# 6.11 Common Data Structures

This section describes common data structures referenced in this chapter and in Appendix A. The data structures presented here define objects and example parameters needed to define them. The parameters described are the most common for energy simulation engines. However, other parameters or data constructs are acceptable. It is not the intent of COMNET to impose a single format for a data structure when alternative structures could be equally acceptable.

## 6.11.1 Schedule

This data structure provides information on how equipment, people, lights, or other items are operated on an hourly basis. The ultimate construct of a schedule is an hourly time series for the simulation period, typically 8,760 hours (365 days time 24 hours/day). However, software has often built up the hourly schedule from 24-hour schedules for different day types: weekdays, Saturdays, Sundays, holidays, etc.

There are several types of schedules:

- **Temperature** schedules specify a temperature to be maintained in a space, a temperature to be delivered from an air handler, or the leaving temperature from a chiller or other equipment.
- **Fraction** schedules specify the fraction of lights that are on, the fraction of people that are in the space, the fraction of maximum infiltration, or other factors.
- **On/off** schedules specify when equipment is operating or when infiltration is occurring.
- **Time period** schedules define periods of time for equipment sequencing, utility tariffs, etc. A time period schedule typically breaks the year in to two or more seasons. For each season, day types are identified such as weekday, Saturday, Sunday and holidays. Each day type in each season is then divided into time periods.

Software may accommodate any appropriate user specification of the schedule as long as the schedules listed in Appendix C are supported.

## 6.11.2 Holidays

A series of dates defining holidays for the simulation period. Dates identified are operated for the schedule specified for holidays.

## 6.11.3 Surface Geometry

This data structure represents the location, size, and position of a surface. Surfaces include roofs, walls, floors, and partitions. Surfaces are typically planar and can be represented in various manners, including the following:

- Rectangular surfaces may be represented by a height and width along with the X, Y, and Z of surface origin and the tilt and azimuth
- Surfaces may also be represented by a series of vertices (X, Y, and Z coordinates defining the perimeter of a surface). More complex polygons may be represented in this manner.

## 6.11.4 Opening Geometry

This data structure represents the location and size of an opening within a surface. The most common method of specifying the geometry of an opening is to identify the parent surface, the height and width of the opening, and the horizontal and vertical offset (X and Y coordinates relative to the origin of the parent surface). An opening can also include a recess into the parent surface, which provides shading. However, other geometric constructs are acceptable.

## 6.11.5 Opening Shade

This data structure describes the dimensions and position of external shading devices such as overhangs, side fins, or louvers that shade the opening. Overhangs are commonly specified in terms of the projection distance, height above the opening, and extension distance on each side of the opening. Side fins may be described in a similar manner. Any geometric construct is acceptable as long as it accounts for the physical and geometric relationship between the opening and the objects around it that provide shading.

## 6.11.6 Construction Assembly

This data structure describes the layers that make up the construction of a wall, roof, floor, or partition. Typically, a construction consists of a sequence of materials, described from the outside surface to the inside surface. A construction assembly may also be defined in terms of its U-factor and the time pattern of heat transmission related to the thermal mass.

## 6.11.7 Fenestration Construction

This data structure describes the frame, glass, and other features of a window or skylight. Information may be defined in multiple ways, but the criteria themselves are published as a combination of U-factor, solar heat gain coefficient (SHGC), and visible light transmission (VT). Some simulation programs use more detailed methods of describing the performance of fenestration that take into account the angle of incidence of sun striking the fenestration and other factors.

## 6.11.8 Material

This data structure describes a material that is used to build up a construction assembly. Typical material properties include specific heat, density, conductivity, and thickness. Materials can also be described in terms of their thermal resistance. The latter approach is sometimes used to approximate construction layers that are not homogeneous, such as framing members in combination with cavity insulation.

## 6.11.9 Slab Construction

This data structure describes the composition of a slab-on-grade. There are many acceptable ways to represent slabs in energy simulation models. Some models have building descriptors for the perimeter length and the F-factor, which represents the heat loss per lineal foot. Other models require that the slab surface area within two feet of the building perimeter be specified along with the interior slab area. In the latter case, coefficients of heat loss either to the air temperature, the ground temperature, or both are linked to insulation configurations.

## 6.11.10 Exterior Surface Properties

This data structure describes the characteristics of exterior surfaces. Exterior surface properties may include emissivity, reflectivity, and roughness. The first two govern radiation exchange from the surface, while the latter governs the magnitude of the exterior air film resistance.

## 6.11.11 Building Shade

This data structure describes trees, adjacent buildings, terrain, and other objects near the proposed building that would shade the building for a significant portion of the year. Exterior shading objects typically have the same properties as surfaces, e.g. the coordinates of the origin, height, width, azimuth, and tilt. They may also have transparency in terms of both SHGC and VT, and the transparency may be varied according to a schedule or algorithm.

## 6.11.12 Utility Rate

This data structure describes how energy costs are calculated for the consumption of a particular fuel such as electricity, gas, chilled water, or steam. A utility rate typically references a Time Period Schedule (see above). For each period, an energy cost, a peak demand charge, or other costs may be assigned.

## 6.11.13 Occupant Heat Rate

This data structure represents the rate of heat and moisture generated by building occupants. This is typically specified in terms of a sensible heat rate and a latent heat rate. Both are typically specified in Btu/h.

## 6.11.14 Furniture and Contents

This data structure represents the thermal mass effect of furniture and other building contents. This is sometimes expressed in terms of lb/ft² for the space in question.

## 6.11.15 Reference Position in a Space

This data structure locates a reference point in a space, typically for the purposes of daylighting control. The typical construct for the reference

This data structure locates a reference point in a space, typically for the purposes of daylighting control. The typical construct for the reference point is a set of coordinates (X, Y, and Z) relative to the space coordinate system.

# 6.11.16 Two Dimensional Curve

This data structure explains one parameter in terms of another. An example is a curve that modifies the efficiency of an air conditioner relative to the fraction of time that the equipment operates within the period of an hour, for example. The relationship can be expressed in terms of the X and Y coordinates of points on the curve or it can be expressed as an equation.

# 6.11.17 Three Dimensional Curve

This data structure explains one parameter in terms of two others. An example is a curve that modifies the efficiency of an air conditioner relative to the outside air dry-bulb temperature and the wet-bulb temperature of air returning to the coil. The relationship is a three-dimensional surface and can be expressed in terms of the X and Y coordinates of points on the curve or it can be expressed as an equation.

# 6.11.18 Temperature Reset Schedule

This data structure describes the relationship between one temperature and another. For example, the independent variable might be outside air temperature and the dependent variable is supply air temperature. In this case, a common schedule would be to set the supply air temperature at 55°F when the outside air temperature is 80°F or warmer and at 62°F when the outside air temperature is 58°F or cooler with the supply air temperature scaling between 55°F and 62°F when the outside air temperature is between 80°F and 58°F. Temperature reset schedules can be specified in various ways.

# 6.11.19 Photovoltaic (PV) Panel

This data structure describes the power produced by a PV panel as a function of the solar insolation, incident angle, temperature, and other parameters.

# 6.11.20 Contact

This data structure describes a contact which is used to identify a stakeholder in the process, such as the architect, engineer, or owner. Information includes the name, address, email, telephone and other relevant information. See the COMNET schema for more information.

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