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Engineering Digital Model Analysis Based on BIM Technology in Engineering Cost Management

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Abstract
Bim is a architectural model based on various relevant information data of construction projects. It simulate the factual information possessed by buildings through digital information simulation. BIM technology has been widely applied in engineering project management, which can improve the level of cost management. This article based on the analysis of a digital model of a particular project. Through the comparison analysis between the manual engineering quantity and the computer engineering quantity of Glodon No. 11 plant project, collision checks between civil and installation models are carried out in revit model, followed by a summary and analysis of various aspects, and the digital model of engineering is understood according to the analysis.

Keywords: glodon *software calculation , cost application, revit modeling, digital model analysis*

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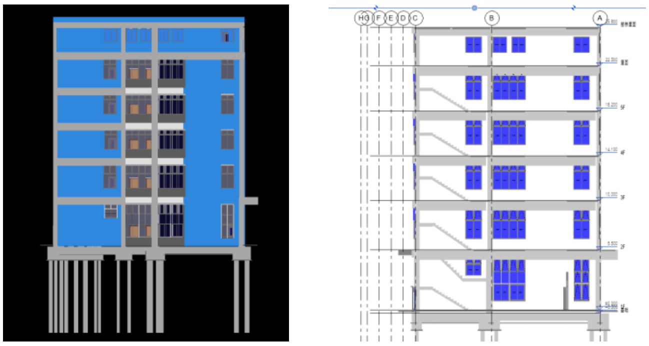
Ⅰ.INTRODUCATION

The applied digital model analysis of engineering cost is to analyze the three-dimensional model for a certain engineering manual calculation and the creation of Glodon software and revit model, providing effective data and analysis for the specific engineering cost and practical engineering application. It is mentioned in the article " Fine Management Analysis of engineering cost based on bim technology"[1], that bim technology can effectively control construction efficiency and construction cost, and cost personnel should also strengthen the study and application of bim technology, so as to better improve profits for enterprises.In the process of analysis, in the article " Based on the Application of Planning Method -- A Case Study of Minnan Polytechnics No. 3 Complex"[2], Wu Zuoliang and Hong Xiujun through the analysis of planning method in a project cost has a great impact and far-reaching significance, the combination of hand and computer calculation, can improve the relative strength of the industry.The application of BIM technology in engineering cost calculation software " explains that BIM technology is not yet well-developed in China. The application of bim technology in engineering cost calculation software "[3], explains that bim technology is not yet developed in our country. bim calculation will pull us from tedious to simple, make the cost personnel use bim technology calculation to become daily, and well promote the promotion of building information. " Application of Glodon BIM calculation software in frame beam reinforcement engineering"[4], concludes that BIM calculation software has a very important role in fast and accurate calculation of reinforcement engineering. " A Comparative Study of Glodon Software computation and manual computation in Engineering cost Management -- Taking Guangxi WuxiangLantingfu Project as an example"[5]. This paper mainly analyzes the advantages and disadvantages of Glodon software computation and manual computation, and makes a comparative analysis based on the long time spent in the application of software computation and manual computation in practical construction projects and the accuracy of the results. Based on the above articles and materials,a digital model analysis of engineering cost was conducted.

This paper also takes the No.11 workshop of the project of Sino-Keke Ganghui Industrial Park as an example, adopts the engineering quantity calculation based on the morning light valuation, and analyzes the characteristics and internal relations between the engineering quantity of each sub-item. Through revit model and the analysis of Chenxi manuscript and Glodon computer engineering quantity, more effective digital model analysis is carried out. The project covers an above-ground building area of 6027.33m^3, and the building covers an area of 1176.94m^3. There are 5 above-ground building layers and 0 underground floors. The height of the building is 22.3m, and the body structure system is the frame structure. Seismic fortification intensity seven degrees seismic level three.

Ⅱ..REVIT MODEL CREATION

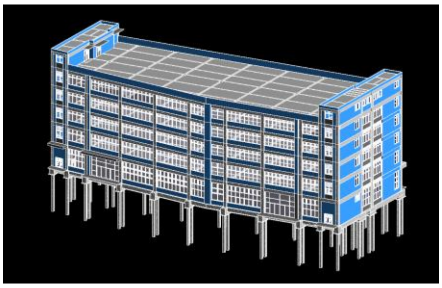
Bim modeling is to use BIM software to design and establish building models. The establishment of bim is to break through the traditional 2D CAD which only has various forms of point and line representation, to develop a model view visible in any direction, and then break through and change the previous thinking of unclear or careless illustration, which is solved by the site itself. revit, as the main modeling software of bim, can establish a digital building information model in three-dimensional space. All the information of a building comes from the model, and the information is stored in a digital form in the database. Here are some images of the revit model:



（a）Front elevation (b) sectional view

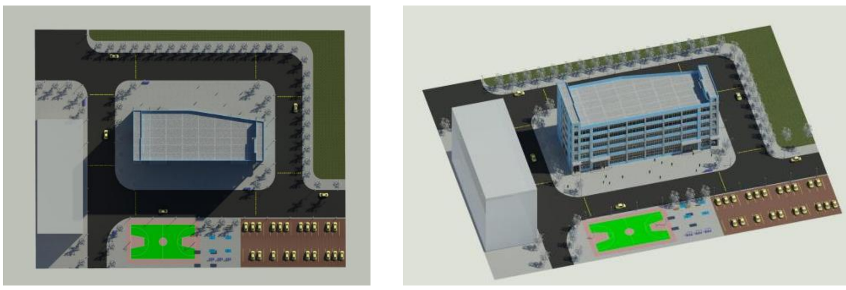
Figure 1: Civil engineering model diagram

(a) Mechanical and Electrical 3D Drawing (b) Front Elevation



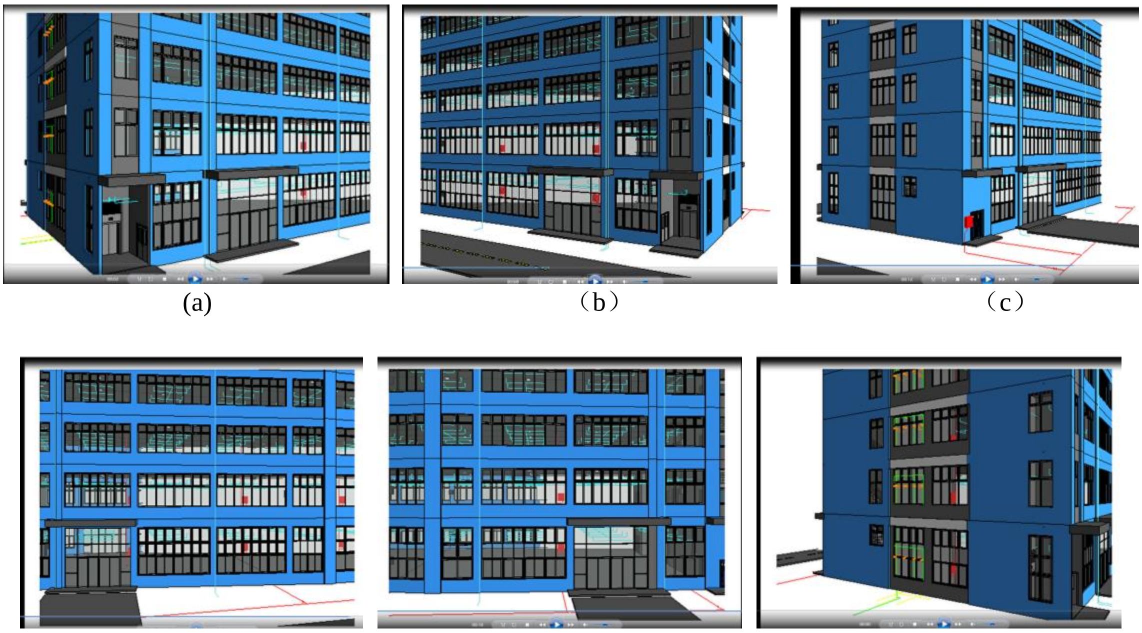
(c) Elevation Drawing

Figure 2: 3D model diagram



（a）Top view (b) Elevation view

Figure 3: 3D Greening Model



(a) (b) (c)

(d) (e) (f)

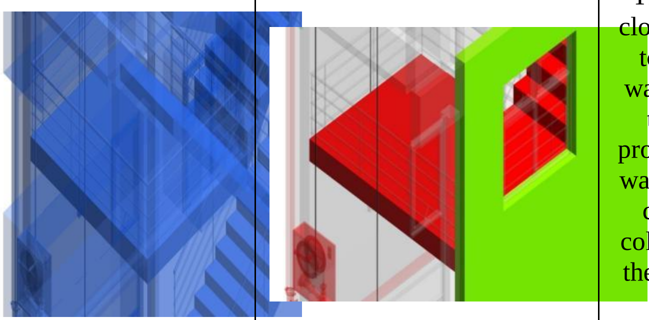
Figure 4: Revit Roaming Video Section

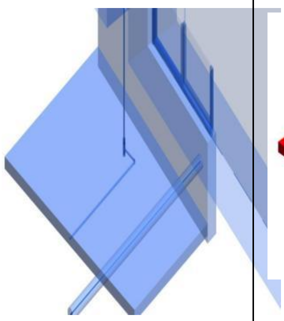
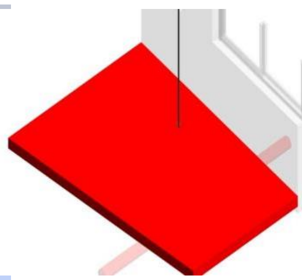
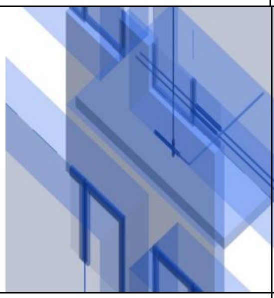
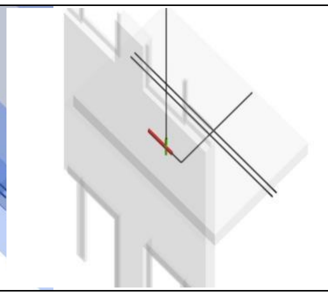
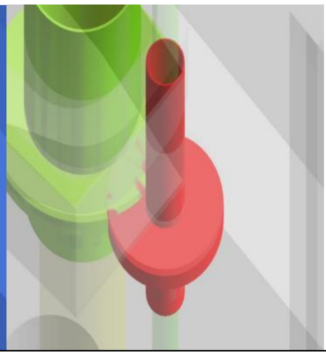
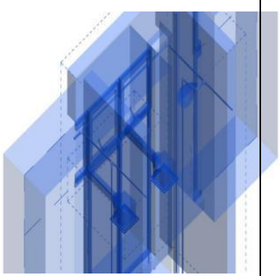
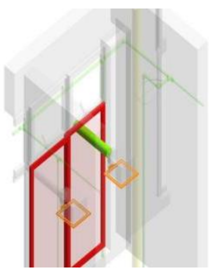
Ⅲ. COLLISION DETECTION REPORT AND ANALYSIS

As is well known, collision detection is a veteran of BIM applications, and its practicality has been evident in the promotion of BIM in China in recent years. Collision inspection is an important symbol of the transition from two dimensional era to three dimensional era. A large number of problems hidden in the design can be found in this process through the comprehensive "three-dimensional check". Theoretically, it can eliminate all types of collisions, reduce rework, shorten construction periods, and save costs before actual construction.

Generally speaking, the collision inspection in BIM is divided into hard collision and soft collision: hard collision and soft collision. Hard crash refers to the cross-collision between entities. In contrast, soft crash refers to the actual absence of crash, but the spacing and space cannot meet the relevant construction requirements (installation, maintenance, etc.). Soft crash also includes collision requirements based on time, which may occur during dynamic construction processes, such as the operation of construction machineries such as vehicles in the field layout and tower cranes. The following are some typical collision issues in this project:

Table 1: Partial analysis of revit collision detection

Collision position	Comparison Chart	analysis	terms of settlement
Wall: 200 thick exterior wall light blue — Stairs: stairs		The staircase is closely connected to the exterior wall, resulting in two separate projects: the outer wall and staircase colliding.The collision between the two positions leads to this situation.	The position of the stairs is adjusted to create a partial spacing with the outer wall.

Line pipe accessories: power — Floor slab: 120 floors			The position of the floor slab is at the same height as the accessories of the power pipeline, and the same elevation is used. Therefore, collision problems may occur during the collision between electromechanical and civil engineering.	Offset the floor elevation by -100mm to prevent pipeline fittings from colliding with the floor, thereby eliminating collisions.
Mechanical equipment: steel casing — Mechanical equipment: steel casing			Two mechanical equipment steel sleeves intersect and overlap in position, which also leads to collision issues at this location.	Change the position of one of the two steel sleeves so that there is no overlap at this position.
Mechanical equipment: rigid waterproof casing — Mechanical equipment: rigid waterproof casing			There was an overlapping collision between the rigid waterproof sleeves of two pieces of mechanical equipment at this location, as the distance between the two pipes was too close.	Change the position of the two pipes connected to the tough waterproof casing so that the rigid waterproof caes does not want to collide.
Ducts: Default — Windows: window panels_ Double leaf push-pull frameless aluminum window			This is the crash between the air duct and the window. The reason for the crash at this position is due to the inaccurate elevation of the air duct, which caused the collision with the window.	Change the elevation of the air duct to the bottom of the beam so that it does not overlap with the position of the window to change the collision here.

Ⅳ. MANUAL CALCULATION AND COMPUTERIZED ANALYSIS

The budget design software for this project is the widely used Glodon BIM calculation software in the cost industry. This software is currently dedicated to budgeters in China, and has strong professionalism. This software has a strong professional, design is also very humanized, complete functions, welcomed by the industry.The Glodon bim calculation software used this time includes Glodon civil construction calculation software and Glodon installation calculation software.Based on the rigor of the paper, the quotas used are all local quotas in Fujian province, and the reasons are analyzed by comparing the manual calculation and the engineering quantity calculated by computer. The following is a list of engineering quantity analysis for some manual and electronic calculations:

Table 2: Manual calculation and computer analysis report

Subdivisional engineering	Manual calculation of engineering quantity	Computerized engineering quantity	Cause analysis
1. Earth and rock engineering			
1.1 Excavation of foundation pit earthwork	579.975m ³	581.0561m ³	There is a difference of 1.08m between the manual calculation of earthwork quantities for excavation of foundation pits and the electronic calculation of Glodon ³, This difference is within 1% of the computerized engineering quantity, which is within the standard error range.
1.2 Excavation of Trench Earthwork	294.165m ³	268.077m ³	There is a difference of 26.088m between the manual calculation of earthwork excavation and the analysis of Glodon Electric Power in terms of engineering costs .This difference far exceeds 3% of the engineering quantity of the computer calculation, which is a significant difference. The reason for this is that the deduction in the computer software is based on the actual volume of the intersecting part . At the same time, the engineering quantity in the manual calculation only deducts the bottom length of the foundation pit without considering the actual intersecting importance,resulting in a significant difference in engineering quantity.
2. Concrete engineering			
2.1 Concrete with beams and slabs	1145.423m ³	1149.6077m ³	The difference between the manual calculation of the quantity of concrete with beams and slabs and the electronic calculation of Glodon software is 4.1847m ³. The difference is within 1% of the computerized engineering quantity, and the error is within the standard error range.
2.2 Construction column concrete	32.287m ³	29.6954m ³	The difference in the engineering quantity between the manual analysis of the construction column concrete and the electronic calculation of Glodon software is 2.5916m ³. This difference far exceeds 3% of the electrical engineering quantity, which is a significant difference. The main reason for this difference is that in the calculation software, the deduction of the beam according to the actual intersection part in the construction column also deducted the essential intersection part of the board part. However, in my manual engineering quantity, only the approximate deduction of the beam intersection part and the board intersection part were not deducted.Therefore, the amount of the two projects is very different.
3. Ceiling engineering			
3.1 Production workshop ceiling	5172.085m ³	5243.9522m ³	The amount of each room is calculated in the ceiling project.In calculating the production workshop and tool room, the difference between the manually calculated quantities and the calculated quantities using Glodon software was 71.8672m ³ Within 2% of the engineering

engineering			quantity calculated by computer, this difference is within the standard of calculation error and can be ignored.
3.2 Elevator Hall Ceiling Engineering	111.6m ³	136.703m ³	In the measures section of the ceiling project, there is a difference of 25.103m between the manual calculation of the elevator hall and the electronic calculation of Glodon ³, This gap is far beyond the error range of manual and electronic calculations, and the reason for this error should be due to the significant differences in deduction details between the electronic software and manual calculations.
4. Reinforcement engineering			
4.1 Foundation reinforcement engineering	5.135t	4.962t	In calculating the foundation steel bars, the difference between the manual and electronic engineering quantities is 0.173t. Analyzing the reason and checking the three-dimensional steel bar of Guanglian Da, I found that only 1 steel bar in the middle side of the foundation of ZT3.5-2 was calculated in the software, while 7 steel bars in the side bar of the foundation of every ZT3.5-2 were calculated in my hand calculation. As a result, the engineering quantity difference of C16 steel bar is 0.173t.
5. Water and sanitation engineering			
5.1 UPVC-100 pipeline (Drainage Engineering)	384.17m	318.251m	The pipeline of UPVC-100 includes the riser and branch pipes of FL1 and FL2 in the drainage system, as well as the riser and branch pipes of FL1 to FL14 in the rainwater system; The difference between the manual engineering quantity and the electronic engineering quantity of Glodon is 65.919m, which is far beyond the standard error range of the electronic engineering quantity. Comparing the calculation formula and pipeline engineering quantity in Glodon software, the reason for this is that the engineering quantity of the 5.5m riser height in Glodon software is 3.6m, which leads to a significant gap in the engineering quantity between manual calculation and electronic calculation.
5.2 PPR-25 pipeline (Water supply engineering)	37.625m	38.057m	The water supply pipe of PPR-25 includes horizontal lines for toilets from the first to fifth floors and vertical lines for urinals. The difference between the manual calculation and the engineering quantity calculated by Glodon Electric, is 0.432m, which is within 3% of the engineering quantity calculated by Electric.It can be considered within the correct error range so that it can be ignored.
6. electrical engineering			
6.1 FPC-16 piping	2366.413m	2177.8m	The piping of FPC-16 is from the distribution box AL on each floor to the distribution box on each floor. The difference between the length of the piping in the manual calculation and that in the Glodon calculation is 188.613m, far beyond the error range. The reason for the error is that in my manual calculation draft, the height of the piping riser is calculated separately for each circuit.However, the standpipe can not be arranged repeatedly, so there is a considerable error between

			manual calculation and computer calculation.
6.2 Trough type bridge 100 * * 100	71.033m	72.97m	The trough-type cable tray is 100 * 100 on the first floor , and the roof layer , respectively and the cable tray on the first floor is arranged as a vertical cable tray that directly connects to the roof layer; The difference between the manual and electronic quantities is 1.937m, while the 3% of the electronic quantities is 2.1891m, which is greater than the difference between my manual and electronic quantities. Therefore, this error is within the normal range, there is no greater impact on the overall engineering quantity.

Ⅴ. CONCLUSION

The above is a rough analysis and adjustment of the project. For the creation of the bidding control price for the 11 # factory building of the Zhongke Ganghui Industrial Park project in Hanjiang District, Putian City, Through Glodon GTJ and GQI model creation, Chenxi manuscript manual calculation and valuation application, as well as revit model creation and collision detection.By analyzing the overall cost of an engineering project through the production of these projects, each person has their ideas and characteristics regarding the price of a project. Their understanding of pricing and engineering construction varies, so even the total cost of the same project may not be the same for each person. In the entire process of engineering analysis, the most crucial is also the process of price setting and quantity analysis. In this process, one should also spend more time learning and in-depth research to identify their shortcomings, which also adds formless difficulty to the digital analysis of the entire project. And this is what we should know the most about becoming a cost engineer in the cost industry in the future, which is the most basic and ordinary job.

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