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Construction Progress Delays in High-Rise Residential Developments: Evidence from a Malaysian Development Project

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ABSTRACT

Construction delay in Malaysia's high-rise residential sector is widely documented, yet the gap between what project governance systems record and what actually drives slippage on the ground remains poorly understood. This paper examines the gap through a case study of an urban high-rise residential development in the Klang Valley. Approximately valued in excess of RM110 million, this ongoing serviced apartment project was being constructed by a private developer at the time of the study. The project was 21 months into a 24-month contract and had a schedule deviation of 36%, equivalent to 219 calendar days. The architectural work was 40% complete against a programmed target of 85% and the mechanical and electrical (M&E) work were 55% complete against a target of 90%. Using internal project data throughout the study period, the paper identifies and evaluates the factors behind these shortfalls, which include insufficient workforce deployment, disruption in material supply chain in M&E trades, fragmented nominated subcontractor (NSC) performance and lengthy statutory approval processes. The findings carry implications for how procurement frameworks, NSC accountability mechanisms, and regulatory compliance programmes are structured in comparable urban high-rise developments across Malaysia.

Keywords*: project management, construction delays, high-rise residential, project governance, statutory compliance*

1.0 INTRODUCTION

Malaysian construction has a delay problem. It shows up across project types, contract values, and procurement arrangements. Sambasivan and Soon (2007) mapped 28 potential causes in their widely cited study, and the industry has not moved far from that picture in the years since (Wei et al., 2024). High-rise residential projects are particularly exposed, because they combine tight site conditions, layered regulatory requirements, and many interdependent trades under a single programme that does not tolerate much slippage before the consequences start compounding. This paper presents a case study of an ongoing high-rise serviced apartment project in the Klang Valley which sits squarely in that category. Situated in a highly active urban development corridor, the site features prominent road frontage and proximity to transit infrastructure.

Entering the final quarter of its contract period, the project had accumulated 219 days of schedule slippage against a baseline that had already been extended by 80 days. This represents a 36% deviation at a highly critical juncture. The question this study addresses is not simply how much slippage occurred, but why it built up the way it did, what the project records show about the warning signals that were there, and what the governance system's response tells us about the limits of monitoring without sufficient corrective capacity. Three questions guide the analysis. First, what were the main drivers of schedule slippage at this development and how did they interact with each other? Second, how did the project team respond, and where did that response fall short? Third, what can comparable projects take from this experience?

2.0 LITERATURE REVIEW

The literature on construction delay is wide and reasonably consistent in its findings. Sambasivan and Soon (2007) ranked factors tied to the contractor, covering site management quality, planning adequacy, and subcontractor reliability, as the most consequential causes of delay in the Malaysian context, ahead of causes tied to clients or external parties. That hierarchy shows up in other markets too (Sambasivan & Soon, 2007; Dehdasht et al., 2021; Gunawardena et al., 2022; Yap et al., 2021). Practically, these findings imply prioritizing contractor development, improving on-site planning and supervision, and ensuring robust procurement and payment processes that do not overburden contractor cash flow. Given the cross-country consistency, policies aimed at enhancing contractor capacity through training, standardization of planning practices, and improved contract administration, are likely to yield benefits beyond Malaysia (Gunawardena et al., 2022; Ismail et al., 2023; Keng et al., 2020; Venkatesh et al., 2012; Yap et al., 2021). Taken across contexts, contractor capacity appears to be the most reliable predictor of schedule outcome.

Within Malaysian high-rise construction, Majid and McCaffer (1998) identified a dynamic that is easy to overlook. Client-side decisions, including late variation orders and deferred material selections, do not just add time. They disrupt sequences that were already fragile and compound delays that the contractor had already created. This effect is especially pronounced under the nominated subcontractor (NSC) model, which is the standard procurement arrangement in Malaysian including for high-rise projects. When NSC appointments lag or NSC resourcing is thin, the main contractor absorbs the schedule risk without having the authority to fix the problem directly. To mitigate NSC-related schedule risks, practitioners should: (a) strengthen tripartite coordination among the client, main contractor, and NSC; (b) enforce early design freezes to minimize late variation orders; (c) finalize NSC appointments and resource allocation during the pre-construction phase; and (d) enhance the main contractor's planning and on-site supervision to absorb sequencing disruptions without compromising the critical path (Shehu et al., 2014; Yap et al., 2021; Yusof et al., 2021).

Aziz (2013) framed manpower shortages as a structural feature of construction markets that depend heavily on migrant labour, not something that varies from one project to the next. In Malaysia, where workers from Indonesia, Bangladesh, and Nepal make up a large share of the site workforce, immigration policy changes, predictable festival absences, and competition for skilled tradespeople across sites all create volatility that planners tend to underestimate. The common response is to compress contingency rather than model the risk explicitly. However, given the structural volatility from migrant labour, the industry should explicitly model labour availability risk in pre-construction planning, incorporating probability distributions for workforce

absences, strike days, and migration policy shocks. This aligns with calls to move beyond contingency buffering toward explicit risk quantification of labour flows in Malaysian projects (Abdul-Rahman et al., 2012; Ashaari et al., 2018; Dehdasht et al., 2021; Jamalulil et al., 2022).

On the regulatory side, Alaghbari et al. (2007) observed that approval processes managed by multiple independent authorities add time that the contractor cannot recover through effort or acceleration. Each body has its own submission requirements, inspection protocols, and internal resource constraints. In the Malaysian setting, the Certificate of Completion and Compliance (CCC) requires formal approvals from bodies including the Department of Sewerage Services (IWK), Water Supply (Air Selangor), Tenaga Nasional Berhad (TNB), Kuala Lumpur City Hall (DBKL), and the Department of Safety and Health (DOSH). When physical works and regulatory certifications are not programmed to run together, a gap opens between practical completion and lawful occupancy. That gap has real financial consequences for both developer and contractor.

Progress monitoring tools have received attention separately. Lipke et al. (2009) showed using earned value and earned schedule methods that projects deviating more than 15% from their planned S-curve at the midpoint carry a substantially higher probability of terminal delay. For a project sitting 36% behind in its final quarter, that finding has direct relevance. Meng (2012) focused on the governance side and concluded that monitoring systems built around regular meetings are only as effective as the corrective action they produce. Frequency matters less than what happens after each recorded deficiency.

The subject of this case study, an ongoing high-rise serviced apartment project is highly representative of this broader body of literature. It exemplifies a scenario where recognized risks converged. The core value of this analysis is observing how these risks unfolded in practice, leveraging contemporaneous project records rather than relying on retrospective accounts.

3.0 METHODOLOGY

The study uses a qualitative single case design, following the approach Yin (2017) sets out for research into phenomena where context and mechanism are inseparable. The project was chosen as a case study because of data access, the complexity of the case, and the availability of detailed contemporaneous records covering a period of active schedule distress. Two categories of internal project records provided the primary data. The first covered multidisciplinary project governance documentation compiled at the 21-month mark, including contractor progress returns, outstanding authority matters, subcontractor status, quality and safety issues, and action items across all project disciplines. The second was the contractor's formal progress submission for the same period, covering physical progress by work package, manpower and machinery figures, shop drawing and material approval registers, instrumentation monitoring data, and site photographs. Both sets of records are routine project administration documents, not materials prepared for research, which strengthens their evidential weight.

Analysis used thematic content analysis, with delay causes coded against a classification framework adapted from Sambasivan and Soon (2007). That framework separates delays attributable to the contractor, delays attributable to the client or consultants, and external delay factors. Cross-referencing reported progress figures against recorded action items and outstanding compliance milestones provided a check on internal consistency.

Individual personnel are referred to solely by their organisational roles rather than by name, in accordance with standard practices for research utilising industry documentation. To maintain strict confidentiality, the project itself is identified using generic descriptors; however, its general location, scale, and typology are provided, as these details offer necessary context for the analysis without compromising anonymity. Furthermore, all firm names have been withheld to avoid publishing performance observations regarding specific companies without their consent, aligning with established ethical standards for research involving confidential commercial data.

4.0 PROJECT OVERVIEW

The case study project is located within a highly active transit-oriented development corridor in the Klang Valley (Shakur et al., 2018). This ongoing development was selected as a case study due to its complexity, scale, and strategic urban location, which collectively make it highly representative of contemporary premium high-rise residential construction in Malaysia (Shakur et al., 2021). The project offers an invaluable opportunity for an in-depth exploration of real-world construction dynamics, generating practical insights beneficial to developers, contractors, consultants, and policymakers.

The development occupies a highly constrained urban footprint characterized by active road frontage, immediate proximity to mass transit infrastructure, and adjacent buildings that impose rigorous access, noise, and safety limitations. The architectural brief encompasses a low-density residential tower, a dedicated amenities floor, and a multi-zone parking podium. Commissioned by a private property developer, the lump-sum contract is valued in excess of RM110 million. The baseline construction programme was set for 24 months but was subsequently granted an 80-day extension. The contract enforces a stringent daily rate for liquidated damages, alongside an extended 30-month defect liability period. To maintain strict confidentiality, the main contractor, lead consultants, and specialist subcontractors are anonymised throughout this paper and are referred to exclusively by their functional roles.

Specialist trades are brought in through nominated sub-contractors (NSC) appointed under the main contract. Confirmed NSC appointments at the time of the study covered lift installation, active fire protection, air-conditioning and mechanical ventilation, electrical and extra-low voltage services, and soft landscaping works. Fit-out for typical apartment units had been awarded, but tendering for common areas and lift lobbies was still running. A number of other packages, including loose furniture, landscape features, and a smart home system, remained at provisional sum stage with no appointment made.

5.0 DATA COLLECTION AND ANALYSIS

The data collection and analysis is grounded in primary project documentation, specifically leveraging site progress meeting minutes, formal project progress reports, and scheduled revision. To translate this raw documentation into actionable findings, a structured content analysis was applied. By systematically coding the textual data for recurring project management challenges and schedule deviations, the analysis effectively isolates the primary drivers of the observed delay. Data collection did not involve formal interviews. Instead, informal discussions were conducted with the site personnel during site visits to supplement field observations and enhance contextual understanding.

5.1 The Scale of the Slippage

At the point of data collection, 21 months had passed on a contract originally set for 24 months and extended to 20 August 2026. Physical progress was at 52% against a scheduled 88%, a gap of 36 percentage points that translated to 219 calendar days. Table 1 breaks the figures down by work package.

Table 1. Physical Progress by Work Package at Month 21

Work Package	Scheduled (%)	Actual (%)	Variance	Status
Overall	88	52	-36	Delayed
Structural	99	82	-17	Delayed
Architectural	85	40	-45	Delayed
M&E	90	55	-35	Delayed

The architectural figure is the one that stands out. A 45-point shortfall with only a few months of programme left cannot be closed through acceleration alone. Finishing trades depend on a completed structural enclosure, first-fix M&E installation, and approved material selections. None of those conditions were fully in place. The structural package, while less severe in its variance, was still incomplete at a point where the

programme showed it at 99%, meaning downstream trades had been waiting in a queue longer than the single number suggests. M&E, 35 points behind, was partly a cause of that queue and partly a product of it.

The 80-day extension of time had already been granted before the study period. Even after absorbing that, the project was running 219 days late. The EOT addressed some of the delay but did not fix the conditions producing it.

5.2 Contractor-Side Delay Factors

Several of the most visible delay factors sit within the contractor's own operations. Manpower is the most immediate. Project records at the time of assessment showed 16 site staff and 261 workers deployed across the full scope of works, a figure that was flagged as insufficient, particularly for conventional formwork where an increase was directed with a firm deadline. One NSC was separately noted as critically short of workers, with the main contractor directed to resolve the matter internally. That instruction points to a real limitation: the main contractor is responsible for the schedule outcome of NSC performance but does not employ the NSC's workforce and has limited tools to compel it.

RC structure works were still incomplete, with a revised target roughly four weeks out from the data collection date. The top-up ceremony, which in Malaysian construction practice marks the formal completion of the structural frame, was targeted for 30 April 2026, more than 22 months into a 24-month contract. Mock-up apartment units, a contractual milestone originally due in April 2025, were still unfinished over a year past that date. Corridor lighting, texture paint demarcation, and timber skirting decisions remained open.

M&E works were held back by material shortages. Second-fix completion at Level 1 had missed its December 2025 target without delivery. Fire-fighting installations at the podium levels were stalled because the water tank had not arrived. BIM modelling for the roof facility floor was outstanding. Revised aluminium screen shop drawings were due in mid-April 2026. Entrance signage details were waiting on a third-party consultant whose input was running well behind the works it was supposed to inform.

5.3 Regulatory and External Delay Factors

The regulatory picture was, in some ways, harder to manage than the site conditions. Several statutory processes were running significantly behind what the programme required, and none of them could be accelerated through contractor effort.

Sewerage approval under the Sewerage Service process had stalled. The Local Authority open-cut permit for external sewerage works was still outstanding with no confirmed start date, and the PDC7 intermediate inspection, which is a prerequisite for the G14 CCC form, had not yet been scheduled. The G14 form itself had an authority inspection target of 27 June 2026. Without the intermediate inspection cleared first, that date was not going to hold.

Utility Service Provider related works presented a separate problem on a similar timeline. The contractual Utility Service Provider completion milestone had been set for February 2025. More than 13 months later, full documentation had still not been passed from the main contractor to the M&E engineer. HDD power supply works on the MRT walkway were underway but subject to a permit that required renewal, adding an external dependency that the project team could not control.

Lift regulatory approvals were spread through the second half of 2026. Occupational Safety And Health inspection was targeted for May, PMA certification for July, and Bomba inspection for 31 July. These are fixed sequencing requirements, not administrative conveniences. They feed directly into the CCC process and cannot be brought forward. The D28 paint compliance process with Local Authority, combined with a public complaint from the neighbouring building about mosquito breeding on site, added further administrative load without contributing to programme progress.

5.4 CCC Readiness and the Compliance Gap

The CCC checklist compiled during the study period shows the compliance exposure in concrete terms. Table 2 lists the authority inspection targets for the principal G-forms.

Table 2. CCC G-Form Inspection Targets as at March 2026

Form	Scope	Authority	Target Date
G4	Structural Works	Local Authority	7 May 2026
G5	Internal Water Plumbing	Water Supply / Local Authority	27 June 2026
G7	Internal Electrical	Utility Service Provider / Local Authority	19 August 2026
G8	Fire-fighting (Passive)	Fire and Safety / Local Authority	22 August 2026
G9	Fire-fighting (Active)	Fire and Safety / Local Authority	22 August 2026
G11	Lift Installation	Occupational Safety and Health / Local Authority	23 July 2026
G12	Building (Overall)	Local Authority / Planning and Development	28 September 2026
G14	Sewerage Reticulation	Sewerage Service	27 June 2026
G20	Telecommunication	Telecommunications Service Provider / Local Authority	29 September 2026
F-CCC	**Final CCC**	**Local Authority**	**30 October 2026**

The revised construction completion date is 20 August 2026. G12 is targeted for 28 September, G20 for 29 September, and the final CCC for 30 October. So even if the contractor met the 20 August physical completion target, lawful occupancy would still be at least ten weeks away. That is not a minor administrative delay. It is a period during which LAD could continue to accrue depending on how completion is defined under the contract, and during which the developer carries holding costs with no ability to hand over or sell.

5.5 Health, Safety and Quality Observations

The chain of dependencies behind those dates makes the picture worse. G14 needs the Sewerage Service intermediate inspection, which had not been scheduled. G7 needs the Utility Service documentation package, which had not been handed over. G11 needs the Occupational Safety and Health inspection, which was still two months away at the time of the study. Each unresolved item pushes the next one back.

Geotechnical monitoring at the IS7 inclinometer at adjacent neighbourhood recorded a peak lateral displacement of 60.9 mm against an alert limit of 62.75 mm. The residual margin was less than 2 mm, roughly 3% of the threshold. The reading did not trigger an alarm condition, but on a congested urban site with active works nearby, that level of proximity to an alert limit is something that requires continued attention. The IS4 instrument at the site was in a more comfortable position, with a reading of 38.6 mm against a 77.8 mm limit.

One architectural non-conformance report remained open at the time of the study. It related to a passenger hoist being operated without Occupational Safety and Health approval, first raised in January 2026 and still unresolved two months later. A separate site observation recorded workers at height without safety harnesses, with corrective instructions issued. Site housekeeping was flagged as needing improvement. The mosquito complaint from adjacent neighbourhood, which required fogging at least three times a week, sat at the intersection of public health compliance and community relations, neither of which advances the construction programme but both of which carry consequences if neglected.

6.0 DISCUSSION AND FINDINGS

The manifestation of a 219-day schedule slippage at month 21 of a 24-month contract, despite a preceding 80-day extension, is the result of compounding systemic failures. The case study analysis points to four primary reinforcing factors: inadequate workforce scaling for late-stage workloads; an NSC model that assigns schedule risk to the main contractor without commensurate managerial authority; an uncommunicative supply chain that failed to mitigate the downstream impacts of long-lead M&E delays; and the persistent exclusion of regulatory compliance programs from the master schedule.

The architectural shortfall of 45 percentage points represents the culmination of these compounding issues. As Leach (2014) explains, delays in structural or rough-in phases create a bottleneck for finishing trades not merely because the work cannot physically proceed, but because a compressed schedule forces trades to operate under conditions of restricted access and sequencing conflicts. This dynamic is clearly evident at the case study site. Architectural subcontractors were mobilized into a building where the reinforced concrete (RC) structure remained incomplete, facade shop drawings were still undergoing revision, mock-up units were severely delayed, and material sample approvals were still pending. Fundamentally, finishing works cannot be accelerated when the prerequisite conditions for their execution have not yet been established.

The manpower numbers need more scrutiny than they typically receive at site meetings. A workforce of 261 workers across a 14-storey tower, six carpark levels, active MEP installation, external civil works, landscaping, and ongoing documentation is a thin spread. The Hari Raya festive break between 19 and 24 March 2026 was a highly foreseeable event. The data suggest it was treated as a brief pause rather than an absence that would affect the programme. Aziz (2013) noted that planners in markets dependent on migrant labour consistently underestimate labour volatility, preferring to compress contingency rather than model it. This project appears to fit that pattern.

The NSC coordination problems are worth examining carefully because they point to something structural rather than incidental. When an NSC is flagged as critically short of workers and the remedy is to ask the main contractor to resolve it internally, that is a governance gap dressed up as a site instruction. The main contractor does not employ the NSC's workers. It has formal notice and default provisions available, but invoking them partway through the programme risks a dispute that causes more delay than it solves. Majid and McCaffer (1998) documented this dynamic in the Malaysian context over 25 years ago. Evidence from this case study suggests it remains an unresolved feature of how NSC procurement operates.

Regulatory compliance represents the domain where conventional project management tools have the least leverage. No volume of contractor directives or site meetings can expedite a local authority inspection or compress an Occupational Safety and Health approval timeline. However, what remained within the project team's control was the parallel tracking of regulatory milestones alongside physical construction progress, a practice that project records indicate was lacking. Consequently, the Certificate of Completion and Compliance (CCC) delay was highly foreseeable. Statutory G-form inspection dates are not unforeseen events; rather, they are mathematically derived from appointment dates, physical completion sequences, and standard authority processing times established early in the project lifecycle. Treating these requirements as reactive administrative tasks to be addressed post-construction, instead of proactive programme items integrated from inception, represents a critical strategic oversight.

The governance record for the case study project is, on paper, active and thorough. With nearly fifty meetings convened over the study period, an average of more than two per month, action items were systematically tracked with named parties and deadline dates across all disciplines. Meng (2012) would classify this as a properly functioning monitoring system. Yet, the delay persisted and deepened despite it, pointing to a dynamic the literature has highlighted more clearly in recent years: governance records what has happened and directs what should happen next, but it cannot supply execution capacity that was not there to begin with. When action items carry forward week after week without resolution, the monitoring system has done its job. It is the system being monitored that has not.

The financial exposure of the delay is structurally quantifiable. Based on the contractually stipulated daily rate for liquidated ascertained damages (LAD), the 219-day schedule overrun generates a theoretical liability amounting to 8.6% of the total contract sum. The actual enforcement of these damages relies on several mitigating factors: the main contractor's extension of time (EOT) entitlements for regulatory delays, contractual claims related to delayed design information or project variations, and the client's strategic evaluation of whether dispute resolution or negotiated adjustment best serves the project's delivery. Furthermore, while external delays such as those pertaining to national utility providers and local authority approvals bolster the contractor's position regarding excusable delays, they fail to mitigate the concurrent delays caused by workforce deficits and material procurement shortfalls, which remain the direct responsibility of the contractor.

7.0 CONCLUSION

Despite significant delays, the subject project is not in freefall; governance frameworks, consultant engagement, and physical works remain active. The fundamental failure lies in the protracted pace of construction and the delayed mitigation of its root causes. The case demonstrates how standard, text-book risk factors historically prevalent within the regional construction sector can incrementally compound. Because these factors intertwine subtly, they fail to produce the kind of singular, catastrophic failure that typically forces decisive intervention.

Four things stand out from the analysis. Manpower planning for the finishing stage needs to be treated as a separate scheduling exercise from the structural stage. The demand profile is different. The trades are different. The productivity dependencies are different. NSC minimum workforce levels should be written into subcontracts as a condition of appointment, with escalation triggers that fire before the critical path is affected, not after.

Four critical directives emerge from the analysis. First, workforce planning for the finishing stage must be segregated from the structural stage schedule, as it involves fundamentally distinct demand profiles, specialized trades, and productivity dependencies. To enforce this, minimum workforce thresholds for nominated sub-contractors (NSC) should be stated within subcontracts as conditions of appointment, utilising proactive escalation triggers that activate before the critical path is compromised. Second, long-lead mechanical and electrical (M&E) procurement encompassing items such as water tanks, fire suppression equipment, electrical panels, and lift components must be integrated into the master programme with the same contractual weight as physical construction milestones. Where delivery dates impact the critical path, full team visibility is mandatory; leaving procurement sequencing entirely to the contractor's discretion without programmatic transparency frequently transforms material shortages into schedule crises.

Third, the certificate of completion and compliance (CCC) framework must be executed as a parallel track from project inception rather than treated as a post-construction administrative hurdle. Given that G-form inspection dates, statutory authority sequences, and documentation prerequisites are highly predictable from contract commencement, delaying compliance integration carries severe cost implications. Finally, the analysis highlights a fundamental flaw in the prevailing NSC model utilized in Malaysian high-rise construction, which disproportionately assigns schedule risk to the main contractor while leaving the authoritative management of that risk with the NSC. Revisiting NSC appointment conditions to include stringent performance benchmarks, direct reporting obligations to the consultant team, and flow-down liquidated ascertained damages (LAD) provisions would establish a more equitable alignment between risk exposure and managerial authority.

Although the case study reveals that the project has incurred substantial delays, partial schedule recovery remains feasible as pending regulatory inspections progress. More critically, the empirical insights derived from this case study carry immediate relevance for contemporary large-scale projects across urban Malaysia facing identical systemic pressures. By identifying the primary drivers of high-rise construction delays and proposing strategic interventions for enhanced delivery, stakeholder alignment, and regulatory compliance,

this research offers a dual contribution. It directly informs industry strategies for minimizing schedule overruns and cost liabilities while concurrently advancing scholarly discourse in construction management.

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9.0 AUTHOR CONTRIBUTIONS

Suria Natasha Zulhilmi, Wan Jihana Amirah Wan Nor Azman, Shuang Fan, Chou Chee Jun, and Teh Yi Hern is a Master of Real Estate candidate who works on this topic; Elia Syarafina Abdul Shakur is the candidate's supervisor and the corresponding author; and Anuar Alias is a research collaborator and adjunct professor at Universiti Malaya.

10.0 CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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