

BIM Application in Material Take-Off

建筑信息模型(BIM)在材料测量/量算的应用

Presented by

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Outline of Presentation

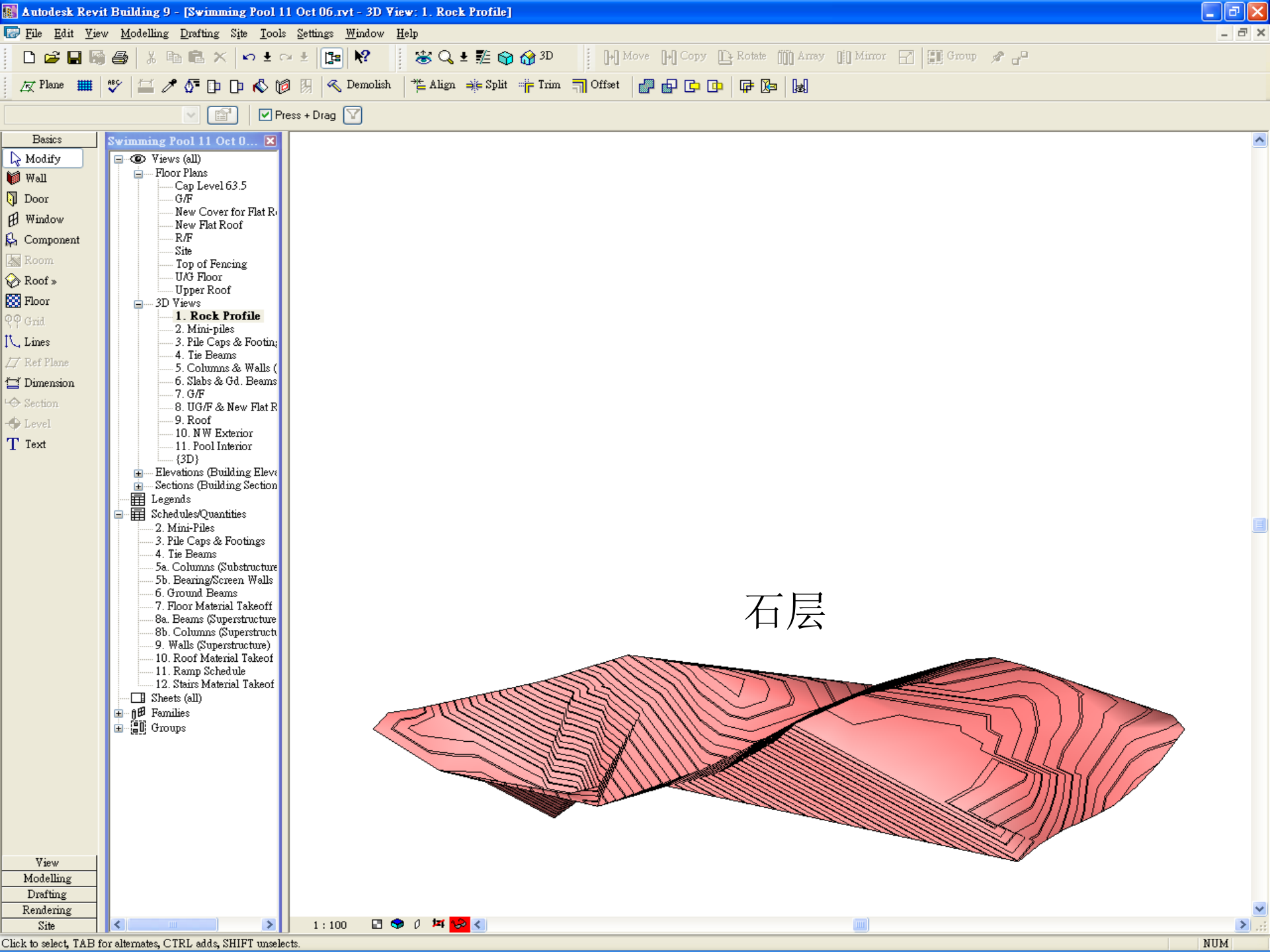
演讲程序

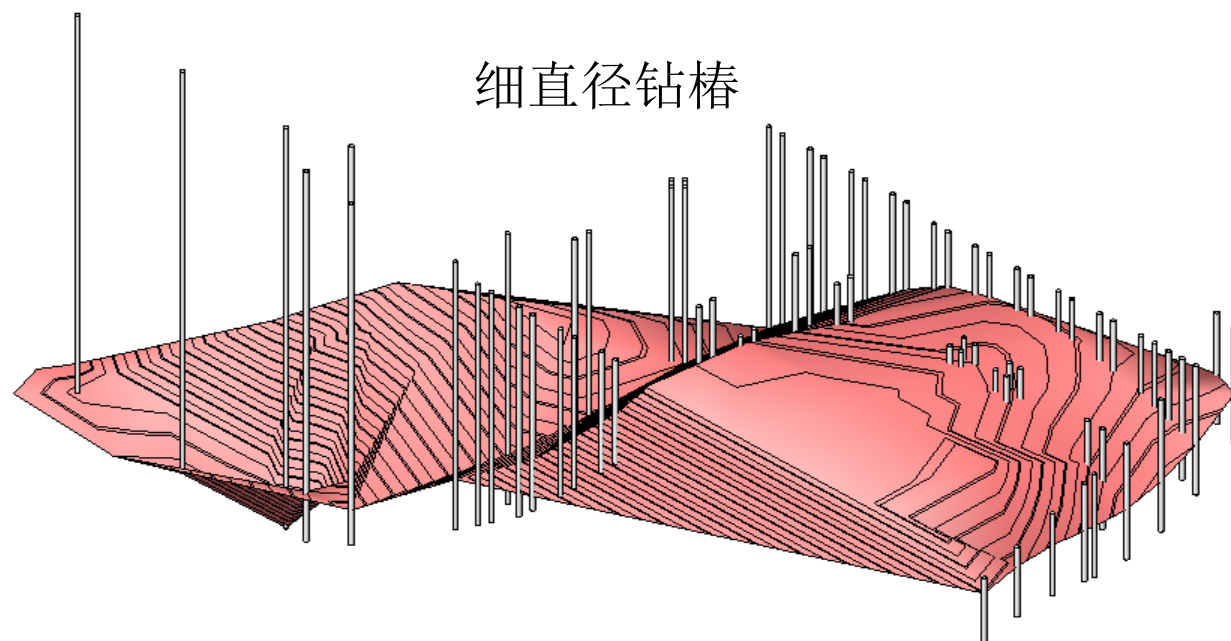
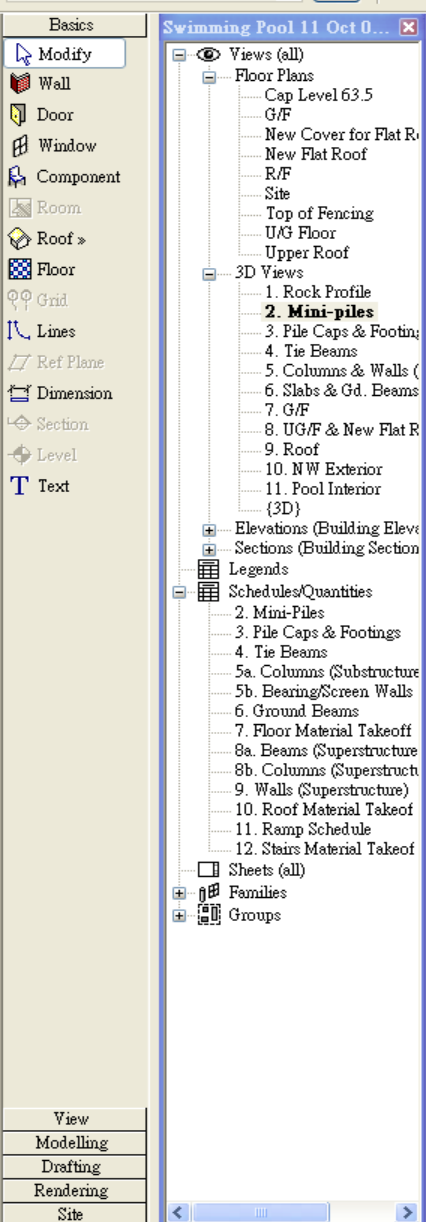
- Introduction to the BIM Case Study
建筑信息模型个案简介
- Material Take-Off Practice in Hong Kong
香港的工料测量(材料量算)工作
- Material Take-off Features in Revit
Revit 材料量算工能
- Material Take-Off with BIM: Key Points
应用 BIM 在材料量算的注意事项
- Conclusion
总结

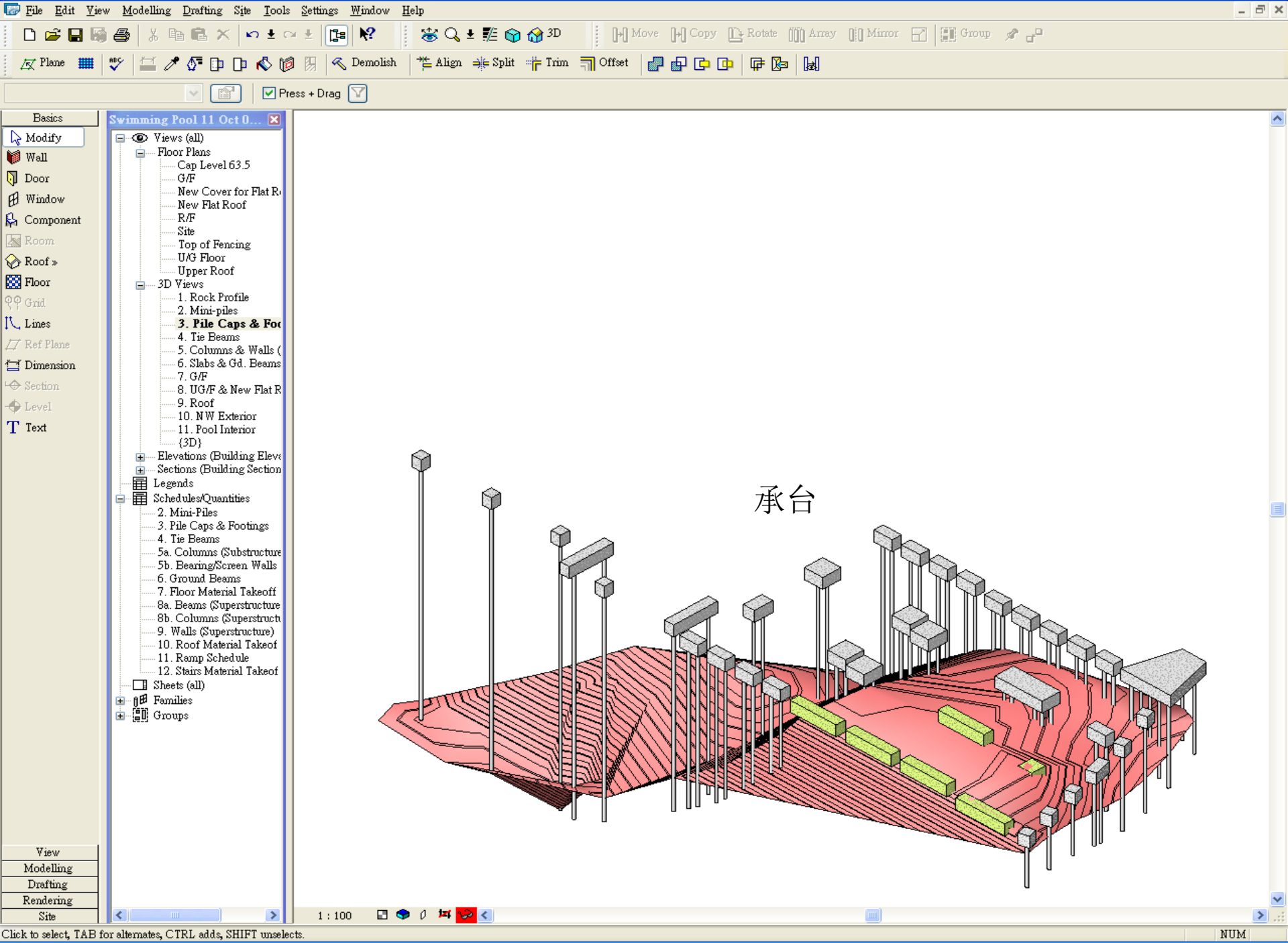
Introduction to the BIM Case Study

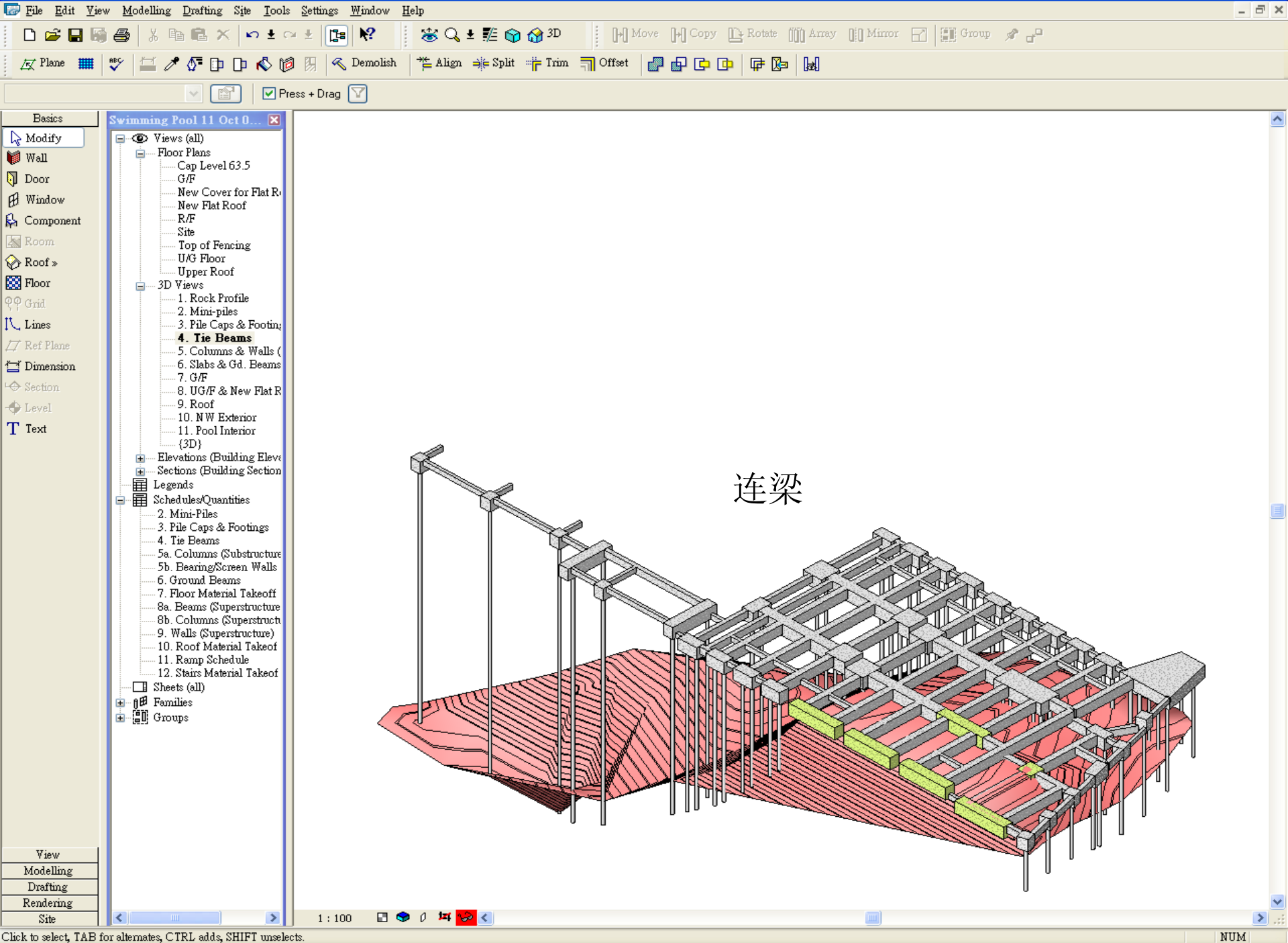
建筑信息模型个案简介

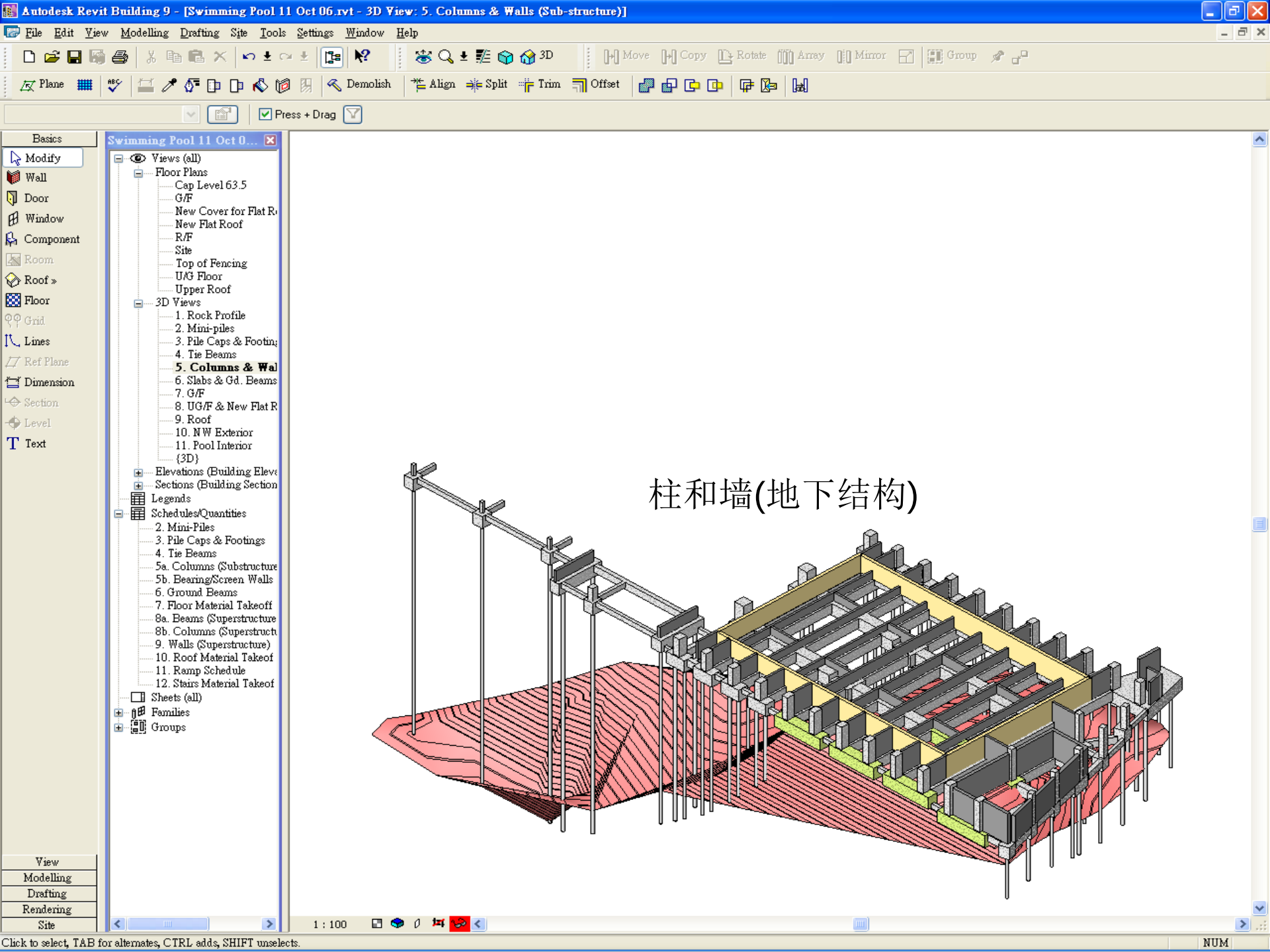
- A new in-door swimming pool for Fukien Secondary School, Hong Kong
香港福建中學新建游泳池
- Project Management, Quantity Surveying & Modelling - The Hong Kong Polytechnic University (Dr. Andy Wong & Mr. Kenny Tse)
項目管理, 工料測量與建模 - 香港理工大学 (王金殿博士, 谢道超先生)
- Construction Period: Nov 2006 to Aug 2007
施工期: 2006年11月至2007年8月

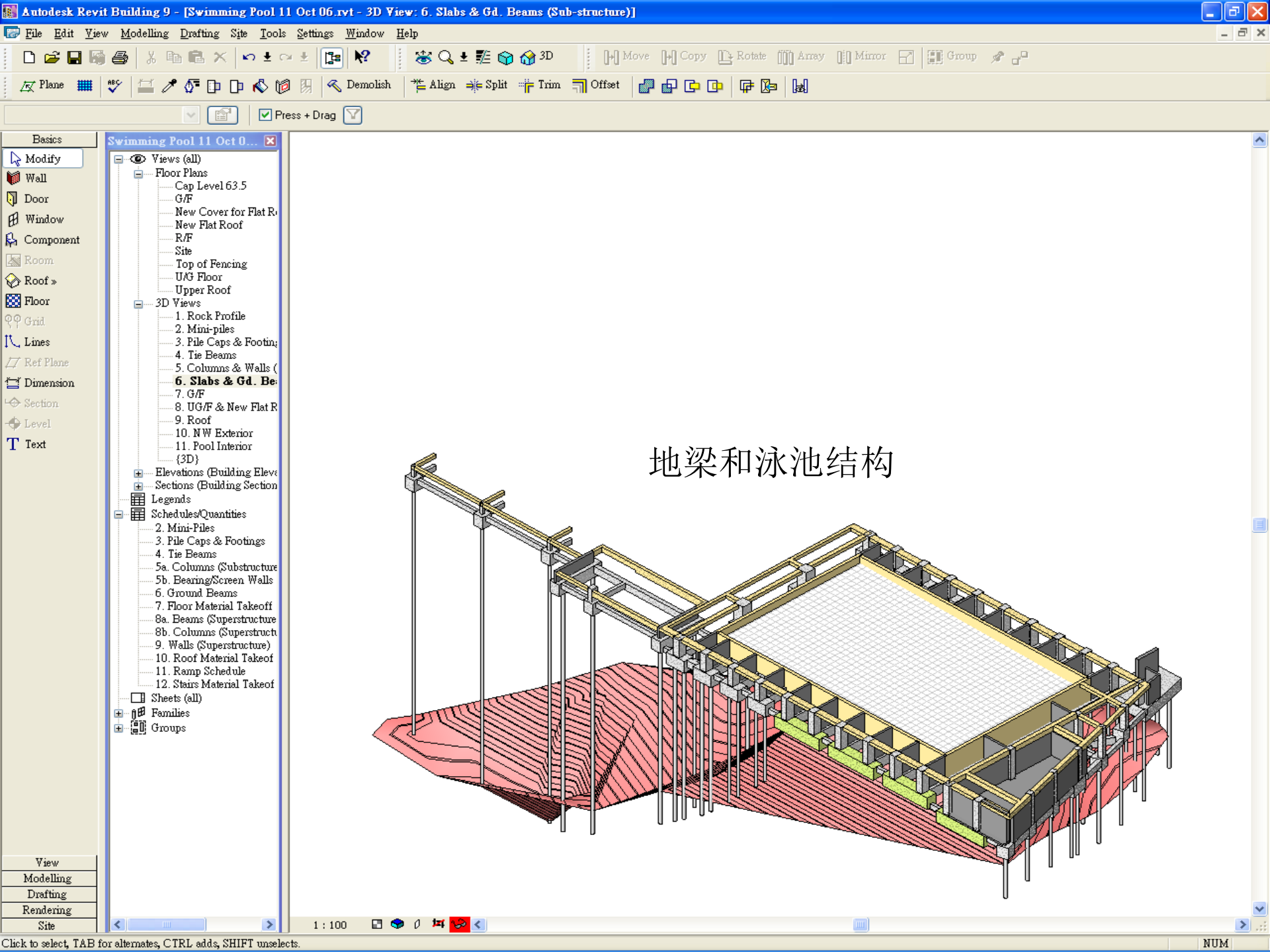


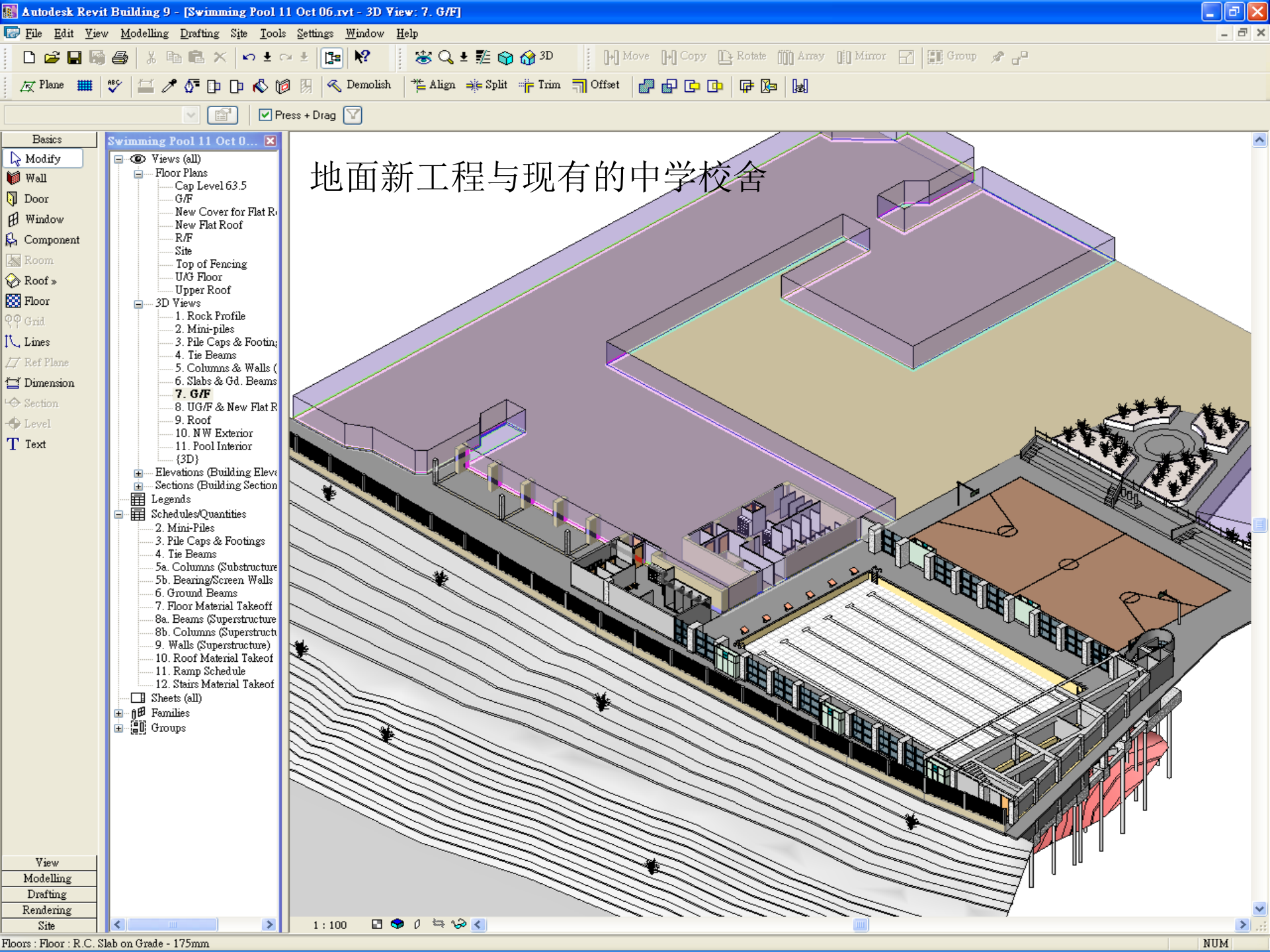


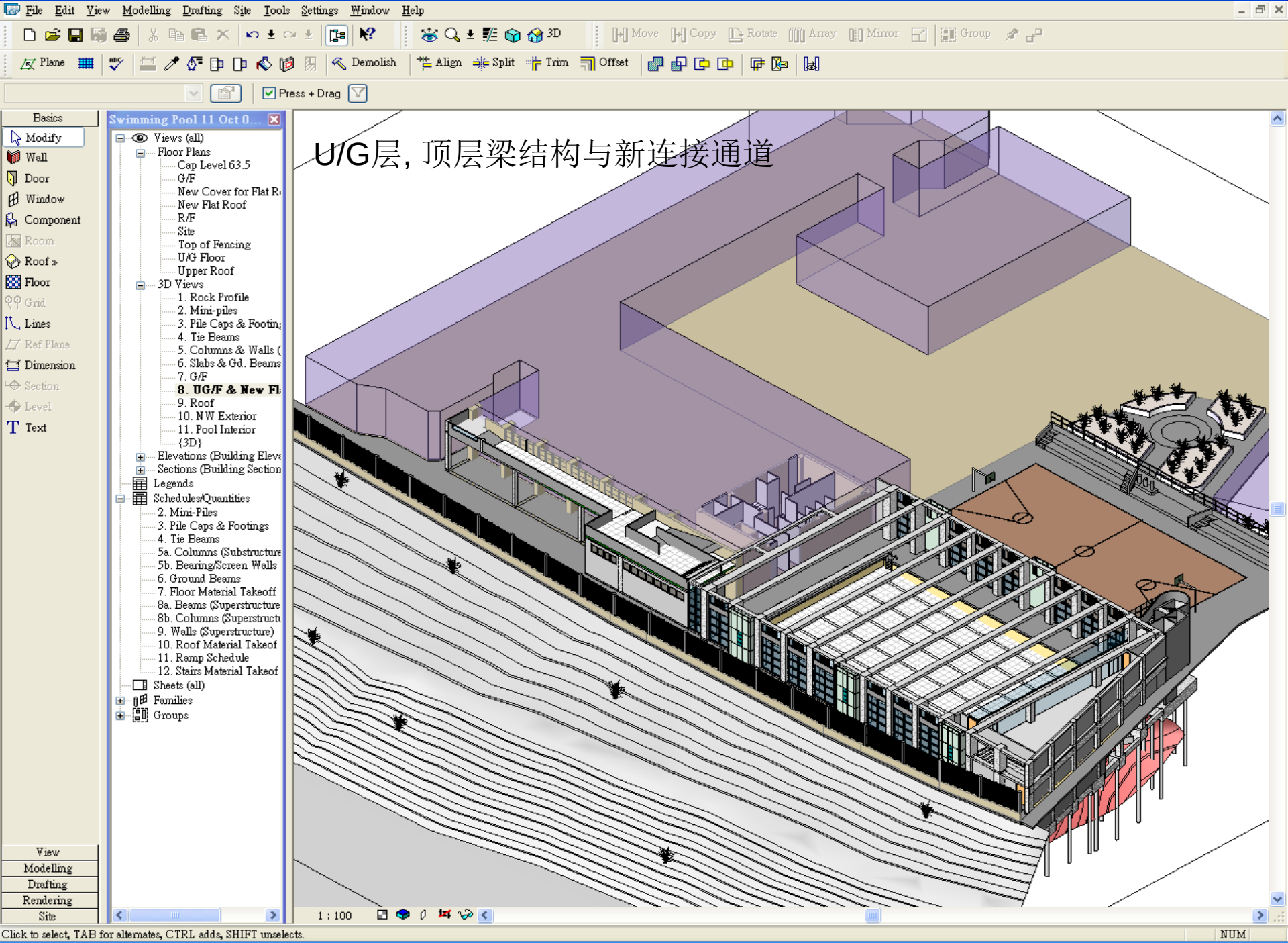












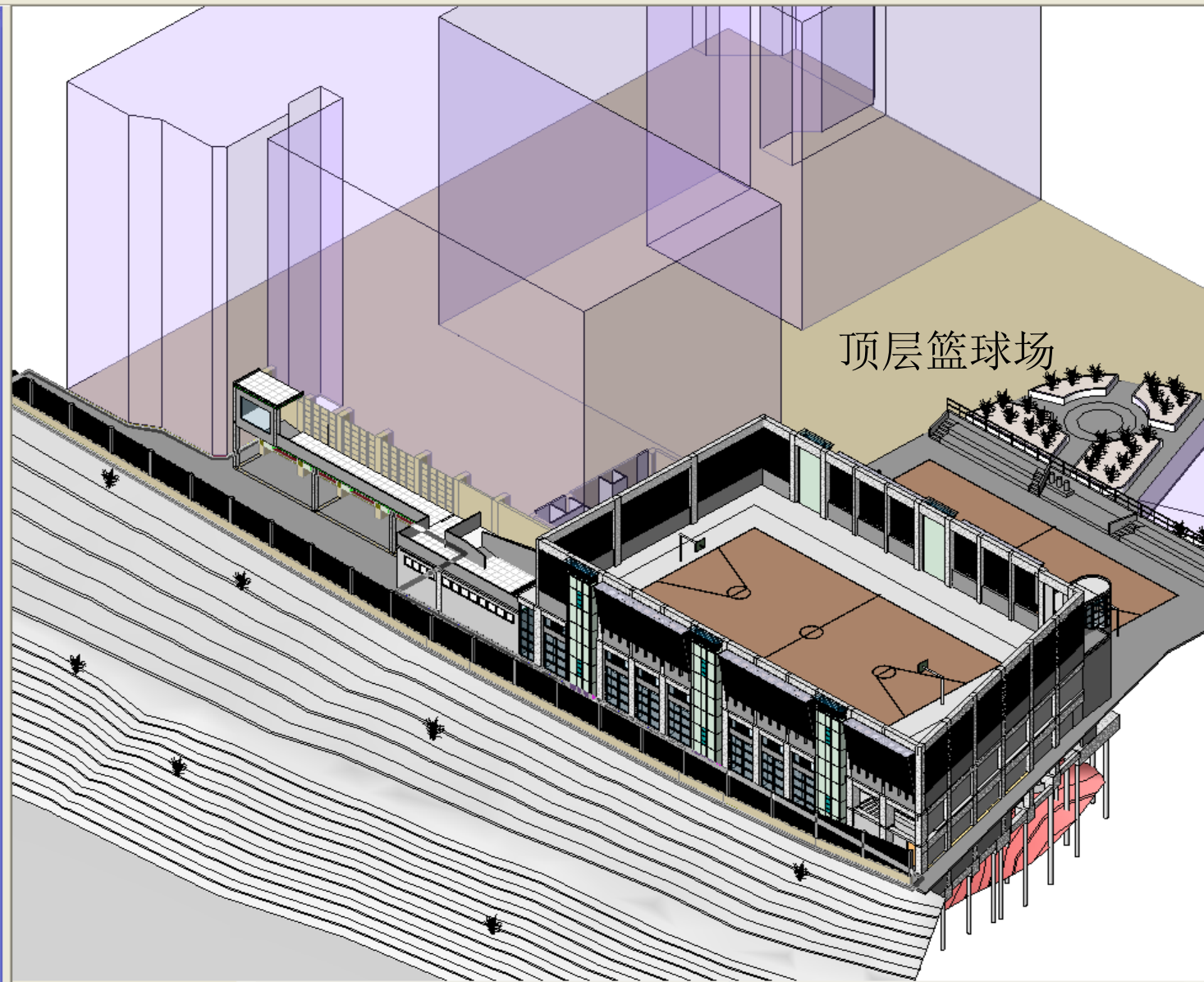


Basics

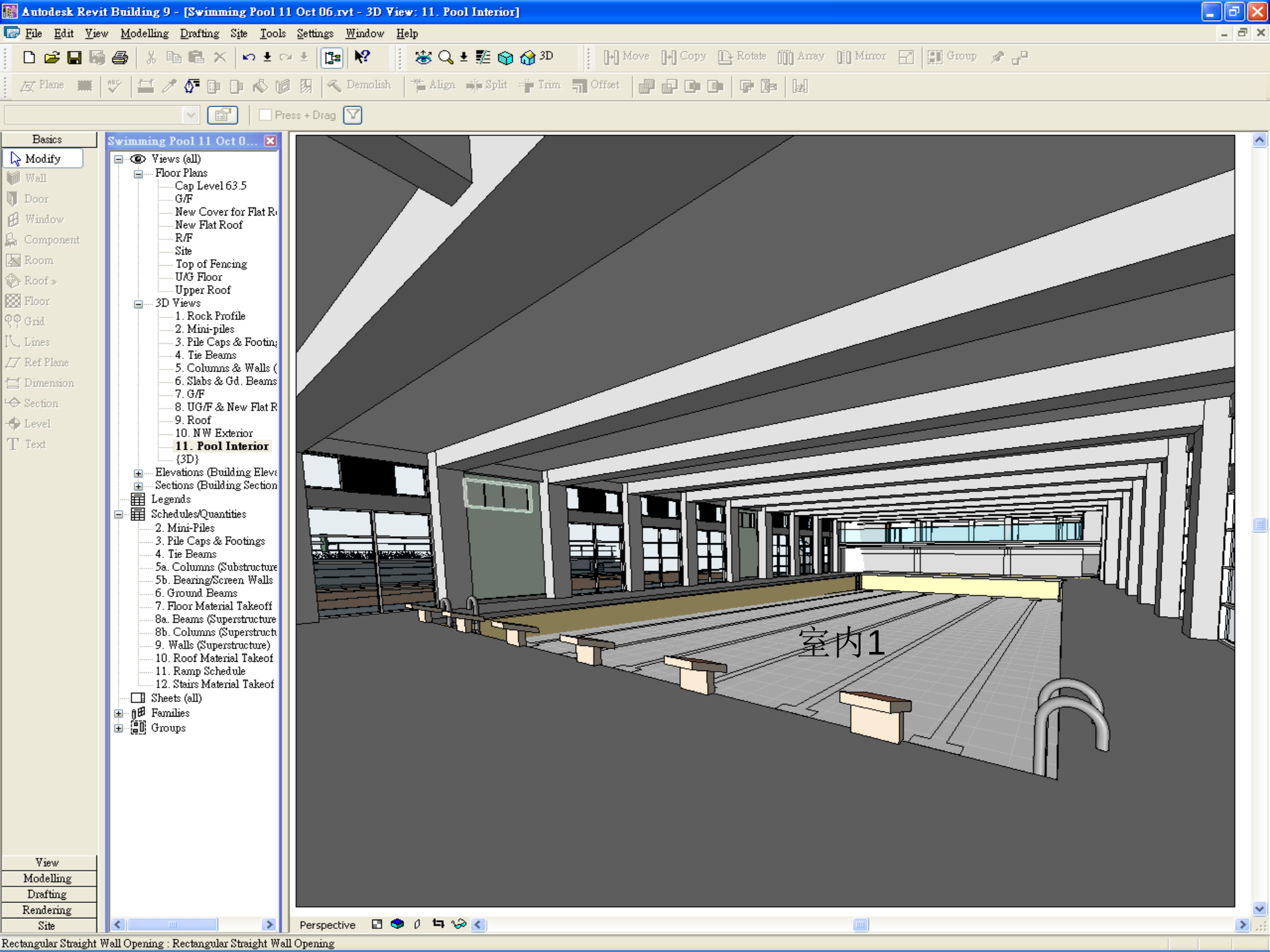
- Modify
- Wall
- Door
- Window
- Component
- Room
- Roof »
- Floor
- Grid
- Lines
- Ref Plane
- Dimension
- Section
- Level
- Text

Swimming Pool 11 Oct 06.rvt

- Views (all)
 - Floor Plans
 - Cap Level 63.5
 - G/F
 - New Cover for Flat R
 - New Flat Roof
 - R/F
 - Site
 - Top of Fencing
 - UG Floor
 - Upper Roof
 - 3D Views
 - 1. Rock Profile
 - 2. Mini-piles
 - 3. Pile Caps & Footings
 - 4. Tie Beams
 - 5. Columns & Walls (
 - 6. Slabs & Gd. Beams
 - 7. G/F
 - 8. UG/F & New Flat R
 - 9. Roof**
 - 10. NW Exterior
 - 11. Pool Interior (3D)
 - Elevations (Building Elev
 - Sections (Building Section
 - Legends
 - Schedules/Quantities
 - 2. Mini-Piles
 - 3. Pile Caps & Footings
 - 4. Tie Beams
 - 5a. Columns (Substructure
 - 5b. Bearing/Screen Walls
 - 6. Ground Beams
 - 7. Floor Material Takeoff
 - 8a. Beams (Superstructure
 - 8b. Columns (Superstruct
 - 9. Walls (Superstructure)
 - 10. Roof Material Takeof
 - 11. Ramp Schedule
 - 12. Stairs Material Takeof
 - Sheets (all)
 - Families
 - Groups



外观1



Material Take-Off in Hong Kong

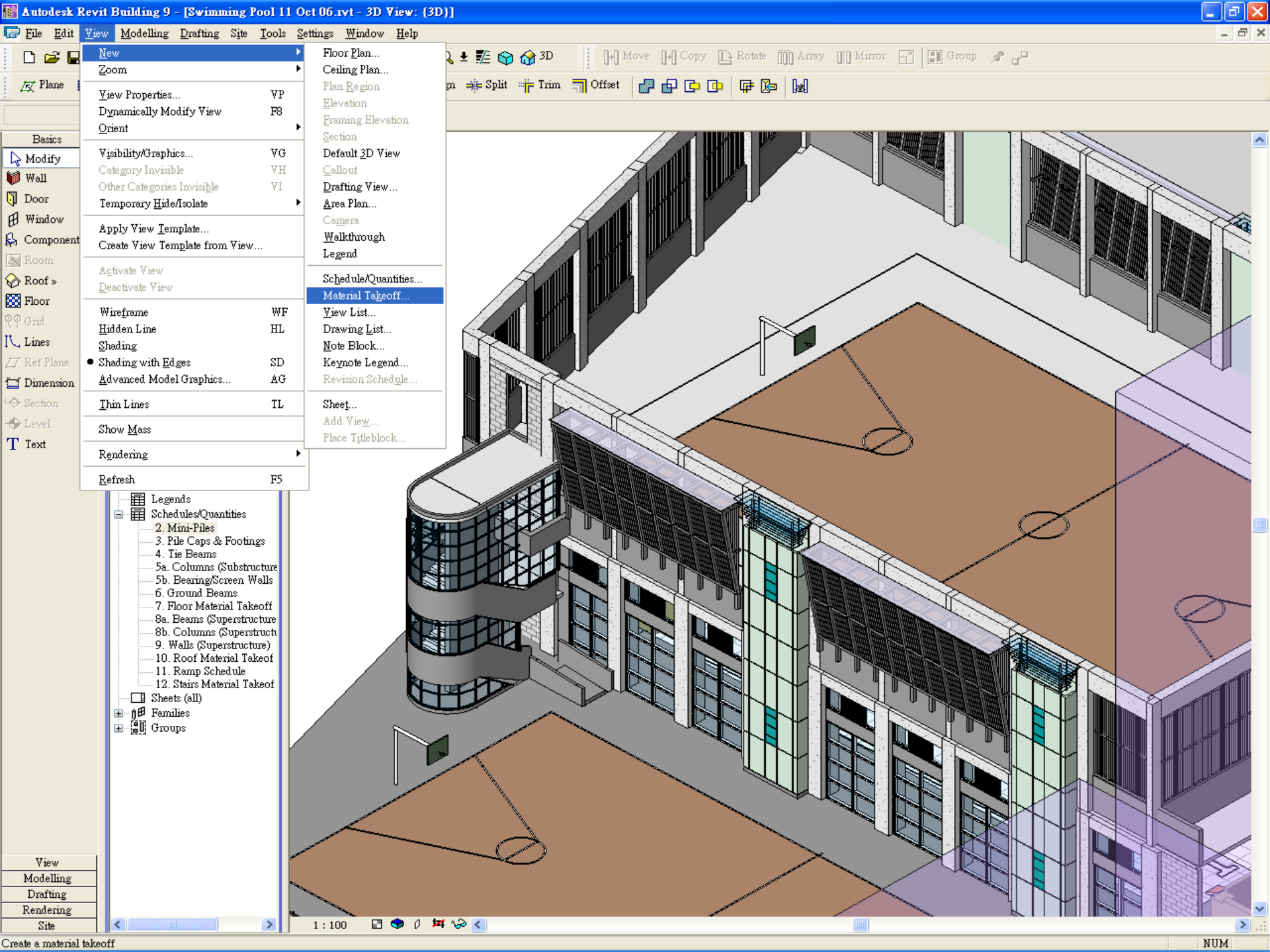
香港的材料量算工作

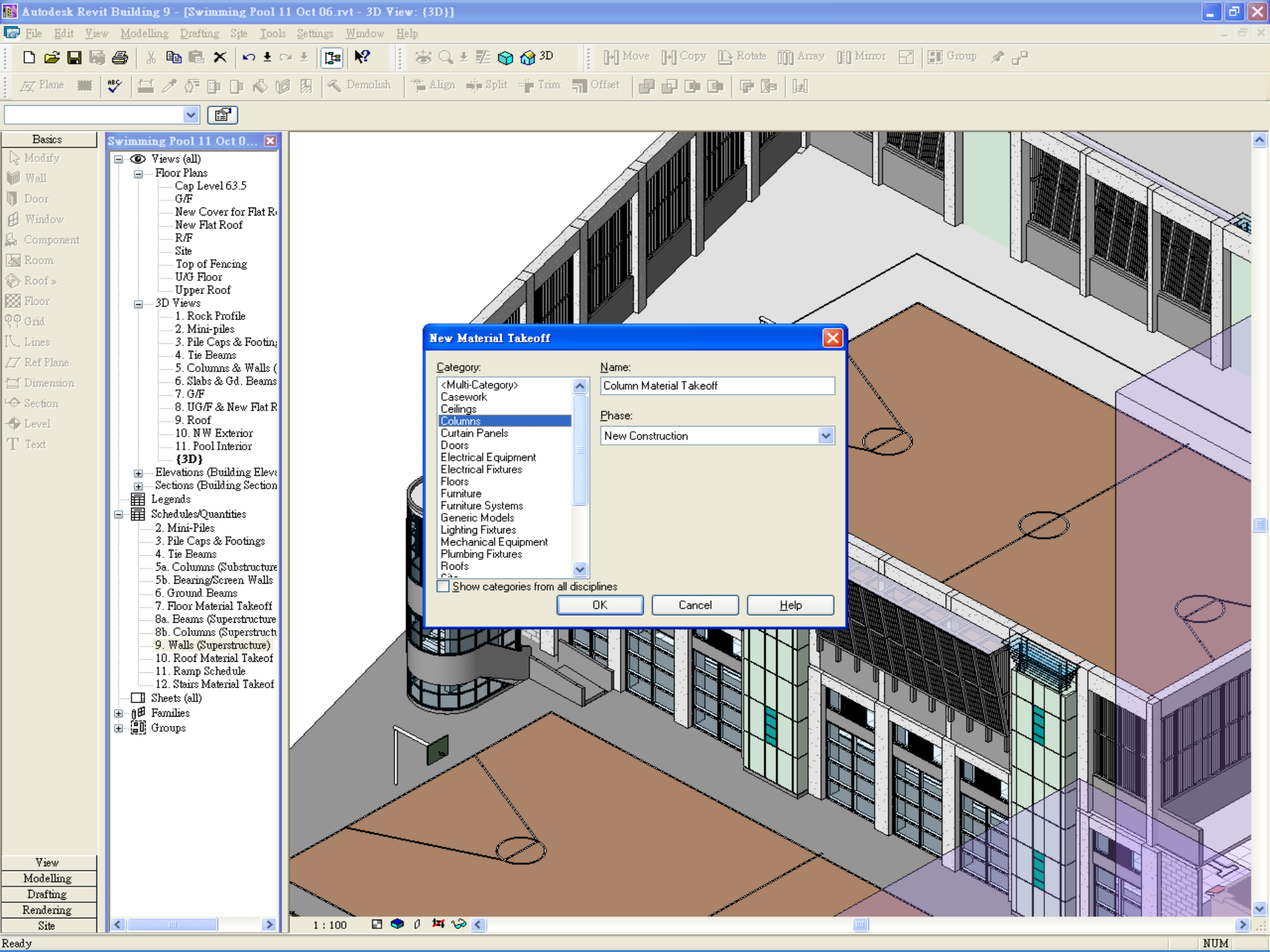
- For estimation – approximate quantities
概算 – 接受大概的材料数量
- For production of Bills of Materials (B.M.) –
firm/accurate quantities
生产标书/工程量清单 – 需要准确材料数量
 - taken-off by Quantity Surveyors (Q.S.) – a profession in the
consulting team 由工料测量师负责
 - generally in accordance with the Hong Kong Standard Method of
Measurement published by the Hong Kong Institute of Surveyors
(HKIS) 根据香港工料测量师学会出版的标准工程量之量算方法
 - take-off the quantities from the hardcopy drawings manually
主要以人手从图纸中量度出材料量
 - a labour-intensive and time-consuming approach
人力密集和耗时的方法

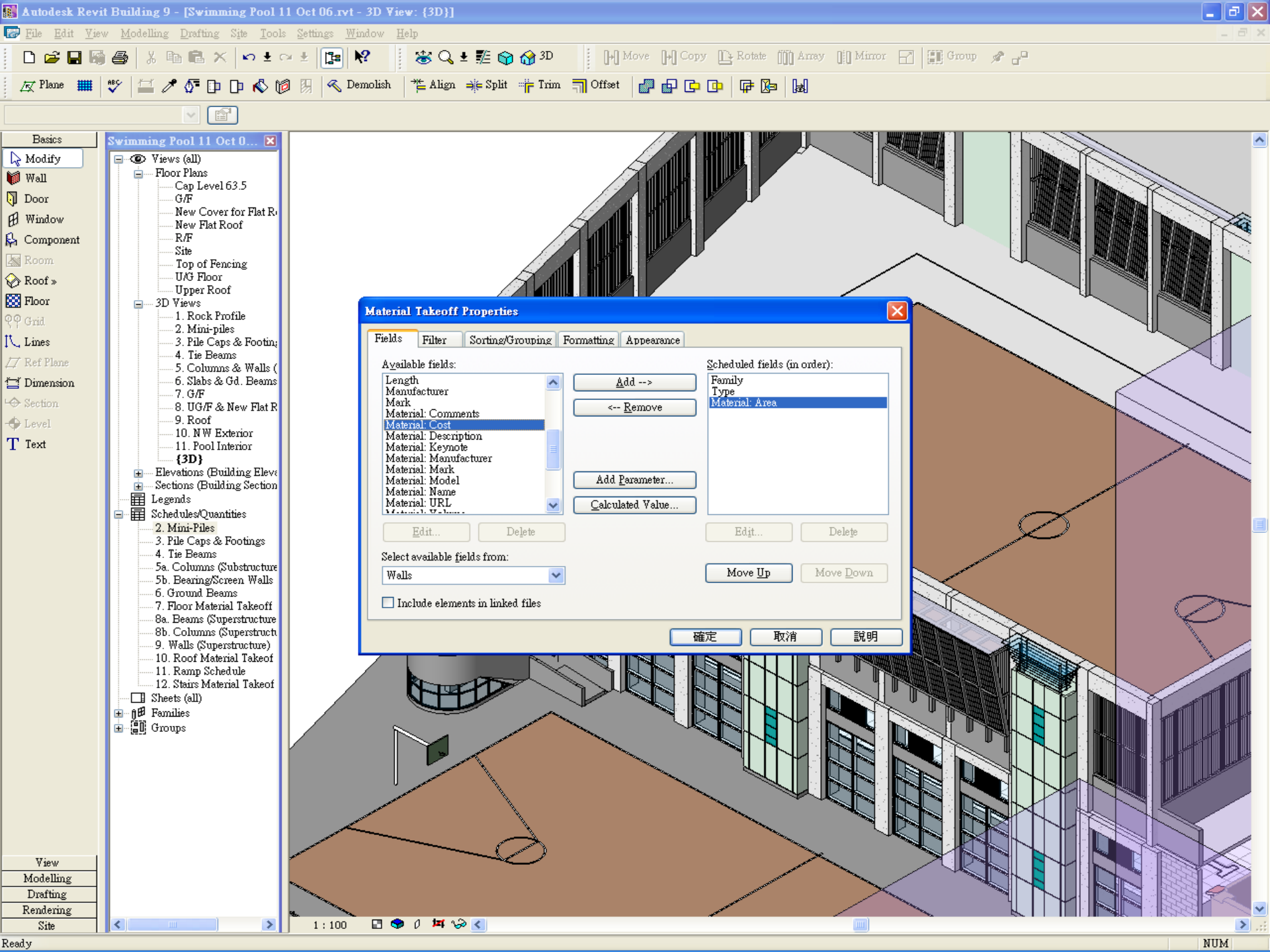
Material Take-Off Function in Revit

Revit 列表/材料量算工能









8b. Columns (Superstructure)												
Family	Type	Material: Name	Mark	Length	Base Level	Base Offset	Top Level	Top Offset	Material: Area	Concrete: Volume	Location	
R.C. Column (Superstructure)	400 x 850m	R.C. Grade 40/20 (Superstructure)	C24G	2550	G/F	0	U/G Floor	-150	7.055 m²	0.87 m³		
R.C. Column (Superstructure)	400 x 500m	R.C. Grade 40/20 (Superstructure)	C35G	2700	G/F	0	U/G Floor	0	5.260 m²	0.54 m³		
R.C. Column (Superstructure)	400 x 500m	R.C. Grade 40/20 (Superstructure)	C37G	2700	G/F	0	U/G Floor	0	5.260 m²	0.54 m³		
R.C. Column (Superstructure)	400 x 500m	R.C. Grade 40/20 (Superstructure)	C25G	2700	G/F	0	U/G Floor	0	5.260 m²	0.54 m³		
R.C. Column (Superstructure)	400 x 500m	R.C. Grade 40/20 (Superstructure)	C36G	2700	G/F	0	U/G Floor	0	5.260 m²	0.54 m³		
R.C. Column (Superstructure)	400 x 500m	R.C. Grade 40/20 (Superstructure)	C26G	2700	G/F	0	U/G Floor	0	5.260 m²	0.54 m³		
R.C. Column (Superstructure)	600 x 600m	R.C. Grade 40/20 (Superstructure)	C22G	5350	G/F	0	R/F	-150	13.560 m²	1.98 m³		
R.C. Column (Superstructure)	500 x 500m	R.C. Grade 40/20 (Superstructure)	C34G	2550	G/F	0	U/G Floor	-150	5.600 m²	0.64 m³		
R.C. Column (Superstructure)	500 x 500m	R.C. Grade 40/20 (Superstructure)	C33G	2550	G/F	0	U/G Floor	-150	5.600 m²	0.64 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C21G	2550	G/F	0	U/G Floor	-150	8.100 m²	1.22 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C28G	2550	G/F	0	U/G Floor	-150	8.100 m²	1.22 m³		
R.C. Column (Superstructure)	1150 x 600	R.C. Grade 40/20 (Superstructure)	C17G	5350	G/F	0	R/F	-150	20.105 m²	3.69 m³		
R.C. Column (Superstructure)	1150 x 600	R.C. Grade 40/20 (Superstructure)	C19G	5350	G/F	0	R/F	-150	20.105 m²	3.69 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C6G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C5G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C7G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C9G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C11G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C13G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C15G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C8G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C10G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C12G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C14G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C16G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C18G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	1150 x 700	R.C. Grade 40/20 (Superstructure)	C2G	5350	G/F	0	R/F	-150	21.405 m²	4.31 m³		
R.C. Column (Superstructure)	1150 x 700	R.C. Grade 40/20 (Superstructure)	C1G	5350	G/F	0	R/F	-150	21.405 m²	4.31 m³		
R.C. Column (Superstructure)	1150 x 600	R.C. Grade 40/20 (Superstructure)	C3G	5350	G/F	0	R/F	-150	20.105 m²	3.69 m³		
R.C. Column (Superstructure)	1150 x 600	R.C. Grade 40/20 (Superstructure)	C4G	5350	G/F	0	R/F	-150	20.105 m²	3.69 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C20G	5350	G/F	0	R/F	-150	15.940 m²	2.57 m³		
R.C. Column (Superstructure)	500 x 600m	R.C. Grade 40/20 (Superstructure)	C38G	3600	G/F	0	New Flat R	-150	8.520 m²	1.08 m³		
: 32									429.225 m²	69.63 m³		
R.C. Column (Superstructure)	300 x 300m	R.C. Grade 40/20 (Superstructure)	C39G	3750	G/F	0	New Flat R	0	4.680 m²	0.34 m³	New flat roof	
R.C. Column (Superstructure)	300 x 300m	R.C. Grade 40/20 (Superstructure)	C40G	3750	G/F	0	New Flat R	0	4.680 m²	0.34 m³	New flat roof	
R.C. Column (Superstructure)	300 x 300m	R.C. Grade 40/20 (Superstructure)	C41G	3900	G/F	0	New Flat R	150	4.860 m²	0.35 m³	New flat roof	
New flat roof: 3									14.220 m²	1.08 m³		
R.C. Column (Superstructure)	400 x 500m	R.C. Grade 40/20 (Superstructure)	C35U	2650	U/G Floor	0	R/F	-150	5.170 m²	0.53 m³		
R.C. Column (Superstructure)	400 x 500m	R.C. Grade 40/20 (Superstructure)	C37U	2650	U/G Floor	0	R/F	-150	5.170 m²	0.53 m³		
R.C. Column (Superstructure)	400 x 500m	R.C. Grade 40/20 (Superstructure)	C25U	2650	U/G Floor	0	R/F	-150	5.170 m²	0.53 m³		
R.C. Column (Superstructure)	400 x 500m	R.C. Grade 40/20 (Superstructure)	C36U	2650	U/G Floor	0	R/F	-150	5.170 m²	0.53 m³		
R.C. Column (Superstructure)	400 x 500m	R.C. Grade 40/20 (Superstructure)	C26U	2650	U/G Floor	0	R/F	-150	5.170 m²	0.53 m³		
R.C. Column (Superstructure)	500 x 500m	R.C. Grade 40/20 (Superstructure)	C34U	2200	U/G Floor	0	R/F	-600	4.900 m²	0.55 m³		
R.C. Column (Superstructure)	500 x 500m	R.C. Grade 40/20 (Superstructure)	C33U	2200	U/G Floor	0	R/F	-600	4.900 m²	0.55 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C21U	2650	U/G Floor	0	R/F	-150	8.380 m²	1.27 m³		
R.C. Column (Superstructure)	800 x 600m	R.C. Grade 40/20 (Superstructure)	C23U	2650	U/G Floor	0	R/F	-150	8.380 m²	1.27 m³		
R.C. Column (Superstructure)	400 x 850m	R.C. Grade 40/20 (Superstructure)	C24U	2800	U/G Floor	0	R/F	0	7.680 m²	0.95 m³		
: 10									60.090 m²	7.25 m³		
R.C. Column (Substructure)	300 x 300m	R.C. Grade 40/20 (Superstructure)	F3F	3400	New Flat	0	New Cover f	0	4.260 m²	0.31 m³	New flat roof	
R.C. Column (Substructure)	300 x 300m	R.C. Grade 40/20 (Superstructure)	C41F	3100	New Flat	300	New Cover f	0	3.900 m²	0.28 m³	New flat roof	
New flat roof: 2									8.160 m²	0.59 m³		

Default Model Quantities Explained

模型材料量的解释

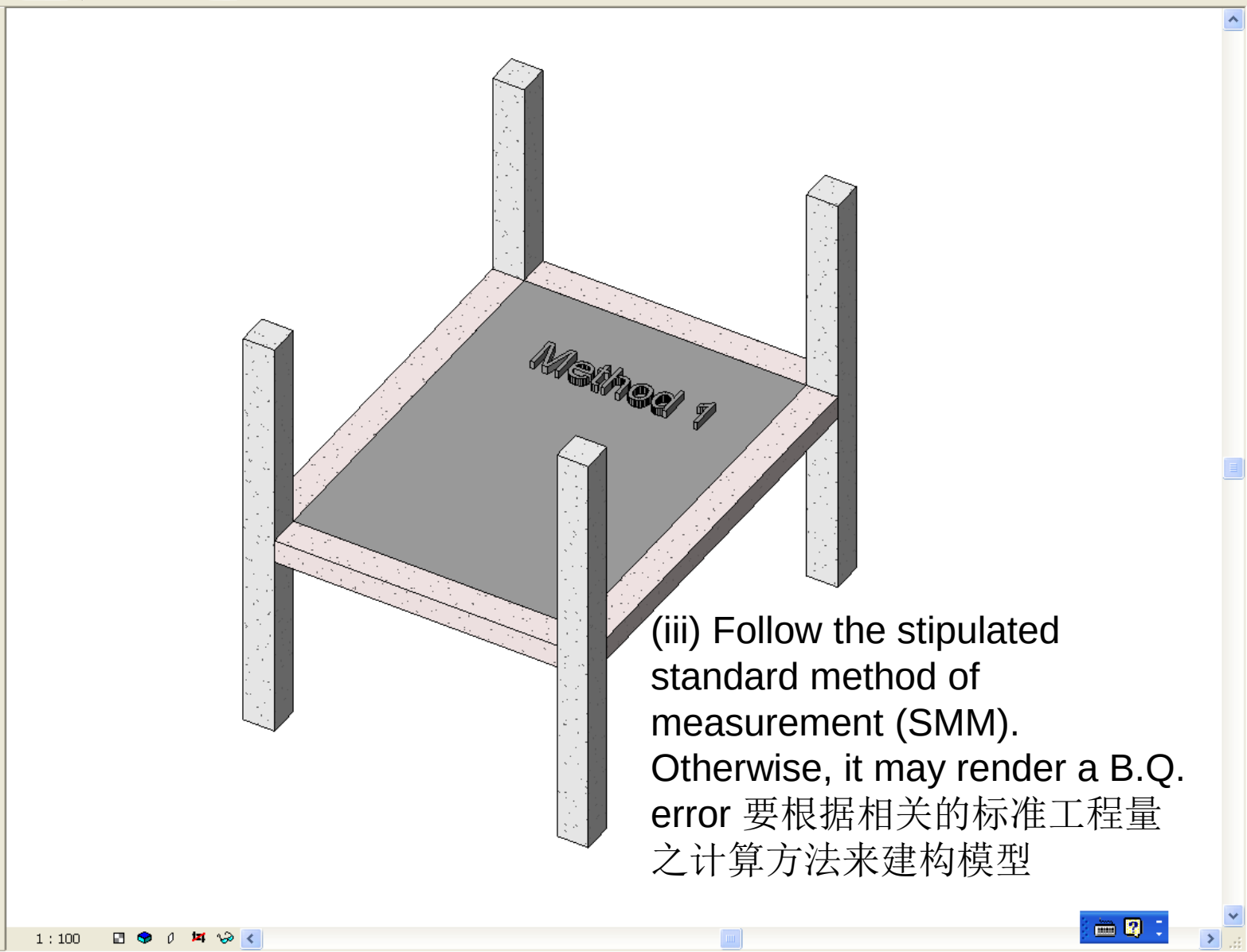
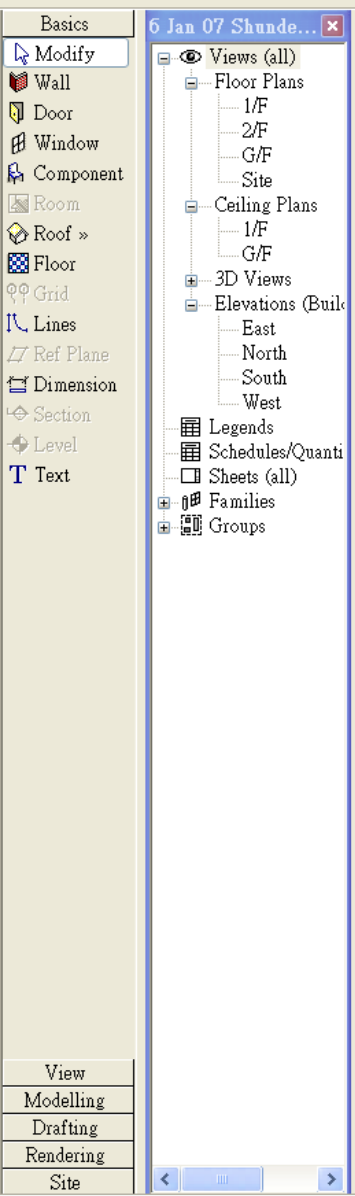
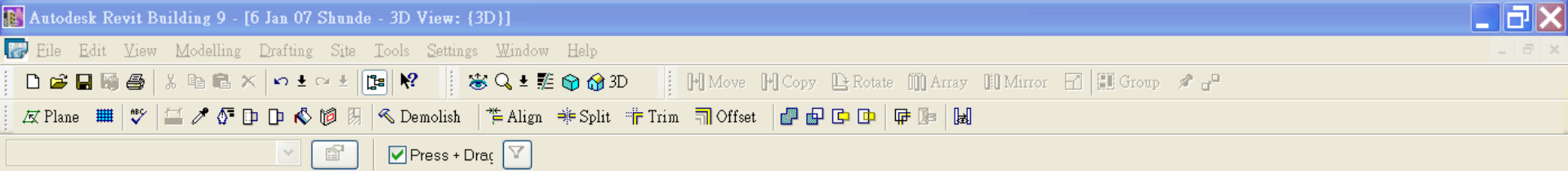
	Area	Volume	Length
Concrete Wall	1 vertical face (LxH) 一垂直面	LxWxH 长x阔x高	L
Concrete Structural Column	4 vertical faces 四垂直面 [2(L+W)xH]	LxWxH 长x阔x高	L
Concrete Floor	1 horizontal face 一平面 (LxW)	LxWxT 长x阔x厚	n/a

Material Take-Off with BIM - Key Issues

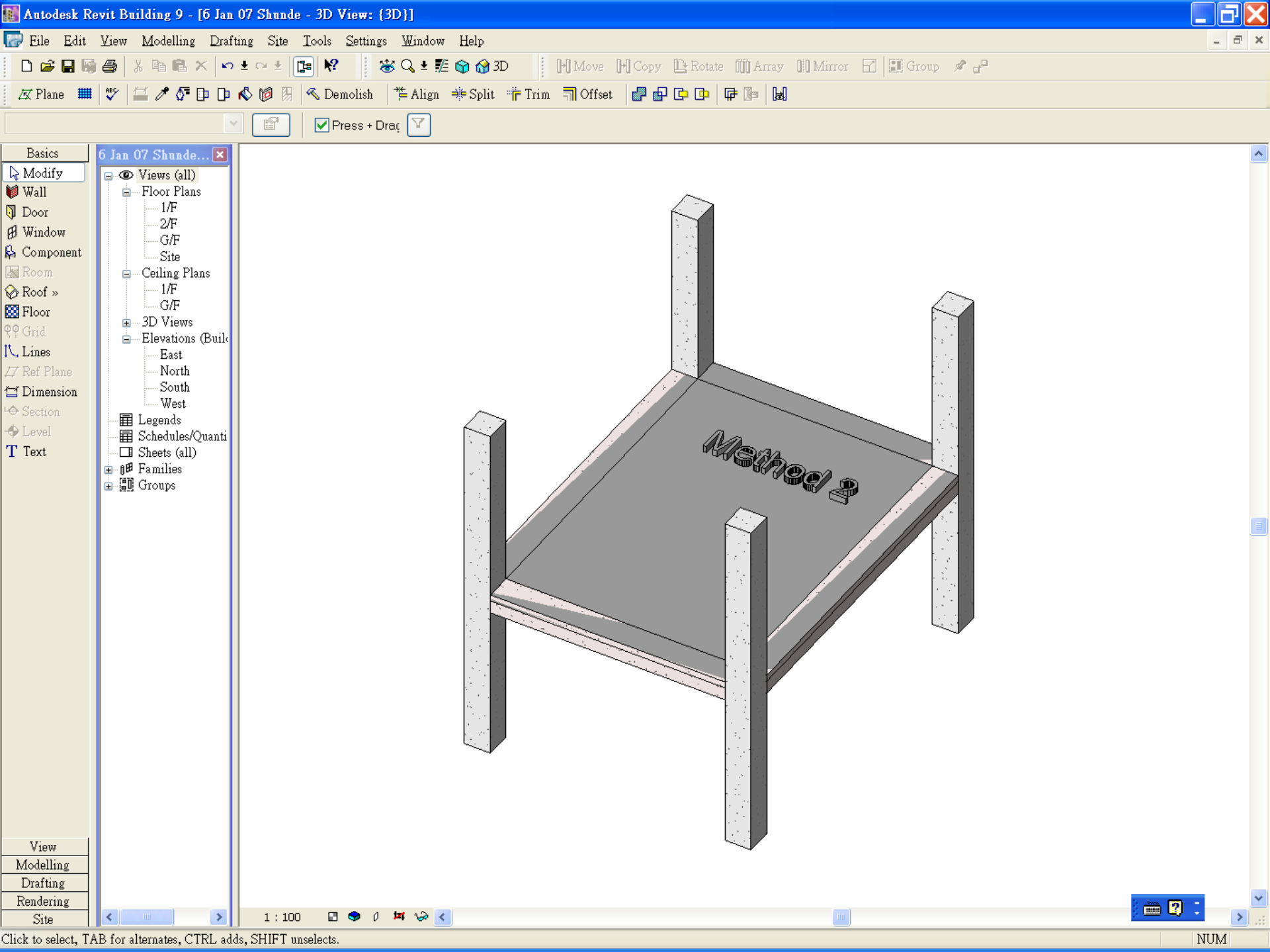
应用BIM在材料量算的注意事项

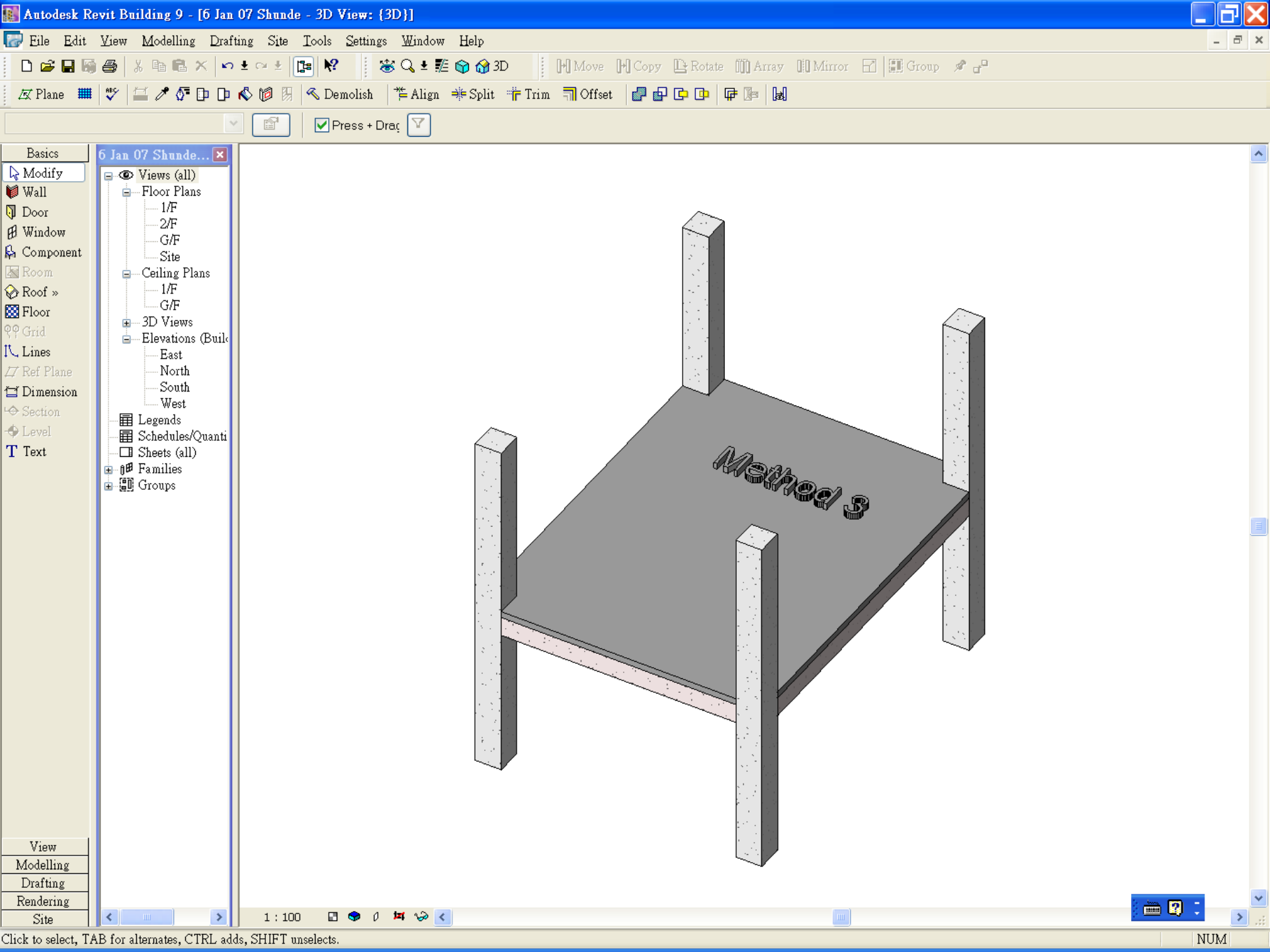
- (i) The default schedules only list out the objects which are appear in the model, i.e. No object → No quantity
材料量算工能只列出在模型存在的构件
- (ii) Use the correct object, e.g. An *Architecture Column* (no *quantity parameter*) vs. a *Structural Column*
选取合适的构件来建构模型
- (iii) Follow the stipulated standard method of measurement (SMM)? Otherwise, it may render a B.Q. error
要根据相关的标准工程量之计算方法来建构模型
- (iv) The model quantity may not necessary equal to the B.Q. quantity

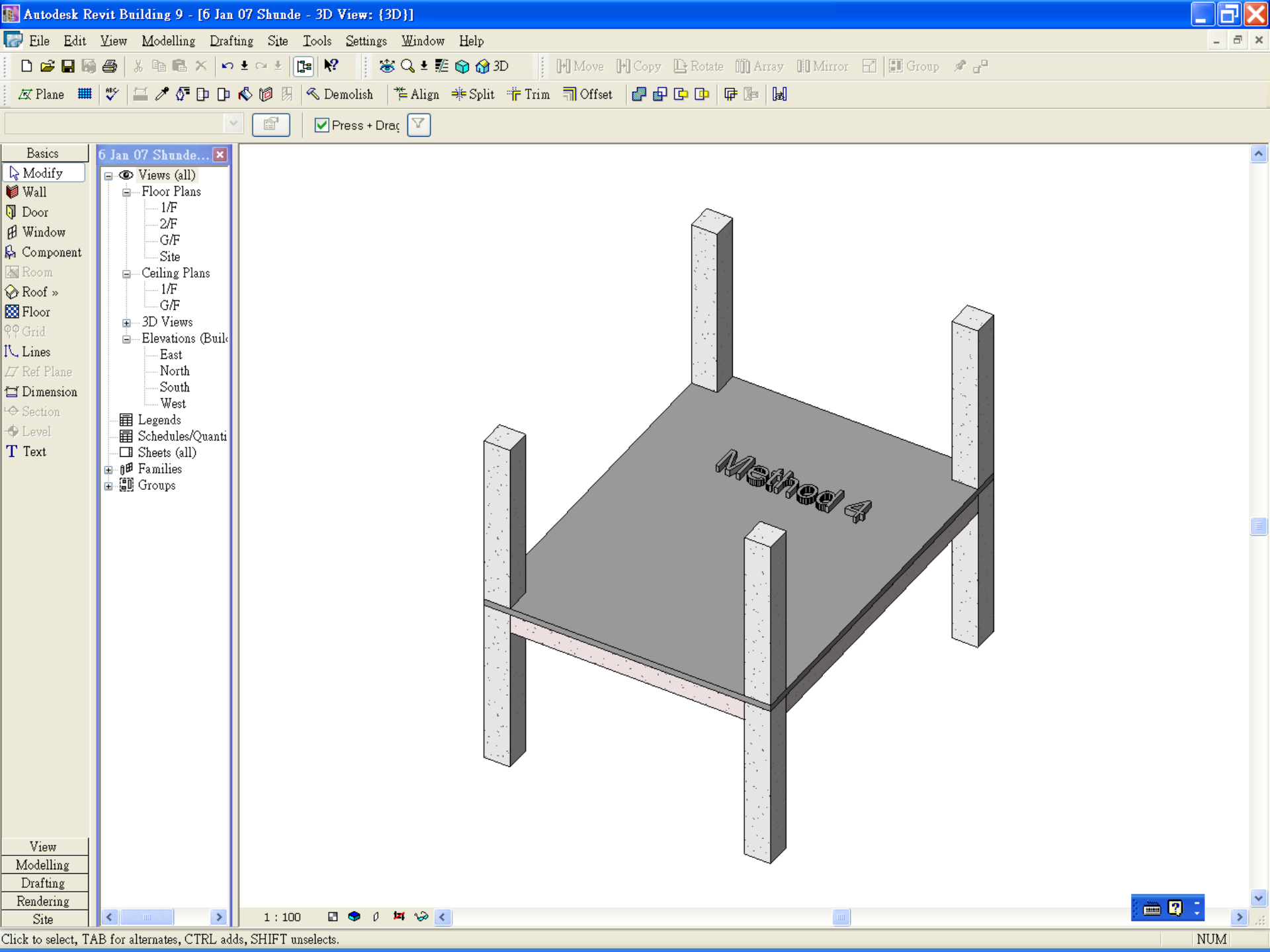
模型材料量并不一定与工程清单量相等



(iii) Follow the stipulated standard method of measurement (SMM). Otherwise, it may render a B.Q. error 要根据相关的标准工程量之计算方法来建构模型







Department of Building & Surveying
Hong Kong Polytechnic, Kowloon, Hong Kong



Author: Aston M.A.(1991)

Measurement of Building Works
for
Bills of Quantities
in
Hong Kong

Intermediate Level

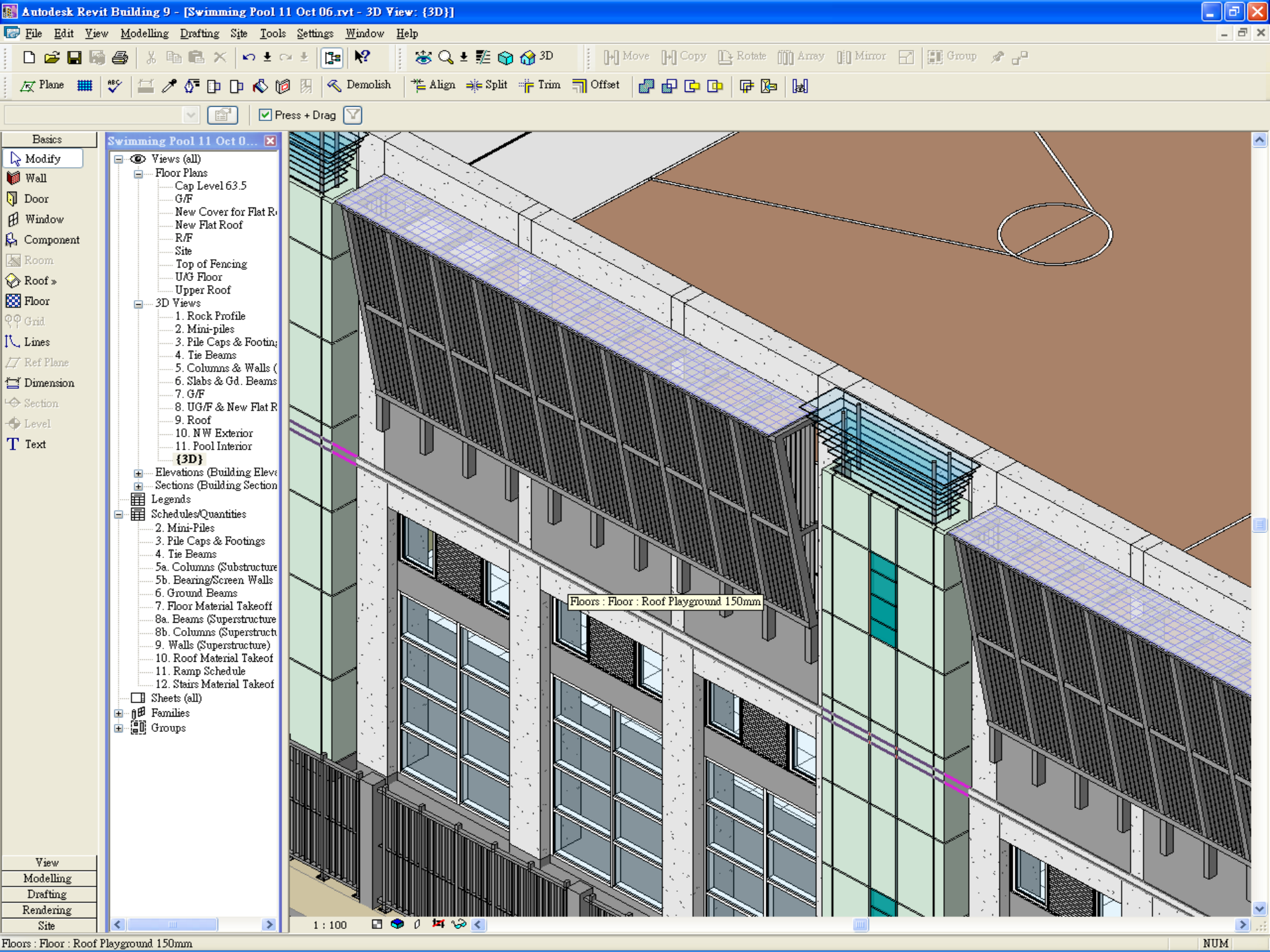
Book II

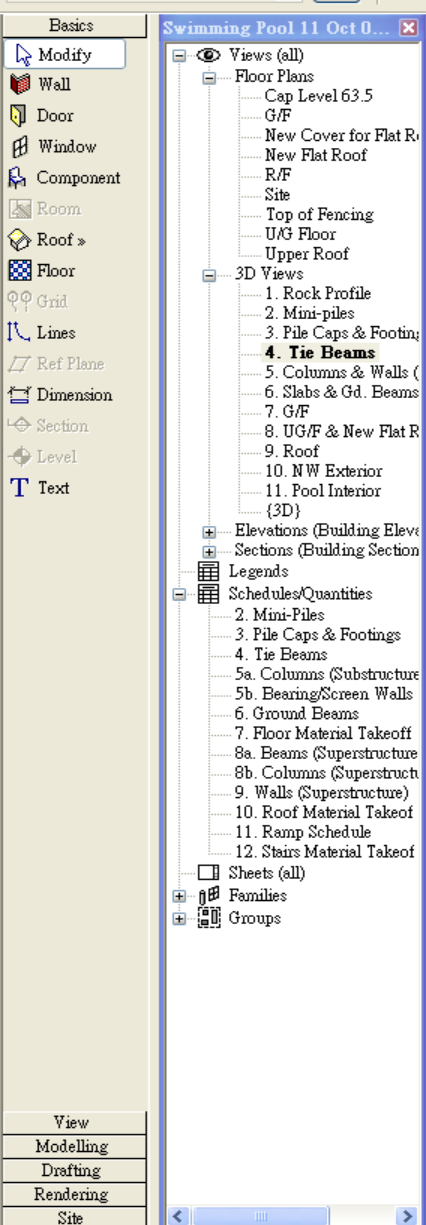
The Superstructure

香港工程量计算方法
的教科书

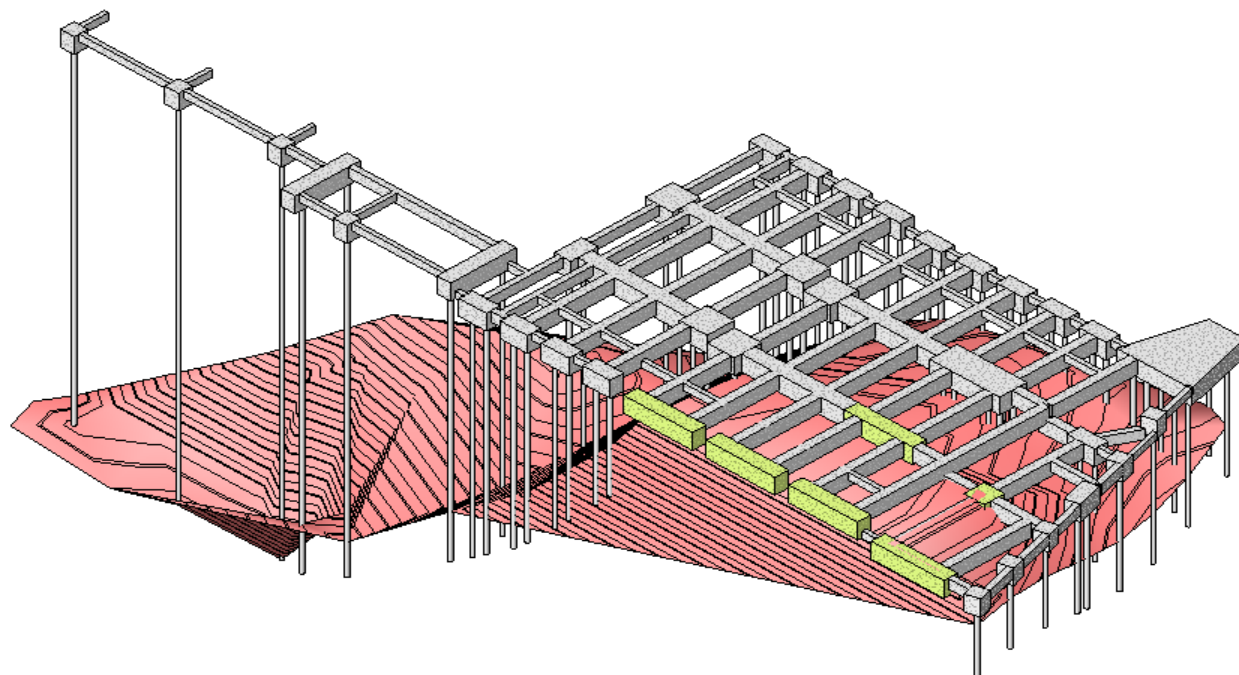
Concrete Measurement 混凝土量的计算方法

- 1) Suspended slabs are measured over everything, including over beams and column heads.* 楼板量的计算以楼板覆盖所有构件,包括梁及柱头
- 2) Columns before walls and beams.
- 3) Beams before walls except at end and intermediate bearings.
- 4) Primary beams before secondary beams, etc.
- 5) Staircases (waist and treads in flights) measured between suspended slabs and landings.
- 6) Staircase beams measured below staircase landings and waists.
- 7) Upstand beams measured above suspended slabs.





(iv) The model quantity may not necessary equal to the B.Q. quantity 模型材料量并不一定与工程清单量相等



输出列表至Excel 作后期运算

Microsoft Excel - Bill No. 4 - Piling.xls								
File Edit View Insert Format Tools Data Window Help Adobe PDF								
新細明體 12 B I U \$ % , .00 .00								
A1								
	A	B	C	D	E	F	G	H
1						BILL NO. 4		
2						PILING		
3								
4	Item	Description	Quantity	Unit	Rate	Total		
5								
6		Bill No. 4						
7		PILING						
8								
9		MINI-PILE FOUNDATION						
10								
11	A	Vertical pile 273mm diameter including drilling, steel casing, steel reinforcement, coupler and grouting		m				
12								
13	B	Extra over for drilling in rock socket (PROVISIONAL)		m				
14								
15	C	Raking pile 273mm diameter including drilling, steel reinforcement and grouting		m				
16								
17	D	Extra over for drilling in rock socket (PROVISIONAL)		m				
18								

Conclusion 总结

- BIM is a tool to facilitate material take-off BIM是材料量算的辅助工具
- Save resources in material take-off; could use the saved resources to enhance other services of quantity surveyors
节省材料量算所需资源;所节省的资源可用来提高工料测量师的其它服务
- The default material schedules only list out the objects which are appear in the model
列表/材料量算工能只列出在模型存在的构件
- Use the correct object
选取合适的对象来建构模型
- Pay attention to the stipulated standard method of measurement (SMM).
要根据相关的标准工程量之计算方法来建构模型
- Model Quantities are not necessarily = Bill of Quantities
模型材料量并不一定与工程清单量相等
- BIM in Material take-off: QS's domain knowledge is essential
BIM 材料量算: 工料测量师的知识领域是不可缺的



Thank you!