

以BIM鋼筋技術應用於傳統建案

從軟體研發的角度看營建產業

吳杰彥



鋼筋工程的特性

- 單一材料最高價
- 資料量大
- 繁瑣



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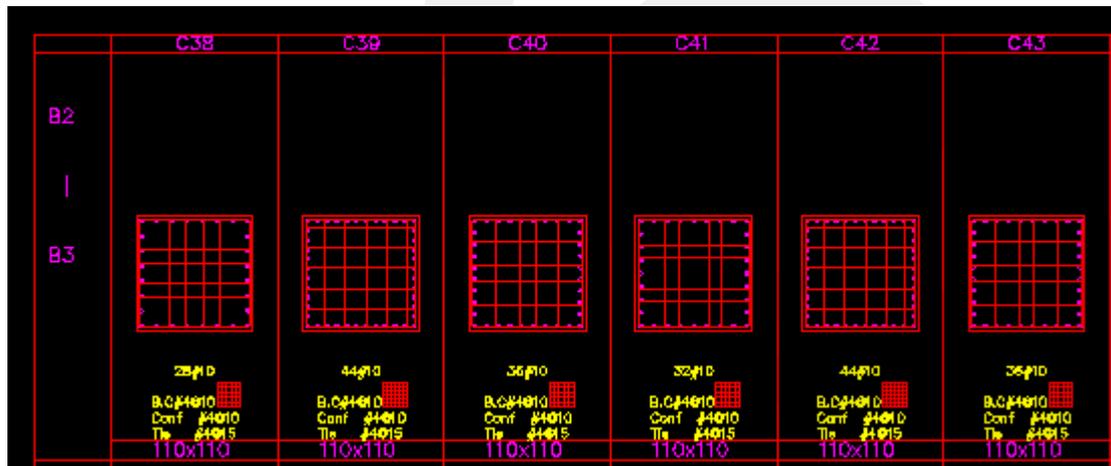


● **誰** 在主導鋼筋工程?

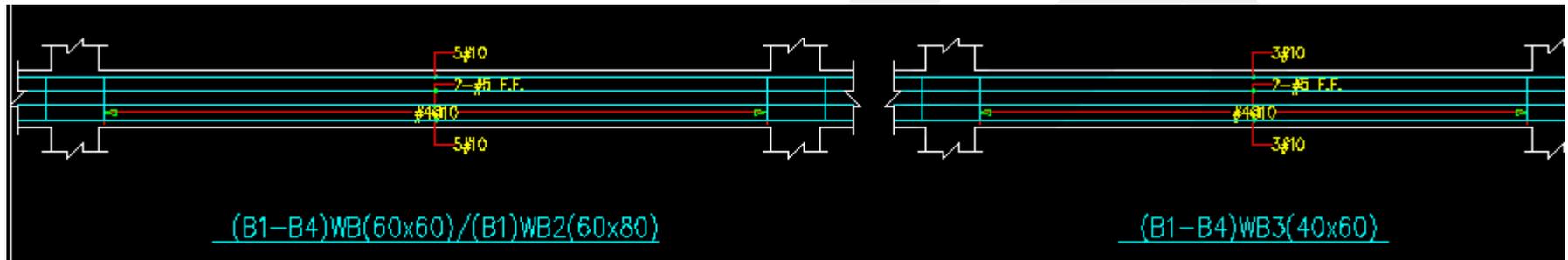
● **誰** 最在意鋼筋量?



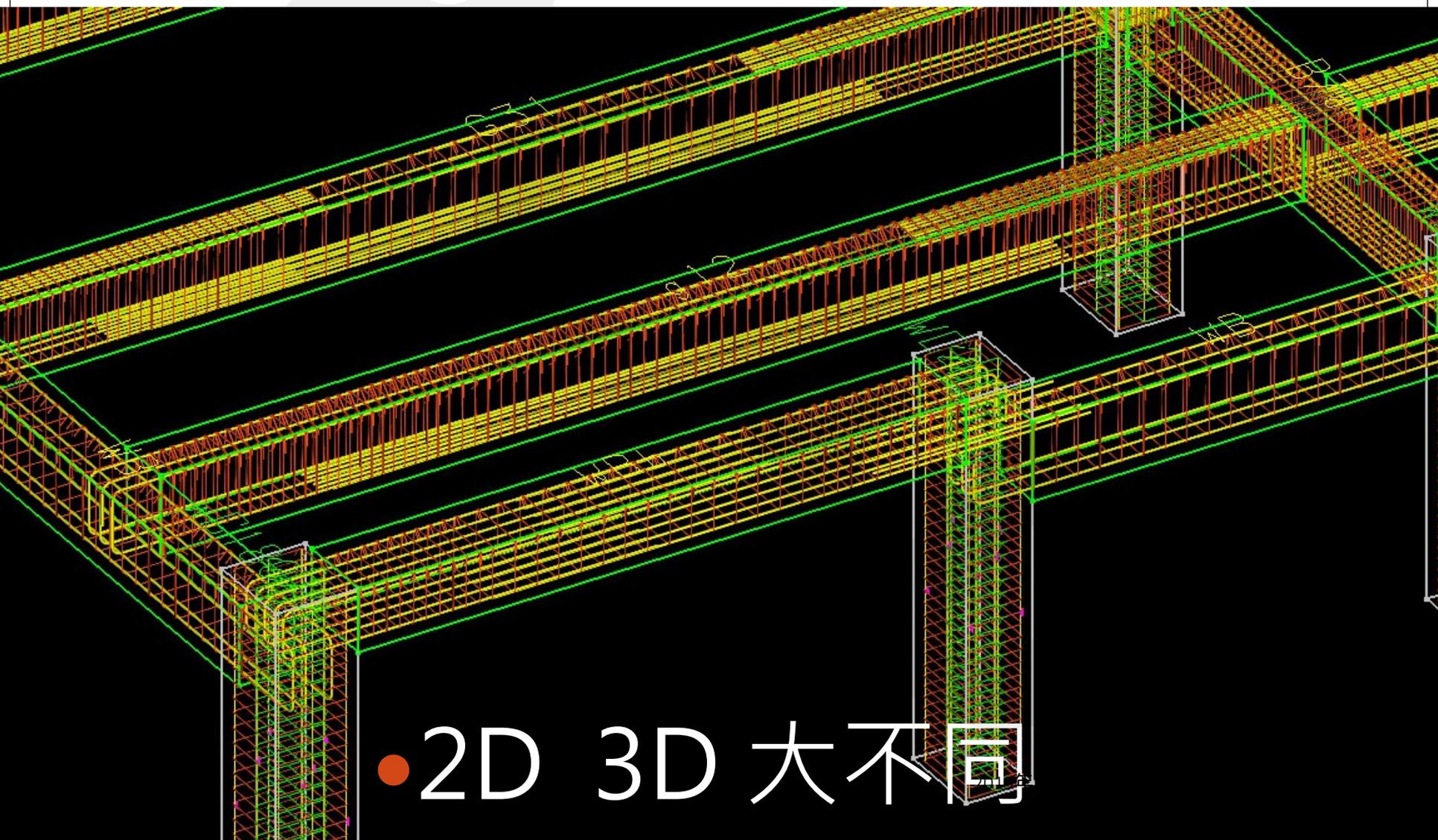
資料複雜



● 2D



鋼筋行為的複雜性



- 2D 3D 大不同

自動化可以解決問題

BIM



業界面臨問題

- 人才斷層
- 軟體價位高
- 輸入太麻煩
- 不合乎本土需求



RCAD_鋼筋模型系統

用**新**技術
處理鋼筋



程式架構



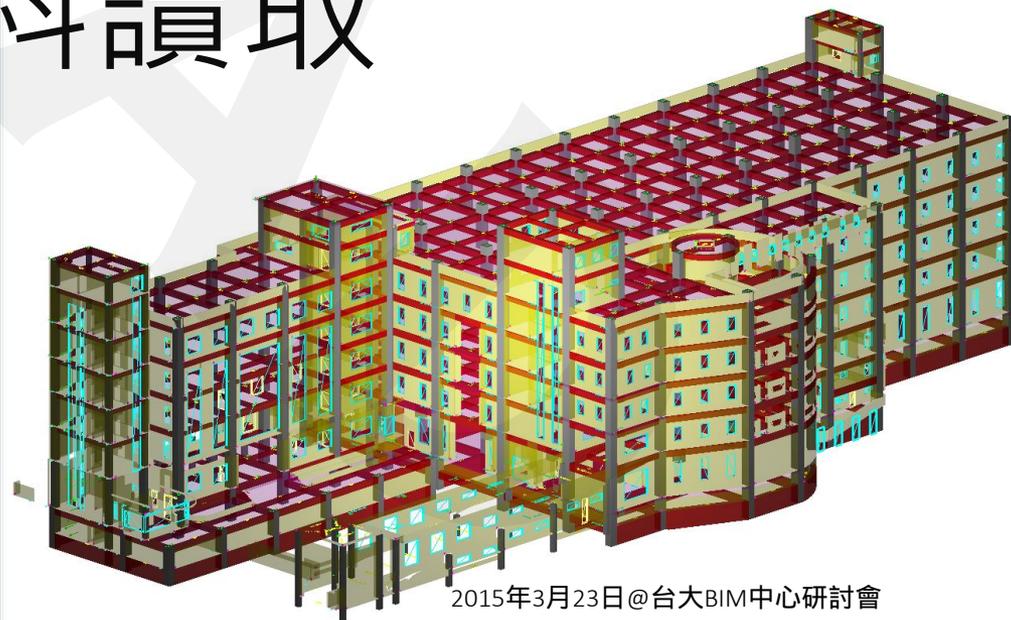
程式發展與技術整合

1. 組成檢料團隊
2. 工務所的需求
3. 老師傅的經驗



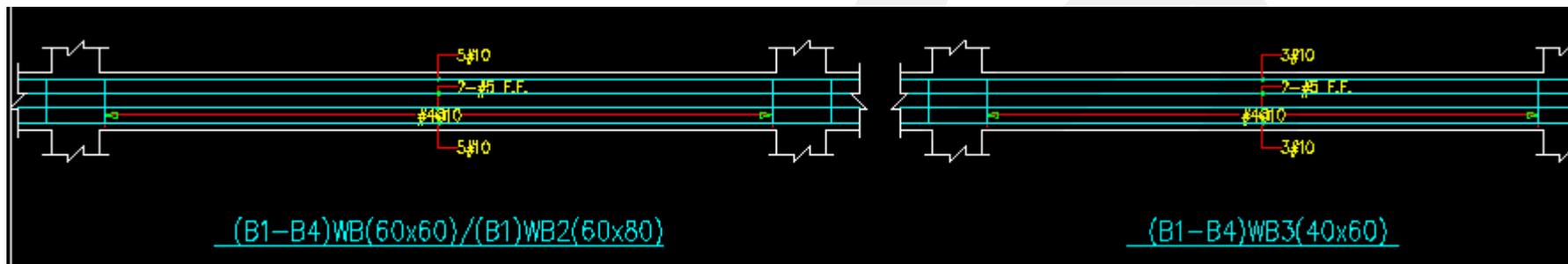
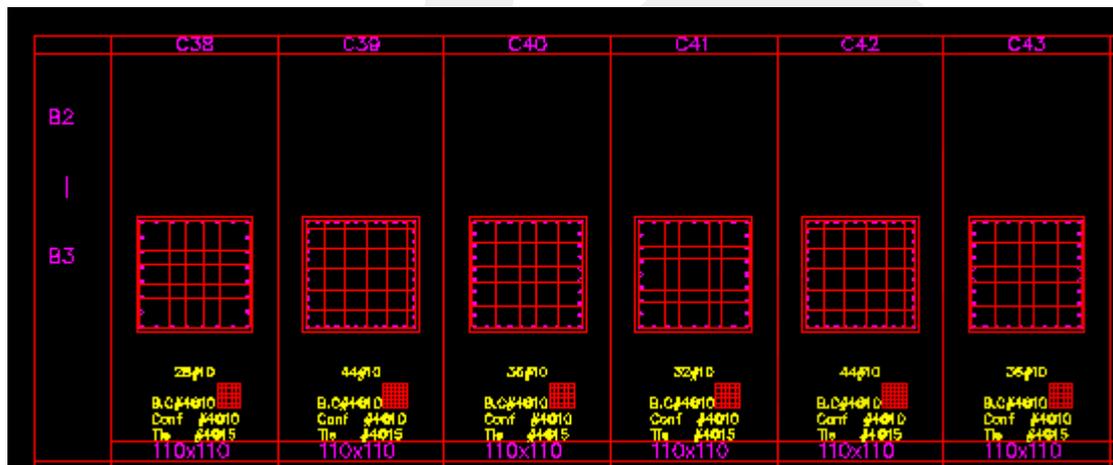
PART 1

資料讀取

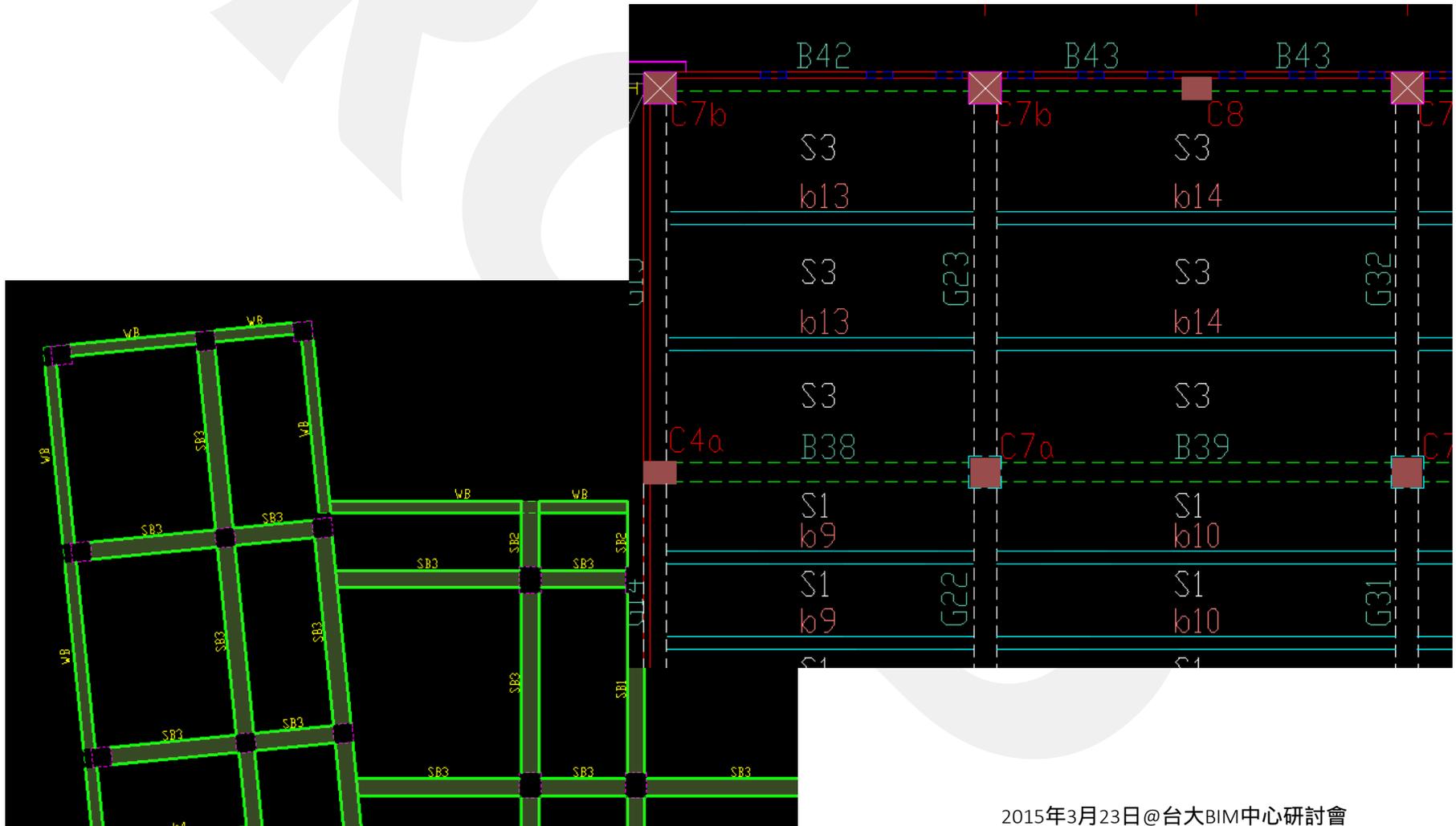


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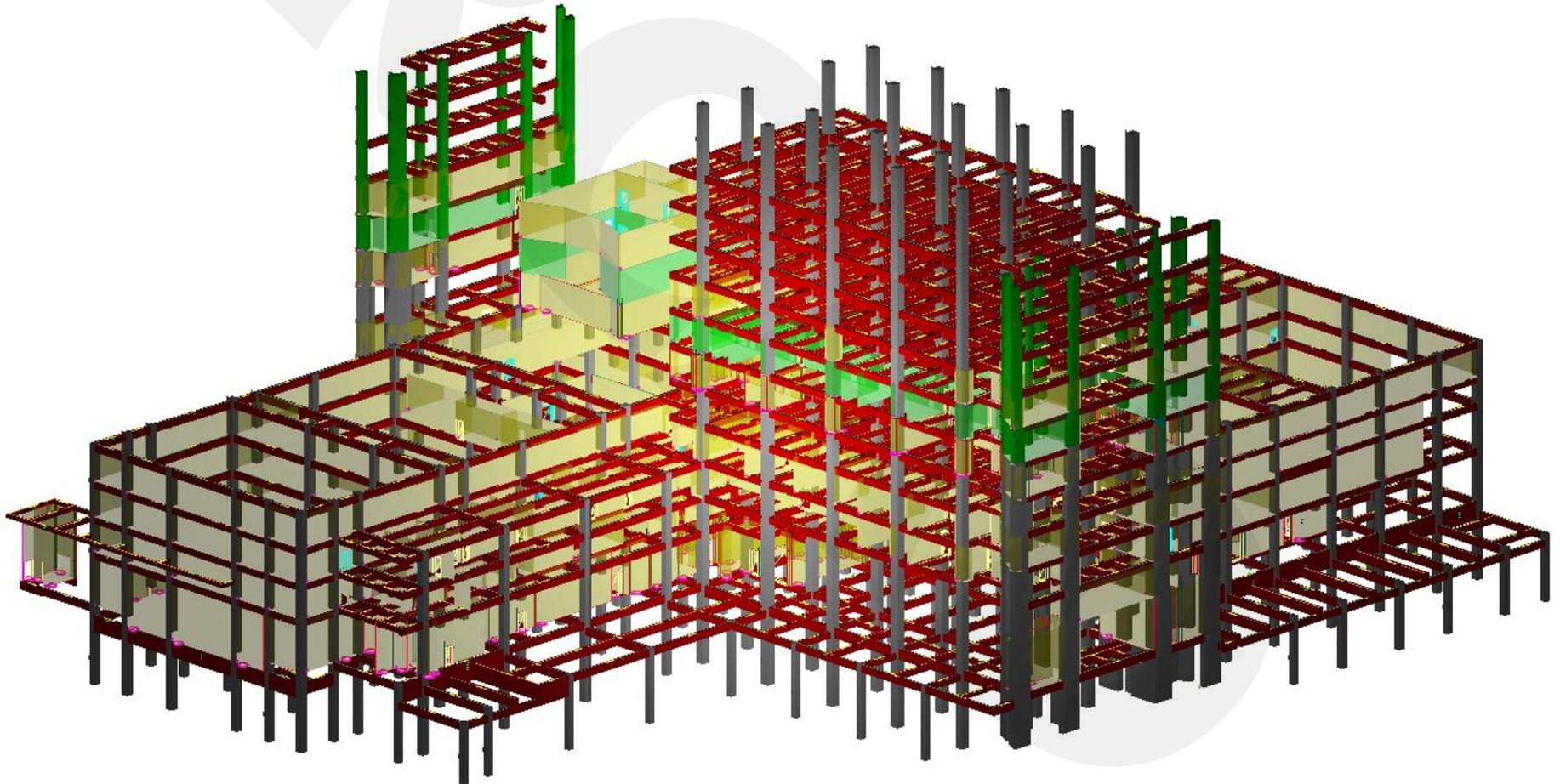
1. 如何讀取梁柱配筋



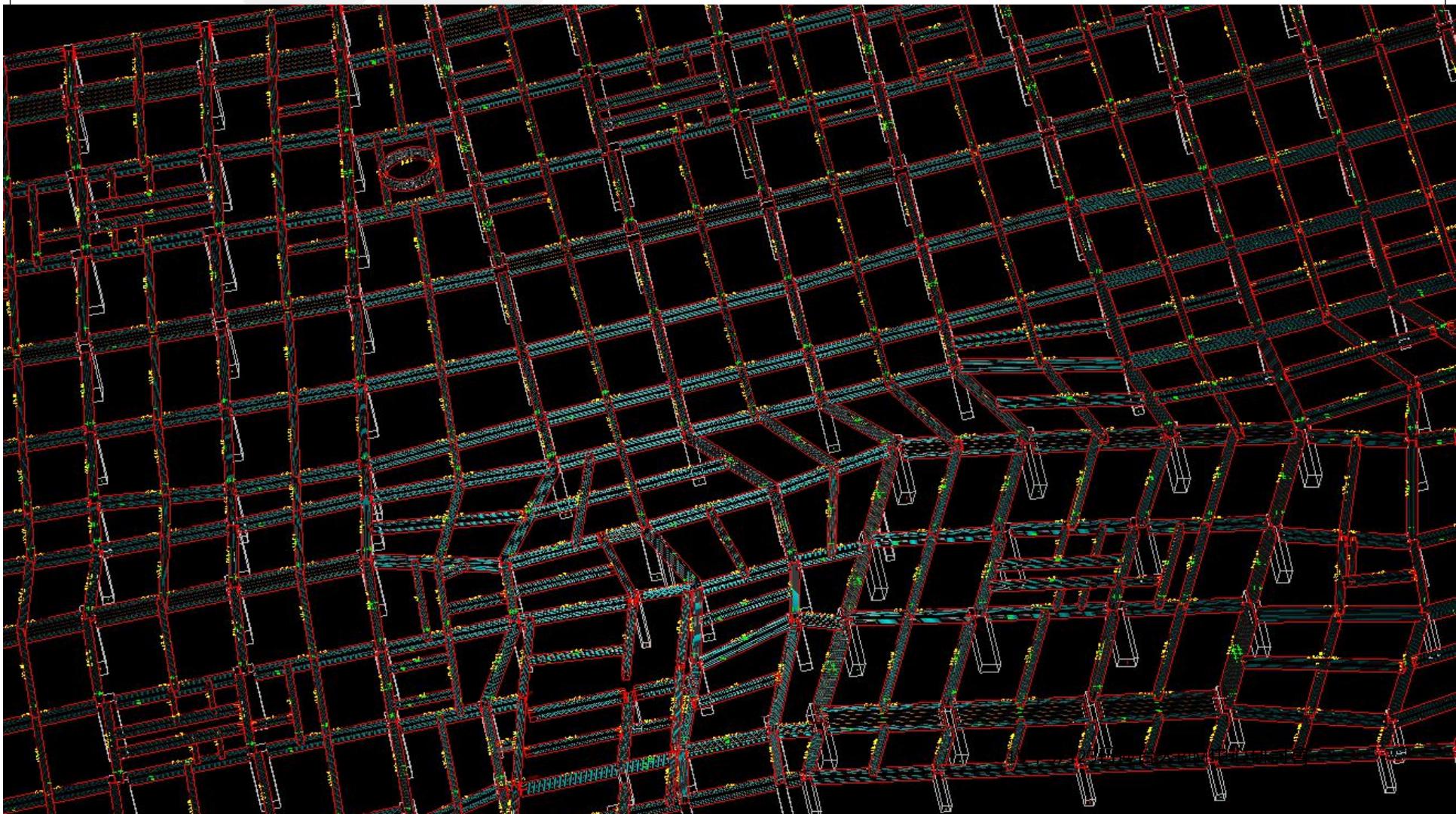
2. 如何讀取梁柱位



3. 如何建構模型



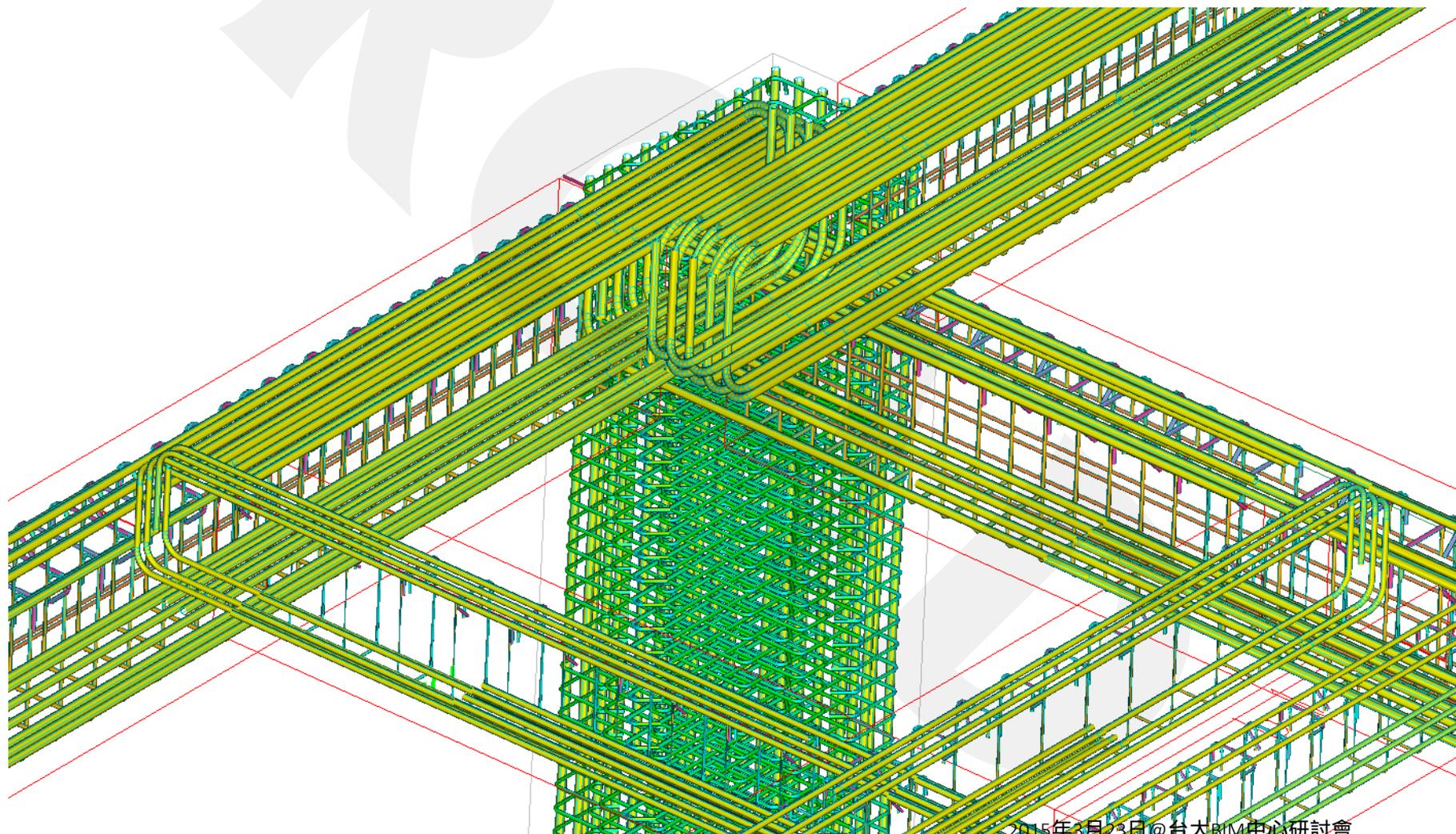
梁柱模型 → 鋼筋模型



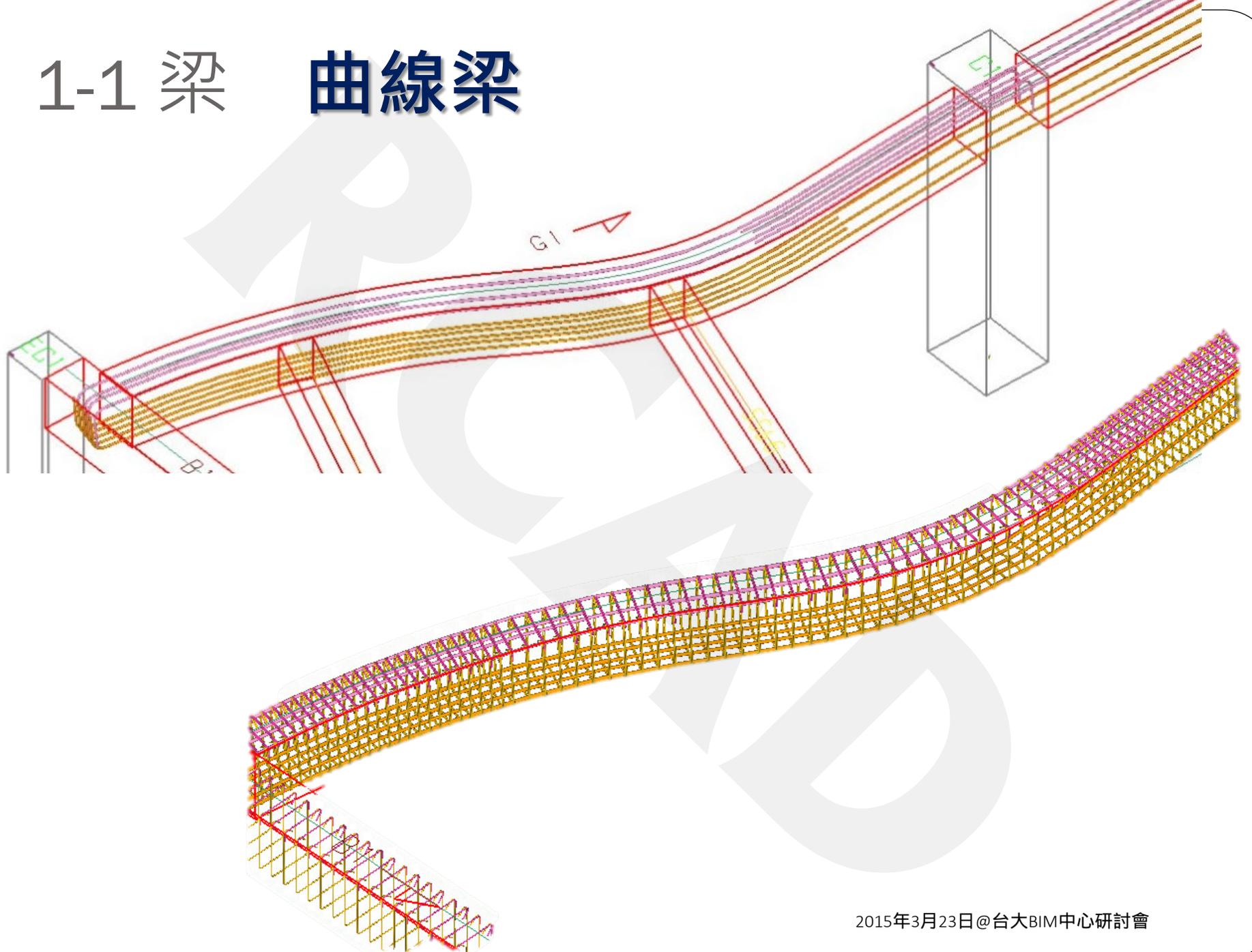
PART 2

編輯鋼筋

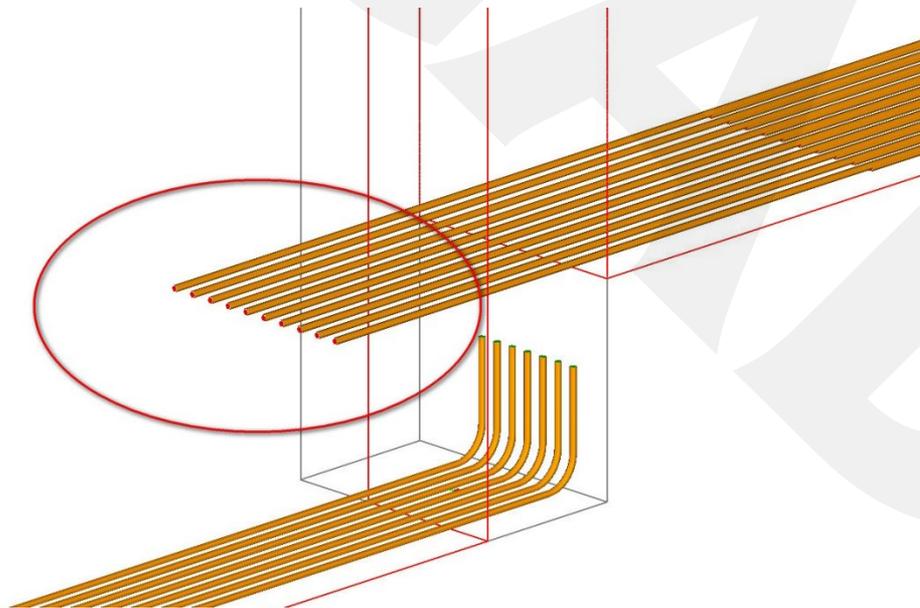
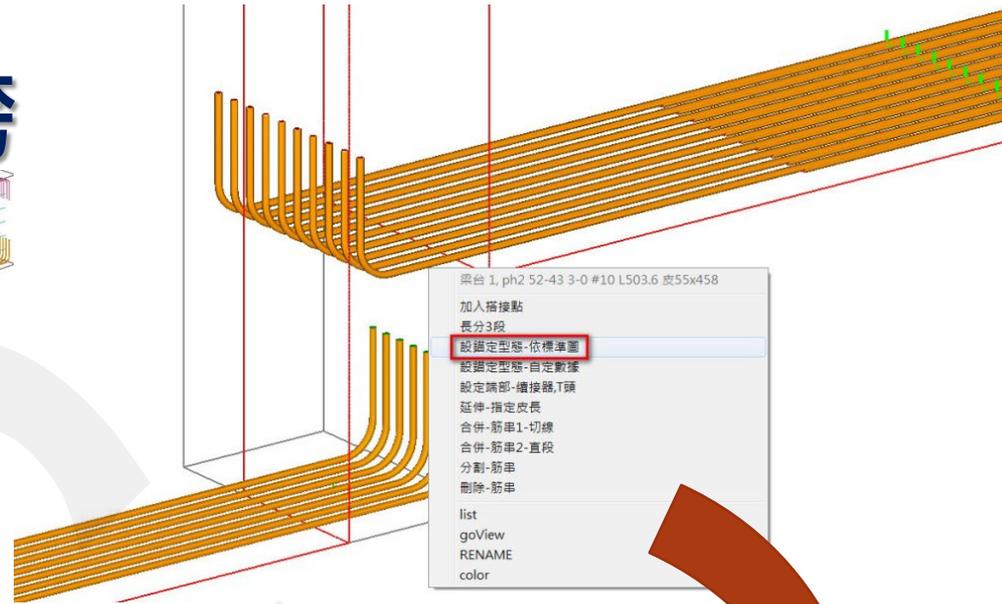
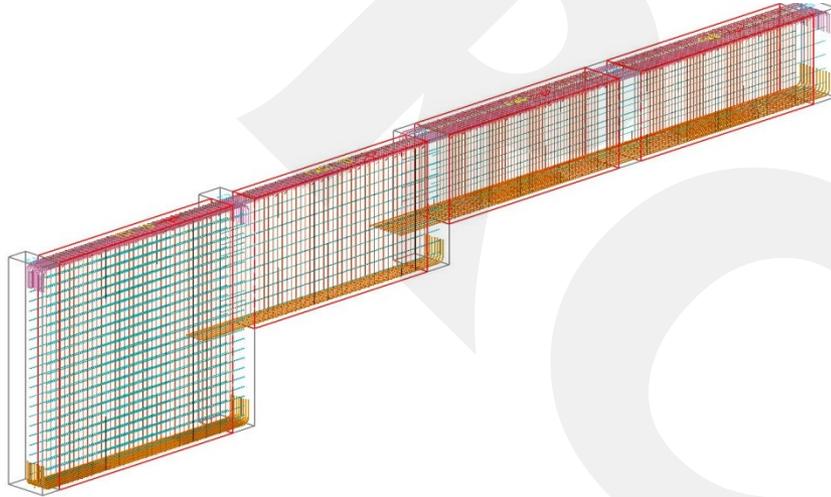
1. 梁 面面觀



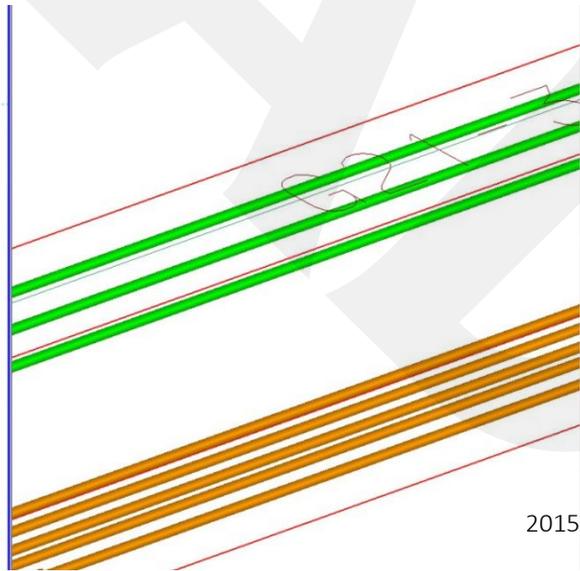
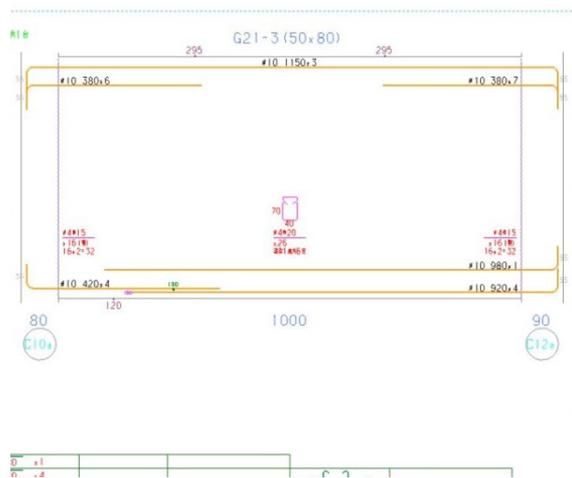
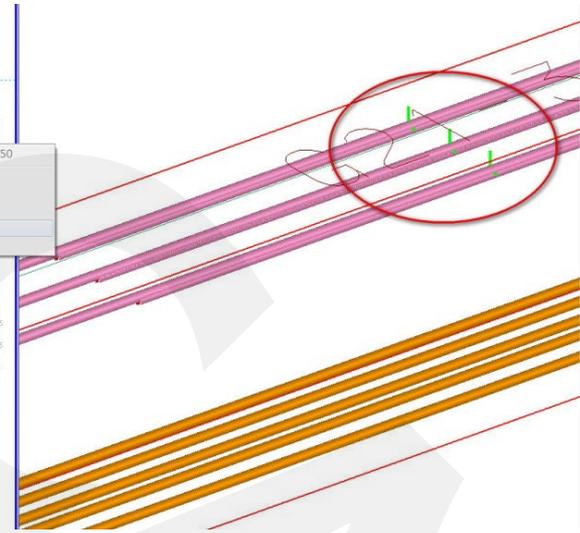
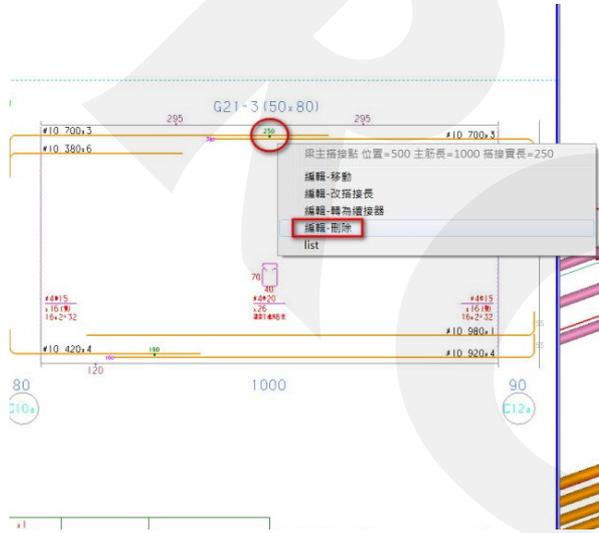
1-1 梁 曲線梁



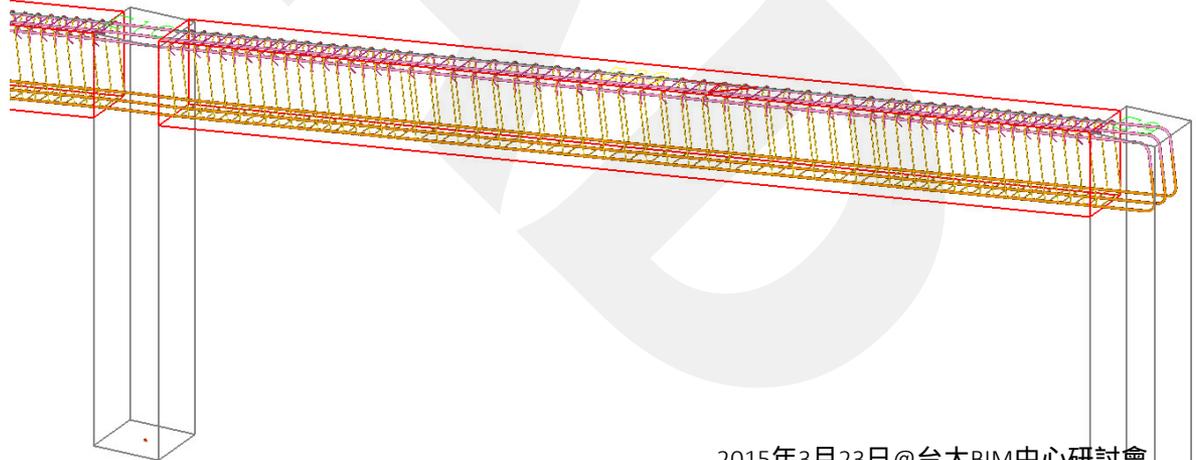
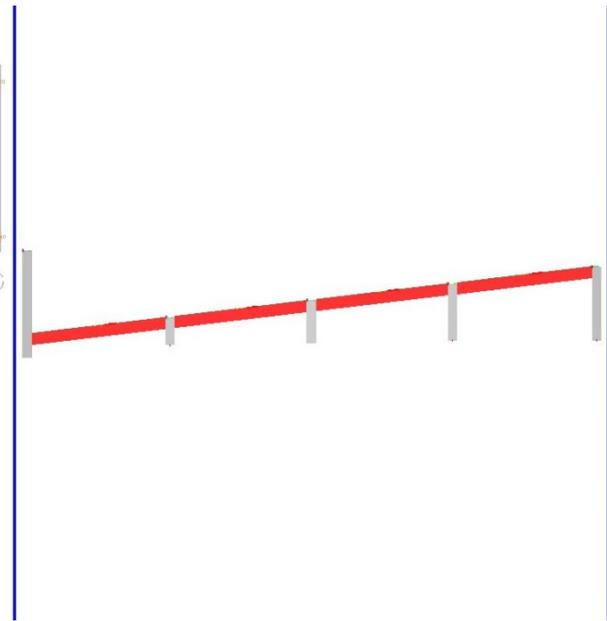
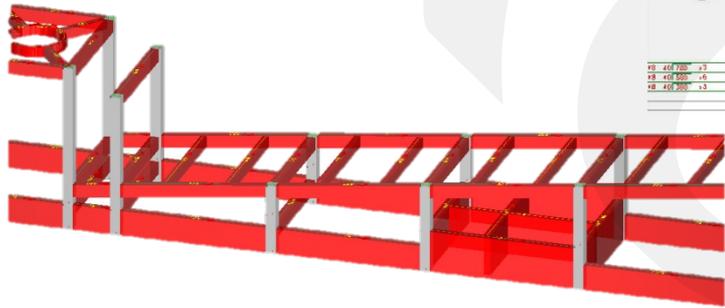
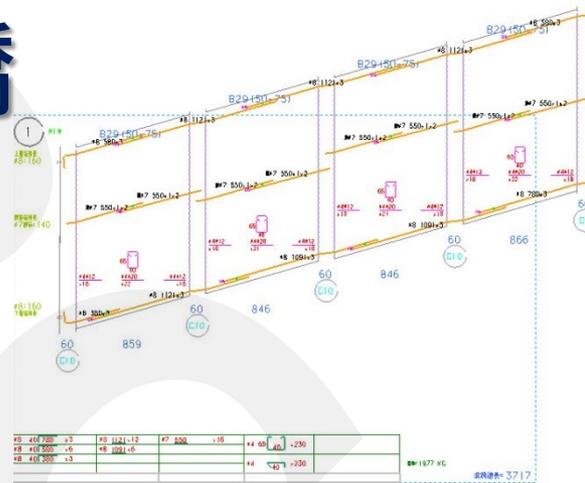
1-2 梁 伸入鄰跨



1-3 梁 刪除搭接點



1-4 梁 車橋



1-5 梁 鋼筋模型共用概念

The image shows a screenshot of the RCAD software interface. On the left, a tree view lists various rebar models, with '42 CRCAD_RebarModel_Tie' highlighted. In the center, a data table window displays the properties for this model. On the right, a 3D model of a beam is shown with rebar reinforcement. Red arrows point from the data table to the corresponding rebar in the 3D model.

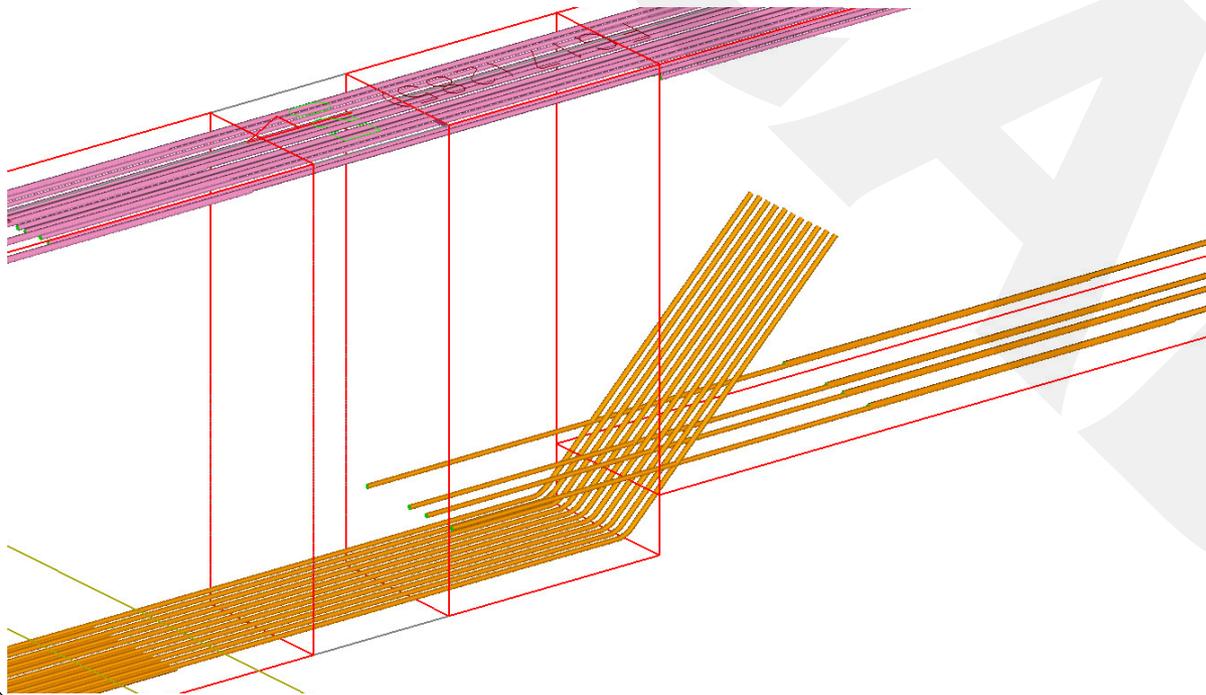
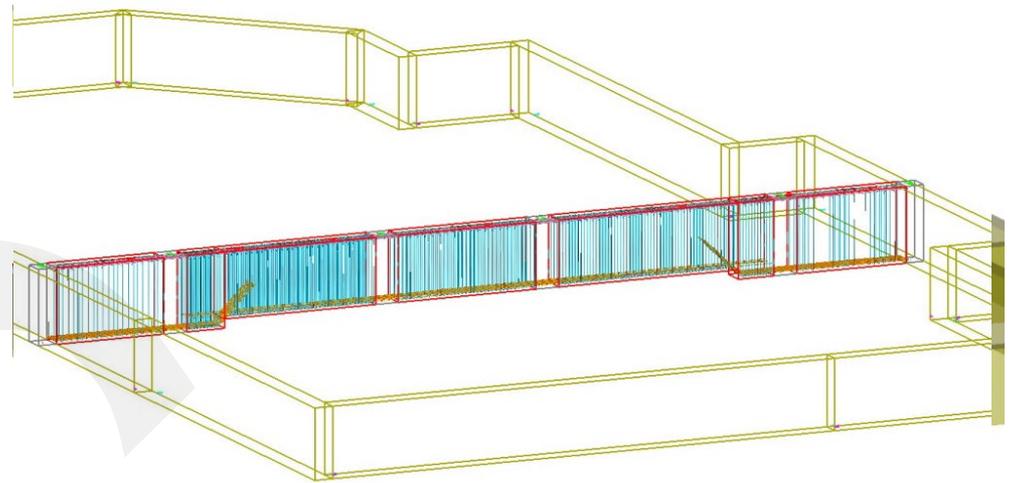
Table Data:

Index	Length (cm)	Weight (kg)	Angle (rad)
0	6.318099	10.808218	0.000000
1	0.929936	5.420064	0.000000
2	0.585394	5.012281	0.000000
3	0.314424	4.552581	0.000000
4	0.174088	4.053953	0.000000
5	0.049964	3.530487	0.000000
6	0.004995	2.996976	0.000000
7	0.079604	2.468496	0.000000
8	0.241682	1.959980	0.000000
9	0.486651	1.485798	0.000000
10	0.807586	1.059350	0.000000
11	1.195420	0.692685	0.000000
12	1.639193	0.396166	0.000000
13	2.126364	0.178170	0.000000
14	2.643168	0.044860	0.000000
15	3.175000	0.000000	0.000000
16	22.825000	0.000000	0.000000
17	23.376333	0.048235	0.000000
18	23.910914	0.191476	0.000000
19	24.412500	0.425369	0.000000
20	24.865851	0.742809	0.000000
21	25.277191	1.134149	0.000000
22	25.6474631	1.587500	0.000000
23	25.898524	2.089086	0.000000
24	25.951765	2.623667	0.000000
25	26.000000	3.175000	0.000000
26	26.000000	10.795000	0.000000

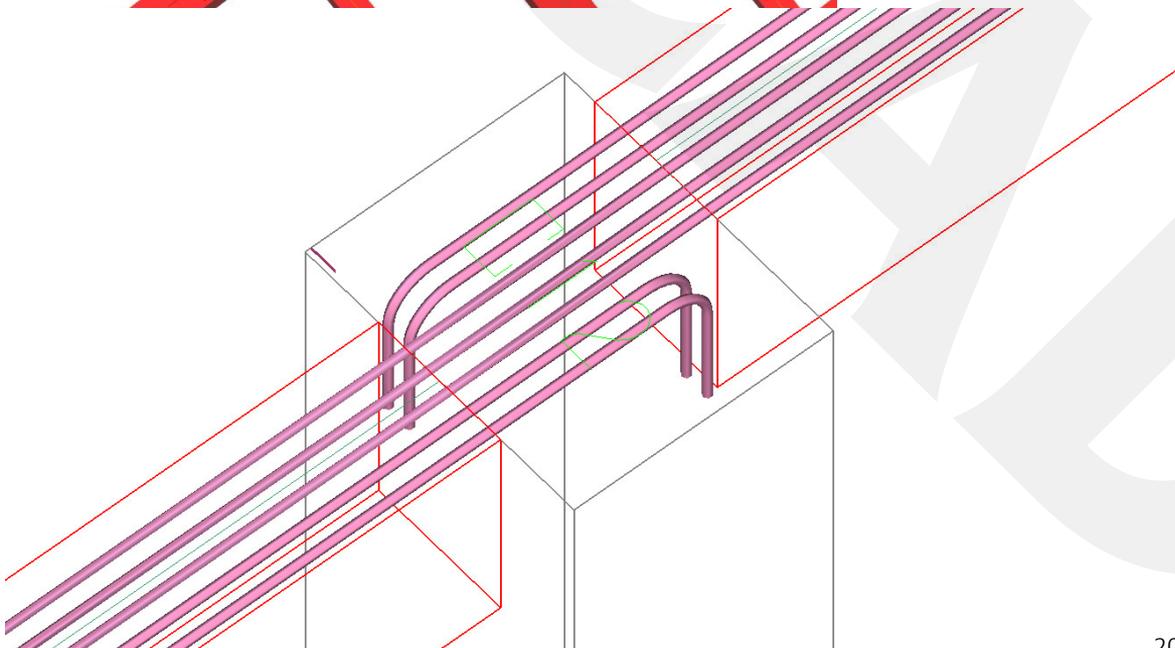
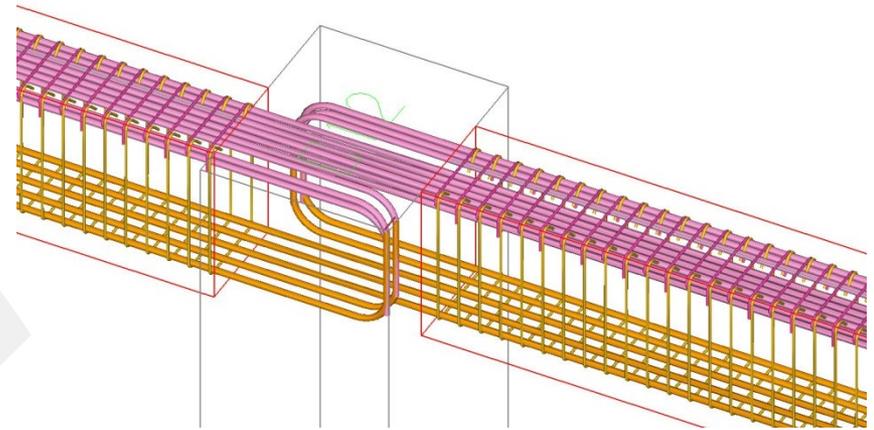
Additional Parameters:

- class=CRCAD_RebarModel_Tie;
- name= 42;
- 鋼筋號數= #4
- 三角片數= 208
- length= 47.358
- weight= 0.47
- 基線長度= 26.000
- 導角半徑= 3.175
- 左側彎鉤處之直線延伸長度及角度= 7.620,135.000
- 右側彎鉤處之直線延伸長度及角度= 7.620,90.000

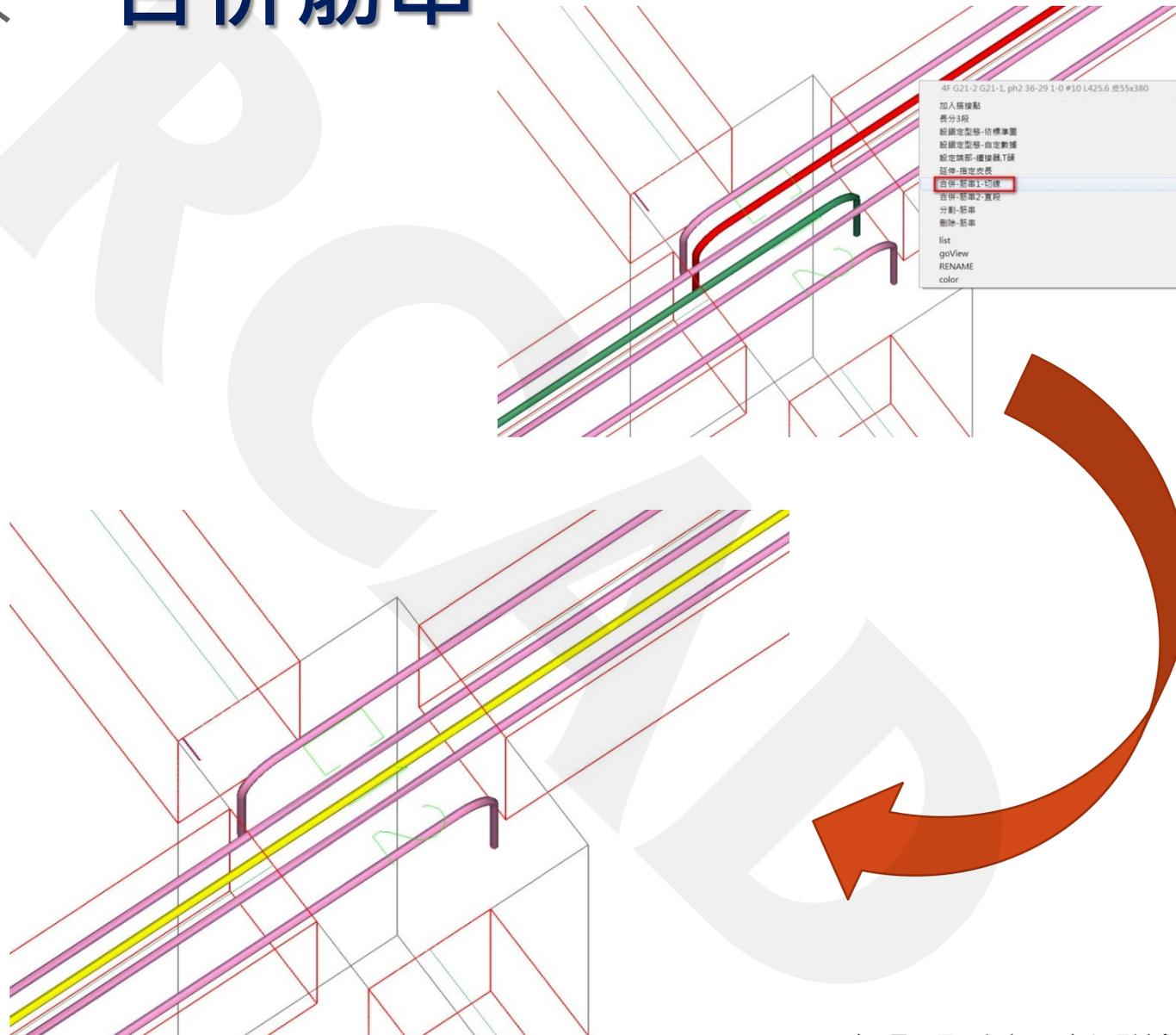
1-6 梁 變斷面



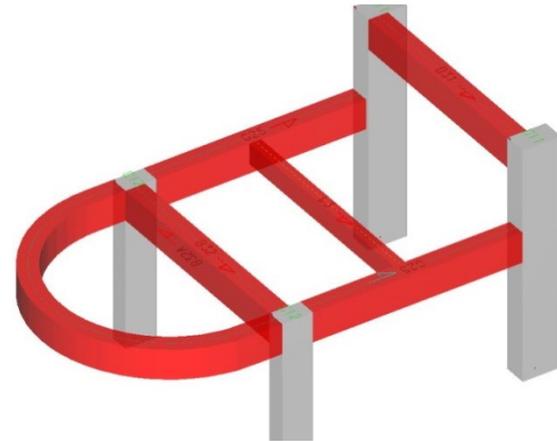
1-7 梁 梁錯位



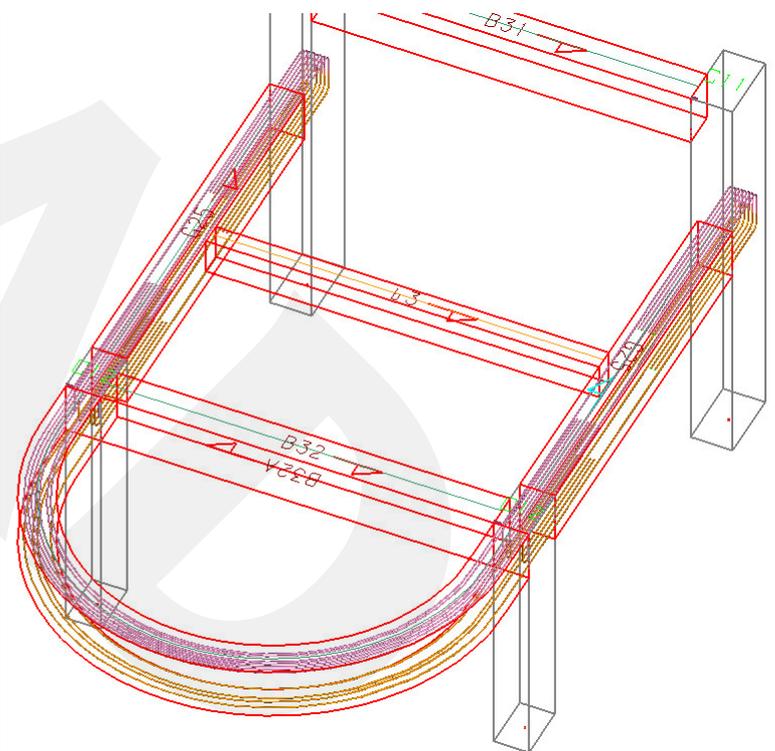
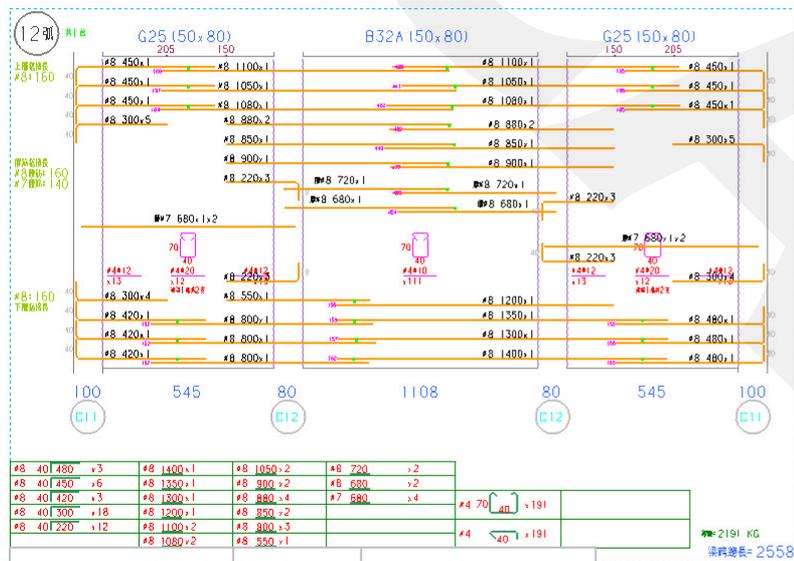
1-8 梁 合併筋串



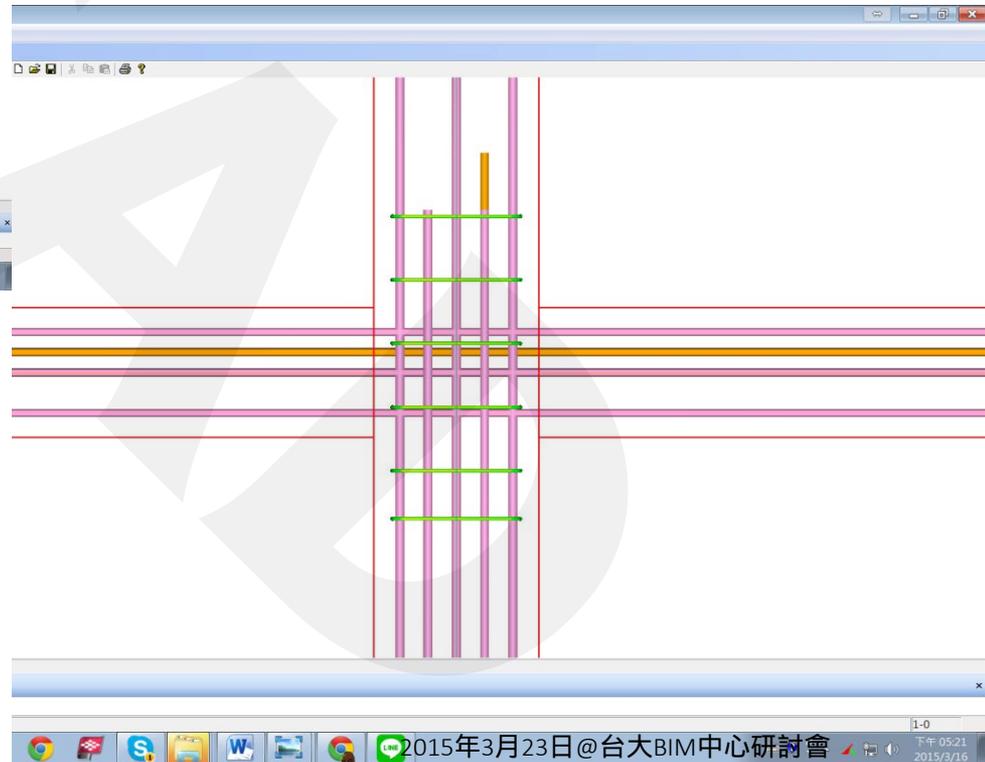
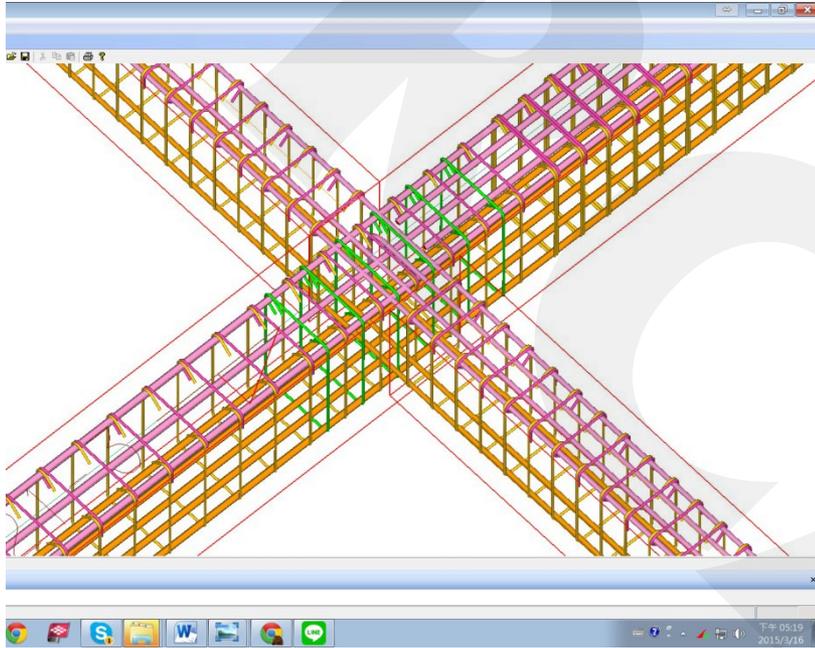
1-9 梁 圓弧梁



- 2D 3D 施工圖同步

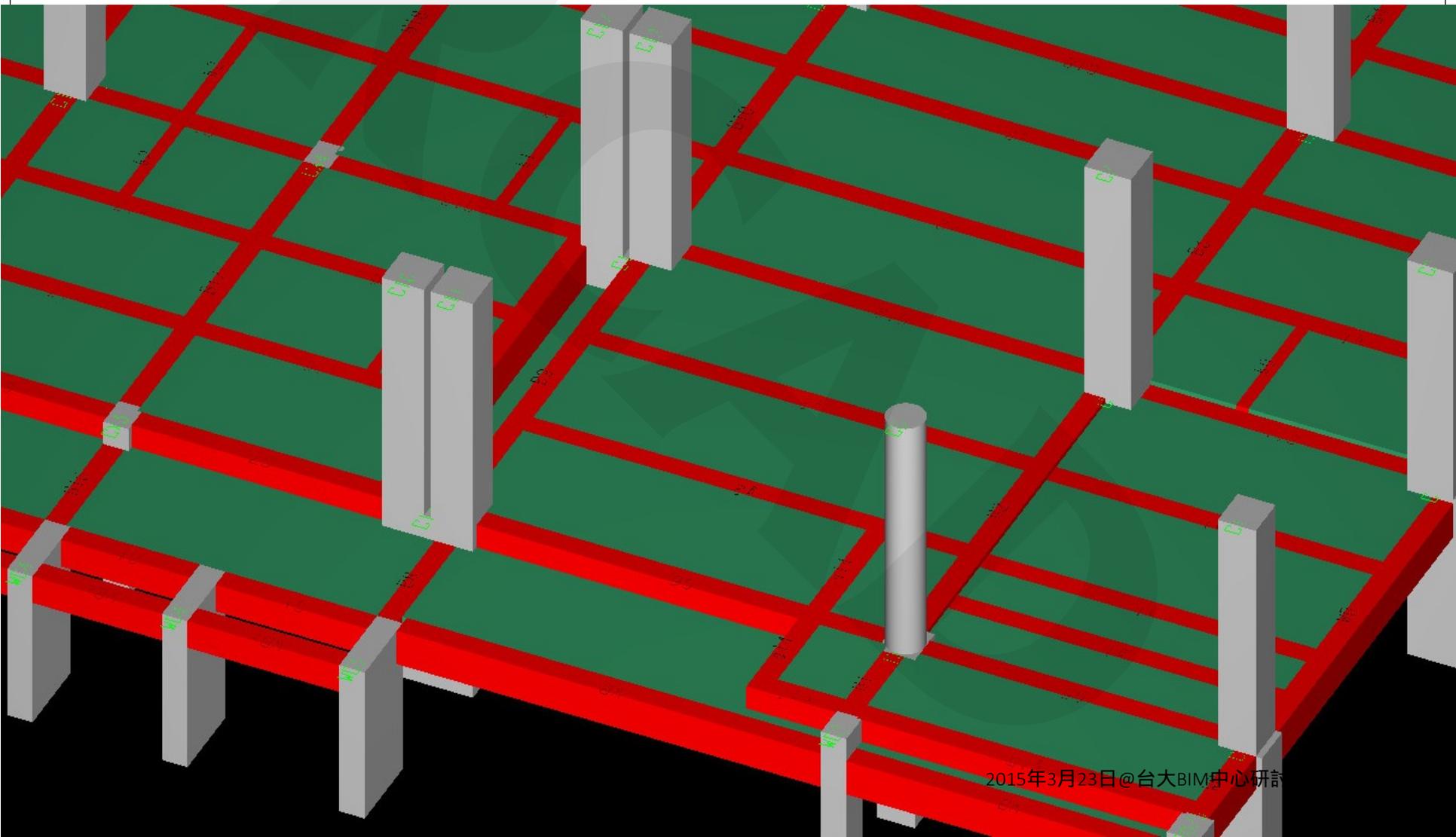


1-10 梁 補強箍筋



- 自動計算
- 可手動修改

2. 柱 的疑難雜症



2-1 2D3D同步移動續接器

The screenshot displays the RCAD software interface for editing a column reinforcement stack. The main view shows a 2D/3D perspective of the column with reinforcement bars and a context menu open over a specific bar. The context menu options are:

- 移動 (Move)
- 編輯-續接器設定 (Edit - Connector Settings)
- 刪除 (Delete)
- list

The left sidebar shows the BOM tree structure:

- CRCAD_BuildingsCt
- 柱綁定-柱綁定-總結: 7
- 2 Materials 1
- 3 Floors 8
- Roof
- RF
- 4F
- 3F
- 2F
- 1F
- B1F
- PC
- 4 配筋-柱 95
- 5 配筋-梁 238
- 6 配筋-板 22
- 7 配筋-樑 18
- 8 門窗模型 39
- Frames 0
- 柱線 1
- 31 C19 B1F~RF 6
- 設置 0
- 模型斷面 12
- Sections 37
- 分區 0
- 水平支撐 0
- 鋼筋模型 1387
- 磁磚石材模型 0
- Else 0
- Else 0

The central panel shows the '移動 2F:C19' dialog with the following parameters:

- 設定參數
- 搭接位置: 160.
- 搭接位置-現值: 160.
- 設定參數
- 異動範圍: 2.本柱線-同層-同
- 物件總數: 10
- Highlight
- 柱主筋: FFFF00
- 分段點-顏色: FF0000
- 分段點-線寬: 3
- else
- 重算高度

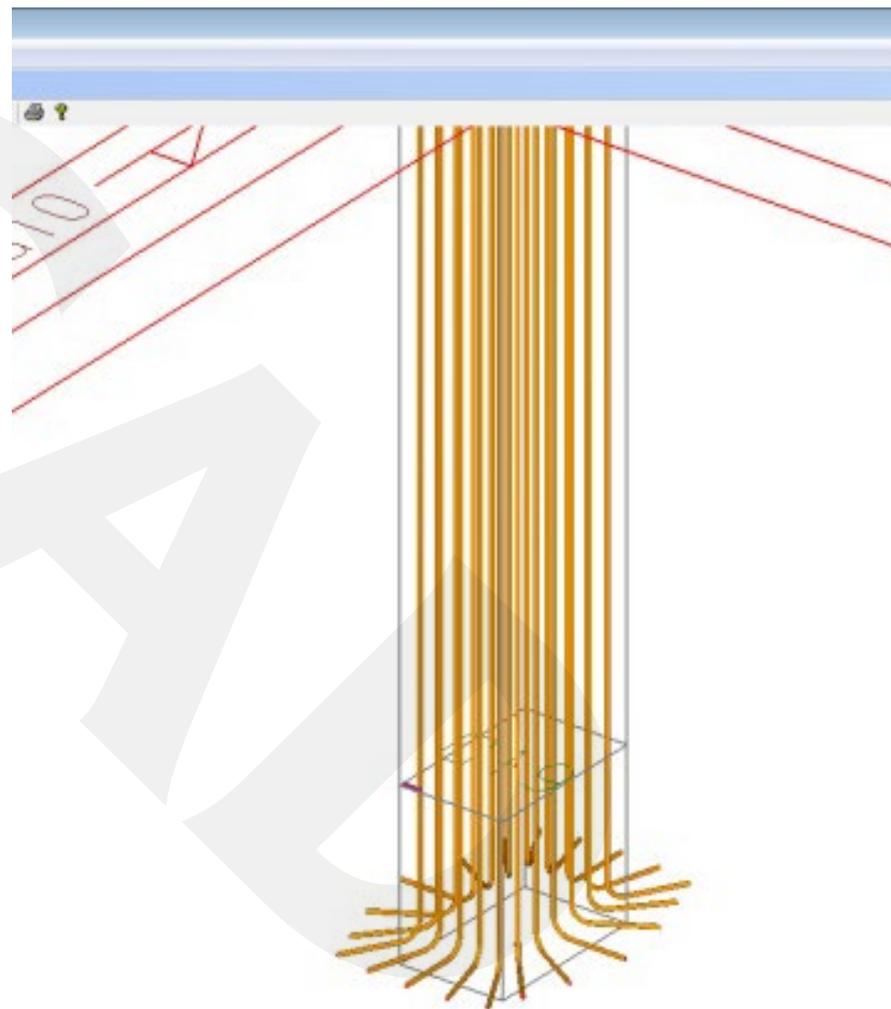
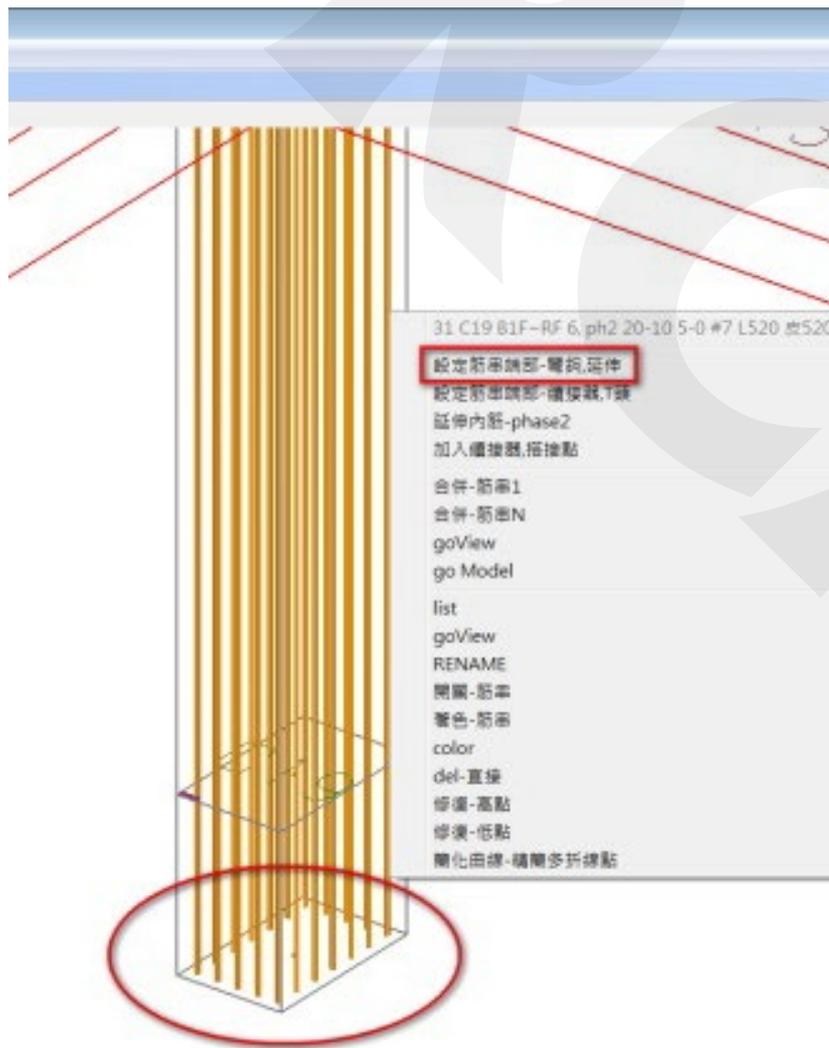
The main view shows a column with reinforcement bars and a context menu open over a specific bar. The context menu options are:

- 移動
- 編輯-續接器設定
- 刪除
- list

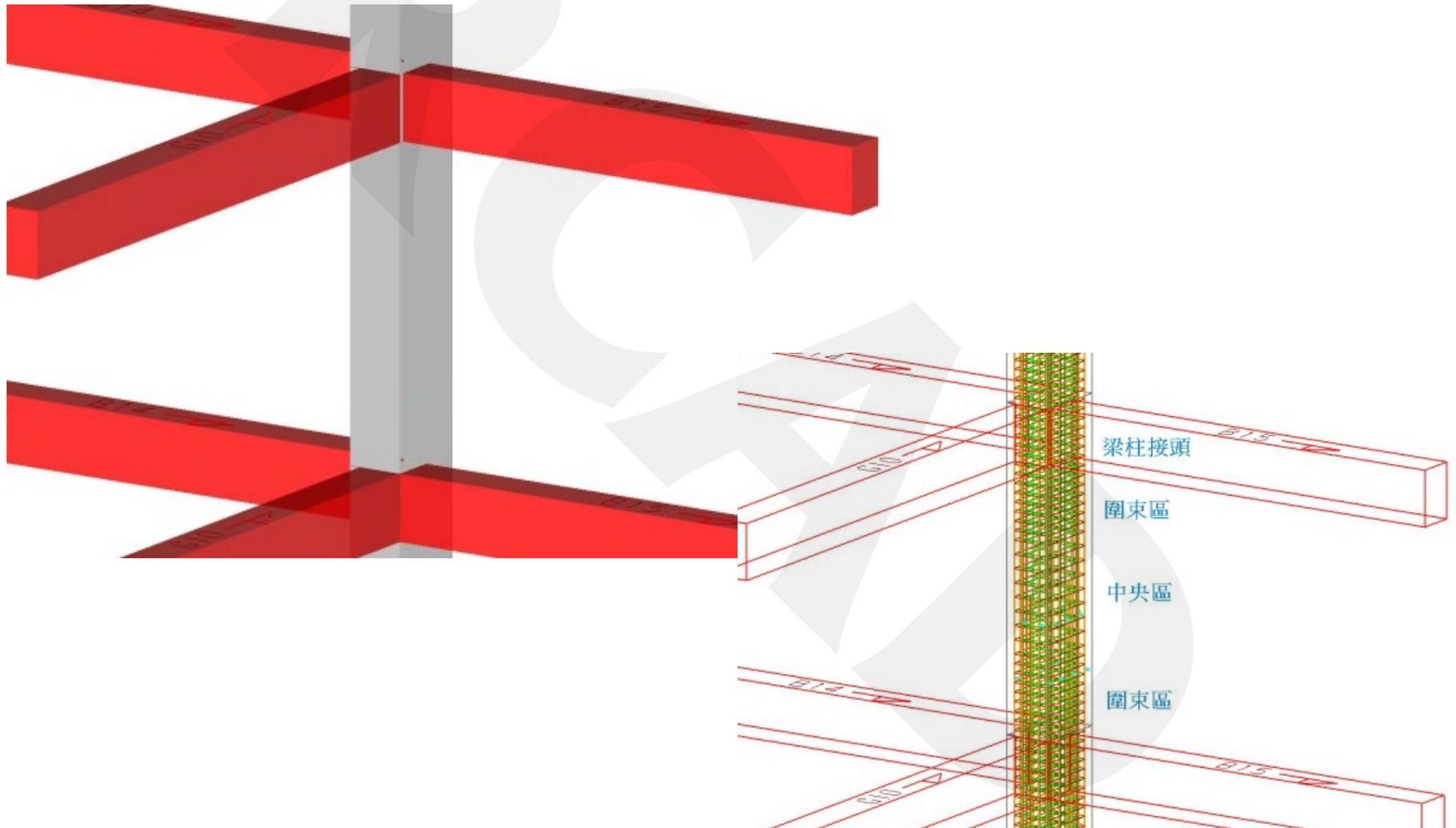
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- 刪除
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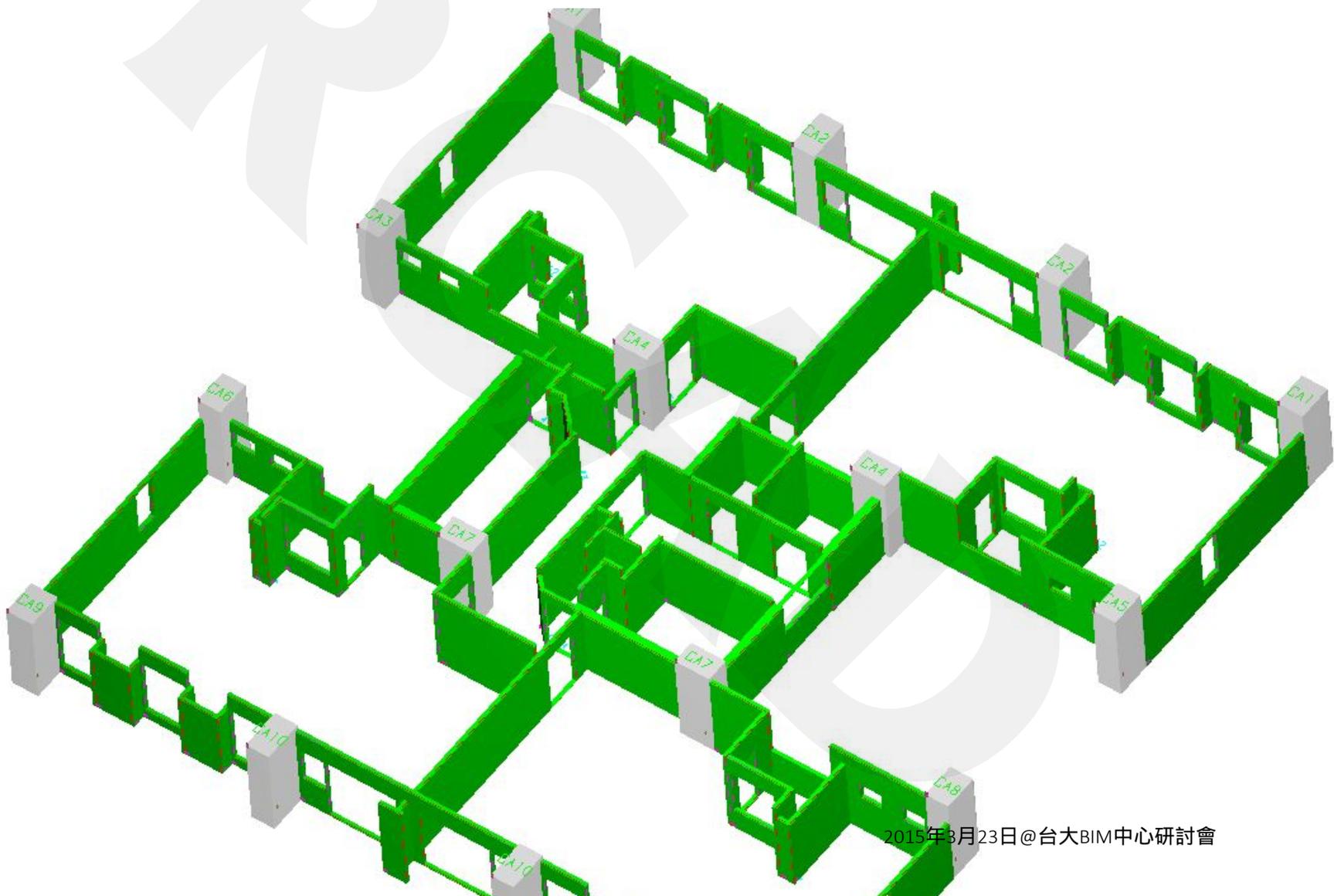
2-2 柱錨定



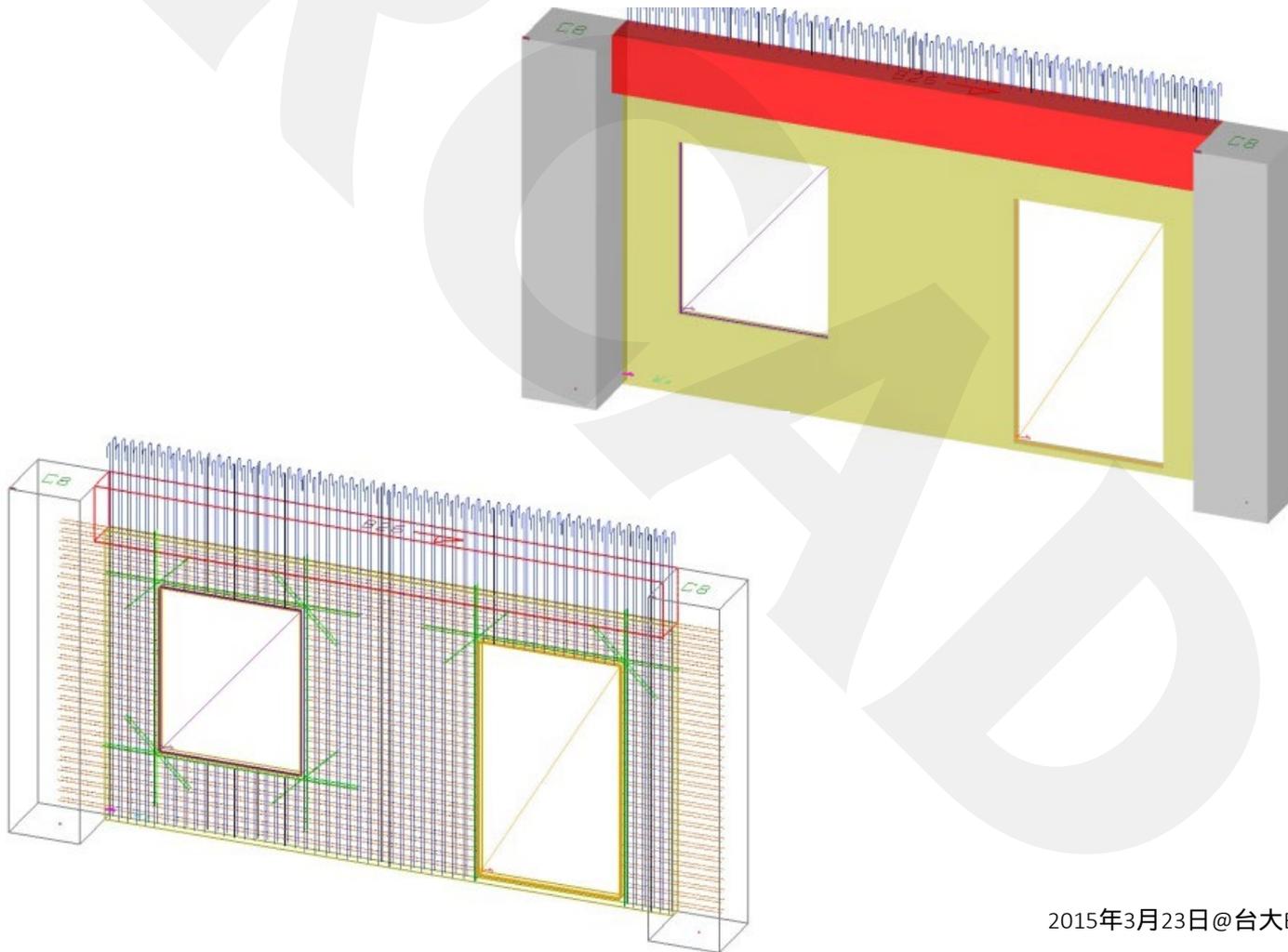
2-3 箍筋自動配設



3. 牆的細節



3-1 牆開口補強 / 預留筋安全彎勾



PART 3

產生施工圖與料單

程式特色：2D 3D 施工圖 同步

The screenshot displays the RCAD Building software interface. On the left, a vertical list of levels from 16F to 2F is shown, with 3F selected. A central panel shows a 2D structural floor plan with various elements highlighted in different colors. To the right, a 3D perspective view of the building's structural frame is shown in red and yellow. Below the 2D plan, a detailed reinforcement drawing is visible, featuring a grid of columns and beams with associated dimensions and labels.

2D Reinforcement Drawing Labels:

GA3-12(50x80)	GA3-23(50x80)	GA3-34(50x80)	GA3-
GA3-12(50x80)	GA3-23(50x80)	GA3-34(50x80)	GA3-
GA3-12(50x80)	GA3-23(50x80)	GA3-34(50x80)	GA3-
GA3-12(50x80)	GA3-23(50x80)	GA3-34(50x80)	GA3-
GA3-12(50x80)	GA3-23(50x80)	GA3-34(50x80)	GA3-
GA3-12(50x80)	GA3-23(50x80)	GA3-34(50x80)	GA3-
GA3-12(50x80)	GA3-23(50x80)	GA3-34(50x80)	GA3-
GA3-12(50x80)	GA3-23(50x80)	GA3-34(50x80)	GA3-
GA3-12(50x80)	GA3-23(50x80)	GA3-34(50x80)	GA3-
GA3-12(50x80)	GA3-23(50x80)	GA3-34(50x80)	GA3-

Dimensions and Labels: 765, 120, 705, 120, 750, 80, 612, 81, 750, 0. Labels include CAG, CAT, CAB.

1.料單

編號	號數	圖示	長度(cm)	數量	重量(kg)	備註
1	#10	55└───┐ 265 10	320	167	3,415	#4=6,714
2	#10	55└───┐ 295 10	350	323	7,224	#10=14,378
3	#10	55└───┐ 325 10	380	154	3,739	合計=21,092
4	#4	80└──┐ 12 80	344	480	1,641	
5	#4	135└──┐ 12 80	454	30	135	
6	#4	160└──┐ 12 80	504	30	150	
7	#4	12└───┐ 80.5 18	100	3430	3,409	
8	#4	12└───┐ 135.5 18	155	104	160	
9	#4	12└───┐ 160.5 18	180	104	186	
10	#4	15└──┐ 80	110	78	85	
11	#4	35└──┐ 80 15 100	230	27	62	

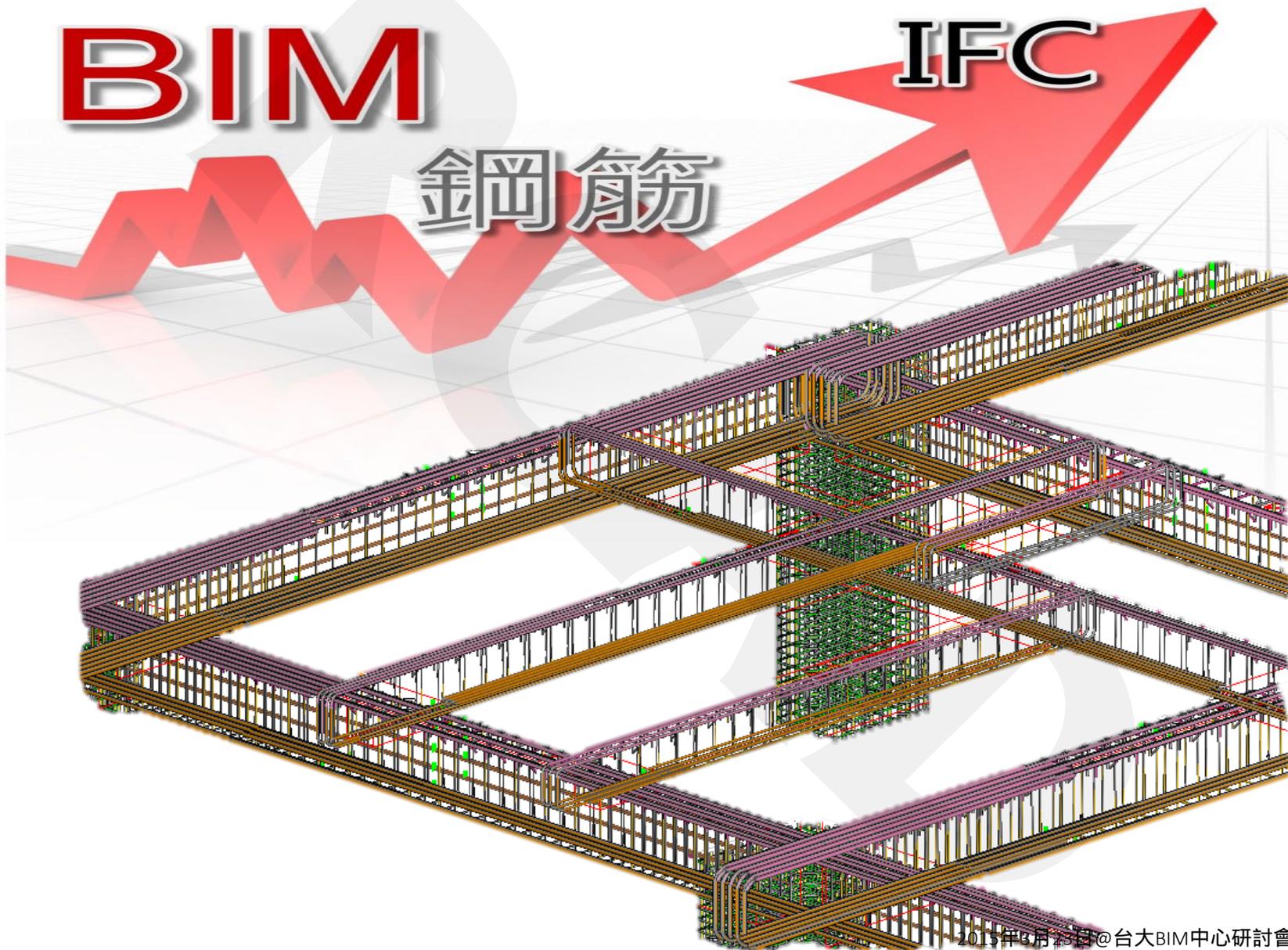
PART 4

IFC IN IFC OUT

BIM

IFC

鋼筋



值得想一想

有**想法** 才會**改變**

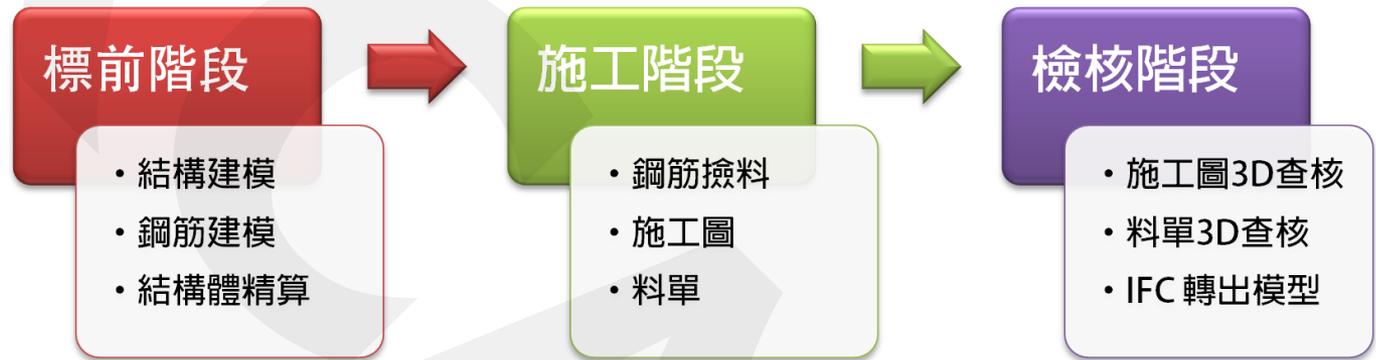


BIM 是最好的溝通工具

- 每個人都點頭
- 但是腦海中的 3D 都不同



● 如何善用BIM的鋼筋檢料



傳統流程

清圖

讀2D建築平立剖

讀2D結構配筋

建3D建築模型

佈3D鋼筋模型

調整鋼筋細節

產生鋼筋施工圖

輸出料單

BIM流程

結論

1. 營造廠可善用BIM檢料效益
2. 可獨立發檢料包
3. 檢料技術可提高鋼筋估算效能
4. 進入3D溝通的時代

結論

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環佳富科技
吳杰彥