056*1.16
                  (10) (.070)                                          $ .060*1.16
                  (11) (.068)                                          $ .059*1.16
                  (12) (.053)                                          $ .046*1.16
                  (13) (.052)                                          $ .045*1.16
                  (14) (.035)                                          $ .030*1.16
                  (15) (.032)                                          $ .028*1.16
                  (16) (.036)                                          $ .031*1.16
                  (17) (.066)                                          $ .057*1.16
                (18,19) (.074)                                         $ .064*1.16
                  (20) (.060)                                          $ .052*1.16
                  (21) (.058)                                          $ .050*1.16
                  (22) (.064)                                          $ .055*1.16
                  (23) (.051)                                          $ .044*1.16
                  (24) (.031) ..                                       $ .027*1.16

 I-GAIN-DEC=D-SCH  (1) (.030)                                          $ .024*1.27
                   (2) (.028)                                          $ .022*1.27
                 (3,5) (.027)                                          $ .021*1.27
                   (6) (.033)                                          $ .026*1.27
                   (7) (.048)                                          $ .038*1.27
                   (8) (.075)                                          $ .059*1.27
                   (9) (.071)                                          $ .056*1.27
                  (10) (.076)                                          $ .060*1.27
                  (11) (.075)                                          $ .059*1.27
                  (12) (.058)                                          $ .046*1.27
                  (13) (.057)                                          $ .045*1.27
                  (14) (.038)                                          $ .030*1.27
                  (15) (.036)                                          $ .028*1.27
                  (16) (.039)                                          $ .031*1.27
                  (17) (.072)                                          $ .057*1.27
                (18,19) (.081)                                         $ .064*1.27
                  (20) (.066)                                          $ .052*1.27
                  (21) (.064)                                          $ .050*1.27
                  (22) (.070)                                          $ .055*1.27
                  (23) (.056)                                          $ .044*1.27
                  (24) (.034) ..                                       $ .027*1.27

 INT-LOADS=SCH  THRU JAN 31  (ALL) I-GAIN-JAN
                THRU FEB 28  (ALL) I-GAIN-FEB
                THRU MAR 31  (ALL) I-GAIN-MAR
                THRU APR 30  (ALL) I-GAIN-APR
                THRU MAY 31  (ALL) I-GAIN-MAY
                THRU JUN 30  (ALL) I-GAIN-JUN
                THRU JUL 31  (ALL) I-GAIN-JUL
                THRU AUG 31  (ALL) I-GAIN-AUG
                THRU SEP 30  (ALL) I-GAIN-SEP
                THRU OCT 31  (ALL) I-GAIN-OCT
                THRU NOV 30  (ALL) I-GAIN-NOV
                THRU DEC 31  (ALL) I-GAIN-DEC ..

 MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.968) ..                 $ no roller shades
 $ MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.595) ..               $$ roller shades


 $ ----------------------------- Materials -----------------------------
 GYPBRD=MAT     COND=.1330  TH=.0417  DENS=50.00    S-H=0.20 ..
 INS-R13=MAT    COND=.0224  TH=.2917  DENS=.71      S-H=.20 ..
 STUCCO=MAT     COND=.4167  TH=.0729  DENS=166.00   S-H=.20 ..
```

```
WOOD=MAT       COND=.0667  TH=.2917  DENS=32.00   S-H=.33 ..
DAMPSOIL=MAT   COND=1.000  TH=1.000  DENS=115.00  S-H=.28 ..                $ typical damp soil
RUGNPAD=MAT    RES=2.08 ..                                                  $ carpet and pad
CONCRETE=MAT   COND=.8000  TH=.3333  DENS=144.    S-H=.139 ..               $ 4" heavy concrete

$ ------------------------------ Layers -------------------------------
WOOD-FRM-R13=LA  MAT=(STUCCO,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
WOOD-FRM-R19=LA  MAT=(STUCCO,IN12,WOOD,GYPBRD)  I-F-R=0.68 ..
INT-WALL=LA      MAT=(GYPBRD,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
CEIL=LA          MAT=(PW04,AL33,GYPBRD)  I-F-R=.76 ..
ROOF-LA=LA       MAT=(AR02,AR01,PW04)  I-F-R=.76 ..
ROOF-R30=LA      MAT=(AR02,AR01,PW04,IN11,IN12)  I-F-R=.76 ..
ROOF-R38=LA      MAT=(AR02,AR01,PW04,IN12,IN12)  I-F-R=.76 ..
FSLABLDP=LA      MAT=(DAMPSOIL,CONCRETE,RUGNPAD)                           $ slab, 1'-0" damp soil
                THICKNESS(1.0,.333,1.)  I-F-R=0.765 ..
BSLABLDP=LA     MAT=(DAMPSOIL,CONCRETE)                                    $ slab, 1'-0" damp soil
                THICKNESS(1.0,.333)  I-F-R=0.765 ..

$ --------------------------- Construction ----------------------------
WALL1CON=CONS       LA=WOOD-FRM-R13  RO=3  ABS=0.7 ..
WALL2CON=CONS       LA=WOOD-FRM-R19  RO=3  ABS=0.7 ..
IWALL1CON=CONS      LA=INT-WALL  RO=3  ABS=0.7 ..
DOORCON=CONS        U=.33 ..
CEILCON=CONS        LA=CEIL ..
ROOFCON=CONS        LA=ROOF-LA ..
ROOF1CON=CONS       LA=ROOF-R30 ..
ROOF2CON=CONS       LA=ROOF-R38 ..
SLAB-CARP=CONS      LA=FSLABLDP ..
SLAB-NO-CARP=CONS   LA=BSLABLDP ..

##if #[run[] eqs f00 ]
        DEFINE  SPCW-CS=.0852  SPCM-CS=.0551  SPCY-CS=.0028               $ carpeted slab R-0
        SCCM-CS=.0418  SCCY-CS=.0224 ..
        DEFINE  SPCW-US=.1692  SPCM-US=.0737  SPCY-US=.0014               $ uncarpeted slab R-0
        SCCM-US=.0503  SCCY-US=.0238 ..
##elseif #[run[] eqs f02 ]
        DEFINE  SPCW-CS=.0291  SPCM-CS=.0685  SPCY-CS=.0100               $ carpeted slab R-5
        SCCM-CS=.0303  SCCY-CS=.0261 ..
        DEFINE  SPCW-US=.0600  SPCM-US=.0909  SPCY-US=.0086               $ uncarpeted slab R-5
        SCCM-US=.0366  SCCY-US=.0275 ..
##elseif #[run[] eqs f04 ]
        DEFINE  SPCW-CS=.0224  SPCM-CS=.0629  SPCY-CS=.0141               $ carpeted slab R-10
        SCCM-CS=.0255  SCCY-CS=.0278 ..
        DEFINE  SPCW-US=.0422  SPCM-US=.0912  SPCY-US=.0115               $ uncarpeted slab R-10
        SCCM-US=.0338  SCCY-US=.0284 ..
##endif

$ ----------------------------- Glazing ------------------------------
WINDOW2ATB=G-T  G-T-C=2000 ..

$ ------------------------- Shading from eaves -------------------------
SEAVE-1=B-S X=0  Y=-2.33  Z=7.95  H=2.48  W=14.58  AZ=180  TILT=20.00 ..
SEAVE-2=B-S LIKE SEAVE-1  X=14.58  Z=7.95  H=4.80  W=9.75 ..
SWEAVE=B-S  X=-1.00 Y=-2.33 Z=7.95  H=20.25 W=1.00  AZ=180 TILT=20.00 ..
SEEAVE=B-S LIKE SWEAVE  X=45.25  Y=7.48  Z=11.52  H=9.84 ..
NEAVE-1=B-S  X=46.25 Y=44.46  Z=7.98  H=3.07 W=47.25  AZ=0 TILT=12.00 ..
NEEAVE-1=B-S LIKE NEAVE-1  Y=22.76  Z=12.68  H=6.5 W=1.00  TILT=20.00 ..
NEEAVE-2=B-S  X=46.25 Y=41.46 Z=8.80  H=19.10 W=1.00  AZ=0 TILT=12.00 ..
NWEAVE-1=B-S LIKE NEEAVE-1  X=0 ..
NWEAVE-2=B-S LIKE NEEAVE-2  X=0 ..
GSEAVE-1=B-S X=21.87 Y=-20.33 Z=7.95 H=2.48 W=25.59 AZ=180 TILT=15.00 ..
GWEAVE=B-S  X=21.87 Y=-2.33 Z=7.95  H=2.48 W=15.67  AZ=270 TILT=15.00 ..
GEEAVE=B-S LIKE GWEAVE  X=47.58  Y=-18.00  W=25.48  AZ=90 ..

$ ------------------------- Space conditions -------------------------
SET FOR S-C  SOURCE-SCHEDULE=INT-LOADS  SOURCE-BTU/HR=47135  F-W=0   $ total internal gain:
             S-S=1.0  S-L=0 ..                                       $ 20,000 Btu/day +
                                                                     $ (1,809 sqft. X 15 Btu/d)=
                                                                     $ 47135 Btu/d

HOUSE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0005
```

```
              TEMPERATURE=(78)  ZONE-TYPE=CONDITIONED ..

ATTIC-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .00167  SOURCE-BTU/HR=0     $ 1ft2 vents/450ft2 fl.
              ZONE-TYPE=UNCONDITIONED ..                                   $ 0.75 discharge eff.
                                                                           $ (0.75/450 = .00167)

GARAGE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0015  SOURCE-BTU/HR=0    $ (E-L-F cond. space)X3
              ZONE-TYPE=UNCONDITIONED ..

$ ------------------------- Space descriptions -------------------------
SET FOR WI  G-T=WINDOW2ATB  FRAME-WIDTH 0.125 S-SCH=MULTIPLIERS ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
             H=8.0 ..


GARAGE=S  A=424  V=3390  S-C=GARAGE-SC ..
E-W  X=24.33  Y=-18.00  W=20.92  AZ=180 ..
  DOOR  X=2.42  H=7.00  W=16.00  CONS=DOORCON ..
E-W  X=45.25  Y=-18.00  W=20.25  AZ=90 ..
  DOOR  X=16.25  H=6.75  W=2.75  CONS=DOORCON ..
E-W  X=24.33  Y=2.25  W=20.25  AZ=270 ..
GCEILING=I-W  A=424  CONS=CEILCON  N-T=ATTIC ..
U-F  AZ=0  TILT=180  CONS=SLAB-NO-CARP  AREA=424
     PERIM-EXPOSED=61.42  PERIM-COND-WEEK=SPCW-US
     PERIM-COND-MONTH=SPCM-US  PERIM-COND-YEAR=SPCY-US
     CORE-COND-MONTH=SCCM-US  CORE-COND-YEAR=SCCY-US ..


HOUSE=S  A=1809  V=14472  X=0  Y=0  S-C=HOUSE-SC ..
E-W  W=14.58  AZ=180 ..
  WI  X=.12  Y=1.58  H=6.00  W=14.33 ..
E-W  X=14.58  Y=2.25  W=9.25  AZ=180 ..
  DOOR  X=0.75  H=6.75  W=3.00  CONS=DOORCON ..
  WI  X=4.83  Y=1.67  H=4.92  W=3.83 ..
E-W  X=45.25  Y=2.25  W=39.21  AZ=90 ..
  WI  X=2.50  Y=2.83  H=3.92  W=6.92 ..
  WI  X=17.50  Y=2.83  H=3.92  W=6.92 ..
E-W  X=14.58  Y=0  W=2.00  AZ=90 ..
```

```
E-W  X=45.25  Y=41.46  W=45.30  AZ=0 ..
  WI  X=13.75  Y=5.33  H=1.83  W=2.92 ..
  WI  X=22.75  Y=.12  H=6.5  W=9.42 ..
  WI  X=33.5  Y=1.83  H=4.92  W=7.75 ..
E-W   X=0  Y=41.46  W=41.46  AZ=270 ..
  WI  X=4.71  Y=2.00  H=4.83  W=3.92 ..
  WI  X=16.13  Y=2.5  H=3.33  W=3.75 ..
  WI  X=20.46  Y=.12  H=6.83  W=11.17 ..
SET FOR I-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
..
I-W  A=167.36  N-T=GARAGE ..
SET FOR I-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
```

```
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
..
CEILING=I-W  A=1809  N-T=ATTIC ..
U-F  AZ=0  TILT=180  CONS=SLAB-CARP  AREA=1447
     PERIM-EXPOSED=121.74  PERIM-COND-WEEK=SPCW-CS
     PERIM-COND-MONTH=SPCM-CS  PERIM-COND-YEAR=SPCY-CS
     CORE-COND-MONTH=SCCM-CS  CORE-COND-YEAR=SCCY-CS ..
U-F  AZ=0  TILT=180  CONS=SLAB-NO-CARP  AREA=362
     PERIM-EXPOSED=30.44  PERIM-COND-WEEK=SPCW-US
     PERIM-COND-MONTH=SPCM-US  PERIM-COND-YEAR=SPCY-US
     CORE-COND-MONTH=SCCM-US  CORE-COND-YEAR=SCCY-US ..


ATTIC=S  A=2233  V=6780  Z=8.80  S-C=ATTIC-SC ..
EGABLE=E-W  X=45.25  Y=8.75  H=4.59  W=17.5  AZ=90 ..
WGABLE=E-W LIKE EGABLE  X=0  Y=26.25  AZ=270 ..
SET FOR ROOF  CONS=ROOFCON  TILT=15.00 ..
SROOF-1=ROOF  X=0  Y=0  H=17.80  W=24.38  AZ=180  TILT=20.00 ..
SROOF-2=ROOF LIKE SROOF-1  X=24.33  Y=7.48  Z=2.723  H=9.84  W=20.92 ..
NROOF-1=ROOF  X=45.25  Y=41.46  H=19.10  W=45.25  AZ=0  TILT=12.00 ..
NROOF-2=ROOF LIKE NROOF-1  Y=22.76  Z=3.88  H=6.5  TILT=20.00 ..
GSROOF-1=ROOF  X=24.33  Y=-18.00  H=5.41  W=20.92  AZ=180  TILT=15.00 ..
GWROOF=ROOF  X=24.33  Y=7.48  H=10.80  W=20.25  AZ=270  TILT=15.00 ..
GEROOF=ROOF LIKE GWROOF  X=45.25  Y=-12.77  AZ=90 ..


LOADS-REPORT  SUMMARY=(LS-F) ..
$ LOADS-REPORT  SUMMARY=(LS-F)  HOURLY-DATA-SAVE = FORMATTED ..
$ LOADS-REPORT  VERIFICATION = (LV-I) ..
$ LOADS-REPORT  H-D-S=FORMATTED  R-F=HOURLY ..


END ..
COMPUTE LOADS ..


INPUT SYSTEMS ..

$ -------------------- Set simulation conditions ----------------------
##set1 accap   32000                                                  $ measured on site
##set1 accfm   1000                                                   $ measured on site
$ ##set1 vent    sg
$ ##set1 hrpt no
$ ##set1 hrpt yes

DEFINE  HEATSET=68  SETBACK=60  COOLSET=78
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
   VTYPE=-1                                                          $ enthalpic venting
##else
   VTYPE=0                                                           $ no venting
##endif
        FHIR=1.4286  MAXTEMP=120                                     $ assumed furnace input
        HCAPF=-50000                                                 $ 77% eff.+10% ductloss
##set1 sen_cap = #[accap[] * 0.75 ]
        CTCAP=accap[]  CSCAP=sen_cap[]  ACCFM=accfm[]  CBF=0.9 ..


SUBR-FUNCTIONS  RESYS-5=*PRTAC* ..


$ ----------------------------- Schedules ------------------------------
HTSCH     SCHEDULE  THRU DEC 31 (ALL)  (1,6)  (SETBACK)
                                     (7,23)  (HEATSET)
                                       (24)  (SETBACK)  ..
WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (1.0) ..                $ natural vent. always
```

```
$ WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (0.0) ..                    $$ no natural vent.
VOPSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (VTYPE) ..
CTSCH      SCHEDULE  THRU DEC 31 (ALL) (1,24) (COOLSET) ..
VTSCH      SCHEDULE  THRU DEC 31 (ALL) (1,24) (72) ..                     $ vent schedule 72 F

$ ------------------------------ Zones --------------------------------
ZC1                ZONE-CONTROL
                            DESIGN-HEAT-T 68.
                            DESIGN-COOL-T 78.
                            COOL-TEMP-SCH CTSCH
                            HEAT-TEMP-SCH HTSCH
                            THERMOSTAT-TYPE TWO-POSITION ..
HOUSE              ZONE     ZONE-CONTROL ZC1 ..
ATTIC              ZONE     ZONE-TYPE UNCONDITIONED ..
GARAGE             ZONE     ZONE-TYPE UNCONDITIONED ..

$ ----------------------------- Systems -----------------------------
SYSCONTRL SYSTEM-CONTROL
                MAX-SUPPLY-T MAXTEMP
                MIN-SUPPLY-T 50
                  ..
SYSAIR     SYSTEM-AIR
                SUPPLY-CFM ACCFM
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
                NATURAL-VENT-SCH VOPSCH
                VENT-TEMP-SCH VTSCH
                OPEN-VENT-SCH WINDOPER
  ##if #[vent[] eqs sg]
                HOR-VENT-FRAC 0.0
                FRAC-VENT-AREA=.0242                                     $ 10% gross win. A open
                VENT-METHOD S-G                                          $ discharge coeff. 0.6
                MAX-VENT-RATE 20
  ##endif
  ##if #[vent[] eqs ach]                                                 $ 10 ach when venting
                NATURAL-VENT-AC 10
                VENT-METHOD AIR-CHANGE
  ##endif
##endif
 ..

SYSEQP     SYSTEM-EQUIPMENT
                COOLING-CAPACITY CTCAP
                COOL-SH-CAP CSCAP
                COIL-BF CBF
                COMPRESSOR-TYPE SINGLE-SPEED
                COOLING-EIR .39985
                HEATING-CAPACITY HCAPF                                   $ furnace specs
                FURNACE-AUX 0.
                FURNACE-HIR FHIR ..                                      $ duct losses in FHIR

RESIDEN  SYSTEM  SYSTEM-TYPE RESYS
                   Z-N=(HOUSE,GARAGE,ATTIC)
                SYSTEM-CONTROL SYSCONTRL
                SYSTEM-AIR SYSAIR
                SYSTEM-EQUIPMENT SYSEQP
                HEAT-SOURCE FURNACE ..


$ -------------------------- System reports --------------------------
##if #[hrpt[] eqs yes]
HRSCH=SCH  THRU DEC 31 (ALL) (1,24) (1)  ..
RB-1=R-B  V-T=GLOBAL   V-L=(8) ..
RB-2=R-B  V-T=RESIDEN  V-L=(61,62) ..                                    $ part-loads
DUMP=H-R  R-SCH=HRSCH  R-B=(RB-1,RB-2) ..
##endif

SYSTEMS-REPORT
##if #[hrpt[] eqs yes]
                HOURLY-DATA-SAVE=FORMATTED
##endif
```

```
$ S=(SS-A,SS-B,SS-C,SS-F,SS-H,SS-I) $ ..


END ..

FUNCTION  NAME=PRTAC ..
  $
  $ This function prints out whether the AC is on for each hour
  $
  ASSIGN IMO=IMO IDAY=IDAY IHR=IHR
         xQNOW=QNOW ..
      CALCULATE  ..
      IF (IMO.EQ.1.AND.IDAY.EQ.1.AND.IHR.EQ.1) REWIND 52
      WRITE(52,120) xQNOW
 120  FORMAT(E14.7)
      END
      END-FUNCTION ..

COMPUTE  SYSTEMS ..


$
$ SECOND SIMULATION WITH ADJUSTED ROLLER SHADE CONDITIONS PER AIR-CONDITIONING STATUS
$

$ --------------------- Set simulation conditions ----------------------
$ ##set1 run f00
$ ##set1 run f02
$ ##set1 run f04

$ ##set1 loc cz01
$ ##set1 loc cz02
$ ##set1 loc cz03
$ ##set1 loc cz04
$ ##set1 loc cz05
$ ##set1 loc cz06
$ ##set1 loc cz07
$ ##set1 loc cz08
$ ##set1 loc cz09
$ ##set1 loc cz10
$ ##set1 loc cz11
$ ##set1 loc cz12
$ ##set1 loc cz13
$ ##set1 loc cz14
$ ##set1 loc cz15
$ ##set1 loc cz16

$ ##set1 fndtn standard
$ ##set1 fndtn simplifd
$ ----------------------------------------------------------------------


INPUT LOADS ..
ABORT ERRORS ..
LIST WARNINGS ..



TITLE LINE-1 = *Typical One-story House*

##if #[run[] eqs f00 ]
      LINE-2 = *            No slab insulation*
##elseif #[run[] eqs f02 ]
      LINE-2 = *           Slab insulation R-5*
##elseif #[run[] eqs f04 ]
      LINE-2 = *           Slab insulation R-10*
##endif

##if #[fndtn[] eqs standard ]
      LINE-3 = *Slab: STANDARD calculation*
##elseif #[fndtn[] eqs simplifd ]
```

```
      LINE-3 = *Slab: SIMPLIFIED METHOD*
##endif

##if #[loc[] eqs cz01 ]
      LINE-4 = *              cz01 (Arcata)*
##elseif #[loc[] eqs cz02 ]
      LINE-4 = *            cz02 (Sta. Rosa)*
##elseif #[loc[] eqs cz03 ]
     LINE-4 = *             cz03 (Oakland)*
##elseif #[loc[] eqs cz04 ]
      LINE-4 = *            cz04 (Sunnyvale)*
##elseif #[loc[] eqs cz05 ]
      LINE-4 = *            cz05 (Sta. Maria)*
##elseif #[loc[] eqs cz06 ]
      LINE-4 = *            cz06 (Long Beach)*
##elseif #[loc[] eqs cz07 ]
      LINE-4 = *            cz07 (San Diego)*
##elseif #[loc[] eqs cz08 ]
      LINE-4 = *             cz08 (El Toro)*
##elseif #[loc[] eqs cz09 ]
      LINE-4 = *             cz09 (Pasadena)*
##elseif #[loc[] eqs cz10 ]
      LINE-4 = *            cz10 (Riverside)*
##elseif #[loc[] eqs cz11 ]
      LINE-4 = *            cz11 (Red Bluff)*
##elseif #[loc[] eqs cz12 ]
      LINE-4 = *            cz12 (Sacrmento)*
##elseif #[loc[] eqs cz13 ]
      LINE-4 = *              cz13 (Fresno)*
##elseif #[loc[] eqs cz14 ]
      LINE-4 = *            cz14 (China Lake)*
##elseif #[loc[] eqs cz15 ]
      LINE-4 = *            cz15 (El Centro)*
##elseif #[loc[] eqs cz16 ]
      LINE-4 = *            cz16 (Mt. Shasta)*
##endif

      LINE-5 = *  input file: cec_house7_simp-method.inp* ..


RUN-PERIOD JAN 1, 1991 THRU DEC 31, 1991 ..


BUILDING-LOCATION
FUNCTION =(*SHADING*,*NONE*)                                    $ roller shade use
##if #[loc[] eqs cz01 ]
        LAT=40.8 LON=124.2  ALT=218
##elseif #[loc[] eqs cz02 ]
        LAT=38.4 LON=122.7  ALT=167
##elseif #[loc[] eqs cz03 ]
        LAT=37.7 LON=122.2  ALT=6
##elseif #[loc[] eqs cz04 ]
        LAT=37.4 LON=122.1  ALT=97
##elseif #[loc[] eqs cz05 ]
        LAT=34.9 LON=120.4  ALT=236
##elseif #[loc[] eqs cz06 ]
        LAT=33.8 LON=118.2  ALT=25
##elseif #[loc[] eqs cz07 ]
        LAT=32.7 LON=117.2  ALT=13
##elseif #[loc[] eqs cz08 ]
        LAT=33.6 LON=117.7  ALT=380
##elseif #[loc[] eqs cz09 ]
        LAT=34.2 LON=117.2  ALT=864
##elseif #[loc[] eqs cz10 ]
        LAT=34.1 LON=117.3  ALT=840
##elseif #[loc[] eqs cz11 ]
        LAT=40.2 LON=122.2  ALT=342
##elseif #[loc[] eqs cz12 ]
        LAT=38.5 LON=121.5  ALT=17
##elseif #[loc[] eqs cz13 ]
        LAT=36.8 LON=119.7  ALT=326
```

```
##elseif #[loc[] eqs cz14 ]
        LAT=35.7 LON=117.7  ALT=2220
##elseif #[loc[] eqs cz15 ]
        LAT=33.0 LON=115.6  ALT=-30
##elseif #[loc[] eqs cz16 ]
        LAT=41.3 LON=122.3  ALT=3535
##endif
                  HOL=YES  D-S=YES  AZ=0  T-Z=8 ..


$ -------------------------- Internal loads --------------------------
I-GAIN-JAN=D-SCH  (1) (.029)                                        $ .024*1.19
                  (2) (.026)                                        $ .022*1.19
                (3,5) (.025)                                        $ .021*1.19
                  (6) (.031)                                        $ .026*1.19
                  (7) (.045)                                        $ .038*1.19
                  (8) (.070)                                        $ .059*1.19
                  (9) (.067)                                        $ .056*1.19
                 (10) (.071)                                        $ .060*1.19
                 (11) (.070)                                        $ .059*1.19
                 (12) (.055)                                        $ .046*1.19
                 (13) (.054)                                        $ .045*1.19
                 (14) (.036)                                        $ .030*1.19
                 (15) (.033)                                        $ .028*1.19
                 (16) (.037)                                        $ .031*1.19
                 (17) (.068)                                        $ .057*1.19
               (18,19) (.076)                                       $ .064*1.19
                 (20) (.062)                                        $ .052*1.19
                 (21) (.060)                                        $ .050*1.19
                 (22) (.065)                                        $ .055*1.19
                 (23) (.052)                                        $ .044*1.19
                 (24) (.032) ..                                     $ .027*1.19

I-GAIN-FEB=D-SCH  (1) (.027)                                        $ .024*1.11
                  (2) (.024)                                        $ .022*1.11
                (3,5) (.023)                                        $ .021*1.11
                  (6) (.029)                                        $ .026*1.11
                  (7) (.042)                                        $ .038*1.11
                  (8) (.065)                                        $ .059*1.11
                  (9) (.062)                                        $ .056*1.11
                 (10) (.067)                                        $ .060*1.11
                 (11) (.065)                                        $ .059*1.11
                 (12) (.051)                                        $ .046*1.11
                 (13) (.050)                                        $ .045*1.11
                 (14) (.033)                                        $ .030*1.11
                 (15) (.031)                                        $ .028*1.11
                 (16) (.034)                                        $ .031*1.11
                 (17) (.063)                                        $ .057*1.11
               (18,19) (.071)                                       $ .064*1.11
                 (20) (.058)                                        $ .052*1.11
                 (21) (.056)                                        $ .050*1.11
                 (22) (.061)                                        $ .055*1.11
                 (23) (.049)                                        $ .044*1.11
                 (24) (.030) ..                                     $ .027*1.11

I-GAIN-MAR=D-SCH  (1) (.024)                                        $ .024*1.02
                  (2) (.022)                                        $ .022*1.02
                (3,5) (.021)                                        $ .021*1.02
                  (6) (.026)                                        $ .026*1.02
                  (7) (.039)                                        $ .038*1.02
                  (8) (.060)                                        $ .059*1.02
                  (9) (.057)                                        $ .056*1.02
                 (10) (.061)                                        $ .060*1.02
                 (11) (.060)                                        $ .059*1.02
                 (12) (.047)                                        $ .046*1.02
                 (13) (.046)                                        $ .045*1.02
                 (14) (.031)                                        $ .030*1.02
                 (15) (.029)                                        $ .028*1.02
                 (16) (.032)                                        $ .031*1.02
                 (17) (.058)                                        $ .057*1.02
               (18,19) (.065)                                       $ .064*1.02
```

	(20)	(.053)	$ .052*1.02
	(21)	(.051)	$ .050*1.02
	(22)	(.056)	$ .055*1.02
	(23)	(.045)	$ .044*1.02
	(24)	(.028) ..	$ .027*1.02
I-GAIN-APR=D-SCH	(1)	(.022)	$ .024*.93
	(2)	(.020)	$ .022*.93
	(3,5)	(.020)	$ .021*.93
	(6)	(.024)	$ .026*.93
	(7)	(.035)	$ .038*.93
	(8)	(.055)	$ .059*.93
	(9)	(.052)	$ .056*.93
	(10)	(.056)	$ .060*.93
	(11)	(.055)	$ .059*.93
	(12)	(.043)	$ .046*.93
	(13)	(.042)	$ .045*.93
	(14)	(.030)	$ .030*.93
	(15)	(.026)	$ .028*.93
	(16)	(.029)	$ .031*.93
	(17)	(.053)	$ .057*.93
	(18,19)	(.060)	$ .064*.93
	(20)	(.048)	$ .052*.93
	(21)	(.047)	$ .050*.93
	(22)	(.051)	$ .055*.93
	(23)	(.041)	$ .044*.93
	(24)	(.025) ..	$ .027*.93
I-GAIN-MAY=D-SCH	(1)	(.020)	$ .024*.84
	(2)	(.018)	$ .022*.84
	(3,5)	(.018)	$ .021*.84
	(6)	(.022)	$ .026*.84
	(7)	(.032)	$ .038*.84
	(8)	(.050)	$ .059*.84
	(9)	(.047)	$ .056*.84
	(10)	(.050)	$ .060*.84
	(11)	(.050)	$ .059*.84
	(12)	(.039)	$ .046*.84
	(13)	(.038)	$ .045*.84
	(14)	(.025)	$ .030*.84
	(15)	(.024)	$ .028*.84
	(16)	(.026)	$ .031*.84
	(17)	(.048)	$ .057*.84
	(18,19)	(.054)	$ .064*.84
	(20)	(.044)	$ .052*.84
	(21)	(.042)	$ .050*.84
	(22)	(.046)	$ .055*.84
	(23)	(.037)	$ .044*.84
	(24)	(.023) ..	$ .027*.84
I-GAIN-JUN=D-SCH	(1)	(.019)	$ .024*.80
	(2)	(.018)	$ .022*.80
	(3,5)	(.017)	$ .021*.80
	(6)	(.021)	$ .026*.80
	(7)	(.030)	$ .038*.80
	(8)	(.047)	$ .059*.80
	(9)	(.045)	$ .056*.80
	(10)	(.048)	$ .060*.80
	(11)	(.047)	$ .059*.80
	(12)	(.037)	$ .046*.80
	(13)	(.036)	$ .045*.80
	(14)	(.024)	$ .030*.80
	(15)	(.022)	$ .028*.80
	(16)	(.025)	$ .031*.80
	(17)	(.046)	$ .057*.80
	(18,19)	(.051)	$ .064*.80
	(20)	(.042)	$ .052*.80
	(21)	(.040)	$ .050*.80
	(22)	(.044)	$ .055*.80
	(23)	(.035)	$ .044*.80
	(24)	(.022) ..	$ .027*.80

I-GAIN-JUL=D-SCH	(1)	(.020)	$ .024*.82
	(2)	(.018)	$ .022*.82
	(3,5)	(.017)	$ .021*.82
	(6)	(.021)	$ .026*.82
	(7)	(.031)	$ .038*.82
	(8)	(.048)	$ .059*.82
	(9)	(.046)	$ .056*.82
	(10)	(.049)	$ .060*.82
	(11)	(.048)	$ .059*.82
	(12)	(.038)	$ .046*.82
	(13)	(.037)	$ .045*.82
	(14)	(.025)	$ .030*.82
	(15)	(.023)	$ .028*.82
	(16)	(.025)	$ .031*.82
	(17)	(.047)	$ .057*.82
	(18,19)	(.052)	$ .064*.82
	(20)	(.043)	$ .052*.82
	(21)	(.041)	$ .050*.82
	(22)	(.045)	$ .055*.82
	(23)	(.036)	$ .044*.82
	(24)	(.022) ..	$ .027*.82
I-GAIN-AUG=D-SCH	(1)	(.021)	$ .024*.88
	(2)	(.019)	$ .022*.88
	(3,5)	(.018)	$ .021*.88
	(6)	(.023)	$ .026*.88
	(7)	(.033)	$ .038*.88
	(8)	(.052)	$ .059*.88
	(9)	(.049)	$ .056*.88
	(10)	(.053)	$ .060*.88
	(11)	(.052)	$ .059*.88
	(12)	(.040)	$ .046*.88
	(13)	(.040)	$ .045*.88
	(14)	(.026)	$ .030*.88
	(15)	(.025)	$ .028*.88
	(16)	(.028)	$ .031*.88
	(17)	(.050)	$ .057*.88
	(18,19)	(.056)	$ .064*.88
	(20)	(.046)	$ .052*.88
	(21)	(.044)	$ .050*.88
	(22)	(.048)	$ .055*.88
	(23)	(.039)	$ .044*.88
	(24)	(.024) ..	$ .027*.88
I-GAIN-SEP=D-SCH	(1)	(.024)	$ .024*.98
	(2)	(.022)	$ .022*.98
	(3,5)	(.021)	$ .021*.98
	(6)	(.026)	$ .026*.98
	(7)	(.037)	$ .038*.98
	(8)	(.058)	$ .059*.98
	(9)	(.055)	$ .056*.98
	(10)	(.059)	$ .060*.98
	(11)	(.058)	$ .059*.98
	(12)	(.045)	$ .046*.98
	(13)	(.044)	$ .045*.98
	(14)	(.029)	$ .030*.98
	(15)	(.027)	$ .028*.98
	(16)	(.030)	$ .031*.98
	(17)	(.056)	$ .057*.98
	(18,19)	(.063)	$ .064*.98
	(20)	(.051)	$ .052*.98
	(21)	(.049)	$ .050*.98
	(22)	(.054)	$ .055*.98
	(23)	(.043)	$ .044*.98
	(24)	(.026) ..	$ .027*.98
I-GAIN-OCT=D-SCH	(1)	(.026)	$ .024*1.07
	(2)	(.024)	$ .022*1.07
	(3,5)	(.022)	$ .021*1.07
	(6)	(.028)	$ .026*1.07

```
                  (7) (.041)                                        $ .038*1.07
                  (8) (.069)                                        $ .059*1.07
                  (9) (.060)                                        $ .056*1.07
                 (10) (.064)                                        $ .060*1.07
                 (11) (.069)                                        $ .059*1.07
                 (12) (.049)                                        $ .046*1.07
                 (13) (.048)                                        $ .045*1.07
                 (14) (.032)                                        $ .030*1.07
                 (15) (.030)                                        $ .028*1.07
                 (16) (.033)                                        $ .031*1.07
                 (17) (.061)                                        $ .057*1.07
               (18,19) (.068)                                       $ .064*1.07
                 (20) (.056)                                        $ .052*1.07
                 (21) (.054)                                        $ .050*1.07
                 (22) (.059)                                        $ .055*1.07
                 (23) (.047)                                        $ .044*1.07
                 (24) (.029) ..                                     $ .027*1.07

I-GAIN-NOV=D-SCH  (1) (.028)                                        $ .024*1.16
                  (2) (.026)                                        $ .022*1.16
                (3,5) (.024)                                        $ .021*1.16
                  (6) (.030)                                        $ .026*1.16
                  (7) (.044)                                        $ .038*1.16
                  (8) (.068)                                        $ .059*1.16
                  (9) (.065)                                        $ .056*1.16
                 (10) (.070)                                        $ .060*1.16
                 (11) (.068)                                        $ .059*1.16
                 (12) (.053)                                        $ .046*1.16
                 (13) (.052)                                        $ .045*1.16
                 (14) (.035)                                        $ .030*1.16
                 (15) (.032)                                        $ .028*1.16
                 (16) (.036)                                        $ .031*1.16
                 (17) (.066)                                        $ .057*1.16
               (18,19) (.074)                                       $ .064*1.16
                 (20) (.060)                                        $ .052*1.16
                 (21) (.058)                                        $ .050*1.16
                 (22) (.064)                                        $ .055*1.16
                 (23) (.051)                                        $ .044*1.16
                 (24) (.031) ..                                     $ .027*1.16

I-GAIN-DEC=D-SCH  (1) (.030)                                        $ .024*1.27
                  (2) (.028)                                        $ .022*1.27
                (3,5) (.027)                                        $ .021*1.27
                  (6) (.033)                                        $ .026*1.27
                  (7) (.048)                                        $ .038*1.27
                  (8) (.075)                                        $ .059*1.27
                  (9) (.071)                                        $ .056*1.27
                 (10) (.076)                                        $ .060*1.27
                 (11) (.075)                                        $ .059*1.27
                 (12) (.058)                                        $ .046*1.27
                 (13) (.057)                                        $ .045*1.27
                 (14) (.038)                                        $ .030*1.27
                 (15) (.036)                                        $ .028*1.27
                 (16) (.039)                                        $ .031*1.27
                 (17) (.072)                                        $ .057*1.27
               (18,19) (.081)                                       $ .064*1.27
                 (20) (.066)                                        $ .052*1.27
                 (21) (.064)                                        $ .050*1.27
                 (22) (.070)                                        $ .055*1.27
                 (23) (.056)                                        $ .044*1.27
                 (24) (.034) ..                                     $ .027*1.27

INT-LOADS=SCH  THRU JAN 31  (ALL) I-GAIN-JAN
               THRU FEB 28  (ALL) I-GAIN-FEB
               THRU MAR 31  (ALL) I-GAIN-MAR
               THRU APR 30  (ALL) I-GAIN-APR
               THRU MAY 31  (ALL) I-GAIN-MAY
               THRU JUN 30  (ALL) I-GAIN-JUN
               THRU JUL 31  (ALL) I-GAIN-JUL
               THRU AUG 31  (ALL) I-GAIN-AUG
               THRU SEP 30  (ALL) I-GAIN-SEP
```

```
              THRU OCT 31  (ALL) I-GAIN-OCT
              THRU NOV 30  (ALL) I-GAIN-NOV
              THRU DEC 31  (ALL) I-GAIN-DEC ..

MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.968) ..                    $ no roller shades
$ MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.595) ..                  $$ roller shades


$ ----------------------------- Materials -----------------------------
GYPBRD=MAT     COND=.1330  TH=.0417  DENS=50.00   S-H=0.20 ..
INS-R13=MAT    COND=.0224  TH=.2917  DENS=.71     S-H=.20 ..
STUCCO=MAT     COND=.4167  TH=.0729  DENS=166.00  S-H=.20 ..
WOOD=MAT       COND=.0667  TH=.2917  DENS=32.00   S-H=.33 ..
DAMPSOIL=MAT   COND=1.000  TH=1.000  DENS=115.00  S-H=.28 ..            $ typical damp soil
RUGNPAD=MAT    RES=2.08 ..                                              $ carpet and pad
CONCRETE=MAT   COND=.8000  TH=.3333  DENS=144.    S-H=.139 ..          $ 4" heavy concrete

$ ------------------------------ Layers -------------------------------
WOOD-FRM-R13=LA  MAT=(STUCCO,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
WOOD-FRM-R19=LA  MAT=(STUCCO,IN12,WOOD,GYPBRD)  I-F-R=0.68 ..
INT-WALL=LA      MAT=(GYPBRD,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
CEIL=LA          MAT=(PW04,AL33,GYPBRD)  I-F-R=.76 ..
ROOF-LA=LA       MAT=(AR02,AR01,PW04)  I-F-R=.76 ..
ROOF-R30=LA      MAT=(AR02,AR01,PW04,IN11,IN12)  I-F-R=.76 ..
ROOF-R38=LA      MAT=(AR02,AR01,PW04,IN12,IN12)  I-F-R=.76 ..
FSLABLDP=LA      MAT=(DAMPSOIL,CONCRETE,RUGNPAD)                        $ slab, 1'-0" damp soil
                THICKNESS(1.0,.333,1.)  I-F-R=0.765 ..
BSLABLDP=LA     MAT=(DAMPSOIL,CONCRETE)                                 $ slab, 1'-0" damp soil
                THICKNESS(1.0,.333)  I-F-R=0.765 ..

$ ---------------------------- Construction -----------------------------
WALL1CON=CONS       LA=WOOD-FRM-R13  RO=3  ABS=0.7 ..
WALL2CON=CONS       LA=WOOD-FRM-R19  RO=3  ABS=0.7 ..
IWALL1CON=CONS      LA=INT-WALL  RO=3  ABS=0.7 ..
DOORCON=CONS        U=.33 ..
CEILCON=CONS        LA=CEIL ..
ROOFCON=CONS        LA=ROOF-LA ..
ROOF1CON=CONS       LA=ROOF-R30 ..
ROOF2CON=CONS       LA=ROOF-R38 ..
SLAB-CARP=CONS      LA=FSLABLDP ..
SLAB-NO-CARP=CONS   LA=BSLABLDP ..

##if #[run[] eqs f00 ]
       DEFINE  SPCW-CS=.0852  SPCM-CS=.0551  SPCY-CS=.0028              $ carpeted slab R-0
       SCCM-CS=.0418  SCCY-CS=.0224 ..
       DEFINE  SPCW-US=.1692  SPCM-US=.0737  SPCY-US=.0014              $ uncarpeted slab R-0
       SCCM-US=.0503  SCCY-US=.0238 ..
##elseif #[run[] eqs f02 ]
       DEFINE  SPCW-CS=.0291  SPCM-CS=.0685  SPCY-CS=.0100              $ carpeted slab R-5
       SCCM-CS=.0303  SCCY-CS=.0261 ..
       DEFINE  SPCW-US=.0600  SPCM-US=.0909  SPCY-US=.0086              $ uncarpeted slab R-5
       SCCM-US=.0366  SCCY-US=.0275 ..
##elseif #[run[] eqs f04 ]
       DEFINE  SPCW-CS=.0224  SPCM-CS=.0629  SPCY-CS=.0141              $ carpeted slab R-10
       SCCM-CS=.0255  SCCY-CS=.0278 ..
       DEFINE  SPCW-US=.0422  SPCM-US=.0912  SPCY-US=.0115              $ uncarpeted slab R-10
       SCCM-US=.0338  SCCY-US=.0284 ..
##endif

$ ------------------------------ Glazing ------------------------------
WINDOW2ATB=G-T  G-T-C=2000 ..

$ ------------------------- Shading from eaves -------------------------
SEAVE-1=B-S X=0  Y=-2.33  Z=7.95  H=2.48  W=14.58  AZ=180  TILT=20.00 ..
SEAVE-2=B-S LIKE SEAVE-1  X=14.58  Z=7.95  H=4.80  W=9.75 ..
SWEAVE=B-S  X=-1.00 Y=-2.33 Z=7.95  H=20.25 W=1.00  AZ=180 TILT=20.00 ..
SEEAVE=B-S LIKE SWEAVE  X=45.25  Y=7.48  Z=11.52  H=9.84 ..
NEAVE-1=B-S  X=46.25 Y=44.46  Z=7.98  H=3.07 W=47.25  AZ=0 TILT=12.00 ..
NEEAVE-1=B-S LIKE NEAVE-1  Y=22.76  Z=12.68  H=6.5 W=1.00  TILT=20.00 ..
NEEAVE-2=B-S  X=46.25 Y=41.46 Z=8.80  H=19.10 W=1.00  AZ=0 TILT=12.00 ..
NWEAVE-1=B-S LIKE NEEAVE-1  X=0 ..
```

```
NWEAVE-2=B-S LIKE NEEAVE-2  X=0 ..
GSEAVE-1=B-S X=21.87 Y=-20.33 Z=7.95 H=2.48 W=25.59 AZ=180 TILT=15.00 ..
GWEAVE=B-S  X=21.87 Y=-2.33 Z=7.95  H=2.48 W=15.67  AZ=270 TILT=15.00 ..
GEEAVE=B-S LIKE GWEAVE  X=47.58  Y=-18.00  W=25.48  AZ=90 ..

$ -------------------------- Space conditions -------------------------
SET FOR S-C  SOURCE-SCHEDULE=INT-LOADS  SOURCE-BTU/HR=47135  F-W=0    $ total internal gain:
            S-S=1.0  S-L=0 ..                                         $ 20,000 Btu/day +
                                                                      $ (1,809 sqft. X 15 Btu/d)=
                                                                      $ 47135 Btu/d

HOUSE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0005
              TEMPERATURE=(78)  ZONE-TYPE=CONDITIONED ..

ATTIC-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .00167  SOURCE-BTU/HR=0    $ ft2 vents/450ft2 floor
              ZONE-TYPE=UNCONDITIONED ..                                  $ 0.75 discharge eff.
                                                                          $ (0.75/450 = .00167)

GARAGE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0015  SOURCE-BTU/HR=0    $ (E-L-F cond. space)X3
              ZONE-TYPE=UNCONDITIONED ..

$ -------------------------- Space descriptions -------------------------
SET FOR WI  G-T=WINDOW2ATB  FRAME-WIDTH 0.125 S-SCH=MULTIPLIERS ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
             H=8.0 ..


GARAGE=S  A=424  V=3390  S-C=GARAGE-SC ..
E-W  X=24.33  Y=-18.00  W=20.92  AZ=180 ..
  DOOR  X=2.42  H=7.00  W=16.00  CONS=DOORCON ..
E-W  X=45.25  Y=-18.00  W=20.25  AZ=90 ..
  DOOR  X=16.25  H=6.75  W=2.75  CONS=DOORCON ..
E-W  X=24.33  Y=2.25  W=20.25  AZ=270 ..
GCEILING=I-W  A=424  CONS=CEILCON  N-T=ATTIC ..
U-F  AZ=0  TILT=180  CONS=SLAB-NO-CARP  AREA=424
     PERIM-EXPOSED=61.42  PERIM-COND-WEEK=SPCW-US
     PERIM-COND-MONTH=SPCM-US  PERIM-COND-YEAR=SPCY-US
     CORE-COND-MONTH=SCCM-US  CORE-COND-YEAR=SCCY-US ..
```

```
HOUSE=S  A=1809  V=14472  X=0  Y=0  S-C=HOUSE-SC ..
E-W  W=14.58  AZ=180 ..
  WI  X=.12  Y=1.58  H=6.00  W=14.33 ..
E-W  X=14.58  Y=2.25  W=9.25  AZ=180 ..
  DOOR  X=0.75  H=6.75  W=3.00  CONS=DOORCON ..
  WI  X=4.83  Y=1.67  H=4.92  W=3.83 ..
E-W  X=45.25  Y=2.25  W=39.21  AZ=90 ..
  WI  X=2.50  Y=2.83  H=3.92  W=6.92 ..
  WI  X=17.50  Y=2.83  H=3.92  W=6.92 ..
E-W  X=14.58  Y=0  W=2.00  AZ=90 ..
E-W  X=45.25  Y=41.46  W=45.30  AZ=0 ..
  WI  X=13.75  Y=5.33  H=1.83  W=2.92 ..
  WI  X=22.75  Y=.12  H=6.5  W=9.42 ..
  WI  X=33.5  Y=1.83  H=4.92  W=7.75 ..
E-W  X=0  Y=41.46  W=41.46  AZ=270 ..
  WI  X=4.71  Y=2.00  H=4.83  W=3.92 ..
  WI  X=16.13  Y=2.5  H=3.33  W=3.75 ..
  WI  X=20.46  Y=.12  H=6.83  W=11.17 ..
SET FOR I-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
..
I-W  A=167.36  N-T=GARAGE ..
SET FOR I-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
```

```
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
..
CEILING=I-W  A=1809  N-T=ATTIC ..
U-F  AZ=0  TILT=180  CONS=SLAB-CARP  AREA=1447
     PERIM-EXPOSED=121.74  PERIM-COND-WEEK=SPCW-CS
     PERIM-COND-MONTH=SPCM-CS  PERIM-COND-YEAR=SPCY-CS
     CORE-COND-MONTH=SCCM-CS  CORE-COND-YEAR=SCCY-CS ..
U-F  AZ=0  TILT=180  CONS=SLAB-NO-CARP  AREA=362
     PERIM-EXPOSED=30.44  PERIM-COND-WEEK=SPCW-US
     PERIM-COND-MONTH=SPCM-US  PERIM-COND-YEAR=SPCY-US
     CORE-COND-MONTH=SCCM-US  CORE-COND-YEAR=SCCY-US ..


ATTIC=S  A=2233  V=6780  Z=8.80  S-C=ATTIC-SC ..
EGABLE=E-W  X=45.25  Y=8.75  H=4.59  W=17.5  AZ=90 ..
WGABLE=E-W LIKE EGABLE  X=0  Y=26.25  AZ=270 ..
SET FOR ROOF  CONS=ROOFCON  TILT=15.00 ..
SROOF-1=ROOF  X=0  Y=0  H=17.80  W=24.38  AZ=180  TILT=20.00 ..
SROOF-2=ROOF LIKE SROOF-1  X=24.33  Y=7.48  Z=2.723  H=9.84  W=20.92 ..
NROOF-1=ROOF  X=45.25  Y=41.46  H=19.10  W=45.25  AZ=0  TILT=12.00 ..
NROOF-2=ROOF LIKE NROOF-1  Y=22.76  Z=3.88  H=6.5  TILT=20.00 ..
GSROOF-1=ROOF  X=24.33  Y=-18.00  H=5.41  W=20.92  AZ=180  TILT=15.00 ..
GWROOF=ROOF  X=24.33  Y=7.48  H=10.80  W=20.25  AZ=270  TILT=15.00 ..
GEROOF=ROOF LIKE GWROOF  X=45.25  Y=-12.77  AZ=90 ..


LOADS-REPORT  SUMMARY=(LS-F) ..
$ LOADS-REPORT  SUMMARY=(LS-F)  HOURLY-DATA-SAVE = FORMATTED ..
$ LOADS-REPORT  VERIFICATION = (LV-I) ..
$ LOADS-REPORT  H-D-S=FORMATTED  R-F=HOURLY ..


END ..

FUNCTION  NAME=SHADING
          LEVEL=BUILDING    ..
  ASSIGN IMO=IMO IDAY=IDAY IHR=IHR DBT=DBT
         Y=SCHEDULE-NAME(MULTIPLIERS)  ..
CALCULATE   ..
      IF (IMO.EQ.1.AND.IDAY.EQ.1.AND.IHR.EQ.1) REWIND 52
      SC=0.968
      READ(52,1) xQNOW
   1  FORMAT(E14.7)
      IF (xQNOW.GT.0.0) SC=0.595
      Y=SC
      IF (IHR.EQ.15) PRINT 80,IMO,IDAY,IHR,DBT,xQNOW,Y
   80 FORMAT( ' SHADING POST ' ,3F4.0,F5.1,F10.2,F10.3)
      END
END-FUNCTION   ..

COMPUTE LOADS ..
```

```
INPUT SYSTEMS ..

$ --------------------- Set simulation conditions ----------------------
##set1 accap   32000                                                    $ measured on site
##set1 accfm   1000                                                     $ measured on site
$ ##set1 vent    sg
$ ##set1 hrpt no
$ ##set1 hrpt yes

DEFINE  HEATSET=68  SETBACK=60  COOLSET=78
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
   VTYPE=-1                                                            $ enthalpic venting
##else
   VTYPE=0                                                             $ no venting
##endif
       FHIR=1.4286  MAXTEMP=120                                        $ assumed furnace input
       HCAPF=-50000                                                    $ 77%eff.+10% duct loss
##set1 sen_cap = #[accap[] * 0.75 ]
       CTCAP=accap[]  CSCAP=sen_cap[]  ACCFM=accfm[]  CBF=0.9 ..

$ ----------------------------- Schedules ------------------------------
HTSCH     SCHEDULE  THRU DEC 31 (ALL)  (1,6) (SETBACK)
                                    (7,23) (HEATSET)
                                      (24) (SETBACK)  ..
WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (1.0) ..                  $ natural vent. always
$ WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (0.0) ..                $$ no natural vent.
VOPSCH    SCHEDULE  THRU DEC 31 (ALL) (1,24) (VTYPE) ..
CTSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (COOLSET) ..
VTSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (72) ..                   $ vent. schedule 72 F

$ ------------------------------- Zones --------------------------------
ZC1                 ZONE-CONTROL
                            DESIGN-HEAT-T 68.
                            DESIGN-COOL-T 78.
                            COOL-TEMP-SCH CTSCH
                            HEAT-TEMP-SCH HTSCH
                            THERMOSTAT-TYPE TWO-POSITION ..
HOUSE               ZONE    ZONE-CONTROL ZC1 ..
ATTIC               ZONE    ZONE-TYPE UNCONDITIONED ..
GARAGE              ZONE    ZONE-TYPE UNCONDITIONED ..

$ ------------------------------ Systems -------------------------------
SYSCONTRL SYSTEM-CONTROL
                MAX-SUPPLY-T MAXTEMP
                MIN-SUPPLY-T 50
                  ..
SYSAIR    SYSTEM-AIR
                SUPPLY-CFM ACCFM
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
                NATURAL-VENT-SCH VOPSCH
                VENT-TEMP-SCH VTSCH
                OPEN-VENT-SCH WINDOPER
  ##if #[vent[] eqs sg]
                HOR-VENT-FRAC 0.0
                FRAC-VENT-AREA=.0242                                   $ 10% gross window area
                VENT-METHOD S-G                                        $ discharge coeff. 0.6
                MAX-VENT-RATE 20
  ##endif
  ##if #[vent[] eqs ach]                                               $ 10 ach when venting
                NATURAL-VENT-AC 10
                VENT-METHOD AIR-CHANGE
  ##endif
##endif
 ..

SYSEQP    SYSTEM-EQUIPMENT
                COOLING-CAPACITY CTCAP
                COOL-SH-CAP CSCAP
                COIL-BF CBF
                COMPRESSOR-TYPE SINGLE-SPEED
                COOLING-EIR .39985
```

```
                HEATING-CAPACITY HCAPF                                  $ furnace specs
                FURNACE-AUX 0.
                FURNACE-HIR FHIR ..                                     $ duct losses in FHIR


RESIDEN  SYSTEM  SYSTEM-TYPE RESYS
                    Z-N=(HOUSE,GARAGE,ATTIC)
                SYSTEM-CONTROL SYSCONTRL
                SYSTEM-AIR SYSAIR
                SYSTEM-EQUIPMENT SYSEQP
                HEAT-SOURCE FURNACE ..


$ -------------------------- System reports --------------------------
##if #[hrpt[] eqs yes]
HRSCH=SCH  THRU DEC 31 (ALL) (1,24) (1)  ..
RB-1=R-B  V-T=GLOBAL   V-L=(8) ..
RB-2=R-B  V-T=RESIDEN  V-L=(61,62) ..                                   $ part-loads
DUMP=H-R  R-SCH=HRSCH  R-B=(RB-1,RB-2) ..
##endif

SYSTEMS-REPORT
##if #[hrpt[] eqs yes]
                HOURLY-DATA-SAVE=FORMATTED
##endif

$ S=(SS-A,SS-B,SS-C,SS-F,SS-H,SS-I) ..
S=(SS-A,SS-H) ..
$ S=(SS-H) ..


END ..
COMPUTE  SYSTEMS ..


INPUT PLANT ..
PLANT-REPORT  S=(PS-B,PS-E,BEPS) ..
END ..

COMPUTE PLANT ..
STOP  ..
```

APPENDIX C: Listing of BDL File for the Two-story House, Standard Method

The listing below is the BDL file that describes the two-story house used as the subject of simulation in this study using F2 factors in the calculation of heat flow through slab-on-grade. The graphic and textual descriptions of the subject house are found in Section 3: TWO-STORY HOUSE.

This BDL file contains the input for the Standard Method and must be executed with the standard version of DOE-2.1E. Attempts to execute it with the special version of DOE-2.1E that contains the Simplified Method will fail.

```
$ --------------------- Set simulation conditions ----------------------
$ ##set1 run f00
$ ##set1 run f02
$ ##set1 run f04

$ ##set1 loc cz01
$ ##set1 loc cz02
$ ##set1 loc cz03
$ ##set1 loc cz04
$ ##set1 loc cz05
$ ##set1 loc cz06
$ ##set1 loc cz07
$ ##set1 loc cz08
$ ##set1 loc cz09
$ ##set1 loc cz10
$ ##set1 loc cz11
$ ##set1 loc cz12
$ ##set1 loc cz13
$ ##set1 loc cz14
$ ##set1 loc cz15
$ ##set1 loc cz16

$ ##set1 fndtn standard
$ ##set1 fndtn simplifd
$ ------------------------------------------------------------------------


$ INPUT LOADS ..
$ ABORT ERRORS ..
$ LIST WARNINGS ..


TITLE LINE-1 = *Typical Two-Story House*

##if #[run[] eqs f00 ]
      LINE-2 = *            No slab insulation*
##elseif #[run[] eqs f02 ]
      LINE-2 = *           Slab insulation R-5*
##elseif #[run[] eqs f04 ]
      LINE-2 = *           Slab insulation R-10*
##endif

##if #[fndtn[] eqs standard ]
      LINE-3 = *Slab: STANDARD calculation*
##elseif #[fndtn[] eqs simplifd ]
      LINE-3 = *Slab: SIMPLIFIED METHOD*
##endif

##if #[loc[] eqs cz01 ]
      LINE-4 = *              cz01 (Arcata)*
##elseif #[loc[] eqs cz02 ]
      LINE-4 = *            cz02 (Sta. Rosa)*
##elseif #[loc[] eqs cz03 ]
     LINE-4 = *             cz03 (Oakland)*
##elseif #[loc[] eqs cz04 ]
      LINE-4 = *            cz04 (Sunnyvale)*
##elseif #[loc[] eqs cz05 ]
      LINE-4 = *            cz05 (Sta. Maria)*
```

```
##elseif #[loc[] eqs cz06 ]
      LINE-4 = *            cz06 (Long Beach)*
##elseif #[loc[] eqs cz07 ]
      LINE-4 = *            cz07 (San Diego)*
##elseif #[loc[] eqs cz08 ]
      LINE-4 = *             cz08 (El Toro)*
##elseif #[loc[] eqs cz09 ]
      LINE-4 = *             cz09 (Pasadena)*
##elseif #[loc[] eqs cz10 ]
      LINE-4 = *            cz10 (Riverside)*
##elseif #[loc[] eqs cz11 ]
      LINE-4 = *            cz11 (Red Bluff)*
##elseif #[loc[] eqs cz12 ]
      LINE-4 = *            cz12 (Sacrmento)*
##elseif #[loc[] eqs cz13 ]
      LINE-4 = *              cz13 (Fresno)*
##elseif #[loc[] eqs cz14 ]
      LINE-4 = *            cz14 (China Lake)*
##elseif #[loc[] eqs cz15 ]
      LINE-4 = *            cz15 (El Centro)*
##elseif #[loc[] eqs cz16 ]
      LINE-4 = *            cz16 (Mt. Shasta)*
##endif

      LINE-5 = *   input: cec_2-story_house_standard.inp* ..


RUN-PERIOD JAN 1, 1991 THRU DEC 31, 1991 ..


BUILDING-LOCATION
##if #[loc[] eqs cz01 ]
        LAT=40.8 LON=124.2  ALT=218
##elseif #[loc[] eqs cz02 ]
        LAT=38.4 LON=122.7  ALT=167
##elseif #[loc[] eqs cz03 ]
        LAT=37.7 LON=122.2  ALT=6
##elseif #[loc[] eqs cz04 ]
        LAT=37.4 LON=122.1  ALT=97
##elseif #[loc[] eqs cz05 ]
        LAT=34.9 LON=120.4  ALT=236
##elseif #[loc[] eqs cz06 ]
        LAT=33.8 LON=118.2  ALT=25
##elseif #[loc[] eqs cz07 ]
        LAT=32.7 LON=117.2  ALT=13
##elseif #[loc[] eqs cz08 ]
        LAT=33.6 LON=117.7  ALT=380
##elseif #[loc[] eqs cz09 ]
        LAT=34.2 LON=117.2  ALT=864
##elseif #[loc[] eqs cz10 ]
        LAT=34.1 LON=117.3  ALT=840
##elseif #[loc[] eqs cz11 ]
        LAT=40.2 LON=122.2  ALT=342
##elseif #[loc[] eqs cz12 ]
        LAT=38.5 LON=121.5  ALT=17
##elseif #[loc[] eqs cz13 ]
        LAT=36.8 LON=119.7  ALT=326
##elseif #[loc[] eqs cz14 ]
        LAT=35.7 LON=117.7  ALT=2220
##elseif #[loc[] eqs cz15 ]
        LAT=33.0 LON=115.6  ALT=-30
##elseif #[loc[] eqs cz16 ]
        LAT=41.3 LON=122.3  ALT=3535
##endif
                  HOL=YES  D-S=YES  AZ=0  T-Z=8 ..


$ --------------------------- Internal loads ---------------------------
I-GAIN-JAN=D-SCH  (1) (.029)                                    $ .024*1.19
                  (2) (.026)                                    $ .022*1.19
                (3,5) (.025)                                    $ .021*1.19
```

	(6)	(.031)	$ .026*1.19
	(7)	(.045)	$ .038*1.19
	(8)	(.070)	$ .059*1.19
	(9)	(.067)	$ .056*1.19
	(10)	(.071)	$ .060*1.19
	(11)	(.070)	$ .059*1.19
	(12)	(.055)	$ .046*1.19
	(13)	(.054)	$ .045*1.19
	(14)	(.036)	$ .030*1.19
	(15)	(.033)	$ .028*1.19
	(16)	(.037)	$ .031*1.19
	(17)	(.068)	$ .057*1.19
	(18,19)	(.076)	$ .064*1.19
	(20)	(.062)	$ .052*1.19
	(21)	(.060)	$ .050*1.19
	(22)	(.065)	$ .055*1.19
	(23)	(.052)	$ .044*1.19
	(24)	(.032) ..	$ .027*1.19
I-GAIN-FEB=D-SCH	(1)	(.027)	$ .024*1.11
	(2)	(.024)	$ .022*1.11
	(3,5)	(.023)	$ .021*1.11
	(6)	(.029)	$ .026*1.11
	(7)	(.042)	$ .038*1.11
	(8)	(.065)	$ .059*1.11
	(9)	(.062)	$ .056*1.11
	(10)	(.067)	$ .060*1.11
	(11)	(.065)	$ .059*1.11
	(12)	(.051)	$ .046*1.11
	(13)	(.050)	$ .045*1.11
	(14)	(.033)	$ .030*1.11
	(15)	(.031)	$ .028*1.11
	(16)	(.034)	$ .031*1.11
	(17)	(.063)	$ .057*1.11
	(18,19)	(.071)	$ .064*1.11
	(20)	(.058)	$ .052*1.11
	(21)	(.056)	$ .050*1.11
	(22)	(.061)	$ .055*1.11
	(23)	(.049)	$ .044*1.11
	(24)	(.030) ..	$ .027*1.11
I-GAIN-MAR=D-SCH	(1)	(.024)	$ .024*1.02
	(2)	(.022)	$ .022*1.02
	(3,5)	(.021)	$ .021*1.02
	(6)	(.026)	$ .026*1.02
	(7)	(.039)	$ .038*1.02
	(8)	(.060)	$ .059*1.02
	(9)	(.057)	$ .056*1.02
	(10)	(.061)	$ .060*1.02
	(11)	(.060)	$ .059*1.02
	(12)	(.047)	$ .046*1.02
	(13)	(.046)	$ .045*1.02
	(14)	(.031)	$ .030*1.02
	(15)	(.029)	$ .028*1.02
	(16)	(.032)	$ .031*1.02
	(17)	(.058)	$ .057*1.02
	(18,19)	(.065)	$ .064*1.02
	(20)	(.053)	$ .052*1.02
	(21)	(.051)	$ .050*1.02
	(22)	(.056)	$ .055*1.02
	(23)	(.045)	$ .044*1.02
	(24)	(.028) ..	$ .027*1.02
I-GAIN-APR=D-SCH	(1)	(.022)	$ .024*.93
	(2)	(.020)	$ .022*.93
	(3,5)	(.020)	$ .021*.93
	(6)	(.024)	$ .026*.93
	(7)	(.035)	$ .038*.93
	(8)	(.055)	$ .059*.93
	(9)	(.052)	$ .056*.93
	(10)	(.056)	$ .060*.93

	(11)	(.055)	$ .059*.93
	(12)	(.043)	$ .046*.93
	(13)	(.042)	$ .045*.93
	(14)	(.030)	$ .030*.93
	(15)	(.026)	$ .028*.93
	(16)	(.029)	$ .031*.93
	(17)	(.053)	$ .057*.93
	(18,19)	(.060)	$ .064*.93
	(20)	(.048)	$ .052*.93
	(21)	(.047)	$ .050*.93
	(22)	(.051)	$ .055*.93
	(23)	(.041)	$ .044*.93
	(24)	(.025) ..	$ .027*.93
I-GAIN-MAY=D-SCH	(1)	(.020)	$ .024*.84
	(2)	(.018)	$ .022*.84
	(3,5)	(.018)	$ .021*.84
	(6)	(.022)	$ .026*.84
	(7)	(.032)	$ .038*.84
	(8)	(.050)	$ .059*.84
	(9)	(.047)	$ .056*.84
	(10)	(.050)	$ .060*.84
	(11)	(.050)	$ .059*.84
	(12)	(.039)	$ .046*.84
	(13)	(.038)	$ .045*.84
	(14)	(.025)	$ .030*.84
	(15)	(.024)	$ .028*.84
	(16)	(.026)	$ .031*.84
	(17)	(.048)	$ .057*.84
	(18,19)	(.054)	$ .064*.84
	(20)	(.044)	$ .052*.84
	(21)	(.042)	$ .050*.84
	(22)	(.046)	$ .055*.84
	(23)	(.037)	$ .044*.84
	(24)	(.023) ..	$ .027*.84
I-GAIN-JUN=D-SCH	(1)	(.019)	$ .024*.80
	(2)	(.018)	$ .022*.80
	(3,5)	(.017)	$ .021*.80
	(6)	(.021)	$ .026*.80
	(7)	(.030)	$ .038*.80
	(8)	(.047)	$ .059*.80
	(9)	(.045)	$ .056*.80
	(10)	(.048)	$ .060*.80
	(11)	(.047)	$ .059*.80
	(12)	(.037)	$ .046*.80
	(13)	(.036)	$ .045*.80
	(14)	(.024)	$ .030*.80
	(15)	(.022)	$ .028*.80
	(16)	(.025)	$ .031*.80
	(17)	(.046)	$ .057*.80
	(18,19)	(.051)	$ .064*.80
	(20)	(.042)	$ .052*.80
	(21)	(.040)	$ .050*.80
	(22)	(.044)	$ .055*.80
	(23)	(.035)	$ .044*.80
	(24)	(.022) ..	$ .027*.80
I-GAIN-JUL=D-SCH	(1)	(.020)	$ .024*.82
	(2)	(.018)	$ .022*.82
	(3,5)	(.017)	$ .021*.82
	(6)	(.021)	$ .026*.82
	(7)	(.031)	$ .038*.82
	(8)	(.048)	$ .059*.82
	(9)	(.046)	$ .056*.82
	(10)	(.049)	$ .060*.82
	(11)	(.048)	$ .059*.82
	(12)	(.038)	$ .046*.82
	(13)	(.037)	$ .045*.82
	(14)	(.025)	$ .030*.82
	(15)	(.023)	$ .028*.82

	(16)	(.025)	$ .031*.82
	(17)	(.047)	$ .057*.82
	(18,19)	(.052)	$ .064*.82
	(20)	(.043)	$ .052*.82
	(21)	(.041)	$ .050*.82
	(22)	(.045)	$ .055*.82
	(23)	(.036)	$ .044*.82
	(24)	(.022) ..	$ .027*.82
I-GAIN-AUG=D-SCH	(1)	(.021)	$ .024*.88
	(2)	(.019)	$ .022*.88
	(3,5)	(.018)	$ .021*.88
	(6)	(.023)	$ .026*.88
	(7)	(.033)	$ .038*.88
	(8)	(.052)	$ .059*.88
	(9)	(.049)	$ .056*.88
	(10)	(.053)	$ .060*.88
	(11)	(.052)	$ .059*.88
	(12)	(.040)	$ .046*.88
	(13)	(.040)	$ .045*.88
	(14)	(.026)	$ .030*.88
	(15)	(.025)	$ .028*.88
	(16)	(.028)	$ .031*.88
	(17)	(.050)	$ .057*.88
	(18,19)	(.056)	$ .064*.88
	(20)	(.046)	$ .052*.88
	(21)	(.044)	$ .050*.88
	(22)	(.048)	$ .055*.88
	(23)	(.039)	$ .044*.88
	(24)	(.024) ..	$ .027*.88
I-GAIN-SEP=D-SCH	(1)	(.024)	$ .024*.98
	(2)	(.022)	$ .022*.98
	(3,5)	(.021)	$ .021*.98
	(6)	(.026)	$ .026*.98
	(7)	(.037)	$ .038*.98
	(8)	(.058)	$ .059*.98
	(9)	(.055)	$ .056*.98
	(10)	(.059)	$ .060*.98
	(11)	(.058)	$ .059*.98
	(12)	(.045)	$ .046*.98
	(13)	(.044)	$ .045*.98
	(14)	(.029)	$ .030*.98
	(15)	(.027)	$ .028*.98
	(16)	(.030)	$ .031*.98
	(17)	(.056)	$ .057*.98
	(18,19)	(.063)	$ .064*.98
	(20)	(.051)	$ .052*.98
	(21)	(.049)	$ .050*.98
	(22)	(.054)	$ .055*.98
	(23)	(.043)	$ .044*.98
	(24)	(.026) ..	$ .027*.98
I-GAIN-OCT=D-SCH	(1)	(.026)	$ .024*1.07
	(2)	(.024)	$ .022*1.07
	(3,5)	(.022)	$ .021*1.07
	(6)	(.028)	$ .026*1.07
	(7)	(.041)	$ .038*1.07
	(8)	(.069)	$ .059*1.07
	(9)	(.060)	$ .056*1.07
	(10)	(.064)	$ .060*1.07
	(11)	(.069)	$ .059*1.07
	(12)	(.049)	$ .046*1.07
	(13)	(.048)	$ .045*1.07
	(14)	(.032)	$ .030*1.07
	(15)	(.030)	$ .028*1.07
	(16)	(.033)	$ .031*1.07
	(17)	(.061)	$ .057*1.07
	(18,19)	(.068)	$ .064*1.07
	(20)	(.056)	$ .052*1.07
	(21)	(.054)	$ .050*1.07

```
                 (22) (.059)                                          $ .055*1.07
                 (23) (.047)                                          $ .044*1.07
                 (24) (.029) ..                                       $ .027*1.07

I-GAIN-NOV=D-SCH  (1) (.028)                                          $ .024*1.16
                  (2) (.026)                                          $ .022*1.16
                (3,5) (.024)                                          $ .021*1.16
                  (6) (.030)                                          $ .026*1.16
                  (7) (.044)                                          $ .038*1.16
                  (8) (.068)                                          $ .059*1.16
                  (9) (.065)                                          $ .056*1.16
                 (10) (.070)                                          $ .060*1.16
                 (11) (.068)                                          $ .059*1.16
                 (12) (.053)                                          $ .046*1.16
                 (13) (.052)                                          $ .045*1.16
                 (14) (.035)                                          $ .030*1.16
                 (15) (.032)                                          $ .028*1.16
                 (16) (.036)                                          $ .031*1.16
                 (17) (.066)                                          $ .057*1.16
               (18,19) (.074)                                         $ .064*1.16
                 (20) (.060)                                          $ .052*1.16
                 (21) (.058)                                          $ .050*1.16
                 (22) (.064)                                          $ .055*1.16
                 (23) (.051)                                          $ .044*1.16
                 (24) (.031) ..                                       $ .027*1.16

I-GAIN-DEC=D-SCH  (1) (.030)                                          $ .024*1.27
                  (2) (.028)                                          $ .022*1.27
                (3,5) (.027)                                          $ .021*1.27
                  (6) (.033)                                          $ .026*1.27
                  (7) (.048)                                          $ .038*1.27
                  (8) (.075)                                          $ .059*1.27
                  (9) (.071)                                          $ .056*1.27
                 (10) (.076)                                          $ .060*1.27
                 (11) (.075)                                          $ .059*1.27
                 (12) (.058)                                          $ .046*1.27
                 (13) (.057)                                          $ .045*1.27
                 (14) (.038)                                          $ .030*1.27
                 (15) (.036)                                          $ .028*1.27
                 (16) (.039)                                          $ .031*1.27
                 (17) (.072)                                          $ .057*1.27
               (18,19) (.081)                                         $ .064*1.27
                 (20) (.066)                                          $ .052*1.27
                 (21) (.064)                                          $ .050*1.27
                 (22) (.070)                                          $ .055*1.27
                 (23) (.056)                                          $ .044*1.27
                 (24) (.034) ..                                       $ .027*1.27

INT-LOADS=SCH  THRU JAN 31  (ALL) I-GAIN-JAN
               THRU FEB 28  (ALL) I-GAIN-FEB
               THRU MAR 31  (ALL) I-GAIN-MAR
               THRU APR 30  (ALL) I-GAIN-APR
               THRU MAY 31  (ALL) I-GAIN-MAY
               THRU JUN 30  (ALL) I-GAIN-JUN
               THRU JUL 31  (ALL) I-GAIN-JUL
               THRU AUG 31  (ALL) I-GAIN-AUG
               THRU SEP 30  (ALL) I-GAIN-SEP
               THRU OCT 31  (ALL) I-GAIN-OCT
               THRU NOV 30  (ALL) I-GAIN-NOV
               THRU DEC 31  (ALL) I-GAIN-DEC ..

MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.968) ..                  $ no roller shades
$ MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.595) ..                $$ roller shades


$ ----------------------------- Materials -----------------------------
GYPBRD=MAT     COND=.1330  TH=.0417  DENS=50.00   S-H=0.20 ..
INS-R13=MAT    COND=.0224  TH=.2917  DENS=.71     S-H=.20 ..
STUCCO=MAT     COND=.4167  TH=.0729  DENS=166.00  S-H=.20 ..
WOOD=MAT       COND=.0667  TH=.2917  DENS=32.00   S-H=.33 ..
DAMPSOIL=MAT   COND=1.000  TH=1.000  DENS=115.00  S-H=.28 ..          $ typical damp soil
```

```
RUGNPAD=MAT    RES=2.08 ..                                          $ carpet and pad
CONCRETE=MAT   COND=.8000  TH=.3333  DENS=144.    S-H=.139 ..      $ 4" heavy concrete

$ ----------------------------- Layers -------------------------------
WOOD-FRM-R13=LA  MAT=(STUCCO,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
WOOD-FRM-R19=LA  MAT=(STUCCO,IN12,WOOD,GYPBRD)  I-F-R=0.68 ..
INT-WALL=LA      MAT=(GYPBRD,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
CEIL=LA          MAT=(PW04,AL33,GYPBRD)  I-F-R=.76 ..
ROOF-LA=LA       MAT=(AR02,AR01,PW04)  I-F-R=.76 ..
ROOF-R30=LA      MAT=(AR02,AR01,PW04,IN11,IN12)  I-F-R=.76 ..
ROOF-R38=LA      MAT=(AR02,AR01,PW04,IN12,IN12)  I-F-R=.76 ..
FSLABLDP=LA      MAT=(IN52,IN14,DAMPSOIL,CONCRETE,RUGNPAD)          $ slab, R-50, 1' dampsoil
                THICKNESS(1.0,.333,1.)  I-F-R=0.765 ..
BSLABLDP=LA     MAT=(IN52,IN14,DAMPSOIL,CONCRETE)                   $ slab, R-50, 1' dampsoil
                THICKNESS(1.0,.333)  I-F-R=0.765 ..


$ --------------------------- Construction ----------------------------
WALL1CON=CONS       LA=WOOD-FRM-R13  RO=3  ABS=0.7 ..
WALL2CON=CONS       LA=WOOD-FRM-R19  RO=3  ABS=0.7 ..
IWALL1CON=CONS      LA=INT-WALL  RO=3  ABS=0.7 ..
DOORCON=CONS        U=.33 ..
CEILCON=CONS        LA=CEIL ..
ROOFCON=CONS        LA=ROOF-LA ..
ROOF1CON=CONS       LA=ROOF-R30 ..
ROOF2CON=CONS       LA=ROOF-R38 ..
SLAB-CARP=CONS      LA=FSLABLDP ..
SLAB-NO-CARP=CONS   LA=BSLABLDP ..

##if #[run[] eqs f00 ]
        DEFINE  SPCW-CS=.0852  SPCM-CS=.0551  SPCY-CS=.0028          $ carpeted slab R-0
        SCCM-CS=.0418  SCCY-CS=.0224 ..
        DEFINE  SPCW-US=.1692  SPCM-US=.0737  SPCY-US=.0014          $ uncarpeted slab R-0
        SCCM-US=.0503  SCCY-US=.0238 ..
        SLAB-PERIM-CARP=CONS    U=.72 ..                             $ F2: carpeted R-0
        SLAB-PERIM-UNCARP=CONS    U=.90 ..                           $ F2: uncarpeted R-0
##elseif #[run[] eqs f02 ]
        DEFINE  SPCW-CS=.0291  SPCM-CS=.0685  SPCY-CS=.0100          $ carpeted slab R-5
        SCCM-CS=.0303  SCCY-CS=.0261 ..
        DEFINE  SPCW-US=.0600  SPCM-US=.0909  SPCY-US=.0086          $ uncarpeted slab R-5
        SCCM-US=.0366  SCCY-US=.0275 ..
        SLAB-PERIM-CARP=CONS    U=.53 ..                             $ F2: carpeted R-5
        SLAB-PERIM-UNCARP=CONS    U=.58 ..                           $ F2: uncarpeted R-5
##elseif #[run[] eqs f04 ]
        DEFINE  SPCW-CS=.0224  SPCM-CS=.0629  SPCY-CS=.0141          $ carpeted slab R-10
        SCCM-CS=.0255  SCCY-CS=.0278 ..
        DEFINE  SPCW-US=.0422  SPCM-US=.0912  SPCY-US=.0115          $ uncarpeted slab R-10
        SCCM-US=.0338  SCCY-US=.0284 ..
        SLAB-PERIM-CARP=CONS    U=.50 ..                             $ F2 carpeted R-10
        SLAB-PERIM-UNCARP=CONS    U=.53 ..                           $ F2 uncarpeted R-10
##endif

$ ----------------------------- Glazing -------------------------------
WINDOW2ATB=G-T  G-T-C=2000 ..

$ -------------------------- Space conditions -------------------------
SET FOR S-C  SOURCE-SCHEDULE=INT-LOADS  SOURCE-BTU/HR=30943  F-W=0    $ total internal gain:
             S-S=1.0  S-L=0 ..                                       $ 20,000 Btu/day +
                                                                     $ (1,761 sqft. X 15 Btu/d)=
                                                                     $ 46415 Btu/d
                                                                     $ 2/3 goes to ground floor
HOUSE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0005
              TEMPERATURE=(78)  ZONE-TYPE=CONDITIONED ..

GARAGE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0015  SOURCE-BTU/HR=0    $ (E-L-F cond. space)X3
               ZONE-TYPE=UNCONDITIONED ..

$ ------------------------- Space descriptions ------------------------
SET FOR WI  G-T=WINDOW2ATB  FRAME-WIDTH 0.125 S-SCH=MULTIPLIERS ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
```

```
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
             H=8.0 ..
SET FOR I-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
..

GARAGE=S  A=528.00  V=4718.340  S-C=GARAGE-SC ..                    $ V=4224.000+494.340
E-W  X=37.00  Y=49.00  H=10.94  W=22.00  AZ=0 ..
```

```
  DOOR  X=1.00  H=7.00  W=20.00  CONS=DOORCON ..
E-W  X=37.00  Y=25.50  W=23.50  AZ=90 ..
E-W  X=15.00  Y=49.00  W=23.50  AZ=270 ..
I-W  A=176.00  N-T=GROUND-FL ..
I-W  A=275.00  N-T=UPSTAIRS ..
ROOF  X=15.00  Y=49.00  Z=8.80  H=12.47  W=12.50  CONS=ROOF1CON  AZ=270
      TILT=28.07 ..
ROOF  X=26.00  Y=49.00  Z=14.67  H=12.47  W=12.50  CONS=ROOF1CON  AZ=270
      TILT=-28.07 ..
SET FOR E-W  H=1.00 ..
E-W  X=37.00  Y=49.00  W=22.00  AZ=0 ..
E-W  X=37.00  Y=25.50  W=23.50  AZ=90 ..
E-W  X=15.00  Y=49.00  W=23.50  AZ=270 ..
U-F  A=528.00  U-EFF=.0001  CONS=SLAB-NO-CARP ..


SET FOR E-W  H=8.00 ..

GROUND-FL=S  A=925.00  V=8802.875  S-C=HOUSE-SC ..                    $ V=7400.000+1402.875
E-W  X=14.50  Y=25.00  W=14.50  AZ=0 ..
  WI  X=5.00  Y=.33  H=6.67  W=6.00 ..
E-W  X=14.50  Y=25.00  Z=8.80  H=3.87  W=14.50  AZ=0 ..
E-W  X=37.00  W=25.00  AZ=90 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50  M=2 ..
E-W  W=37.00  AZ=180 ..
  WI  X=4.00  H=6.67  W=6.00 ..
  WI  X=20.00  Y=3.00  H=4.00  W=4.00 ..
E-W  Z=8.80  H=3.87  W=14.50  AZ=180 ..
E-W  Y=25.00  W=25.00  AZ=270 ..
  WI  X=4.00  Y=1.50  H=5.50  W=6.00  M=2 ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
            H=16.43 ..
ROOF  Y=25.00  Z=8.80  W=25.00  AZ=270  TILT=28.07 ..
SET FOR E-W  H=1.00 ..
E-W  CONS=SLAB-PERIM-CARP  X=14.50  Y=25.00  W=14.50  AZ=0 ..
E-W  CONS=SLAB-PERIM-UNCARP  X=37.00  Y=14.50  W=10.50  AZ=90 ..
E-W  CONS=SLAB-PERIM-CARP  X=37.00  W=14.50  AZ=90 ..
E-W  CONS=SLAB-PERIM-CARP  W=37.00  AZ=180 ..
```

```
E-W  CONS=SLAB-PERIM-CARP  Y=25.00  W=25.00  AZ=270 ..
U-F  A=694.00  U-EFF=.0001  CONS=SLAB-CARP ..
U-F  A=231.00  U-EFF=.0001  CONS=SLAB-NO-CARP ..


SET FOR E-W  H=8.00 ..

UPSTAIRS=S  A=836.00  V=8477.040  Z=8.80  S-C=HOUSE-SC
            SOURCE-BTU/HR=15472 ..                                  $ 1/3 bldg. source load
E-W  X=37.00  Y=38.00  H=10.94  W=22.00  AZ=0 ..
  WI  X=8.00  Y=4.00  H=3.00  W=5.33  M=3 ..
E-W  X=37.00  W=38.00  AZ=90 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50  M=2 ..
E-W  X=15.00  H=10.94  W=22.00  AZ=180 ..
  WI  X=5.00  Y=3.00  H=4.00  W=4.00  M=2 ..
E-W  X=15.00  Y=38.00  W=12.50  AZ=270 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50 ..
I-W  A=200.00  CONS=IWALL1CON  N-T=GROUND-FL ..
I-W  A=550.00  CONS=CEILCON  N-T=GROUND-FL ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
               H=12.47 ..
ROOF  X=15.00  Y=38.00  Z=16.80  W=38.00  AZ=270  TILT=28.07 ..
ROOF  X=26.00  Y=38.00  Z=22.67  W=38.00  AZ=270  TILT=-28.07 ..


LOADS-REPORT  SUMMARY=(LS-F) ..
$ LOADS-REPORT  SUMMARY=(LS-F)  HOURLY-DATA-SAVE = FORMATTED ..
$ LOADS-REPORT  VERIFICATION = (LV-I) ..
$ LOADS-REPORT  H-D-S=FORMATTED  R-F=HOURLY ..


END ..
COMPUTE LOADS ..


INPUT SYSTEMS ..

$ --------------------- Set simulation conditions ----------------------
```

```
##set1 accap   32000                                                    $ measured on site
##set1 accfm   1000                                                     $ measured on site
$ ##set1 vent    sg
$ ##set1 hrpt no
$ ##set1 hrpt yes

DEFINE  HEATSET=68  SETBACK=60  COOLSET=78
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
   VTYPE=-1                                                            $ enthalpic venting
##else
   VTYPE=0                                                             $ no venting
##endif
        FHIR=1.4286  MAXTEMP=120                                       $ assumed furnace input
        HCAPF=-50000                                                   $ 77% eff.+10% ductloss
##set1 sen_cap = #[accap[] * 0.75 ]
        CTCAP=accap[]  CSCAP=sen_cap[]  ACCFM=accfm[]  CBF=0.9 ..

$ ----------------------------- Schedules -----------------------------
HTSCH      SCHEDULE  THRU DEC 31 (ALL)  (1,6)  (SETBACK)
                                     (7,23)  (HEATSET)
                                       (24)  (SETBACK)  ..
WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (1.0) ..                  $ natural vent. always
$ WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (0.0) ..                $$ no natural vent.
VOPSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (VTYPE) ..
CTSCH      SCHEDULE  THRU DEC 31 (ALL) (1,24) (COOLSET) ..
VTSCH      SCHEDULE  THRU DEC 31 (ALL) (1,24) (72) ..                  $ vent schedule 72 F

$ ------------------------------- Zones -------------------------------
ZC1                ZONE-CONTROL
                             DESIGN-HEAT-T 68.
                             DESIGN-COOL-T 78.
                             COOL-TEMP-SCH CTSCH
                             HEAT-TEMP-SCH HTSCH
                             THERMOSTAT-TYPE TWO-POSITION ..
HOUSE              ZONE      ZONE-CONTROL ZC1 ..
ATTIC              ZONE      ZONE-TYPE UNCONDITIONED ..
GARAGE             ZONE      ZONE-TYPE UNCONDITIONED ..

$ ----------------------------- Systems -----------------------------
SYSCONTRL SYSTEM-CONTROL
                 MAX-SUPPLY-T MAXTEMP
                 MIN-SUPPLY-T 50
                   ..
SYSAIR     SYSTEM-AIR
                 SUPPLY-CFM ACCFM
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
                 NATURAL-VENT-SCH VOPSCH
                 VENT-TEMP-SCH VTSCH
                 OPEN-VENT-SCH WINDOPER
  ##if #[vent[] eqs sg]
                 HOR-VENT-FRAC 0.0
                 FRAC-VENT-AREA=.0242                                  $ 10% window area open
                 VENT-METHOD S-G                                       $ discharge coeff. 0.6
                 MAX-VENT-RATE 20
  ##endif
  ##if #[vent[] eqs ach]                                              $ 10 ach when venting
                 NATURAL-VENT-AC 10
                 VENT-METHOD AIR-CHANGE
  ##endif
##endif
 ..

SYSEQP     SYSTEM-EQUIPMENT
                 COOLING-CAPACITY CTCAP
                 COOL-SH-CAP CSCAP
                 COIL-BF CBF
                 COMPRESSOR-TYPE SINGLE-SPEED
                 COOLING-EIR .39985
                 HEATING-CAPACITY HCAPF                                $ furnace specs
                 FURNACE-AUX 0.
                 FURNACE-HIR FHIR ..                                   $ duct losses in FHIR
```

```
SUBR-FUNCTIONS  RESYS-5=*PRTAC* ..

RESIDEN  SYSTEM  SYSTEM-TYPE RESYS
                    Z-N=(HOUSE,GARAGE,ATTIC)
                 SYSTEM-CONTROL SYSCONTRL
                 SYSTEM-AIR SYSAIR
                 SYSTEM-EQUIPMENT SYSEQP
                 HEAT-SOURCE FURNACE ..


$ --------------------------- System reports --------------------------
##if #[hrpt[] eqs yes]
HRSCH=SCH  THRU DEC 31 (ALL) (1,24) (1)  ..
RB-1=R-B  V-T=GLOBAL   V-L=(8) ..
RB-2=R-B  V-T=RESIDEN  V-L=(61,62) ..                                  $ part-loads
DUMP=H-R  R-SCH=HRSCH  R-B=(RB-1,RB-2) ..
##endif

SYSTEMS-REPORT
##if #[hrpt[] eqs yes]
                 HOURLY-DATA-SAVE=FORMATTED
##endif

$ S=(SS-A,SS-B,SS-C,SS-F,SS-H,SS-I) $ ..


END ..

FUNCTION  NAME=PRTAC ..
  $
  $ This function prints out whether the AC is on for each hour
  $
  ASSIGN IMO=IMO IDAY=IDAY IHR=IHR
         xQNOW=QNOW ..
      CALCULATE  ..
      IF (IMO.EQ.1.AND.IDAY.EQ.1.AND.IHR.EQ.1) REWIND 52
      WRITE(52,120) xQNOW
 120  FORMAT(E14.7)
      END
      END-FUNCTION ..

COMPUTE  SYSTEMS ..


$
$ SECOND SIMULATION WITH ADJUSTED ROLLER SHADE CONDITIONS PER AIR-CONDITIONING STATUS
$

$ --------------------- Set simulation conditions ----------------------
$ ##set1 run f00
$ ##set1 run f02
$ ##set1 run f04

$ ##set1 loc cz01
$ ##set1 loc cz02
$ ##set1 loc cz03
$ ##set1 loc cz04
$ ##set1 loc cz05
$ ##set1 loc cz06
$ ##set1 loc cz07
$ ##set1 loc cz08
$ ##set1 loc cz09
$ ##set1 loc cz10
$ ##set1 loc cz11
$ ##set1 loc cz12
$ ##set1 loc cz13
$ ##set1 loc cz14
$ ##set1 loc cz15
$ ##set1 loc cz16
```

```
$ ##set1 fndtn standard
$ ##set1 fndtn simplifd
$ ----------------------------------------------------------------------


INPUT LOADS ..
ABORT ERRORS ..
LIST WARNINGS ..



TITLE LINE-1 = *Typical Two-story House*

##if #[run[] eqs f00 ]
      LINE-2 = *            No slab insulation*
##elseif #[run[] eqs f02 ]
      LINE-2 = *           Slab insulation R-5*
##elseif #[run[] eqs f04 ]
      LINE-2 = *           Slab insulation R-10*
##endif

##if #[fndtn[] eqs standard ]
      LINE-3 = *Slab: STANDARD calculation*
##elseif #[fndtn[] eqs simplifd ]
      LINE-3 = *Slab: SIMPLIFIED METHOD*
##endif

##if #[loc[] eqs cz01 ]
      LINE-4 = *              cz01 (Arcata)*
##elseif #[loc[] eqs cz02 ]
      LINE-4 = *            cz02 (Sta. Rosa)*
##elseif #[loc[] eqs cz03 ]
     LINE-4 = *             cz03 (Oakland)*
##elseif #[loc[] eqs cz04 ]
      LINE-4 = *            cz04 (Sunnyvale)*
##elseif #[loc[] eqs cz05 ]
      LINE-4 = *            cz05 (Sta. Maria)*
##elseif #[loc[] eqs cz06 ]
      LINE-4 = *            cz06 (Long Beach)*
##elseif #[loc[] eqs cz07 ]
      LINE-4 = *            cz07 (San Diego)*
##elseif #[loc[] eqs cz08 ]
      LINE-4 = *             cz08 (El Toro)*
##elseif #[loc[] eqs cz09 ]
      LINE-4 = *             cz09 (Pasadena)*
##elseif #[loc[] eqs cz10 ]
      LINE-4 = *            cz10 (Riverside)*
##elseif #[loc[] eqs cz11 ]
      LINE-4 = *            cz11 (Red Bluff)*
##elseif #[loc[] eqs cz12 ]
      LINE-4 = *            cz12 (Sacrmento)*
##elseif #[loc[] eqs cz13 ]
      LINE-4 = *              cz13 (Fresno)*
##elseif #[loc[] eqs cz14 ]
      LINE-4 = *            cz14 (China Lake)*
##elseif #[loc[] eqs cz15 ]
      LINE-4 = *            cz15 (El Centro)*
##elseif #[loc[] eqs cz16 ]
      LINE-4 = *            cz16 (Mt. Shasta)*
##endif

      LINE-5 = *   input: cec_2-story_house_standard.inp* ..


RUN-PERIOD JAN 1, 1991 THRU DEC 31, 1991 ..


BUILDING-LOCATION
FUNCTION =(*SHADING*,*NONE*)                                    $ roller shade use
##if #[loc[] eqs cz01 ]
        LAT=40.8 LON=124.2  ALT=218
```

```
##elseif #[loc[] eqs cz02 ]
        LAT=38.4 LON=122.7  ALT=167
##elseif #[loc[] eqs cz03 ]
        LAT=37.7 LON=122.2  ALT=6
##elseif #[loc[] eqs cz04 ]
        LAT=37.4 LON=122.1  ALT=97
##elseif #[loc[] eqs cz05 ]
        LAT=34.9 LON=120.4  ALT=236
##elseif #[loc[] eqs cz06 ]
        LAT=33.8 LON=118.2  ALT=25
##elseif #[loc[] eqs cz07 ]
        LAT=32.7 LON=117.2  ALT=13
##elseif #[loc[] eqs cz08 ]
        LAT=33.6 LON=117.7  ALT=380
##elseif #[loc[] eqs cz09 ]
        LAT=34.2 LON=117.2  ALT=864
##elseif #[loc[] eqs cz10 ]
        LAT=34.1 LON=117.3  ALT=840
##elseif #[loc[] eqs cz11 ]
        LAT=40.2 LON=122.2  ALT=342
##elseif #[loc[] eqs cz12 ]
        LAT=38.5 LON=121.5  ALT=17
##elseif #[loc[] eqs cz13 ]
        LAT=36.8 LON=119.7  ALT=326
##elseif #[loc[] eqs cz14 ]
        LAT=35.7 LON=117.7  ALT=2220
##elseif #[loc[] eqs cz15 ]
        LAT=33.0 LON=115.6  ALT=-30
##elseif #[loc[] eqs cz16 ]
        LAT=41.3 LON=122.3  ALT=3535
##endif
                  HOL=YES  D-S=YES  AZ=0  T-Z=8 ..


$ -------------------------- Internal loads --------------------------
I-GAIN-JAN=D-SCH  (1) (.029)                                    $ .024*1.19
                  (2) (.026)                                    $ .022*1.19
                (3,5) (.025)                                    $ .021*1.19
                  (6) (.031)                                    $ .026*1.19
                  (7) (.045)                                    $ .038*1.19
                  (8) (.070)                                    $ .059*1.19
                  (9) (.067)                                    $ .056*1.19
                 (10) (.071)                                    $ .060*1.19
                 (11) (.070)                                    $ .059*1.19
                 (12) (.055)                                    $ .046*1.19
                 (13) (.054)                                    $ .045*1.19
                 (14) (.036)                                    $ .030*1.19
                 (15) (.033)                                    $ .028*1.19
                 (16) (.037)                                    $ .031*1.19
                 (17) (.068)                                    $ .057*1.19
               (18,19) (.076)                                   $ .064*1.19
                 (20) (.062)                                    $ .052*1.19
                 (21) (.060)                                    $ .050*1.19
                 (22) (.065)                                    $ .055*1.19
                 (23) (.052)                                    $ .044*1.19
                 (24) (.032) ..                                 $ .027*1.19

I-GAIN-FEB=D-SCH  (1) (.027)                                    $ .024*1.11
                  (2) (.024)                                    $ .022*1.11
                (3,5) (.023)                                    $ .021*1.11
                  (6) (.029)                                    $ .026*1.11
                  (7) (.042)                                    $ .038*1.11
                  (8) (.065)                                    $ .059*1.11
                  (9) (.062)                                    $ .056*1.11
                 (10) (.067)                                    $ .060*1.11
                 (11) (.065)                                    $ .059*1.11
                 (12) (.051)                                    $ .046*1.11
                 (13) (.050)                                    $ .045*1.11
                 (14) (.033)                                    $ .030*1.11
                 (15) (.031)                                    $ .028*1.11
                 (16) (.034)                                    $ .031*1.11
```

	(17)	(.063)	$ .057*1.11
	(18,19)	(.071)	$ .064*1.11
	(20)	(.058)	$ .052*1.11
	(21)	(.056)	$ .050*1.11
	(22)	(.061)	$ .055*1.11
	(23)	(.049)	$ .044*1.11
	(24)	(.030) ..	$ .027*1.11
I-GAIN-MAR=D-SCH	(1)	(.024)	$ .024*1.02
	(2)	(.022)	$ .022*1.02
	(3,5)	(.021)	$ .021*1.02
	(6)	(.026)	$ .026*1.02
	(7)	(.039)	$ .038*1.02
	(8)	(.060)	$ .059*1.02
	(9)	(.057)	$ .056*1.02
	(10)	(.061)	$ .060*1.02
	(11)	(.060)	$ .059*1.02
	(12)	(.047)	$ .046*1.02
	(13)	(.046)	$ .045*1.02
	(14)	(.031)	$ .030*1.02
	(15)	(.029)	$ .028*1.02
	(16)	(.032)	$ .031*1.02
	(17)	(.058)	$ .057*1.02
	(18,19)	(.065)	$ .064*1.02
	(20)	(.053)	$ .052*1.02
	(21)	(.051)	$ .050*1.02
	(22)	(.056)	$ .055*1.02
	(23)	(.045)	$ .044*1.02
	(24)	(.028) ..	$ .027*1.02
I-GAIN-APR=D-SCH	(1)	(.022)	$ .024*.93
	(2)	(.020)	$ .022*.93
	(3,5)	(.020)	$ .021*.93
	(6)	(.024)	$ .026*.93
	(7)	(.035)	$ .038*.93
	(8)	(.055)	$ .059*.93
	(9)	(.052)	$ .056*.93
	(10)	(.056)	$ .060*.93
	(11)	(.055)	$ .059*.93
	(12)	(.043)	$ .046*.93
	(13)	(.042)	$ .045*.93
	(14)	(.030)	$ .030*.93
	(15)	(.026)	$ .028*.93
	(16)	(.029)	$ .031*.93
	(17)	(.053)	$ .057*.93
	(18,19)	(.060)	$ .064*.93
	(20)	(.048)	$ .052*.93
	(21)	(.047)	$ .050*.93
	(22)	(.051)	$ .055*.93
	(23)	(.041)	$ .044*.93
	(24)	(.025) ..	$ .027*.93
I-GAIN-MAY=D-SCH	(1)	(.020)	$ .024*.84
	(2)	(.018)	$ .022*.84
	(3,5)	(.018)	$ .021*.84
	(6)	(.022)	$ .026*.84
	(7)	(.032)	$ .038*.84
	(8)	(.050)	$ .059*.84
	(9)	(.047)	$ .056*.84
	(10)	(.050)	$ .060*.84
	(11)	(.050)	$ .059*.84
	(12)	(.039)	$ .046*.84
	(13)	(.038)	$ .045*.84
	(14)	(.025)	$ .030*.84
	(15)	(.024)	$ .028*.84
	(16)	(.026)	$ .031*.84
	(17)	(.048)	$ .057*.84
	(18,19)	(.054)	$ .064*.84
	(20)	(.044)	$ .052*.84
	(21)	(.042)	$ .050*.84
	(22)	(.046)	$ .055*.84

	(23)	(.037)	$ .044*.84
	(24)	(.023) ..	$ .027*.84
I-GAIN-JUN=D-SCH	(1)	(.019)	$ .024*.80
	(2)	(.018)	$ .022*.80
	(3,5)	(.017)	$ .021*.80
	(6)	(.021)	$ .026*.80
	(7)	(.030)	$ .038*.80
	(8)	(.047)	$ .059*.80
	(9)	(.045)	$ .056*.80
	(10)	(.048)	$ .060*.80
	(11)	(.047)	$ .059*.80
	(12)	(.037)	$ .046*.80
	(13)	(.036)	$ .045*.80
	(14)	(.024)	$ .030*.80
	(15)	(.022)	$ .028*.80
	(16)	(.025)	$ .031*.80
	(17)	(.046)	$ .057*.80
	(18,19)	(.051)	$ .064*.80
	(20)	(.042)	$ .052*.80
	(21)	(.040)	$ .050*.80
	(22)	(.044)	$ .055*.80
	(23)	(.035)	$ .044*.80
	(24)	(.022) ..	$ .027*.80
I-GAIN-JUL=D-SCH	(1)	(.020)	$ .024*.82
	(2)	(.018)	$ .022*.82
	(3,5)	(.017)	$ .021*.82
	(6)	(.021)	$ .026*.82
	(7)	(.031)	$ .038*.82
	(8)	(.048)	$ .059*.82
	(9)	(.046)	$ .056*.82
	(10)	(.049)	$ .060*.82
	(11)	(.048)	$ .059*.82
	(12)	(.038)	$ .046*.82
	(13)	(.037)	$ .045*.82
	(14)	(.025)	$ .030*.82
	(15)	(.023)	$ .028*.82
	(16)	(.025)	$ .031*.82
	(17)	(.047)	$ .057*.82
	(18,19)	(.052)	$ .064*.82
	(20)	(.043)	$ .052*.82
	(21)	(.041)	$ .050*.82
	(22)	(.045)	$ .055*.82
	(23)	(.036)	$ .044*.82
	(24)	(.022) ..	$ .027*.82
I-GAIN-AUG=D-SCH	(1)	(.021)	$ .024*.88
	(2)	(.019)	$ .022*.88
	(3,5)	(.018)	$ .021*.88
	(6)	(.023)	$ .026*.88
	(7)	(.033)	$ .038*.88
	(8)	(.052)	$ .059*.88
	(9)	(.049)	$ .056*.88
	(10)	(.053)	$ .060*.88
	(11)	(.052)	$ .059*.88
	(12)	(.040)	$ .046*.88
	(13)	(.040)	$ .045*.88
	(14)	(.026)	$ .030*.88
	(15)	(.025)	$ .028*.88
	(16)	(.028)	$ .031*.88
	(17)	(.050)	$ .057*.88
	(18,19)	(.056)	$ .064*.88
	(20)	(.046)	$ .052*.88
	(21)	(.044)	$ .050*.88
	(22)	(.048)	$ .055*.88
	(23)	(.039)	$ .044*.88
	(24)	(.024) ..	$ .027*.88
I-GAIN-SEP=D-SCH	(1)	(.024)	$ .024*.98
	(2)	(.022)	$ .022*.98

	(3,5)	(.021)	$ .021*.98
	(6)	(.026)	$ .026*.98
	(7)	(.037)	$ .038*.98
	(8)	(.058)	$ .059*.98
	(9)	(.055)	$ .056*.98
	(10)	(.059)	$ .060*.98
	(11)	(.058)	$ .059*.98
	(12)	(.045)	$ .046*.98
	(13)	(.044)	$ .045*.98
	(14)	(.029)	$ .030*.98
	(15)	(.027)	$ .028*.98
	(16)	(.030)	$ .031*.98
	(17)	(.056)	$ .057*.98
	(18,19)	(.063)	$ .064*.98
	(20)	(.051)	$ .052*.98
	(21)	(.049)	$ .050*.98
	(22)	(.054)	$ .055*.98
	(23)	(.043)	$ .044*.98
	(24)	(.026) ..	$ .027*.98
I-GAIN-OCT=D-SCH	(1)	(.026)	$ .024*1.07
	(2)	(.024)	$ .022*1.07
	(3,5)	(.022)	$ .021*1.07
	(6)	(.028)	$ .026*1.07
	(7)	(.041)	$ .038*1.07
	(8)	(.069)	$ .059*1.07
	(9)	(.060)	$ .056*1.07
	(10)	(.064)	$ .060*1.07
	(11)	(.069)	$ .059*1.07
	(12)	(.049)	$ .046*1.07
	(13)	(.048)	$ .045*1.07
	(14)	(.032)	$ .030*1.07
	(15)	(.030)	$ .028*1.07
	(16)	(.033)	$ .031*1.07
	(17)	(.061)	$ .057*1.07
	(18,19)	(.068)	$ .064*1.07
	(20)	(.056)	$ .052*1.07
	(21)	(.054)	$ .050*1.07
	(22)	(.059)	$ .055*1.07
	(23)	(.047)	$ .044*1.07
	(24)	(.029) ..	$ .027*1.07
I-GAIN-NOV=D-SCH	(1)	(.028)	$ .024*1.16
	(2)	(.026)	$ .022*1.16
	(3,5)	(.024)	$ .021*1.16
	(6)	(.030)	$ .026*1.16
	(7)	(.044)	$ .038*1.16
	(8)	(.068)	$ .059*1.16
	(9)	(.065)	$ .056*1.16
	(10)	(.070)	$ .060*1.16
	(11)	(.068)	$ .059*1.16
	(12)	(.053)	$ .046*1.16
	(13)	(.052)	$ .045*1.16
	(14)	(.035)	$ .030*1.16
	(15)	(.032)	$ .028*1.16
	(16)	(.036)	$ .031*1.16
	(17)	(.066)	$ .057*1.16
	(18,19)	(.074)	$ .064*1.16
	(20)	(.060)	$ .052*1.16
	(21)	(.058)	$ .050*1.16
	(22)	(.064)	$ .055*1.16
	(23)	(.051)	$ .044*1.16
	(24)	(.031) ..	$ .027*1.16
I-GAIN-DEC=D-SCH	(1)	(.030)	$ .024*1.27
	(2)	(.028)	$ .022*1.27
	(3,5)	(.027)	$ .021*1.27
	(6)	(.033)	$ .026*1.27
	(7)	(.048)	$ .038*1.27
	(8)	(.075)	$ .059*1.27
	(9)	(.071)	$ .056*1.27

```
                (10) (.076)                                          $ .060*1.27
                (11) (.075)                                          $ .059*1.27
                (12) (.058)                                          $ .046*1.27
                (13) (.057)                                          $ .045*1.27
                (14) (.038)                                          $ .030*1.27
                (15) (.036)                                          $ .028*1.27
                (16) (.039)                                          $ .031*1.27
                (17) (.072)                                          $ .057*1.27
             (18,19) (.081)                                          $ .064*1.27
                (20) (.066)                                          $ .052*1.27
                (21) (.064)                                          $ .050*1.27
                (22) (.070)                                          $ .055*1.27
                (23) (.056)                                          $ .044*1.27
                (24) (.034) ..                                       $ .027*1.27

INT-LOADS=SCH  THRU JAN 31  (ALL) I-GAIN-JAN
               THRU FEB 28  (ALL) I-GAIN-FEB
               THRU MAR 31  (ALL) I-GAIN-MAR
               THRU APR 30  (ALL) I-GAIN-APR
               THRU MAY 31  (ALL) I-GAIN-MAY
               THRU JUN 30  (ALL) I-GAIN-JUN
               THRU JUL 31  (ALL) I-GAIN-JUL
               THRU AUG 31  (ALL) I-GAIN-AUG
               THRU SEP 30  (ALL) I-GAIN-SEP
               THRU OCT 31  (ALL) I-GAIN-OCT
               THRU NOV 30  (ALL) I-GAIN-NOV
               THRU DEC 31  (ALL) I-GAIN-DEC ..

MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.968) ..                 $ no roller shades
$ MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.595) ..               $$ roller shades


$ ----------------------------- Materials -----------------------------
GYPBRD=MAT     COND=.1330  TH=.0417  DENS=50.00   S-H=0.20 ..
INS-R13=MAT    COND=.0224  TH=.2917  DENS=.71     S-H=.20 ..
STUCCO=MAT     COND=.4167  TH=.0729  DENS=166.00  S-H=.20 ..
WOOD=MAT       COND=.0667  TH=.2917  DENS=32.00   S-H=.33 ..
DAMPSOIL=MAT   COND=1.000  TH=1.000  DENS=115.00  S-H=.28 ..         $ typical damp soil
RUGNPAD=MAT    RES=2.08 ..                                           $ carpet and pad
CONCRETE=MAT   COND=.8000  TH=.3333  DENS=144.    S-H=.139 ..       $ 4" heavy concrete

$ ------------------------------ Layers -------------------------------
WOOD-FRM-R13=LA  MAT=(STUCCO,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
WOOD-FRM-R19=LA  MAT=(STUCCO,IN12,WOOD,GYPBRD)  I-F-R=0.68 ..
INT-WALL=LA      MAT=(GYPBRD,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
CEIL=LA          MAT=(PW04,AL33,GYPBRD)  I-F-R=.76 ..
ROOF-LA=LA       MAT=(AR02,AR01,PW04)  I-F-R=.76 ..
ROOF-R30=LA      MAT=(AR02,AR01,PW04,IN11,IN12)  I-F-R=.76 ..
ROOF-R38=LA      MAT=(AR02,AR01,PW04,IN12,IN12)  I-F-R=.76 ..
FSLABLDP=LA      MAT=(IN52,IN14,DAMPSOIL,CONCRETE,RUGNPAD)          $ slab, R-50, 1' dampsoil
                THICKNESS(1.0,.333,1.)  I-F-R=0.765 ..
BSLABLDP=LA     MAT=(IN52,IN14,DAMPSOIL,CONCRETE)                   $ slab, R-50, 1' dampsoil
                THICKNESS(1.0,.333)  I-F-R=0.765 ..

$ --------------------------- Construction ----------------------------
WALL1CON=CONS       LA=WOOD-FRM-R13  RO=3  ABS=0.7 ..
WALL2CON=CONS       LA=WOOD-FRM-R19  RO=3  ABS=0.7 ..
IWALL1CON=CONS      LA=INT-WALL  RO=3  ABS=0.7 ..
DOORCON=CONS        U=.33 ..
CEILCON=CONS        LA=CEIL ..
ROOFCON=CONS        LA=ROOF-LA ..
ROOF1CON=CONS       LA=ROOF-R30 ..
ROOF2CON=CONS       LA=ROOF-R38 ..
SLAB-CARP=CONS      LA=FSLABLDP ..
SLAB-NO-CARP=CONS   LA=BSLABLDP ..

##if #[run[] eqs f00 ]
        DEFINE  SPCW-CS=.0852  SPCM-CS=.0551  SPCY-CS=.0028          $ carpeted slab R-0
        SCCM-CS=.0418  SCCY-CS=.0224 ..
        DEFINE  SPCW-US=.1692  SPCM-US=.0737  SPCY-US=.0014          $ uncarpeted slab R-0
        SCCM-US=.0503  SCCY-US=.0238 ..
```

```
        SLAB-PERIM-CARP=CONS     U=.72 ..                                  $ F2: carpeted R-0
        SLAB-PERIM-UNCARP=CONS     U=.90 ..                                $ F2: uncarpeted R-0
##elseif #[run[] eqs f02 ]
        DEFINE  SPCW-CS=.0291  SPCM-CS=.0685  SPCY-CS=.0100                $ carpeted slab R-5
        SCCM-CS=.0303  SCCY-CS=.0261 ..
        DEFINE  SPCW-US=.0600  SPCM-US=.0909  SPCY-US=.0086                $ uncarpeted slab R-5
        SCCM-US=.0366  SCCY-US=.0275 ..
        SLAB-PERIM-CARP=CONS     U=.53 ..                                  $ F2: carpeted R-5
        SLAB-PERIM-UNCARP=CONS     U=.58 ..                                $ F2: uncarpeted R-5
##elseif #[run[] eqs f04 ]
        DEFINE  SPCW-CS=.0224  SPCM-CS=.0629  SPCY-CS=.0141                $ carpeted slab R-10
        SCCM-CS=.0255  SCCY-CS=.0278 ..
        DEFINE  SPCW-US=.0422  SPCM-US=.0912  SPCY-US=.0115                $ uncarpeted slab R-10
        SCCM-US=.0338  SCCY-US=.0284 ..
        SLAB-PERIM-CARP=CONS     U=.50 ..                                  $ F2 carpeted R-10
        SLAB-PERIM-UNCARP=CONS     U=.53 ..                                $ F2 uncarpeted R-10
##endif

$ ------------------------------ Glazing ------------------------------
WINDOW2ATB=G-T  G-T-C=2000 ..

$ -------------------------- Space conditions --------------------------
SET FOR S-C  SOURCE-SCHEDULE=INT-LOADS  SOURCE-BTU/HR=30943  F-W=0    $ total internal gain:
             S-S=1.0  S-L=0 ..                                        $ 20,000 Btu/day +
                                                                      $ (1,761 sqft. X 15 Btu/d)=
                                                                      $ 46415 Btu/d
                                                                      $ 2/3 goes to ground floor
HOUSE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0005
              TEMPERATURE=(78)  ZONE-TYPE=CONDITIONED ..

GARAGE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0015  SOURCE-BTU/HR=0    $ (E-L-F cond. space)X3
               ZONE-TYPE=UNCONDITIONED ..

$ ------------------------- Space descriptions -------------------------
SET FOR WI  G-T=WINDOW2ATB  FRAME-WIDTH 0.125 S-SCH=MULTIPLIERS ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
             H=8.0 ..
SET FOR I-W
```

```
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
..

GARAGE=S  A=528.00  V=4718.340  S-C=GARAGE-SC ..                    $ V=4224.000+494.340
E-W  X=37.00  Y=49.00  H=10.94  W=22.00  AZ=0 ..
  DOOR  X=1.00  H=7.00  W=20.00  CONS=DOORCON ..
E-W  X=37.00  Y=25.50  W=23.50  AZ=90 ..
E-W  X=15.00  Y=49.00  W=23.50  AZ=270 ..
I-W  A=176.00  N-T=GROUND-FL ..
I-W  A=275.00  N-T=UPSTAIRS ..
ROOF  X=15.00  Y=49.00  Z=8.80  H=12.47  W=12.50  CONS=ROOF1CON  AZ=270
      TILT=28.07 ..
ROOF  X=26.00  Y=49.00  Z=14.67  H=12.47  W=12.50  CONS=ROOF1CON  AZ=270
      TILT=-28.07 ..
SET FOR E-W  H=1.00 ..
E-W  X=37.00  Y=49.00  W=22.00  AZ=0 ..
E-W  X=37.00  Y=25.50  W=23.50  AZ=90 ..
E-W  X=15.00  Y=49.00  W=23.50  AZ=270 ..
U-F  A=528.00  U-EFF=.0001  CONS=SLAB-NO-CARP ..


SET FOR E-W  H=8.00 ..

GROUND-FL=S  A=925.00  V=8802.875  S-C=HOUSE-SC ..                 $ V=7400.000+1402.875
E-W  X=14.50  Y=25.00  W=14.50  AZ=0 ..
  WI  X=5.00  Y=.33  H=6.67  W=6.00 ..
E-W  X=14.50  Y=25.00  Z=8.80  H=3.87  W=14.50  AZ=0 ..
E-W  X=37.00  W=25.00  AZ=90 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50  M=2 ..
E-W  W=37.00  AZ=180 ..
  WI  X=4.00  H=6.67  W=6.00 ..
  WI  X=20.00  Y=3.00  H=4.00  W=4.00 ..
E-W  Z=8.80  H=3.87  W=14.50  AZ=180 ..
E-W  Y=25.00  W=25.00  AZ=270 ..
  WI  X=4.00  Y=1.50  H=5.50  W=6.00  M=2 ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
```

```
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
             H=16.43 ..
ROOF  Y=25.00  Z=8.80  W=25.00  AZ=270  TILT=28.07 ..
SET FOR E-W  H=1.00 ..
E-W  CONS=SLAB-PERIM-CARP  X=14.50  Y=25.00  W=14.50  AZ=0 ..
E-W  CONS=SLAB-PERIM-UNCARP  X=37.00  Y=14.50  W=10.50  AZ=90 ..
E-W  CONS=SLAB-PERIM-CARP  X=37.00  W=14.50  AZ=90 ..
E-W  CONS=SLAB-PERIM-CARP  W=37.00  AZ=180 ..
E-W  CONS=SLAB-PERIM-CARP  Y=25.00  W=25.00  AZ=270 ..
U-F  A=694.00  U-EFF=.0001  CONS=SLAB-CARP ..
U-F  A=231.00  U-EFF=.0001  CONS=SLAB-NO-CARP ..


SET FOR E-W  H=8.00 ..

UPSTAIRS=S  A=836.00  V=8477.040  Z=8.80  S-C=HOUSE-SC
            SOURCE-BTU/HR=15472 ..                                  $ 1/3 bldg. source load
E-W  X=37.00  Y=38.00  H=10.94  W=22.00  AZ=0 ..
  WI  X=8.00  Y=4.00  H=3.00  W=5.33  M=3 ..
E-W  X=37.00  W=38.00  AZ=90 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50  M=2 ..
E-W  X=15.00  H=10.94  W=22.00  AZ=180 ..
  WI  X=5.00  Y=3.00  H=4.00  W=4.00  M=2 ..
E-W  X=15.00  Y=38.00  W=12.50  AZ=270 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50 ..
I-W  A=200.00  CONS=IWALL1CON  N-T=GROUND-FL ..
I-W  A=550.00  CONS=CEILCON  N-T=GROUND-FL ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
```

```
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
               H=12.47 ..
ROOF  X=15.00  Y=38.00  Z=16.80  W=38.00  AZ=270  TILT=28.07 ..
ROOF  X=26.00  Y=38.00  Z=22.67  W=38.00  AZ=270  TILT=-28.07 ..


LOADS-REPORT  SUMMARY=(LS-F) ..
$ LOADS-REPORT  SUMMARY=(LS-F)  HOURLY-DATA-SAVE = FORMATTED ..
$ LOADS-REPORT  VERIFICATION = (LV-I) ..
$ LOADS-REPORT  H-D-S=FORMATTED  R-F=HOURLY ..


END ..

FUNCTION  NAME=SHADING
          LEVEL=BUILDING    ..
  ASSIGN IMO=IMO IDAY=IDAY IHR=IHR DBT=DBT
         Y=SCHEDULE-NAME(MULTIPLIERS)  ..
CALCULATE   ..
      IF (IMO.EQ.1.AND.IDAY.EQ.1.AND.IHR.EQ.1) REWIND 52
      SC=0.968
      READ(52,1) xQNOW
   1  FORMAT(E14.7)
      IF (xQNOW.GT.0.0) SC=0.595
      Y=SC
      IF (IHR.EQ.15) PRINT 80,IMO,IDAY,IHR,DBT,xQNOW,Y
   80 FORMAT( ' SHADING POST ' ,3F4.0,F5.1,F10.2,F10.3)
      END
END-FUNCTION   ..

COMPUTE LOADS ..


INPUT SYSTEMS ..

$ --------------------- Set simulation conditions ----------------------
##set1 accap   32000                                                $ measured on site
##set1 accfm   1000                                                 $ measured on site
$ ##set1 vent    sg
$ ##set1 hrpt no
$ ##set1 hrpt yes

DEFINE  HEATSET=68  SETBACK=60  COOLSET=78
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
   VTYPE=-1                                                        $ enthalpic venting
##else
   VTYPE=0                                                         $ no venting
##endif
        FHIR=1.4286  MAXTEMP=120                                   $ assumed furnace input
        HCAPF=-50000                                               $ 77% eff.+10% ductloss
##set1 sen_cap = #[accap[] * 0.75 ]
        CTCAP=accap[]  CSCAP=sen_cap[]  ACCFM=accfm[]  CBF=0.9 ..
```

```
$ ---------------------------- Schedules ----------------------------
HTSCH     SCHEDULE  THRU DEC 31 (ALL)  (1,6) (SETBACK)
                                     (7,23) (HEATSET)
                                       (24) (SETBACK)  ..
WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (1.0) ..                  $ natural vent. always
$ WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (0.0) ..                $$ no natural vent.
VOPSCH    SCHEDULE  THRU DEC 31 (ALL) (1,24) (VTYPE) ..
CTSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (COOLSET) ..
VTSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (72) ..                   $ vent schedule 72 F

$ ------------------------------ Zones ------------------------------
ZC1                 ZONE-CONTROL
                              DESIGN-HEAT-T 68.
                              DESIGN-COOL-T 78.
                              COOL-TEMP-SCH CTSCH
                              HEAT-TEMP-SCH HTSCH
                              THERMOSTAT-TYPE TWO-POSITION ..
HOUSE               ZONE      ZONE-CONTROL ZC1 ..
ATTIC               ZONE      ZONE-TYPE UNCONDITIONED ..
GARAGE              ZONE      ZONE-TYPE UNCONDITIONED ..

$ ----------------------------- Systems -----------------------------
MAX-SUPPLY-T MAXTEMP
                MIN-SUPPLY-T 50
                  ..
SYSAIR    SYSTEM-AIR
                SUPPLY-CFM ACCFM
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
                NATURAL-VENT-SCH VOPSCH
                VENT-TEMP-SCH VTSCH
                OPEN-VENT-SCH WINDOPER
  ##if #[vent[] eqs sg]
                HOR-VENT-FRAC 0.0
                FRAC-VENT-AREA=.0242                                   $ 10% window area open
                VENT-METHOD S-G                                        $ discharge coeff. 0.6
                MAX-VENT-RATE 20
  ##endif
  ##if #[vent[] eqs ach]                                               $ 10 ach when venting
                NATURAL-VENT-AC 10
                VENT-METHOD AIR-CHANGE
  ##endif
##endif
 ..

SYSEQP    SYSTEM-EQUIPMENT
                COOLING-CAPACITY CTCAP
                COOL-SH-CAP CSCAP
                COIL-BF CBF
                COMPRESSOR-TYPE SINGLE-SPEED
                COOLING-EIR .39985
                HEATING-CAPACITY HCAPF                                 $ furnace specs
                FURNACE-AUX 0.
                FURNACE-HIR FHIR ..                                    $ duct losses in FHIR


RESIDEN  SYSTEM  SYSTEM-TYPE RESYS
                   Z-N=(HOUSE,GARAGE,ATTIC)
                SYSTEM-CONTROL SYSCONTRL
                SYSTEM-AIR SYSAIR
                SYSTEM-EQUIPMENT SYSEQP
                HEAT-SOURCE FURNACE ..


$ -------------------------- System reports --------------------------
##if #[hrpt[] eqs yes]
HRSCH=SCH  THRU DEC 31 (ALL) (1,24) (1)  ..
RB-1=R-B  V-T=GLOBAL   V-L=(8) ..
RB-2=R-B  V-T=RESIDEN  V-L=(61,62) ..                                  $ part-loads
DUMP=H-R  R-SCH=HRSCH  R-B=(RB-1,RB-2) ..
##endif
```

```
SYSTEMS-REPORT
##if #[hrpt[] eqs yes]
                    HOURLY-DATA-SAVE=FORMATTED
##endif

$ S=(SS-A,SS-B,SS-C,SS-F,SS-H,SS-I) ..
S=(SS-A,SS-H) ..
$ S=(SS-H) ..


END ..
COMPUTE  SYSTEMS ..


INPUT PLANT ..
PLANT-REPORT  S=(PS-B,PS-E,BEPS) ..
END ..

COMPUTE PLANT ..
STOP  ..
```

APPENDIX D: Listing of BDL File for the Two-story House, Simplified Method

The listing below is the BDL file that describes the two-story house used as the subject of simulation in this study using a method of calculation of heat flow through slab-on-grade that is based on (and simplified relative to) the two-dimensional finite-difference method 2DFD. The graphic and textual descriptions of the subject house are found in Section 3: TWO-STORY HOUSE.

This BDL file contains the input for the Simplified Method and must be executed with the special version of DOE-2.1E that contains the Simplified Method. Attempts to execute it with the standard version of DOE-2.1E will fail.

```
$ --------------------- Set simulation conditions ----------------------
$ ##set1 run f00
$ ##set1 run f02
$ ##set1 run f04

$ ##set1 loc cz01
$ ##set1 loc cz02
$ ##set1 loc cz03
$ ##set1 loc cz04
$ ##set1 loc cz05
$ ##set1 loc cz06
$ ##set1 loc cz07
$ ##set1 loc cz08
$ ##set1 loc cz09
$ ##set1 loc cz10
$ ##set1 loc cz11
$ ##set1 loc cz12
$ ##set1 loc cz13
$ ##set1 loc cz14
$ ##set1 loc cz15
$ ##set1 loc cz16

$ ##set1 fndtn standard
$ ##set1 fndtn simplifd
$ ----------------------------------------------------------------------


$ INPUT LOADS ..
$ ABORT ERRORS ..
$ LIST WARNINGS ..


TITLE LINE-1 = *Typical Two-Story House*

##if #[run[] eqs f00 ]
      LINE-2 = *            No slab insulation*
##elseif #[run[] eqs f02 ]
      LINE-2 = *           Slab insulation R-5*
##elseif #[run[] eqs f04 ]
      LINE-2 = *           Slab insulation R-10*
##endif

##if #[fndtn[] eqs standard ]
      LINE-3 = *Slab: STANDARD calculation*
##elseif #[fndtn[] eqs simplifd ]
      LINE-3 = *Slab: SIMPLIFIED METHOD*
##endif

##if #[loc[] eqs cz01 ]
      LINE-4 = *              cz01 (Arcata)*
##elseif #[loc[] eqs cz02 ]
      LINE-4 = *            cz02 (Sta. Rosa)*
##elseif #[loc[] eqs cz03 ]
     LINE-4 = *             cz03 (Oakland)*
##elseif #[loc[] eqs cz04 ]
      LINE-4 = *            cz04 (Sunnyvale)*
```

```
##elseif #[loc[] eqs cz05 ]
      LINE-4 = *             cz05 (Sta. Maria)*
##elseif #[loc[] eqs cz06 ]
      LINE-4 = *             cz06 (Long Beach)*
##elseif #[loc[] eqs cz07 ]
      LINE-4 = *             cz07 (San Diego)*
##elseif #[loc[] eqs cz08 ]
      LINE-4 = *              cz08 (El Toro)*
##elseif #[loc[] eqs cz09 ]
      LINE-4 = *              cz09 (Pasadena)*
##elseif #[loc[] eqs cz10 ]
      LINE-4 = *             cz10 (Riverside)*
##elseif #[loc[] eqs cz11 ]
      LINE-4 = *             cz11 (Red Bluff)*
##elseif #[loc[] eqs cz12 ]
      LINE-4 = *             cz12 (Sacramento)*
##elseif #[loc[] eqs cz13 ]
      LINE-4 = *               cz13 (Fresno)*
##elseif #[loc[] eqs cz14 ]
      LINE-4 = *             cz14 (China Lake)*
##elseif #[loc[] eqs cz15 ]
      LINE-4 = *             cz15 (El Centro)*
##elseif #[loc[] eqs cz16 ]
      LINE-4 = *             cz16 (Mt. Shasta)*
##endif

      LINE-5 = *input: cec_2-story_house_simp-method.inp* ..


RUN-PERIOD JAN 1, 1991 THRU DEC 31, 1991 ..


BUILDING-LOCATION
##if #[loc[] eqs cz01 ]
        LAT=40.8 LON=124.2  ALT=218
##elseif #[loc[] eqs cz02 ]
        LAT=38.4 LON=122.7  ALT=167
##elseif #[loc[] eqs cz03 ]
        LAT=37.7 LON=122.2  ALT=6
##elseif #[loc[] eqs cz04 ]
        LAT=37.4 LON=122.1  ALT=97
##elseif #[loc[] eqs cz05 ]
        LAT=34.9 LON=120.4  ALT=236
##elseif #[loc[] eqs cz06 ]
        LAT=33.8 LON=118.2  ALT=25
##elseif #[loc[] eqs cz07 ]
        LAT=32.7 LON=117.2  ALT=13
##elseif #[loc[] eqs cz08 ]
        LAT=33.6 LON=117.7  ALT=380
##elseif #[loc[] eqs cz09 ]
        LAT=34.2 LON=117.2  ALT=864
##elseif #[loc[] eqs cz10 ]
        LAT=34.1 LON=117.3  ALT=840
##elseif #[loc[] eqs cz11 ]
        LAT=40.2 LON=122.2  ALT=342
##elseif #[loc[] eqs cz12 ]
        LAT=38.5 LON=121.5  ALT=17
##elseif #[loc[] eqs cz13 ]
        LAT=36.8 LON=119.7  ALT=326
##elseif #[loc[] eqs cz14 ]
        LAT=35.7 LON=117.7  ALT=2220
##elseif #[loc[] eqs cz15 ]
        LAT=33.0 LON=115.6  ALT=-30
##elseif #[loc[] eqs cz16 ]
        LAT=41.3 LON=122.3  ALT=3535
##endif
                  HOL=YES  D-S=YES  AZ=0  T-Z=8 ..


$ -------------------------- Internal loads --------------------------
I-GAIN-JAN=D-SCH  (1) (.029)                                    $ .024*1.19
```

	(2)	(.026)	$ .022*1.19
	(3,5)	(.025)	$ .021*1.19
	(6)	(.031)	$ .026*1.19
	(7)	(.045)	$ .038*1.19
	(8)	(.070)	$ .059*1.19
	(9)	(.067)	$ .056*1.19
	(10)	(.071)	$ .060*1.19
	(11)	(.070)	$ .059*1.19
	(12)	(.055)	$ .046*1.19
	(13)	(.054)	$ .045*1.19
	(14)	(.036)	$ .030*1.19
	(15)	(.033)	$ .028*1.19
	(16)	(.037)	$ .031*1.19
	(17)	(.068)	$ .057*1.19
	(18,19)	(.076)	$ .064*1.19
	(20)	(.062)	$ .052*1.19
	(21)	(.060)	$ .050*1.19
	(22)	(.065)	$ .055*1.19
	(23)	(.052)	$ .044*1.19
	(24)	(.032) ..	$ .027*1.19
I-GAIN-FEB=D-SCH	(1)	(.027)	$ .024*1.11
	(2)	(.024)	$ .022*1.11
	(3,5)	(.023)	$ .021*1.11
	(6)	(.029)	$ .026*1.11
	(7)	(.042)	$ .038*1.11
	(8)	(.065)	$ .059*1.11
	(9)	(.062)	$ .056*1.11
	(10)	(.067)	$ .060*1.11
	(11)	(.065)	$ .059*1.11
	(12)	(.051)	$ .046*1.11
	(13)	(.050)	$ .045*1.11
	(14)	(.033)	$ .030*1.11
	(15)	(.031)	$ .028*1.11
	(16)	(.034)	$ .031*1.11
	(17)	(.063)	$ .057*1.11
	(18,19)	(.071)	$ .064*1.11
	(20)	(.058)	$ .052*1.11
	(21)	(.056)	$ .050*1.11
	(22)	(.061)	$ .055*1.11
	(23)	(.049)	$ .044*1.11
	(24)	(.030) ..	$ .027*1.11
I-GAIN-MAR=D-SCH	(1)	(.024)	$ .024*1.02
	(2)	(.022)	$ .022*1.02
	(3,5)	(.021)	$ .021*1.02
	(6)	(.026)	$ .026*1.02
	(7)	(.039)	$ .038*1.02
	(8)	(.060)	$ .059*1.02
	(9)	(.057)	$ .056*1.02
	(10)	(.061)	$ .060*1.02
	(11)	(.060)	$ .059*1.02
	(12)	(.047)	$ .046*1.02
	(13)	(.046)	$ .045*1.02
	(14)	(.031)	$ .030*1.02
	(15)	(.029)	$ .028*1.02
	(16)	(.032)	$ .031*1.02
	(17)	(.058)	$ .057*1.02
	(18,19)	(.065)	$ .064*1.02
	(20)	(.053)	$ .052*1.02
	(21)	(.051)	$ .050*1.02
	(22)	(.056)	$ .055*1.02
	(23)	(.045)	$ .044*1.02
	(24)	(.028) ..	$ .027*1.02
I-GAIN-APR=D-SCH	(1)	(.022)	$ .024*.93
	(2)	(.020)	$ .022*.93
	(3,5)	(.020)	$ .021*.93
	(6)	(.024)	$ .026*.93
	(7)	(.035)	$ .038*.93
	(8)	(.055)	$ .059*.93

	(9)	(.052)	$ .056*.93
	(10)	(.056)	$ .060*.93
	(11)	(.055)	$ .059*.93
	(12)	(.043)	$ .046*.93
	(13)	(.042)	$ .045*.93
	(14)	(.030)	$ .030*.93
	(15)	(.026)	$ .028*.93
	(16)	(.029)	$ .031*.93
	(17)	(.053)	$ .057*.93
	(18,19)	(.060)	$ .064*.93
	(20)	(.048)	$ .052*.93
	(21)	(.047)	$ .050*.93
	(22)	(.051)	$ .055*.93
	(23)	(.041)	$ .044*.93
	(24)	(.025) ..	$ .027*.93
I-GAIN-MAY=D-SCH	(1)	(.020)	$ .024*.84
	(2)	(.018)	$ .022*.84
	(3,5)	(.018)	$ .021*.84
	(6)	(.022)	$ .026*.84
	(7)	(.032)	$ .038*.84
	(8)	(.050)	$ .059*.84
	(9)	(.047)	$ .056*.84
	(10)	(.050)	$ .060*.84
	(11)	(.050)	$ .059*.84
	(12)	(.039)	$ .046*.84
	(13)	(.038)	$ .045*.84
	(14)	(.025)	$ .030*.84
	(15)	(.024)	$ .028*.84
	(16)	(.026)	$ .031*.84
	(17)	(.048)	$ .057*.84
	(18,19)	(.054)	$ .064*.84
	(20)	(.044)	$ .052*.84
	(21)	(.042)	$ .050*.84
	(22)	(.046)	$ .055*.84
	(23)	(.037)	$ .044*.84
	(24)	(.023) ..	$ .027*.84
I-GAIN-JUN=D-SCH	(1)	(.019)	$ .024*.80
	(2)	(.018)	$ .022*.80
	(3,5)	(.017)	$ .021*.80
	(6)	(.021)	$ .026*.80
	(7)	(.030)	$ .038*.80
	(8)	(.047)	$ .059*.80
	(9)	(.045)	$ .056*.80
	(10)	(.048)	$ .060*.80
	(11)	(.047)	$ .059*.80
	(12)	(.037)	$ .046*.80
	(13)	(.036)	$ .045*.80
	(14)	(.024)	$ .030*.80
	(15)	(.022)	$ .028*.80
	(16)	(.025)	$ .031*.80
	(17)	(.046)	$ .057*.80
	(18,19)	(.051)	$ .064*.80
	(20)	(.042)	$ .052*.80
	(21)	(.040)	$ .050*.80
	(22)	(.044)	$ .055*.80
	(23)	(.035)	$ .044*.80
	(24)	(.022) ..	$ .027*.80
I-GAIN-JUL=D-SCH	(1)	(.020)	$ .024*.82
	(2)	(.018)	$ .022*.82
	(3,5)	(.017)	$ .021*.82
	(6)	(.021)	$ .026*.82
	(7)	(.031)	$ .038*.82
	(8)	(.048)	$ .059*.82
	(9)	(.046)	$ .056*.82
	(10)	(.049)	$ .060*.82
	(11)	(.048)	$ .059*.82
	(12)	(.038)	$ .046*.82
	(13)	(.037)	$ .045*.82

	(14)	(.025)	$ .030*.82
	(15)	(.023)	$ .028*.82
	(16)	(.025)	$ .031*.82
	(17)	(.047)	$ .057*.82
	(18,19)	(.052)	$ .064*.82
	(20)	(.043)	$ .052*.82
	(21)	(.041)	$ .050*.82
	(22)	(.045)	$ .055*.82
	(23)	(.036)	$ .044*.82
	(24)	(.022) ..	$ .027*.82
I-GAIN-AUG=D-SCH	(1)	(.021)	$ .024*.88
	(2)	(.019)	$ .022*.88
	(3,5)	(.018)	$ .021*.88
	(6)	(.023)	$ .026*.88
	(7)	(.033)	$ .038*.88
	(8)	(.052)	$ .059*.88
	(9)	(.049)	$ .056*.88
	(10)	(.053)	$ .060*.88
	(11)	(.052)	$ .059*.88
	(12)	(.040)	$ .046*.88
	(13)	(.040)	$ .045*.88
	(14)	(.026)	$ .030*.88
	(15)	(.025)	$ .028*.88
	(16)	(.028)	$ .031*.88
	(17)	(.050)	$ .057*.88
	(18,19)	(.056)	$ .064*.88
	(20)	(.046)	$ .052*.88
	(21)	(.044)	$ .050*.88
	(22)	(.048)	$ .055*.88
	(23)	(.039)	$ .044*.88
	(24)	(.024) ..	$ .027*.88
I-GAIN-SEP=D-SCH	(1)	(.024)	$ .024*.98
	(2)	(.022)	$ .022*.98
	(3,5)	(.021)	$ .021*.98
	(6)	(.026)	$ .026*.98
	(7)	(.037)	$ .038*.98
	(8)	(.058)	$ .059*.98
	(9)	(.055)	$ .056*.98
	(10)	(.059)	$ .060*.98
	(11)	(.058)	$ .059*.98
	(12)	(.045)	$ .046*.98
	(13)	(.044)	$ .045*.98
	(14)	(.029)	$ .030*.98
	(15)	(.027)	$ .028*.98
	(16)	(.030)	$ .031*.98
	(17)	(.056)	$ .057*.98
	(18,19)	(.063)	$ .064*.98
	(20)	(.051)	$ .052*.98
	(21)	(.049)	$ .050*.98
	(22)	(.054)	$ .055*.98
	(23)	(.043)	$ .044*.98
	(24)	(.026) ..	$ .027*.98
I-GAIN-OCT=D-SCH	(1)	(.026)	$ .024*1.07
	(2)	(.024)	$ .022*1.07
	(3,5)	(.022)	$ .021*1.07
	(6)	(.028)	$ .026*1.07
	(7)	(.041)	$ .038*1.07
	(8)	(.069)	$ .059*1.07
	(9)	(.060)	$ .056*1.07
	(10)	(.064)	$ .060*1.07
	(11)	(.069)	$ .059*1.07
	(12)	(.049)	$ .046*1.07
	(13)	(.048)	$ .045*1.07
	(14)	(.032)	$ .030*1.07
	(15)	(.030)	$ .028*1.07
	(16)	(.033)	$ .031*1.07
	(17)	(.061)	$ .057*1.07
	(18,19)	(.068)	$ .064*1.07

	(20)	(.056)	$ .052*1.07
	(21)	(.054)	$ .050*1.07
	(22)	(.059)	$ .055*1.07
	(23)	(.047)	$ .044*1.07
	(24)	(.029) ..	$ .027*1.07
I-GAIN-NOV=D-SCH	(1)	(.028)	$ .024*1.16
	(2)	(.026)	$ .022*1.16
	(3,5)	(.024)	$ .021*1.16
	(6)	(.030)	$ .026*1.16
	(7)	(.044)	$ .038*1.16
	(8)	(.068)	$ .059*1.16
	(9)	(.065)	$ .056*1.16
	(10)	(.070)	$ .060*1.16
	(11)	(.068)	$ .059*1.16
	(12)	(.053)	$ .046*1.16
	(13)	(.052)	$ .045*1.16
	(14)	(.035)	$ .030*1.16
	(15)	(.032)	$ .028*1.16
	(16)	(.036)	$ .031*1.16
	(17)	(.066)	$ .057*1.16
	(18,19)	(.074)	$ .064*1.16
	(20)	(.060)	$ .052*1.16
	(21)	(.058)	$ .050*1.16
	(22)	(.064)	$ .055*1.16
	(23)	(.051)	$ .044*1.16
	(24)	(.031) ..	$ .027*1.16
I-GAIN-DEC=D-SCH	(1)	(.030)	$ .024*1.27
	(2)	(.028)	$ .022*1.27
	(3,5)	(.027)	$ .021*1.27
	(6)	(.033)	$ .026*1.27
	(7)	(.048)	$ .038*1.27
	(8)	(.075)	$ .059*1.27
	(9)	(.071)	$ .056*1.27
	(10)	(.076)	$ .060*1.27
	(11)	(.075)	$ .059*1.27
	(12)	(.058)	$ .046*1.27
	(13)	(.057)	$ .045*1.27
	(14)	(.038)	$ .030*1.27
	(15)	(.036)	$ .028*1.27
	(16)	(.039)	$ .031*1.27
	(17)	(.072)	$ .057*1.27
	(18,19)	(.081)	$ .064*1.27
	(20)	(.066)	$ .052*1.27
	(21)	(.064)	$ .050*1.27
	(22)	(.070)	$ .055*1.27
	(23)	(.056)	$ .044*1.27
	(24)	(.034) ..	$ .027*1.27
I-GAIN-JAN=D-SCH	(1)	(.029)	$ .024*1.19
	(2)	(.026)	$ .022*1.19
	(3,5)	(.025)	$ .021*1.19
	(6)	(.031)	$ .026*1.19
	(7)	(.045)	$ .038*1.19
	(8)	(.070)	$ .059*1.19
	(9)	(.067)	$ .056*1.19
	(10)	(.071)	$ .060*1.19
	(11)	(.070)	$ .059*1.19
	(12)	(.055)	$ .046*1.19
	(13)	(.054)	$ .045*1.19
	(14)	(.036)	$ .030*1.19
	(15)	(.033)	$ .028*1.19
	(16)	(.037)	$ .031*1.19
	(17)	(.068)	$ .057*1.19
	(18,19)	(.076)	$ .064*1.19
	(20)	(.062)	$ .052*1.19
	(21)	(.060)	$ .050*1.19
	(22)	(.065)	$ .055*1.19
	(23)	(.052)	$ .044*1.19
	(24)	(.032) ..	$ .027*1.19

I-GAIN-FEB=D-SCH	(1)	(.027)	$ .024*1.11
	(2)	(.024)	$ .022*1.11
	(3,5)	(.023)	$ .021*1.11
	(6)	(.029)	$ .026*1.11
	(7)	(.042)	$ .038*1.11
	(8)	(.065)	$ .059*1.11
	(9)	(.062)	$ .056*1.11
	(10)	(.067)	$ .060*1.11
	(11)	(.065)	$ .059*1.11
	(12)	(.051)	$ .046*1.11
	(13)	(.050)	$ .045*1.11
	(14)	(.033)	$ .030*1.11
	(15)	(.031)	$ .028*1.11
	(16)	(.034)	$ .031*1.11
	(17)	(.063)	$ .057*1.11
	(18,19)	(.071)	$ .064*1.11
	(20)	(.058)	$ .052*1.11
	(21)	(.056)	$ .050*1.11
	(22)	(.061)	$ .055*1.11
	(23)	(.049)	$ .044*1.11
	(24)	(.030) ..	$ .027*1.11
I-GAIN-MAR=D-SCH	(1)	(.024)	$ .024*1.02
	(2)	(.022)	$ .022*1.02
	(3,5)	(.021)	$ .021*1.02
	(6)	(.026)	$ .026*1.02
	(7)	(.039)	$ .038*1.02
	(8)	(.060)	$ .059*1.02
	(9)	(.057)	$ .056*1.02
	(10)	(.061)	$ .060*1.02
	(11)	(.060)	$ .059*1.02
	(12)	(.047)	$ .046*1.02
	(13)	(.046)	$ .045*1.02
	(14)	(.031)	$ .030*1.02
	(15)	(.029)	$ .028*1.02
	(16)	(.032)	$ .031*1.02
	(17)	(.058)	$ .057*1.02
	(18,19)	(.065)	$ .064*1.02
	(20)	(.053)	$ .052*1.02
	(21)	(.051)	$ .050*1.02
	(22)	(.056)	$ .055*1.02
	(23)	(.045)	$ .044*1.02
	(24)	(.028) ..	$ .027*1.02
I-GAIN-APR=D-SCH	(1)	(.022)	$ .024*.93
	(2)	(.020)	$ .022*.93
	(3,5)	(.020)	$ .021*.93
	(6)	(.024)	$ .026*.93
	(7)	(.035)	$ .038*.93
	(8)	(.055)	$ .059*.93
	(9)	(.052)	$ .056*.93
	(10)	(.056)	$ .060*.93
	(11)	(.055)	$ .059*.93
	(12)	(.043)	$ .046*.93
	(13)	(.042)	$ .045*.93
	(14)	(.030)	$ .030*.93
	(15)	(.026)	$ .028*.93
	(16)	(.029)	$ .031*.93
	(17)	(.053)	$ .057*.93
	(18,19)	(.060)	$ .064*.93
	(20)	(.048)	$ .052*.93
	(21)	(.047)	$ .050*.93
	(22)	(.051)	$ .055*.93
	(23)	(.041)	$ .044*.93
	(24)	(.025) ..	$ .027*.93
I-GAIN-MAY=D-SCH	(1)	(.020)	$ .024*.84
	(2)	(.018)	$ .022*.84
	(3,5)	(.018)	$ .021*.84
	(6)	(.022)	$ .026*.84
	(7)	(.032)	$ .038*.84

	(8)	(.050)	$ .059*.84
	(9)	(.047)	$ .056*.84
	(10)	(.050)	$ .060*.84
	(11)	(.050)	$ .059*.84
	(12)	(.039)	$ .046*.84
	(13)	(.038)	$ .045*.84
	(14)	(.025)	$ .030*.84
	(15)	(.024)	$ .028*.84
	(16)	(.026)	$ .031*.84
	(17)	(.048)	$ .057*.84
	(18,19)	(.054)	$ .064*.84
	(20)	(.044)	$ .052*.84
	(21)	(.042)	$ .050*.84
	(22)	(.046)	$ .055*.84
	(23)	(.037)	$ .044*.84
	(24)	(.023) ..	$ .027*.84
I-GAIN-JUN=D-SCH	(1)	(.019)	$ .024*.80
	(2)	(.018)	$ .022*.80
	(3,5)	(.017)	$ .021*.80
	(6)	(.021)	$ .026*.80
	(7)	(.030)	$ .038*.80
	(8)	(.047)	$ .059*.80
	(9)	(.045)	$ .056*.80
	(10)	(.048)	$ .060*.80
	(11)	(.047)	$ .059*.80
	(12)	(.037)	$ .046*.80
	(13)	(.036)	$ .045*.80
	(14)	(.024)	$ .030*.80
	(15)	(.022)	$ .028*.80
	(16)	(.025)	$ .031*.80
	(17)	(.046)	$ .057*.80
	(18,19)	(.051)	$ .064*.80
	(20)	(.042)	$ .052*.80
	(21)	(.040)	$ .050*.80
	(22)	(.044)	$ .055*.80
	(23)	(.035)	$ .044*.80
	(24)	(.022) ..	$ .027*.80
I-GAIN-JUL=D-SCH	(1)	(.020)	$ .024*.82
	(2)	(.018)	$ .022*.82
	(3,5)	(.017)	$ .021*.82
	(6)	(.021)	$ .026*.82
	(7)	(.031)	$ .038*.82
	(8)	(.048)	$ .059*.82
	(9)	(.046)	$ .056*.82
	(10)	(.049)	$ .060*.82
	(11)	(.048)	$ .059*.82
	(12)	(.038)	$ .046*.82
	(13)	(.037)	$ .045*.82
	(14)	(.025)	$ .030*.82
	(15)	(.023)	$ .028*.82
	(16)	(.025)	$ .031*.82
	(17)	(.047)	$ .057*.82
	(18,19)	(.052)	$ .064*.82
	(20)	(.043)	$ .052*.82
	(21)	(.041)	$ .050*.82
	(22)	(.045)	$ .055*.82
	(23)	(.036)	$ .044*.82
	(24)	(.022) ..	$ .027*.82
I-GAIN-AUG=D-SCH	(1)	(.021)	$ .024*.88
	(2)	(.019)	$ .022*.88
	(3,5)	(.018)	$ .021*.88
	(6)	(.023)	$ .026*.88
	(7)	(.033)	$ .038*.88
	(8)	(.052)	$ .059*.88
	(9)	(.049)	$ .056*.88
	(10)	(.053)	$ .060*.88
	(11)	(.052)	$ .059*.88
	(12)	(.040)	$ .046*.88

	(13)	(.040)	$ .045*.88
	(14)	(.026)	$ .030*.88
	(15)	(.025)	$ .028*.88
	(16)	(.028)	$ .031*.88
	(17)	(.050)	$ .057*.88
	(18,19)	(.056)	$ .064*.88
	(20)	(.046)	$ .052*.88
	(21)	(.044)	$ .050*.88
	(22)	(.048)	$ .055*.88
	(23)	(.039)	$ .044*.88
	(24)	(.024) ..	$ .027*.88
I-GAIN-SEP=D-SCH	(1)	(.024)	$ .024*.98
	(2)	(.022)	$ .022*.98
	(3,5)	(.021)	$ .021*.98
	(6)	(.026)	$ .026*.98
	(7)	(.037)	$ .038*.98
	(8)	(.058)	$ .059*.98
	(9)	(.055)	$ .056*.98
	(10)	(.059)	$ .060*.98
	(11)	(.058)	$ .059*.98
	(12)	(.045)	$ .046*.98
	(13)	(.044)	$ .045*.98
	(14)	(.029)	$ .030*.98
	(15)	(.027)	$ .028*.98
	(16)	(.030)	$ .031*.98
	(17)	(.056)	$ .057*.98
	(18,19)	(.063)	$ .064*.98
	(20)	(.051)	$ .052*.98
	(21)	(.049)	$ .050*.98
	(22)	(.054)	$ .055*.98
	(23)	(.043)	$ .044*.98
	(24)	(.026) ..	$ .027*.98
I-GAIN-OCT=D-SCH	(1)	(.026)	$ .024*1.07
	(2)	(.024)	$ .022*1.07
	(3,5)	(.022)	$ .021*1.07
	(6)	(.028)	$ .026*1.07
	(7)	(.041)	$ .038*1.07
	(8)	(.069)	$ .059*1.07
	(9)	(.060)	$ .056*1.07
	(10)	(.064)	$ .060*1.07
	(11)	(.069)	$ .059*1.07
	(12)	(.049)	$ .046*1.07
	(13)	(.048)	$ .045*1.07
	(14)	(.032)	$ .030*1.07
	(15)	(.030)	$ .028*1.07
	(16)	(.033)	$ .031*1.07
	(17)	(.061)	$ .057*1.07
	(18,19)	(.068)	$ .064*1.07
	(20)	(.056)	$ .052*1.07
	(21)	(.054)	$ .050*1.07
	(22)	(.059)	$ .055*1.07
	(23)	(.047)	$ .044*1.07
	(24)	(.029) ..	$ .027*1.07
I-GAIN-NOV=D-SCH	(1)	(.028)	$ .024*1.16
	(2)	(.026)	$ .022*1.16
	(3,5)	(.024)	$ .021*1.16
	(6)	(.030)	$ .026*1.16
	(7)	(.044)	$ .038*1.16
	(8)	(.068)	$ .059*1.16
	(9)	(.065)	$ .056*1.16
	(10)	(.070)	$ .060*1.16
	(11)	(.068)	$ .059*1.16
	(12)	(.053)	$ .046*1.16
	(13)	(.052)	$ .045*1.16
	(14)	(.035)	$ .030*1.16
	(15)	(.032)	$ .028*1.16
	(16)	(.036)	$ .031*1.16
	(17)	(.066)	$ .057*1.16

```
              (18,19) (.074)                                          $ .064*1.16
                 (20) (.060)                                          $ .052*1.16
                 (21) (.058)                                          $ .050*1.16
                 (22) (.064)                                          $ .055*1.16
                 (23) (.051)                                          $ .044*1.16
                 (24) (.031) ..                                       $ .027*1.16

I-GAIN-DEC=D-SCH  (1) (.030)                                          $ .024*1.27
                  (2) (.028)                                          $ .022*1.27
                (3,5) (.027)                                          $ .021*1.27
                  (6) (.033)                                          $ .026*1.27
                  (7) (.048)                                          $ .038*1.27
                  (8) (.075)                                          $ .059*1.27
                  (9) (.071)                                          $ .056*1.27
                 (10) (.076)                                          $ .060*1.27
                 (11) (.075)                                          $ .059*1.27
                 (12) (.058)                                          $ .046*1.27
                 (13) (.057)                                          $ .045*1.27
                 (14) (.038)                                          $ .030*1.27
                 (15) (.036)                                          $ .028*1.27
                 (16) (.039)                                          $ .031*1.27
                 (17) (.072)                                          $ .057*1.27
              (18,19) (.081)                                          $ .064*1.27
                 (20) (.066)                                          $ .052*1.27
                 (21) (.064)                                          $ .050*1.27
                 (22) (.070)                                          $ .055*1.27
                 (23) (.056)                                          $ .044*1.27
                 (24) (.034) ..                                       $ .027*1.27

INT-LOADS=SCH  THRU JAN 31  (ALL) I-GAIN-JAN
               THRU FEB 28  (ALL) I-GAIN-FEB
               THRU MAR 31  (ALL) I-GAIN-MAR
               THRU APR 30  (ALL) I-GAIN-APR
               THRU MAY 31  (ALL) I-GAIN-MAY
               THRU JUN 30  (ALL) I-GAIN-JUN
               THRU JUL 31  (ALL) I-GAIN-JUL
               THRU AUG 31  (ALL) I-GAIN-AUG
               THRU SEP 30  (ALL) I-GAIN-SEP
               THRU OCT 31  (ALL) I-GAIN-OCT
               THRU NOV 30  (ALL) I-GAIN-NOV
               THRU DEC 31  (ALL) I-GAIN-DEC ..


MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.968) ..                  $ no roller shades
$ MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.595) ..                $$ roller shades


$ ----------------------------- Materials -----------------------------
GYPBRD=MAT     COND=.1330  TH=.0417  DENS=50.00   S-H=0.20 ..
INS-R13=MAT    COND=.0224  TH=.2917  DENS=.71     S-H=.20 ..
STUCCO=MAT     COND=.4167  TH=.0729  DENS=166.00  S-H=.20 ..
WOOD=MAT       COND=.0667  TH=.2917  DENS=32.00   S-H=.33 ..
DAMPSOIL=MAT   COND=1.000  TH=1.000  DENS=115.00  S-H=.28 ..        $ typical damp soil
RUGNPAD=MAT    RES=2.08 ..                                          $ carpet and pad
CONCRETE=MAT   COND=.8000  TH=.3333  DENS=144.    S-H=.139 ..       $ 4" heavy concrete

$ ------------------------------ Layers -------------------------------
WOOD-FRM-R13=LA  MAT=(STUCCO,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
WOOD-FRM-R19=LA  MAT=(STUCCO,IN12,WOOD,GYPBRD)  I-F-R=0.68 ..
INT-WALL=LA      MAT=(GYPBRD,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
CEIL=LA          MAT=(PW04,AL33,GYPBRD)  I-F-R=.76 ..
ROOF-LA=LA       MAT=(AR02,AR01,PW04)  I-F-R=.76 ..
ROOF-R30=LA      MAT=(AR02,AR01,PW04,IN11,IN12)  I-F-R=.76 ..
ROOF-R38=LA      MAT=(AR02,AR01,PW04,IN12,IN12)  I-F-R=.76 ..
FSLABLDP=LA      MAT=(DAMPSOIL,CONCRETE,RUGNPAD)                      $ slab, 1'-0" damp soil
                THICKNESS(1.0,.333,1.)  I-F-R=0.765 ..
BSLABLDP=LA     MAT=(DAMPSOIL,CONCRETE)                               $ slab, 1'-0" damp soil
                THICKNESS(1.0,.333)  I-F-R=0.765 ..

$ --------------------------- Construction ----------------------------
WALL1CON=CONS      LA=WOOD-FRM-R13  RO=3  ABS=0.7 ..
```

```
WALL2CON=CONS       LA=WOOD-FRM-R19  RO=3  ABS=0.7 ..
IWALL1CON=CONS      LA=INT-WALL  RO=3  ABS=0.7 ..
DOORCON=CONS        U=.33 ..
CEILCON=CONS        LA=CEIL ..
ROOFCON=CONS        LA=ROOF-LA ..
ROOF1CON=CONS       LA=ROOF-R30 ..
ROOF2CON=CONS       LA=ROOF-R38 ..
SLAB-CARP=CONS      LA=FSLABLDP ..
SLAB-NO-CARP=CONS   LA=BSLABLDP ..

##if #[run[] eqs f00 ]
        DEFINE  SPCW-CS=.0852  SPCM-CS=.0551  SPCY-CS=.0028              $ carpeted slab R-0
        SCCM-CS=.0418  SCCY-CS=.0224 ..
        DEFINE  SPCW-US=.1692  SPCM-US=.0737  SPCY-US=.0014              $ uncarpeted slab R-0
        SCCM-US=.0503  SCCY-US=.0238 ..
##elseif #[run[] eqs f02 ]
        DEFINE  SPCW-CS=.0291  SPCM-CS=.0685  SPCY-CS=.0100              $ carpeted slab R-5
        SCCM-CS=.0303  SCCY-CS=.0261 ..
        DEFINE  SPCW-US=.0600  SPCM-US=.0909  SPCY-US=.0086              $ uncarpeted slab R-5
        SCCM-US=.0366  SCCY-US=.0275 ..
##elseif #[run[] eqs f04 ]
        DEFINE  SPCW-CS=.0224  SPCM-CS=.0629  SPCY-CS=.0141              $ carpeted slab R-10
        SCCM-CS=.0255  SCCY-CS=.0278 ..
        DEFINE  SPCW-US=.0422  SPCM-US=.0912  SPCY-US=.0115              $ uncarpeted slab R-10
        SCCM-US=.0338  SCCY-US=.0284 ..
##endif

$ ------------------------------ Glazing ------------------------------
WINDOW2ATB=G-T  G-T-C=2000 ..

$ -------------------------- Space conditions --------------------------
SET FOR S-C  SOURCE-SCHEDULE=INT-LOADS  SOURCE-BTU/HR=30943  F-W=0   $ total internal gain:
             S-S=1.0  S-L=0 ..                                      $ 20,000 Btu/day +
                                                                    $ (1,761 sqft. X 15 Btu/d)=
                                                                    $ 46415 Btu/d
                                                                    $ 2/3 goes to ground floor
HOUSE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0005
              TEMPERATURE=(78)  ZONE-TYPE=CONDITIONED ..

GARAGE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0015  SOURCE-BTU/HR=0    $ (E-L-F cond. space)X3
               ZONE-TYPE=UNCONDITIONED ..

$ -------------------------- Space descriptions -------------------------
SET FOR WI  G-T=WINDOW2ATB  FRAME-WIDTH 0.125 S-SCH=MULTIPLIERS ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
```

```
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
             H=8.0 ..
SET FOR I-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
..


GARAGE=S  A=528.00  V=4718.340  S-C=GARAGE-SC ..                    $ V=4224.000+494.340
E-W  X=37.00  Y=49.00  H=10.94  W=22.00  AZ=0 ..
  DOOR  X=1.00  H=7.00  W=20.00  CONS=DOORCON ..
E-W  X=37.00  Y=25.50  W=23.50  AZ=90 ..
E-W  X=15.00  Y=49.00  W=23.50  AZ=270 ..
I-W  A=176.00  N-T=GROUND-FL ..
I-W  A=275.00  N-T=UPSTAIRS ..
ROOF  X=15.00  Y=49.00  Z=8.80  H=12.47  W=12.50  CONS=ROOF1CON  AZ=270
      TILT=28.07 ..
ROOF  X=26.00  Y=49.00  Z=14.67  H=12.47  W=12.50  CONS=ROOF1CON  AZ=270
      TILT=-28.07 ..
U-F  AZ=0  TILT=180  CONS=SLAB-NO-CARP  AREA=528.00
     PERIM-EXPOSED=69.00  PERIM-COND-WEEK=SPCW-US
     PERIM-COND-MONTH=SPCM-US  PERIM-COND-YEAR=SPCY-US
     CORE-COND-MONTH=SCCM-US  CORE-COND-YEAR=SCCY-US ..


GROUND-FL=S  A=925.00  V=8802.875  S-C=HOUSE-SC ..                 $ V=7400.000+1402.875
E-W  X=14.50  Y=25.00  W=14.50  AZ=0 ..
  WI  X=5.00  Y=.33  H=6.67  W=6.00 ..
E-W  X=14.50  Y=25.00  Z=8.80  H=3.87  W=14.50  AZ=0 ..
E-W  X=37.00  W=25.00  AZ=90 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50  M=2 ..
E-W  W=37.00  AZ=180 ..
  WI  X=4.00  H=6.67  W=6.00 ..
  WI  X=20.00  Y=3.00  H=4.00  W=4.00 ..
```

```
E-W  Z=8.80  H=3.87  W=14.50  AZ=180 ..
E-W  Y=25.00  W=25.00  AZ=270 ..
  WI  X=4.00  Y=1.50  H=5.50  W=6.00  M=2 ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
              H=16.43 ..
ROOF  Y=25.00  Z=8.80  W=25.00  AZ=270  TILT=28.07 ..
U-F  AZ=0  TILT=180  CONS=SLAB-CARP  AREA=694.00
     PERIM-EXPOSED=81.00  PERIM-COND-WEEK=SPCW-CS
     PERIM-COND-MONTH=SPCM-CS  PERIM-COND-YEAR=SPCY-CS
     CORE-COND-MONTH=SCCM-CS  CORE-COND-YEAR=SCCY-CS ..
U-F  AZ=0  TILT=180  CONS=SLAB-NO-CARP  AREA=231.00
     PERIM-EXPOSED=10.50  PERIM-COND-WEEK=SPCW-US
     PERIM-COND-MONTH=SPCM-US  PERIM-COND-YEAR=SPCY-US
     CORE-COND-MONTH=SCCM-US  CORE-COND-YEAR=SCCY-US ..


SET FOR E-W  H=8.00 ..

UPSTAIRS=S  A=836.00  V=8477.040  Z=8.80  S-C=HOUSE-SC
            SOURCE-BTU/HR=15472 ..                          $ 1/3 of bldg. source load
E-W  X=37.00  Y=38.00  H=10.94  W=22.00  AZ=0 ..
  WI  X=8.00  Y=4.00  H=3.00  W=5.33  M=3 ..
E-W  X=37.00  W=38.00  AZ=90 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50  M=2 ..
E-W  X=15.00  H=10.94  W=22.00  AZ=180 ..
  WI  X=5.00  Y=3.00  H=4.00  W=4.00  M=2 ..
E-W  X=15.00  Y=38.00  W=12.50  AZ=270 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50 ..
I-W  A=200.00  CONS=IWALL1CON  N-T=GROUND-FL ..
I-W  A=550.00  CONS=CEILCON  N-T=GROUND-FL ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
```

```
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
                H=12.47 ..
ROOF  X=15.00  Y=38.00  Z=16.80  W=38.00  AZ=270  TILT=28.07 ..
ROOF  X=26.00  Y=38.00  Z=22.67  W=38.00  AZ=270  TILT=-28.07 ..


LOADS-REPORT  SUMMARY=(LS-F) ..
$ LOADS-REPORT  SUMMARY=(LS-F)  HOURLY-DATA-SAVE = FORMATTED ..
$ LOADS-REPORT  VERIFICATION = (LV-I) ..
$ LOADS-REPORT  H-D-S=FORMATTED  R-F=HOURLY ..


END ..
COMPUTE LOADS ..


INPUT SYSTEMS ..

$ --------------------- Set simulation conditions ----------------------
##set1 accap   32000                                                    $ measured on site
##set1 accfm   1000                                                     $ measured on site
$ ##set1 vent    sg
$ ##set1 hrpt no
$ ##set1 hrpt yes

DEFINE  HEATSET=68  SETBACK=60  COOLSET=78
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
   VTYPE=-1                                                            $ enthalpic venting
##else
   VTYPE=0                                                             $ no venting
##endif
        FHIR=1.4286  MAXTEMP=120                                       $ assumed furnace input
        HCAPF=-50000                                                   $ 77% eff.+10% ductloss
##set1 sen_cap = #[accap[] * 0.75 ]
        CTCAP=accap[]  CSCAP=sen_cap[]  ACCFM=accfm[]  CBF=0.9 ..


SUBR-FUNCTIONS  RESYS-5=*PRTAC* ..


$ ----------------------------- Schedules ------------------------------
HTSCH     SCHEDULE  THRU DEC 31 (ALL)  (1,6)  (SETBACK)
                                     (7,23)  (HEATSET)
                                       (24)  (SETBACK)  ..
WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (1.0) ..                  $ natural vent. always
$ WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (0.0) ..                $$ no natural vent.
```

```
VOPSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (VTYPE) ..
CTSCH      SCHEDULE  THRU DEC 31 (ALL) (1,24) (COOLSET) ..
VTSCH      SCHEDULE  THRU DEC 31 (ALL) (1,24) (72) ..                    $ vent schedule 72 F

$ ------------------------------ Zones ------------------------------
ZC1                  ZONE-CONTROL
                              DESIGN-HEAT-T 68.
                              DESIGN-COOL-T 78.
                              COOL-TEMP-SCH CTSCH
                              HEAT-TEMP-SCH HTSCH
                              THERMOSTAT-TYPE TWO-POSITION ..
HOUSE                ZONE     ZONE-CONTROL ZC1 ..
ATTIC                ZONE     ZONE-TYPE UNCONDITIONED ..
GARAGE               ZONE     ZONE-TYPE UNCONDITIONED ..

$ ------------------------------ Systems ------------------------------
SYSCONTRL SYSTEM-CONTROL
                  MAX-SUPPLY-T MAXTEMP
                  MIN-SUPPLY-T 50
                    ..
SYSAIR     SYSTEM-AIR
                  SUPPLY-CFM ACCFM
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
                  NATURAL-VENT-SCH VOPSCH
                  VENT-TEMP-SCH VTSCH
                  OPEN-VENT-SCH WINDOPER
  ##if #[vent[] eqs sg]
                  HOR-VENT-FRAC 0.0
                  FRAC-VENT-AREA=.0242                                  $ 10% gross win. A open
                  VENT-METHOD S-G                                       $ discharge coeff. 0.6
                  MAX-VENT-RATE 20
  ##endif
  ##if #[vent[] eqs ach]                                               $ 10 ach when venting
                  NATURAL-VENT-AC 10
                  VENT-METHOD AIR-CHANGE
  ##endif
##endif
 ..

SYSEQP     SYSTEM-EQUIPMENT
                  COOLING-CAPACITY CTCAP
                  COOL-SH-CAP CSCAP
                  COIL-BF CBF
                  COMPRESSOR-TYPE SINGLE-SPEED
                  COOLING-EIR .39985
                  HEATING-CAPACITY HCAPF                                $ furnace specs
                  FURNACE-AUX 0.
                  FURNACE-HIR FHIR ..                                   $ duct losses in FHIR

RESIDEN   SYSTEM  SYSTEM-TYPE RESYS
                     Z-N=(HOUSE,GARAGE,ATTIC)
                  SYSTEM-CONTROL SYSCONTRL
                  SYSTEM-AIR SYSAIR
                  SYSTEM-EQUIPMENT SYSEQP
                  HEAT-SOURCE FURNACE ..


$ ---------------------------- System reports ----------------------------
##if #[hrpt[] eqs yes]
HRSCH=SCH  THRU DEC 31 (ALL) (1,24) (1)  ..
RB-1=R-B  V-T=GLOBAL   V-L=(8) ..                                       $ part-loads
RB-2=R-B  V-T=RESIDEN  V-L=(61,62) ..
DUMP=H-R  R-SCH=HRSCH  R-B=(RB-1,RB-2) ..
##endif

SYSTEMS-REPORT
##if #[hrpt[] eqs yes]
                  HOURLY-DATA-SAVE=FORMATTED
##endif

$ S=(SS-A,SS-B,SS-C,SS-F,SS-H,SS-I) $ ..
```

```
END ..

FUNCTION  NAME=PRTAC ..
  $
  $ This function prints out whether the AC is on for each hour
  $
  ASSIGN IMO=IMO IDAY=IDAY IHR=IHR
         xQNOW=QNOW ..
      CALCULATE  ..
      IF (IMO.EQ.1.AND.IDAY.EQ.1.AND.IHR.EQ.1) REWIND 52
      WRITE(52,120) xQNOW
 120  FORMAT(E14.7)
      END
      END-FUNCTION ..

COMPUTE  SYSTEMS ..



$
$ SECOND SIMULATION WITH ADJUSTED ROLLER SHADE CONDITIONS PER AIR-CONDITIONING STATUS
$

$ --------------------- Set simulation conditions ----------------------
$ ##set1 run f00
$ ##set1 run f02
$ ##set1 run f04

$ ##set1 loc cz01
$ ##set1 loc cz02
$ ##set1 loc cz03
$ ##set1 loc cz04
$ ##set1 loc cz05
$ ##set1 loc cz06
$ ##set1 loc cz07
$ ##set1 loc cz08
$ ##set1 loc cz09
$ ##set1 loc cz10
$ ##set1 loc cz11
$ ##set1 loc cz12
$ ##set1 loc cz13
$ ##set1 loc cz14
$ ##set1 loc cz15
$ ##set1 loc cz16

$ ##set1 fndtn standard
$ ##set1 fndtn simplifd
$ ----------------------------------------------------------------------


INPUT LOADS ..
ABORT ERRORS ..
LIST WARNINGS ..



TITLE LINE-1 = *Typical Two-Story House*

##if #[run[] eqs f00 ]
      LINE-2 = *            No slab insulation*
##elseif #[run[] eqs f02 ]
      LINE-2 = *           Slab insulation R-5*
##elseif #[run[] eqs f04 ]
      LINE-2 = *           Slab insulation R-10*
##endif

##if #[fndtn[] eqs standard ]
      LINE-3 = *Slab: STANDARD calculation*
##elseif #[fndtn[] eqs simplifd ]
```

```
      LINE-3 = *Slab: SIMPLIFIED METHOD*
##endif

##if #[loc[] eqs cz01 ]
      LINE-4 = *              cz01 (Arcata)*
##elseif #[loc[] eqs cz02 ]
      LINE-4 = *            cz02 (Sta. Rosa)*
##elseif #[loc[] eqs cz03 ]
     LINE-4 = *             cz03 (Oakland)*
##elseif #[loc[] eqs cz04 ]
      LINE-4 = *            cz04 (Sunnyvale)*
##elseif #[loc[] eqs cz05 ]
      LINE-4 = *            cz05 (Sta. Maria)*
##elseif #[loc[] eqs cz06 ]
      LINE-4 = *            cz06 (Long Beach)*
##elseif #[loc[] eqs cz07 ]
      LINE-4 = *            cz07 (San Diego)*
##elseif #[loc[] eqs cz08 ]
      LINE-4 = *             cz08 (El Toro)*
##elseif #[loc[] eqs cz09 ]
      LINE-4 = *             cz09 (Pasadena)*
##elseif #[loc[] eqs cz10 ]
      LINE-4 = *            cz10 (Riverside)*
##elseif #[loc[] eqs cz11 ]
      LINE-4 = *            cz11 (Red Bluff)*
##elseif #[loc[] eqs cz12 ]
      LINE-4 = *            cz12 (Sacramento)*
##elseif #[loc[] eqs cz13 ]
      LINE-4 = *              cz13 (Fresno)*
##elseif #[loc[] eqs cz14 ]
      LINE-4 = *            cz14 (China Lake)*
##elseif #[loc[] eqs cz15 ]
      LINE-4 = *            cz15 (El Centro)*
##elseif #[loc[] eqs cz16 ]
      LINE-4 = *            cz16 (Mt. Shasta)*
##endif

      LINE-5 = *input: cec_2-story_house_simp-method.inp* ..


RUN-PERIOD JAN 1, 1991 THRU DEC 31, 1991 ..


BUILDING-LOCATION
FUNCTION =(*SHADING*,*NONE*)                                    $ roller shade use
##if #[loc[] eqs cz01 ]
        LAT=40.8 LON=124.2  ALT=218
##elseif #[loc[] eqs cz02 ]
        LAT=38.4 LON=122.7  ALT=167
##elseif #[loc[] eqs cz03 ]
        LAT=37.7 LON=122.2  ALT=6
##elseif #[loc[] eqs cz04 ]
        LAT=37.4 LON=122.1  ALT=97
##elseif #[loc[] eqs cz05 ]
        LAT=34.9 LON=120.4  ALT=236
##elseif #[loc[] eqs cz06 ]
        LAT=33.8 LON=118.2  ALT=25
##elseif #[loc[] eqs cz07 ]
        LAT=32.7 LON=117.2  ALT=13
##elseif #[loc[] eqs cz08 ]
        LAT=33.6 LON=117.7  ALT=380
##elseif #[loc[] eqs cz09 ]
        LAT=34.2 LON=117.2  ALT=864
##elseif #[loc[] eqs cz10 ]
        LAT=34.1 LON=117.3  ALT=840
##elseif #[loc[] eqs cz11 ]
        LAT=40.2 LON=122.2  ALT=342
##elseif #[loc[] eqs cz12 ]
        LAT=38.5 LON=121.5  ALT=17
##elseif #[loc[] eqs cz13 ]
        LAT=36.8 LON=119.7  ALT=326
```

```
##elseif #[loc[] eqs cz14 ]
        LAT=35.7 LON=117.7  ALT=2220
##elseif #[loc[] eqs cz15 ]
        LAT=33.0 LON=115.6  ALT=-30
##elseif #[loc[] eqs cz16 ]
        LAT=41.3 LON=122.3  ALT=3535
##endif
                  HOL=YES  D-S=YES  AZ=0  T-Z=8 ..


$ -------------------------- Internal loads --------------------------
I-GAIN-JAN=D-SCH  (1) (.029)                                        $ .024*1.19
                  (2) (.026)                                        $ .022*1.19
                (3,5) (.025)                                        $ .021*1.19
                  (6) (.031)                                        $ .026*1.19
                  (7) (.045)                                        $ .038*1.19
                  (8) (.070)                                        $ .059*1.19
                  (9) (.067)                                        $ .056*1.19
                 (10) (.071)                                        $ .060*1.19
                 (11) (.070)                                        $ .059*1.19
                 (12) (.055)                                        $ .046*1.19
                 (13) (.054)                                        $ .045*1.19
                 (14) (.036)                                        $ .030*1.19
                 (15) (.033)                                        $ .028*1.19
                 (16) (.037)                                        $ .031*1.19
                 (17) (.068)                                        $ .057*1.19
               (18,19) (.076)                                       $ .064*1.19
                 (20) (.062)                                        $ .052*1.19
                 (21) (.060)                                        $ .050*1.19
                 (22) (.065)                                        $ .055*1.19
                 (23) (.052)                                        $ .044*1.19
                 (24) (.032) ..                                     $ .027*1.19

I-GAIN-FEB=D-SCH  (1) (.027)                                        $ .024*1.11
                  (2) (.024)                                        $ .022*1.11
                (3,5) (.023)                                        $ .021*1.11
                  (6) (.029)                                        $ .026*1.11
                  (7) (.042)                                        $ .038*1.11
                  (8) (.065)                                        $ .059*1.11
                  (9) (.062)                                        $ .056*1.11
                 (10) (.067)                                        $ .060*1.11
                 (11) (.065)                                        $ .059*1.11
                 (12) (.051)                                        $ .046*1.11
                 (13) (.050)                                        $ .045*1.11
                 (14) (.033)                                        $ .030*1.11
                 (15) (.031)                                        $ .028*1.11
                 (16) (.034)                                        $ .031*1.11
                 (17) (.063)                                        $ .057*1.11
               (18,19) (.071)                                       $ .064*1.11
                 (20) (.058)                                        $ .052*1.11
                 (21) (.056)                                        $ .050*1.11
                 (22) (.061)                                        $ .055*1.11
                 (23) (.049)                                        $ .044*1.11
                 (24) (.030) ..                                     $ .027*1.11

I-GAIN-MAR=D-SCH  (1) (.024)                                        $ .024*1.02
                  (2) (.022)                                        $ .022*1.02
                (3,5) (.021)                                        $ .021*1.02
                  (6) (.026)                                        $ .026*1.02
                  (7) (.039)                                        $ .038*1.02
                  (8) (.060)                                        $ .059*1.02
                  (9) (.057)                                        $ .056*1.02
                 (10) (.061)                                        $ .060*1.02
                 (11) (.060)                                        $ .059*1.02
                 (12) (.047)                                        $ .046*1.02
                 (13) (.046)                                        $ .045*1.02
                 (14) (.031)                                        $ .030*1.02
                 (15) (.029)                                        $ .028*1.02
                 (16) (.032)                                        $ .031*1.02
                 (17) (.058)                                        $ .057*1.02
               (18,19) (.065)                                       $ .064*1.02
```

	(20)	(.053)	$ .052*1.02
	(21)	(.051)	$ .050*1.02
	(22)	(.056)	$ .055*1.02
	(23)	(.045)	$ .044*1.02
	(24)	(.028) ..	$ .027*1.02
I-GAIN-APR=D-SCH	(1)	(.022)	$ .024*.93
	(2)	(.020)	$ .022*.93
	(3,5)	(.020)	$ .021*.93
	(6)	(.024)	$ .026*.93
	(7)	(.035)	$ .038*.93
	(8)	(.055)	$ .059*.93
	(9)	(.052)	$ .056*.93
	(10)	(.056)	$ .060*.93
	(11)	(.055)	$ .059*.93
	(12)	(.043)	$ .046*.93
	(13)	(.042)	$ .045*.93
	(14)	(.030)	$ .030*.93
	(15)	(.026)	$ .028*.93
	(16)	(.029)	$ .031*.93
	(17)	(.053)	$ .057*.93
	(18,19)	(.060)	$ .064*.93
	(20)	(.048)	$ .052*.93
	(21)	(.047)	$ .050*.93
	(22)	(.051)	$ .055*.93
	(23)	(.041)	$ .044*.93
	(24)	(.025) ..	$ .027*.93
I-GAIN-MAY=D-SCH	(1)	(.020)	$ .024*.84
	(2)	(.018)	$ .022*.84
	(3,5)	(.018)	$ .021*.84
	(6)	(.022)	$ .026*.84
	(7)	(.032)	$ .038*.84
	(8)	(.050)	$ .059*.84
	(9)	(.047)	$ .056*.84
	(10)	(.050)	$ .060*.84
	(11)	(.050)	$ .059*.84
	(12)	(.039)	$ .046*.84
	(13)	(.038)	$ .045*.84
	(14)	(.025)	$ .030*.84
	(15)	(.024)	$ .028*.84
	(16)	(.026)	$ .031*.84
	(17)	(.048)	$ .057*.84
	(18,19)	(.054)	$ .064*.84
	(20)	(.044)	$ .052*.84
	(21)	(.042)	$ .050*.84
	(22)	(.046)	$ .055*.84
	(23)	(.037)	$ .044*.84
	(24)	(.023) ..	$ .027*.84
I-GAIN-JUN=D-SCH	(1)	(.019)	$ .024*.80
	(2)	(.018)	$ .022*.80
	(3,5)	(.017)	$ .021*.80
	(6)	(.021)	$ .026*.80
	(7)	(.030)	$ .038*.80
	(8)	(.047)	$ .059*.80
	(9)	(.045)	$ .056*.80
	(10)	(.048)	$ .060*.80
	(11)	(.047)	$ .059*.80
	(12)	(.037)	$ .046*.80
	(13)	(.036)	$ .045*.80
	(14)	(.024)	$ .030*.80
	(15)	(.022)	$ .028*.80
	(16)	(.025)	$ .031*.80
	(17)	(.046)	$ .057*.80
	(18,19)	(.051)	$ .064*.80
	(20)	(.042)	$ .052*.80
	(21)	(.040)	$ .050*.80
	(22)	(.044)	$ .055*.80
	(23)	(.035)	$ .044*.80
	(24)	(.022) ..	$ .027*.80

I-GAIN-JUL=D-SCH	(1)	(.020)	$ .024*.82
	(2)	(.018)	$ .022*.82
	(3,5)	(.017)	$ .021*.82
	(6)	(.021)	$ .026*.82
	(7)	(.031)	$ .038*.82
	(8)	(.048)	$ .059*.82
	(9)	(.046)	$ .056*.82
	(10)	(.049)	$ .060*.82
	(11)	(.048)	$ .059*.82
	(12)	(.038)	$ .046*.82
	(13)	(.037)	$ .045*.82
	(14)	(.025)	$ .030*.82
	(15)	(.023)	$ .028*.82
	(16)	(.025)	$ .031*.82
	(17)	(.047)	$ .057*.82
	(18,19)	(.052)	$ .064*.82
	(20)	(.043)	$ .052*.82
	(21)	(.041)	$ .050*.82
	(22)	(.045)	$ .055*.82
	(23)	(.036)	$ .044*.82
	(24)	(.022) ..	$ .027*.82
I-GAIN-AUG=D-SCH	(1)	(.021)	$ .024*.88
	(2)	(.019)	$ .022*.88
	(3,5)	(.018)	$ .021*.88
	(6)	(.023)	$ .026*.88
	(7)	(.033)	$ .038*.88
	(8)	(.052)	$ .059*.88
	(9)	(.049)	$ .056*.88
	(10)	(.053)	$ .060*.88
	(11)	(.052)	$ .059*.88
	(12)	(.040)	$ .046*.88
	(13)	(.040)	$ .045*.88
	(14)	(.026)	$ .030*.88
	(15)	(.025)	$ .028*.88
	(16)	(.028)	$ .031*.88
	(17)	(.050)	$ .057*.88
	(18,19)	(.056)	$ .064*.88
	(20)	(.046)	$ .052*.88
	(21)	(.044)	$ .050*.88
	(22)	(.048)	$ .055*.88
	(23)	(.039)	$ .044*.88
	(24)	(.024) ..	$ .027*.88
I-GAIN-SEP=D-SCH	(1)	(.024)	$ .024*.98
	(2)	(.022)	$ .022*.98
	(3,5)	(.021)	$ .021*.98
	(6)	(.026)	$ .026*.98
	(7)	(.037)	$ .038*.98
	(8)	(.058)	$ .059*.98
	(9)	(.055)	$ .056*.98
	(10)	(.059)	$ .060*.98
	(11)	(.058)	$ .059*.98
	(12)	(.045)	$ .046*.98
	(13)	(.044)	$ .045*.98
	(14)	(.029)	$ .030*.98
	(15)	(.027)	$ .028*.98
	(16)	(.030)	$ .031*.98
	(17)	(.056)	$ .057*.98
	(18,19)	(.063)	$ .064*.98
	(20)	(.051)	$ .052*.98
	(21)	(.049)	$ .050*.98
	(22)	(.054)	$ .055*.98
	(23)	(.043)	$ .044*.98
	(24)	(.026) ..	$ .027*.98
I-GAIN-OCT=D-SCH	(1)	(.026)	$ .024*1.07
	(2)	(.024)	$ .022*1.07
	(3,5)	(.022)	$ .021*1.07
	(6)	(.028)	$ .026*1.07

```
                 (7) (.041)                                    $ .038*1.07
                 (8) (.069)                                    $ .059*1.07
                 (9) (.060)                                    $ .056*1.07
                (10) (.064)                                    $ .060*1.07
                (11) (.069)                                    $ .059*1.07
                (12) (.049)                                    $ .046*1.07
                (13) (.048)                                    $ .045*1.07
                (14) (.032)                                    $ .030*1.07
                (15) (.030)                                    $ .028*1.07
                (16) (.033)                                    $ .031*1.07
                (17) (.061)                                    $ .057*1.07
              (18,19) (.068)                                   $ .064*1.07
                (20) (.056)                                    $ .052*1.07
                (21) (.054)                                    $ .050*1.07
                (22) (.059)                                    $ .055*1.07
                (23) (.047)                                    $ .044*1.07
                (24) (.029) ..                                 $ .027*1.07

I-GAIN-NOV=D-SCH  (1) (.028)                                   $ .024*1.16
                  (2) (.026)                                   $ .022*1.16
                (3,5) (.024)                                   $ .021*1.16
                  (6) (.030)                                   $ .026*1.16
                  (7) (.044)                                   $ .038*1.16
                  (8) (.068)                                   $ .059*1.16
                  (9) (.065)                                   $ .056*1.16
                 (10) (.070)                                   $ .060*1.16
                 (11) (.068)                                   $ .059*1.16
                 (12) (.053)                                   $ .046*1.16
                 (13) (.052)                                   $ .045*1.16
                 (14) (.035)                                   $ .030*1.16
                 (15) (.032)                                   $ .028*1.16
                 (16) (.036)                                   $ .031*1.16
                 (17) (.066)                                   $ .057*1.16
               (18,19) (.074)                                  $ .064*1.16
                 (20) (.060)                                   $ .052*1.16
                 (21) (.058)                                   $ .050*1.16
                 (22) (.064)                                   $ .055*1.16
                 (23) (.051)                                   $ .044*1.16
                 (24) (.031) ..                                $ .027*1.16

I-GAIN-DEC=D-SCH  (1) (.030)                                   $ .024*1.27
                  (2) (.028)                                   $ .022*1.27
                (3,5) (.027)                                   $ .021*1.27
                  (6) (.033)                                   $ .026*1.27
                  (7) (.048)                                   $ .038*1.27
                  (8) (.075)                                   $ .059*1.27
                  (9) (.071)                                   $ .056*1.27
                 (10) (.076)                                   $ .060*1.27
                 (11) (.075)                                   $ .059*1.27
                 (12) (.058)                                   $ .046*1.27
                 (13) (.057)                                   $ .045*1.27
                 (14) (.038)                                   $ .030*1.27
                 (15) (.036)                                   $ .028*1.27
                 (16) (.039)                                   $ .031*1.27
                 (17) (.072)                                   $ .057*1.27
               (18,19) (.081)                                  $ .064*1.27
                 (20) (.066)                                   $ .052*1.27
                 (21) (.064)                                   $ .050*1.27
                 (22) (.070)                                   $ .055*1.27
                 (23) (.056)                                   $ .044*1.27
                 (24) (.034) ..                                $ .027*1.27

INT-LOADS=SCH  THRU JAN 31  (ALL) I-GAIN-JAN
               THRU FEB 28  (ALL) I-GAIN-FEB
               THRU MAR 31  (ALL) I-GAIN-MAR
               THRU APR 30  (ALL) I-GAIN-APR
               THRU MAY 31  (ALL) I-GAIN-MAY
               THRU JUN 30  (ALL) I-GAIN-JUN
               THRU JUL 31  (ALL) I-GAIN-JUL
               THRU AUG 31  (ALL) I-GAIN-AUG
               THRU SEP 30  (ALL) I-GAIN-SEP
```

```
            THRU OCT 31  (ALL) I-GAIN-OCT
            THRU NOV 30  (ALL) I-GAIN-NOV
            THRU DEC 31  (ALL) I-GAIN-DEC ..

MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.968) ..                $ no roller shades
$ MULTIPLIERS=SCH  THRU DEC 31  (ALL) (1,24) (.595) ..              $$ roller shades

$ ---------------------------- Materials ----------------------------
GYPBRD=MAT     COND=.1330  TH=.0417  DENS=50.00   S-H=0.20 ..
INS-R13=MAT    COND=.0224  TH=.2917  DENS=.71     S-H=.20 ..
STUCCO=MAT     COND=.4167  TH=.0729  DENS=166.00  S-H=.20 ..
WOOD=MAT       COND=.0667  TH=.2917  DENS=32.00   S-H=.33 ..
DAMPSOIL=MAT   COND=1.000  TH=1.000  DENS=115.00  S-H=.28 ..        $ typical damp soil
RUGNPAD=MAT    RES=2.08 ..                                          $ carpet and pad
CONCRETE=MAT   COND=.8000  TH=.3333  DENS=144.    S-H=.139 ..       $ 4" heavy concrete

$ ----------------------------- Layers -----------------------------
WOOD-FRM-R13=LA  MAT=(STUCCO,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
WOOD-FRM-R19=LA  MAT=(STUCCO,IN12,WOOD,GYPBRD)  I-F-R=0.68 ..
INT-WALL=LA      MAT=(GYPBRD,INS-R13,WOOD,GYPBRD)  I-F-R=0.68 ..
CEIL=LA          MAT=(PW04,AL33,GYPBRD)  I-F-R=.76 ..
ROOF-LA=LA       MAT=(AR02,AR01,PW04)  I-F-R=.76 ..
ROOF-R30=LA      MAT=(AR02,AR01,PW04,IN11,IN12)  I-F-R=.76 ..
ROOF-R38=LA      MAT=(AR02,AR01,PW04,IN12,IN12)  I-F-R=.76 ..
FSLABLDP=LA      MAT=(DAMPSOIL,CONCRETE,RUGNPAD)                   $ slab, 1'-0" damp soil
                THICKNESS(1.0,.333,1.)  I-F-R=0.765 ..
BSLABLDP=LA     MAT=(DAMPSOIL,CONCRETE)                            $ slab, 1'-0" damp soil
                THICKNESS(1.0,.333)  I-F-R=0.765 ..

$ --------------------------- Construction ---------------------------
WALL1CON=CONS       LA=WOOD-FRM-R13  RO=3  ABS=0.7 ..
WALL2CON=CONS       LA=WOOD-FRM-R19  RO=3  ABS=0.7 ..
IWALL1CON=CONS      LA=INT-WALL  RO=3  ABS=0.7 ..
DOORCON=CONS        U=.33 ..
CEILCON=CONS        LA=CEIL ..
ROOFCON=CONS        LA=ROOF-LA ..
ROOF1CON=CONS       LA=ROOF-R30 ..
ROOF2CON=CONS       LA=ROOF-R38 ..
SLAB-CARP=CONS      LA=FSLABLDP ..
SLAB-NO-CARP=CONS   LA=BSLABLDP ..

##if #[run[] eqs f00 ]
        DEFINE  SPCW-CS=.0852  SPCM-CS=.0551  SPCY-CS=.0028         $ carpeted slab R-0
        SCCM-CS=.0418  SCCY-CS=.0224 ..
        DEFINE  SPCW-US=.1692  SPCM-US=.0737  SPCY-US=.0014         $ uncarpeted slab R-0
        SCCM-US=.0503  SCCY-US=.0238 ..
##elseif #[run[] eqs f02 ]
        DEFINE  SPCW-CS=.0291  SPCM-CS=.0685  SPCY-CS=.0100         $ carpeted slab R-5
        SCCM-CS=.0303  SCCY-CS=.0261 ..
        DEFINE  SPCW-US=.0600  SPCM-US=.0909  SPCY-US=.0086         $ uncarpeted slab R-5
        SCCM-US=.0366  SCCY-US=.0275 ..
##elseif #[run[] eqs f04 ]
        DEFINE  SPCW-CS=.0224  SPCM-CS=.0629  SPCY-CS=.0141         $ carpeted slab R-10
        SCCM-CS=.0255  SCCY-CS=.0278 ..
        DEFINE  SPCW-US=.0422  SPCM-US=.0912  SPCY-US=.0115         $ uncarpeted slab R-10
        SCCM-US=.0338  SCCY-US=.0284 ..
##endif

$ ---------------------------- Glazing ----------------------------
WINDOW2ATB=G-T  G-T-C=2000 ..

$ ------------------------- Space conditions -------------------------
SET FOR S-C  SOURCE-SCHEDULE=INT-LOADS  SOURCE-BTU/HR=30943  F-W=0   $ total internal gain:
             S-S=1.0  S-L=0 ..                                      $ 20,000 Btu/day +
                                                                    $ (1,761 sqft. X 15 Btu/d)=
                                                                    $ 46415 Btu/d
                                                                    $ 2/3 goes to ground floor

HOUSE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0005
```

```
            TEMPERATURE=(78)   ZONE-TYPE=CONDITIONED ..

GARAGE-SC=S-C  INF-METHOD=S-G FRAC-LEAK-AREA = .0015  SOURCE-BTU/HR0    $ (E-L-F cond. space)X3
            ZONE-TYPE=UNCONDITIONED ..

$ ------------------------- Space descriptions -------------------------
SET FOR WI  G-T=WINDOW2ATB  FRAME-WIDTH 0.125 S-SCH=MULTIPLIERS ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
            H=8.0 ..
SET FOR I-W
##if #[loc[] eqs cz01 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz02 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz03 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz04 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz05 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz06 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz07 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz08 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz09 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz10 ]
     CONS=WALL1CON
##elseif #[loc[] eqs cz11 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz12 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz13 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz14 ]
     CONS=WALL2CON
```

```
##elseif #[loc[] eqs cz15 ]
     CONS=WALL2CON
##elseif #[loc[] eqs cz16 ]
     CONS=WALL2CON
##endif
..

GARAGE=S  A=528.00  V=4718.340  S-C=GARAGE-SC ..                    $ V=4224.000+494.340
E-W  X=37.00  Y=49.00  H=10.94  W=22.00  AZ=0 ..
  DOOR  X=1.00  H=7.00  W=20.00  CONS=DOORCON ..
E-W  X=37.00  Y=25.50  W=23.50  AZ=90 ..
E-W  X=15.00  Y=49.00  W=23.50  AZ=270 ..
I-W  A=176.00  N-T=GROUND-FL ..
I-W  A=275.00  N-T=UPSTAIRS ..
ROOF  X=15.00  Y=49.00  Z=8.80  H=12.47  W=12.50  CONS=ROOF1CON  AZ=270
      TILT=28.07 ..
ROOF  X=26.00  Y=49.00  Z=14.67  H=12.47  W=12.50  CONS=ROOF1CON  AZ=270
      TILT=-28.07 ..
U-F  AZ=0  TILT=180  CONS=SLAB-NO-CARP  AREA=528.00
     PERIM-EXPOSED=69.00  PERIM-COND-WEEK=SPCW-US
     PERIM-COND-MONTH=SPCM-US  PERIM-COND-YEAR=SPCY-US
     CORE-COND-MONTH=SCCM-US  CORE-COND-YEAR=SCCY-US ..

GROUND-FL=S  A=925.00  V=8802.875  S-C=HOUSE-SC ..                 $ V=7400.000+1402.875
E-W  X=14.50  Y=25.00  W=14.50  AZ=0 ..
  WI  X=5.00  Y=.33  H=6.67  W=6.00 ..
E-W  X=14.50  Y=25.00  Z=8.80  H=3.87  W=14.50  AZ=0 ..
E-W  X=37.00  W=25.00  AZ=90 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50  M=2 ..
E-W  W=37.00  AZ=180 ..
  WI  X=4.00  H=6.67  W=6.00 ..
  WI  X=20.00  Y=3.00  H=4.00  W=4.00 ..
E-W  Z=8.80  H=3.87  W=14.50  AZ=180 ..
E-W  Y=25.00  W=25.00  AZ=270 ..
  WI  X=4.00  Y=1.50  H=5.50  W=6.00  M=2 ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
```

```
            H=16.43 ..
ROOF  Y=25.00  Z=8.80  W=25.00  AZ=270  TILT=28.07 ..
U-F  AZ=0  TILT=180  CONS=SLAB-CARP  AREA=694.00
     PERIM-EXPOSED=81.00  PERIM-COND-WEEK=SPCW-CS
     PERIM-COND-MONTH=SPCM-CS  PERIM-COND-YEAR=SPCY-CS
     CORE-COND-MONTH=SCCM-CS  CORE-COND-YEAR=SCCY-CS ..
U-F  AZ=0  TILT=180  CONS=SLAB-NO-CARP  AREA=231.00
     PERIM-EXPOSED=10.50  PERIM-COND-WEEK=SPCW-US
     PERIM-COND-MONTH=SPCM-US  PERIM-COND-YEAR=SPCY-US
     CORE-COND-MONTH=SCCM-US  CORE-COND-YEAR=SCCY-US ..


SET FOR E-W  H=8.00 ..

UPSTAIRS=S  A=836.00  V=8477.040  Z=8.80  S-C=HOUSE-SC
            SOURCE-BTU/HR=15472 ..                          $ 1/3 of bldg. source load
E-W  X=37.00  Y=38.00  H=10.94  W=22.00  AZ=0 ..
  WI  X=8.00  Y=4.00  H=3.00  W=5.33  M=3 ..
E-W  X=37.00  W=38.00  AZ=90 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50  M=2 ..
E-W  X=15.00  H=10.94  W=22.00  AZ=180 ..
  WI  X=5.00  Y=3.00  H=4.00  W=4.00  M=2 ..
E-W  X=15.00  Y=38.00  W=12.50  AZ=270 ..
  WI  X=4.00  Y=3.00  H=4.00  W=5.50 ..
I-W  A=200.00  CONS=IWALL1CON  N-T=GROUND-FL ..
I-W  A=550.00  CONS=CEILCON  N-T=GROUND-FL ..
SET FOR E-W
##if #[loc[] eqs cz01 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz02 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz03 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz04 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz05 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz06 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz07 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz08 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz09 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz10 ]
     CONS=ROOF1CON
##elseif #[loc[] eqs cz11 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz12 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz13 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz14 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz15 ]
     CONS=ROOF2CON
##elseif #[loc[] eqs cz16 ]
     CONS=ROOF2CON
##endif
              H=12.47 ..
ROOF  X=15.00  Y=38.00  Z=16.80  W=38.00  AZ=270  TILT=28.07 ..
ROOF  X=26.00  Y=38.00  Z=22.67  W=38.00  AZ=270  TILT=-28.07 ..


LOADS-REPORT  SUMMARY=(LS-F) ..
$ LOADS-REPORT  SUMMARY=(LS-F)  HOURLY-DATA-SAVE = FORMATTED ..
$ LOADS-REPORT  VERIFICATION = (LV-I) ..
$ LOADS-REPORT  H-D-S=FORMATTED  R-F=HOURLY ..
```

```
END ..

FUNCTION  NAME=SHADING
          LEVEL=BUILDING    ..
  ASSIGN IMO=IMO IDAY=IDAY IHR=IHR DBT=DBT
         Y=SCHEDULE-NAME(MULTIPLIERS)  ..
CALCULATE  ..
      IF (IMO.EQ.1.AND.IDAY.EQ.1.AND.IHR.EQ.1) REWIND 52
      SC=0.968
      READ(52,1) xQNOW
   1  FORMAT(E14.7)
      IF (xQNOW.GT.0.0) SC=0.595
      Y=SC
      IF (IHR.EQ.15) PRINT 80,IMO,IDAY,IHR,DBT,xQNOW,Y
   80 FORMAT( ' SHADING POST ' ,3F4.0,F5.1,F10.2,F10.3)
      END
END-FUNCTION  ..

COMPUTE LOADS ..


INPUT SYSTEMS ..

$ --------------------- Set simulation conditions ----------------------
##set1 accap   32000                                                    $ measured on site
##set1 accfm   1000                                                     $ measured on site
$ ##set1 vent    sg
$ ##set1 hrpt no
$ ##set1 hrpt yes

DEFINE  HEATSET=68  SETBACK=60  COOLSET=78
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
   VTYPE=-1                                                            $ enthalpic venting
##else
   VTYPE=0                                                             $ no venting
##endif
        FHIR=1.4286  MAXTEMP=120                                       $ assumed furnace input
        HCAPF=-50000                                                   $ 77%eff.+10% duct loss
##set1 sen_cap = #[accap[] * 0.75 ]
        CTCAP=accap[]  CSCAP=sen_cap[]  ACCFM=accfm[]  CBF=0.9 ..

$ ----------------------------- Schedules ------------------------------
HTSCH     SCHEDULE  THRU DEC 31 (ALL)  (1,6) (SETBACK)
                                     (7,23) (HEATSET)
                                       (24) (SETBACK)  ..
WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (1.0) ..                  $ natural vent. always
$ WINDOPER  SCHEDULE  THRU DEC 31 (ALL) (1,24) (0.0) ..                $$ no natural vent.
VOPSCH    SCHEDULE  THRU DEC 31 (ALL) (1,24) (VTYPE) ..
CTSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (COOLSET) ..
VTSCH     SCHEDULE  THRU DEC 31 (ALL) (1,24) (72) ..                   $ vent. schedule 72 F

$ ------------------------------- Zones --------------------------------
ZC1                 ZONE-CONTROL
                              DESIGN-HEAT-T 68.
                              DESIGN-COOL-T 78.
                              COOL-TEMP-SCH CTSCH
                              HEAT-TEMP-SCH HTSCH
                              THERMOSTAT-TYPE TWO-POSITION ..
HOUSE               ZONE      ZONE-CONTROL ZC1 ..
ATTIC               ZONE      ZONE-TYPE UNCONDITIONED ..
GARAGE              ZONE      ZONE-TYPE UNCONDITIONED ..

$ ----------------------------- Systems ------------------------------
SYSCONTRL SYSTEM-CONTROL
                 MAX-SUPPLY-T MAXTEMP
                 MIN-SUPPLY-T 50
                   ..
SYSAIR    SYSTEM-AIR
                 SUPPLY-CFM ACCFM
##if #[ #[vent[] eqs sg] or #[vent[] eqs ach] ]
                 NATURAL-VENT-SCH VOPSCH
```

```
                VENT-TEMP-SCH VTSCH
                OPEN-VENT-SCH WINDOPER
  ##if #[vent[] eqs sg]
                HOR-VENT-FRAC 0.0
                FRAC-VENT-AREA=.0242                          $ 10% gross window area
                VENT-METHOD S-G                               $ discharge coeff. 0.6
                MAX-VENT-RATE 20
  ##endif
  ##if #[vent[] eqs ach]                                      $ 10 ach when venting
                NATURAL-VENT-AC 10
                VENT-METHOD AIR-CHANGE
  ##endif
##endif
 ..

SYSEQP    SYSTEM-EQUIPMENT
                COOLING-CAPACITY CTCAP
                COOL-SH-CAP CSCAP
                COIL-BF CBF
                COMPRESSOR-TYPE SINGLE-SPEED
                COOLING-EIR .39985
                HEATING-CAPACITY HCAPF                        $ furnace specs
                FURNACE-AUX 0.
                FURNACE-HIR FHIR ..                           $ duct losses in FHIR


RESIDEN  SYSTEM  SYSTEM-TYPE RESYS
                   Z-N=(HOUSE,GARAGE,ATTIC)
                SYSTEM-CONTROL SYSCONTRL
                SYSTEM-AIR SYSAIR
                SYSTEM-EQUIPMENT SYSEQP
                HEAT-SOURCE FURNACE ..


$ -------------------------- System reports --------------------------
##if #[hrpt[] eqs yes]
HRSCH=SCH  THRU DEC 31 (ALL) (1,24) (1)  ..
RB-1=R-B  V-T=GLOBAL   V-L=(8) ..
RB-2=R-B  V-T=RESIDEN  V-L=(61,62) ..                         $ part-loads
DUMP=H-R  R-SCH=HRSCH  R-B=(RB-1,RB-2) ..
##endif

SYSTEMS-REPORT
##if #[hrpt[] eqs yes]
                HOURLY-DATA-SAVE=FORMATTED
##endif

$ S=(SS-A,SS-B,SS-C,SS-F,SS-H,SS-I) ..
S=(SS-A,SS-H) ..
$ S=(SS-H) ..


END ..
COMPUTE  SYSTEMS ..


INPUT PLANT ..
PLANT-REPORT  S=(PS-B,PS-E,BEPS) ..
END ..

COMPUTE PLANT ..
STOP  ..
```