

Comparative Analysis of Concrete QTO Using BIM and Conventional on XYZ Project

Rizki Adithya Wibowo¹, Putri Ayu Dwiyanas^{2,3✉}, Junita Eka Susanti^{2,3}

¹ Department of Civil Engineering, Faculty of Infrastructure and Regional Technology, Institut Teknologi Sumatera, Indonesia

^{2,3} Engineering and Construction Management Research Group, Institut Teknologi Sumatera, Indonesia

✉ **Corresponding Author** : Putri Ayu Dwiyanas (e-mail: putri.dwiyanas@si.itera.ac.id)

Article Information	ABSTRACT
Article History Received : September 18, 2025 Revised : October 13, 2025 Published : October 26, 2025	The rapid advancement of technology in the construction sector has encouraged the integration of digital modeling systems such as Building Information Modeling (BIM) to improve project efficiency and accuracy. This study analyzes the implementation of BIM using Autodesk Revit 2025 in the integrated design and build construction of the XYZ Project. The objective is to compare the Quantity Take Off (QTO) results between the BIM method and conventional concrete calculation for column and beam structures, as well as to evaluate the resulting cost differences. A quantitative comparative approach was employed by modeling the structure using Revit and manually calculating the quantities through conventional methods. The results show that both methods produced the same concrete volume for columns (891.6 m³), while for beams, the BIM method produced 1,104.59 m³ compared to 1,227.47 m³ from conventional calculations, yielding a difference of 122.88 m³ (11.12%) equivalent to IDR 294,831,618.37 in cost savings. The study concludes that BIM provides higher precision and reduces potential material waste, supporting more efficient budgeting and sustainable construction management.
Keywords: <i>Building Information Modeling (BIM); Autodesk Revit; Quantity Take Off; Construction Efficiency.</i>	

INTRODUCTION

The construction industry plays a crucial role in national development and economic growth because it provides infrastructure that supports social and industrial activities (Ayundari, 2022; Yusuf, 2021; Nugroho, 2024; Laksono, 2023). The increasing need for infrastructure, especially in urban areas, has driven the government to develop sustainable housing projects for the public interest and community housing (Laksono, 2023; Abipraya, 2023; Rahman, 2023). Large-scale projects like the XYZ project require precise time, cost, and quality management for successful implementation and effective and efficient resource utilization (Fardila & Adawyah, 2021; Mahyuddin et al., 2023; Jamal & Rohman, 2017).

In recent years, the construction sector has been influenced by the application of Building Information Modeling (BIM). This is because BIM encourages the digitalization process in construction management, where this technology is able to combine spatial and project data into a single intelligent 3D model, so that various parties involved can collaborate more easily and efficiently (PUPR, 2018; Muhsin et al., 2021; Asih et al., 2022; Bisma, 2023). The use of BIM has been proven to help reduce potential conflicts in design, reduce technical errors, and accelerate project implementation through an integrated work system from the planning stage to construction (Pratama et al., 2024; Mahendra et al., 2023; Rugas et al., 2024). However, the implementation of

BIM itself in developing countries still faces various obstacles, such as limited skilled human resources, relatively high software costs, and a lack of understanding of the benefits of BIM, especially in quantity calculations and project cost management (Amri et al., 2023; Zain et al., 2022; Suwarni & Anondho, 2021).

One of the main advantages of BIM lies in the Quantity Take-Off (QTO) process, which is the system's ability to automatically calculate material quantities and volumes with a higher level of accuracy than conventional methods based on 2D drawings or manual calculations (Asih et al., 2022; Irawan et al., 2023; Ramandhani et al., 2024). Numerous studies have shown that the use of BIM-based QTO not only improves data accuracy but also helps reduce the potential for human error and accelerate productivity in the project planning process (Anggaraini et al., 2022; Lussy et al., 2021; Brutantama & Pontan, 2023; Partomo, 2024). Furthermore, BIM implementation plays a role in reducing material waste, which ultimately impacts cost efficiency and supports more environmentally friendly construction implementation (Brutantama & Pontan, 2023; Fardila & Adawyah, 2021; Mahendra et al., 2023).

Several studies above show that the comparison between the BIM method and traditional methods has a material volume difference ranging from 0.1% to 16%, depending on the type of structural elements such as beams and columns (Zain et al., 2022; Anggaraini et al., 2022; Mahendra et al., 2023; Amri et al., 2023). Although several studies have discussed the accuracy aspect of QTO, studies that discuss in more depth the impact of these differences on the total project cost in the field are still limited (Rugas et al., 2024; Ramandhani et al., 2024; Maghfirona et al., 2023). Based on this, this study focuses on the application of BIM using Autodesk Revit 2025 to model and evaluate reinforced concrete structures, especially column and beam elements in the XYZ Project. The results of the QTO and its cost estimates will then be compared with conventional calculation methods. This research is expected to provide a deeper understanding of the efficiency and economic impact of BIM-based quantity estimation in modern construction projects with a design-build system.

RESEARCH METHODS

In this research, a comparative quantitative approach is employed to analyze and compare the accuracy and efficiency of two methods for estimating the quantity of materials used in construction: the conventional method and Building Information Modeling (BIM). The aim of the study is to assess the volume calculations and cost estimates for concrete in structural elements such as columns and beams, using both methods. The study compares these two methods to determine which one provides more accurate and cost-efficient results, ultimately aiding in the optimization of construction projects.

Project Location and Scope

The research focuses on the Tower 6 in XYZ Project, which is a construction project for a multi-story building. This site was selected as the case study due to its complexity and relevance to the study's objective of comparing conventional methods with BIM. The XYZ Project serves as an ideal setting for evaluating the differences in material calculations and cost predictions for concrete works, specifically for columns and beams. This study is designed to provide insights into how BIM can improve construction processes in terms of both material efficiency and cost reduction.

Data Collection

Data collection for this research was conducted directly from the project team at the XYZ Project. The primary data sources included:

1. Detail Engineering Design (DED) drawings containing comprehensive structural information about the project's columns and beams.
2. AHSP (Unit Price Analysis) providing detailed unit costs for each construction activity.

These data sources allowed for the accurate estimation of material volumes and cost calculations using both the conventional and BIM methods.

Conventional Method for Volume Calculation

The conventional method for calculating material volumes in this study followed traditional practices. In this process, the 2D DED drawings were manually analyzed to determine the dimensions of the structural elements, including columns and beams. The steps followed for this method were:

1. The DED drawings were reviewed to obtain column and beam dimensions and specifications.
2. Volumes were manually calculated in Excel using length, width, and height of each element.
3. Costs were determined by multiplying each element's volume by its unit price from the AHSP.

This method relies heavily on manual calculations, which introduces a higher likelihood of errors in the final estimation.

BIM Method for Volume Calculation

The Building Information Modeling (BIM) method used in this study was based on Autodesk Revit 2025. This software automates the process of calculating material quantities by creating a 3D model of the building. The following steps outline the BIM-based methodology:

1. DED and AHSP were used as the main data sources in the BIM Revit modeling.
2. A 3D building model was created in Autodesk Revit by inputting column and beam dimensions from the primary sources.
3. The QTO feature in Revit automatically and accurately calculated the material volumes of columns and beams.
4. Volume data from the QTO were multiplied by unit prices from the AHSP to obtain the total cost of each element.

This method is more automated and precise, minimizing the risk of errors and reducing the overall time spent on calculations.

Data Analysis and Comparison

Once the volume and cost estimates were obtained from both the conventional and BIM methods, a comparative analysis was performed. The analysis compared the following:

1. Comparison of column and beam volumes between both methods.
2. Comparison of total concrete work costs from both methods to assess cost efficiency.
3. Calculation of percentage differences in volume and cost to identify BIM's advantages in reducing waste and improving efficiency.

The results of this comparison were used to evaluate the relative effectiveness of each method, with particular emphasis on accuracy, efficiency, and cost-effectiveness.

RESULTS AND DISCUSSION

Conventional Method

Conventional calculations are carried out with the help of Microsoft Excel Software with reference to Detail Engineering Design (DED) drawings by calculating length, width, and height. The results of the calculation of Quantity Take Off (QTO) with conventional methods are presented in Table 1 and Table 2.

Table 1. Recapitulation of Conventional Method Column Volume

Column Type	Volume (m ³)
K1-B 700 mm x 900 mm	150,48
K1A-B 700 mm x 900 mm	12,54
K1B-B 700 mm x 900 mm	25,08

K2-B 700 mm x 900 mm	25,08
K3-B 700 mm x 900 mm	12,54
K1-A 500 mm x 800 mm	348,96
K1A-A 500 mm x 800 mm	25,92
K1B-A 500 mm x 800 mm	63,28
K2-A 500 mm x 900 mm	65,44
K3-A 500 mm x 800 mm	29,08
K4 500 mm x 900 mm	125,04
K5 400 mm x 800 mm	8,16
Total	891,60

Based on the column volume calculation table using the conventional method above, the total column volume in cubic units is 891,6m³. The reference for this calculation is the Detail Engineering Design (DED) drawing with the right dimensions.

Table 2. Recapitulation of Conventional Method Beam Volume

Beam Type	Volume (m ³)
G1 300 mm x 600 mm	340,54
G3 400 mm x 600 mm	208,90
G3A 400 mm x 600 mm	43,20
G3B 400 mm x 600 mm	43,20
B1 250 mm x 500 mm	145,90
B2 250 mm x 400 mm	21,61
B3 200 mm x 500 mm	158,18
CB1 300 mm x 500 mm	54,90
G2 300 mm x 600 mm	181,51
G1A 300 mm x 600 mm	6,80
G2A 300 mm x 600 mm	8,57
B1A 250 mm x 500 mm	4,50
BR 300 mm x 500 mm	3,83
BS 400 mm x 150 mm	4,32

Beam Type	Volume (m ³)
B5 300 mm x 500 mm	1,52
Total	1227,47

Based on the beam volume calculation table using the conventional method above, the total column volume in cubic units is 1.227,47m³. The reference for this calculation is the Detail Engineering Design (DED) drawing with the right dimensions.

Building Information Modeling (BIM) Method

BIM modeling in this study uses Autodesk Revit 2025 Software to model column and beam structures which will then issue a modeling volume value in the form of Quantity Take Off (QTO). The results of the BIM modeling method can be seen in Figure 4.

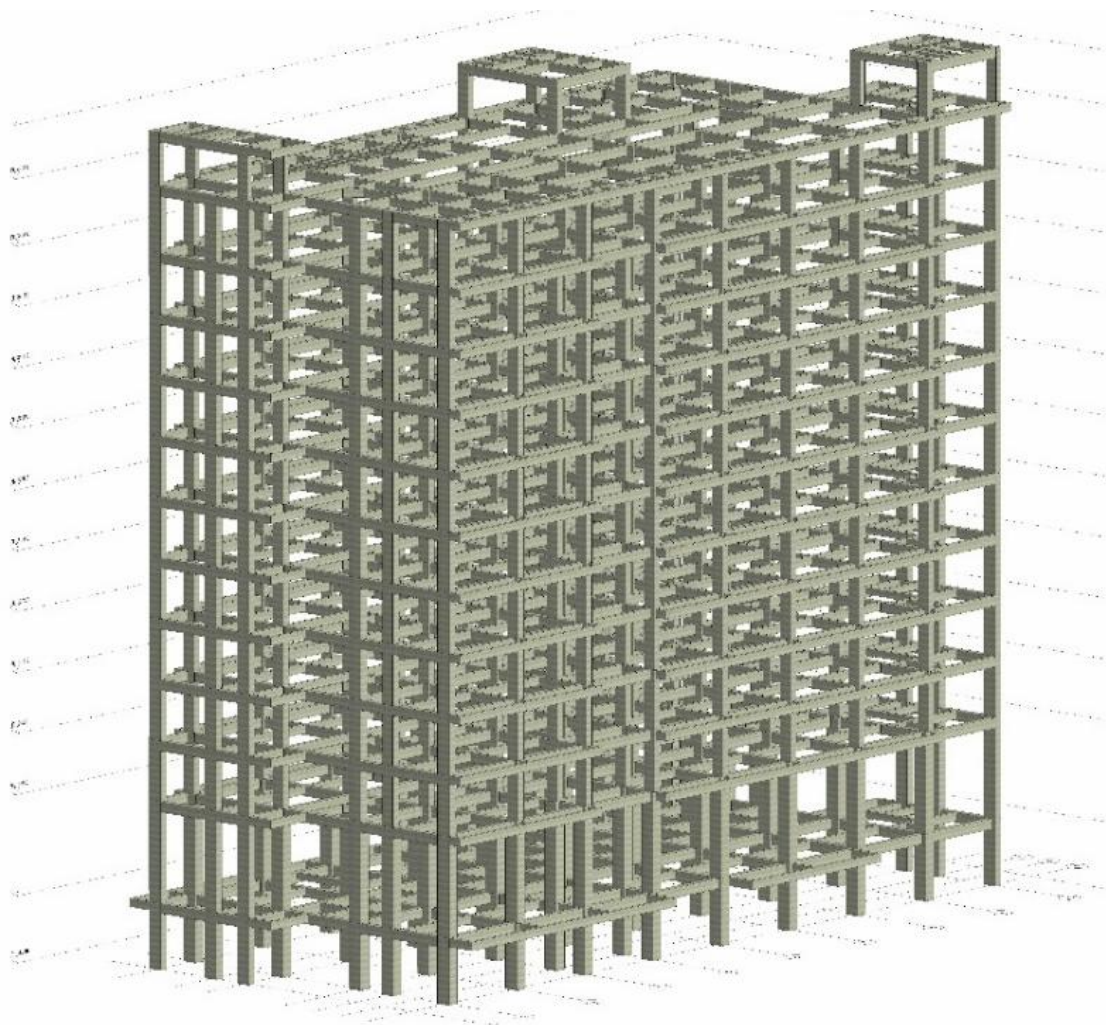


Figure 4. 3D Modeling

Based on the results of modeling, the Autodesk Revit 2025 software can then perform volume dispensing or Quantity Take Off (QTO). The QTO results in the BIM method can be seen in Table 3 and Table 4.

Table 3. Recapitulation of BIM Method Column Volume

Column Type	Volume (m ³)
K1-B 700 mm x 900 mm	150,48
K1A-B 700 mm x 900 mm	12,54
K1B-B 700 mm x 900 mm	25,08
K2-B 700 mm x 900 mm	25,08
K3-B 700 mm x 900 mm	12,54
K1-A 500 mm x 800 mm	348,96
K1A-A 500 mm x 800 mm	25,92
K1B-A 500 mm x 800 mm	63,28
K2-A 500 mm x 900 mm	65,44
K3-A 500 mm x 800 mm	29,08
K4 500 mm x 900 mm	125,04
K5 400 mm x 800 mm	8,16
Total	891,60

Based on the BIM Quantity Take Off output table above, the total column volume in cubic units is 891,6 m³. These results are obtained based on modeling that has been designed using Autodesk Revit software with reference to the Detail Engineering Design (DED) drawing with the right dimensions.

Table 4. Recapitulation of BIM Method Column Volume

Beam Type	Volume (m ³)
G1 300 mm x 600 mm	322,65
G3 400 mm x 600 mm	170,62
G3A 400 mm x 600 mm	38,29
G3B 400 mm x 600 mm	38,15
B1 250 mm x 500 mm	138,50
B2 250 mm x 400 mm	19,67
B3 200 mm x 500 mm	147,15
CB1 300 mm x 500 mm	38,47
G2 300 mm x 600 mm	161,88

Beam Type	Volume (m ³)
G1A 300 mm x 600 mm	12,42
G2A 300 mm x 600 mm	4,40
B1A 250 mm x 500 mm	4,27
BR 300 mm x 500 mm	3,00
BS 400 mm x 150 mm	3,80
B5 300 mm x 500 mm	1,32
Total	1104,59

Based on the BIM Quantity Take Off output table above, the total amount of beam volume in cubic units is 1.104,59 m³. These results are obtained based on modeling that has been designed using Autodesk Revit software with reference to the Detail Engineering Design (DED) drawing with the right dimensions.

Calculation of Cost Budget Plan

The calculation of the cost budget plan in this study uses the results of the QTO calculation of each method and the project AHSP (PUPR No.8 Tahun 2023) data. With the following calculation formula:

$$\text{Cost} = \text{Volume} \times \text{Price} / 1\text{m}^3 \quad (1)$$

Table 5. Recapitulation of Conventional Method Cost Budget Plan

No	Type	Unit	Volume (m ³)	Unit Price	Total Price
1.	Concrete Column	m ³	891,6	Rp 2.399.343,90	Rp 2.139.255.021,24
2.	Concrete Beam	m ²	1227,5	Rp 2.399.343,90	Rp 2.945.122.896,87

Based on the table above, the value of the Budget Plan required for both jobs based on Conventional Quantity Take Off (QTO) is Rp.2.139.255.021,24 for column concreting work and Rp.2.945.122.896,87 for beam concreting work.

Table 6. Recapitulation of BIM Method Cost Budget Plan

No	Type	Unit	Volume (m ³)	Unit Price	Total Price
1.	Concrete Column	m ³	891,60	Rp 2.399.343,90	Rp 2.139.255.021,24
2.	Concrete Beam	m ²	1104,59	Rp 2.399.343,90	Rp 2.650.291.278,50

Based on the table above, the value of the Budget Plan required for both jobs based on the BIM Quantity Take Off (QTO) is Rp.2.139.255.021,24 for column concreting work and Rp.2.650.291.278,50 for beam concreting work.

Comparison of Quantity Take Off and Cost Budget Plan

The comparison of the quantity take off value and the cost budget plan is obtained from comparing the final results of the two methods. The percentage comparison can be calculated using the following formula:

$$\text{Percentage} = \left(\frac{QTO \text{ Konvensional} - QTO \text{ BIM}}{QTO \text{ BIM}} \right) \times 100\% \quad (2)$$

Based on the calculation formula (2), the percentage of quantity taken off and the cost budget plan for each method can be generated in Table 7 and Table 8.

Table 7. Quantity Take Off Comparison

No	Type	QTO Conventional (m ³)	QTO BIM (m ³)	Percentage Difference (%)	Difference Volume (m ³)
1.	Concrete Column	891,60	891,60	0,00%	0,00
2.	Concrete Beam	1227,47	1104,59	11,12%	122,88

Based on the comparison table above, there is no difference in the volume of column concrete structures, while the volume of beam concrete structures in the BIM method has a difference of 11,12% less than the conventional method, with a cubication value of 122,88 m³.

Table 8. Cost Budget Plan Comparison

No	Jenis Struktur	Cost Conventional (m ³)	Cost BIM (m ³)	Percentage Difference (%)	Difference Cost
1.	Concrete Column	Rp.2.139.255.021,24	Rp.2.139.255.021,24	0,00%	Rp.0,00
2.	Concrete Beam	Rp.2.945.122.896,87	Rp.2.650.291.278,50	11,12%	Rp.294.831.618,37

Based on the comparison table above on the value of the column concrete structure cost budget plan there is no difference, while the beam concrete structure cost budget plan in the BIM method has a difference of 11,12% cheaper than the conventional method, with a cost difference of Rp.294.831.618,37 due to the difference from the Quantity Take Off value.

Based on the calculation results between the BIM method using Autodesk Revit 2025 and the conventional method above, there is a difference in beam volume. This happens because in BIM modeling, the meeting of two or more components with the same type of material is dominantly calculated on components that have a larger area, while in conventional methods the small or large area of each component will be taken into account as a whole, in accordance with the research of Amri et al, (2023) with the results of their analysis saying that in modeling using Autodesk Revit, the dominance of volume calculations between the same materials is obtained in the order of the largest area including plates, columns, and beams. Therefore, the conventional method has a considerable difference in QTO volume compared to the BIM method.

In terms of the stages in this study, the BIM method which starts from drawing to producing the Quantity Take Off value, results from a more thorough process and can be corrected directly by the system. While the conventional method starts from drawing and reading drawings manually which has the possibility of human error so that the level of accuracy can be reduced. Therefore, the BIM method has a better level of accuracy compared to conventional methods, this is in line with the statement of Pratama et al, (2024) that Autodesk Revit can be an effective tool in estimating volumes and costs that are more precise so that the difference in calculations can be minimized. In addition, the BIM method also facilitates other activities such as drawing both 2D and 3D which are directly generated from BIM as well as scheduling and many other features of

BIM that can be developed. The results obtained from the BIM method in the form of Quantity Take Off can also increase the efficiency of materials so as to minimize waste which means saving construction work costs.

The findings align with prior studies indicating that BIM enhances precision and minimizes errors in cost estimation (Putri & Wibowo, 2021; Mahendra et al., 2023; Amri et al., 2023). Moreover, BIM facilitates better visualization, clash detection, and coordination across disciplines, which supports more efficient project management (Irawan et al., 2023; Pratama et al., 2024). The reduction of discrepancies in material quantities directly contributes to sustainability through waste minimization, consistent with the findings of Lussy et al. (2021) and Anggaraini et al. (2022).

CONCLUSION

Analysis of the comparison of the two QTO methods found that the volume of concrete in the conventional method on the column amounted to 891,6 m³ and on the beam 1.227,47 m³. While the BIM method obtained a volume in the column of 891,6 m³ and in the beam of 1.104,59 m³. Then in the comparison of the two methods, the difference is obtained in the QTO volume of concrete work using conventional methods and BIM with a volume comparison, namely, 122,88 m³ beam structure with a percentage of 11,12% with the difference in costs in the two methods, namely, Rp.294.831.618,37 however, in the column structure there is no difference. In the calculation results also obtained the RAB value of the two methods where, in the conventional method of concrete RAB on the column structure worth Rp.2.139.255.021,24 and on the beam structure worth Rp.2.945.122.896,87. While using the BIM method on the column structure worth Rp.2.139.255.021,24 and on the beam structure worth Rp.2.650.291.278,50.

REFERENCES

- Amri, S. I., Hardyanti, N., & Sumiyati, S. (2023). Analisis Perbandingan Quantity Take Off (QTO) Beton Menggunakan Metode Building Information Modelling (BIM) dan Metode Konvensional (Studi Kasus: Proyek Kantor PNM Cabang Jember). *Jurnal Profesi Insinyur Indonesia*, 1(6). <https://doi.org/10.14710/jpii.2023.19025>
- Anggaraini, N. L., Yuwana, D. S. A., & Darajat, R. A. (2022). Perbandingan Volume pada Pekerjaan Struktural antara Perhitungan dengan Building Information Modeling.
- Asih, W. R., Bayzoni, B., Husni, H. R., & Niken, C. (2022). Perbandingan Quantity Take Off (QTO) Material Berbasis Building Information Modeling (BIM) Terhadap Metode Konvensional pada Struktur Pelat. *Jurnal Rekayasa Sipil dan Desain*, 10(4), 563-574. <https://doi.org/10.23960/jrsdd.v10i4.2845>
- Ayundari. (2022, Januari). Artikel Kanwil DKJN Kalimantan Barat. Kementerian Keuangan.
- Bisma, L. (2023). Autodesk Revit, Pengertian, Jenis-Jenis, Fungsi, dan Kelebihannya! My Edu Slove.
- Brutantama, D. M., & Pontan, D. (2023). Identifikasi Waste Material Dan Faktor Penyebab Timbulnya Pada Proyek Konstruksi Identification Of Waste Material Factors In Building Construction Projects. <https://doi.org/10.25105/jrltb.v1i2.17993>
- Fardila, D., & Adawyah, N. R. (2021). Optimasi Biaya dan Waktu Proyek Konstruksi dengan Lembur dan Penambahan Tenaga Kerja. *INERSIA: INformasi dan Ekspose hasil Riset teknik Sipil dan Arsitektur*, 17(1), 35–46. <https://doi.org/10.21831/inersia.v17i1.39499>
- Irawan, M. R., Hazairin, & Diredja, N. V. (2023). Analisis Quantity Take Off Struktur Beton Bertulang pada Rumah Sakit di Semarang Menggunakan Metode Building Information Modeling (BIM). *FTSP Series*, 778–783.
- Jamal, N., & Rohman, F. (2017). Analisis Manajemen Konstruksi Proyek Gedung Aula Unswagati. *CIREBON Jurnal Konstruksi*, VI(1), 83.

- Laksono, M. Y. (2023, Januari 31). Alasan Pemerintah Pilih Bangunan Apartemen Sebagai Tempat Tinggal ASN di IKN. Kompas.com.
- Lussy, F., Nuh, S. M., & Rafie, R. (2021). Evaluasi Waste Material Dan Penerapan Lean Contruction. *JeLAST: Jurnal Teknik Kelautan, PWK, Sipil, dan Tambang*, 8(1).
- Maghfirona, A., Iq'bal Khairul Amar, T., & Failasufa, A. A. M. H. (2023). Komparasi Quantity Take Off Pekerjaan Struktur Berdasarkan Metode Konvensional Dan Metode BIM Studi Kasus : Perencanaan Omah DW. 5(1), 60–67. <https://doi.org/10.52005/teslink.v11i1.xxx>
- Mahendra, R., Putri, Y. E., & Akhira, M. G. (2023). Analisis Perbandingan Quantity Take Off (QTO) Dengan Metode Konvensional Dan Metode Building Information Medelling (BIM) Pada Proyek Pembangunan Kantor Kejaksaan Negeri Baturaja Tahun 2023. 2(2), 71–81.
- Mahyuddin, Ritnawati, Rachim, F., Mursalim, E., Pandaranga, A. P., Sidiq, Y. U. R., & Rosytha, A. (2023). *Manajemen Proyek Konstruksi* (1 ed.).
- Megawati, W. B., & Purwanto, H. (2022). Perbandingan BIM Dengan Konvensional Pada Hasil BQ Proyek X. *Journal of Applied Civil Engineering and Infrastructure Technology*, 3(2), 1–9. <https://doi.org/10.52158/jaceit.v3i2.247>
- Muhsin, A., Prawiradinata, R. Y. S., & Razaq, Y. N. (2021). Perbandingan Antara Alur Kerja BIM Dengan CAD Pada Proses Renovasi Rumah Tinggal. *Jurnal Arsitektur TERRACOTTA*, 2(3), 194–204. <https://doi.org/10.26760/terracotta.v2i3.4899>
- Nugroho, S. (2024, Desember 13). Kelanjutan Pembangunan Rusun ASN di IKN. IKNPOS.ID.
- Partomo, S. (2024, Agustus 15). RAB (Rencana Anggaran Biaya). UKIRAMA.
- Pratama, R. E., Hendriyani, I., & Pratiwi, R. (2024). Implementasi Konsep Building Information Modelling (BIM) 5D Pada Pekerjaan Struktur Untuk Efisiensi Biaya Proyek. *JTT (Jurnal Teknologi Terpadu)*, 12(2), 138-143.12(2). <https://doi.org/10.32487/jtt.v12i2.2219>
- PUPR, K. (2018). Pelatihan Perencanaan Konstruksi Dengan Sistem Teknologi Building Information Modeling (BIM) Modul 5.
- Putri, A. D., & Wibowo, A. (2021). Pengaruh Building Information Modeling (BIM) terhadap Efisiensi Estimasi Biaya Proyek Konstruksi. *Jurnal Teknik Sipil dan Perencanaan*, 23(2), 113–122.
- Rahman, M. (2023, Oktober 11). Perbedaan Kondominium, Apartemen dan Rusun. 99 Panduan Properti.
- Ramandhani, E. A., Saefudin, A., & Agustina, S. (2024). Penerapan Buiding Information Modeling (Bim) Dalam Perbandingan Quantity Take Off Material Pada Proyek Pembangunan BSI Tower Jakarta. *Jurnal Deformasi*, 9(2), 98-106. <https://doi.org/10.31851/deformasi.v9i2.17000>
- Rugas, Z., Waluyo, R., & Almuntofa Purwantoro. (2024). Analisis Quantity Take Off Dengan Metode Building Information Modeling Pada Pekerjaan Struktur Gedung Poltekkes Palangka Raya. *JURNAL SAINTIS*, 24(01), 29–38. [https://doi.org/10.25299/saintis.2024.vol24\(01\).16561](https://doi.org/10.25299/saintis.2024.vol24(01).16561)
- Suwarni, A., & Anondho, B. (2021). Perbandingan Perhitungan Volume Kolom Beton Antara Building Information Modeling Dengan Metode Konvensional. *VI No II.*, 75–83.
- Yusuf, A. A. (2021). Catatan-catatan terkait pemindahan IKN dan pemerataan pembangunan.
- Zain, H. A., Mulyono, B., & Sudibyo, G. H. (2022). Comparative Analysis Of The Effectiveness Of Conventional Methods And BIM On Concrete Structure Elements (Case Study Education Service Building of FISIP UNSOED). 13(1), 37–44. <https://doi.org/10.34001/jdpt.v12i2>