WEEK 6 SUBMISSION

QUESTION 1:

Considering the same example you solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with epsilon = 0.1 should you add in order to have the new heat transfer rate to be 1% of the case without shields?

ANSWER 1:

First we look at the example of last week assignment:

The radiative heat transfer between surface 1 and 2. The area is 1.5 m^2, $\varepsilon_1 = 0.2$, $\varepsilon_2 = 0.7$, $T_1 = 37℃$, $T_2 = 17℃$. The answer is:

$Q_{12,\ no\ shields} = A\sigma(T_1^4 - T_1^4)/1/\varepsilon_1+1/\varepsilon_2-1 = 1.5*5.67*10^{-8}\ (310^4-290^4)\ /1/0.1+1/0.1-1 = 9.6789W$

If we would like to have the new heat transfer which is the 1% of this case, then

$1\% * Q_{12,\ no\ shields} = 0.096789W$

According to the equation

$Q_{1-2,\ N\ shields} = A\sigma(T_1^4 - T_1^4)/(N+1)(1/\varepsilon_1+1/\varepsilon_2-1) = 1/N+1 * Q_{1-2,\ no\ shields} = 0.096789W$

Then

$Q_{1-2,\ N\ shields} = 1/N+1 * 9.96789 = 1/100 * 9.96789 = 0.096789W$

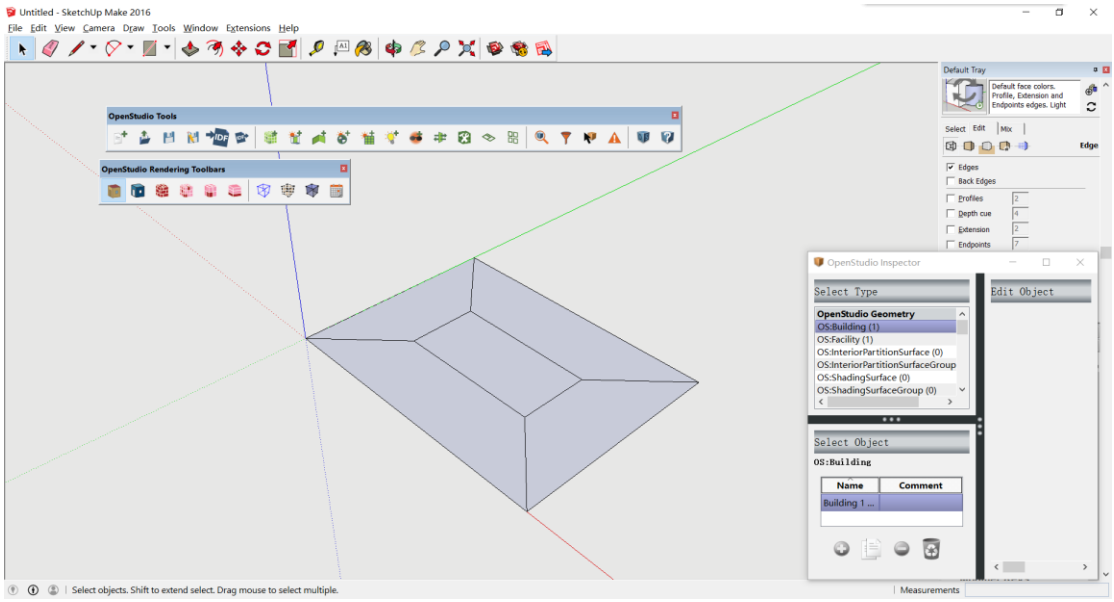
$N=100-1=99$

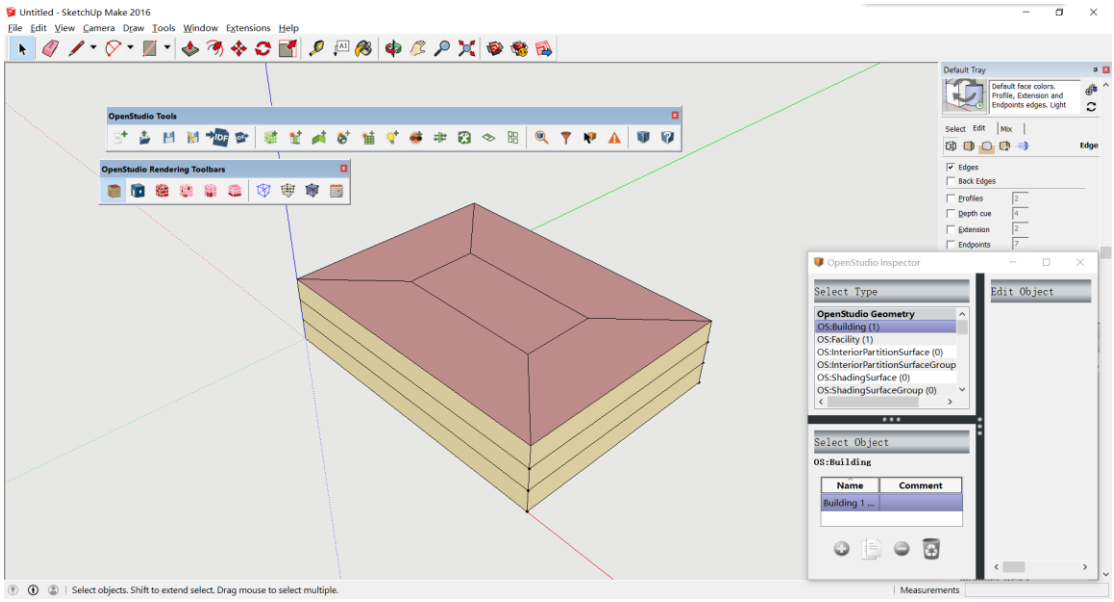
Therefore, we need 99 shields with epsilon = 0.1 to have the new heat transfer rate to be 1% of the case without shields.

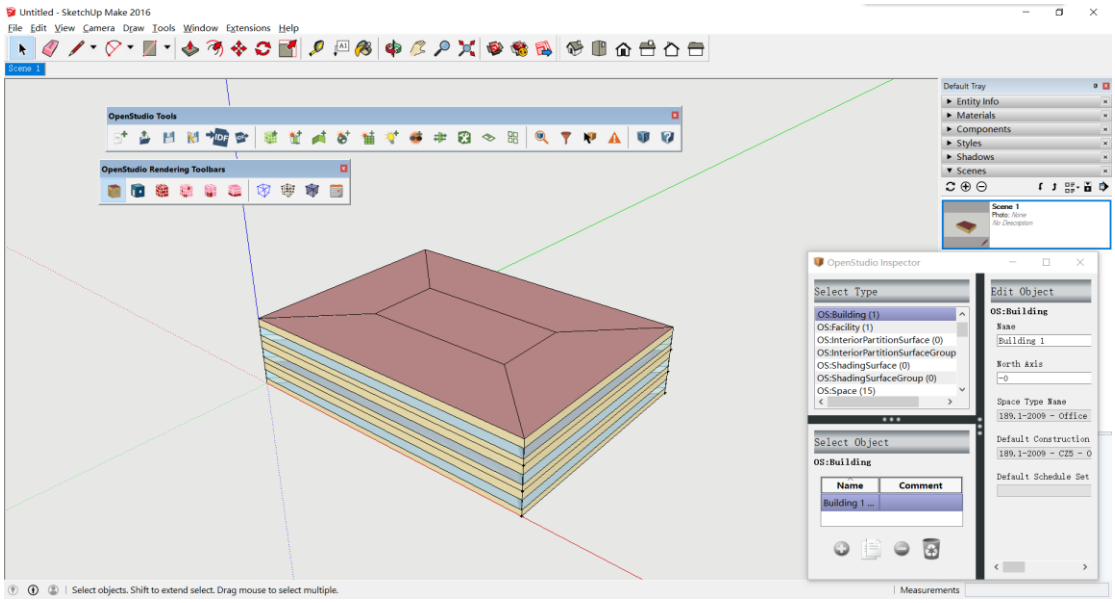
QUESTION 2:

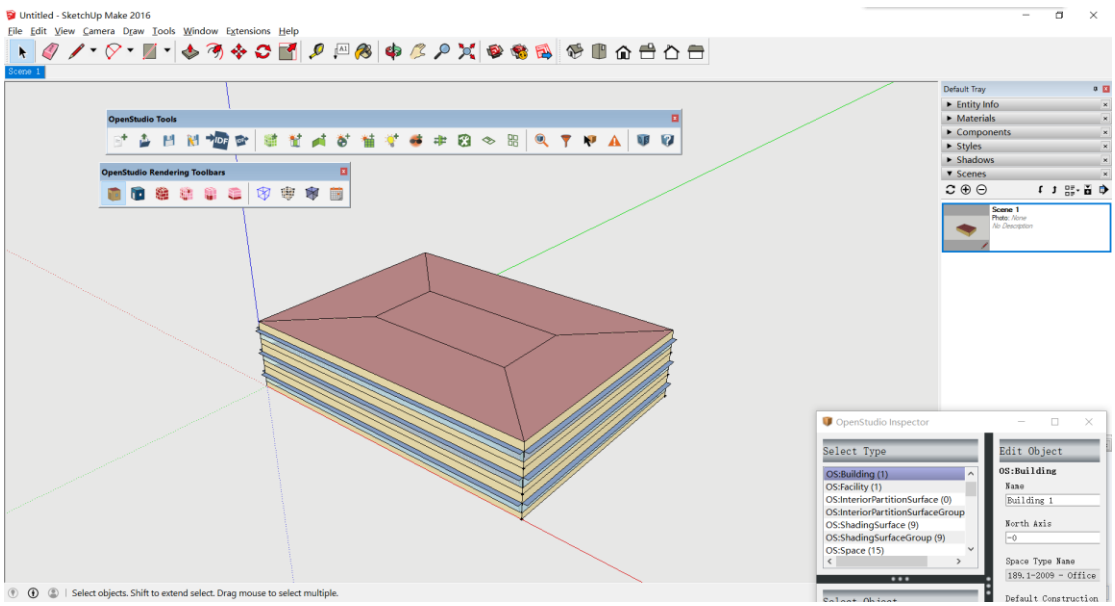
You should create a pdf file with screenshots of all of the steps we went through (clearly from your own file) and explain briefly the reason behind the use of each step (in your own words!)

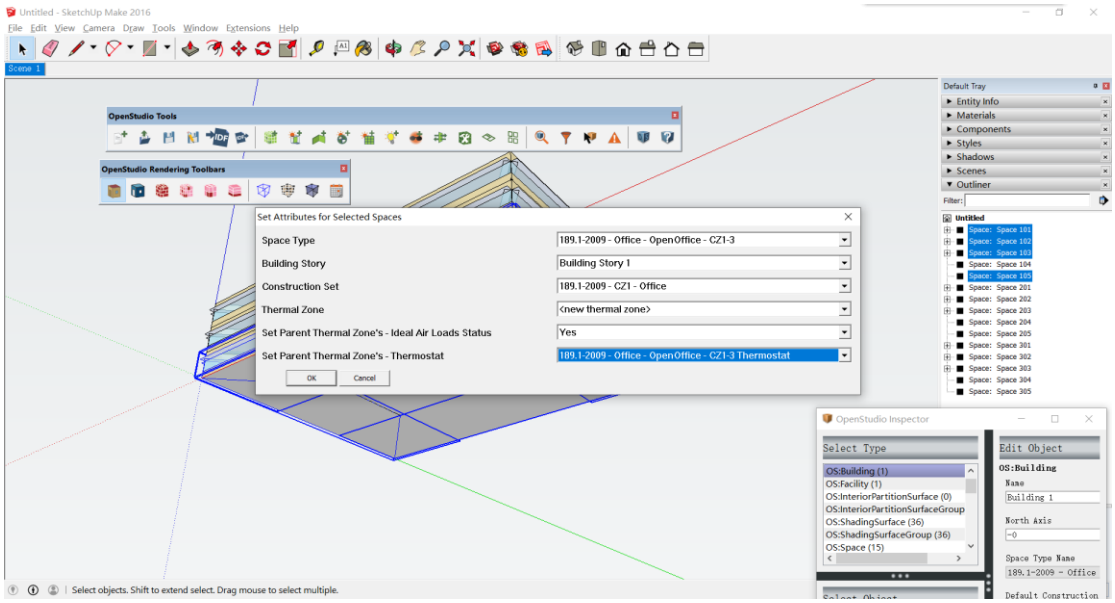
ANSWER 2:

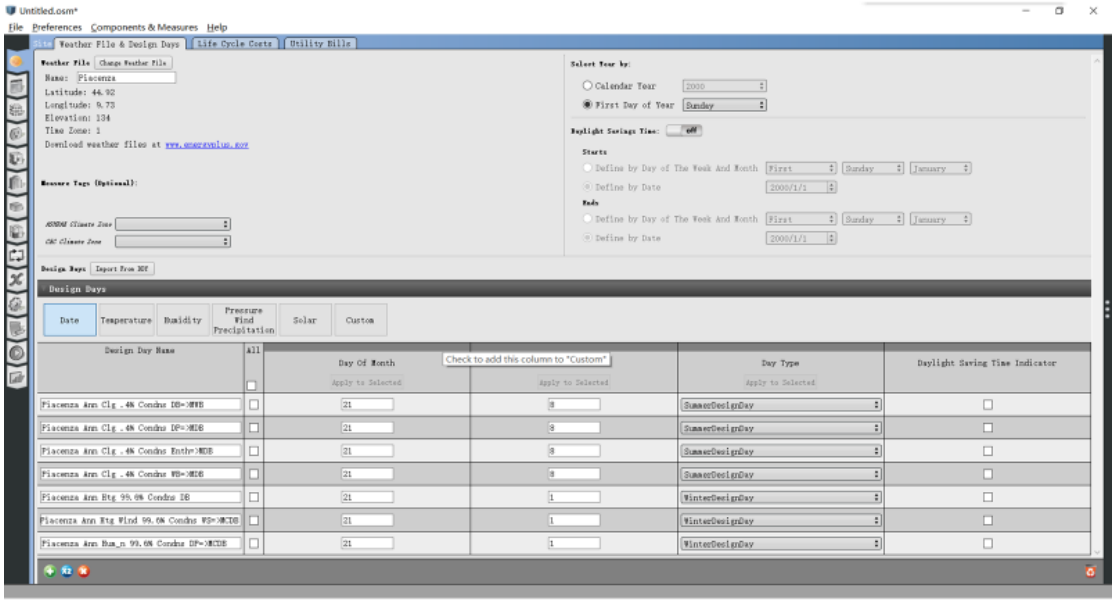

Untitled - SketchUp Make 2016
File Edit View Camera Draw Tools Window Extensions Help
OpenStudio Tools
OpenStudio Rendering Toolbars
Default Tray
OpenStudio Inspector
Select Type
Edit Object
OpenStudio Geometry
OS:Building (1)
OS:Facility (1)
OS:InteriorPartitionSurface (0)
OS:InteriorPartitionSurfaceGroup
OS:ShadingSurface (0)
OS:ShadingSurfaceGroup (0)
Select Object
OS:Building
Name
Comment
Building 1 ...
Select objects. Shift to extend select. Drag mouse to select multiple.
Measurements

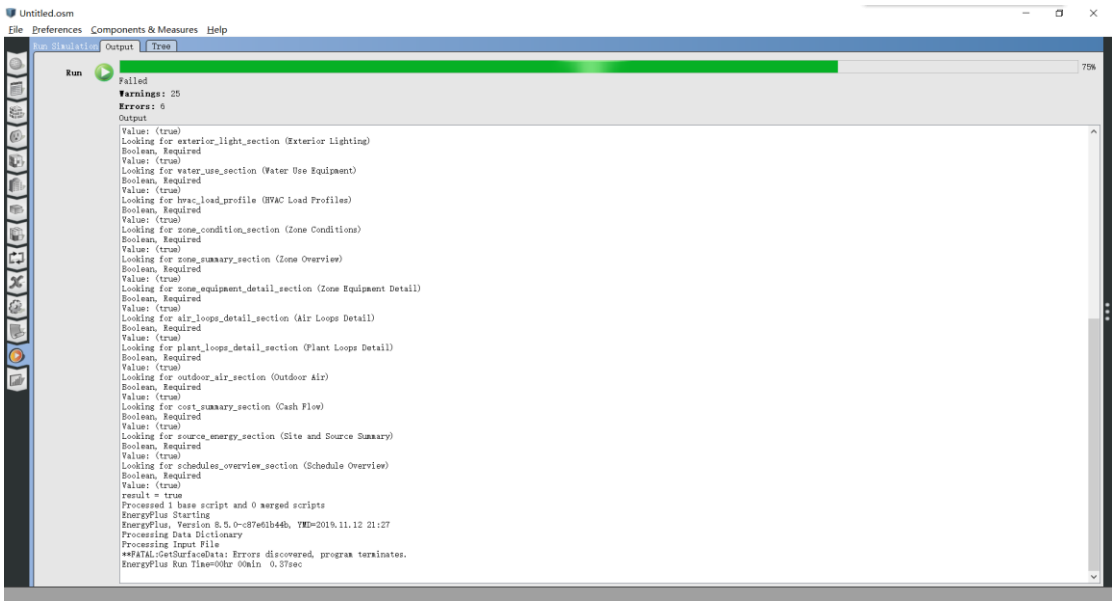

Untitled - SketchUp Make 2016
File Edit View Camera Draw Tools Window Extensions Help
OpenStudio Tools
OpenStudio Rendering Toolbars
Default Tray
OpenStudio Inspector
Select Type
Edit Object
OpenStudio Geometry
OS:Building (1)
OS:Facility (1)
OS:InteriorPartitionSurface (0)
OS:InteriorPartitionSurfaceGroup
OS:ShadingSurface (0)
OS:ShadingSurfaceGroup (0)
Select Object
OS:Building
Name
Comment
Building 1 ...
Select objects. Shift to extend select. Drag mouse to select multiple.
Measurements


Untitled - SketchUp Make 2016
File Edit View Camera Draw Tools Window Extensions Help
Scene 1
OpenStudio Tools
OpenStudio Rendering Toolbars
Default Tray
Entity Info
Materials
Components
Styles
Shadows
Scenes
OpenStudio Inspector
Select Type
Edit Object
OS:Building (1)
OS:Facility (1)
OS:InteriorPartitionSurface (0)
OS:InteriorPartitionSurfaceGroup
OS:ShadingSurface (0)
OS:ShadingSurfaceGroup (0)
OS:Space (15)
Select Object
OS:Building
Name
Comment
Building 1 ...
Building 1
Space Type Name
Default Construction
Default Schedule Set
Select objects. Shift to extend select. Drag mouse to select multiple.
Measurements


Untitled - SketchUp Make 2016
File Edit View Camera Draw Tools Window Extensions Help
Scene 1
OpenStudio Tools
OpenStudio Rendering Toolbars
Default Tray
Entity Info
Materials
Components
Styles
Shadows
Scenes
OpenStudio Inspector
Select Type
OS:Building (1)
OS:Facility (1)
OS:InteriorPartitionSurface (0)
OS:InteriorPartitionSurfaceGroup
OS:ShadingSurface (9)
OS:ShadingSurfaceGroup (9)
OS:Space (15)
Edit Object
OS:Building
Name
Building 1
North Axis
Space Type Name
189.1-2009 - Office
Default Construction
Select objects. Shift to extend select. Drag mouse to select multiple.


Untitled - SketchUp Make 2016
File Edit View Camera Draw Tools Window Extensions Help
Scene 1
OpenStudio Tools
OpenStudio Rendering Toolbars
Set Attributes for Selected Spaces
Space Type
189.1-2009 - Office - OpenOffice - CZ1-3
Building Story
Building Story 1
Construction Set
189.1-2009 - CZ1 - Office
Thermal Zone
<new thermal zone>
Set Parent Thermal Zone's - Ideal Air Loads Status
Yes
Set Parent Thermal Zone's - Thermostat
189.1-2009 - Office - OpenOffice - CZ1-3 Thermostat
OK
Cancel
Default Tray
Entity Info
Materials
Components
Styles
Shadows
Scenes
Outliner
OpenStudio Inspector
Select Type
OS:Building (1)
OS:Facility (1)
OS:InteriorPartitionSurface (0)
OS:InteriorPartitionSurfaceGroup
OS:ShadingSurface (36)
OS:ShadingSurfaceGroup (36)
OS:Space (15)
Edit Object
OS:Building
Name
Building 1
North Axis
Space Type Name
189.1-2009 - Office
Default Construction
Select objects. Shift to extend select. Drag mouse to select multiple.


Untitled.osm*
File Preferences Components & Measures Help
Site Weather File & Design Days Life Cycle Costs Utility Bills
Weather File Change Weather File
Name: Piacenza
Latitude: 44.92
Longitude: 9.73
Elevation: 134
Time Zone: 1
Download weather files at www.energyplus.gov
Measure Tags (Optional):
ASHRAE Climate Zone
CEC Climate Zone
Select Year by:
Calendar Year 2009
First Day of Year Sunday
Daylight Savings Time: Off
Starts
Define by Day of The Week And Month First Sunday January
Define by Date 2009/1/1
Ends
Define by Day of The Week And Month First Sunday January
Define by Date 2009/1/1
Design Days Import From DDY
Design Days
Date Temperature Humidity Pressure Wind Precipitation Solar Custom
Design Day Name
All
Day Of Month
Check to add this column to "Custom"
Apply to Selected
Day Type
Daylight Saving Time Indicator
Piacenza Ann Clg .4% Condns DB=>MWB 21 8 SummerDesignDay
Piacenza Ann Clg .4% Condns DP=>MDB 21 8 SummerDesignDay
Piacenza Ann Clg .4% Condns Enthr=>MDB 21 8 SummerDesignDay
Piacenza Ann Clg .4% Condns WB=>MDB 21 8 SummerDesignDay
Piacenza Ann Htg 99.6% Condns DB 21 1 WinterDesignDay
Piacenza Ann Htg Wind 99.6% Condns WS=>MCDB 21 1 WinterDesignDay
Piacenza Ann Hum_n 99.6% Condns DP=>MCDB 21 1 WinterDesignDay


Untitled.osm
File Preferences Components & Measures Help
Run Simulation Output Tree
Run
75%
Failed
Warnings: 25
Errors: 6
Output
Value: (true)
Looking for exterior_light_section (Exterior Lighting)
Boolean, Required
Value: (true)
Looking for water_use_section (Water Use Equipment)
Boolean, Required
Value: (true)
Looking for hvac_load_profile (HVAC Load Profiles)
Boolean, Required
Value: (true)
Looking for zone_condition_section (Zone Conditions)
Boolean, Required
Value: (true)
Looking for zone_summary_section (Zone Overview)
Boolean, Required
Value: (true)
Looking for zone_equipment_detail_section (Zone Equipment Detail)
Boolean, Required
Value: (true)
Looking for air_loops_detail_section (Air Loops Detail)
Boolean, Required
Value: (true)
Looking for plant_loops_detail_section (Plant Loops Detail)
Boolean, Required
Value: (true)
Looking for outdoor_air_section (Outdoor Air)
Boolean, Required
Value: (true)
Looking for cost_summary_section (Cash Flow)
Boolean, Required
Value: (true)
Looking for source_energy_section (Site and Source Summary)
Boolean, Required
Value: (true)
Looking for schedules_overview_section (Schedule Overview)
Boolean, Required
Value: (true)
result = true
Processed 1 base script and 0 merged scripts
EnergyPlus Starting
EnergyPlus, Version 8.5.0-c87e61b44b, YMD=2019.11.12 21:27
Processing Data Dictionary
Processing Input File
**FATAL:GetSurfaceData: Errors discovered, program terminates.
EnergyPlus Run Time=00hr 00min 0.57sec