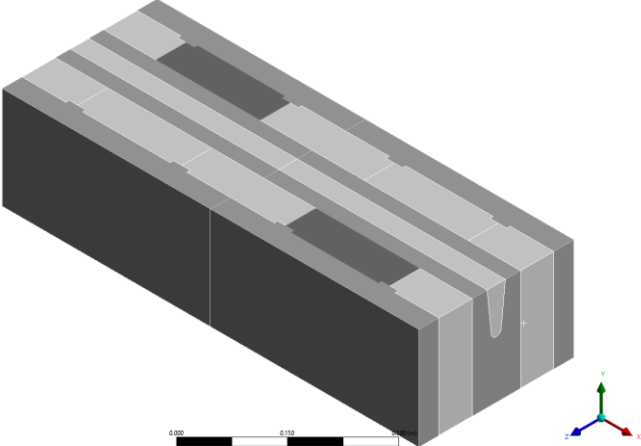
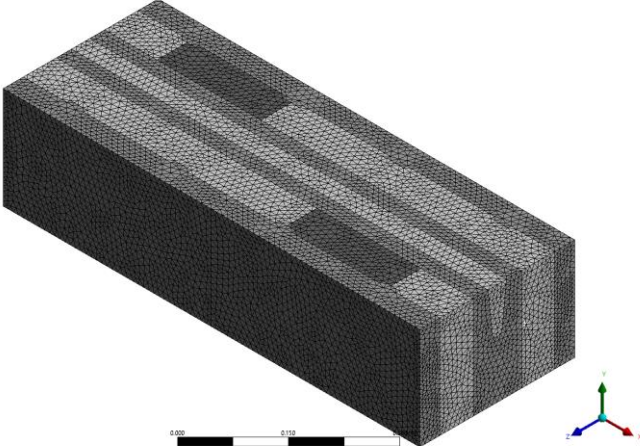
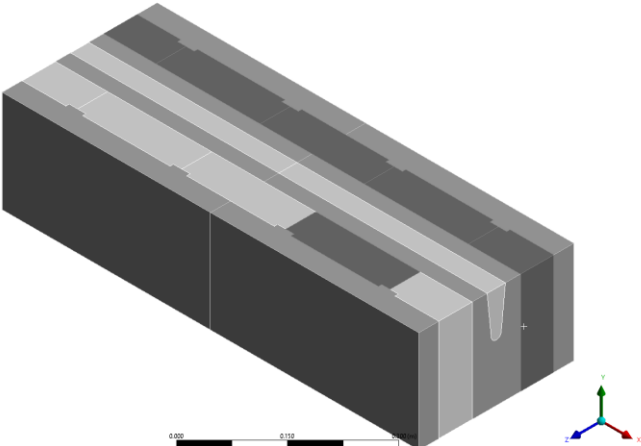
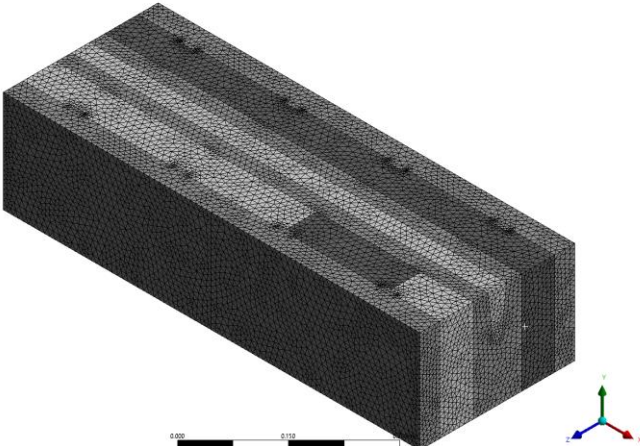
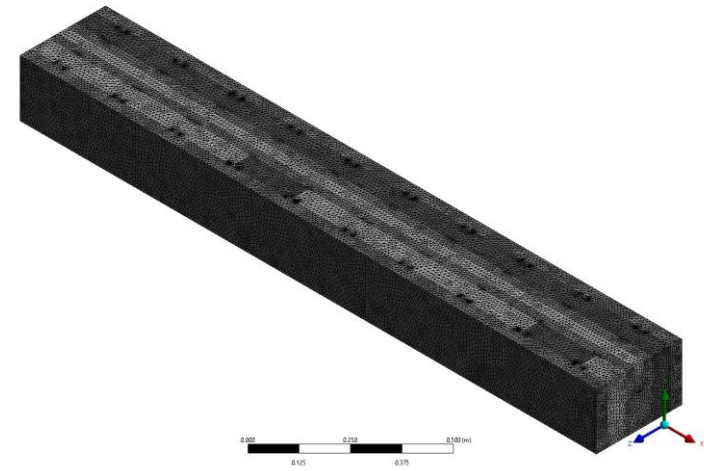
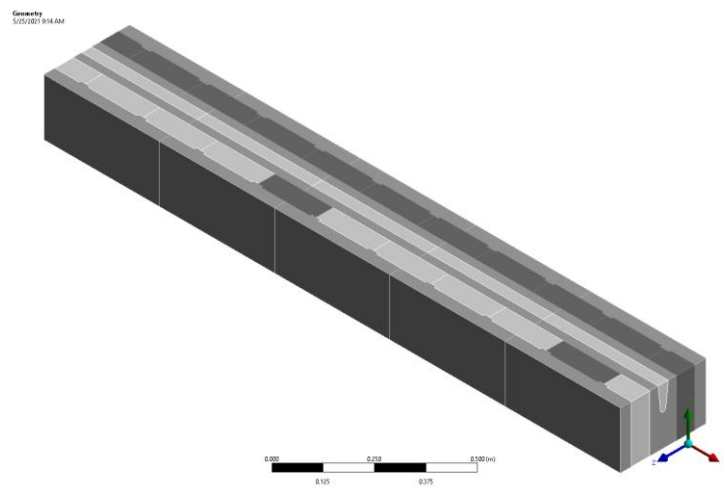


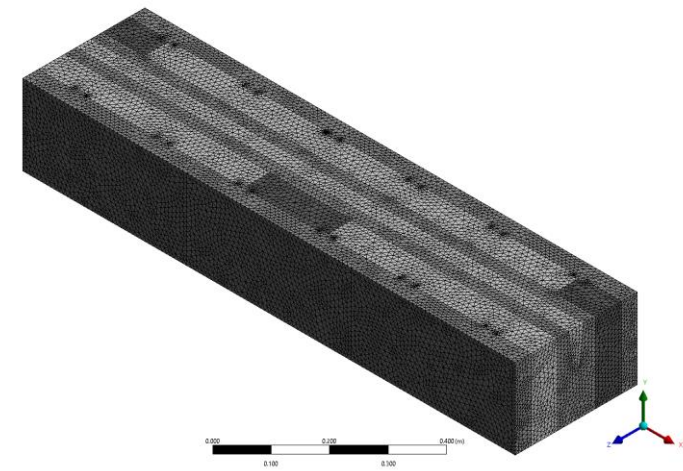
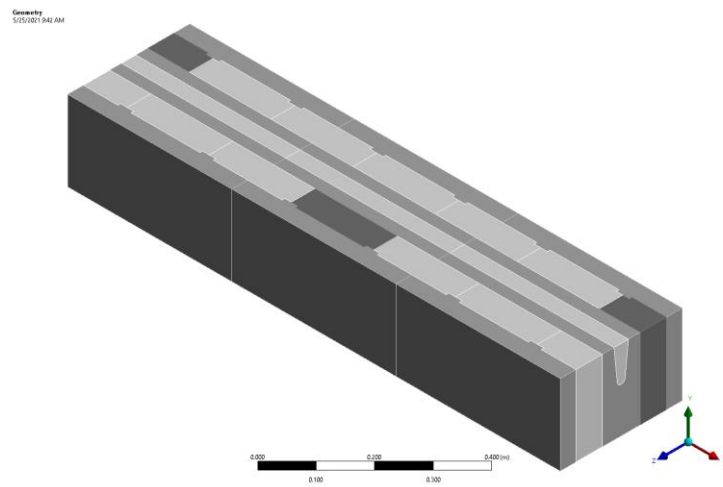
Table 1 – Model Overview

	Model	Mesh
Insul-Block Partially Grouted Configuration 1	<p>Geometry 5/15/2017 9:41 AM</p>  <p>A 3D perspective view of a rectangular masonry block assembly. The block is composed of several layers of insulation (light gray) and masonry units (dark gray). The top surface shows a pattern of grouting. A coordinate system (X, Y, Z) is visible at the bottom right, and a scale bar (0.000 to 0.250) is at the bottom left.</p>	 <p>A 3D perspective view of the same rectangular masonry block assembly, but with a fine mesh applied to the entire surface. A coordinate system (X, Y, Z) is visible at the bottom right, and a scale bar (0.000 to 0.250) is at the bottom left.</p>
Insul-Block Partially Grouted Configuration 2	<p>Geometry 5/15/2017 9:41 AM</p>  <p>A 3D perspective view of a rectangular masonry block assembly, similar to Configuration 1 but with a different grouting pattern. A coordinate system (X, Y, Z) is visible at the bottom right, and a scale bar (0.000 to 0.250) is at the bottom left.</p>	 <p>A 3D perspective view of the same rectangular masonry block assembly, but with a fine mesh applied to the entire surface. A coordinate system (X, Y, Z) is visible at the bottom right, and a scale bar (0.000 to 0.250) is at the bottom left.</p>

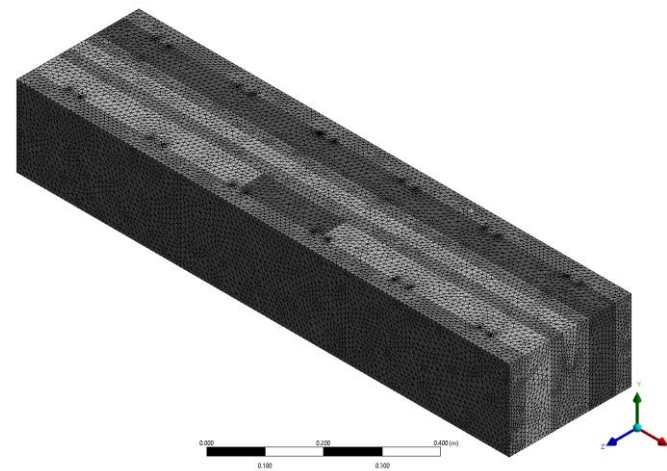
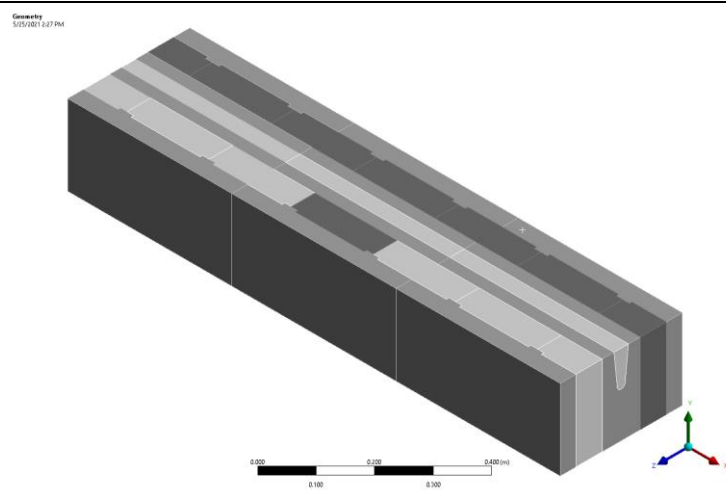
Insul-Block
Partially
Grouted
Configuration
3



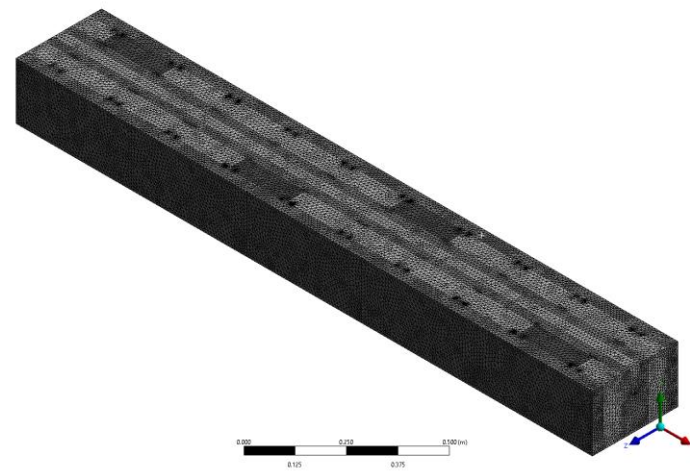
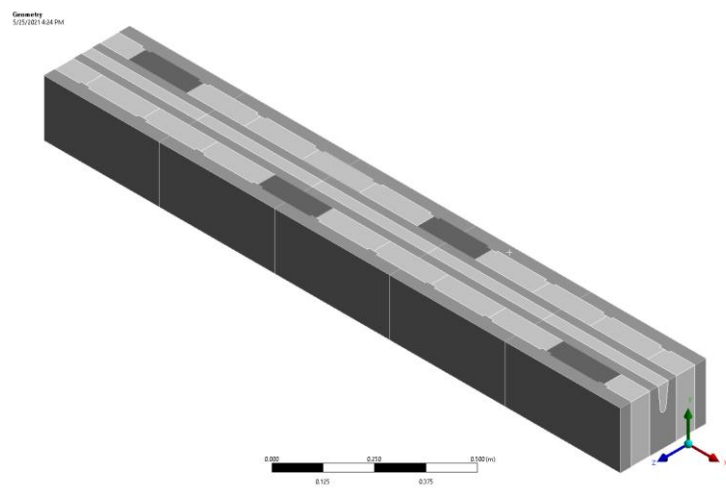
Insul-Block
Partially
Grouted
Configuration
4



Insul-Block
Partially
Grouted
Configuration
5



Insul-Block
Partially
Grouted
Configuration
6



Insul-Block
Partially
Grouted
Configuration
7

Model
S:\25\0811\807 PM4

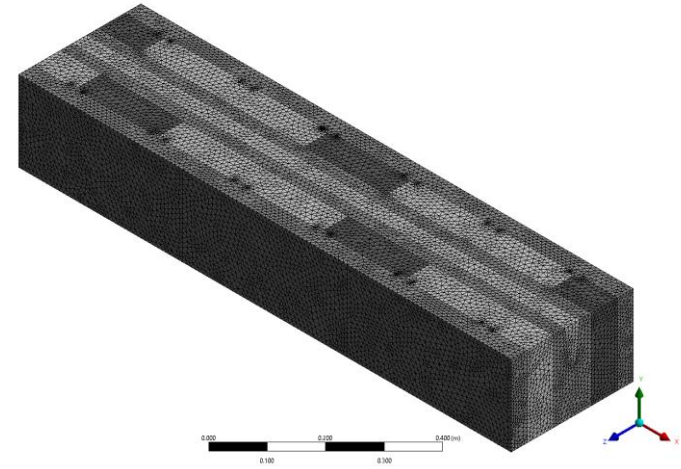
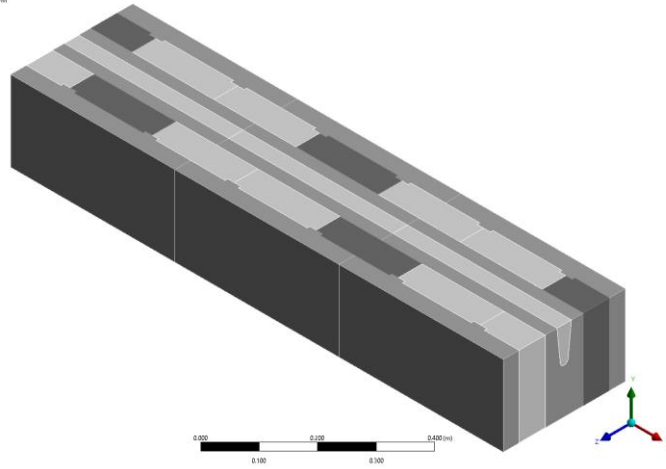


Table 2 – Material Properties

Material	Thermal Conductivity [W/mK]
Concrete – Mix design Oven-Dry	0.479 ⁱ
Grout – Concrete	0.532 ⁱ
Type VIII EPS Cellofoam®	0.03675

Table 3 – Boundary Conditions

Property	All Models
Exterior Air Temperature [C]	29.00
Interior Air Temperature [C]	19.00
Mean Temperature [C]	24.00
Temperature Gradient [C]	10.00
Exterior Heat Transfer Coefficient [W/m ² K]	33.4 ⁱⁱ
Interior Heat Transfer Coefficient [W/m ² K]	8.4 ⁱⁱ
Block Edges	Periodic boundary condition

Table 4 – Numerical Results

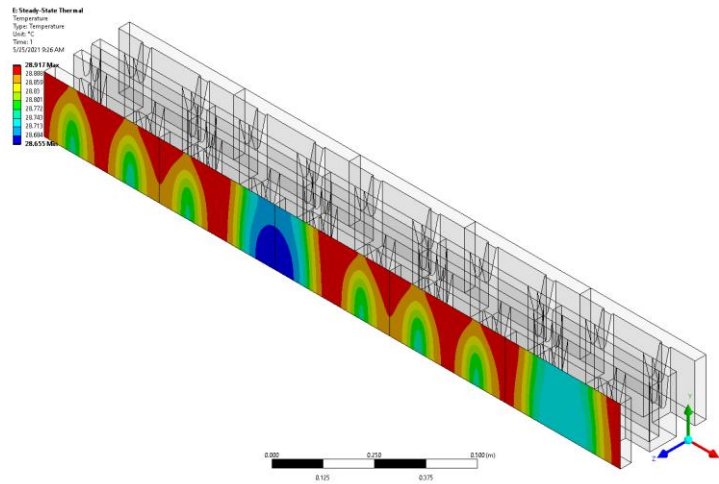
Property	Insul-Block Partially Grouted Configuration 1	Insul-Block Partially Grouted Configuration 2	Insul-Block Partially Grouted Configuration 3	Insul-Block Partially Grouted Configuration 4	Insul-Block Partially Grouted Configuration 5
Exterior Surface Temperature [C]	28.88	28.84	28.84	28.88	28.84
Interior Surface Temperature [C]	19.50	19.66	19.66	19.48	19.63
Exterior Surface Heat Flux [W/m ²]	4.177	5.397	5.461	3.954	5.180
Interior Surface Heat Flux [W/m ²]	4.192	5.549	5.518	4.027	5.264
R-value Oven Dry – With Air Film ⁱⁱ [ft ² °Fhr/BTU]	13.58	10.38	10.35	14.24	10.88
U-factor Oven Dry – With Air Film ⁱⁱ [BTU/ft ² °Fhr]	0.07363	0.09635	0.09661	0.07025	0.09195

Property	Insul-Block Partially Grouted Configuration 6	Insul-Block Partially Grouted Configuration 7
Exterior Surface Temperature [C]	28.88	28.86
Interior Surface Temperature [C]	19.49	19.58
Exterior Surface Heat Flux [W/m ²]	4.117	4.848
Interior Surface Heat Flux [W/m ²]	4.121	4.849
R-value Oven Dry – With Air Film ⁱⁱ [ft ² °Fhr/BTU]	13.80	11.72
U-factor Oven Dry – With Air Film ⁱⁱ [BTU/ft ² °Fhr]	0.07248	0.08532

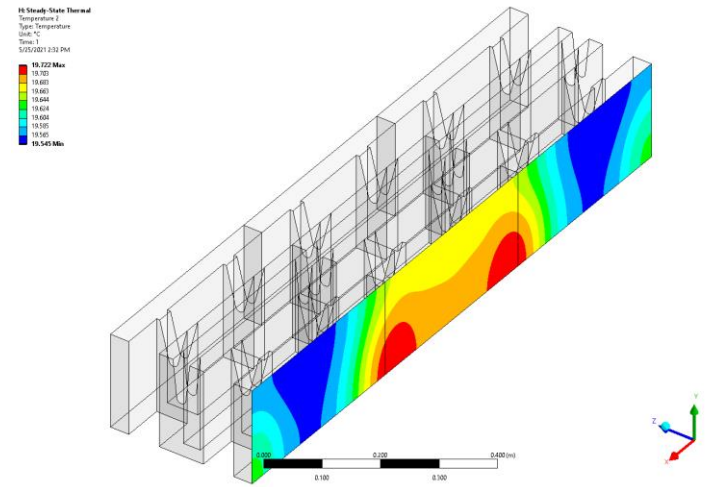
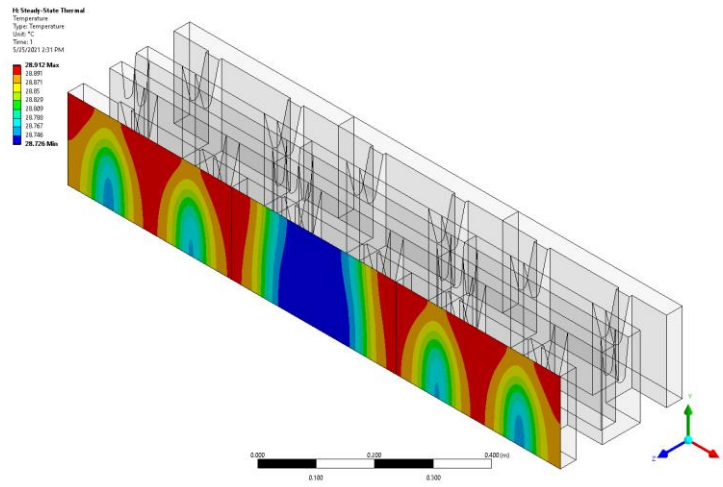
Table 5 - Graphical Results – Surface Temperature

	Exterior Temperature	Interior Temperature
Insul-Block Partially Grouted Configuration 1	<div>C: Steady-State Thermal</div> <div>Temperature</div> <div>Type: Temperature</div> <div>Units: °C</div> <div>Time: 1</div> <div>5/15/2011 8:47 AM</div> <div><div>28.912 Max</div><div>20.917</div><div>19.920</div><div>19.880</div><div>19.875</div><div>19.850</div><div>19.800</div><div>19.750</div><div>19.700</div><div>19.650</div><div>19.600</div><div>19.550</div><div>19.500</div><div>19.450</div><div>19.400</div><div>19.350</div><div>19.300</div><div>19.250</div><div>19.200</div><div>19.150</div><div>19.100</div><div>19.050</div><div>19.000</div><div>18.950</div><div>18.900</div><div>18.850</div><div>18.800</div><div>18.750</div><div>18.700</div><div>18.650</div><div>18.600</div><div>18.550</div><div>18.500</div><div>18.450</div><div>18.400</div><div>18.350</div><div>18.300</div><div>18.250</div><div>18.200</div><div>18.150</div><div>18.100</div><div>18.050</div><div>18.000</div><div>17.950</div><div>17.900</div><div>17.850</div><div>17.800</div><div>17.750</div><div>17.700</div><div>17.650</div><div>17.600</div><div>17.550</div><div>17.500</div><div>17.450</div><div>17.400</div><div>17.350</div><div>17.300</div><div>17.250</div><div>17.200</div><div>17.150</div><div>17.100</div><div>17.050</div><div>17.000</div><div>16.950</div><div>16.900</div><div>16.850</div><div>16.800</div><div>16.750</div><div>16.700</div><div>16.650</div><div>16.600</div><div>16.550</div><div>16.500</div><div>16.450</div><div>16.400</div><div>16.350</div><div>16.300</div><div>16.250</div><div>16.200</div><div>16.150</div><div>16.100</div><div>16.050</div><div>16.000</div><div>15.950</div><div>15.900</div><div>15.850</div><div>15.800</div><div>15.750</div><div>15.700</div><div>15.650</div><div>15.600</div><div>15.550</div><div>15.500</div><div>15.450</div><div>15.400</div><div>15.350</div><div>15.300</div><div>15.250</div><div>15.200</div><div>15.150</div><div>15.100</div><div>15.050</div><div>15.000</div><div>14.950</div><div>14.900</div><div>14.850</div><div>14.800</div><div>14.750</div><div>14.700</div><div>14.650</div><div>14.600</div><div>14.550</div><div>14.500</div><div>14.450</div><div>14.400</div><div>14.350</div><div>14.300</div><div>14.250</div><div>14.200</div><div>14.150</div><div>14.100</div><div>14.050</div><div>14.000</div><div>13.950</div><div>13.900</div><div>13.850</div><div>13.800</div><div>13.750</div><div>13.700</div><div>13.650</div><div>13.600</div><div>13.550</div><div>13.500</div><div>13.450</div><div>13.400</div><div>13.350</div><div>13.300</div><div>13.250</div><div>13.200</div><div>13.150</div><div>13.100</div><div>13.050</div><div>13.000</div><div>12.950</div><div>12.900</div><div>12.850</div><div>12.800</div><div>12.750</div><div>12.700</div><div>12.650</div><div>12.600</div><div>12.550</div><div>12.500</div><div>12.450</div><div>12.400</div><div>12.350</div><div>12.300</div><div>12.250</div><div>12.200</div><div>12.150</div><div>12.100</div><div>12.050</div><div>12.000</div><div>11.950</div><div>11.900</div><div>11.850</div><div>11.800</div><div>11.750</div><div>11.700</div><div>11.650</div><div>11.600</div><div>11.550</div><div>11.500</div><div>11.450</div><div>11.400</div><div>11.350</div><div>11.300</div><div>11.250</div><div>11.200</div><div>11.150</div><div>11.100</div><div>11.050</div><div>11.000</div><div>10.950</div><div>10.900</div><div>10.850</div><div>10.800</div><div>10.750</div><div>10.700</div><div>10.650</div><div>10.600</div><div>10.550</div><div>10.500</div><div>10.450</div><div>10.400</div><div>10.350</div><div>10.300</div><div>10.250</div><div>10.200</div><div>10.150</div><div>10.100</div><div>10.050</div><div>10.000</div><div>9.950</div><div>9.900</div><div>9.850</div><div>9.800</div><div>9.750</div><div>9.700</div><div>9.650</div><div>9.600</div><div>9.550</div><div>9.500</div><div>9.450</div><div>9.400</div><div>9.350</div><div>9.300</div><div>9.250</div><div>9.200</div><div>9.150</div><div>9.100</div><div>9.050</div><div>9.000</div><div>8.950</div><div>8.900</div><div>8.850</div><div>8.800</div><div>8.750</div><div>8.700</div><div>8.650</div><div>8.600</div><div>8.550</div><div>8.500</div><div>8.450</div><div>8.400</div><div>8.350</div><div>8.300</div><div>8.250</div><div>8.200</div><div>8.150</div><div>8.100</div><div>8.050</div><div>8.000</div><div>7.950</div><div>7.900</div><div>7.850</div><div>7.800</div><div>7.750</div><div>7.700</div><div>7.650</div><div>7.600</div><div>7.550</div><div>7.500</div><div>7.450</div><div>7.400</div><div>7.350</div><div>7.300</div><div>7.250</div><div>7.200</div><div>7.150</div><div>7.100</div><div>7.050</div><div>7.000</div><div>6.950</div><div>6.900</div><div>6.850</div><div>6.800</div><div>6.750</div><div>6.700</div><div>6.650</div><div>6.600</div><div>6.550</div><div>6.500</div><div>6.450</div><div>6.400</div><div>6.350</div><div>6.300</div><div>6.250</div><div>6.200</div><div>6.150</div><div>6.100</div><div>6.050</div><div>6.000</div><div>5.950</div><div>5.900</div><div>5.850</div><div>5.800</div><div>5.750</div><div>5.700</div><div>5.650</div><div>5.600</div><div>5.550</div><div>5.500</div><div>5.450</div><div>5.400</div><div>5.350</div><div>5.300</div><div>5.250</div><div>5.200</div><div>5.150</div><div>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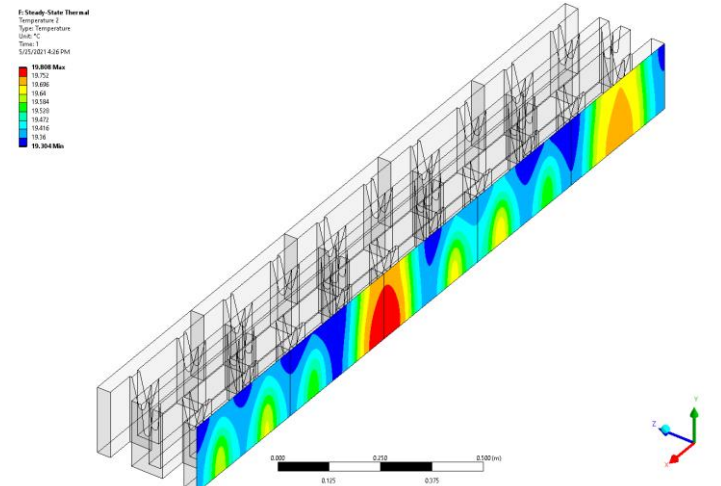
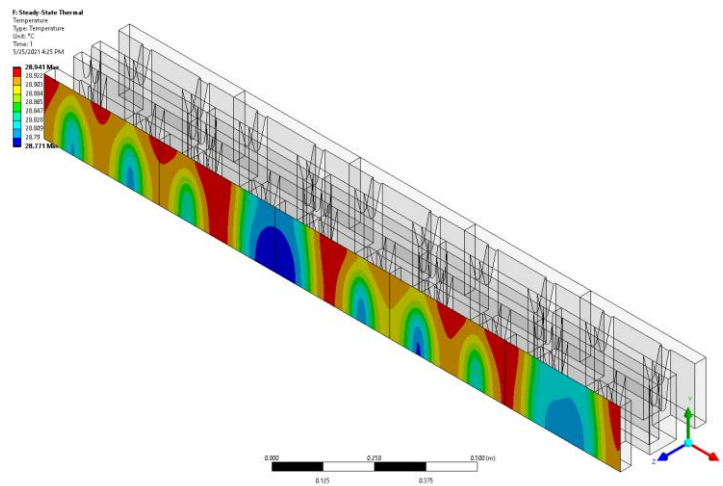
Insul-Block
Partially
Grouted
Configuration
3



Insul-Block
Partially
Grouted
Configuration
5



Insul-Block
Partially
Grouted
Configuration
6



Insul-Block
Partially
Grouted
Configuration
7

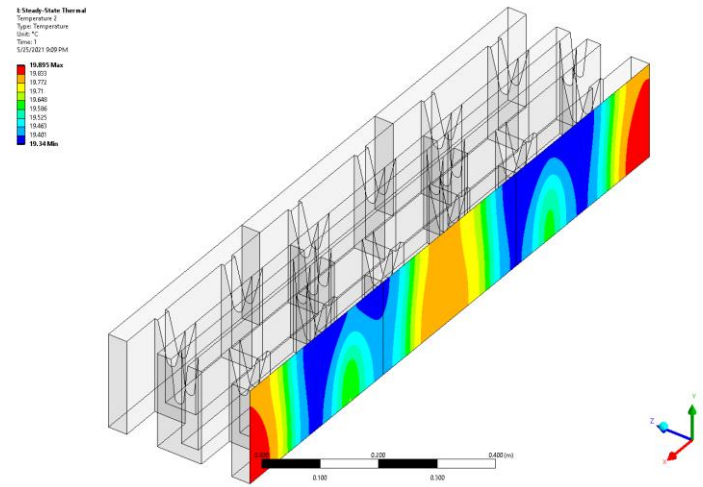
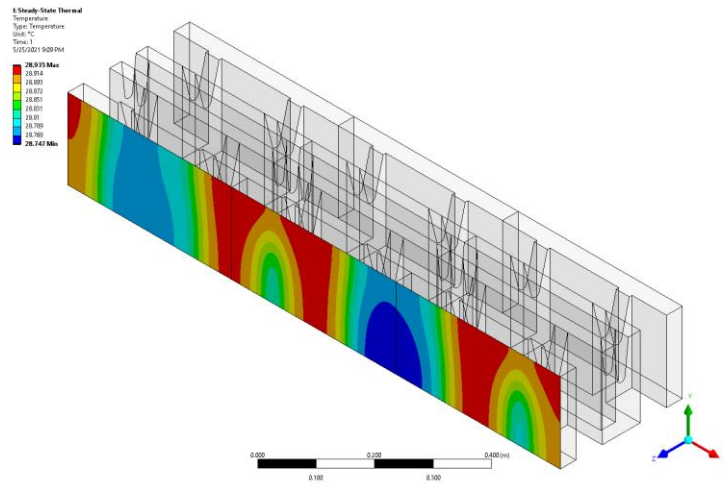
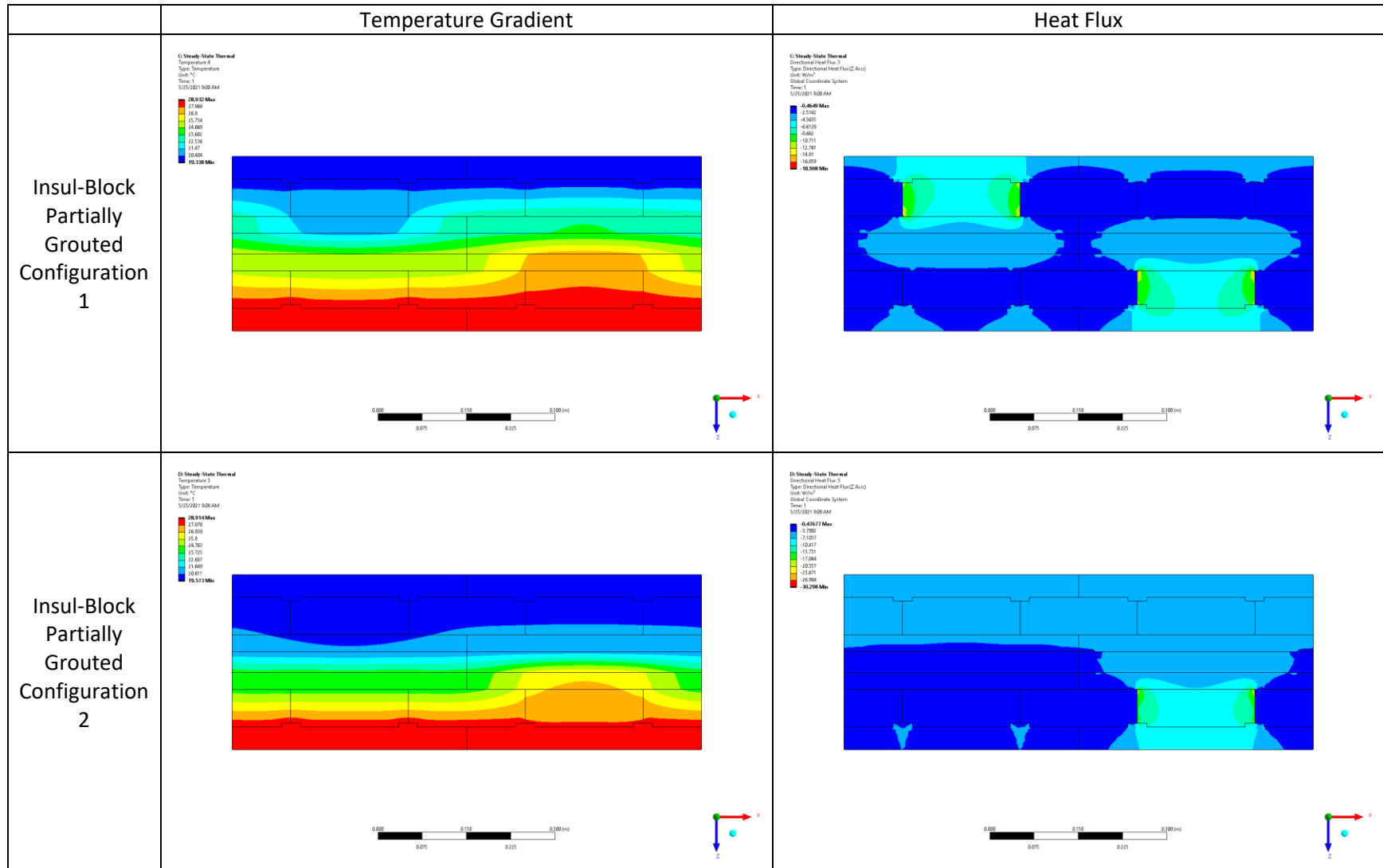


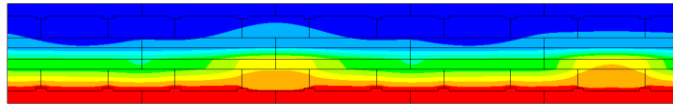
Table 6 – Graphical Results – Top of Block



Insul-Block
Partially
Grouted
Configuration
3

E: Steady-State Thermal
Temperature 3
Type: Temperature
Unit: °C
Time: 1
5/15/2021 9:03 AM

28.917 Max
27.897
26.796
25.795
24.795
23.794
22.676
21.651
20.581
19.552 Min

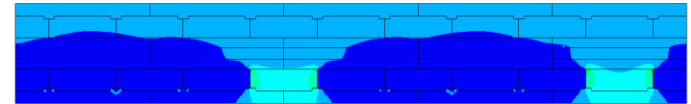


0.000 0.175 0.350 0.525 (m)



E: Steady-State Thermal
Directional Heat Flux 3
Type: Directional Heat Flux(Z Axis)
Unit: W/m²
Global Coordinate System
Time: 1
5/15/2021 9:03 AM

-8.44517 Max
-4.2750
-7.751
-11.547
-14.881
-18.034
-21.648
-25.982
-33.15 Min



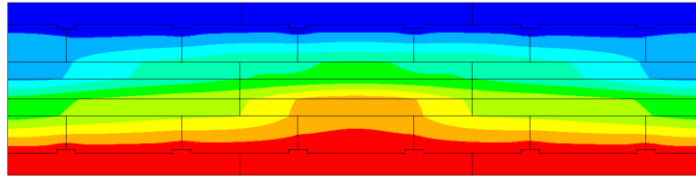
0.000 0.175 0.350 0.525 (m)



Insul-Block
Partially
Grouted
Configuration
4

G: Partial Grout 4
Temperature 3
Type: Temperature
Unit: °C
Time: 1
5/15/2021 1:49 PM

28.917 Max
27.897
26.796
25.795
24.655
23.594
22.514
21.463
20.373
19.367 Min

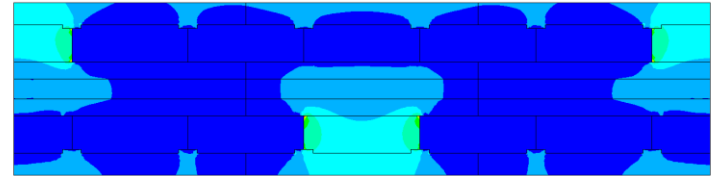


0.000 0.100 0.200 0.400 (m)



G: Partial Grout 4
Directional Heat Flux 3
Type: Directional Heat Flux(Z Axis)
Unit: W/m²
Global Coordinate System
Time: 1
5/15/2021 1:50 PM

-8.35222 Max
-2.7855
-5.1380
-7.5211
-9.8518
-12.317
-14.720
-17.088
-19.485
-21.888 Min



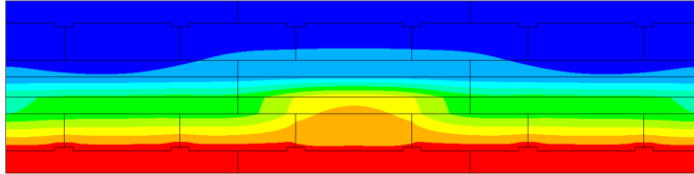
0.000 0.100 0.200 0.400 (m)



Insul-Block
Partially
Grouted
Configuration
5

H: Steady-State Thermal
Temperature 3
Type: Temperature
Unit: °C
Time: 1
5/15/2021 2:32 PM

28.912 Max
27.000
26.000
25.75
24.750
23.750
22.600
21.607
20.500
19.545 Min

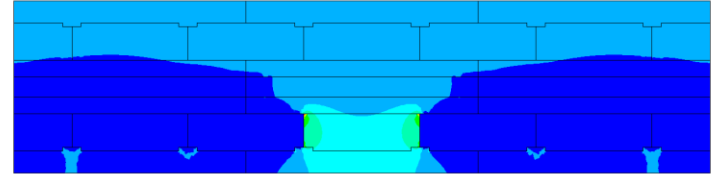


0.000 0.100 0.200 0.300 0.400 (m)



H: Steady-State Thermal
Directional Heat Flux 3
Type: Directional Heat Flux(Z Axis)
Unit: W/m²
Global Coordinate System
Time: 1
5/15/2021 2:32 PM

-6.47081 Max
-3.2000
-7.6007
-10.075
-14.345
-17.000
-21.176
-24.750
-31.678 Min



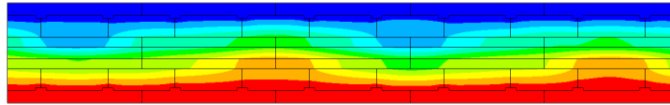
0.000 0.100 0.200 0.300 0.400 (m)



Insul-Block
Partially
Grouted
Configuration
6

H: Steady-State Thermal
Temperature 3
Type: Temperature
Unit: °C
Time: 1
5/15/2021 4:02 PM

28.945 Max
27.000
26.750
25.750
24.000
23.507
22.517
21.406
20.375
19.364 Min

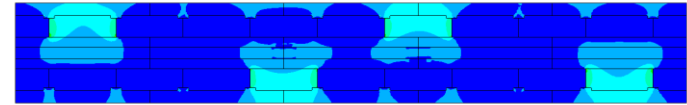


0.000 0.175 0.350 0.525 0.700 (m)



H: Steady-State Thermal
Directional Heat Flux 3
Type: Directional Heat Flux(Z Axis)
Unit: W/m²
Global Coordinate System
Time: 1
5/15/2021 4:02 PM

-6.39196 Max
-3.0000
-5.7000
-8.4712
-11.176
-13.017
-16.52
-19.024
-24.633 Min

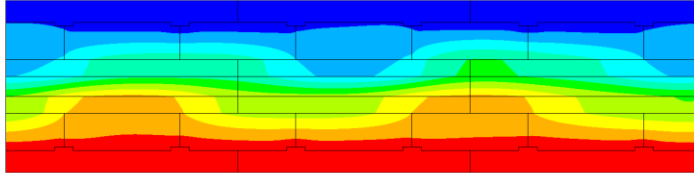


0.000 0.175 0.350 0.525 0.700 (m)



Insul-Block
Partially
Grouted
Configuration
7

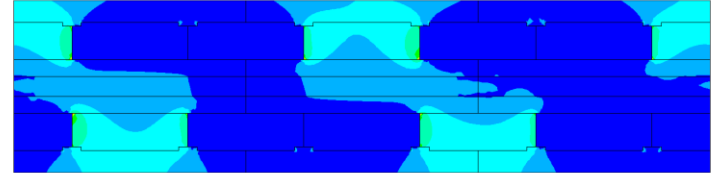
1: Steady-State Thermal
Temperature 3
Type: Temperature
Unit: °C
Time: 1
5/25/2021 9:09 PM
28.935 Max
17.000
16.800
15.754
14.67
13.688
12.518
11.431
10.406
9.345 Min



0.000 0.200 0.400 (m)
0.100 0.300



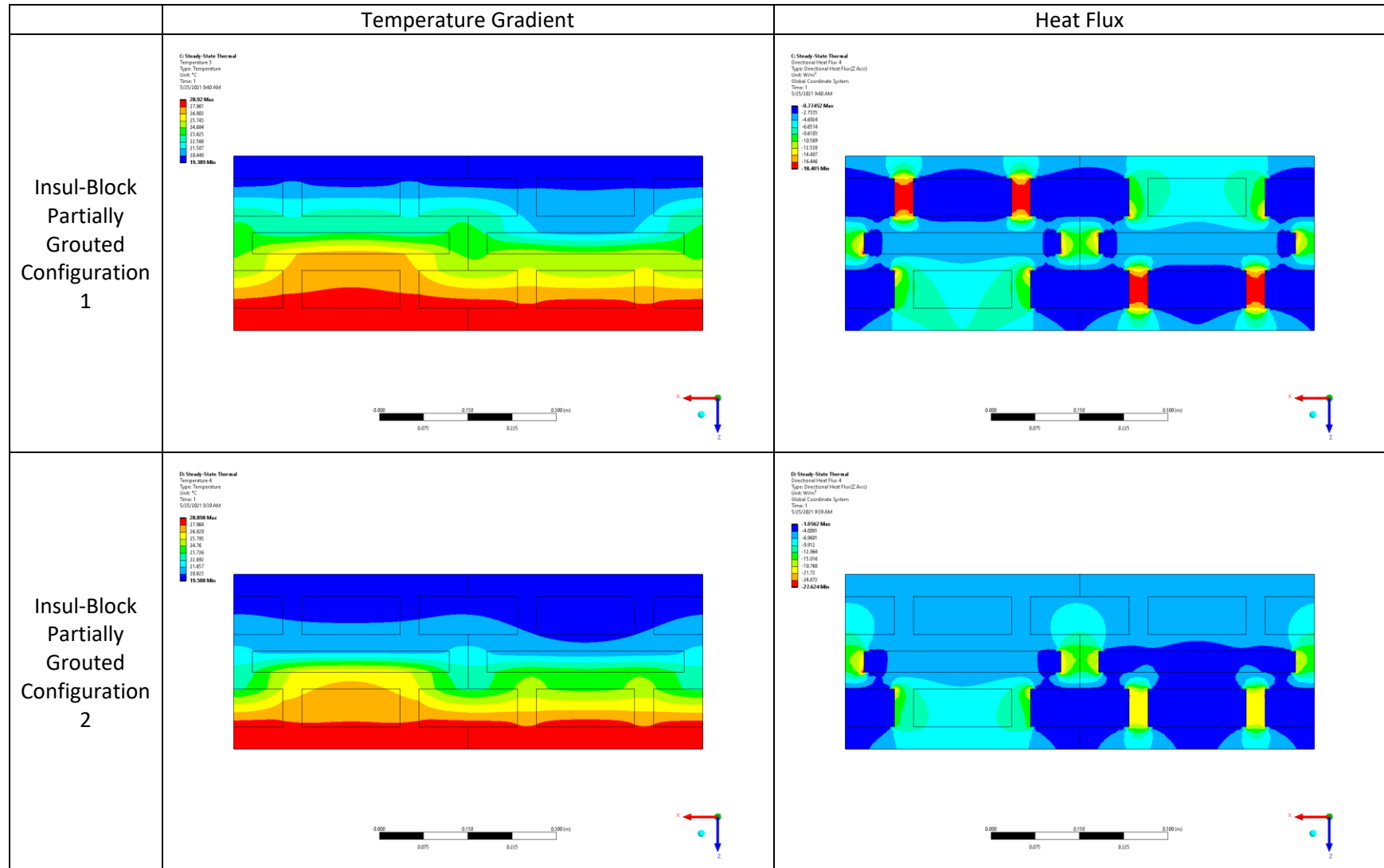
1: Steady-State Thermal
Directional Heat Flux 3
Type: Directional Heat Flux (Z Axis)
Unit: W/m²
Global Coordinate System
Time: 1
5/25/2021 9:10 PM
-8.35816 Max
-3.4885
-6.5788
-9.6098
-12.709
-15.81
-18.82
-22.13
-25.241
-28.351 Min



0.000 0.200 0.400 (m)
0.100 0.300



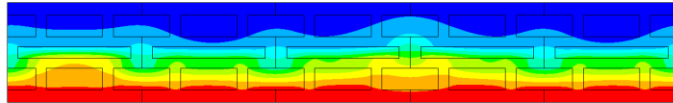
Table 7 – Graphical Results – Bottom of Block



Insul-Block
Partially
Grouted
Configuration
3

E: Steady-State Thermal
Temperature 4
Type: Temperature
Unit: °C
Time: 1
5/15/2021 9:19 AM

28.500 Max
27.880
26.911
25.789
24.705
23.794
22.69
21.663
20.605
19.568 Min

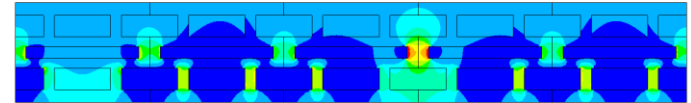


0.000 0.175 0.350 (m)



E: Steady-State Thermal
Directional Heat Flux 4
Type: Directional Heat Flux(Z Axis)
Unit: W/m²
Global Coordinate System
Time: 1
5/15/2021 9:19 AM

-1.0141 Max
-4.6902
-7.9594
-11.454
-14.554
-18.414
-21.689
-25.179
-32.333 Min



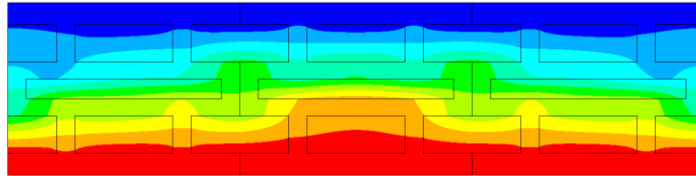
0.000 0.175 0.350 (m)



Insul-Block
Partially
Grouted
Configuration
4

G: Partial Grout 4
Temperature 4
Type: Temperature
Unit: °C
Time: 1
5/15/2021 1:59 PM

28.520 Max
27.881
26.787
25.702
24.680
23.683
22.518
21.434
20.489
19.345 Min

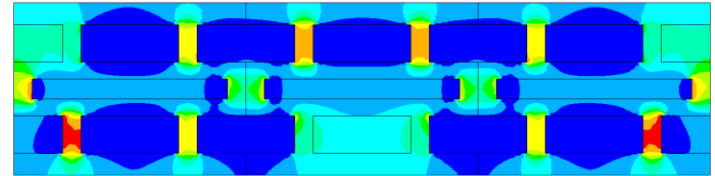


0.000 0.100 0.200 (m)



G: Partial Grout 4
Directional Heat Flux 4
Type: Directional Heat Flux(Z Axis)
Unit: W/m²
Global Coordinate System
Time: 1
5/15/2021 1:59 PM

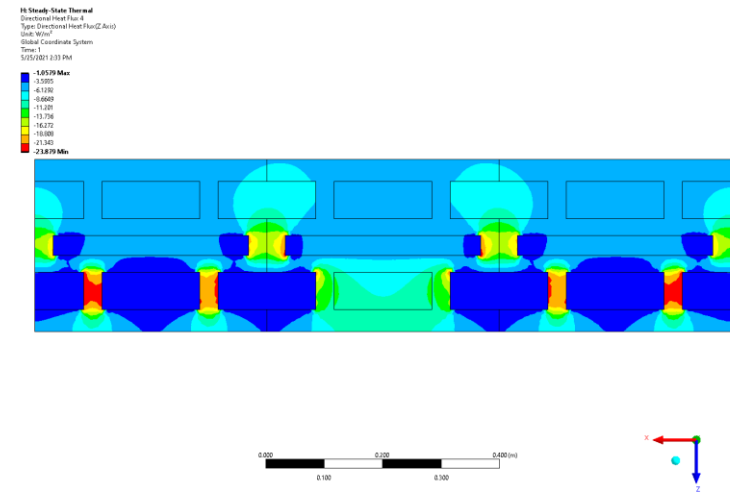
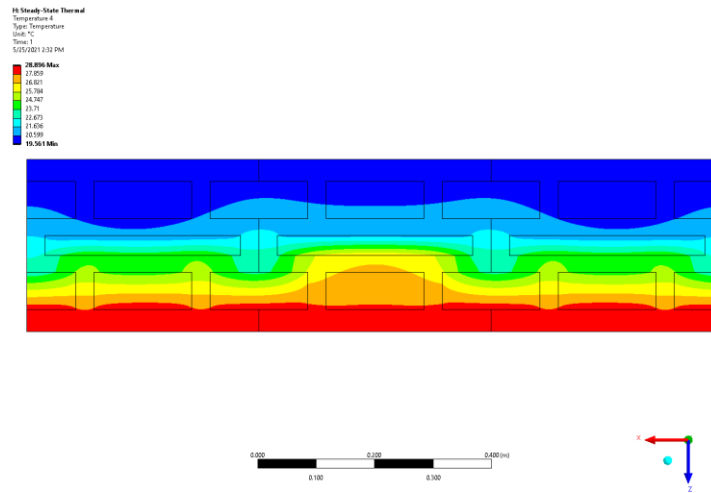
-0.33967 Max
-2.6956
-4.0695
-7.2164
-8.6199
-11.968
-14.289
-16.614
-18.959
-21.264 Min



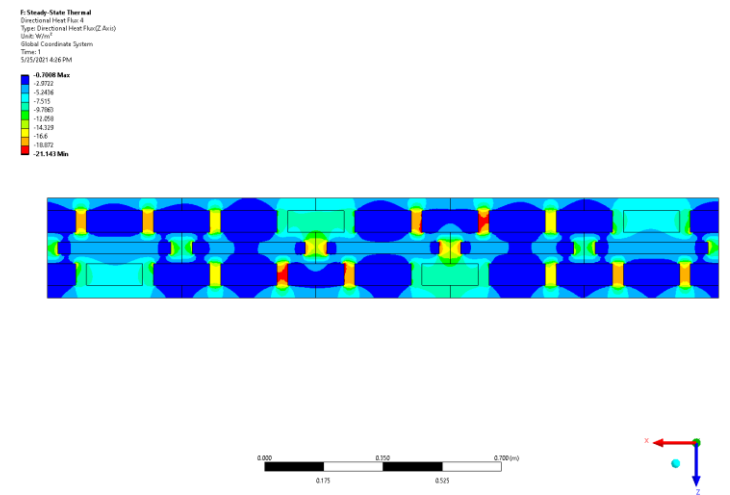
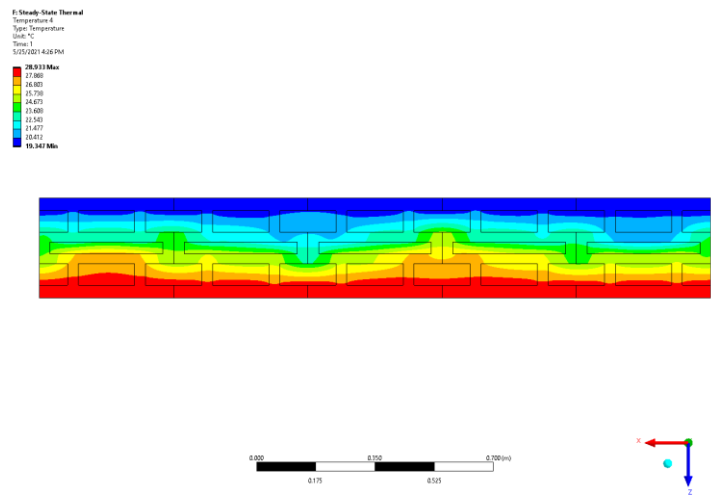
0.000 0.100 0.200 (m)

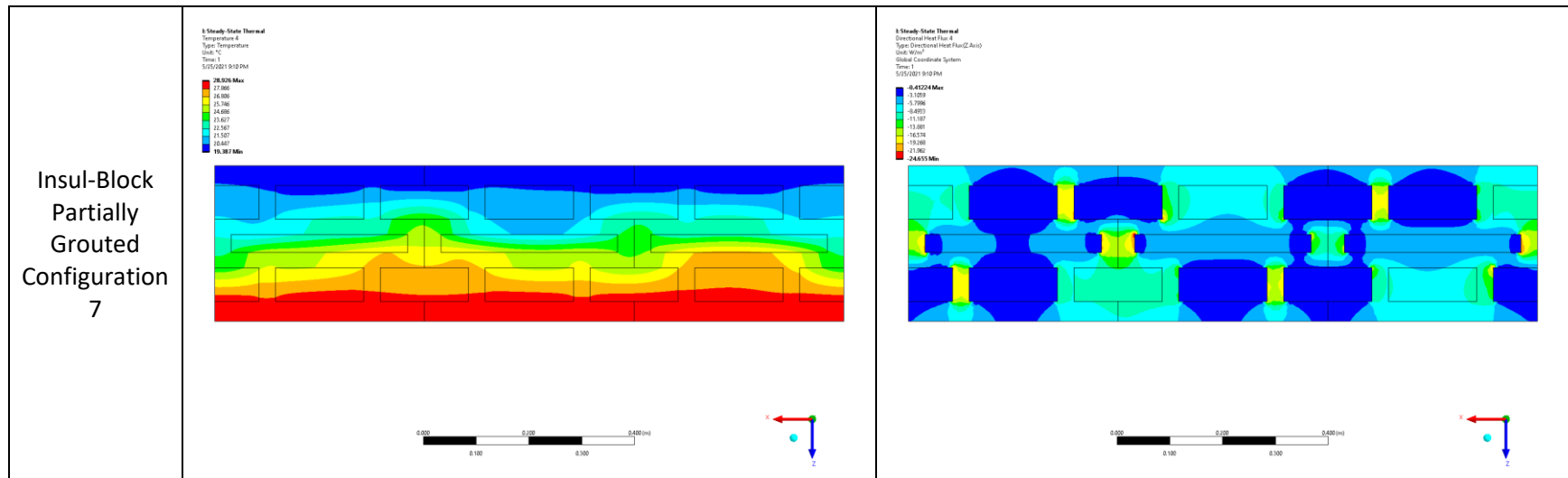


Insul-Block
Partially
Grouted
Configuration
5



Insul-Block
Partially
Grouted
Configuration
6





ⁱ Values obtained from ACI 122R-02

ⁱⁱ Air film values are taken from ASHRAE handbook of fundamentals chapter 26. Interior air film resistance of R-0.68 and exterior air film resistance of R-0.17 were used.