

Task 1 Provide a summary of the main concepts that went through about solar radiation

Solar radiation

The solar radiation is electromagnetic energy emitted by the Sun, its wavelength field goes from 0,3 to 2,5 micrometer with a maximum of 2,5 micrometer. The solar radiation is propagated everywhere and some radiation hits the earth surface. The maximum yearly average solar radiation power density (expressed by the letter G_{SG}) is the solar radiation by unit of receiving surface placed out of the atmosphere and perpendicular to the Sun-Earth ray. The value of this measure out of the Earth's atmosphere is 1367 W/m^2 . Instead the value on the Earth's surface is lower, 1000 W/m^2 . That's why the atmosphere works like barrier an part of the solar radiation is absorbed by the atmosphere itself. The solar radiation is modified both in spectral distribution and in total irradiance. That is due to dispersion and absorption phenomena.

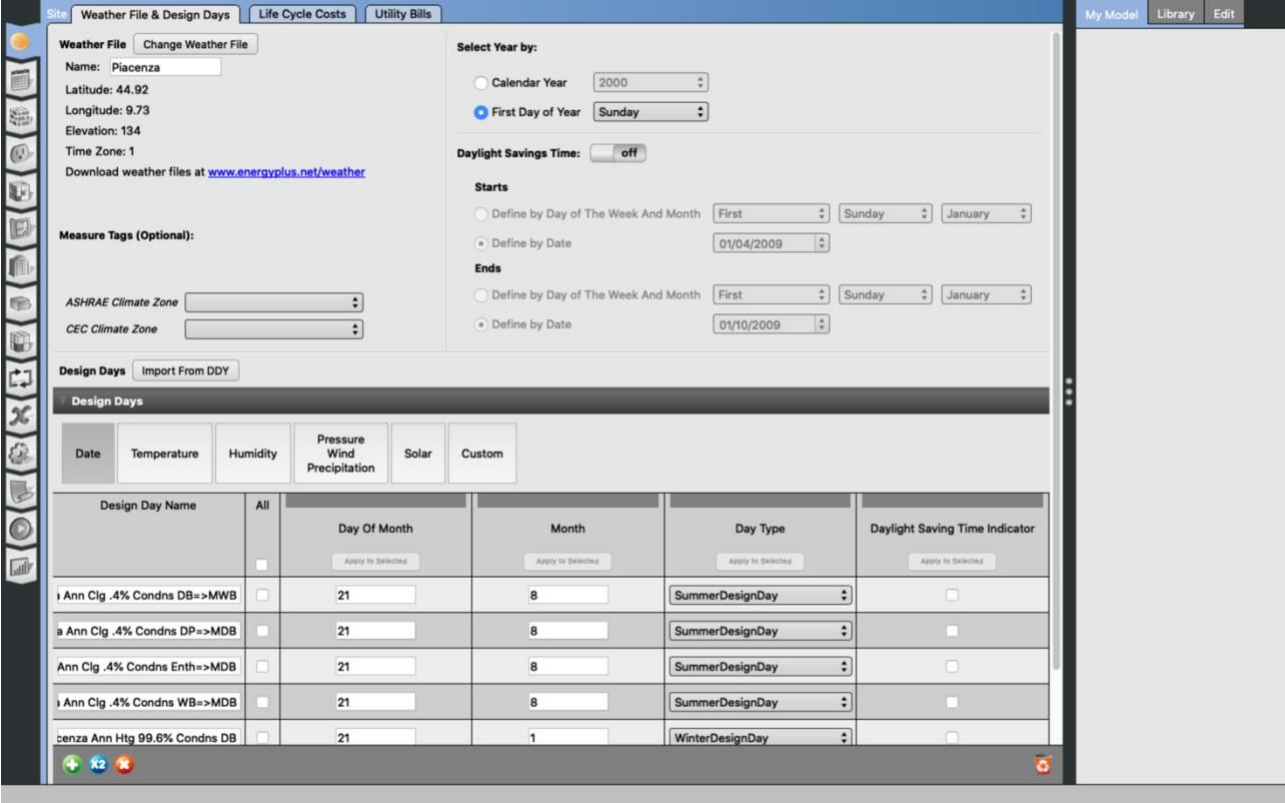
The dispersion is composed by two types: on is the direct radiation and the other one is the diffuse radiation. The first one is the radiation that is not intercepted by molecules instead maintains the incidence direction as the unique direction. The second one is a black reflection of part of the incident radiation on the atmosphere and the radiation deflected in all directions. The sum of the direct and diffuse direction is the global solar radiation.

The solar radiation absorption is when the atmosphere absorbs some of the incident radiation in specific wavelength band and this is due to some atmospheric components like ozone, water and carbon. The ozone for example absorbs most of the ultraviolet component, that is very dangerous for human being.

The solar radiation available on the Erath's surface depend on many factors like the Sun position in the sky, which changes daily and seasonally, the weather condition, the day length and the site altitude over the see level.

Task 2 Create a pdf file with screenshots of all of the steps we went through in the second lesson on openStudio and explain briefly the reason behind the use of each step

Adding weather data of Piacenza using the file .ddy and .epw (to find new data goes to the network of energy plus)



We can see in the “design days” some aspect related to the data of the weather in Piacenza, especially the temperature

Site Weather File & Design Days Life Cycle Costs Utility Bills

Elevation: 134
Time Zone: 1
Download weather files at www.energyplus.net/weather

Measure Tags (Optional):
ASHRAE Climate Zone
CEC Climate Zone

Daylight Savings Time: ☐ off

Starts
☐ Define by Day of The Week And Month First Sunday January
☐ Define by Date 01/04/2009
Ends
☐ Define by Day of The Week And Month First Sunday January
☐ Define by Date 01/10/2009

Design Days Import From DDY

Design Days

Date	Temperature	Humidity	Pressure Wind Precipitation	Solar	Custom
Design Day Name	All				
		Maximum Dry Bulb Temperature	Daily Dry Bulb Temperature Range	Daily Wet Bulb Temperature Range	Dry Bulb Temperature Range Modifier Type
		Apply to Selected	Apply to Selected	Apply to Selected	Apply to Selected
g .4% Condns DB=>MWB		33.100000 C	11.900000 K		DefaultMultipliers
g .4% Condns DP=>MDB		27.400000 C	11.900000 K		DefaultMultipliers
.4% Condns Enth=>MDB		30.300000 C	11.900000 K		DefaultMultipliers
g .4% Condns WB=>MDB		30.100000 C	11.900000 K		DefaultMultipliers
h Htg 99.6% Condns DB		-6.100000 C	0.000000 K		DefaultMultipliers
.6% Condns WS=>MCDB		5.800000 C	0.000000 K		DefaultMultipliers
l.6% Condns DP=>MCDB		3.500000 C	0.000000 K		DefaultMultipliers

After that we can go to the third tab and set the “construction set”. The construction set is referred to the whole type of structure there are in the buildings (floors, windows, walls,...). After the selection of the elements we need to duplicate the data.

Constructions Construction Sets Constructions Materials

My Model Library Edit

Constructions

189.1-2009 - CZ1 - Office
189.1-2009 - CZ2 - Office
189.1-2009 - CZ3 - Office
189.1-2009 - CZ4 - Office
189.1-2009 - CZ5 - Office
189.1-2009 - CZ6 - Office
189.1-2009 - CZ7-8 - Office

Name
NewWall1

Exterior Surface Constructions

Walls Floors Roofs

ASHRAE 189.1-2001 ExtWall
ASHRAE 189.1-2001 4in ClimateZoi
ASHRAE 189.1-2001 ExtRoof

Interior Surface Constructions

Walls Floors Ceilings

Interior Wall
Interior Floor
Interior Ceiling

Ground Contact Surface Constructions

Walls Floors Ceilings

ASHRAE 189.1-2001 4in ClimateZoi
ASHRAE 189.1-2001 4in ClimateZoi
ASHRAE 189.1-2001 4in ClimateZoi

Exterior Sub Surface Constructions

Fixed Windows Operable Windows Doors

ASHRAE 189.1-2001 ExtWindow
ASHRAE 189.1-2001 ExtWindow
Exterior Door

Glass Doors Overhead Doors Skylights

Drag From Library
Drag From Library
Drag From Library

Tubular Daylight Domes Tubular Daylight Diffusers

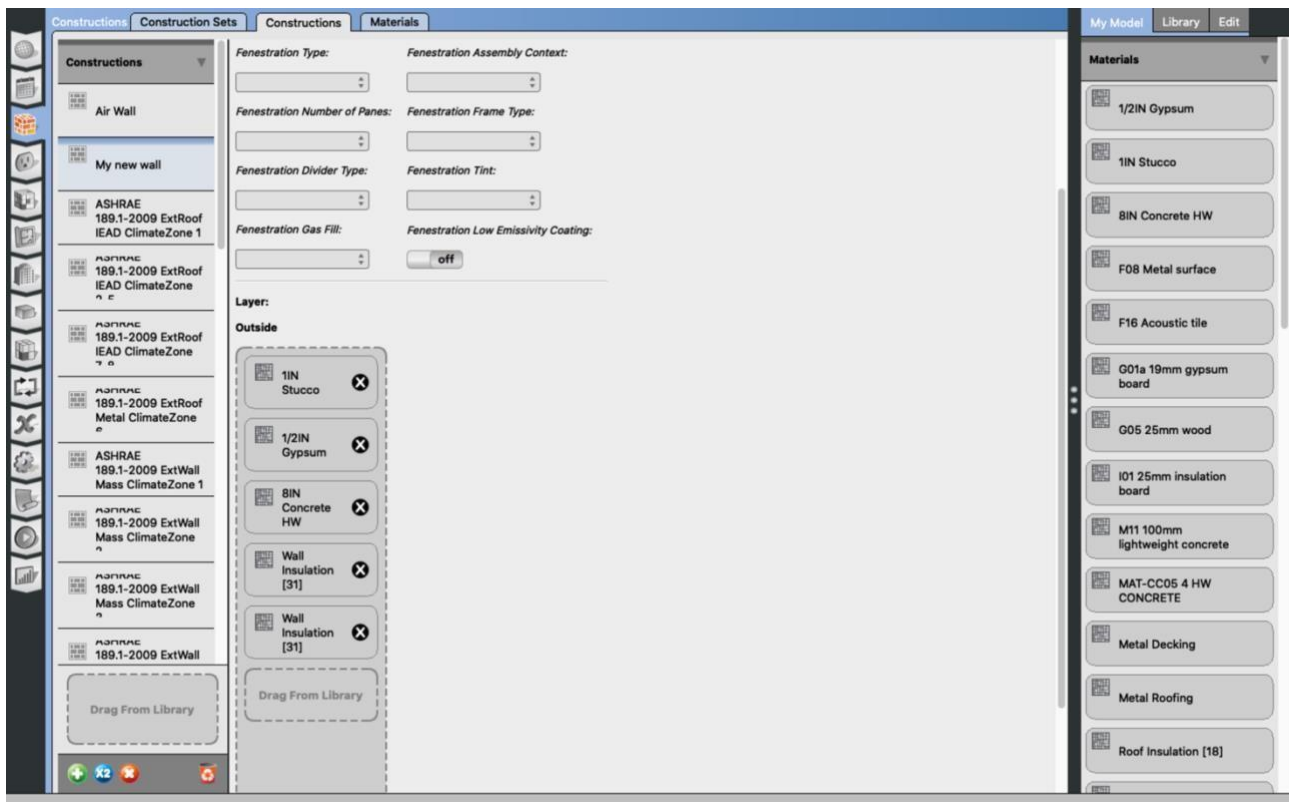
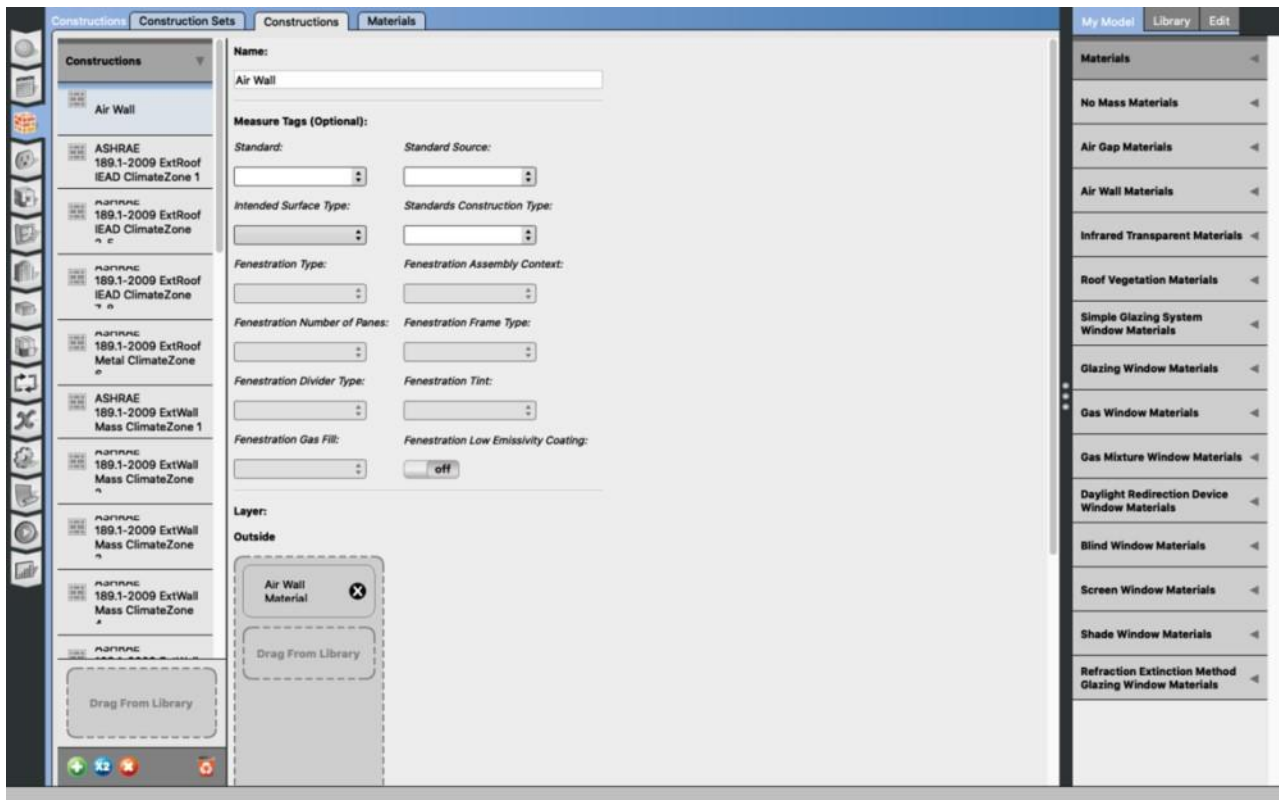
Interior
Interior

Constructions

Air Wall

ASHRAE 189.1-2009 ExtRoof IEAD ClimateZone 1
ASHRAE 189.1-2009 ExtRoof IEAD ClimateZone 2-5
ASHRAE 189.1-2009 ExtRoof IEAD ClimateZone 7-8
ASHRAE 189.1-2009 ExtRoof Metal ClimateZone 6
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 1
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 2
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 3
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 4
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 5
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 6
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 7-8
ASHRAE 189.1-2009 ExtWindow ClimateZone 1

Then we need to define a new type of wall, after the duplication of the existing walls and we have to rename it and change the material. To change the material the only thing is to drag the material from the right list under materials.



Define the material and insulation putting these values: thickness 0,1 ; conductivity 0,3; density 100; specific heat 900.

Constructions Construction Sets Constructions Materials My Model Library Edit

Materials

My new wall

1IN Stucco

8IN Concrete HW

F08 Metal surface

F16 Acoustic tile

G01a 19mm gypsum board

G05 25mm wood

I01 25mm insulation board

M11 100mm lightweight concrete

MAT-CC05 4 HW CONCRETE

Metal Decking

Drag From Library

Name:
My new wall

Measure Tags (Optional):

Standard: **Standard Source:**

Standards Category: **Standards Identifier:**

Composite Framing Material: **Composite Framing Configuration:**

Composite Framing Depth: **Composite Framing Size:**

Composite Cavity Insulation:

Roughness: **Thickness:** m

Conductivity: W/m-K **Density:** kg/m³

Specific Heat: J/kg-K **Thermal Absorptance:**

Solar Absorptance: **Visible Absorptance:**

Constructions Construction Sets Constructions Materials My Model Library Edit

Materials

ExtSlabCarpet 4in ClimateZone 1-8

Interior Ceiling

Interior Door

Interior Floor

Interior Partition

Interior Wall

Interior Window

My new wall

Air Boundary Constructions

Internal Source Constructions

C-factor Underground Wall Constructions

F-factor Ground Floor Constructions

Drag From Library

Name:
My new wall

Measure Tags (Optional):

Standard: **Standard Source:**

Intended Surface Type: **Standards Construction Type:**

Fenestration Type: **Fenestration Assembly Context:**

Fenestration Number of Panes: **Fenestration Frame Type:**

Fenestration Divider Type: **Fenestration Tint:**

Fenestration Gas Fill: **Fenestration Low Emissivity Coating:**

Layer:

Outside

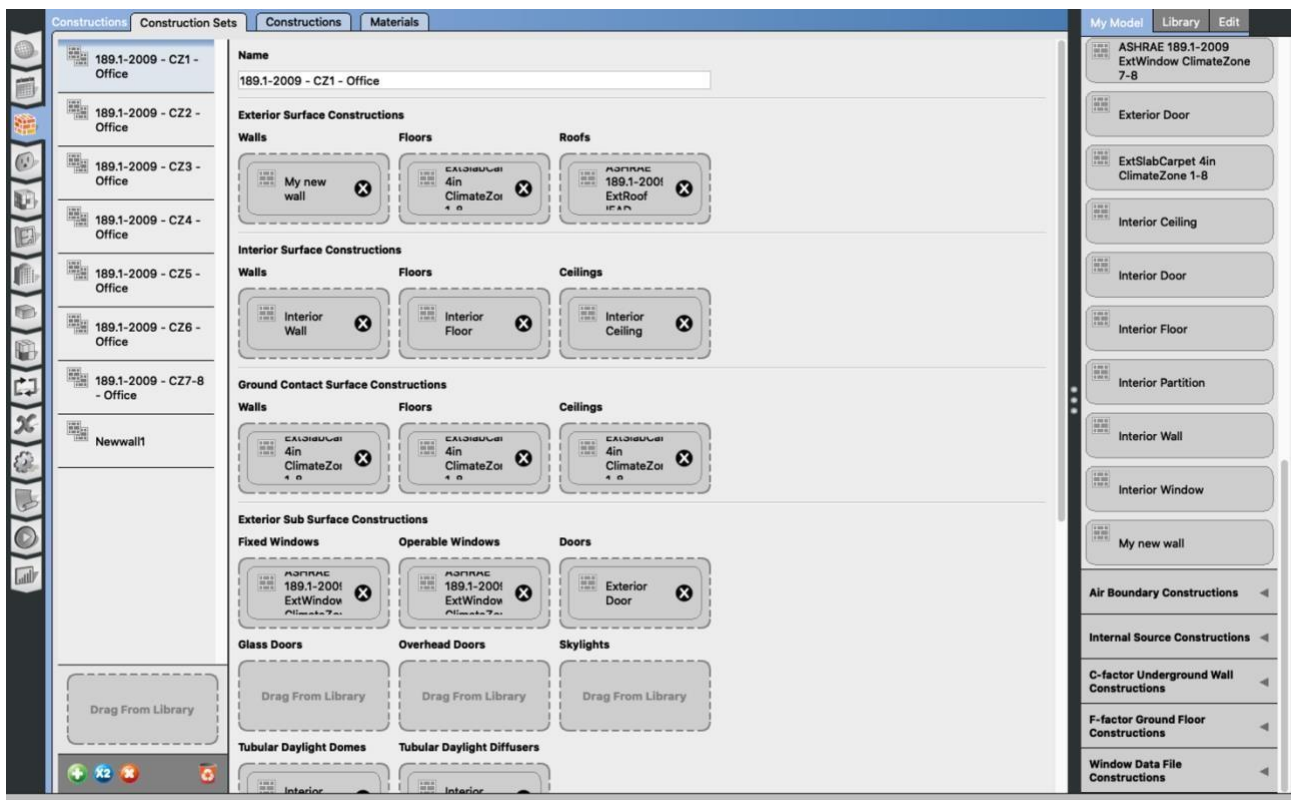
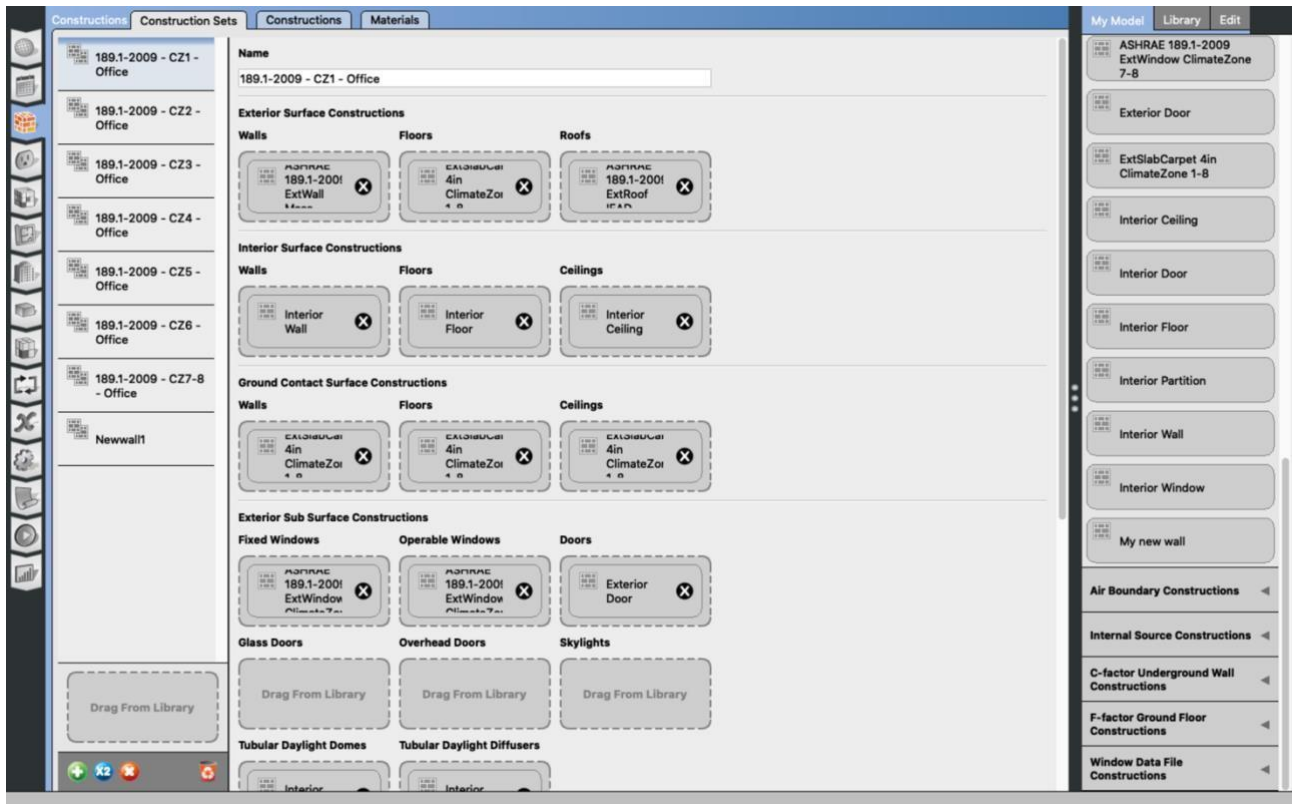
1IN Stucco

My new wall

8IN Concrete HW

Wall Insulation

Return to the construction set and find the new wall with the new material and then replace and add it with the old material from the list on the materials in the right



The next step is to change the material in the skp model with the new material that we created before. Select “spaces tub”, after “properties” and then “general”. Select all and go to the “default construction set” and apply to selected

The screenshot shows the 'Spaces' tab in a software interface. The 'General' sub-tab is active. The 'Filters' section shows 'Story', 'Thermal Zone', and 'Space Type' all set to 'All'. The table below lists various spaces with their properties. The 'All' checkbox in the 'All' column is selected, and the 'Default Construction Set' column is highlighted.

Space Name	All	Story	Thermal Zone	Space Type	Default Construction Set	Default Schedule Set	Part of Total Floor Area
Space 101	<input type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 102	<input type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 103	<input type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 104	<input type="checkbox"/>	Building Story 1	Thermal Zone 2	189.1-2009 - Office - B	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 105	<input type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 201	<input type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 202	<input type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 203	<input type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 204	<input type="checkbox"/>	Building Story 2	Thermal Zone 4	189.1-2009 - Office - B	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 205	<input type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 301	<input type="checkbox"/>	Building Story 3	Thermal Zone 5	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 302	<input type="checkbox"/>	Building Story 3	Thermal Zone 5	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 303	<input type="checkbox"/>	Building Story 3	Thermal Zone 5	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 304	<input type="checkbox"/>	Building Story 3	Thermal Zone 6	189.1-2009 - Office - B	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 305	<input type="checkbox"/>	Building Story 3	Thermal Zone 5	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>

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Space 102	<input checked="" type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 103	<input checked="" type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 104	<input checked="" type="checkbox"/>	Building Story 1	Thermal Zone 2	189.1-2009 - Office - B	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 105	<input checked="" type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 201	<input checked="" type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 202	<input checked="" type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 203	<input checked="" type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 204	<input checked="" type="checkbox"/>	Building Story 2	Thermal Zone 4	189.1-2009 - Office - B	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 205	<input checked="" type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 301	<input checked="" type="checkbox"/>	Building Story 3	Thermal Zone 5	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 302	<input checked="" type="checkbox"/>	Building Story 3	Thermal Zone 5	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 303	<input checked="" type="checkbox"/>	Building Story 3	Thermal Zone 5	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 304	<input checked="" type="checkbox"/>	Building Story 3	Thermal Zone 6	189.1-2009 - Office - B	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 305	<input checked="" type="checkbox"/>	Building Story 3	Thermal Zone 5	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>

Spaces

Properties

Loads

Surfaces

Subsurfaces

Interior Partitions

Shading

General

Airflow

Custom

Filters: Story

Thermal Zone

Space Type

All

All

All

Space Name	All	Story	Thermal Zone	Space Type	Default Construction Set	Default Schedule Set	Part of Total Floor Area
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Space 104	<input checked="" type="checkbox"/>	Building Story 1	Thermal Zone 2	189.1-2009 - Office - B	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 105	<input checked="" type="checkbox"/>	Building Story 1	Thermal Zone 1	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
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Space 204	<input checked="" type="checkbox"/>	Building Story 2	Thermal Zone 4	189.1-2009 - Office - B	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 205	<input checked="" type="checkbox"/>	Building Story 2	Thermal Zone 3	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
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Space 303	<input checked="" type="checkbox"/>	Building Story 3	Thermal Zone 5	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 304	<input checked="" type="checkbox"/>	Building Story 3	Thermal Zone 6	189.1-2009 - Office - B	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>
Space 305	<input checked="" type="checkbox"/>	Building Story 3	Thermal Zone 5	189.1-2009 - Office - C	189.1-2009 - CZ1 - Off		<input checked="" type="checkbox"/>

My Model

Library

Edit

OS:DefaultConstructionSet

Name

189.1-2009 - CZ1 - Office

Default Exterior Surface Construction

Default Surface Constructions 22

Default Interior Surface Construction

Default Surface Constructions 23

Default Ground Contact Surface Construction

Default Surface Constructions 24

Default Exterior SubSurface Construction

Default Sub Surface Constructions 11

Default Interior SubSurface Construction

Default Sub Surface Constructions 11

Interior Partition Construction Name

Interior Partition

Space Shading Construction Name

Building Shading Construction Name

Site Shading Construction Name

Adiabatic Surface Construction Name

Spaces

Properties

Loads

Surfaces

Subsurfaces

Interior Partitions

Shading

General

Airflow

Custom

Filters: Story

Thermal Zone

Space Type

All

All

All

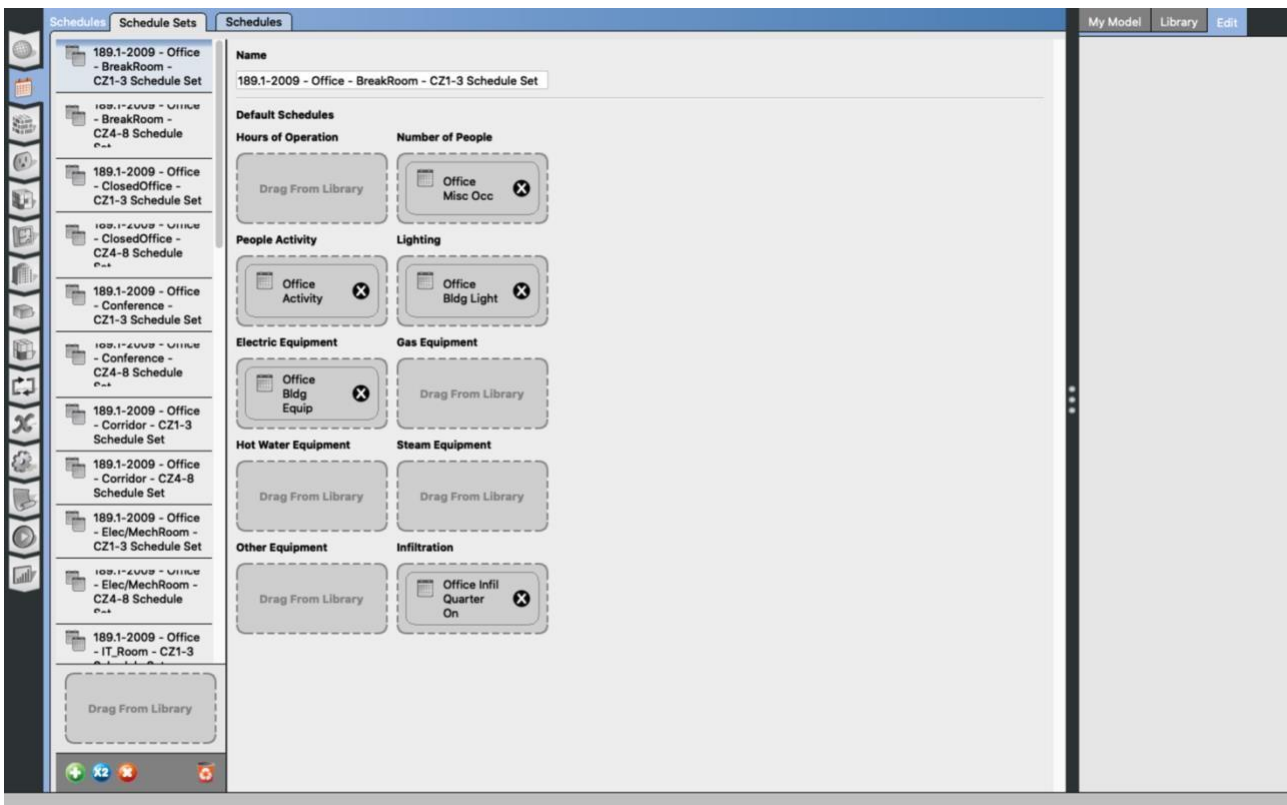
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Space 305	<input checked="" type="checkbox"/>	Building Story 3	Thermal Zone 5	189.1-2009 - Office - C	My new wall		<input checked="" type="checkbox"/>

My Model

Library

Edit

Go to “schedule tub” to define the indoor temperature of the office building



Define the worst scenario that could happen for this building. So in the winter time consider none inside to help the room to stay warmer and in the summer time a lot of people inside.

