

THE UNIVERSITY OF HONG KONG 香港大学
faculty of architecture 建筑学院 

智慧住宅體量 Intelligent Housing Mass

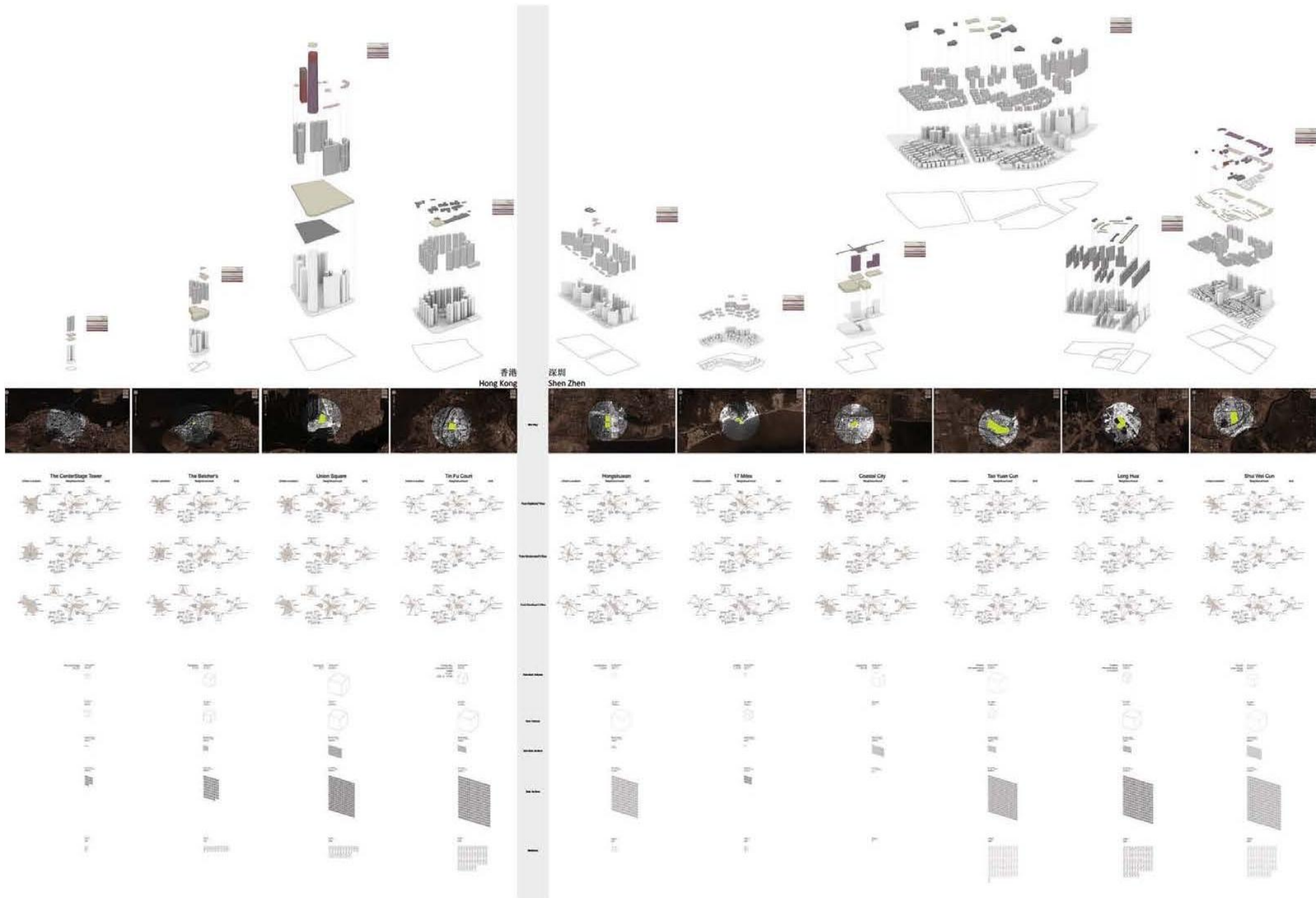
高岩 Gao Yan

創新設計 · 睿智設計 · 跨界設計

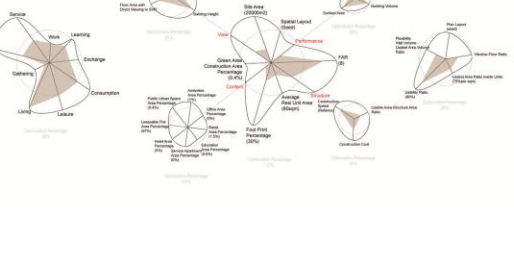
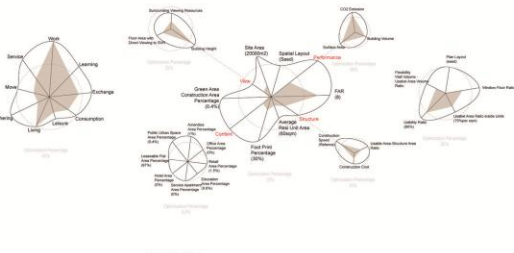
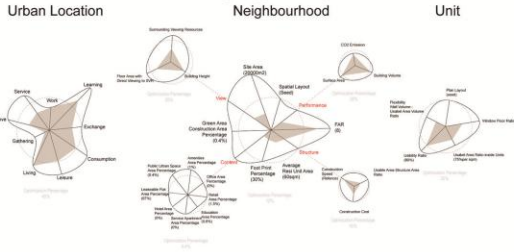
Innovative Design
Intelligent Design
Interdisciplinary Design

基础研究：
基於繼承運算化的智慧體量研究

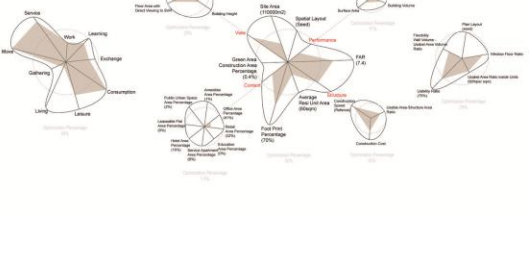
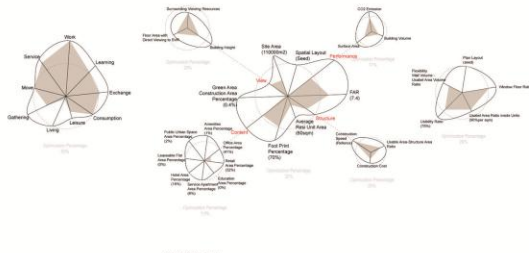
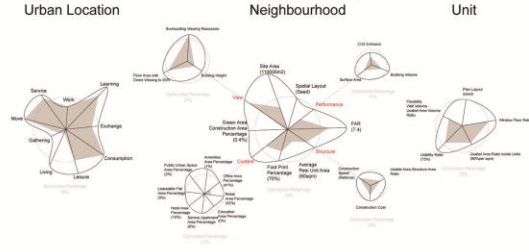
Basic Research: Intelligent Massing through
Synthetic Computation



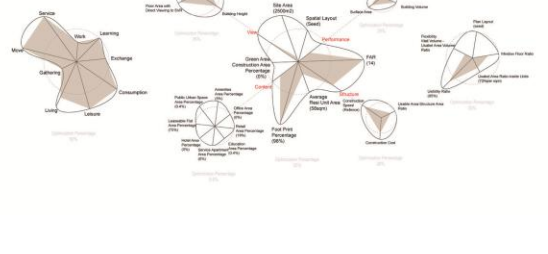
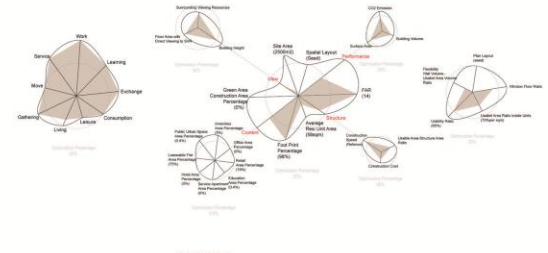
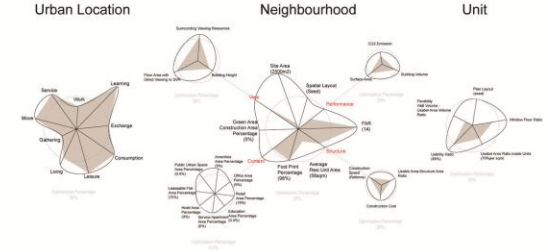
Fujing Huayuan



Harbour City



The CenterStage Tower



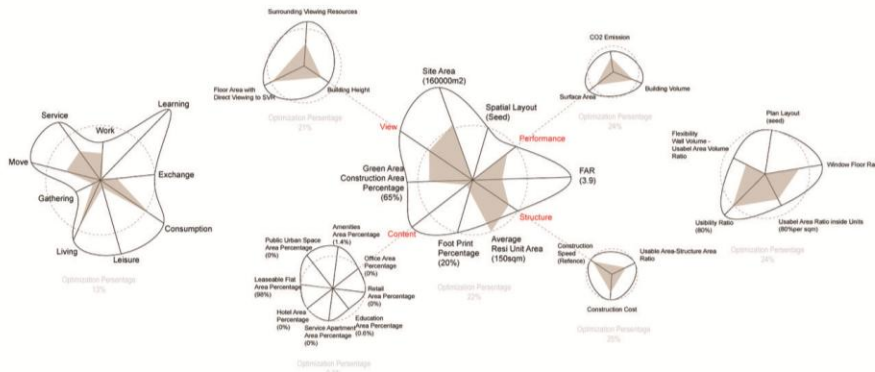
Hongshuwan

Urban Location

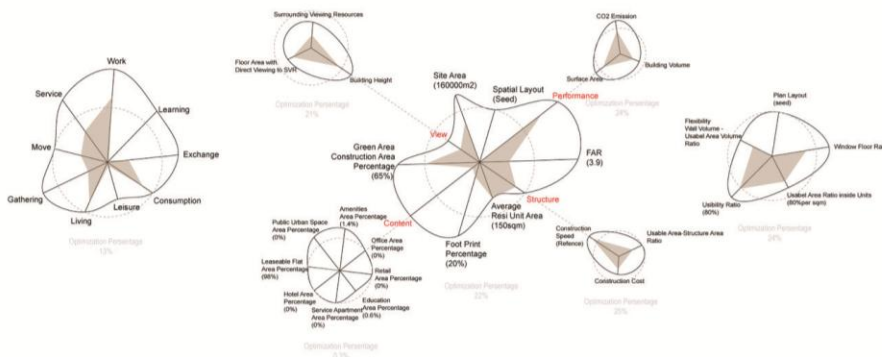
Neighbourhood

Unit

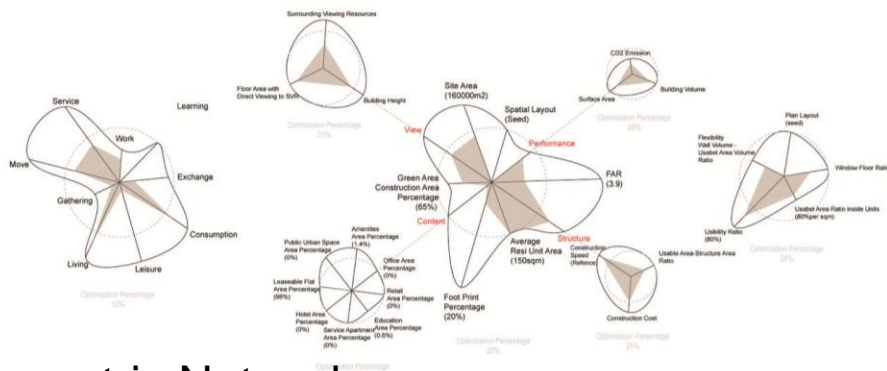
From Residents' View



From Government's View



From Developer's View



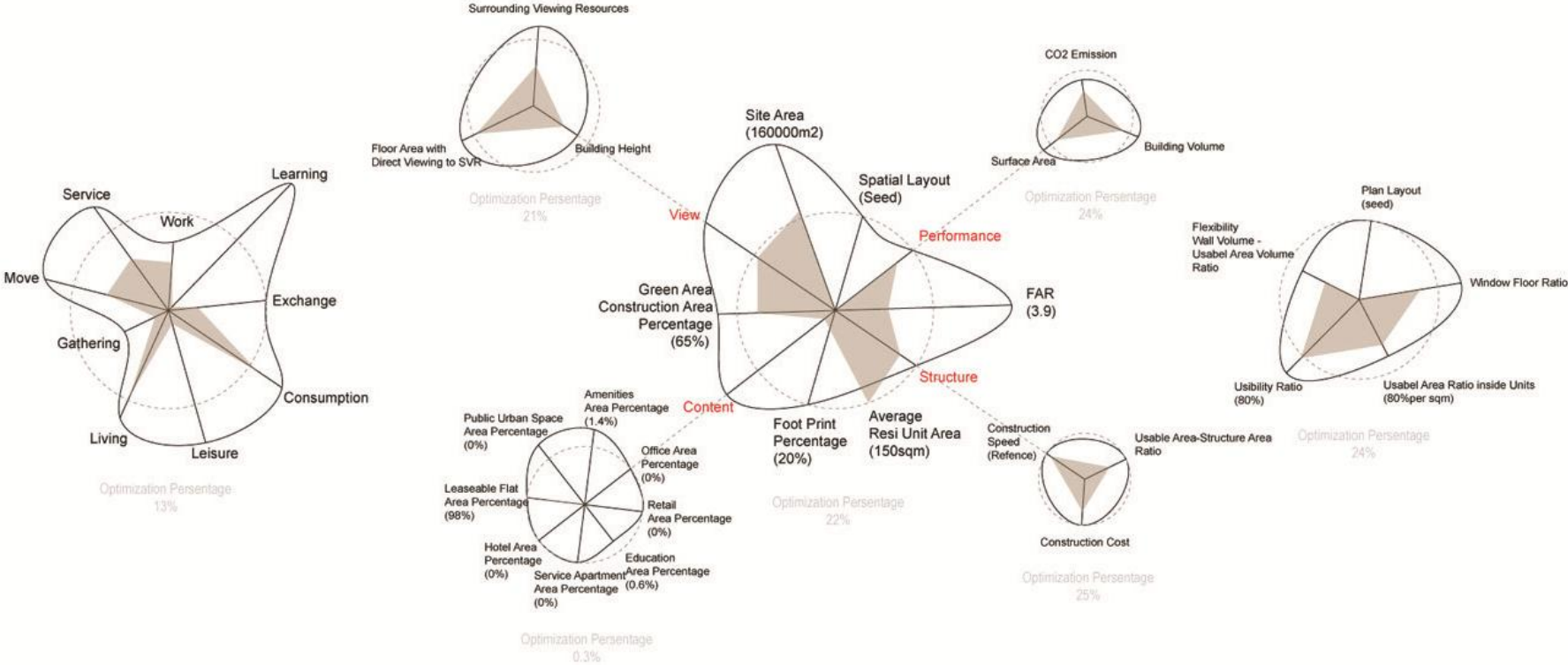
Dynamic Parametric Network

Hongshuwan

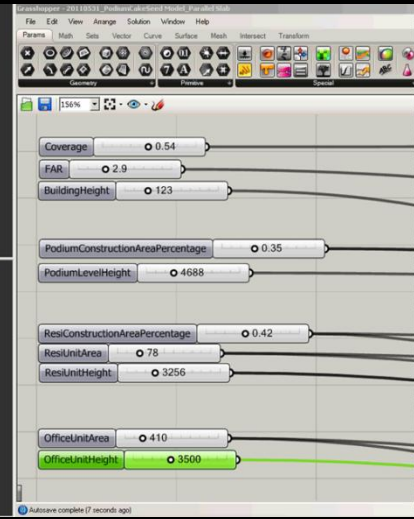
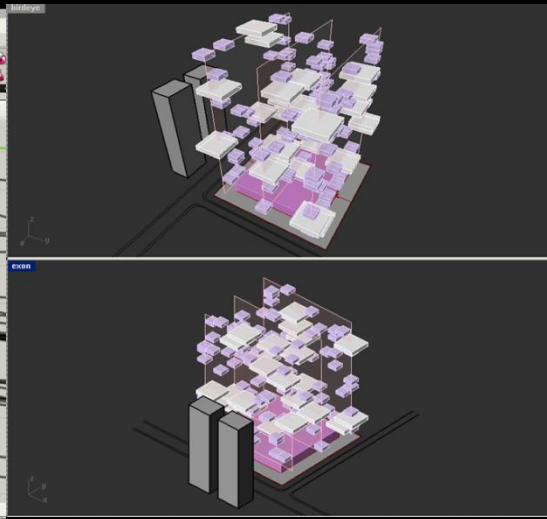
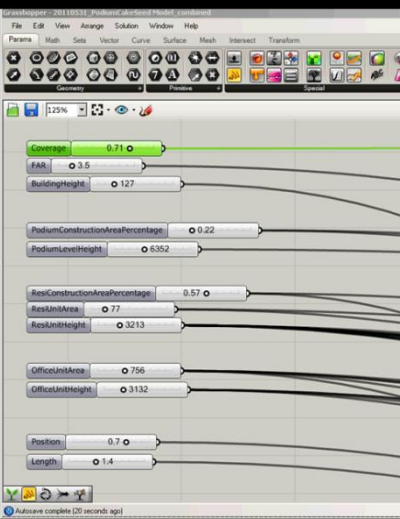
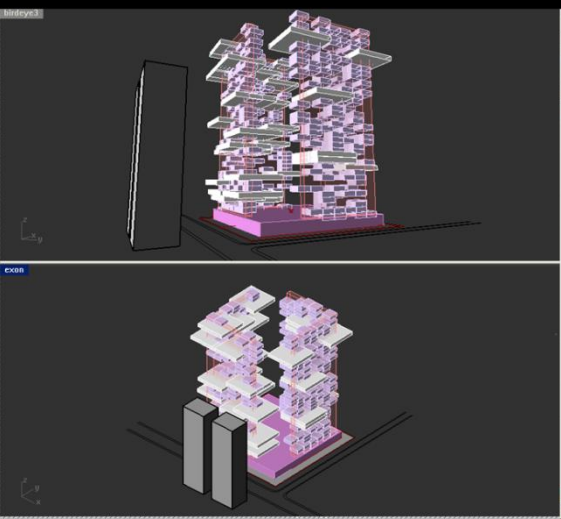
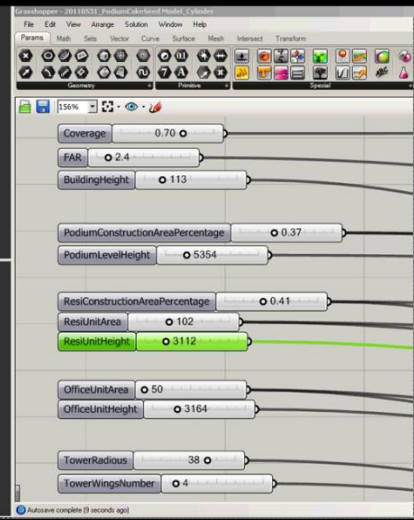
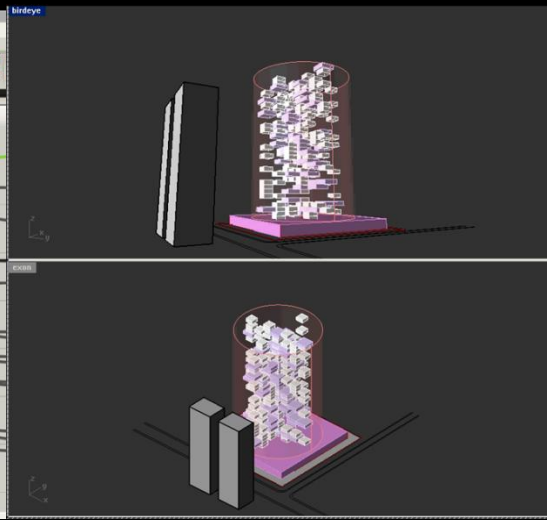
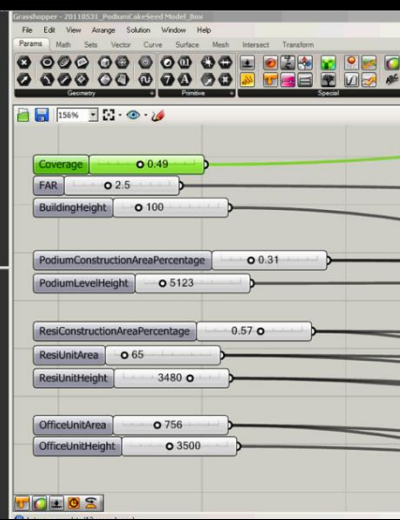
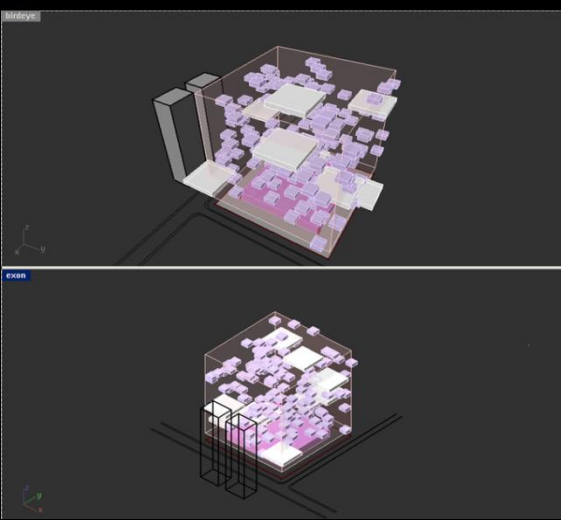
Neighbourhood

Urban Location

Unit



From Residents' View



Task 1: Parametric Negotiation and Transformation

Smart Massing Self-generate according to Different Urban Context

Context Program

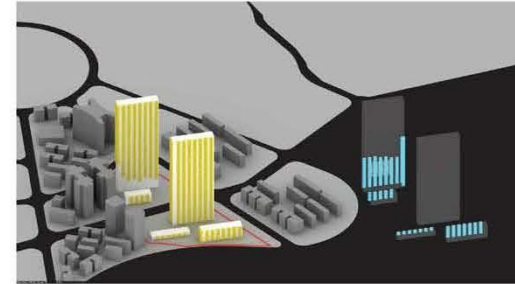
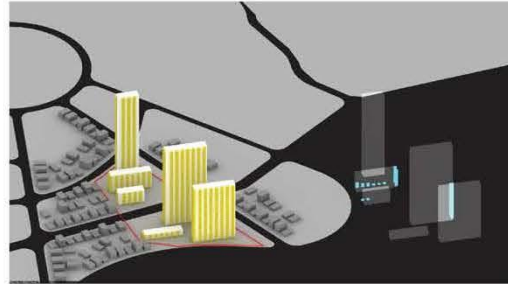
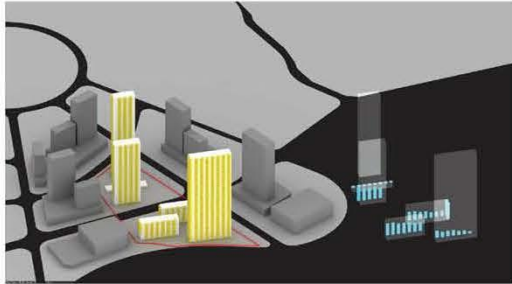
Mix Use

Commercial

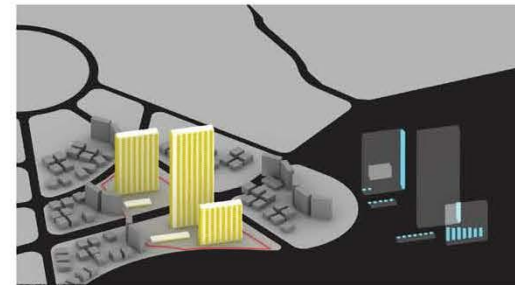
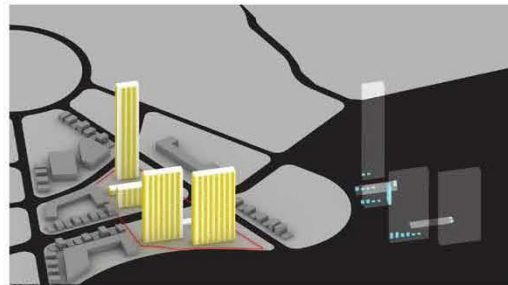
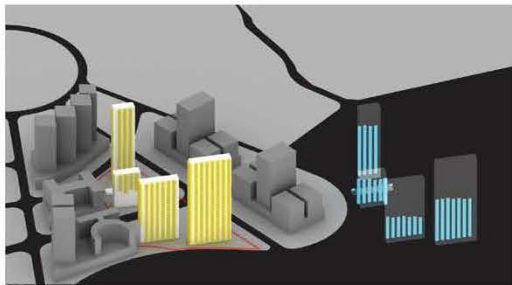
Residencial

Context Density

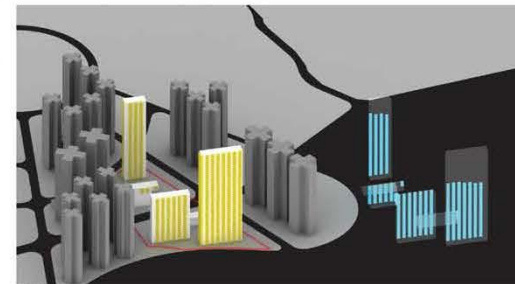
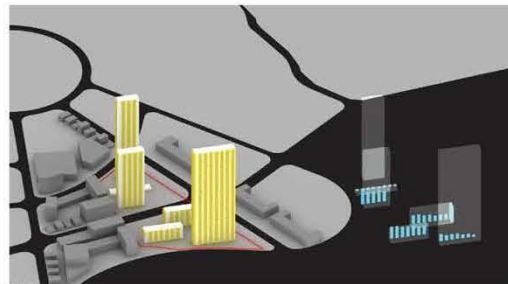
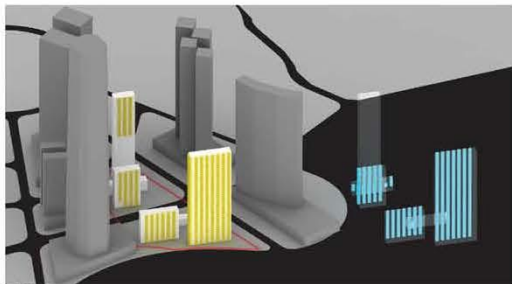
High Density



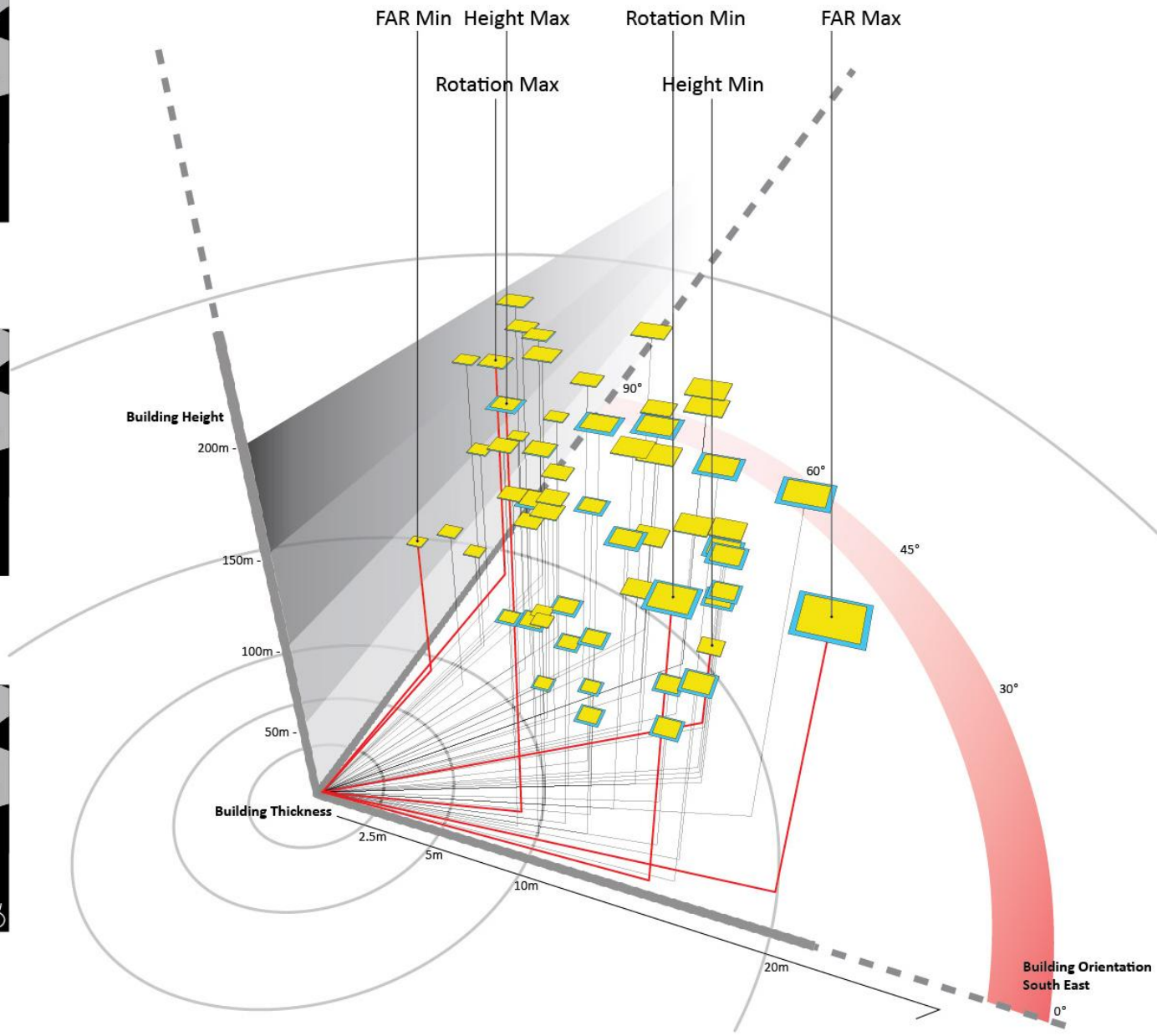
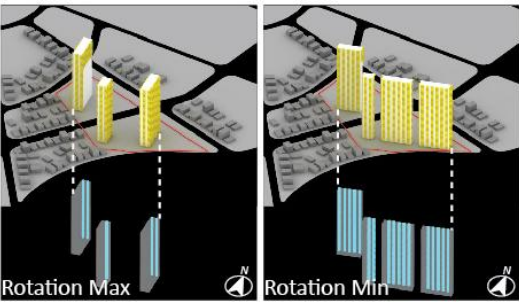
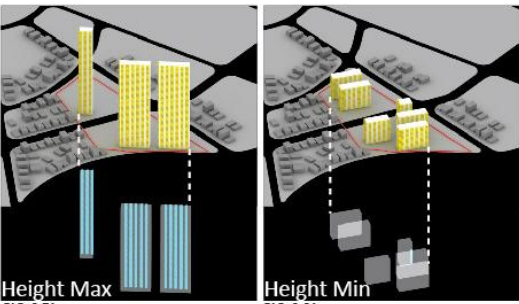
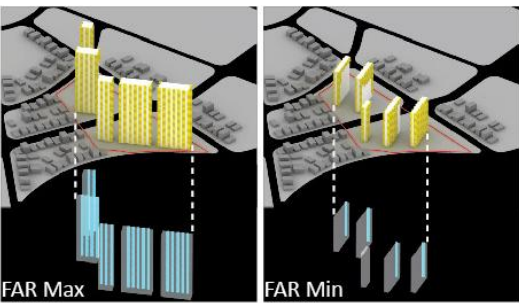
Medium Density



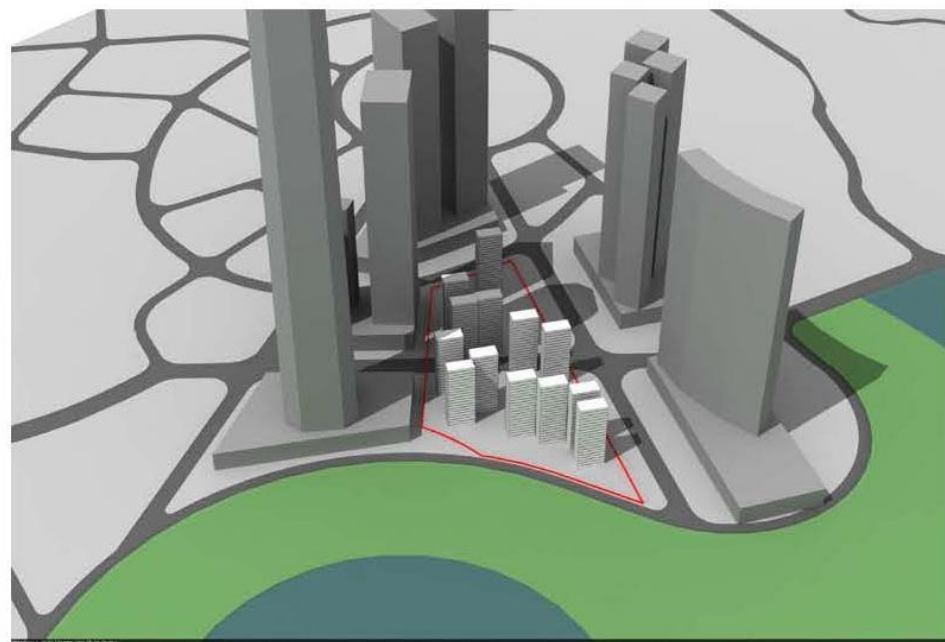
Low Density



Spring 2010 - Spring 2012



Task 3: Computational Diagramming



Title: Generating with a fixed building height

Title: Generating with a fixed building height

Title: Generating in different building width

Title: Generating in different building orientation

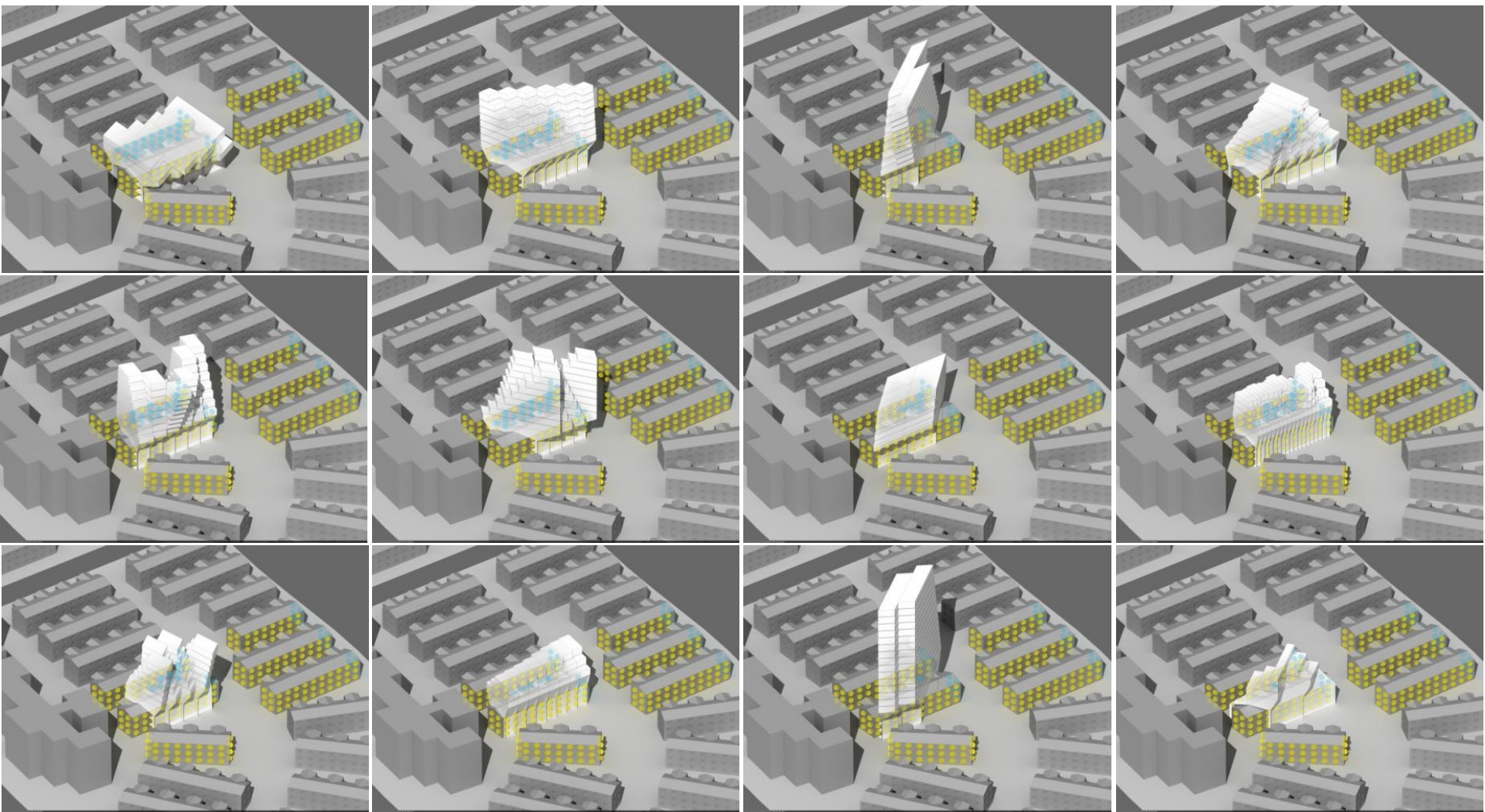
FAR: 2.83
 GFA: 109,200sqm
 Bldg Coverage: 23.6%
 Max Height: 40m
 Rotation Angel: SE 54 degree
 Bldg Width: 25m
 Bldg Depth: 13m
 Sunligh Ratio: 100%

FAR: 5.77
 GFA: 222,300sqm
 Bldg Coverage: 16.1%
 Max Height: 120m
 Rotation Angel: SE 54 degree
 Bldg Width: 25m
 Bldg Depth: 13m
 Sunligh Ratio: 100%

FAR: 2.99
 GFA: 115,400sqm
 Bldg Coverage: 19.9%
 Max Height: 50m
 Rotation Angel: SE 54 degree
 Bldg Width: 37m
 Bldg Depth: 13m
 Sunligh Ratio: 100%

FAR: 2.53
 GFA: 97,300sqm
 Bldg Coverage: 21.1%
 Max Height: 40m
 Rotation Angel: SW 7 degree
 Bldg Width: 25m
 Bldg Depth: 13m
 Sunligh Ratio: 100%

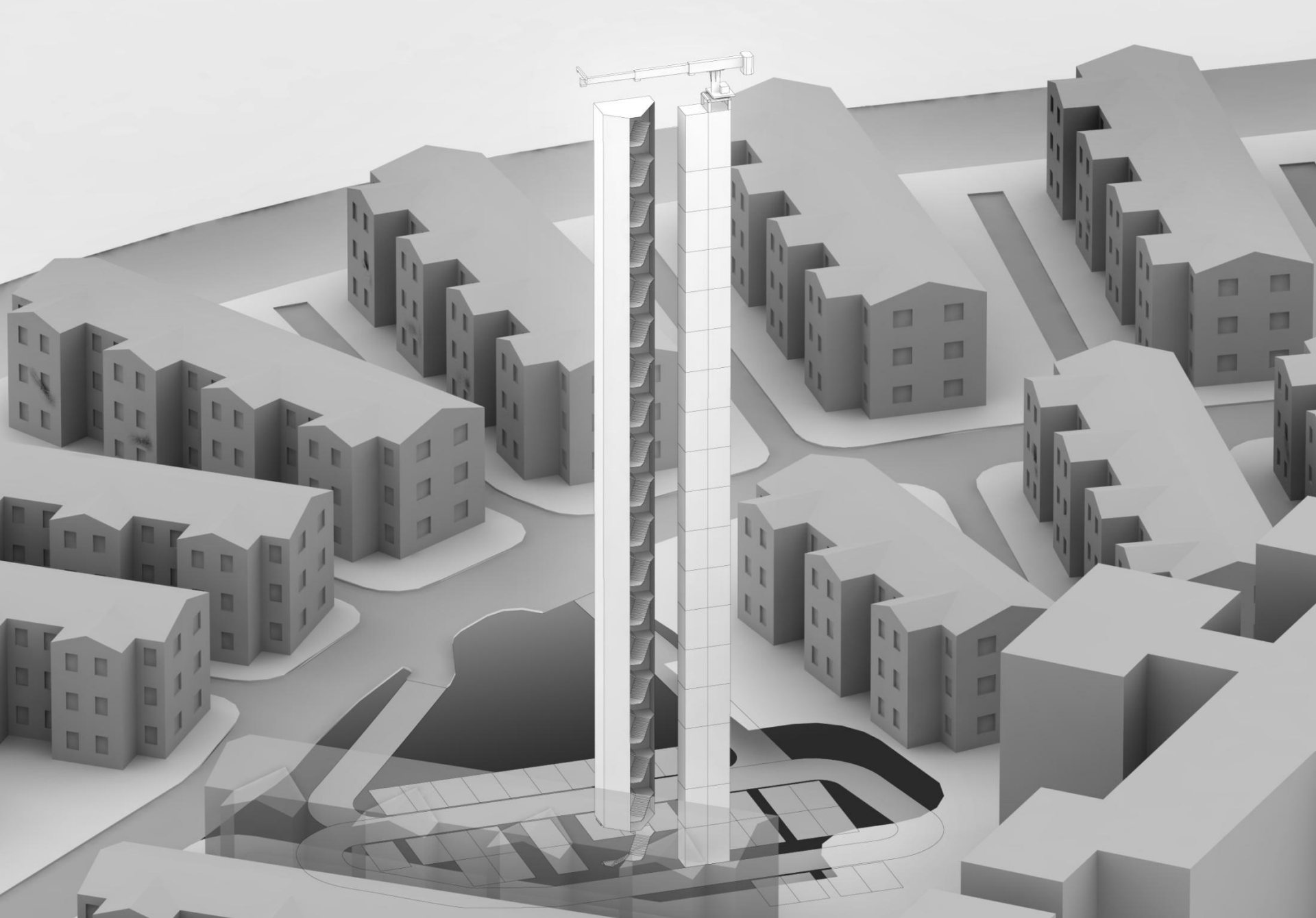
Task 4: Generative Distribution



Task 5: Testing Case for Re-generation



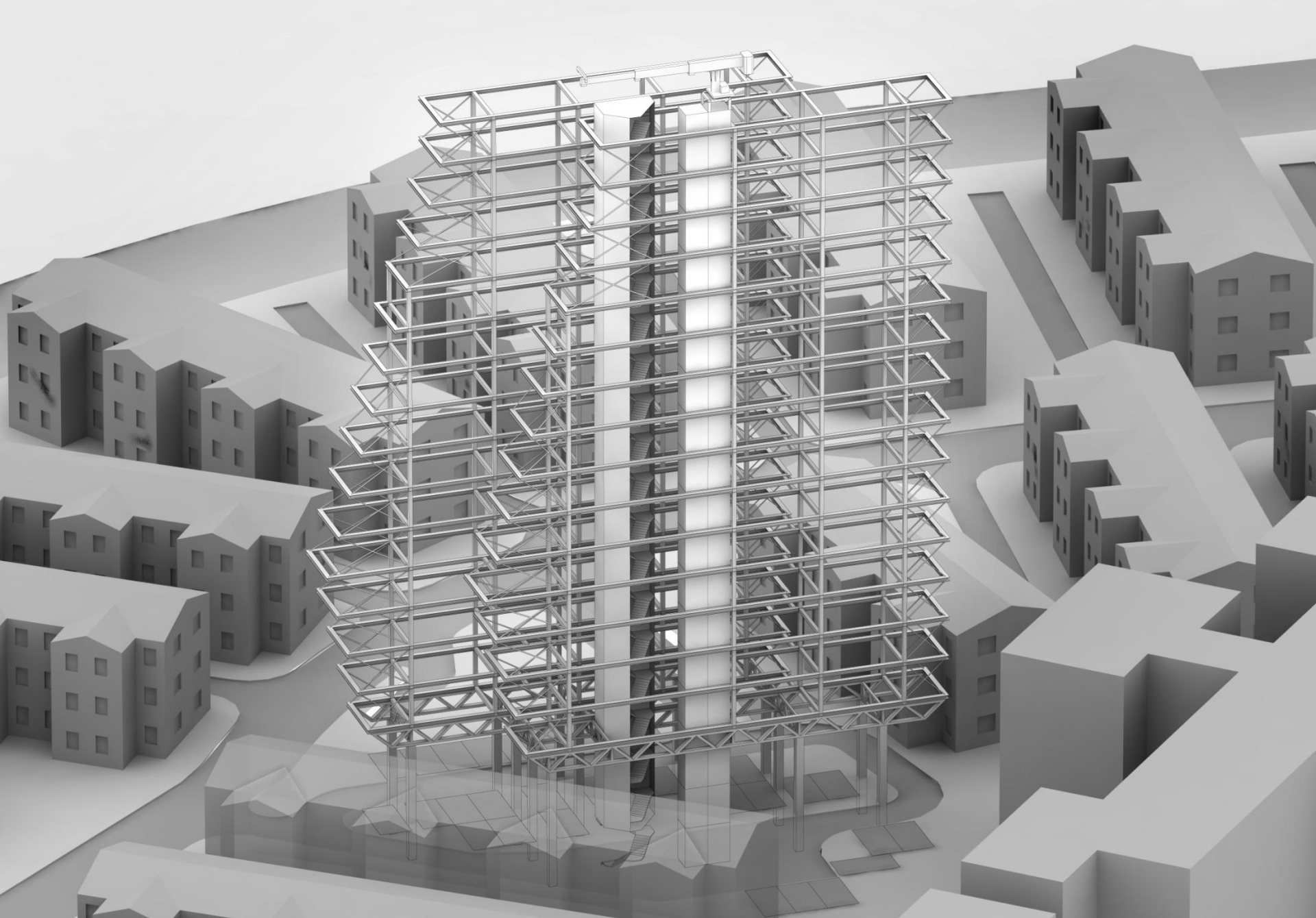
Task 6: Automatic Articulation from Generative Massing



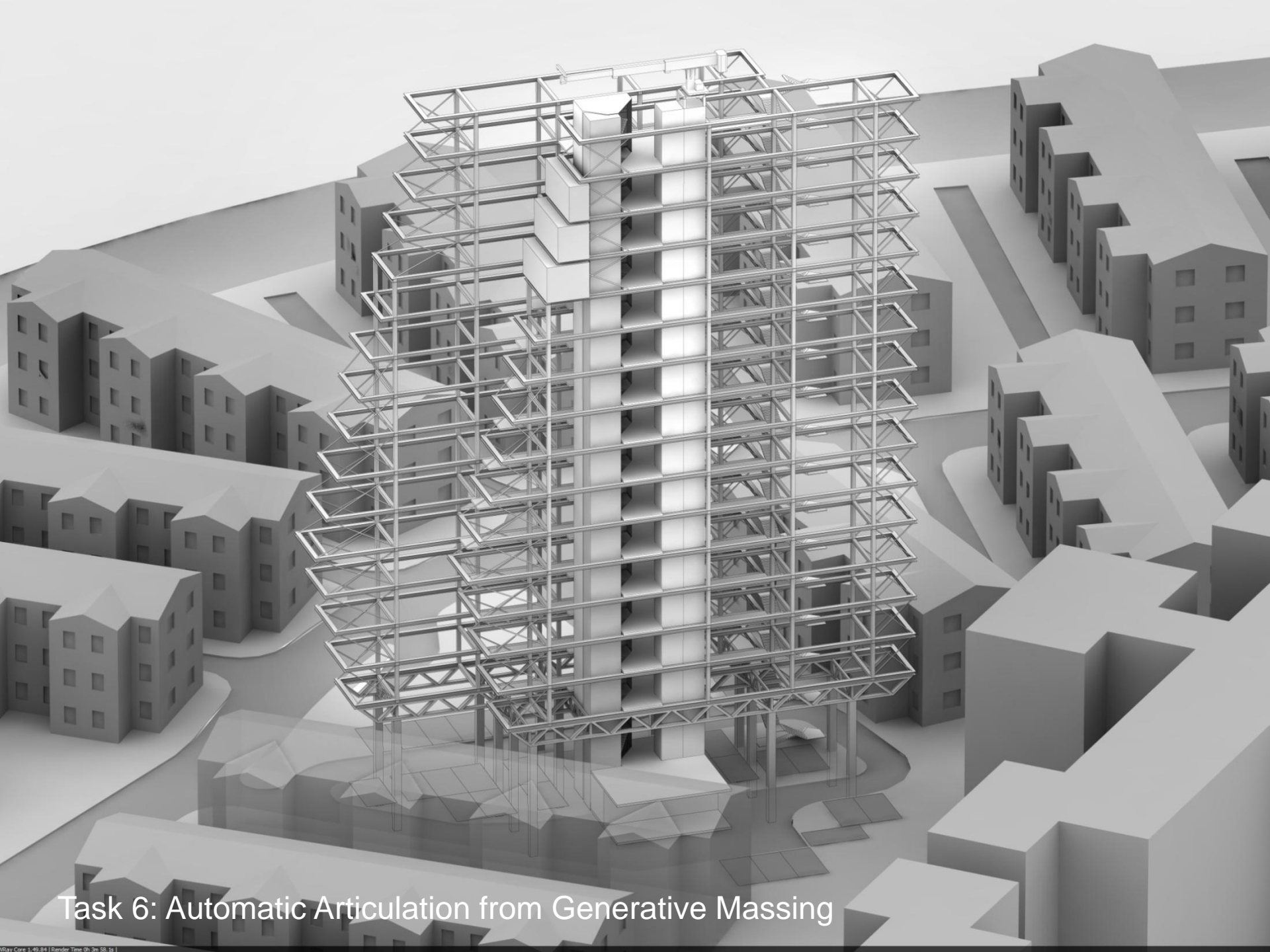
Task 6: Automatic Articulation from Generative Massing



Task 6: Automatic Articulation from Generative Massing



Task 6: Automatic Articulation from Generative Massing



Task 6: Automatic Articulation from Generative Massing



Task 6: Automatic Articulation from Generative Massing

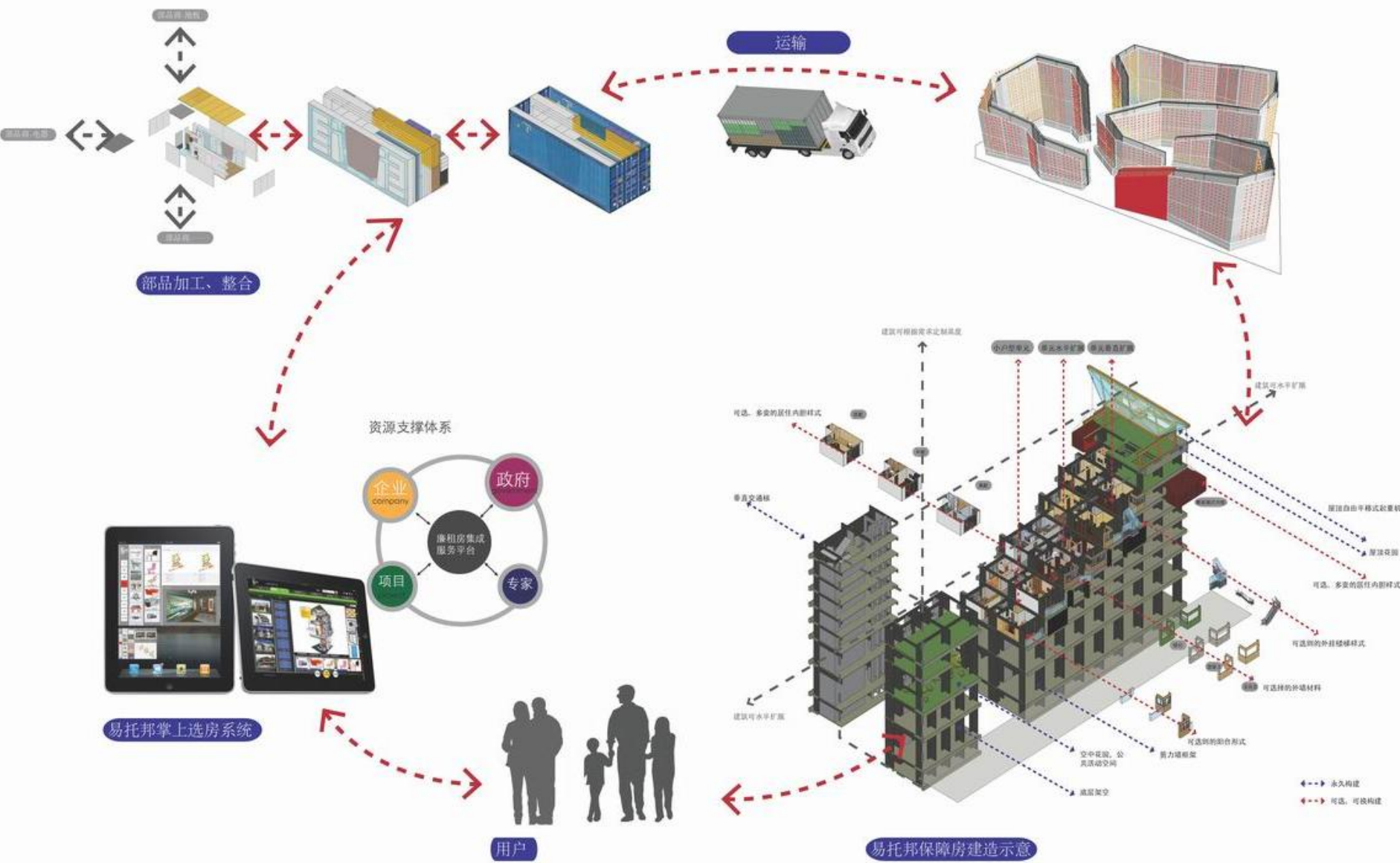


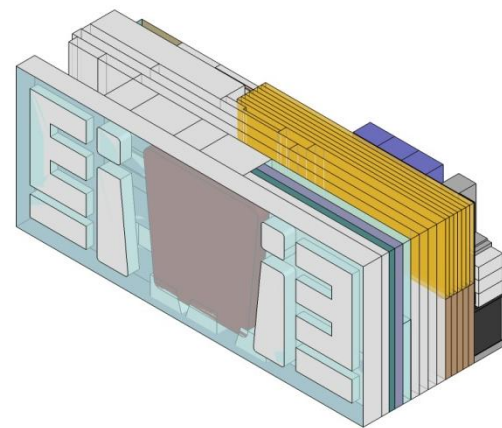
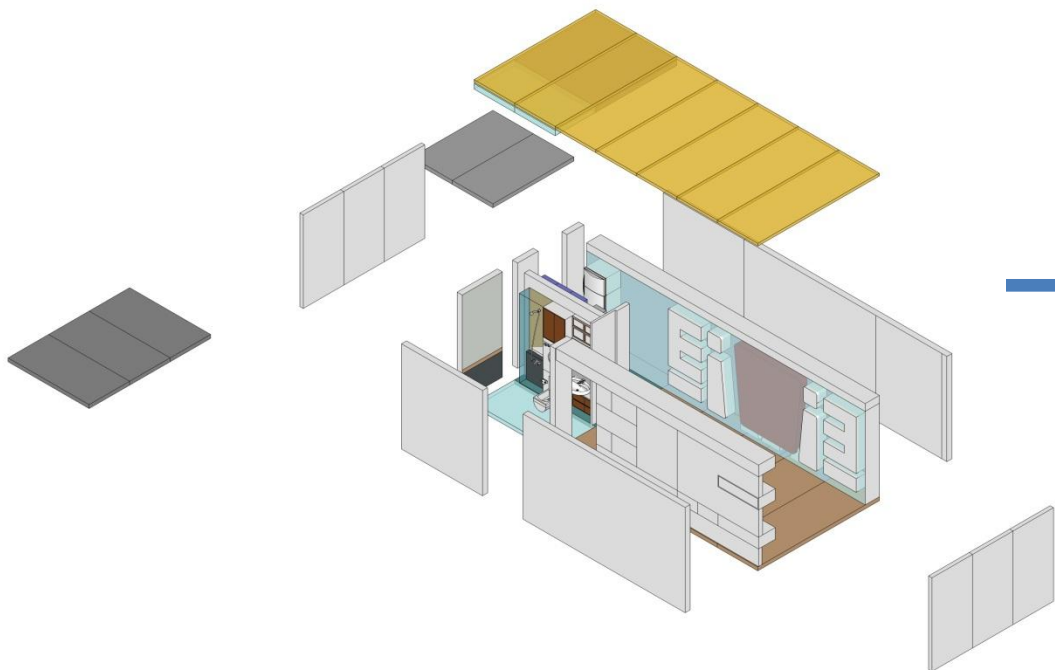
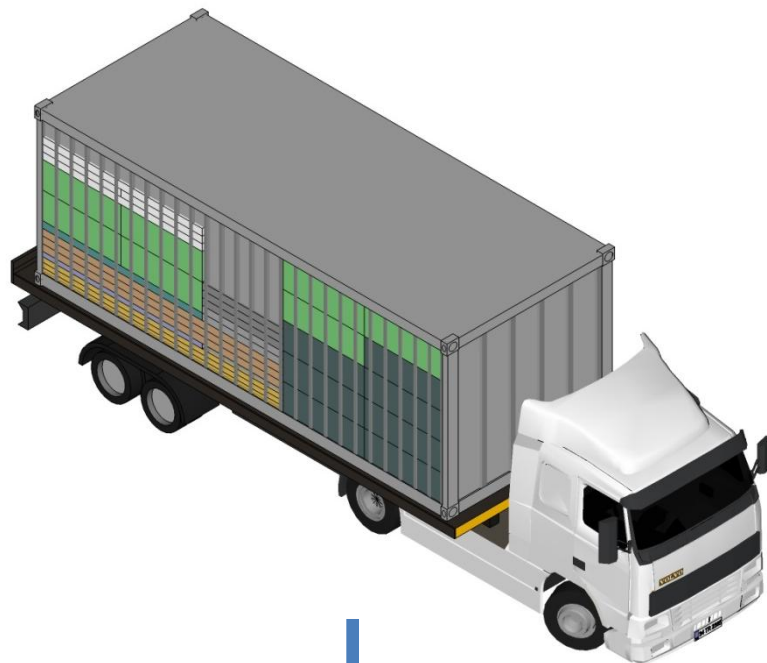
Task 6: Automatic Articulation from Generative Massing

應用案例1: 保障房设计 基于模数化系统的大规模定制设计

Application 1: Social Housing
Mass Customization Based On
Modular Housing Units

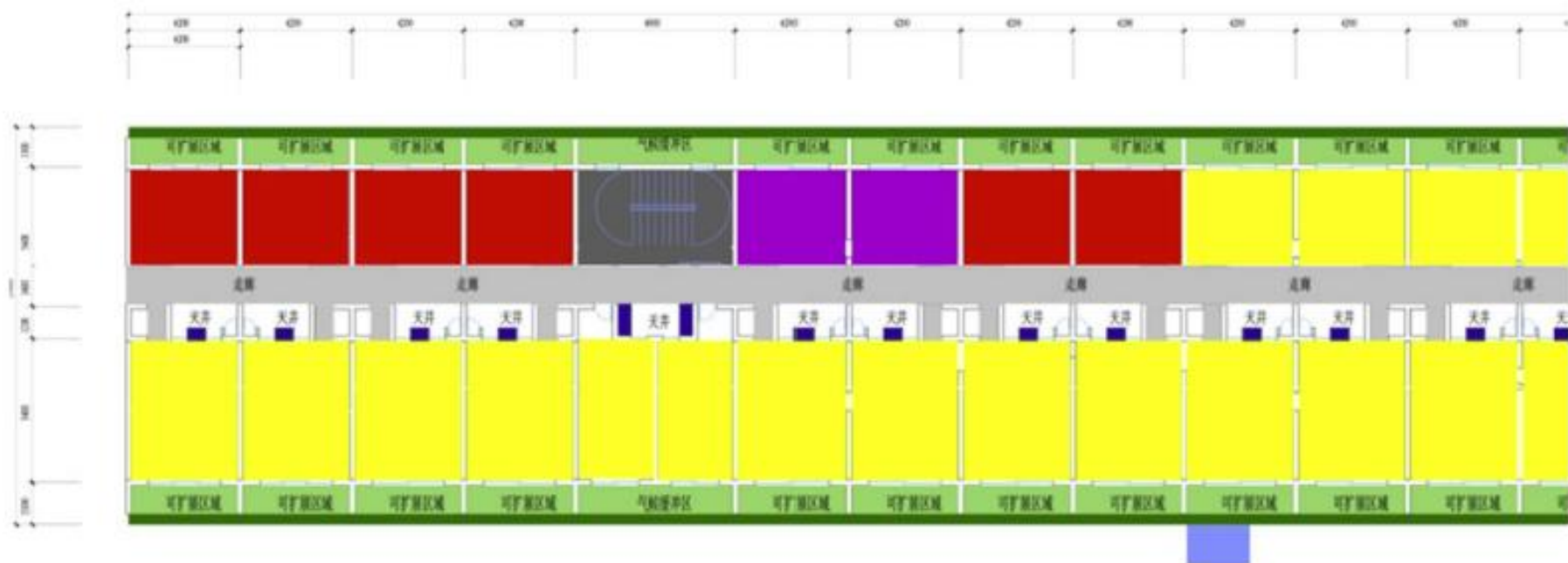
保障房建设流程示意



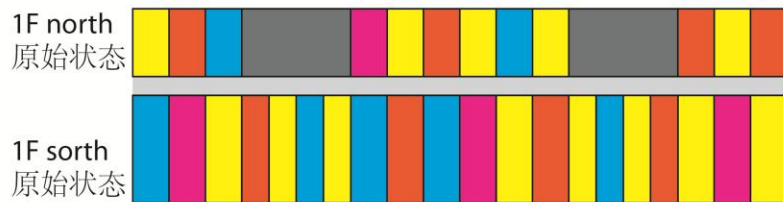
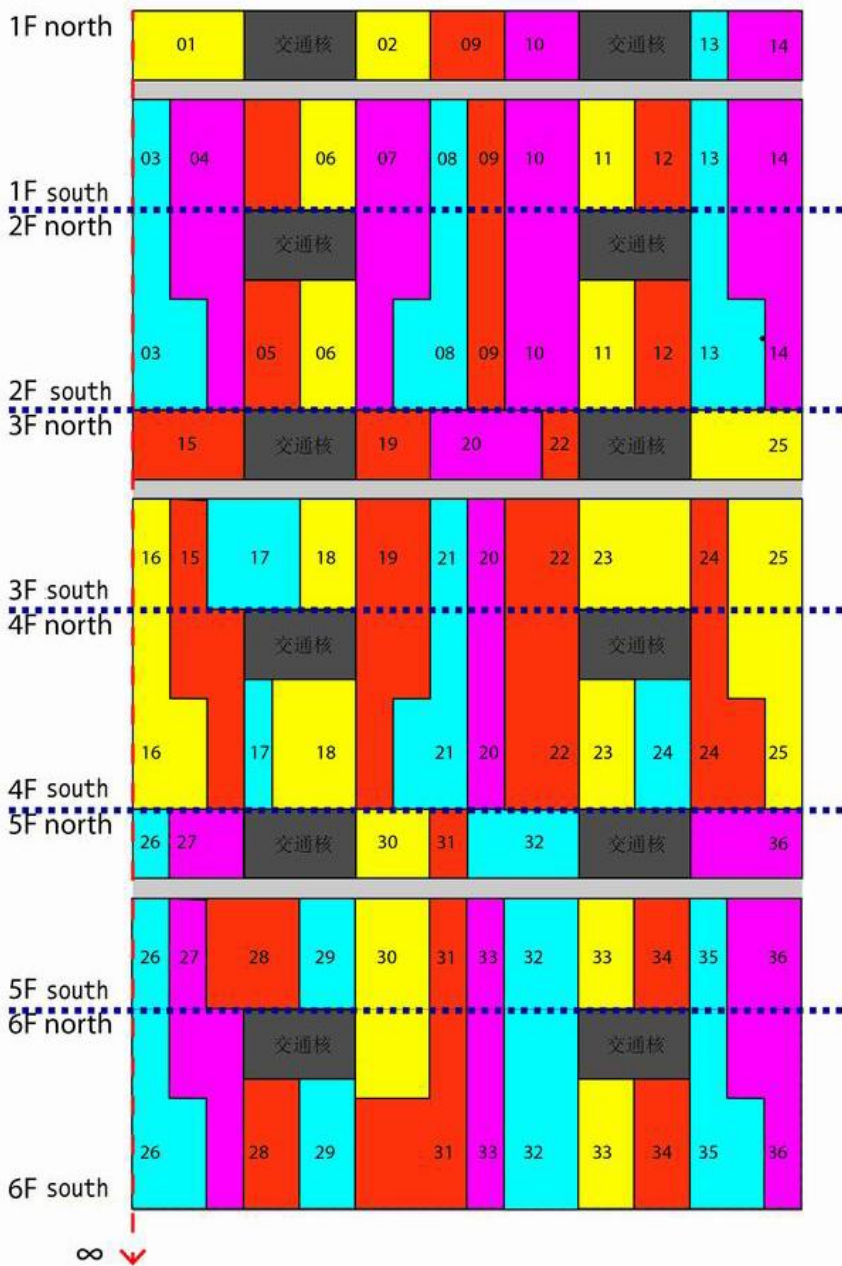


楼层功能布局:

楼层各功能单元呈“内廊式”布局。内廊南侧布置“内胆式”居住单元，北侧布置为居住单元，soho、办公单元，游憩活动单元混合布置。两个垂直交通核同时布置于内廊北侧。



- | | | |
|-------------------|--------------|---------------|
| 内胆式居住单元,可横向扩展 | 垂直交通核 | 可扩展区域 |
| 办公, soho单元, 可横向扩展 | 水平交通廊道 | 外挂绿化墙 |
| 公共活动单元 | 管道井, 可根据需求扩展 | 外挂垂直交通 (示意位置) |



初始状态，每户之占用一个单元格，每层共20户居民。

使用者为单身青年，新婚夫妇，学生，农民工等对住房面积要求不高，且经济基础的市民。

使用者对空间需求增加。单元格开始同层、跨层合并。

随着时间推移，居民有些迁出，继续居住于此的家庭成员数、积累财富增加，对住房面积需求扩大。

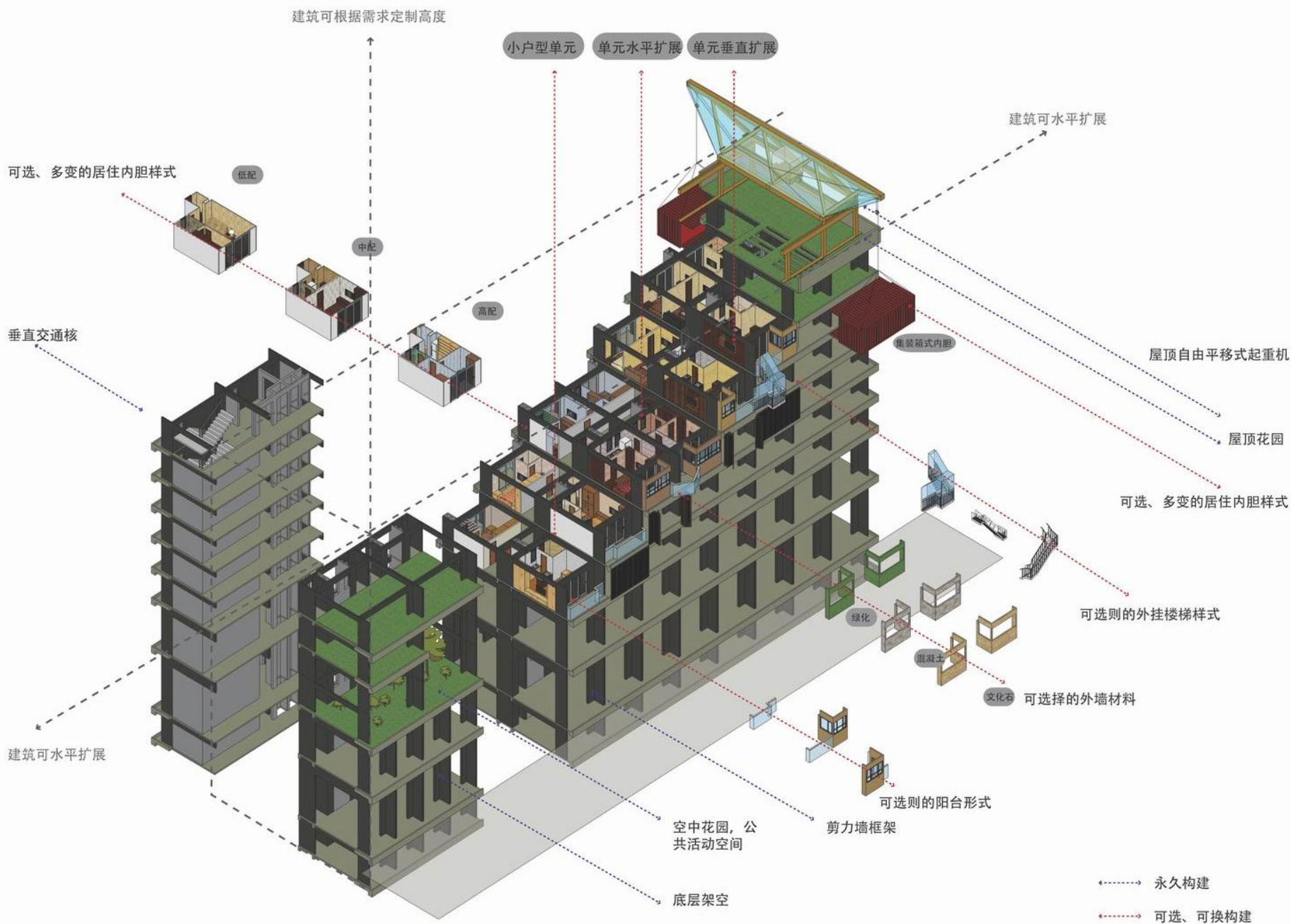
可能性无限的
灵活居住空间

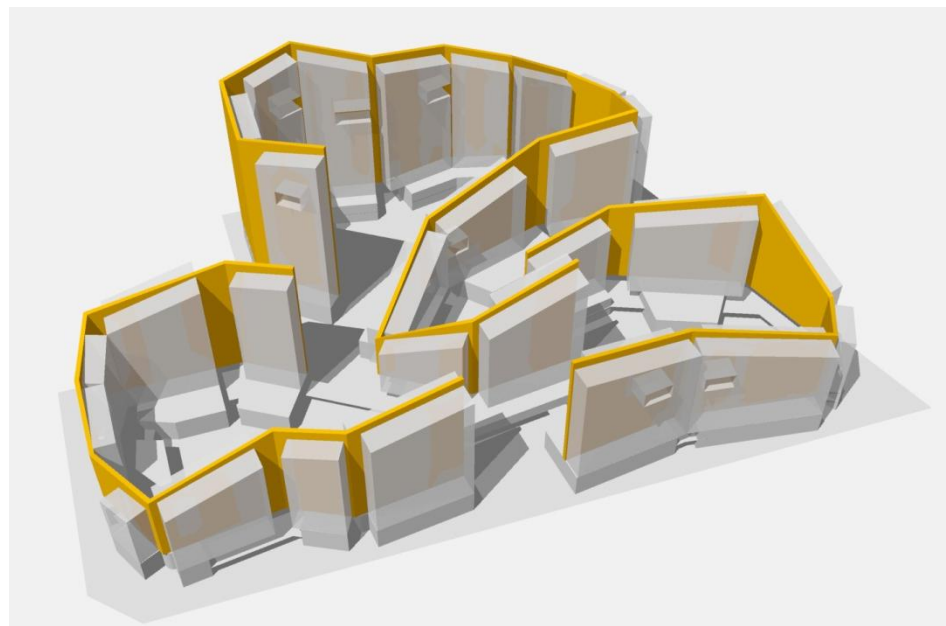
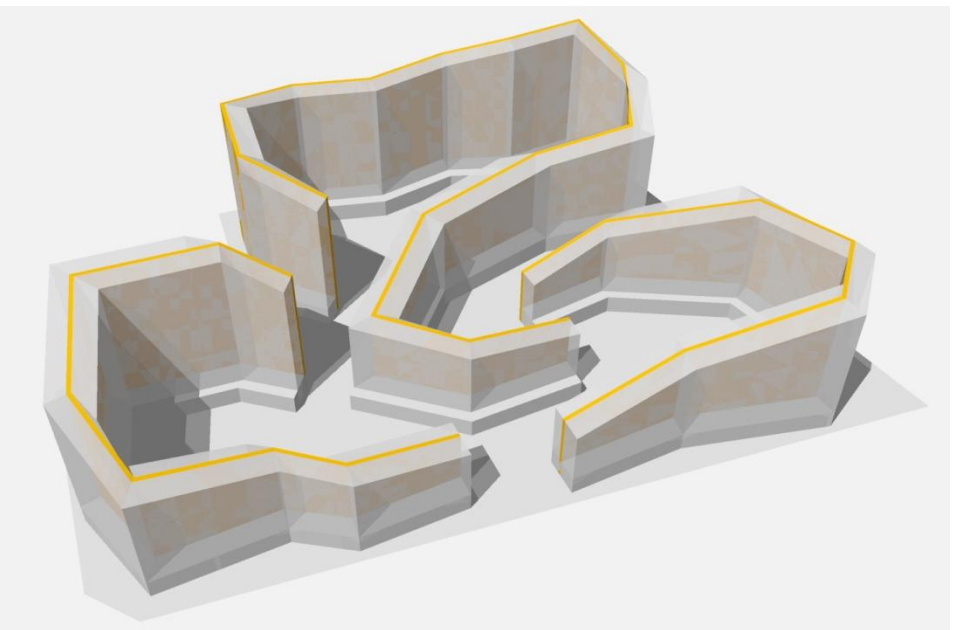
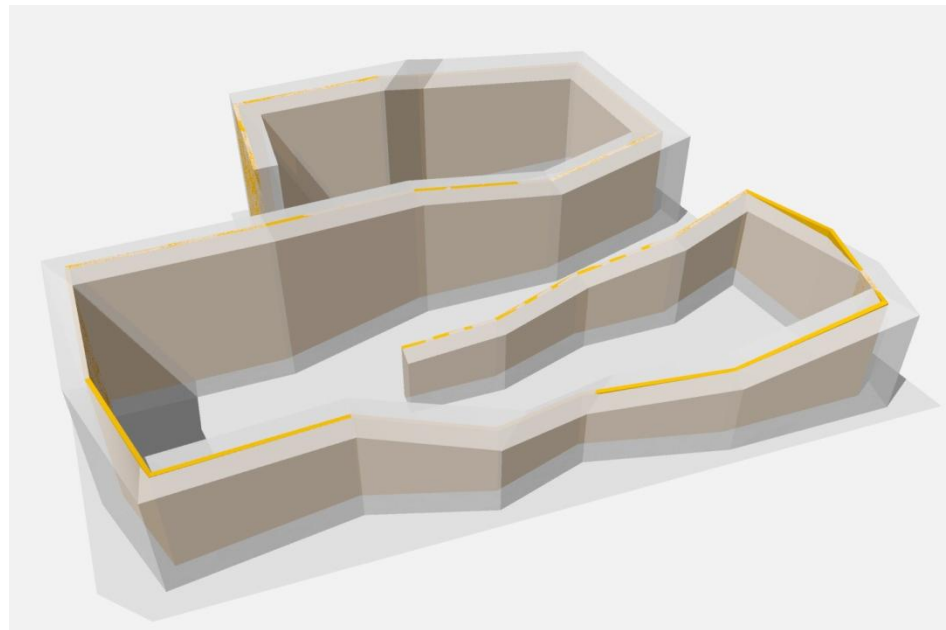
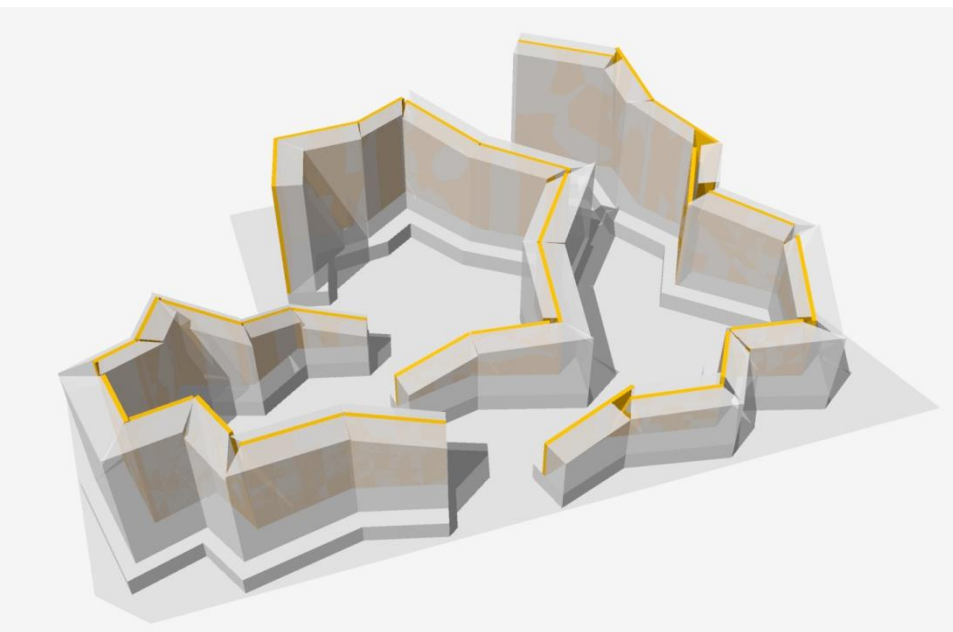
单元合并规则

- 1、单元之间可沿垂直、水平方向自由合并。合并过程中可占用走廊等公共空间。
- 2、单数层走廊不可占用。
- 3、建议单数层单元和本层及上面一层在空间上相邻的单元进行合并。双数层和本层及下面一层单元进行合并。

颜色只用于区分房间权属。无其它含义。可参照后续空间模型。

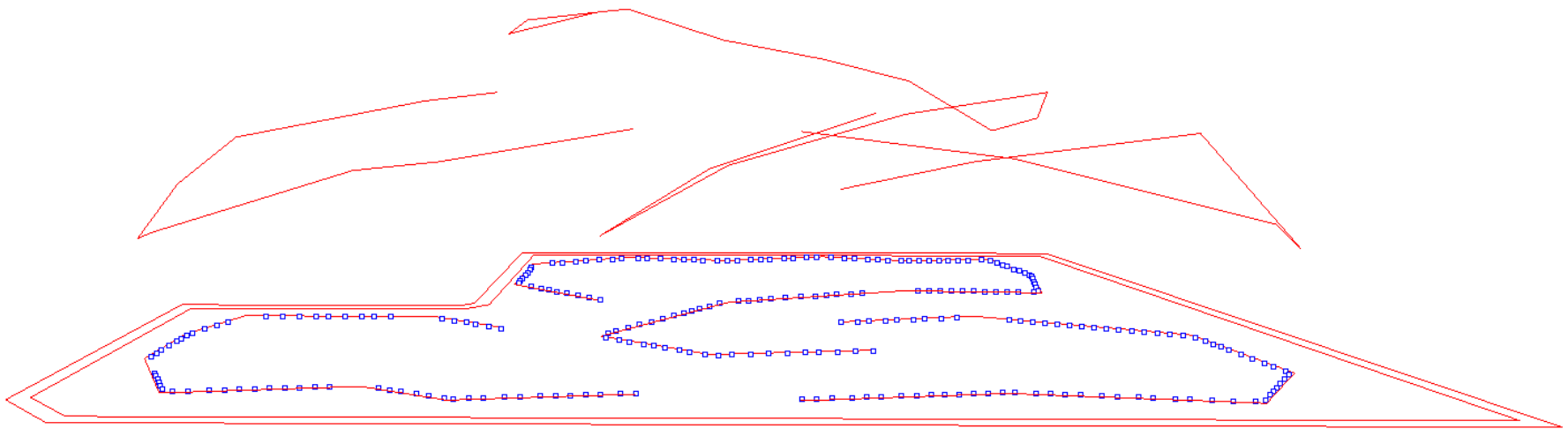
保障房建造模式示意图





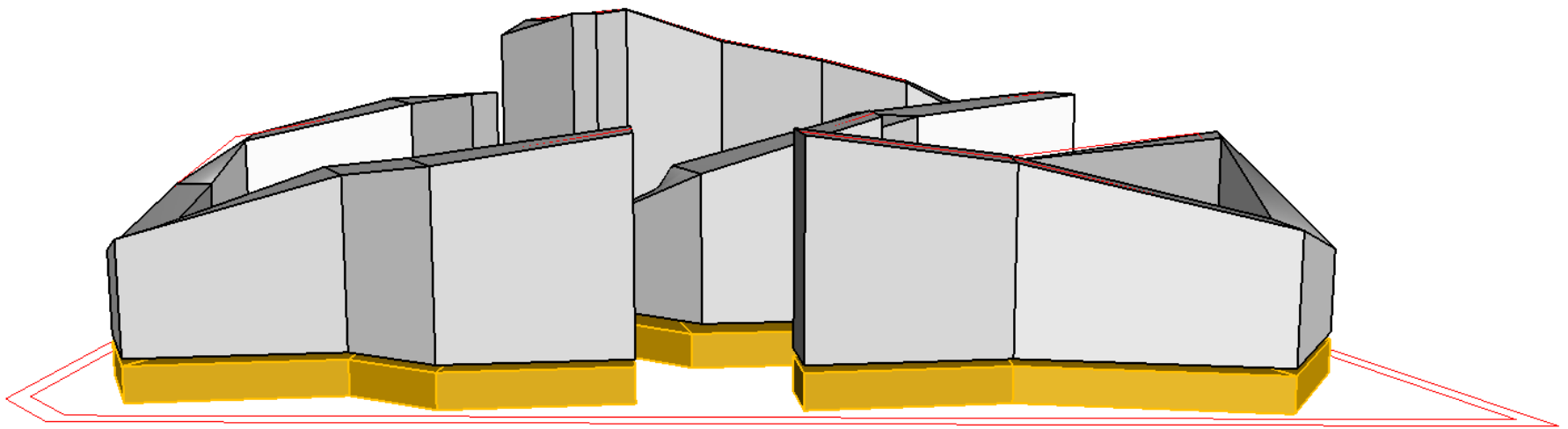


1. Input control polylines for global massing

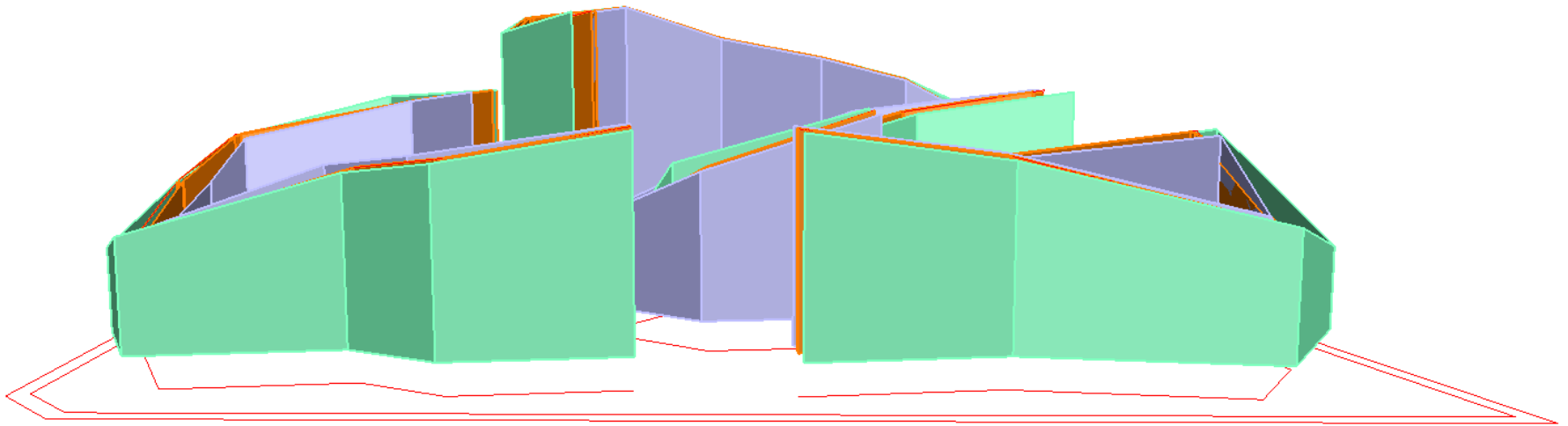


z
x

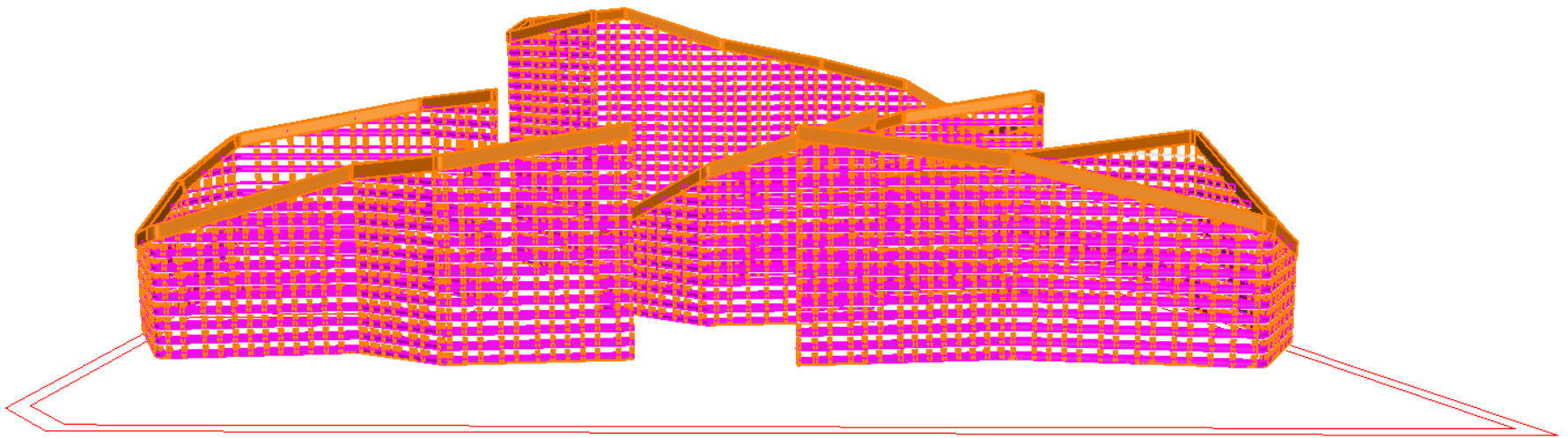
2. Subdivision to various modular segments



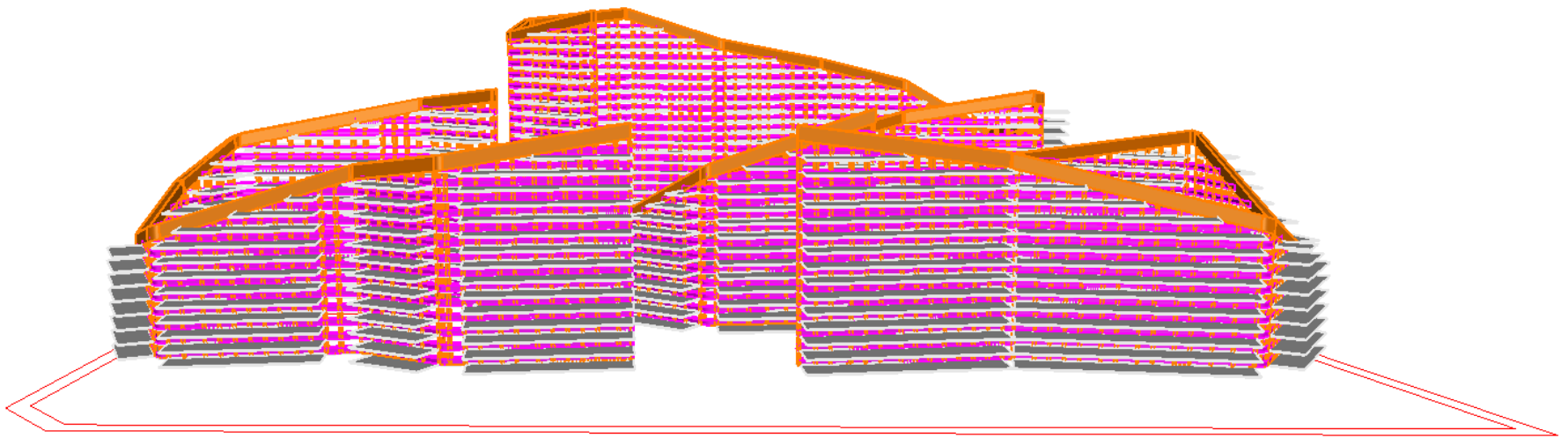
3.Massing for environmental analysis

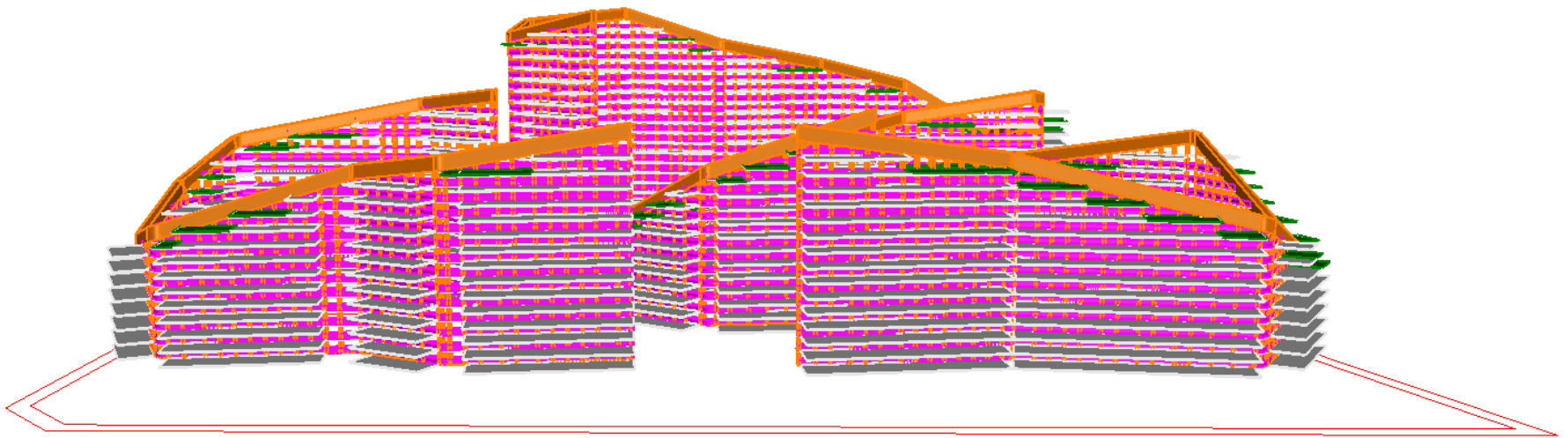


4. External surfaces for façade generation and analysis

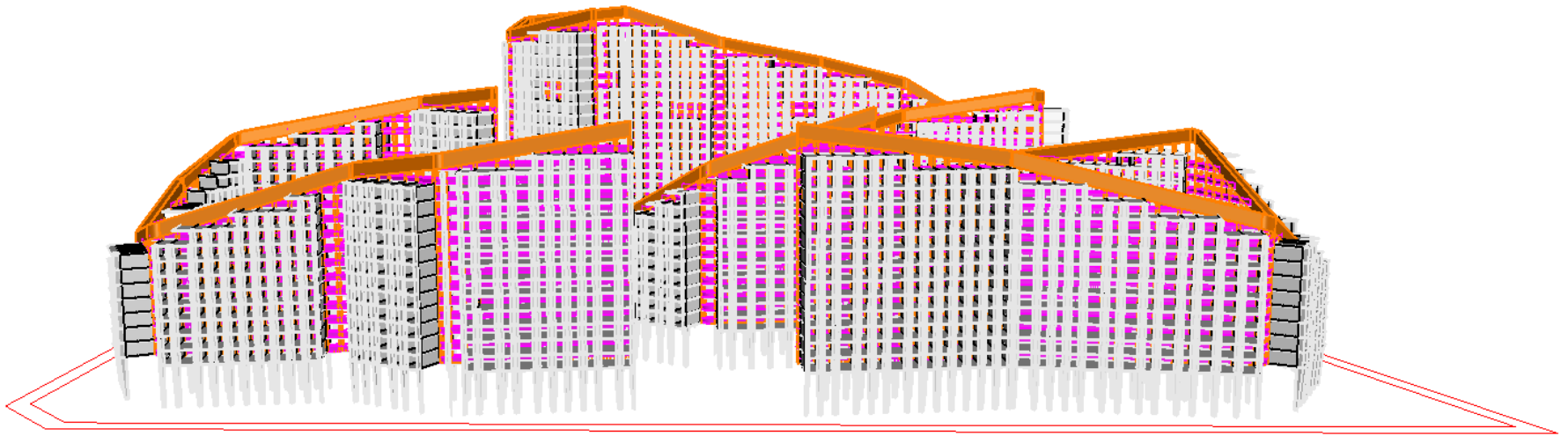


5. Circulation and Structures

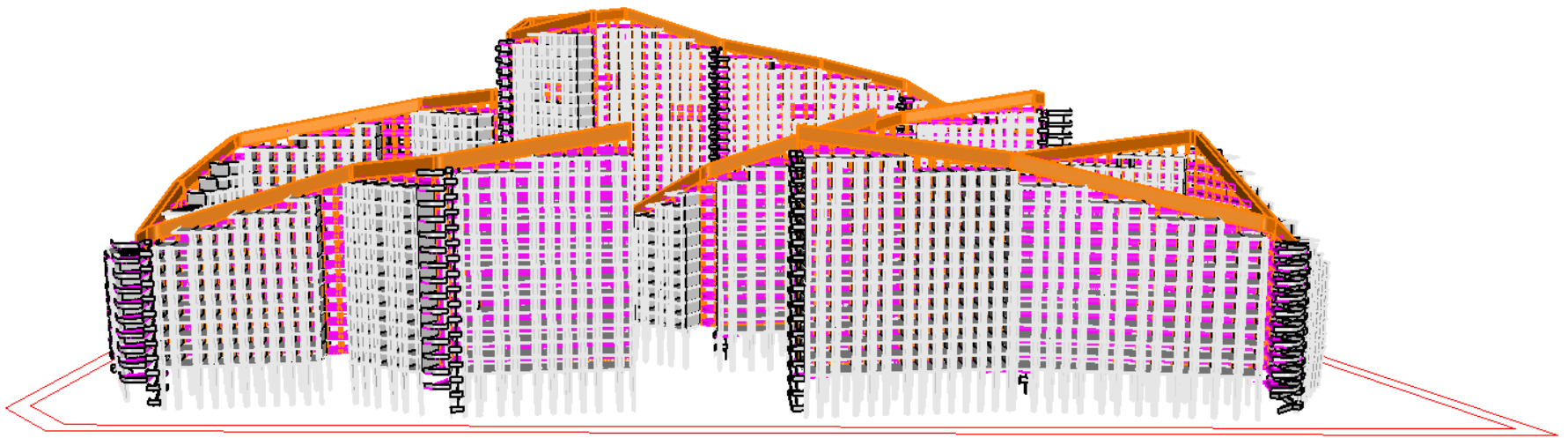




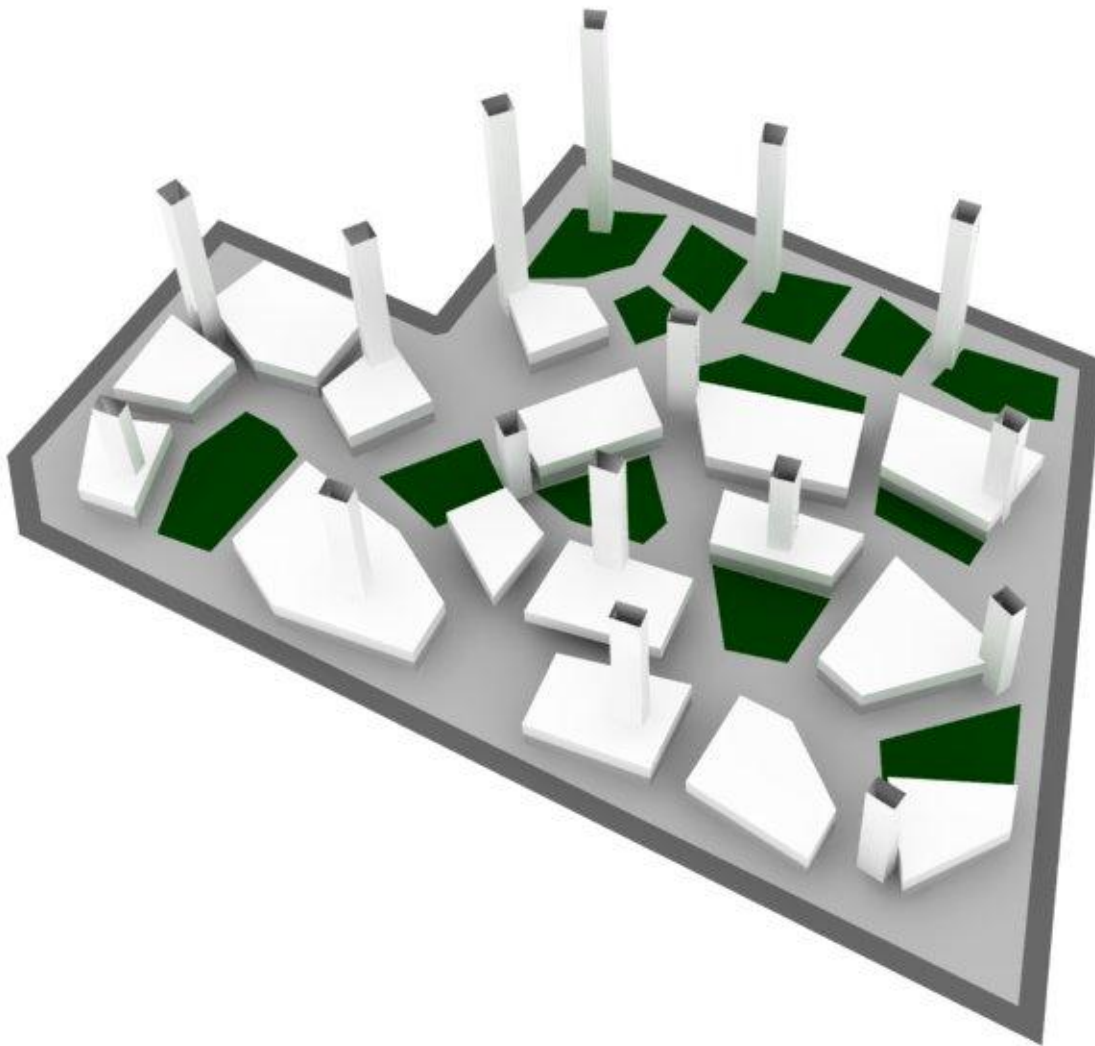
z
x



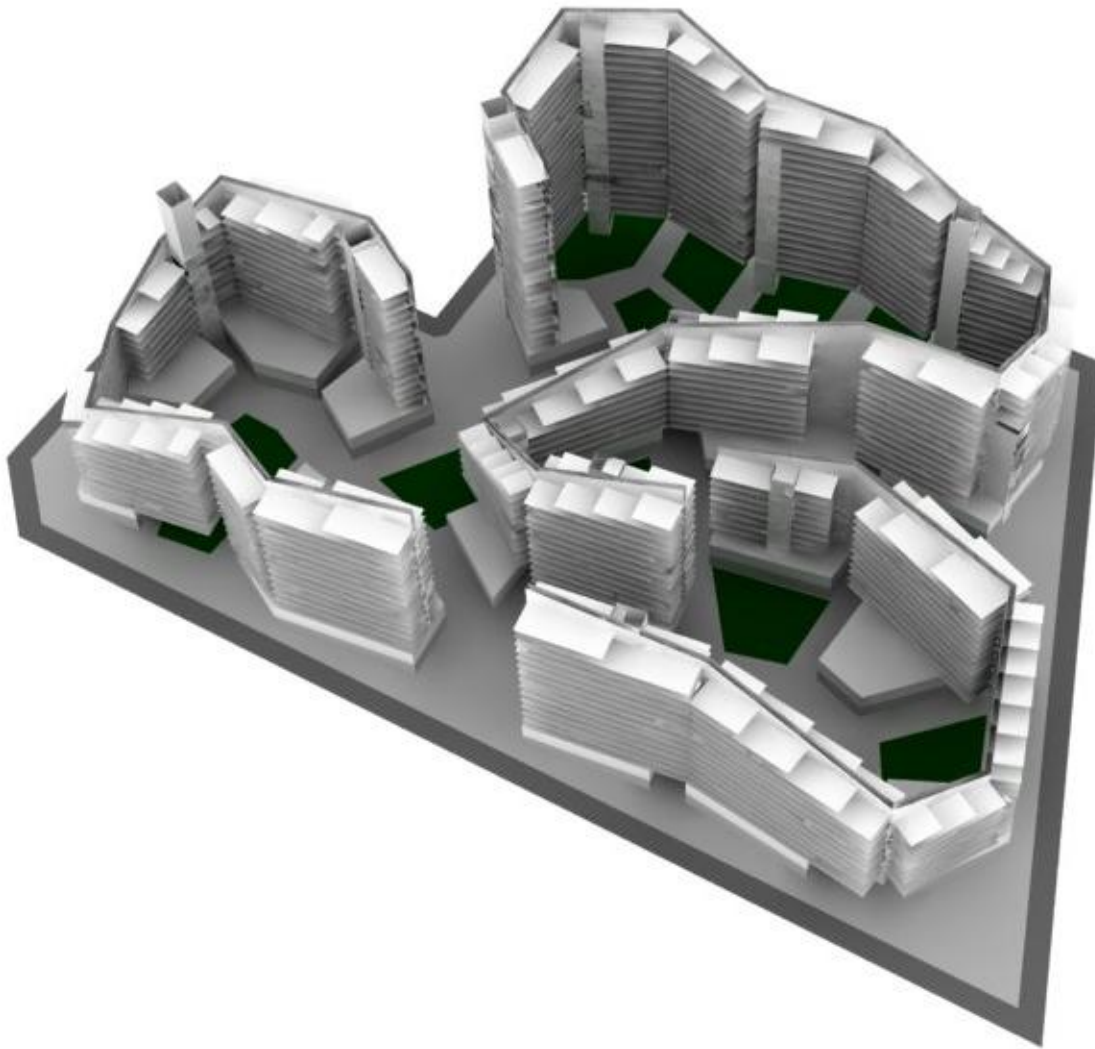
8. Load bearing walls and external structures



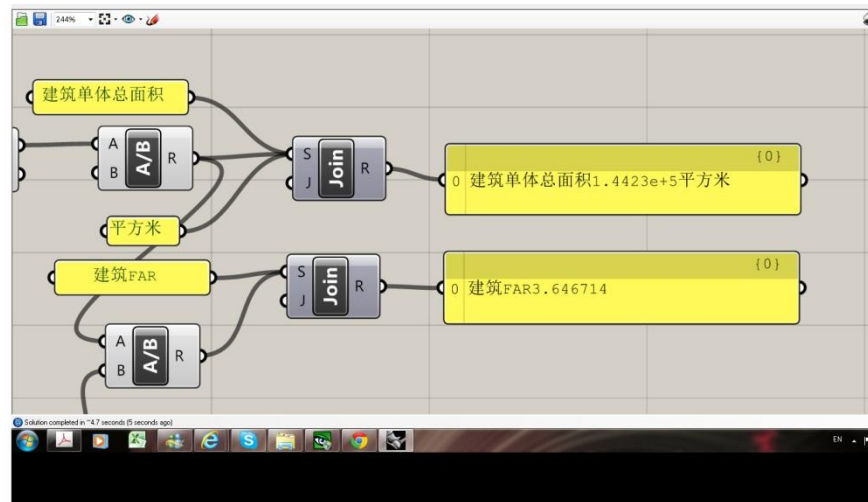
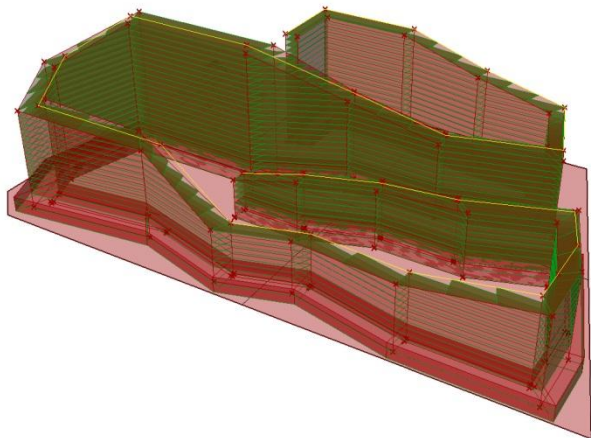
9. Vertical circulations

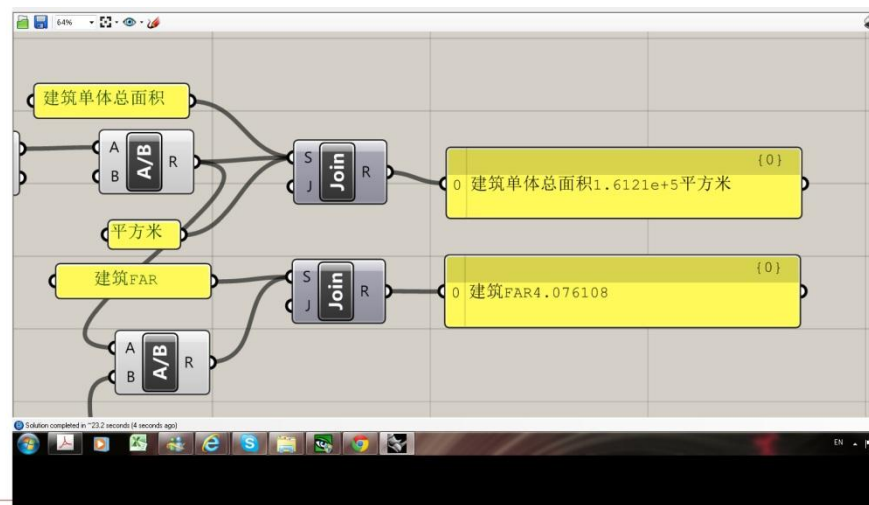
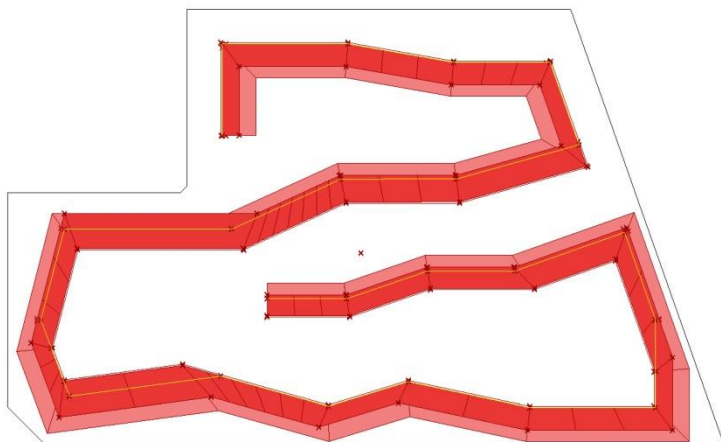


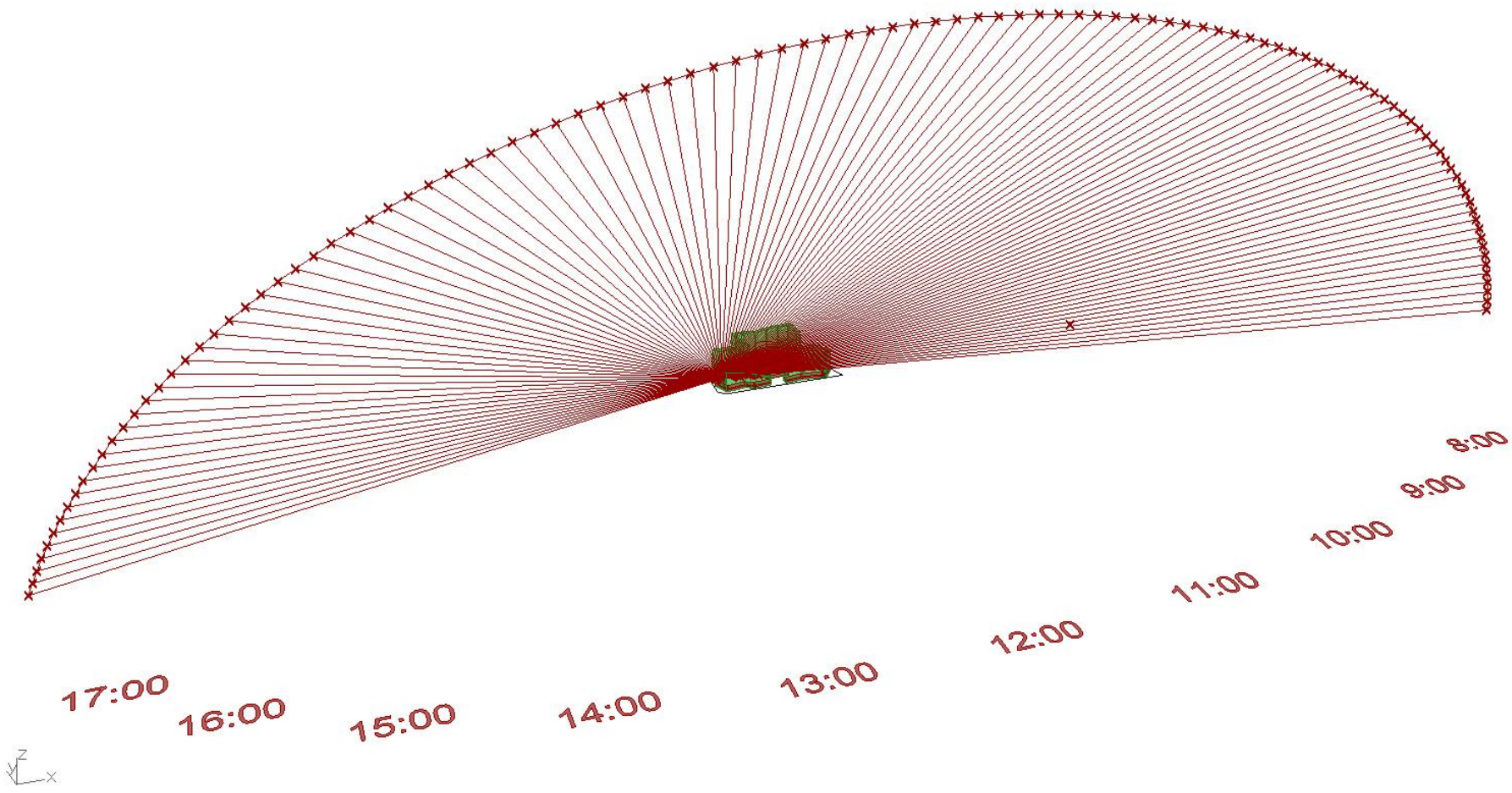
Public domain and circulations



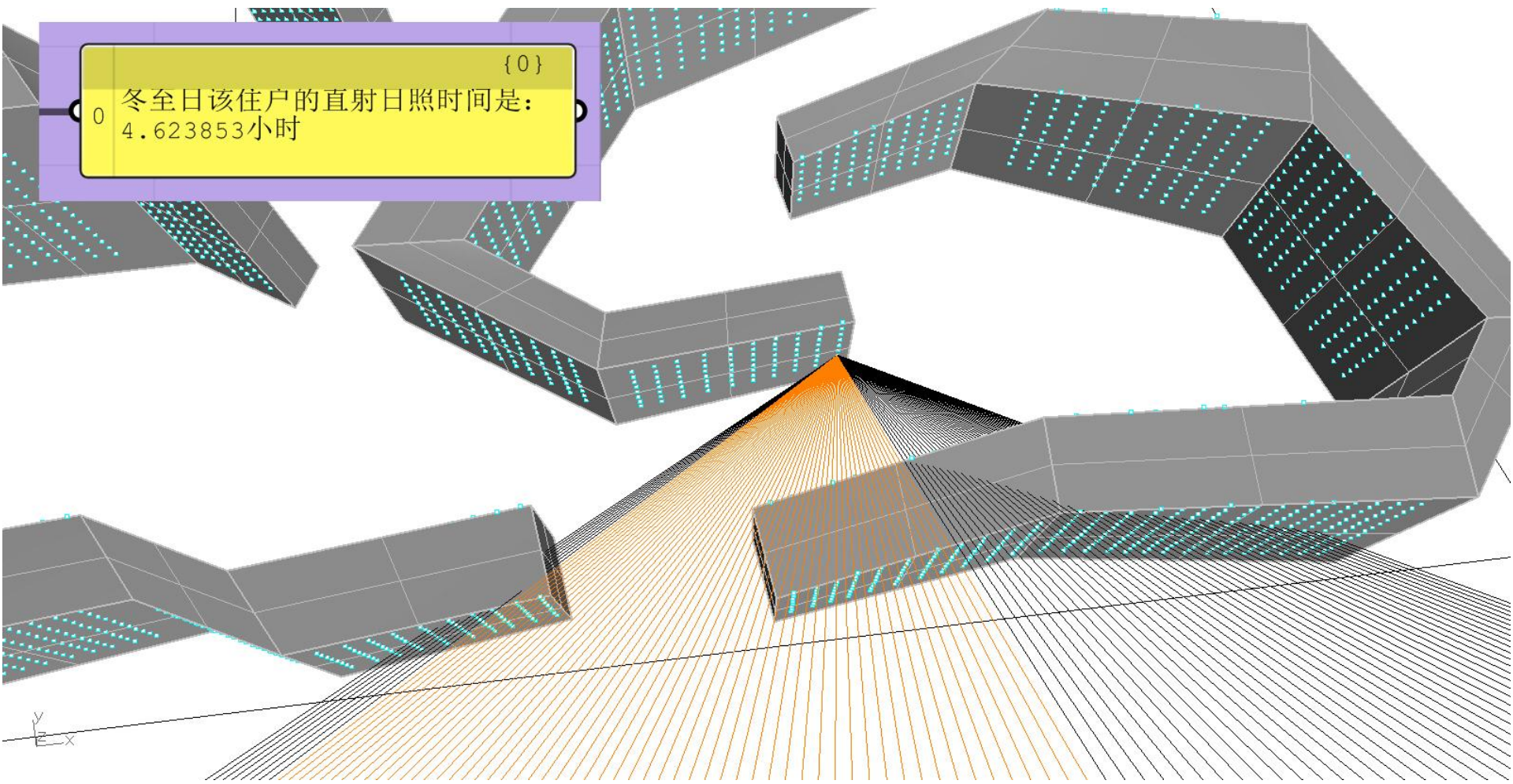
Combination of public space and dwelling units

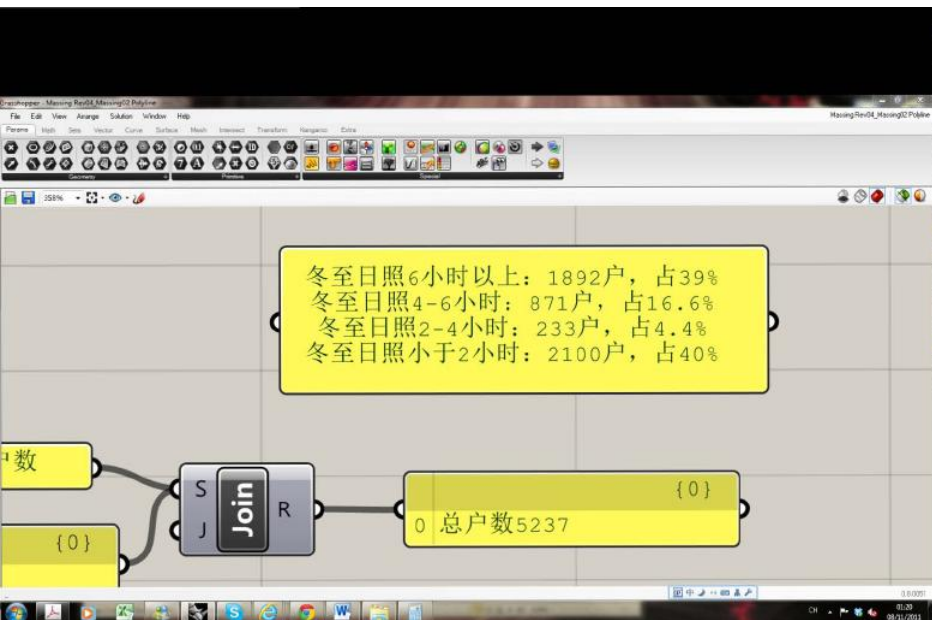




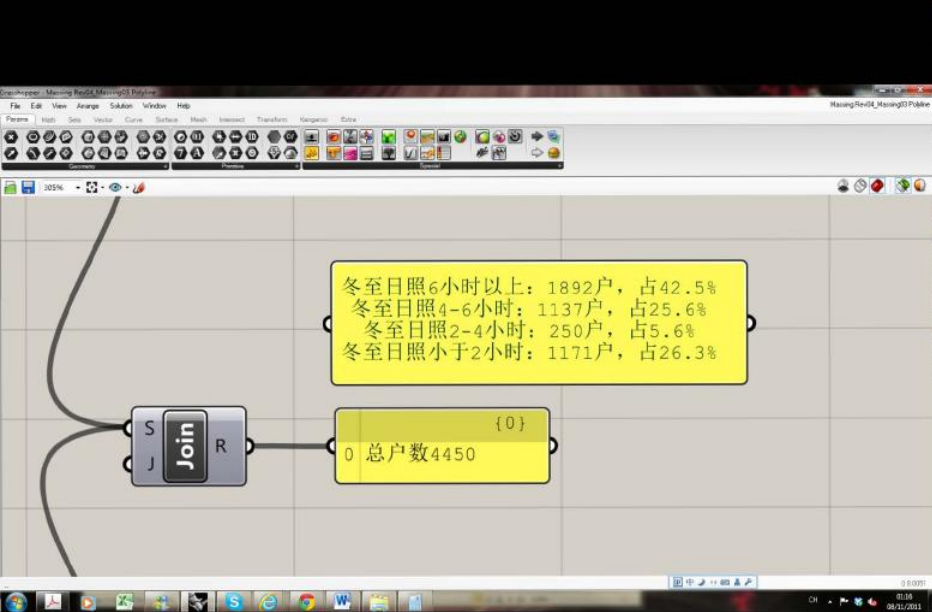
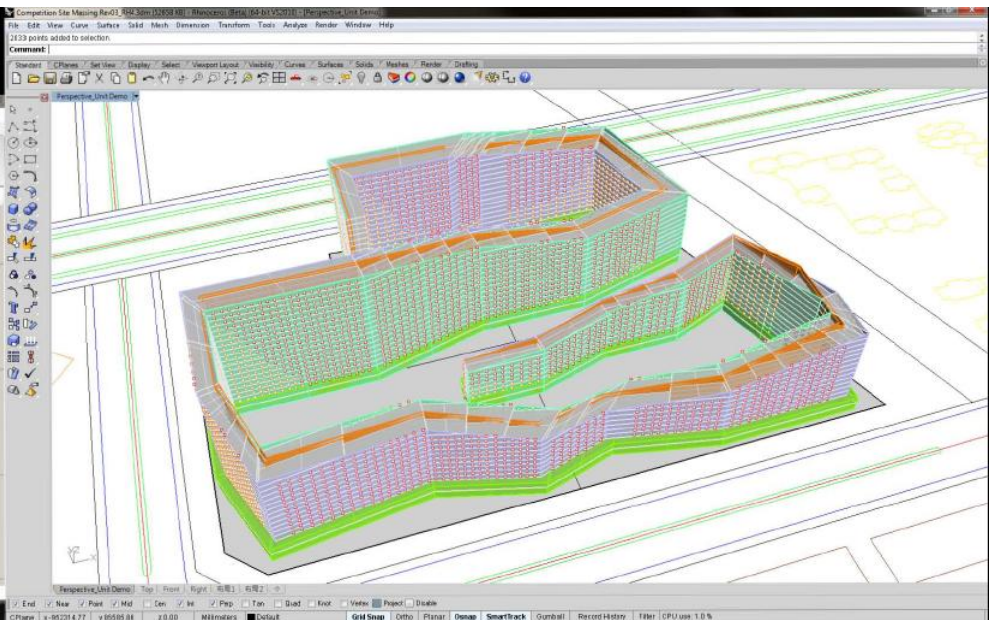


Sunshine Analysis-1

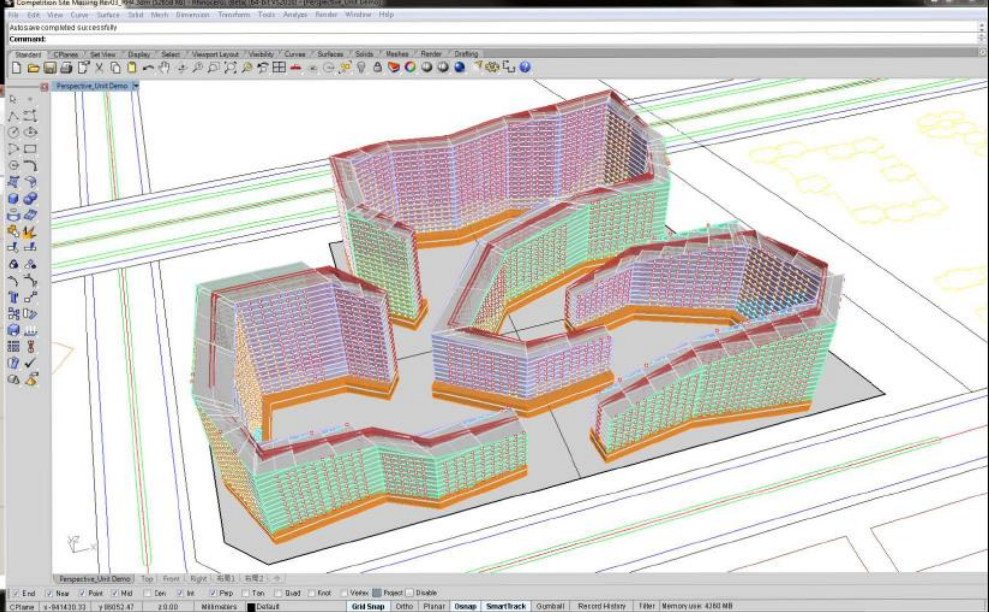


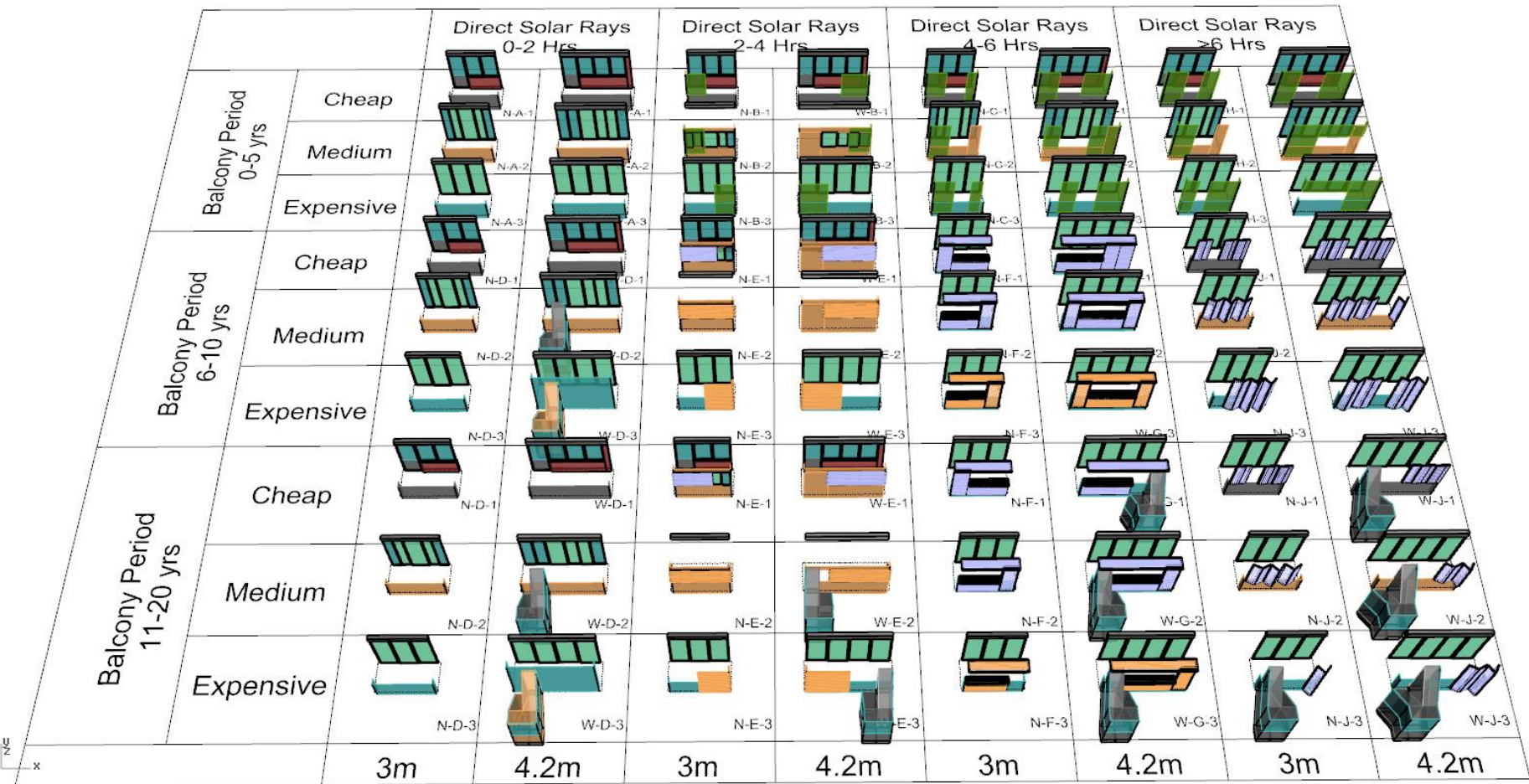


冬至日照6小时以上：1892户，占39%
 冬至日照4-6小时：871户，占16.6%
 冬至日照2-4小时：233户，占4.4%
 冬至日照小于2小时：2100户，占40%

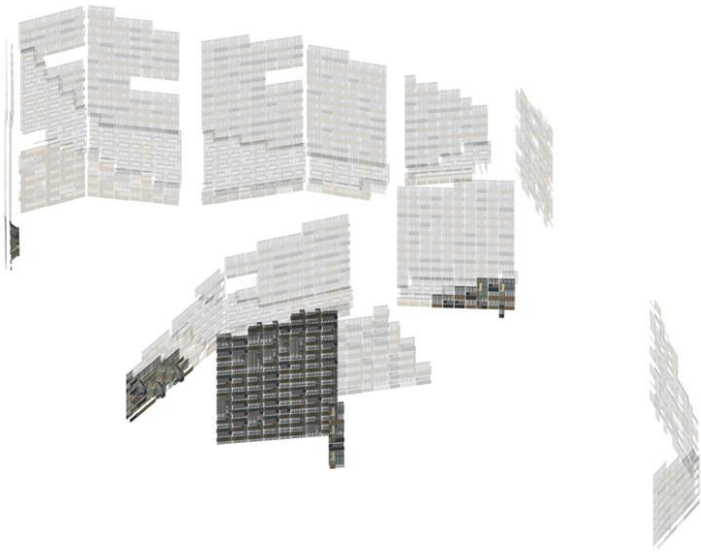


冬至日照6小时以上：1892户，占42.5%
 冬至日照4-6小时：1137户，占25.6%
 冬至日照2-4小时：250户，占5.6%
 冬至日照小于2小时：1171户，占26.3%





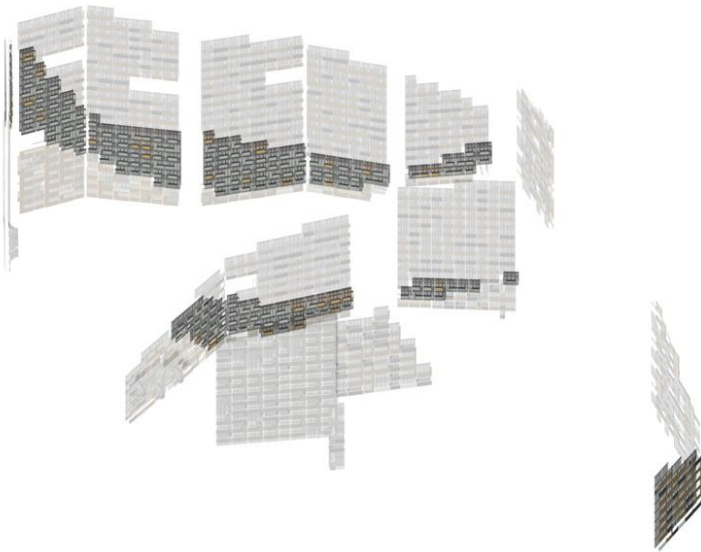
Variation of façade units



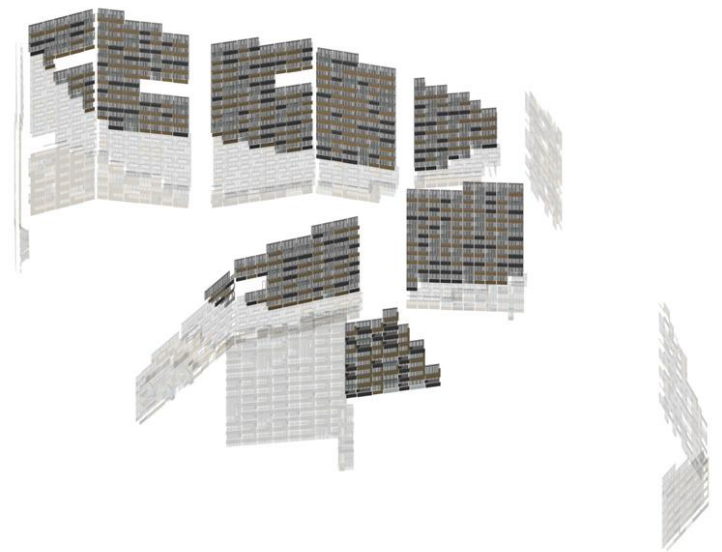
Direct sunshine < 2 hours



2 hours < Direct sunshine < 4 hours



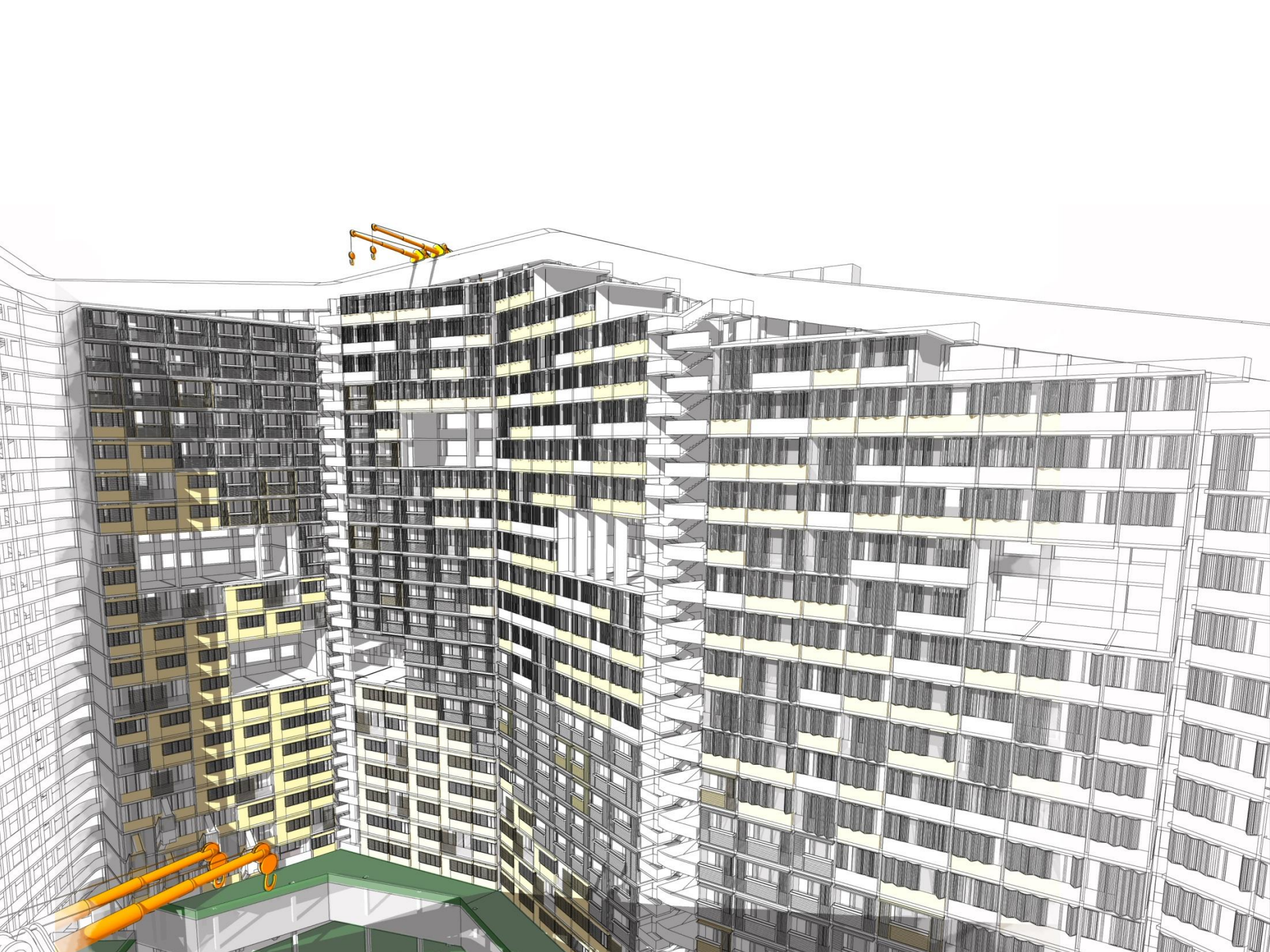
4 hours < Direct sunshine < 6 hours

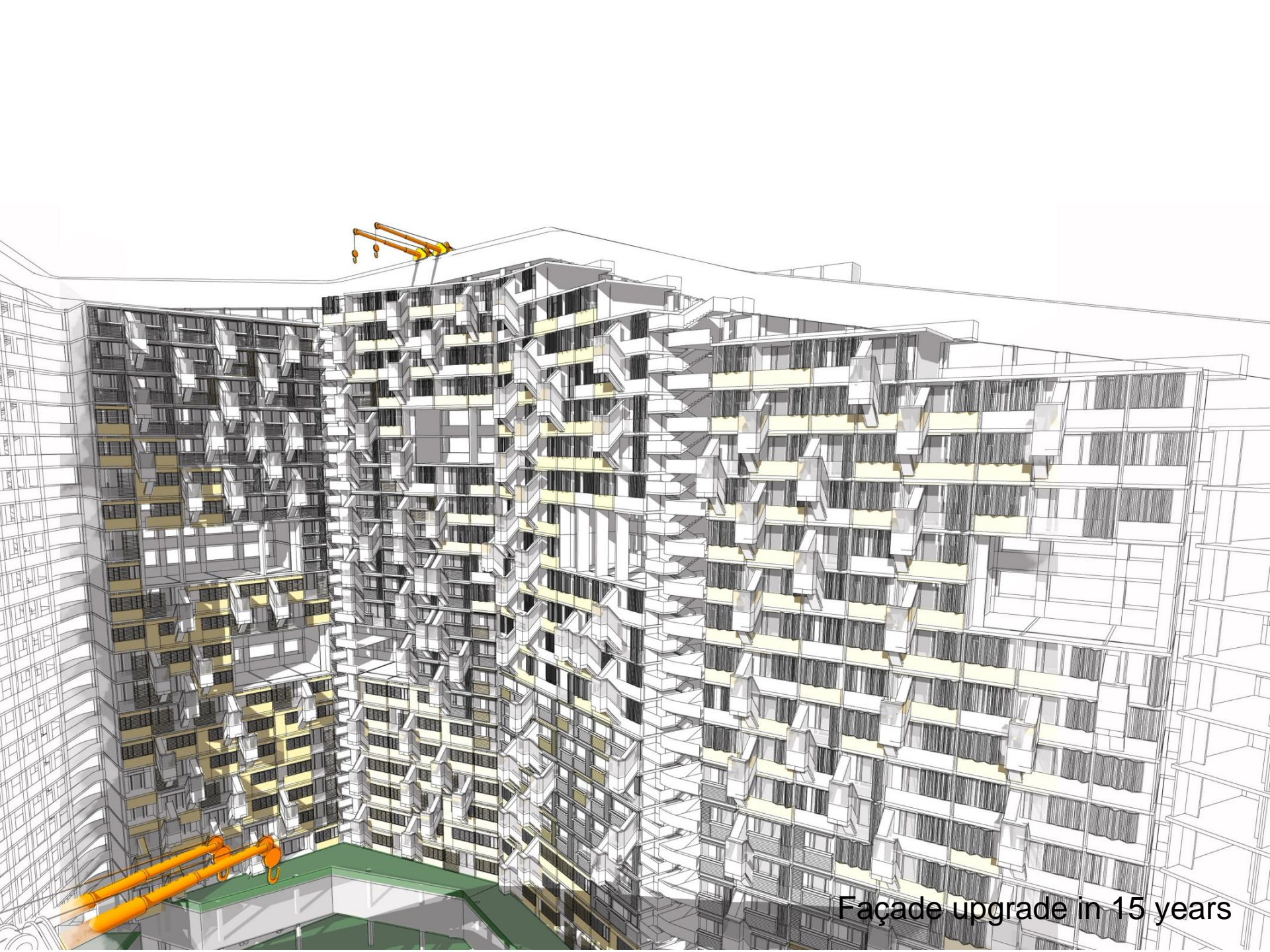


Direct sunshine > 6 hours

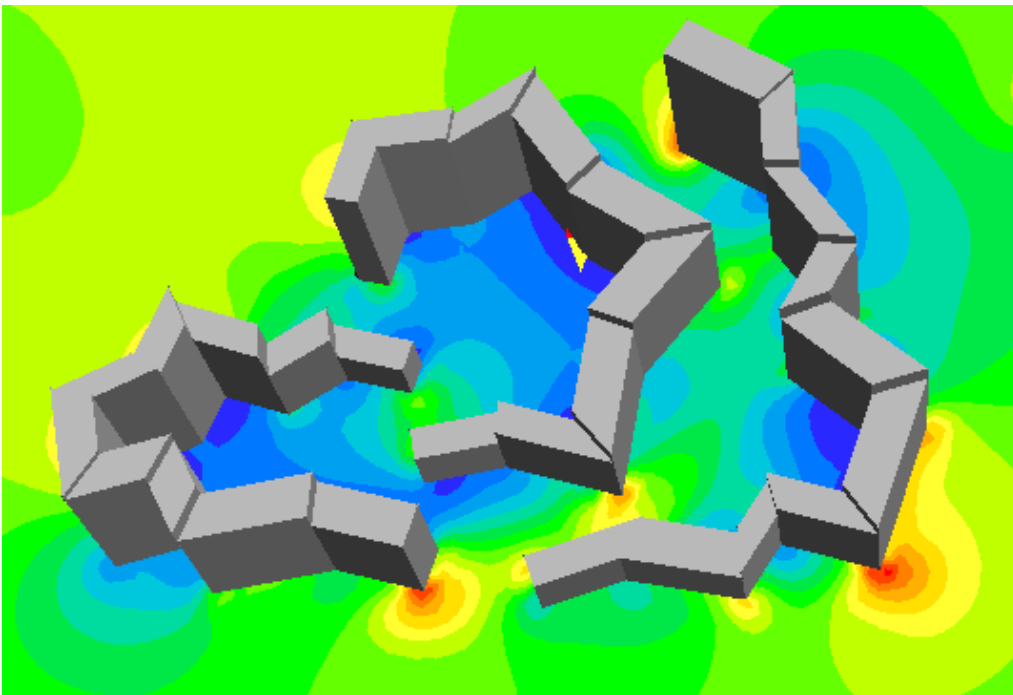


Façade as built

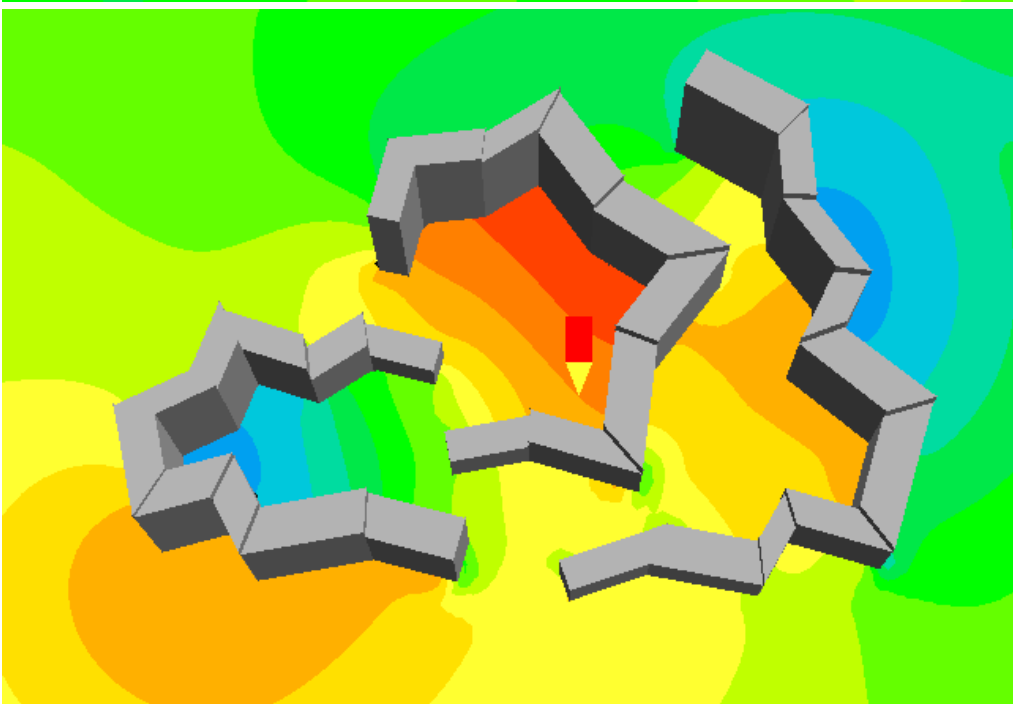




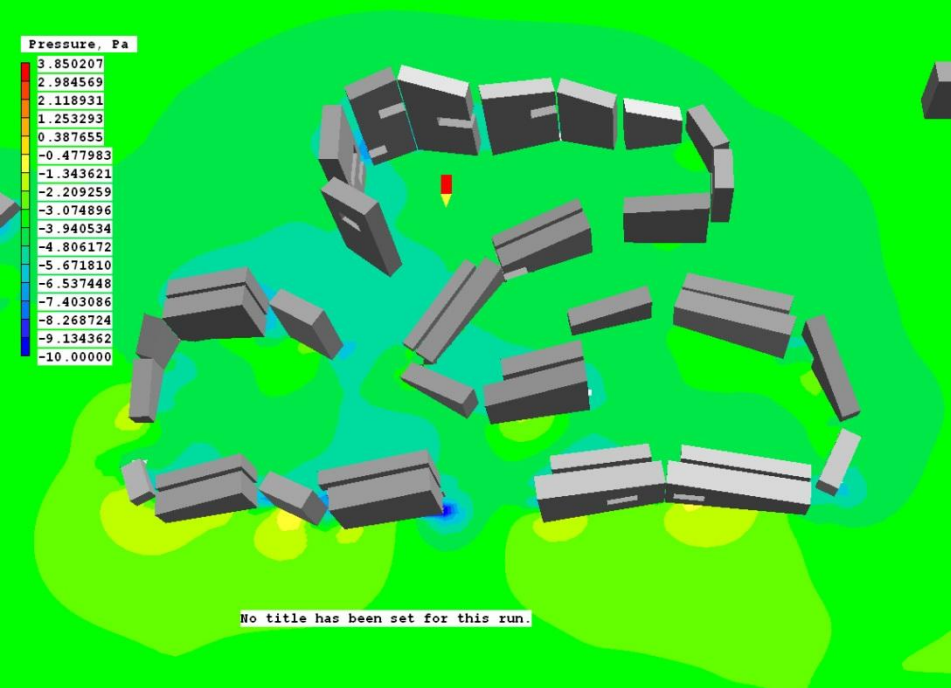
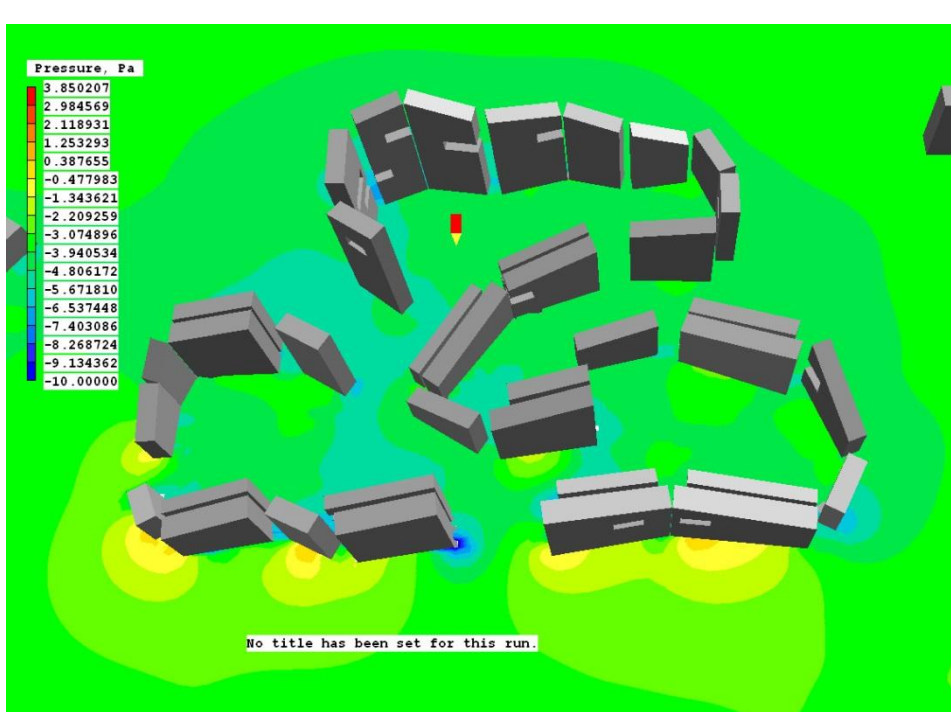
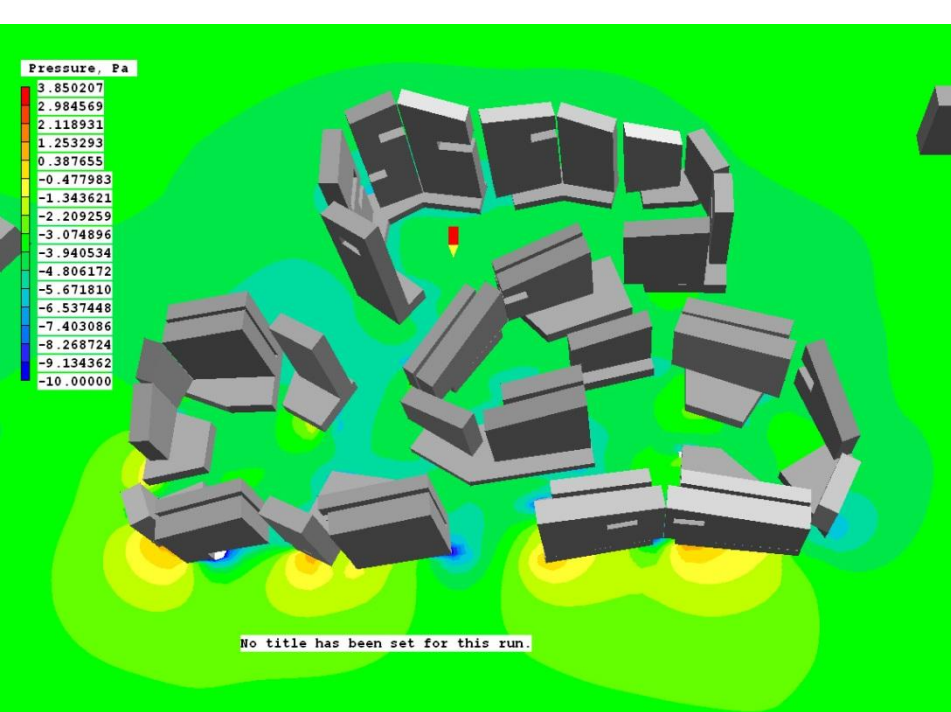
Façade upgrade in 15 years

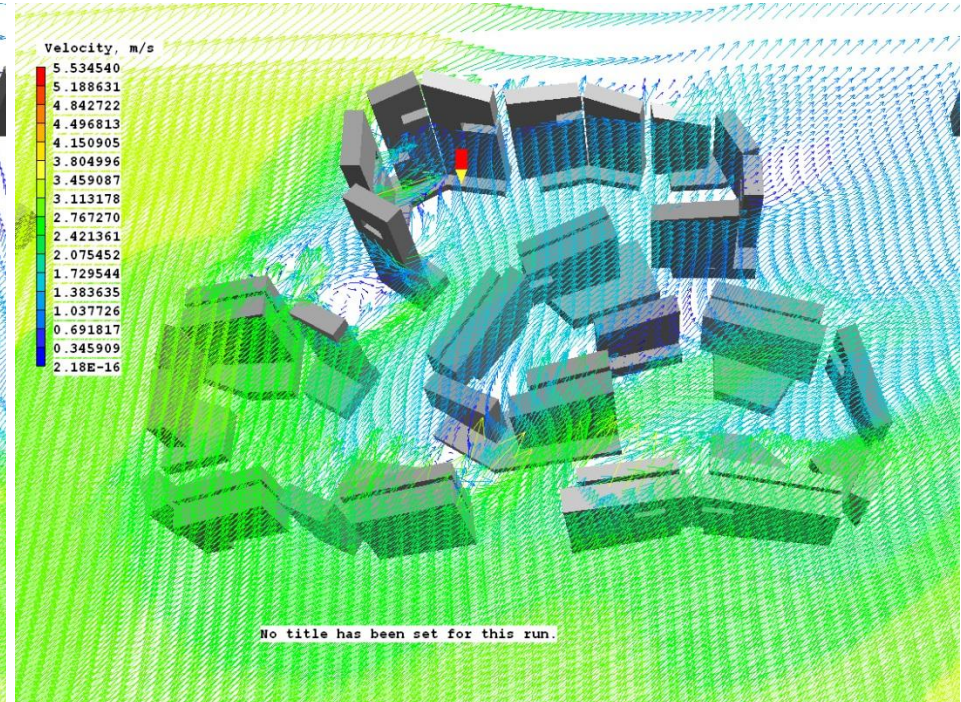
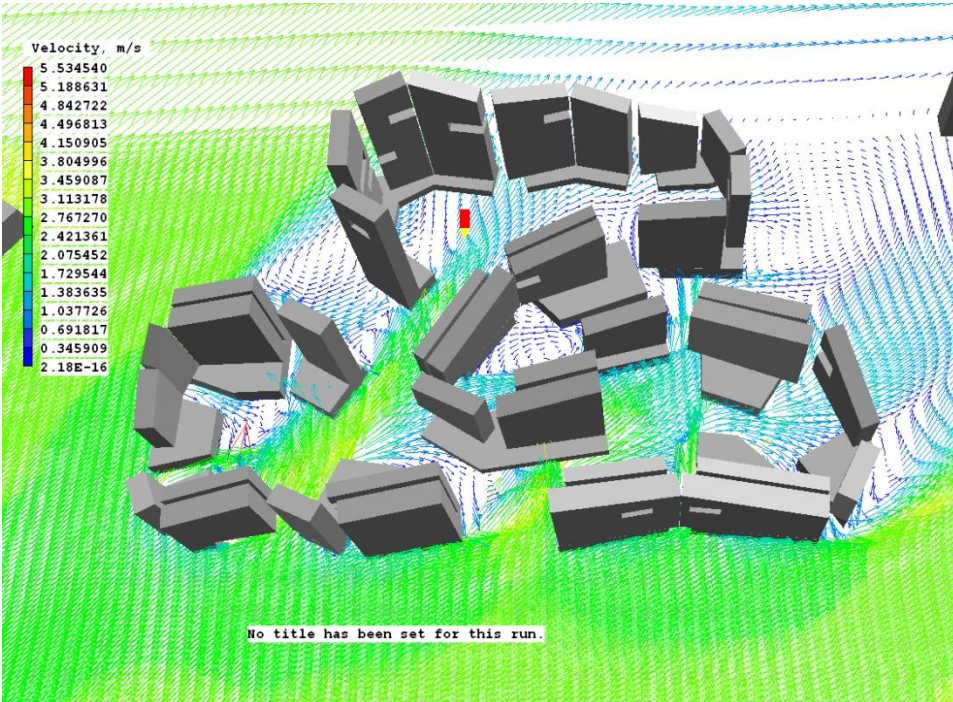
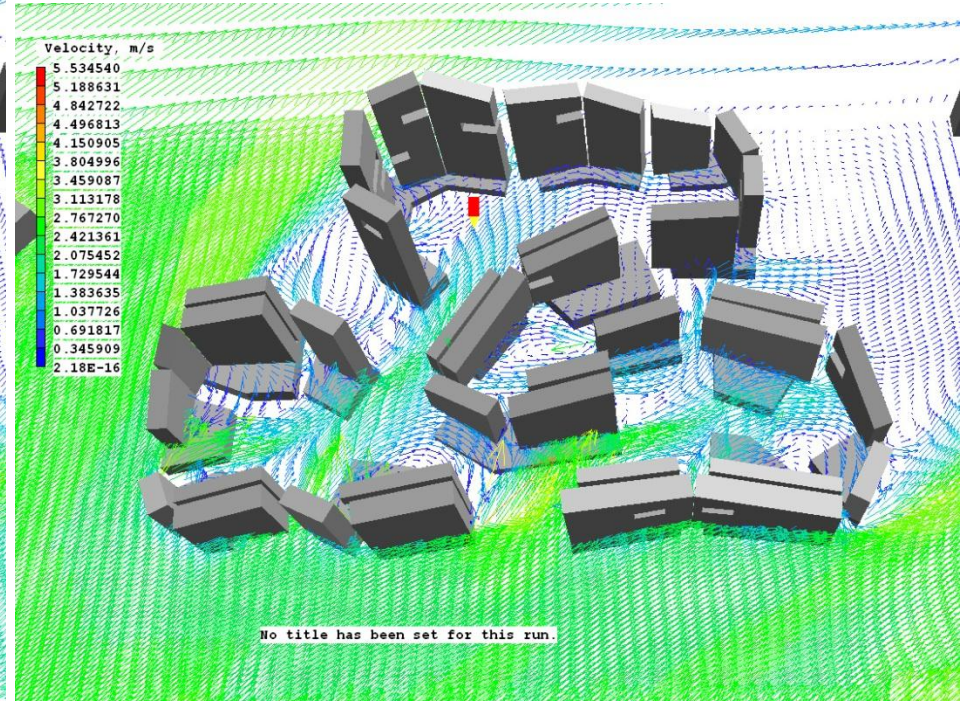
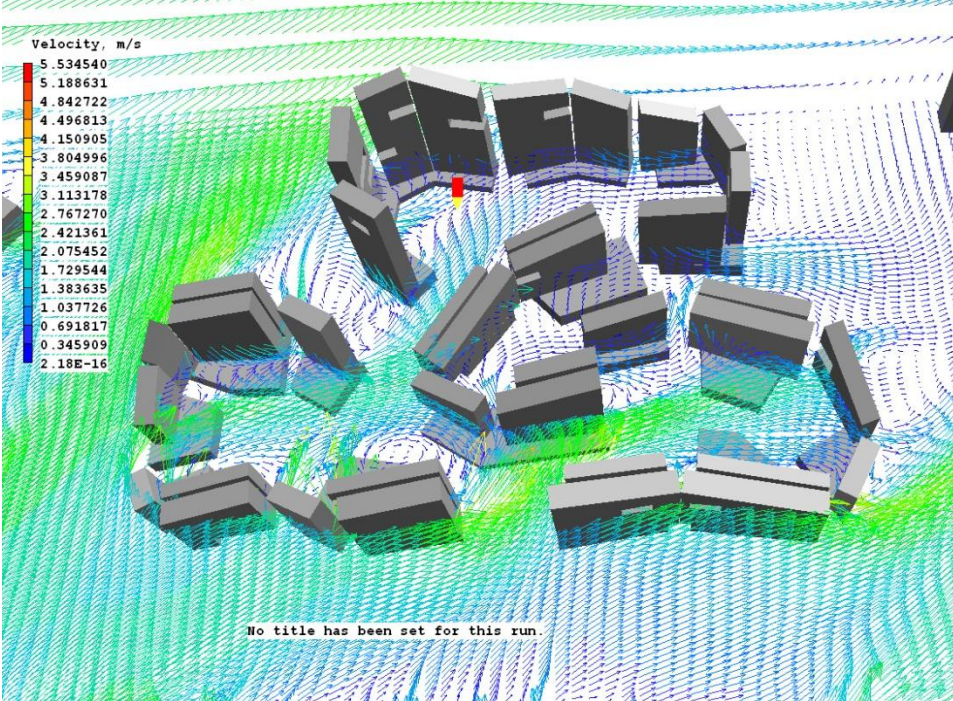


10m Wind Speed



10m Air Pressure

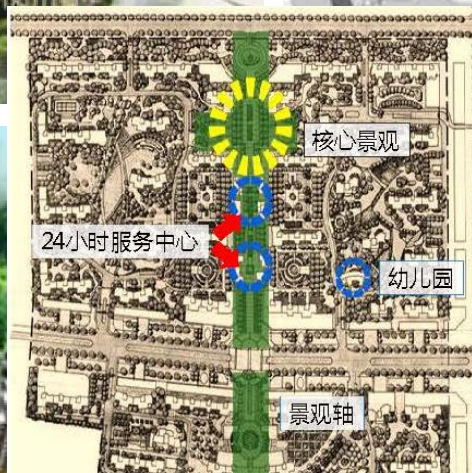
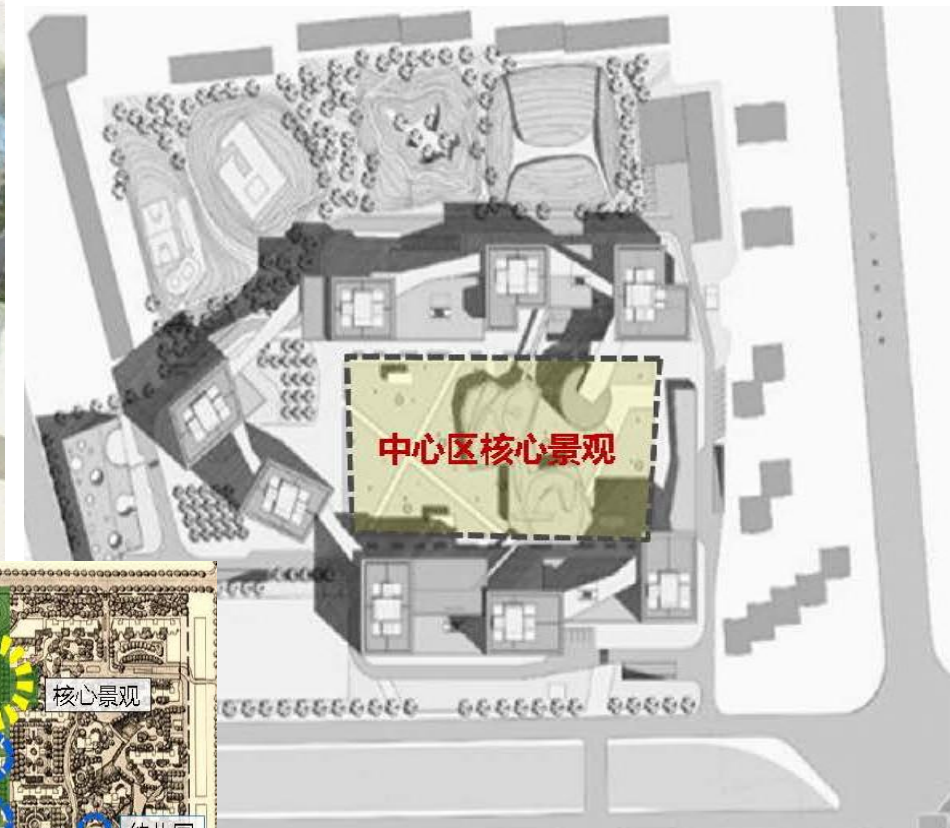




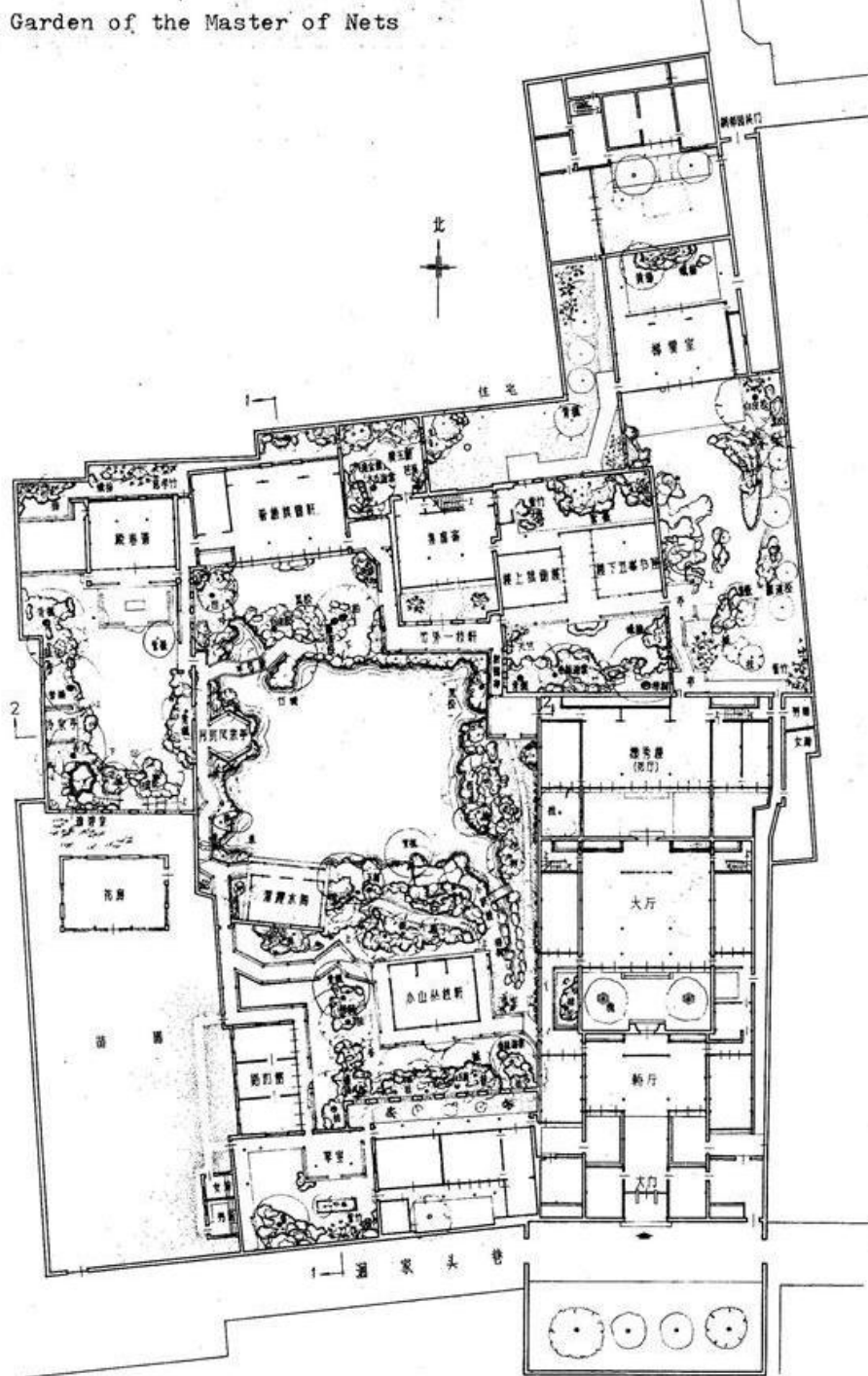


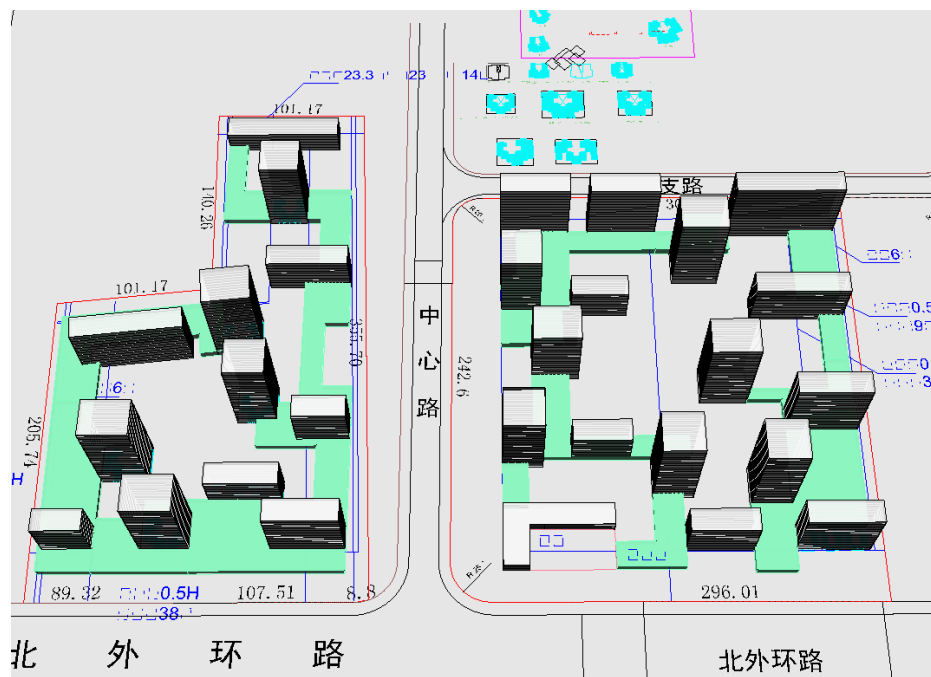
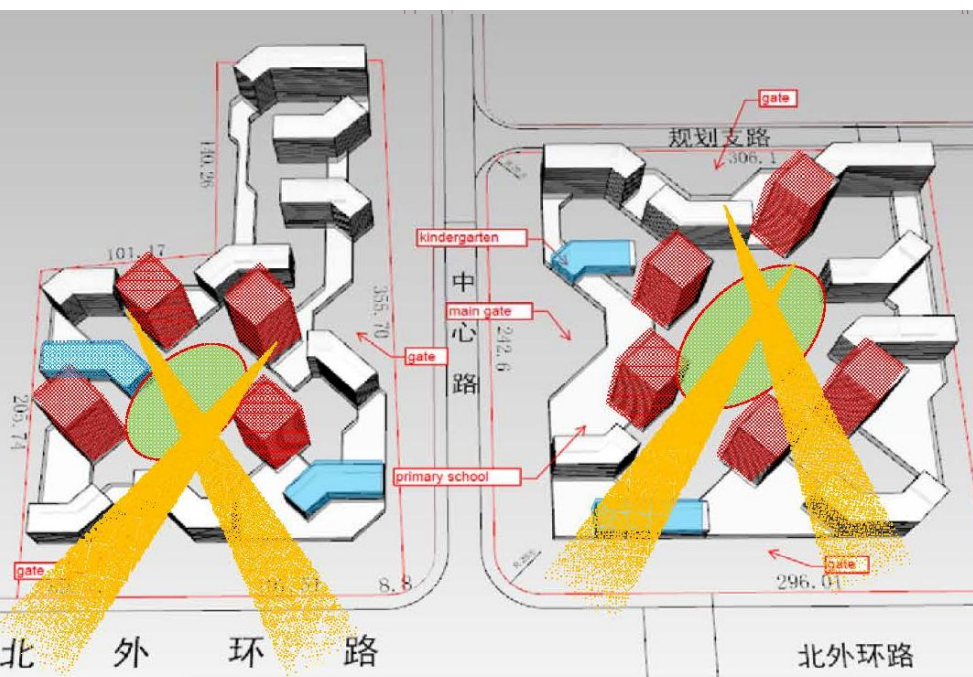
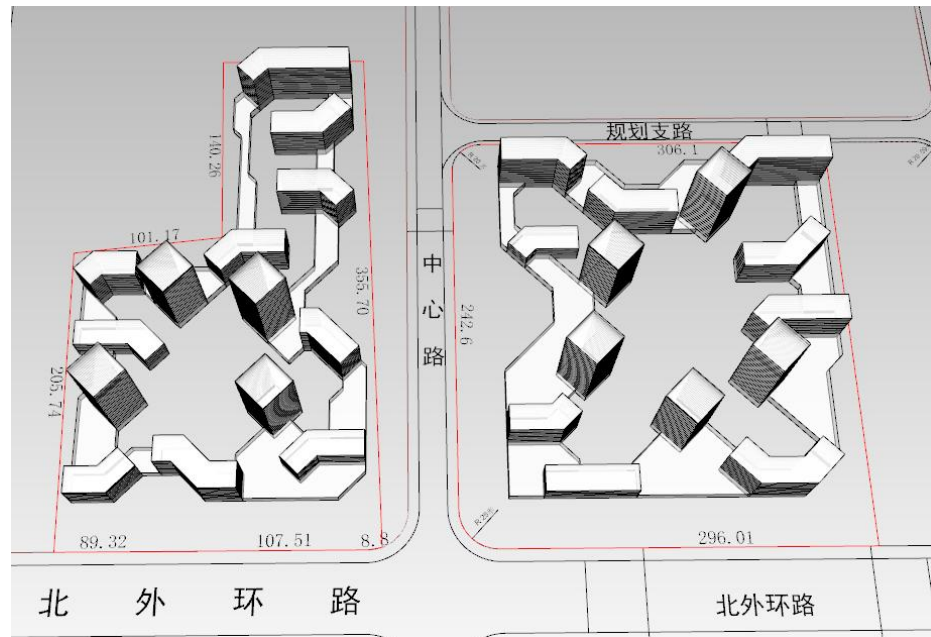
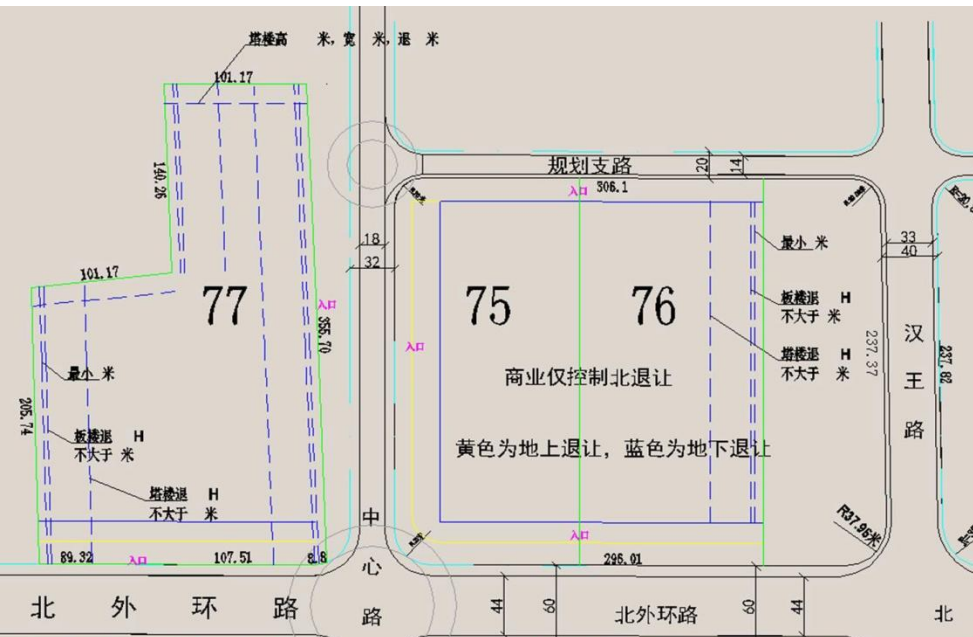
應用案例2: 空間的文化荷載 關注空間秩序而非形式表達

Application 2: Cultural Space
Spatial Order rather than Formal Expression

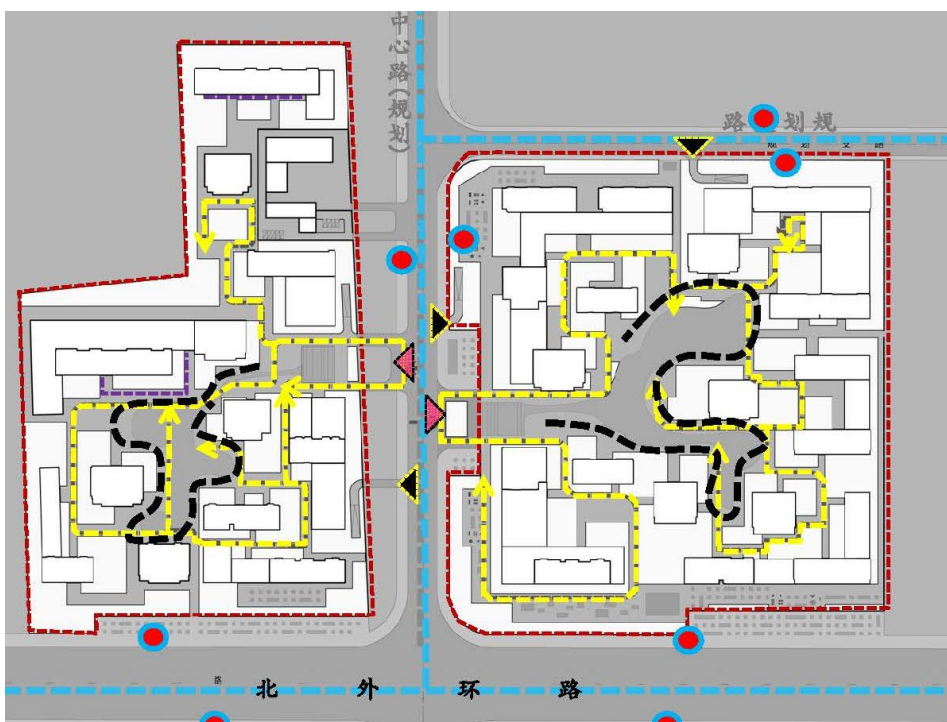


The Garden of the Master of Nets











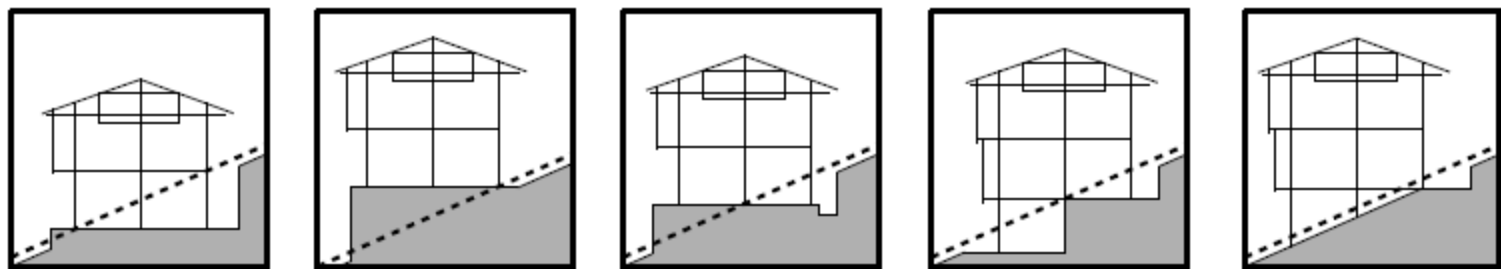
北外环路



應用案例3: 乡土城市设计
不等於表面複雜的形式從地貌到建築形態

Application 3: Vernacular Urban Design
Not Seemingly Complex form-
From Land Form to Building Form





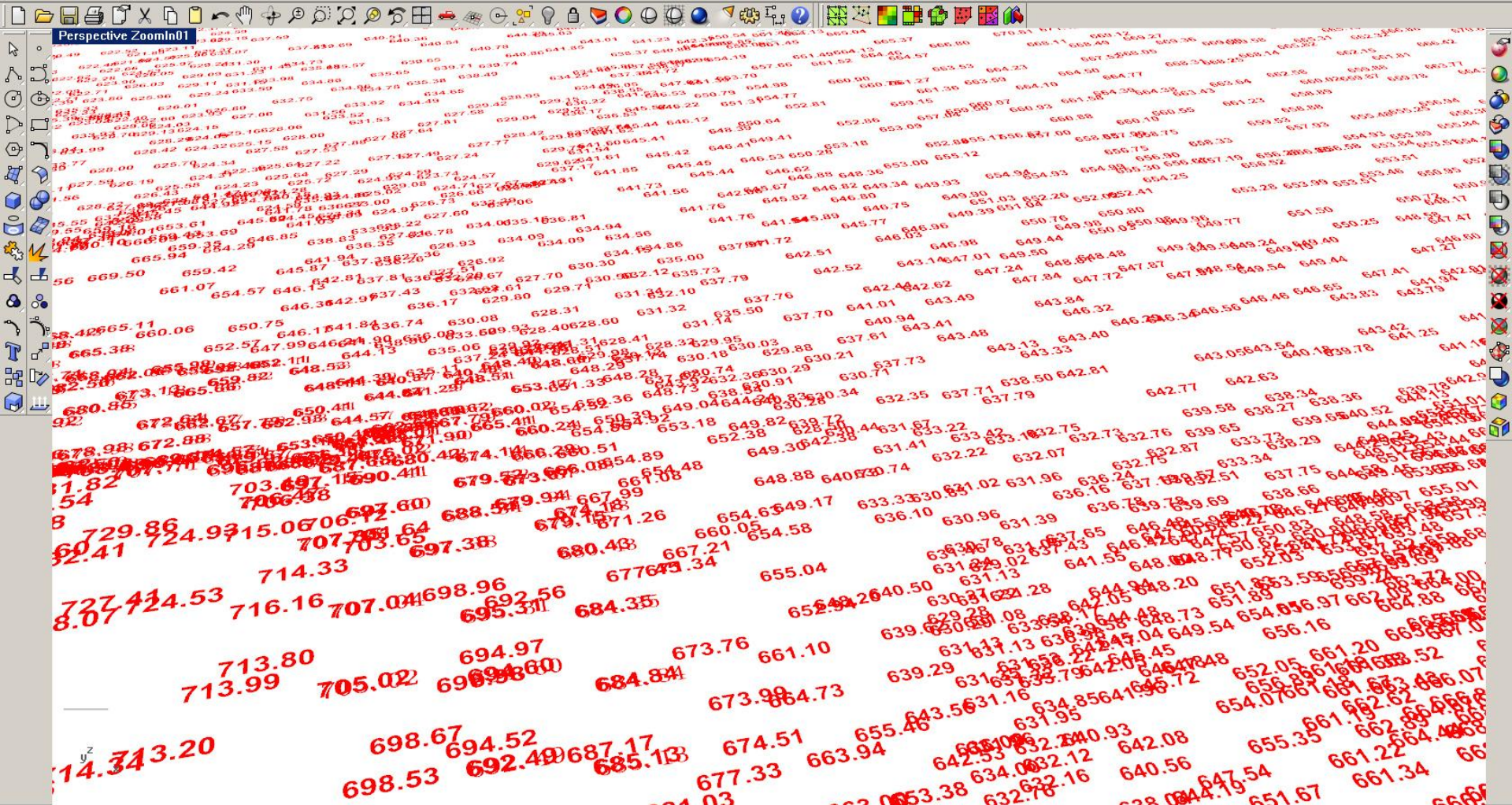


Named view to restore (RestoreBackgroundBitmap=No): "Perspective ZoomIn01"

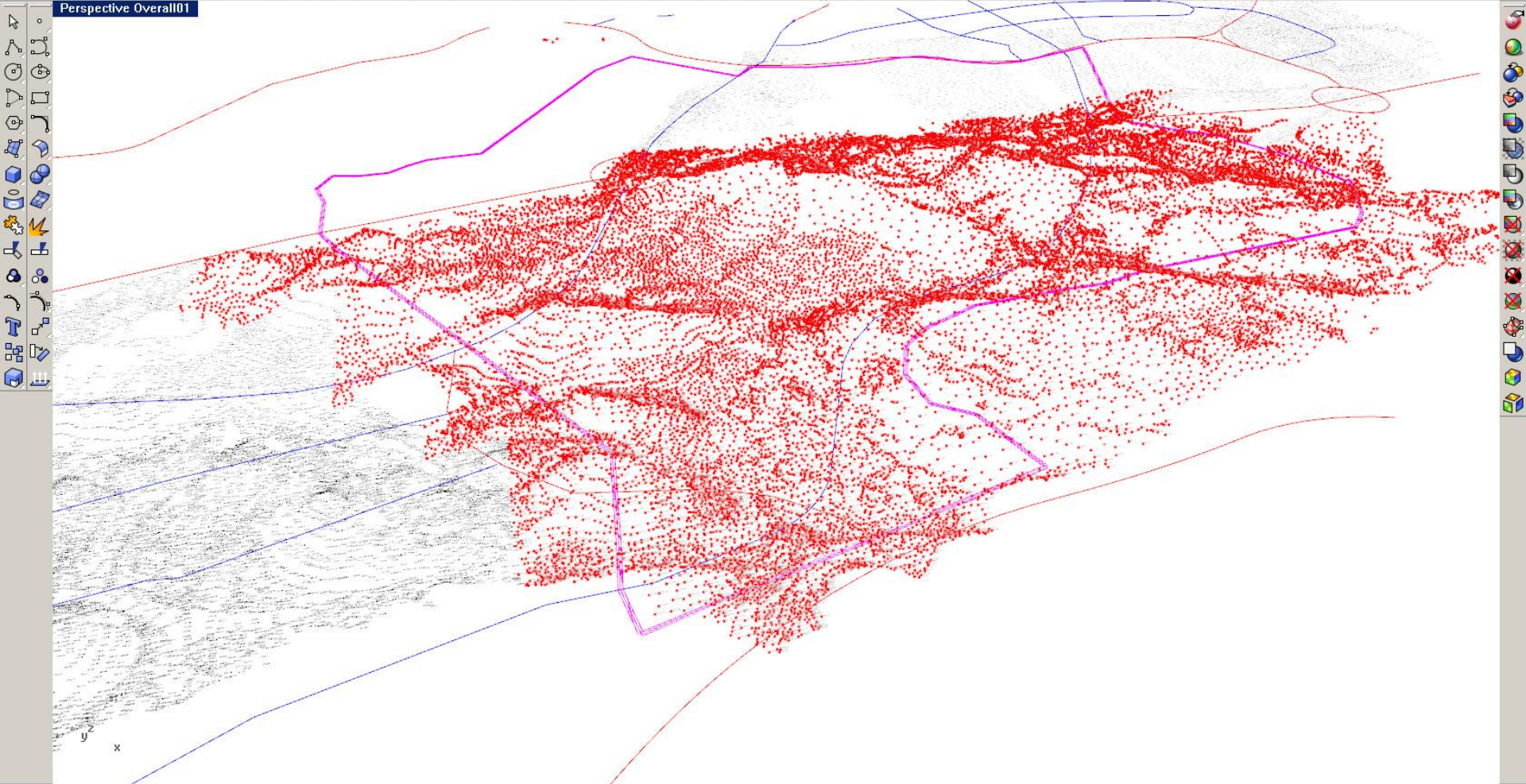
Choose named view option (List Save Restore Delete Rename Import); _Enter

Choose named view option (List Save Restore Delete Rename Import);

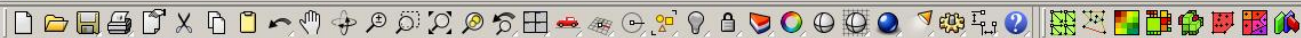
Command:



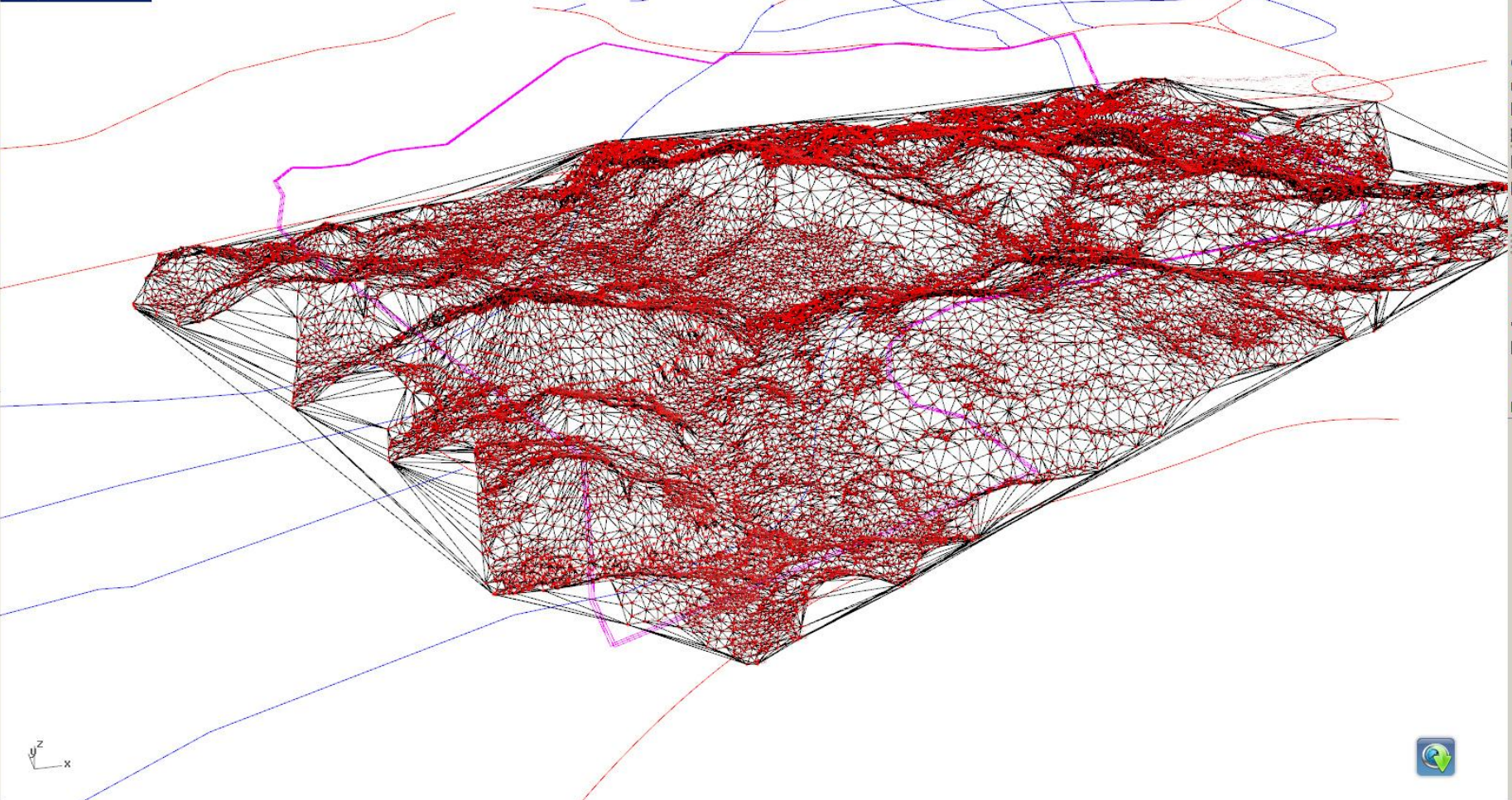
Named view to restore (RestoreBackgroundBitmap=No): "Perspective Overall01"
Choose named view option (List Save Restore Delete Rename Import): _Enter
Choose named view option (List Save Restore Delete Rename Import):
Command:

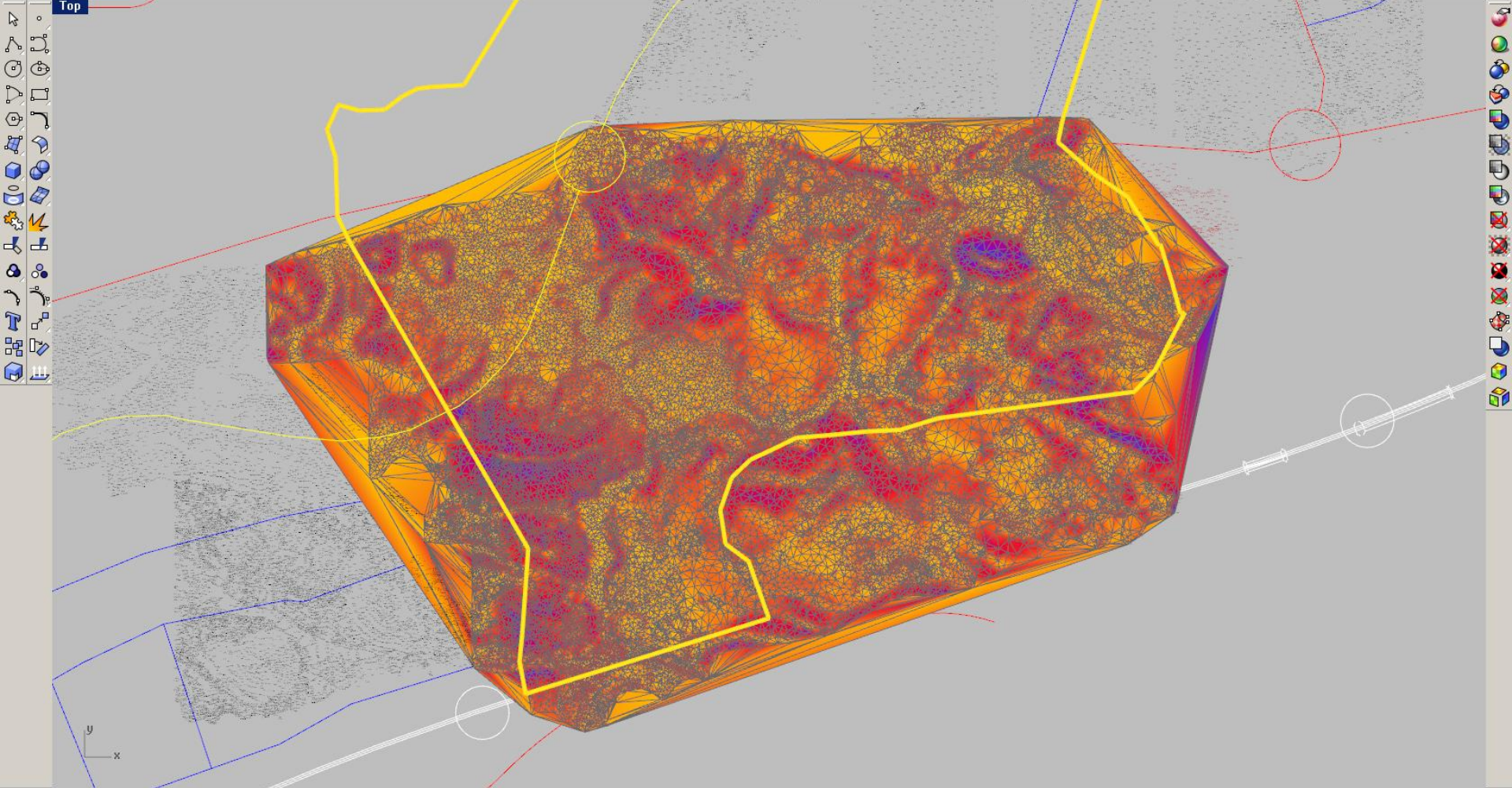
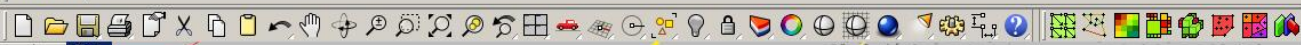


Command: _Delaunay
Delaunay triangulation options (Noise=0 Guide=None Cullers Shader=UVW Complete);
Command: _Layer
Command:



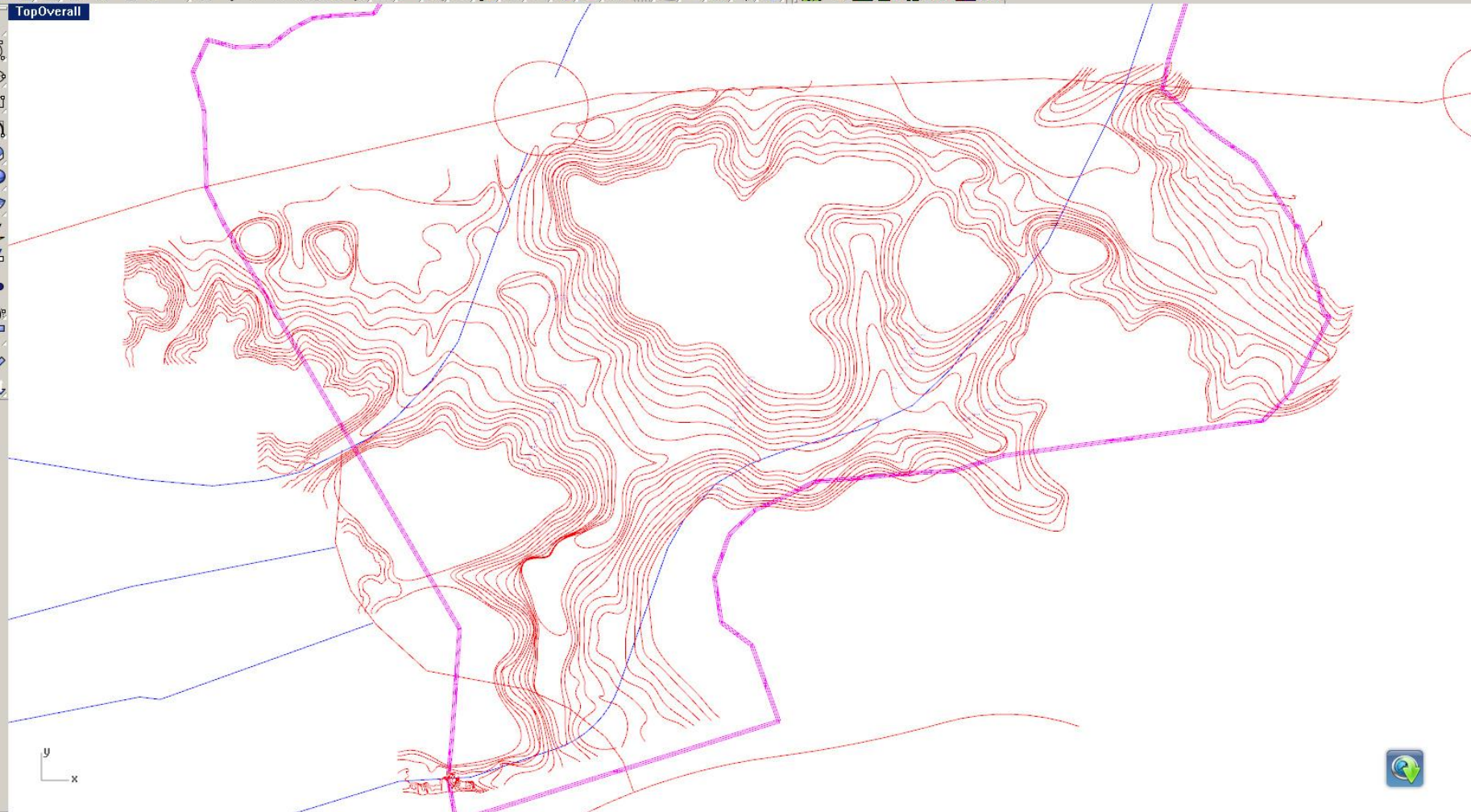
Perspective Overall01

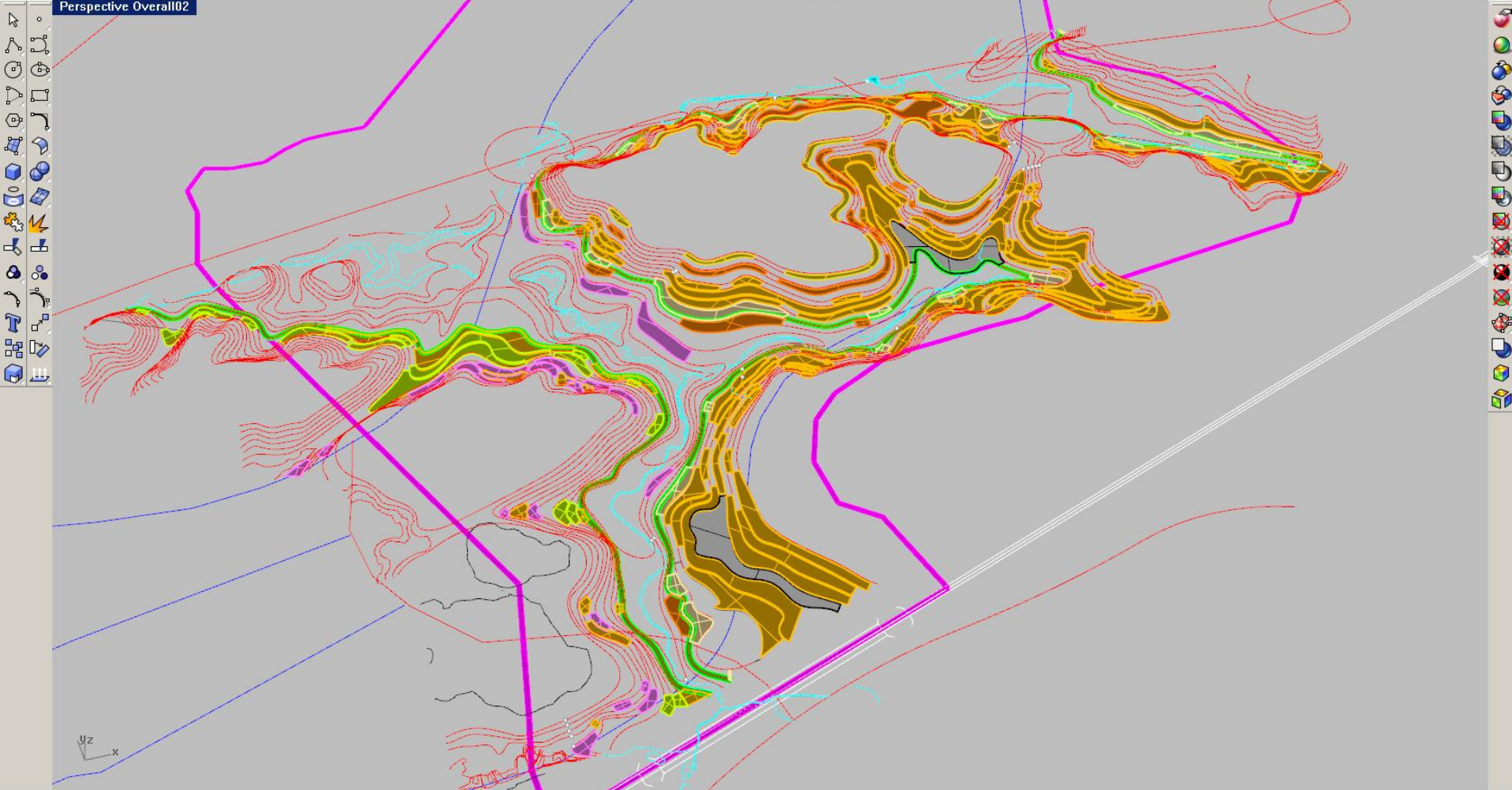






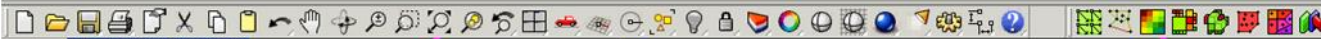
TopOverall



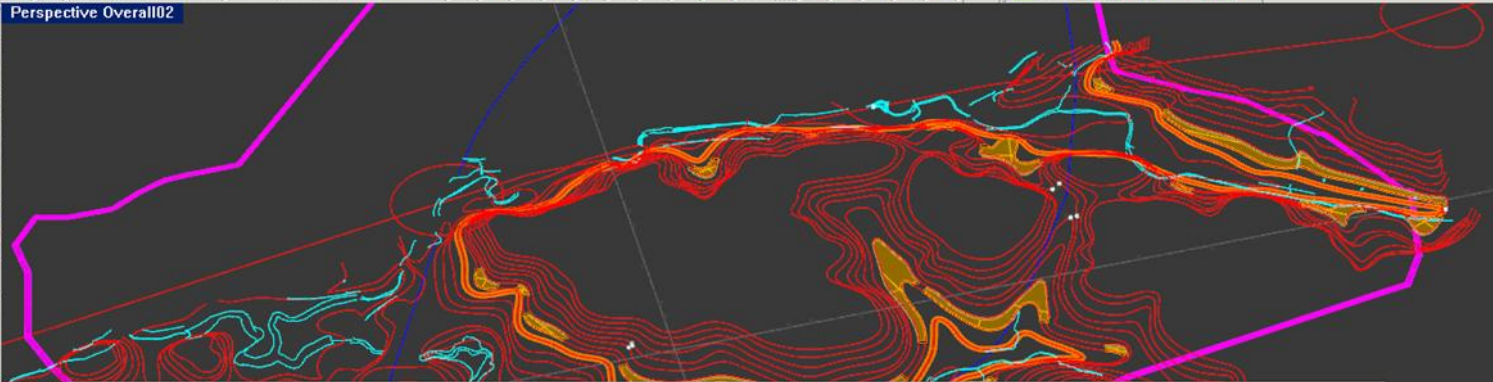


select the contour lines (from lower to higher):
select the contour lines (from lower to higher). Press Enter when done:

Command:



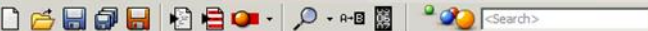
Perspective Overall02



Layers - All Layers

Name	Color	Lock	Hide	Isolate	Freeze
Default					
2D Sketch					
Construction Geo					
3D Geo					
01_Road					
02_Bldg Platform 15m					
Ref Info					
Levels					
Planning plots					
Railway					
Road Layout					
Site Boundary					
Points Coordinates within Site					
Points Coordinates outside ...					
Contour Lines					
DGX Adjacent					
DGX Primary					
DGX Secondary					
Valley Bottom					
655M Contour line					
Stream					
Generative Geo					
3D Points					
Mesh Srf					
Intersecting Lines					
660m Inter					
Generative Annotations					
level labels					

DetectingSuitableBldgPlatform.rvb* - Code Monkey



DetectingSuitableBldgPlatform.rvb* [unsaved]

```

13  dblThresh = rhino.GetReal("what is the minimal threshold to generate the loft lines",10,1,1000)
14  If isnull(dblThresh) Then Exit Sub
15
16  dblStpCrv = rhino.GetReal("what is the spacing you want the detecting point to be?",1,0.1,10^6)
17  If isnull(dblStpCrv) Then Exit Sub
18
19  strToProPlane = rhino.GetObject("select the reference plane to be projected (the plane has to be on z=0)",8)
20  If isnull(strToProPlane) Then Exit Sub
21
22
23  'Call rhino.EnableRedraw(False)
24  For i =0 To ubound(strCrvs)-1
25
26      Dim domCrvA, stpCrvA, lenCrvA, j
27      j=0
28      lenCrvA = rhino.CurveLength(strCrvs(i))
29
30      'this is to make sure that the detecting space is less one 1/10 of the curve length
31      If dblStpCrv > 0.1*lenCrvA Then
32          dblStpCrv = lenCrvA
33      End If
34
35      domCrvA = rhino.CurveDomain(strCrvs(i))
36      stpCrvA = (domCrvA(1)-domCrvA(0))/Rhino.Floor(lenCrvA/dblStpCrv)
37
38      Dim strCrvPlane, arrVecPro, arrNewCrv, arrPtTar, strNewCrv, tCrvA, tCrvB
39      tCrvA=domCrvA(0)
40      arrPtTar = rhino.CurveStartPoint(strCrvs(i))
41      strCrvPlane = rhino.CopyObject(strToProPlane, array(0,0,0), array(0,0, arrPtTar(2)))
42      arrVecPro = rhino.VectorCreate(array(0,0,-100), array(0,0,0))

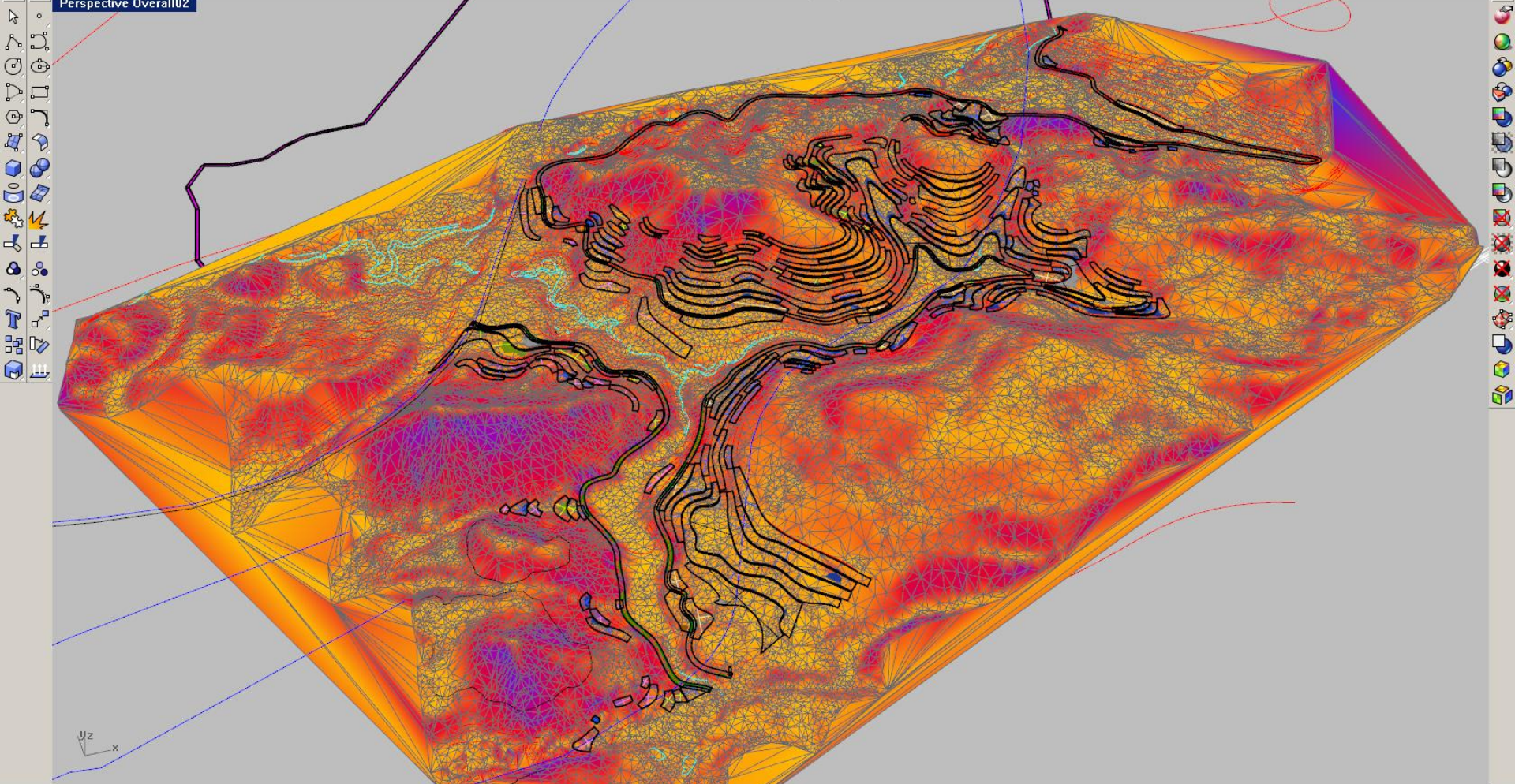
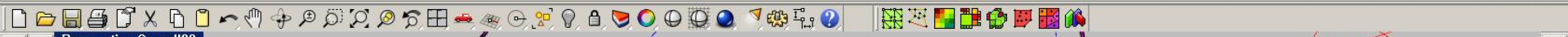
```

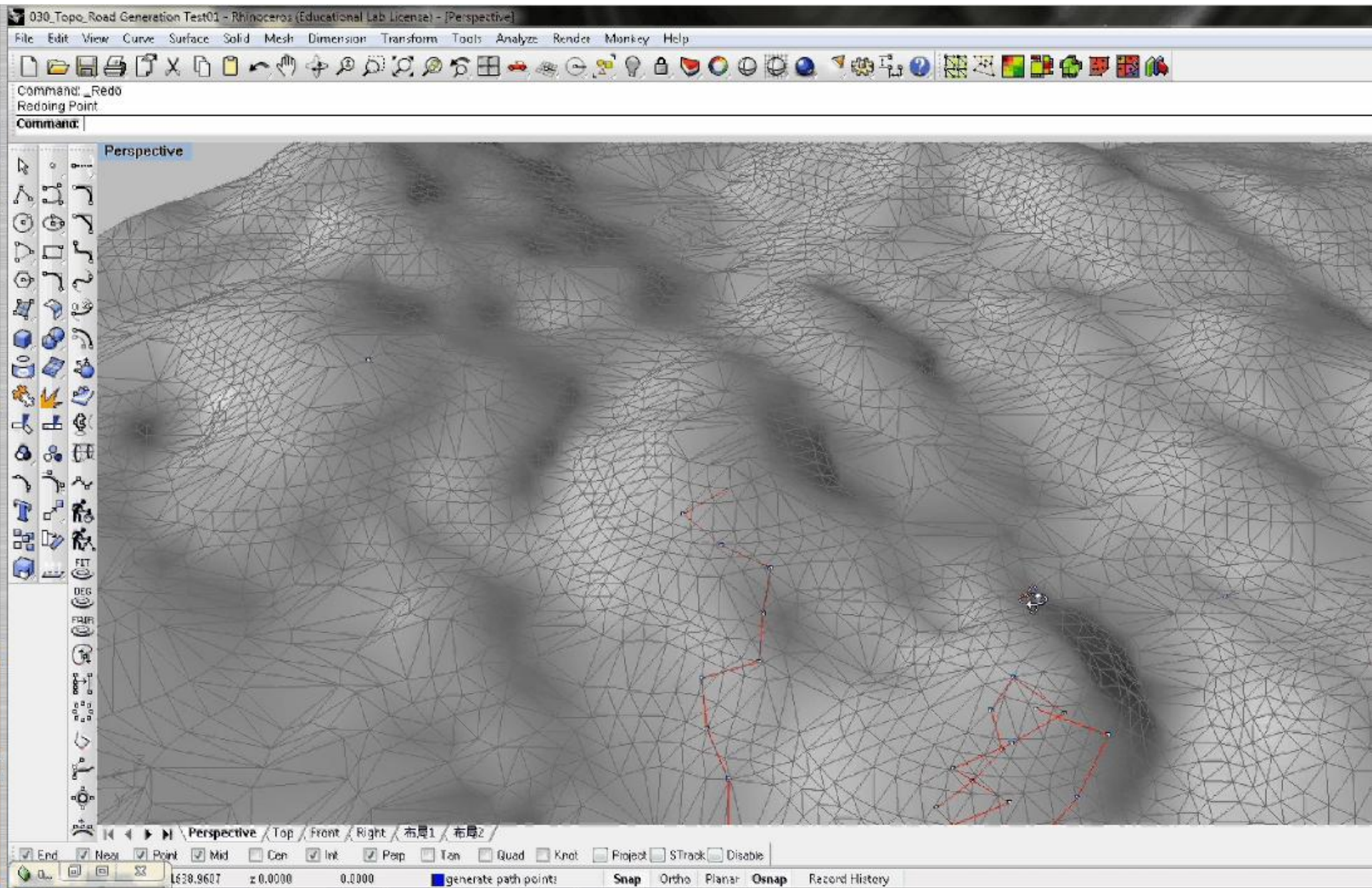
CamStudio

File Region Options Tools View Help

Record to A

Press the Stop Button to stop recording

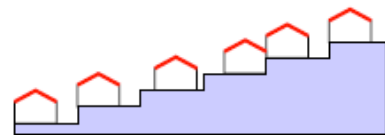
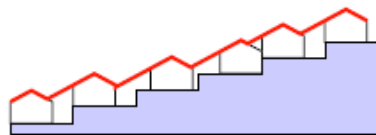
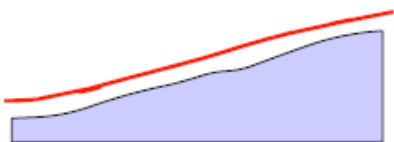




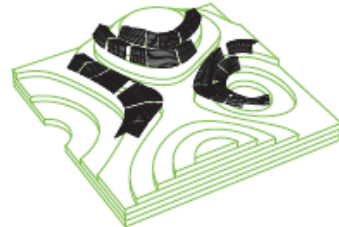
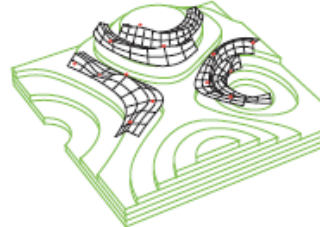
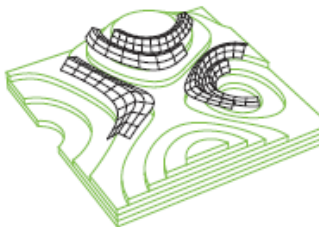
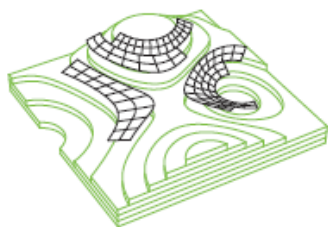
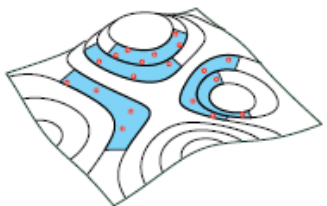
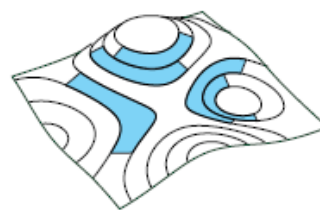
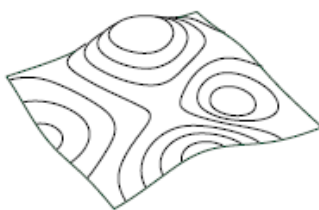
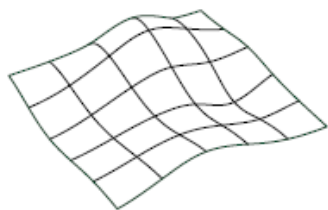
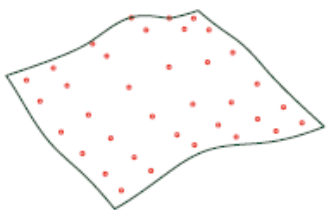


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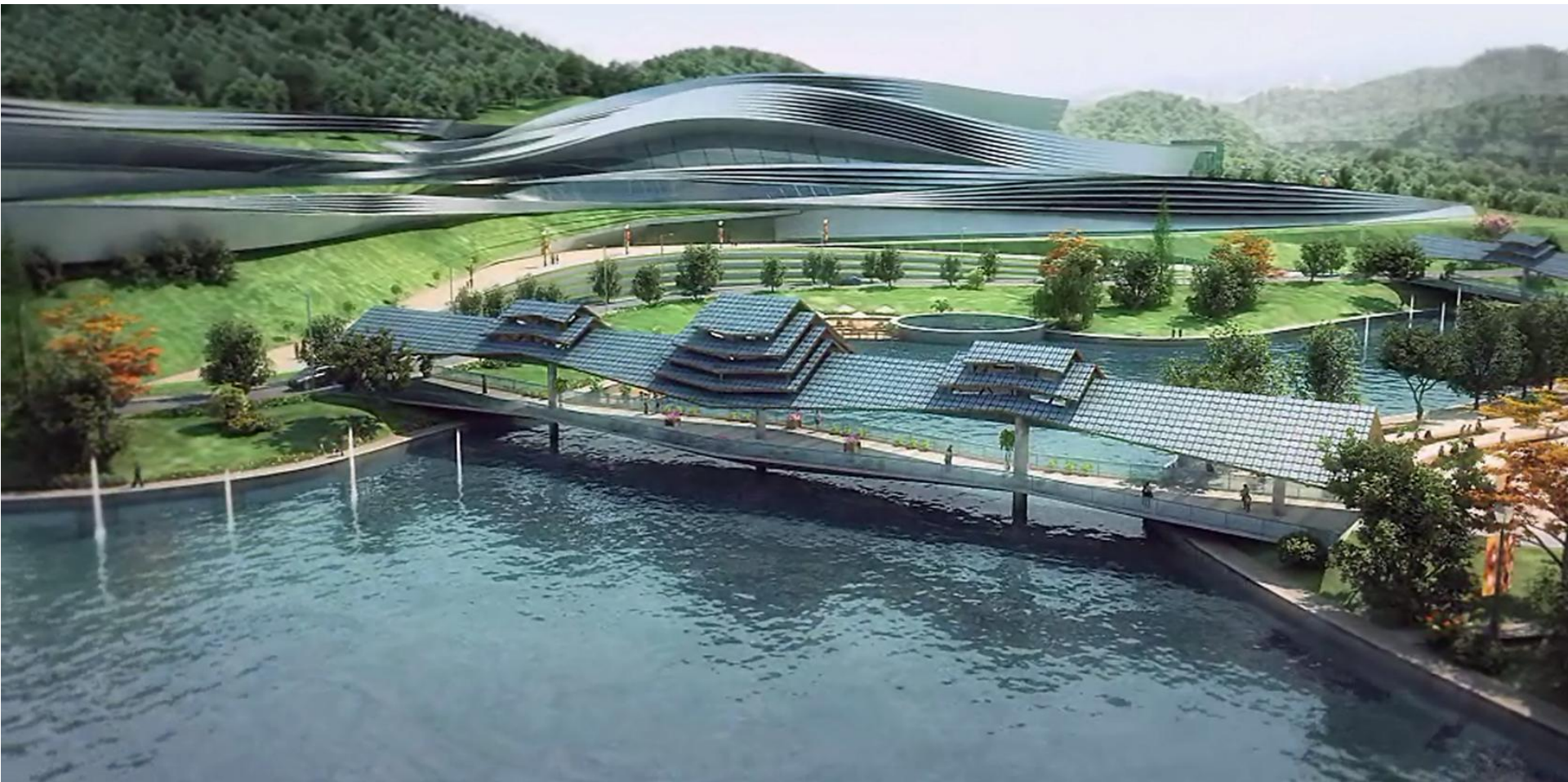


Adaptive building generation to topography and programmatic dimensions









謝謝！
Thank you!