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COST AND ON-SITE DURATION COMPARISON OF CONVENTIONAL AND PRECAST FLOOR SLAB METHODS: A TWO-STORY BOARDING HOUSE CASE STUDY IN YOGYAKARTA

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Abstract: Floor slab construction strongly affects both the cost and the on-site duration of low-rise buildings, yet transparent project-level comparisons for small boarding houses remain scarce. This study compares the direct cost and on-site construction duration of conventional cast-in-place and precast floor slab methods for the 50.36 m² second-floor slab of a two-story type-135 boarding house in Pugeran, Yogyakarta. A quantitative comparative case study was applied using project drawings, an itemized quantity take-off, the Indonesian Unit Price Analysis (AHSP), documented local price bases, a supplier quotation, and labor-based duration calculations. The conventional alternative cost IDR 35,746,962.53 and the supplier-inclusive precast alternative IDR 30,216,000.00, a project-specific saving of IDR 5,530,962.53 (15.47%), while the calculated on-site duration fell from 11 days to 2 days, a reduction of 9 days (81.82%). A sensitivity analysis shows that the cost advantage reverses once the precast price rises by about 18%, identifying the condition under which the conventional method becomes cheaper. The reported savings apply only to the prices, crew composition, and work scope adopted in this case study; they exclude factory lead time and curing, and they do not constitute structural verification of the precast system.

Keywords: Precast Floor Slab; Conventional Floor Slab; Construction Cost; On-Site Duration; Case Study

1. INTRODUCTION

The continuing demand for rental accommodation in Yogyakarta has encouraged the development of boarding houses, including in the Pugeran area (BPS DIY, 2021). In a two-story boarding house, the floor slab is a major structural work package because its construction method determines the sequence of formwork, reinforcement, casting, material handling, labor deployment, and the time at which subsequent work can proceed.

Conventional cast-in-place slabs adapt readily to irregular field conditions and rely on familiar materials and labor, but they require a sequential chain of formwork, reinforcement, casting, and curing, each of which consumes on-site time and skilled labor (Antoni & Nugraha, 2007). Precast floor panels move most of that chain into a factory and can compress on-site activity to erection and jointing, yet their delivered performance depends on supplier availability, transport access, panel dimensions, bearing and connection details, installation resources, and structural compliance. The second-floor slab of a type-135 boarding house was chosen as the unit of comparison for two reasons: at 50.36 m² it is a single, clearly bounded work package whose quantities can be measured

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unambiguously from the drawings, and the slab is repeated on every floor of this common rental-housing type, so a method decision on one slab scales directly to the wider boarding-house stock that dominates Yogyakarta's rental market.

Recent Indonesian studies converge on two findings but diverge on a third. On duration, precast and half-slab systems consistently shorten floor-slab work: Riyadi et al. (2022) reported a 25% time saving on a university building, and Romadhoni and Sahid (2023) and Wijaksono et al. (2018) reported similar on-site time advantages for half- and full-slab systems. On cost, however, the direction of the effect is not settled: Riyadi et al. (2022) found the half-slab option about 4.5% cheaper, Wijaksono et al. (2018) found conventional slabs the cheapest per square metre once full-slab premiums were counted, and Nauly et al. (2022) reported precast to be more economical only under specific price and scope conditions. The third variable, the scope actually priced, is where the studies are least transparent: they rarely state whether the precast figure includes delivery, erection labor, lifting equipment, and grouting, or whether it is a bare panel price, even though that single boundary decision governs whether precast appears cheaper or dearer. Comparisons drawn on different price years, locations, and scope boundaries are therefore difficult to reconcile. International and domestic case studies reinforce this scope-dependence: Sarhan et al. (2021) found precast hollow-core slabs far faster than cast-in-situ work, Trijeti et al. (2018) and Tedja et al. (2013) compared conventional, half-slab, and hollow systems on both cost and time, and Ahmad et al. (2023) showed that the most economical slab type shifts with span length, confirming that no single method is universally cheapest.

The gap addressed here is thus not merely another project comparison but a transparent one, in which the quantity take-off, both price bases, the person-day requirements and crew composition, the on-site duration boundary, and the exact precast scope are reported together and reconciled against one another. The contribution is threefold: an itemized, traceable cost and duration comparison for a small boarding-house slab; an explicit statement of the precast scope priced, so that the result can be compared with other studies on a like-for-like basis; and a sensitivity analysis that identifies the price threshold at which the conventional method becomes the cheaper option, rather than presenting a single point result as if it were general.

This study aims to compare the direct floor-slab cost and calculated on-site construction duration of conventional and precast methods for a two-story type-135 boarding house in Pugeran, Yogyakarta. The study does not redesign the supporting structure or independently certify the structural equivalence of the two systems; it evaluates the two alternatives using the project and supplier specifications available to the authors.

Conceptually, a floor slab transfers dead and live loads to supporting beams and columns and must satisfy strength, stiffness, and serviceability requirements (Setiawan, 2016). A conventional slab is cast at the project site through formwork, reinforcement, concrete placement, and curing. A precast system uses factory-manufactured elements erected on prepared supports and therefore requires appropriate panel capacity, bearing, joints, grouting, anchorage, handling, and installation planning. Cost was analyzed using AHSP and RAB principles, while duration was calculated from total person-day requirements divided by the assigned crew (Ministry of Public Works and Housing, 2016; Soeharto, 1999).

2. METHOD

The research object was a two-story type-135 boarding house in Pugeran, Yogyakarta. The comparison was limited to the second-floor slab work with an analyzed plan area of 50.36 m². For the conventional alternative, the slab thickness was 0.12 m, concrete compressive strength was f'c = 20 MPa, and reinforcing steel yield strength was 420 MPa. The reinforcement quantity was calculated from 10-mm bars at 150-mm spacing in two layers, following the project drawings.

The precast alternative used lightweight concrete floor panels with nominal dimensions of 3.00 m × 0.60 m × 0.12 m. Each full panel covers 1.80 m²; therefore, 50.36/1.80 = 27.98, or a minimum of 28 full-size-equivalent panels, is required before allowing for the supplier's cutting and placement layout. The 17-panel value stated in the thesis would cover only 30.60 m² and was therefore not retained in this revised article. The comparison assumed the same building function, slab coverage, and existing supporting beam-and-column arrangement. The supplier price covered panels, delivery, erection, required installation equipment, and grouting. No additional topping concrete was included in the supplier scope documented in the thesis.

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Table 1. Technical profile and comparison boundary

Parameter	Conventional method	Precast method
Analyzed slab area	50.36 m²	50.36 m²
Nominal thickness	0.12 m	0.12 m
Main specification	f'c 20 MPa; fy 420 MPa; Ø10-150, two layers	3.00 × 0.60 × 0.12 m; minimum 28 full-size-equivalent panels
On-site scope	Formwork, reinforcement, concrete casting	Delivery, erection, installation equipment, grouting
Supporting structure	Existing project beam-column layout	Same layout assumed; no redesign analyzed
Duration boundary	On-site work through casting day	On-site panel installation
Excluded time/aspects	Curing until loading and formwork striking	Factory production/order lead time; independent structural verification

Data Sources and Price Basis

Primary data were the project drawings and the quantities derived from them. Conventional unit prices were built from AHSP coefficients applied to the 2025 Sleman Regency Standard Prices of Goods and Services (SHBJ), the regional price reference documented in the source study; although the project is in Pugeran, Yogyakarta, the Sleman SHBJ is retained because it was the consistently applied benchmark in that study, not a claim that the site lies within Sleman Regency. The precast alternative used a 2026 supplier quotation of IDR 600,000.00/m² (DEPOHEBELYOGYA), accessed in 2026 for this study. The two price bases therefore differ in both year and, for the precast panels, in origin. Rather than leave this as an unquantified caveat, the difference is handled in two ways. First, because published construction-cost inflation in Indonesia over a single year is modest relative to the 15.47% gap observed here, a one-year price offset cannot by itself account for the result. Second, and more importantly, the robustness of the comparison to this and other price movements is tested explicitly through the sensitivity analysis reported in the Discussion, which varies the precast price and identifies the break-even point at which the conventional method becomes cheaper. The comparison is thus presented as a project estimate on two stated price bases whose effect is measured, not concealed.

Quantity, Cost, and Duration Calculations

Quantities were taken from the working drawings and each was recomputed before pricing: the conventional concrete volume from slab area times thickness, the reinforcement mass from the Ø10-150 two-layer arrangement on the drawings, and the formwork area from the slab plan. To guard against the transcription errors common in quantity take-off, the take-off total was reconciled against the cost recapitulation of the source thesis, and two figures were corrected in the process: the reinforcement mass to 784.91 kg (the earlier draft stated 789.91 kg) and the panel count as explained below. The precast quotation was treated as a scope-defined figure and its inclusions, namely panels, delivery, erection, installation equipment, and grouting, were recorded so that it could be compared against the sum of the conventional items on a like-for-like basis. Item cost and the percentage difference were then calculated as follows:

$$\textit{Work-item cost} = \textit{quantity} \times \textit{unit price} \qquad (1)$$

$$\textit{Cost saving (\%)} = (\textit{conventional cost} - \textit{precast cost}) / \textit{conventional cost} \times 100\% \qquad (2)$$

The on-site duration was built from labor requirements rather than assumed directly. For each work item the required person-days (orang-hari, OH) were obtained by multiplying the quantity by the composite AHSP labor coefficient for that item, which aggregates the worker, skilled-worker, foreman, and supervisor components; the resulting item coefficients, expressed as OH per unit of work, are the effective values reported in Table 5 (for example, 52.08 OH over 50.36 m² of formwork is 1.034 OH/m²). Dividing an item's total OH by its assigned crew gives the duration of that item on the simplifying assumption that the crew is balanced across trades; this is a

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deliberate approximation, and where a crew mixes roles with different coefficients it yields an average rather than a trade-by-trade duration. The conventional items were treated as sequential because formwork must precede reinforcement, which must precede casting, so their durations are summed. The precast installation is a single field activity by one crew and so is not decomposed. No conventional activities were assumed to run concurrently; treating them sequentially is the conservative choice because any feasible overlap would shorten the conventional duration and reduce, not enlarge, the reported time advantage of precast.

$$Duration\ (days) = total\ labor\ requirement\ (OH) / assigned\ crew\ (persons) \quad (3)$$

$$Productivity = work\ quantity / unrounded\ duration \quad (4)$$

$$On\text{-}site\ duration\ reduction\ (\%) = (11 - 2) / 11 \times 100\%$$

3. RESULT

The results are presented in three stages. First, the quantity take-off establishes an equivalent comparison boundary for the 50.36 m² slab area. Second, the itemized cost calculation identifies the dominant cost components and the total difference between the alternatives. Third, labor requirements, crew sizes, and productivity are used to derive the on-site duration. Presenting the results in this sequence makes each final cost and duration value traceable to its underlying quantities and assumptions.

Table 2. Quantity take-off for the compared floor slab alternatives

Method	Work item	Quantity	Unit
Conventional	Floor slab formwork	50.36	m²
Conventional	Floor slab reinforcement	784.91	kg
Conventional	Concrete casting	6.04	m³
Precast	Floor panel installation	50.36	m²
Precast	Minimum full-size-equivalent panels	28	units

The value of 28 panels is a geometric floor, not a purchase order. It follows from covering 50.36 m² with panels of 1.80 m² nominal area (50.36 / 1.80 = 27.98, rounded up to 28), and it assumes that panels can be laid across the slab with cut offcuts reused elsewhere on the same floor. The actual number bought depends on the room geometry, the span direction, the bearing arrangement, and how much of each cut piece can be reused, all of which are fixed only by the supplier's shop drawing; a layout in which offcuts cannot be reused would raise the count, while an efficient cutting plan would approach the geometric minimum. Because the supplier price in this study is quoted per square metre of slab (IDR 600,000.00/m²) rather than per panel, the cost estimate is governed by the 50.36 m² area and is unaffected by the exact panel count; the panel figure is reported only to make the physical coverage explicit. The 17-panel value stated in the source thesis, which would cover just 30.60 m², was therefore not retained. Where a per-panel price applies instead, a shop-drawing panel layout would be required before the precast cost could be finalized.

The conventional concrete quantity is 50.36 m² × 0.12 m = 6.0432 m³, rounded to 6.04 m³. For the precast option, 50.36 m² divided by 1.80 m² per nominal panel gives 27.98, rounded upward to a minimum of 28 full-size-equivalent panels; the final purchase count must follow supplier shop drawings because cut pieces may be reused. The reinforcement quantity was corrected to 784.91 kg in accordance with the thesis recapitulation; the earlier journal draft incorrectly stated 789.91 kg.

Table 3. Conventional floor slab cost estimate

Work item	Quantity	Unit	Unit price (IDR)	Amount (IDR)
Formwork	50.36	m²	207,482.91	10,449,710.93
Reinforcement	784.91	kg	21,799.76	17,110,868.96

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Work item	Quantity	Unit	Unit price (IDR)	Amount (IDR)
Concrete	6.04	m³	1,354,530.71	8,186,382.64
Total				35,746,962.53

Reinforcement was the largest conventional cost component at IDR 17,110,868.96 (47.87% of the conventional slab cost), followed by formwork at IDR 10,449,710.93 (29.23%) and concrete at IDR 8,186,382.64 (22.90%).

Table 4. Precast floor slab supplier-based cost estimate

Work item and included scope	Quantity	Unit	Unit price (IDR)	Amount (IDR)
Panels, delivery, erection, installation equipment, and grouting	50.36	m²	600,000.00	30,216,000.00
Total				30,216,000.00

The resulting difference was IDR 35,746,962.53 − IDR 30,216,000.00 = IDR 5,530,962.53. Relative to the conventional alternative, the project-specific saving was 15.47%.

Table 5. Basis of the on-site duration calculation

Method/work item	Quantity	Total OH	Crew	Calculated duration	Scheduled duration	Productivity
Conventional - formwork	50.36 m²	52.08	9	5.79 d	6 d	8.70 m²/d
Conventional - reinforcement	784.91 kg	27.63	9	3.07 d	4 d	255.68 kg/d
Conventional - concrete	6.04 m³	8.31	10	0.83 d	1 d	7.27 m³/d
Precast - panel installation	50.36 m²	14.61	8	1.83 d	2 d	27.59 m²/d

Table 5 makes each duration traceable to its labor requirement. The total person-days for an item are the quantity multiplied by that item's composite AHSP coefficient, and the calculated duration is the person-days divided by the assigned crew. For conventional formwork, 50.36 m² at an effective 1.034 OH/m² gives 52.08 OH, which over a nine-worker crew is 5.79 days (rounded up to 6). For reinforcement, 784.91 kg at 0.0352 OH/kg gives 27.63 OH, or 3.07 days over nine workers (scheduled as 4). For concrete, 6.0432 m³ at 1.375 OH/m³ gives 8.31 OH, or 0.83 days over ten workers (scheduled as 1). Because these three trades are sequential, the conventional slab occupies 6 + 4 + 1 = 11 on-site working days. For precast, 50.36 m² at 0.29 OH/m² gives 14.61 OH, installed by an eight-person crew (four workers, two erection installers, one head installer, one foreman) in 1.83 days, rounded to 2 scheduled days. The on-site difference is therefore 9 days, an 81.82% reduction relative to the 11-day conventional schedule. The effective coefficients quoted here are the item OH totals divided by their quantities, so each can be checked directly against the corresponding row of Table 5.

This duration comparison does not represent the complete procurement-to-use cycle. For the conventional alternative it excludes curing time after the casting day, formwork striking, and the waiting period before design loading. For the precast alternative it excludes factory manufacture and order lead time. Accordingly, the result should be interpreted as an on-site activity comparison under the stated assumptions.

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4. DISCUSSIONS

The precast floor slab alternative was less expensive in this case because the supplier price included panel procurement, transportation, erection labor, installation equipment, and grouting. In contrast, the conventional estimate separately accumulated the costs of formwork, reinforcement, and concrete work, with reinforcement accounting for nearly half of the conventional slab cost. Eliminating conventional formwork and reducing on-site activities therefore offset the cost of the precast panels. This finding is consistent with Rahmawati (2022), who associated precast panels with lower labor and formwork costs, but differs from Prasetyo (2018) and Wibowo (2019), who reported relatively higher material or initial costs for precast construction. This difference can be attributed to the commercial scope applied in the present study, in which delivery, erection labor, installation equipment, and grouting were included in the supplier price of IDR 600,000.00/m². Therefore, the cost advantage should be interpreted as project-specific rather than evidence that precast slabs are always less expensive. Changes in transportation distance, site access, panel cutting requirements, lifting equipment, minimum order quantities, and supplier competition may produce different results.

The shorter on-site duration of the precast alternative follows from replacing three sequential site trades with a single erection activity: conventional work requires formwork, then reinforcement, then casting, each by a different crew, whereas the precast field task is the installation of factory-made panels by one crew. This is why the calculated on-site time falls from 11 days to 2, consistent with Riyadi et al. (2022), Romadhoni and Sahid (2023), and Wijaksono et al. (2018). The 81.82% figure must, however, be read strictly as an on-site activity reduction, not a project-cycle reduction. The precast duration excludes factory production and order lead time, minimum-order and batching constraints at the supplier, and any delay in delivery to a site reached only through the narrow access typical of infill boarding-house plots in Pugeran; it also excludes the panel cutting and lifting that restricted access and irregular room geometry can impose, both of which lower the installation productivity assumed here. The conventional duration, conversely, excludes curing to loading strength and formwork striking, which add calendar time after the casting day but little on-site labor. A complete comparison would set the precast factory-plus-delivery lead time against the conventional cure-and-strike time; on the on-site labor dimension isolated in this study, precast is faster, but the two methods shift time to different, and only partly overlapping, parts of the schedule. Where lifting equipment must be hired specifically for a small slab, or where a minimum order forces the purchase of more panels than the 50.36 m² requires, both the cost and the effective lead-time advantages of precast narrow.

Although the precast alternative was less expensive and faster under the analyzed conditions, cost and duration alone are insufficient to establish its technical suitability. Before implementation, the designer and supplier must verify the panel capacity under dead, live, and construction loads; allowable span; bearing length; panel orientation; joint and grouting details; anchorage and diaphragm requirements; openings; fire resistance; durability; and the effects of panel self-weight on beams, columns, and foundations. The present study assumed that the existing supporting layout could accommodate the precast panels and used the nominal panel dimensions provided by the supplier. However, it did not include a separate structural analysis or an independent examination of the manufacturer's technical certification. Therefore, the findings should be used as economic and scheduling considerations rather than as a stand-alone structural recommendation.

Sensitivity Analysis

Because the 15.47% saving rests on one supplier price and one crew assumption, its robustness was tested by varying the precast price while holding the conventional estimate of IDR 35,746,962.53 fixed. The precast total scales linearly with its per-square-metre rate, so the break-even point is exact: parity occurs at a precast price of IDR 709,828/m², which is 18.3% above the quoted IDR 600,000/m², equivalent to an added IDR 5,530,963 in delivery, cutting, lifting, or minimum-order costs spread over the 50.36 m² slab. Below that threshold precast is cheaper; above it, conventional is. A 10% rise in the precast price (to IDR 660,000/m²) still leaves precast 7.02% cheaper, a 20% rise (to IDR 720,000/m²) makes it 1.43% more expensive, and a 30% rise makes it 9.89% more expensive. Expressed as flat add-ons for logistics and waste, precast retains an advantage up to about IDR 5.5 million of extra cost on this slab and loses it beyond that.

Two implications follow. First, the cost advantage found here is real but not large in absolute terms: a single cost driver that this study excluded, such as dedicated crane hire for an infill site, a minimum order well above 50.36 m², or heavy cutting waste from irregular rooms, could plausibly add 18% and erase it. This identifies the conditions under which the conventional method becomes the more economical choice: restricted access that forces specialised lifting, small slab areas that fall below efficient order sizes, and geometries that generate un-reusable offcuts. Second, the duration advantage is far more robust than the cost advantage; even a large precast

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price increase that removes the cost saving leaves the on-site time reduction essentially unchanged, because time depends on activity sequencing rather than on unit price. For a decision-maker, the practical reading is that precast on this class of project should be selected primarily for on-site speed, with the cost saving treated as conditional on delivery, lifting, and order-quantity terms being confirmed before commitment.

For low-rise boarding-house projects, the precast option is more likely to provide advantages when the panel modules are compatible with the slab geometry, cutting and material waste are limited, delivery and unloading access are available, bearing supports are prepared before erection, and the supplier price includes all necessary installation and joint work. Its application is also more appropriate when on-site time savings are important, factory lead time can be accommodated within the project schedule, and structural compatibility and connection details have been confirmed by the designer. Conversely, conventional slabs may remain preferable for projects with irregular geometry, restricted access, probable design changes, readily available local labor and reusable formwork, or limited access to competitively priced precast panels and installation services. This interpretation is consistent with Santoso (2021), who emphasized the flexibility of conventional construction for smaller projects. Putra's (2020) identification of the floor slab as an important cost component also demonstrates that the construction method should be evaluated explicitly, even for relatively small buildings.

5. CONCLUSION

For the 50.36 m² second-floor slab of this two-story type-135 boarding house, the supplier-inclusive precast alternative was cheaper than the conventional cast-in-place alternative by IDR 5,530,962.53 (15.47%: IDR 30,216,000.00 against IDR 35,746,962.53) and reduced the calculated on-site duration by 9 days (81.82%: 2 days against 11). Reinforcement dominated the conventional cost, and the elimination of site formwork and the compression of three sequential trades into one erection activity account for the precast advantage. The sensitivity analysis, however, shows the cost result to be conditional: the advantage disappears once the precast price rises by about 18%, whereas the on-site time advantage persists regardless of price.

These results hold only within the stated boundaries: the analyzed quantities and crews, the 2025 SHBJ-based conventional prices, the 2026 supplier quotation, the specific precast scope, and on-site activity time excluding conventional curing and formwork striking and precast factory lead time. They should not be read as evidence that precast slabs are generally superior, because the structural equivalence of the two systems was not independently verified. The single most important recommendation is therefore that any decision to adopt the precast option be preceded by structural verification of panel capacity, bearing, and connections and by confirmation of the supplier's scope of supply and delivery terms; economic and schedule findings such as these should inform, but not replace, that verification. Future work should use contemporaneous quotations for both methods, observe actual field productivity, and compare the complete procurement-to-loading cycle.

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