

Supplementary material for the paper  
"Minimizing concrete consumption in slabs by  
optimizing column locations"

Yakov Zelickman, Oded Amir

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## 1 Geometrical Data For Example 2

Herein we list all the geometrical data needed to model the floor plan in example 2. The contour of the floor is defined by vector of points where the  $x$  coordinates are

```
Xcontour =  
[0 4.585774059 4.585774059 5.267402054 6.005832382 6.793964752 7.620641562  
8.478762521  
9.362241663 10.25586408 11.13427159 12.04006593 12.04006593 12.04006593 12.5614302  
13.37593508 14.16508178 14.91771269 15.62267022 15.69671612 15.69671612 16.4148599  
17.66248257 18.84823127 19.89095981 20.72169393 20.72169393 24 24 20.10092557  
20.10092557  
19.23570432 16.33371371 15.29098517 15.13883606 15.13883606 11.35032332 9.895777862  
8.830734119 7.773804996 6.778749842 5.895270699 5.895270699 2.130087486 2.130087486  
1.474832002 0 2.246735134 2.246735134 0]
```

and the  $y$  coordinates are

```
Ycontour =  
[2.488060063 2.488060063 2.245967547 1.672269315 1.174860741 0.758827803 0.431290869  
0.193267135 0.048825381 0 0.046790991 0.809687576 1.03652216 1.105691451 1.169774764  
1.336594817 1.599031242 1.954032453 2.396512473 2.396512473 2.147299588 1.345749576  
1.424073626 1.821797045 2.513489949 3.450326956 3.669023977 3.669023977 13.70467426  
13.70467426 17.59849843 18.48142407 18.48142407 19.52710099 19.52710099 19.46098329  
19.46098329 20.91760717 21 20.84233471 20.45274885 19.85056915 17.56899976  
17.56899976  
13.61719545 13.61719545 10.98164204 10.98164204 8.591232744 8.591232744].
```

The layout of the walls in the floor is represented by a series of rectangular walls with overlaps where appropriate. Thus the corners of each rectangular wall is given by a row at each of the following matrices.

```
Xwall =
[5.743121592 5.996703436 5.996703436 5.743121592;
2.130087486 4.820083682 4.820083682 2.130087486;
2.383669329 2.383669329 2.130087486 2.130087486;
2.130087486 0.000000000 0.000000000 2.130087486;
1.99315329 2.246735134 2.246735134 1.99315329;
1.99315329 0.000000000 0.000000000 1.99315329]
```

```
Ywall =
[13.67720998 13.67720998 17.56899976 17.56899976;
17.3147009 17.3147009 17.56899976 17.56899976;
13.39849843 17.3147009 17.3147009 13.39849843;
13.61719545 13.61719545 13.39849843 13.39849843;
8.591232744 8.591232744 10.98164204 10.98164204;
8.845531606 8.845531606 8.591232744 8.591232744]
```

The floor in the second example has two rectangular openings, each represented by a row in the following matrices

```
Xopen =
[2.383669329 4.718650945 4.718650945 2.383669329;
0.000000000 1.99315329 1.99315329 0.000000000]
```

```
Yopen =
[13.93150884 13.93150884 17.3147009 17.3147009;
8.845531606 8.845531606 10.98164204 10.98164204]
```

Finally, the reference column locations are

```
XcolRef =
[2.028147585 4.694814251 12.24901737 15.58767592 20.20337264 23.89095981 4.500570559
10.77469253 15.70026626 23.89095981 20.1871434 11.95587676 20.1871434 23.89095981
15.6830227 19.99188538 6.004310891 11.44871307 14.83453785]
```

```
YcolRef =
[2.789149915 2.785081133 1.232077985 2.701671107 3.778372487 3.974182611 6.666190361
6.671784936 7.563865343 9.046936304 10.31385323 12.11225478 13.59532574 13.39951562
15.6607411 17.10414144 19.54541051 19.35163478 19.35163478 ]
```

## 2 Geometrical Data For Example 3

The floor geometry was described in Section ?? and plotted in Figure ?. However, herein we provide the required numerical data for easier modeling.

The floor contour is constructed of bottom and top super-ellipses, where the top super-ellipse is

$$y_1 = 27 + 9 \left[ 1 - \left( \left| \frac{x - 17.5}{17.5} \right| \right)^{2.4} \right]^{12.4} \quad \text{with } x \in [0, 35], \quad (1)$$

and the bottom super-ellipse is

$$y_2 = 27 - 27 \left[ 1 - \left( \left| \frac{x - 17.5}{17.5} \right| \right)^{1.5} \right]^{11.5} \quad \text{with } x \in [0, 35]. \quad (2)$$

The core walls are modeled with two polygons, each represents a single face of the core walls.

The external polygon of the core is:

Xwall1 =

[9.800000000000000 9.800000000000000 13.650000000000000 21.350000000000000 25.200000000000000  
25.200000000000000]

Ywall1 =

[16.200000000000000 23.760000000000000 28.800000000000000 28.800000000000000 23.760000000000000  
16.200000000000000]

The internal polygon is

Xwall2 =

[10.150000000000000 10.150000000000000 14.000000000000000 21.000000000000000 24.850000000000000  
24.850000000000000]

Ywall2 =

[16.560000000000000 23.688000000000000 28.440000000000000 28.440000000000000 23.688000000000000  
16.560000000000000]

The floor has three rectangular openings, each represented by one of the rows of the following matrices

Xopen =

[9.835000000000000 9.835000000000000 13.650000000000000 13.650000000000000;  
14.000000000000000 14.000000000000000 21.000000000000000 21.000000000000000;  
21.350000000000000 21.350000000000000 25.165000000000000 25.165000000000000]

Yopen =

[16.200000000000000 19.980000000000000 19.980000000000000 16.200000000000000;  
25.776000000000000 28.800000000000000 28.800000000000000 25.776000000000000;  
19.980000000000000 23.760000000000000 23.760000000000000 19.980000000000000]

The reference location of the columns is

XcolRef =

[18.600000000000000 21.600000000000000 26.100000000000000 29.700000000000000 32.600000000000000  
2.450000000000000 9.950000000000000 17.500000000000000 25.050000000000000 32.550000000000000  
2.400000000000000 5.300000000000000 8.900000000000000 13.400000000000000 16.400000000000000  
18.600000000000000 16.400000000000000 19.100000000000000 15.900000000000000]

YcolRef =

[4.28445728710612 6.08975798188906 10.7304181509290 16.3772768491260 23.9322885355733

28.9490586852402 33.4120456537127 34.000009997259 33.4120456537127 28.9490586852402  
23.9322885355733 16.3772768491260 10.7304181509290 6.08975798188906 4.28445728710612  
10.7304181509290 10.7304181509290 20.1547826923496 20.1547826923496]