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# A Study of BIM Combined with ETABS in Reinforced Concrete Structure Analysis

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**Abstract:** For many structural analysis software which used to establish a simplified element analysis model based on the concept of finite element method. However, there is a certain gap in the actual behavioral effects for simplifying the model so the analysis results will different with real condition such as RC section reinforcement steel layout. So how to describe the real condition for RC detail section is an important problem for engineering. Building information modeling (BIM) software combined with APP program which will establish the actual section and reinforcement effect of three-dimensional member model. In this paper we applied BIM software AutoDesk Revit program to build a structural model including geometry and reinforcement in RC system and then convert it into ETABS analysis software and obtain regional structure behavior and explore real structural security.

## 1. Introduction

For structural analysis, how to clearly define the material cross-section behavior of each member will help to analyze the accuracy of the results. For a long time, the structural engineer analysis tools have analyzed the structural system in a simplified mode, although it has the convenience of being numerical. In the actual design, such as the design of the steel reinforcement, the design of the reinforcement is often based on the experience of the designer, resulting in actual construction or the difficulty of the joint reinforcement is required to be changed again, which will have an impact on the design results. For this, Paola et al. [1] and Wang et al [2] proposed how to establish a drawing method for building systems. Li Yuxi [3] analyzed the effect of energy loss after establishing the Revit building model. For RC building the rebar system is complex in real construction. How to get the detail to numerical model for analysis was an important problem to get real behavior. In this paper we applied Revit program APP to prescribe detail rebar system in RC building then export to ETABS program to get a exact numerical model for numerical analysis.

## 2. Revit Building Modeling and ETABS Program Application

### 2.1. Revit RC Building Modelling

AutoDesk Revit model is built on the concept of "layer" and "grid" to prescribe the beam-column geometry system. In addition to the size of the elements, the expansion function can also be used to describe its details such as steel number and connection method. So we can get more precise way to describe the actual construction process, which can reduce the difficulty of the interface construction caused by the unclear 2D graph. For the RC structure modeling, in addition to setting the section size of the element (as shown in Figure 1), it is also necessary to set the reinforcement configuration to an-



alyze its behavior. In Revit program have provide simple steel bar reinforce model but is not clearly prescribe the connection link method between 2 element.

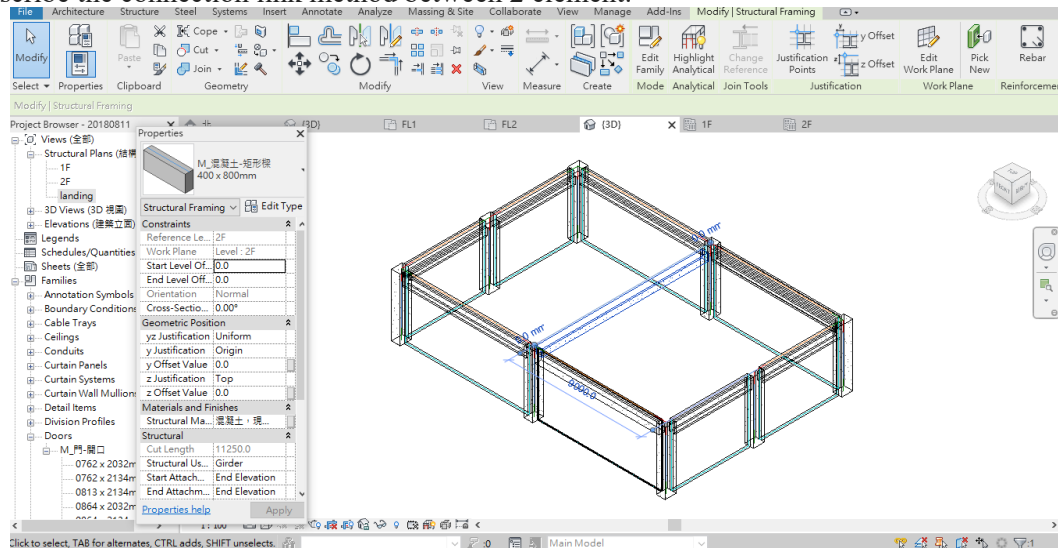


Figure 1. Revit concrete structure system setup

## 2.2. Reinforcement in Revit and ETABS data connection

### 2.2.1. Reinforcement App extension function

After the completion of the structural model, the reinforcement expansion APP function (as Figure 2) is used to set the reinforcement structure of the structural beam, column, and foundation plate for the reinforcement.

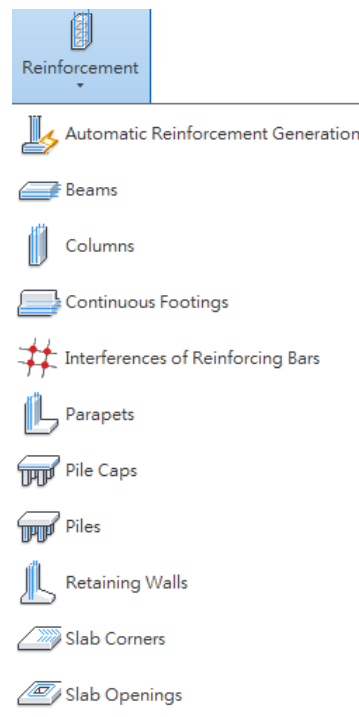


Figure 2. Revit Reinforcement expansion main board

### 2.2.2. Reinforcement for building

User can select beam and column sections to enter the reinforce type and set the parameters related to the beam and column reinforcement (Figure 3).

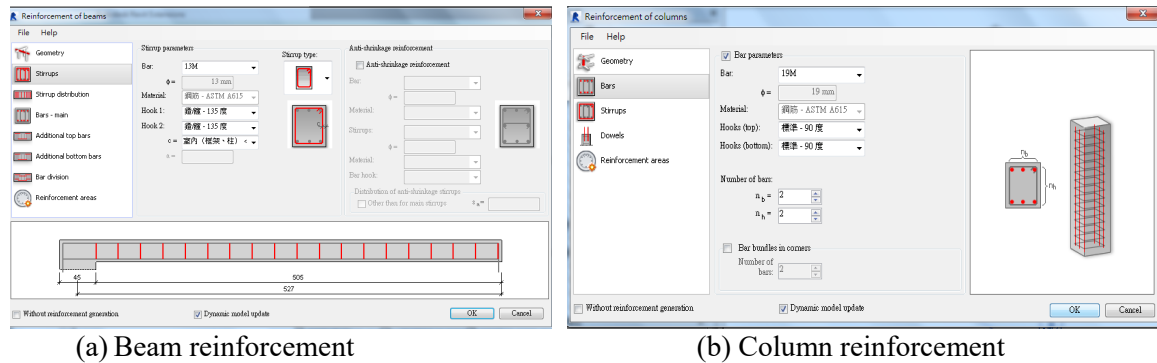


Figure 3. Beam column reinforcement function in reinforcement extension

### 2.2.3. Transport Revit model to ETABS program

We applied “Export to ETABS” to export Revit model as “e2k” file then we can import the system to ETABS program (as Figure 4)

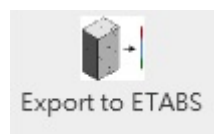


Figure 4. Revit exchange EABS file extension function

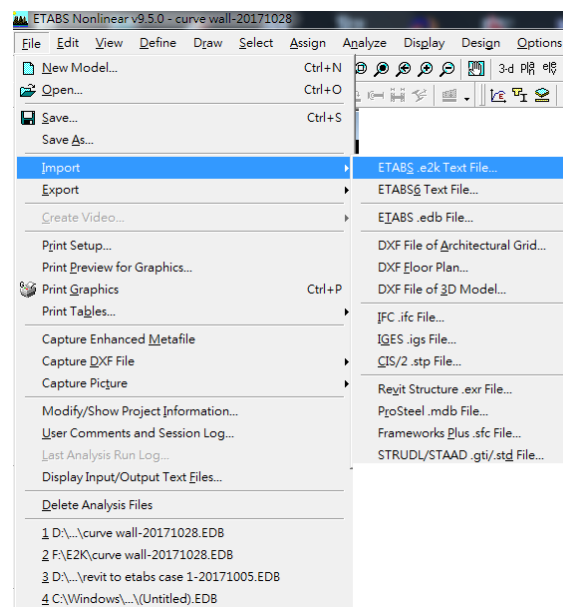


Figure 5. ETABS import e2k file function

## 3. Numerical Application

In this paper we applied an 1F RC building and define the steel reinforce condition of beam column and independent foundation then we applied uniform load as Figure 5 shown.

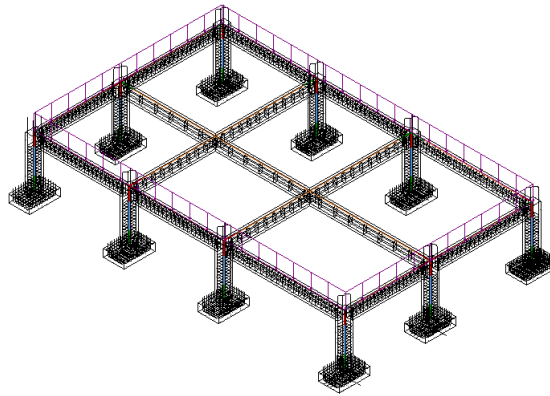


Figure 6. 1F independent footing RC building Revit model

After the above process Revit models are imported into ETABS, the structural related parameters can be directly imported without the need for reinforcement and material setting. As Figure 8 we show the of parameter confirmation transform from Revit and the analysis results of deformation and moment of building as Figure 9 and Figure 10. So we can get the real reaction from RC reinforcement detail layout by Revit model.

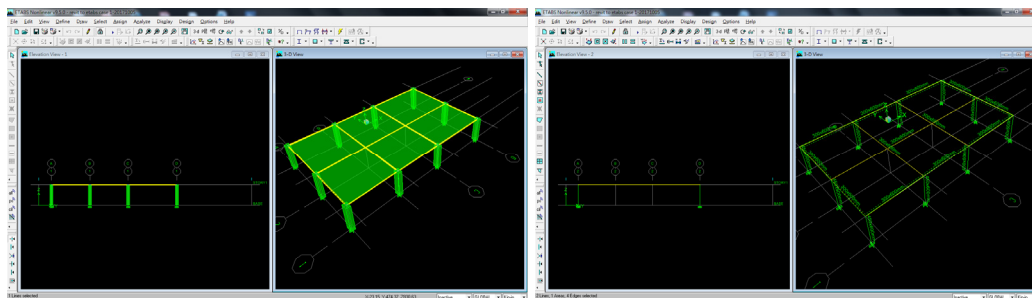


Figure 7. BIM model import ETABS program results

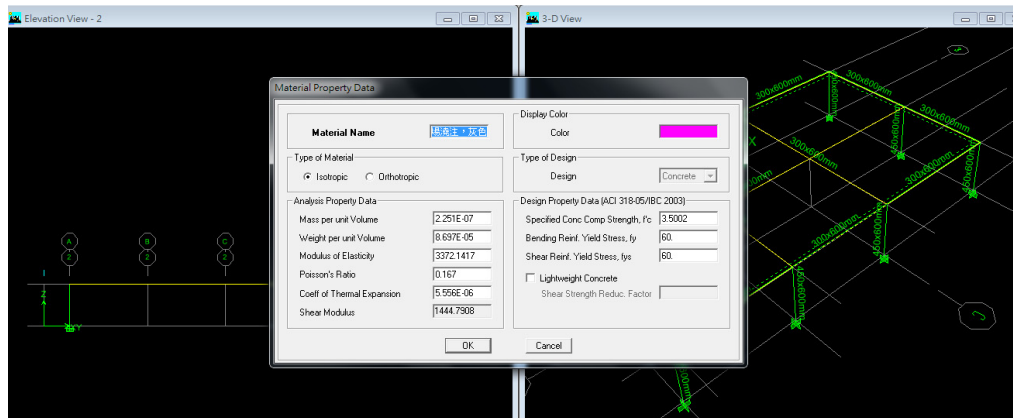


Figure 8. Revit BIM material import to ETABS results

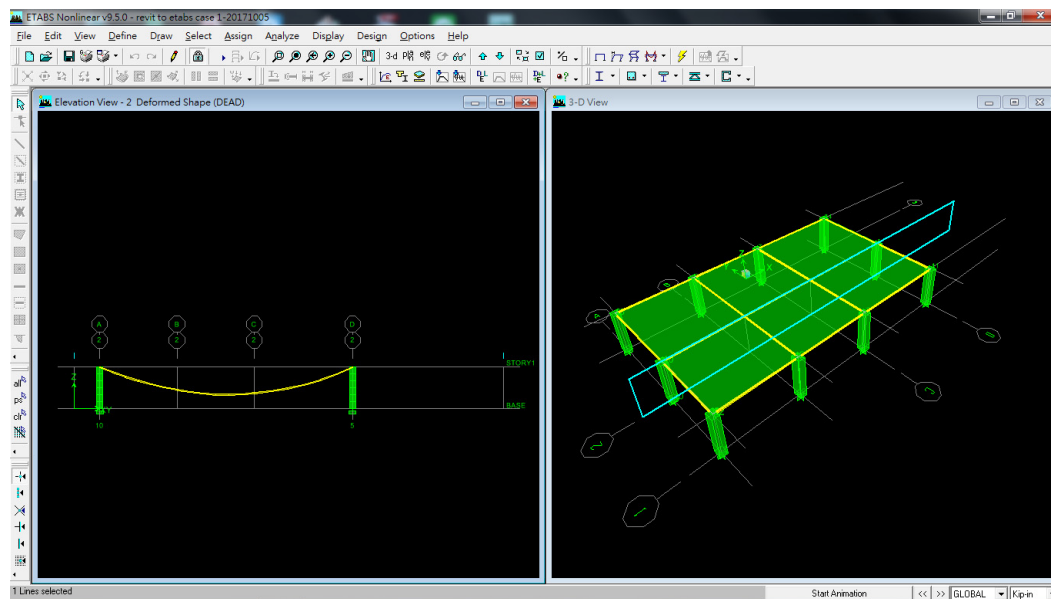


Figure 9. ETABS analysis deformation result

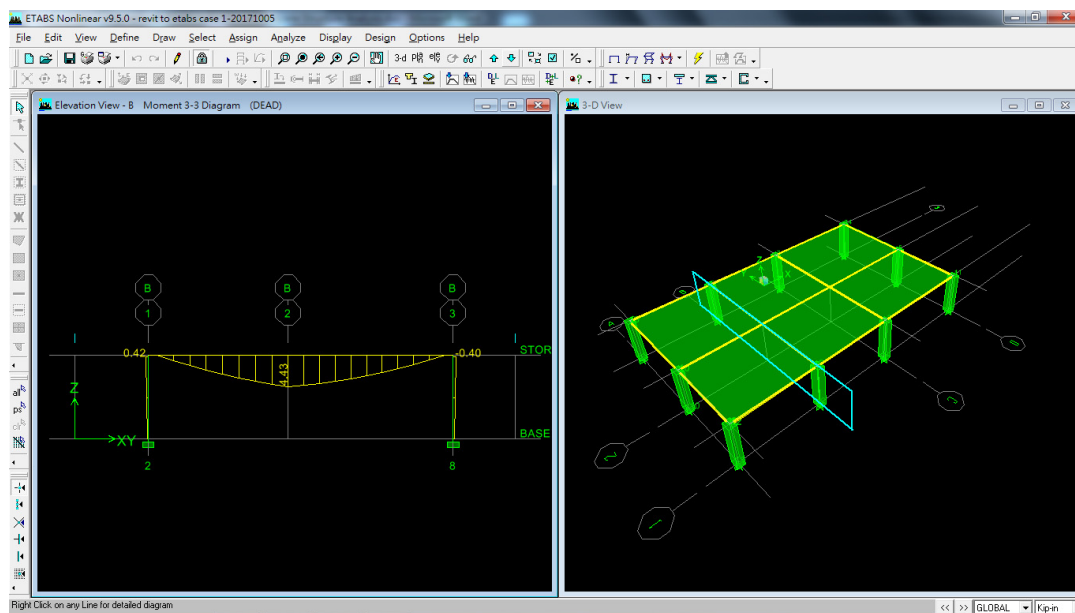


Figure 10. ETABS analysis moment result

#### 4. Conclusions and Discussions

From this analysis we can find BIM Revit combined with ETABS analysis will provide structural detail analysis results, which will be helpful for the accuracy of structural analysis. So the designer can get the real behavior from Revit reinforce detail layout to avoid the gape from tradition simplified numerical model.

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