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Construction Work Sequencing and Zoning Strategy for Structural Works at Summarecon Mall Bandung

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ABSTRACT

Large building projects require a construction sequence that integrates technical dependencies, site access, material flow, and crew allocation. This study analysed the implementation of structural work sequencing and a zoning system in the Summarecon Mall Bandung Phase 2 project. A descriptive case-study approach was used. Data were obtained from project documents, shop drawings, field observations, and photographic documentation produced during the 2023 construction period. The analysis identified the logical dependencies between work packages and examined how six work zones were released. The structural sequence consisted of pile driving, pile-head cutting, excavation and backfilling, soil compaction, pile-cap and tie-beam construction, column works, and beam-and-slab works. Zones 1 and 5 were started first because they did not interfere with the main access and equipment manoeuvring areas. Zones 2 and 3 followed when the first zones reached approximately 30% progress. Zones 4 and 6 were completed last because they functioned as the principal access and logistics corridors. The zoning strategy enabled overlapping activities while maintaining access, but its effectiveness depended on labour competence, material delivery, equipment availability, approvals, financing, and site coordination. The study concluded that explicit access constraints and progress-based release rules should be included in structural work-sequencing plans.

Keywords: *Construction Sequencing; Site Management; Zoning System; Structural Work.*

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INTRODUCTION

Construction projects combine temporary organisations, interdependent work packages, limited working space, and changing resource requirements. Project teams therefore need a logical sequence that links every activity to its predecessor, successor, location, crew, material, and equipment requirements. A clear sequence supports the work breakdown structure, schedule control, quality inspection, safety planning, and site logistics. Mincks and Johnston [1] emphasised that jobsite management must translate project objectives into coordinated field operations. Recent studies also showed that detailed scheduling and 4D Building Information Modelling can improve visual planning and logistical decision making [2], [3].

Large building projects face an additional problem. Several crews must work at the same time, but they cannot occupy the same space or block the same access route. The project team must decide where work starts, when another zone may open, and which area must remain available

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for transport and equipment manoeuvres. Historical schedule analysis confirms that sequence quality depends on recognising recurring predecessor and successor relationships [4]. Digital scheduling research has also stressed the importance of linking activity names, locations, building elements, and schedule data consistently [5], [6].

The Summarecon Mall Bandung Phase 2 project applied a six-zone strategy to structural works. The site team started work in areas with fewer access conflicts, released the next zones after the initial zones reached a defined progress level, and retained the central access areas until the final stage. The original project report documented the activity order, field conditions, shop drawings, and zoning arrangement, but it did not present them as a structured journal case study.

This study aimed to: (1) identify the logical sequence of the main structural work packages; (2) explain the release order of the six construction zones; and (3) analyse the site-management factors that supported or constrained the sequence. The study provides a practical sequence map for large reinforced-concrete building projects with restricted access. It also clarifies the role of progress-based zone release, which field planners can apply even without a full 4D BIM model.

METHOD

The study used a descriptive case-study design. It examined the actual structural work sequence at the Summarecon Mall Bandung Phase 2 project in Bandung, West Java. The project involved structural and architectural works for a 52,616 m² mall building. PT Mahakarya Buana Damai acted as the project owner, while PT Jagat Konstruksi Abdipersada acted as the main contractor. The contract period covered 420 days after the work order, and the reported contract value was approximately IDR 180 billion excluding value-added tax.

The study used four data sources: project profile documents, method and sequence descriptions, structural shop drawings, and field photographs from 2023. The analysis did not estimate productivity or schedule savings because the available documents did not contain activity durations, resource loading, planned versus actual progress, or delay records. The study therefore focused on logical dependencies, spatial constraints, and implementation controls.

The analysis followed four steps. First, the work packages were extracted and arranged according to technical precedence. Second, each activity was reviewed for its inspection, access, material, equipment, and quality-control requirements. Third, the six zones were mapped according to their release order and their relationship with the main access routes. Fourth, the identified constraints were grouped into labour, materials, equipment, management and finance, local environment, access, and stakeholder approval. The resulting sequence and zoning logic were then compared with recent research on 4D scheduling, site logistics, and construction safety [2], [3], [7], [8].

Table 1: Main characteristics of the case-study project

Item	Project information
Project	Summarecon Mall Bandung Phase 2
Location	Jl. Gedebage Selatan No. 98, Bandung, West Java
Owner	PT Mahakarya Buana Damai
Main contractor	PT Jagat Konstruksi Abdipersada
Project type	Shopping mall

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Item	Project information
Scope	Structural and architectural works
Building area	52,616 m²
Contract period	420 days after the work order
Maintenance period	365 days after first handover
Approval-controlled items	Shop drawings, materials, and material samples

RESULTS AND DISCUSSION

Structural Work Sequence

The structural works followed seven main stages. The sequence started with deep-foundation installation and ended with the repeated floor cycle for columns, beams, and slabs. Figure 1 presents the logical dependency. The sequence did not mean that the entire project had to finish one stage before the next stage started. The zoning system allowed the contractor to repeat the same dependency chain in different areas and overlap activities when access, safety, inspection, and resources permitted.

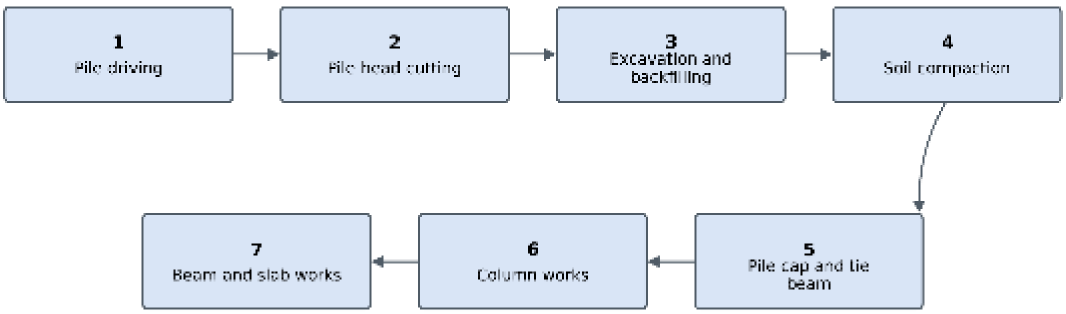

Figure 1: Logical sequence of the main structural work packages

Table 2: Structural sequence and principal control points

Stage	Work package	Principal field controls
1	Pile driving	Approved pile specifications, set-out points, certified piles, serviceable driving rig, and alignment control.
2	Pile-head cutting	Surveyed cut-off level, supervisor approval, and 30–50 cm reinforcement projection for connection to the pile cap.
3	Excavation and backfilling	Pre-excavation survey, excavation to design level, disposal control, and preparation of sand, lean concrete, limestone, or return fill as required.
4	Soil compaction	Suitable moisture condition and layer compaction using a stamper before lean concrete or floor preparation.
5	Pile cap and tie beam	Clean excavation base, reinforcement and formwork inspection, dimensional control, and structural connection between pile groups.
6	Column works	Column set-out, reinforcement installation, stable formwork, concrete placement, vibration, and curing.
7	Beam and slab works	Coordinated formwork and reinforcement, integrated beam-slab casting, vibration, level control, and curing before the next floor cycle.

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Pile driving required the rig, dolly, helmet, and packing to remain aligned with the pile axis. The pile surface also had to remain flat and undamaged. The contractor could cut the pile head only after the field supervisor approved the work and confirmed the cut-off level. These controls protected the connection between the pile and the pile cap.

Excavation followed the foundation layout and included foundation excavation, sand bedding, lean concrete, limestone, return fill, and surplus-soil disposal. The crew compacted the prepared ground before placing the working slab. The pile caps distributed column loads to groups of piles, while tie beams connected the pile caps into an integrated foundation system. The superstructure then progressed from columns to beams and slabs. The contractor cast beams and slabs as one structural cycle to maintain continuity and reduce unnecessary construction joints.

Figure 2: Selected structural activities observed on site. Source: project documentation, 2023

Zoning-Based Sequence

The project divided the structural work area into six zones. The zoning system converted one long site-wide sequence into several shorter production streams. This approach supported crew distribution, material delivery, equipment movement, and quality inspection. The site team selected the release order according to physical access rather than zone numbering.

Table 3: Zone release sequence and spatial rationale

Zone group	Release order	Reason
Zones 1 and 5	First	These edge areas offered easier initial access and did not interfere with the main vehicle route or equipment manoeuvring area.
Zones 2 and 3	Second	The contractor released these zones when Zones 1 and 5 reached approximately 30% progress. The staggered release created an overlapping production flow. Zone 3 also adjoined the existing building.
Zones 4 and 6	Last	These areas contained or bordered the principal entry, exit, logistics, and manoeuvring routes. Keeping them open supported movement during earlier work.

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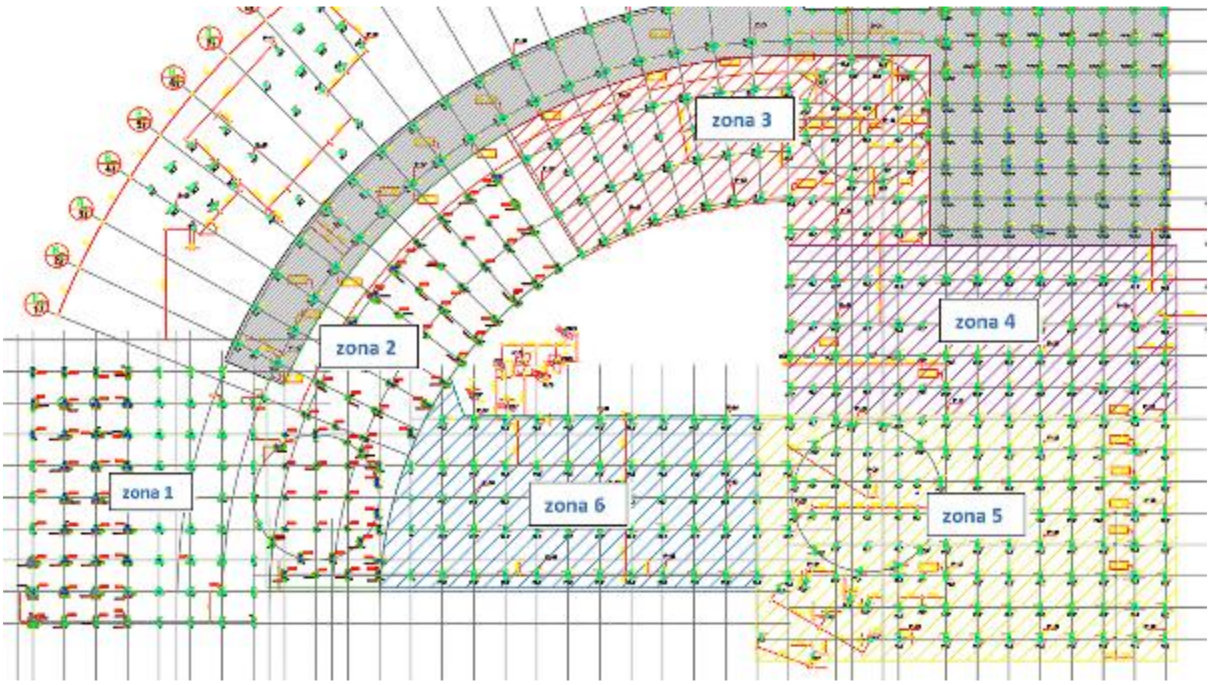

Figure 3: Six-zone structural work plan and principal access routes. Source: project shop drawing, 2023

The 30% progress threshold created a practical lag between zone groups. It allowed the preceding zone to establish a stable work front before the next crew entered another area. This arrangement resembles location-based planning because the same activity chain moves through defined spatial units. It also aligns with research that links schedule detail to dynamic site-logistics planning [3]. A digital 4D model could represent this sequence more clearly, but the underlying logic still depends on reliable work-package definitions, location codes, and predecessor-successor relationships [2], [5], [6].

Zones 4 and 6 carried a different function from the other zones. They were temporary logistics assets before they became final production areas. Starting them too early could have restricted truck circulation, material unloading, and equipment manoeuvres. The sequence therefore balanced structural progress with continued site access. This finding shows why a technically correct activity order can still fail when the planner ignores temporary routes and workspaces.

Driving and Inhibiting Factors

Table 4: Factors affecting sequence implementation

Factor	Effect on the work sequence
Labour competence	Schedulers and field supervisors had to translate the method statement into workable daily and weekly activities. Inadequate planning could create trade conflicts, rework, and idle time.
Material availability and delivery	Deliveries had to follow zone demand. Early excess deliveries could obstruct work areas, while late deliveries could interrupt the production flow.
Equipment availability	The project required suitable and serviceable equipment for piling, excavation, compaction, lifting, concrete placement, and vibration.
Managerial and financial control	Managers had to align funds, procurement, labour, equipment, and subcontractors with the planned zone release.

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Factor	Effect on the work sequence
Site characteristics and access	Restricted movement, existing buildings, entry and exit points, and equipment turning space directly affected the sequence.
Local environment	The project team needed to manage interaction with nearby communities and could use competent local labour where appropriate.
Stakeholder approval	The owner's representative or management consultant inspected shop drawings, materials, samples, and work stages before the contractor continued.

The factors in Table 4 show that sequencing combined technical and organisational decisions. The contractor controlled the execution plan, but the owner's representative controlled approval gates. Material suppliers and equipment operators influenced continuity, while site-access decisions influenced every trade. Safety planning also depended on the same space-time information. Recent 4D safety studies used scheduled building elements and temporary facilities to identify hazards and communicate controls [7], [8]. The Summarecon case did not use the documented sequence as a formal digital safety model, but its zone and access rules provide the spatial structure required for such an application.

Construction sequence also influences structural and operational behaviour. Mudiyanselage et al. [9] showed that modelling construction stages can materially affect structural analysis results in staged earth structures. In building projects, the immediate concern differs, but the principle remains relevant. Planners must represent the order in which temporary and permanent systems develop. A schedule that ignores actual construction states can misrepresent access, load transfer, temporary support, and safety exposure.

Practical Implications and Limitations

The case suggests four practical actions. The site team should define the structural dependency chain before preparing detailed dates. It should divide the site into zones that reflect access and production conditions. It should state a measurable release rule for each zone, such as the 30% threshold used in this project. It should also protect logistics zones until alternative routes become available. These actions can strengthen conventional bar-chart schedules and provide structured inputs for 4D BIM.

The study has several limits. The available report did not include planned and actual activity durations, labour quantities, equipment productivity, cost variance, safety records, or rework data. The analysis therefore cannot quantify time savings or prove that zoning improved productivity. The project also represents one mall project with a specific layout. Future research should compare alternative zone-release thresholds and measure cycle time, crew balance, logistics delay, and schedule reliability across several floors or projects.

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CONCLUSION

The Summarecon Mall Bandung Phase 2 project organised structural works through a seven-stage technical sequence and a six-zone spatial sequence. The technical chain progressed from pile driving to pile-head cutting, excavation and backfilling, compaction, pile caps and tie beams, columns, and beam-slab works. The spatial chain started in Zones 1 and 5, continued in Zones 2 and 3 after the first zones reached approximately 30% progress, and ended in Zones 4 and 6. The project retained the last two zones to protect entry, exit, logistics, and equipment manoeuvring routes. This arrangement allowed the same structural work cycle to move through separate areas without closing essential access too early. Labour competence, material delivery, equipment availability, approvals, financing, and site coordination determined whether the sequence could operate as planned. Project teams can apply the case by combining a work-package dependency map, location-based zoning, measurable release thresholds, and protected logistics corridors. Further studies should quantify the effects on cycle time, productivity, rework, safety, and schedule reliability.

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