

DESIGN PROCESSES OF A MULTI-STOREY PARKING FACILITY AS FUNCTIONAL SUPPORT BUILDING

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Abstract

Most evaluations of multi-storey parking buildings on university campuses focus on final technical performance rather than design evolution. This study reconstructs and compares two alternative proposals for a parking facility at UIN Sunan Kalijaga Yogyakarta using a qualitative comparative case study method and Plowright's triadic framework (exploratory thinking, transformation, evaluative thinking). Data from student internship reports, including site analyses, capacity calculations, national standards applications, and design records, were examined to trace causal links between process depth and design quality. Both alternatives meet minimum requirements. However, the alternative with broader exploration (two floor plans, two ramp types, five façades, separated circulation), systematic transformation, and explicit multi-criteria evaluation produced significantly better spatial organisation, safety, and contextual integration. The same standards and constraints led to different outcomes depending on whether they were treated as fixed limits (Alternative 1) or optimisation benchmarks (Alternative 2). Design quality in functional buildings is determined primarily by process depth and rigour—how well designers explore, transform, and evaluate—rather than formal expression alone. Plowright's framework is operational and replicable for making invisible design processes visible and comparable.

Keywords: Campus context; Comparative case study; Design process analysis; Functional support building; Multi-storey parking facility; Technical standards.

INTRODUCTION

Multi-storey parking buildings are one type of transportation facility in the built environment that is

designed primarily to meet the operational needs of vehicle storage, control of internal traffic movement, and efficient land use. International literature shows that the provision of parking facilities is directly related to mobility management and land use, particularly in dense environments such as campuses and urban areas (Clements, 2019; Ewing & Cervero, 2010; Dukhniak & Terletska, 2022). In this context, parking buildings serve as supporting infrastructure that determines the orderliness of circulation, user safety, and the overall quality of the area's environment. Empirically, the increase in motor vehicles in higher education environments puts pressure on parking availability. Limited open space, conflicts between vehicle and pedestrian traffic, and spatial irregularities often arise when parking is not managed systematically. This condition makes the construction of multi-story parking buildings a rational spatial solution because it can increase parking capacity without expanding the footprint while improving internal campus circulation control. (Herdiansyah et al., 2017; Bahariansyah et al., 2021; Alansyah, 2023)

The core design challenge is not merely related to parking capacity, but to how technical decisions (such as floor plans, structural modules, ramps, and circulation) are constructed throughout the design process (Lawson, 2020; Oxman, 2017; Kysil, 2016). Evaluations often focus on final outputs rather than systematically analyzing the process, despite its impact on solution quality (Lawson, 2020; Oxman, 2017;). The understanding of the architectural design process as a series of rational decisions based on stages is in line with the design thinking framework that emphasizes the implementation of systematic solutions in dealing with complex problems (Tantiyaswasdikul, 2019). Architecture treats the design process as crucial, understanding the final product as the result of rational, stage-based decisions including analysis, concept development, and documentation (Salama, 2015; Lawson, 2020). Evaluating process stages reveals the logic behind solutions.

However, Plowright (2014) argues that the architectural design process involves exploratory

thinking, transformation, and evaluative thinking. Through these three modes of thinking, designers interpret contextual information, generate diverse alternative responses, and assess potential solutions before arriving at final design decisions. Recent studies provide empirical support for these modes. Exploratory thinking is characterized by the repeated generation and revisiting of ideas, which dynamically expands the design space (Casakin, Sopher, Gero, & Anidjar, 2024).

Building on this perspective, a number of studies in architectural education literature offer specific solutions through experiential and practice-based learning approaches that emphasize students' direct involvement in professional projects to comprehensively understand the dynamics of the design process (Salama, 2015; Salama, 2021; Mariya et al., 2024). Through practical work, students produce reports containing site data, analysis, technical considerations, and design drawings. These documents provide a substantial record of the architectural decision-making process.

On the other hand, technical research on parking buildings focuses more on optimizing operational performance, such as capacity efficiency, circulation management, ventilation, and user safety based on a performance-oriented design approach (Chu & Su, 2023). In the Indonesian context, the application of these technical aspects generally refers to the Decree of the Director General of Land Transportation No. 272/HK.105/DRJD/96 concerning Technical Guidelines for the Implementation of Parking Facilities and SNI 03-1733-2004, the Indonesian national standard for urban housing and environmental planning, which includes provisions for parking space requirements and parking design standards. This highlights the distinction between educational and technical approaches in the literature.

Overall, the literature review shows two separate lines of research: studies of the design process that are dominant in the context of education or design theory (Lawson, 2020; Oxman, 2017) and studies of parking buildings that are predominantly technical and operational. In professional architectural practice, the design process generally takes place through sequential stages that include initial data collection and site analysis, formulation of requirements and spatial programs, concept development, synthesis of design alternatives, and technical refinement to working drawing documentation, where each stage produces data and decisions that directly influence the form and performance of the final design product (Lawson, 2020; Salama, 2015). However, contemporary design process theories argue that architectural design cannot be fully understood as a linear problem-solving activity. This perspective emphasizes that architectural outcomes are shaped not only by technical requirements but also by the

quality of decision-making throughout the design process.

Despite growing research on parking facility performance and operational efficiency, limited studies have examined how architectural decisions are developed through exploration, transformative, and evaluative stages during the design process of multi-storey parking facilities. Existing studies predominantly focus on technical outcomes, such as computational efficiency and space optimization (Krasoń & Głab, 2024), while the relationship between design process stages, architectural decision-making, and final design quality remains insufficiently explored. This limitation is particularly evident in functional support buildings, where technical standards and site constraints strongly influence design development (Elvarsson, Martani, & Adey, 2021). Moreover, comparative investigations of alternative design proposals within the same project context remain relatively uncommon, despite their potential to reveal how different decision-making processes lead to different design outcomes (Harputlugil & Prins, 2020; Ogrodnik, 2019).

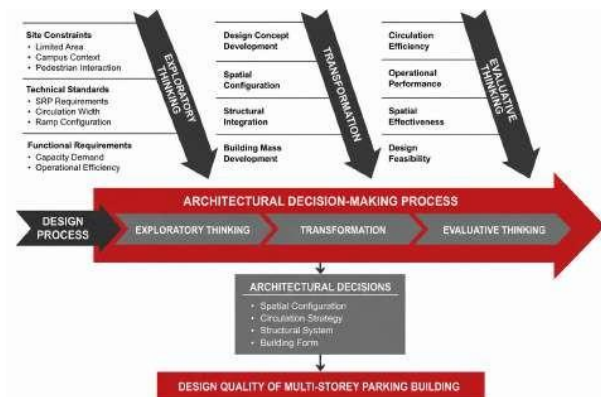


Figure 1. Fishbone diagram of factors determining the quality of multi-storey parking garage design (Author, 2026)

To address this gap in the literature, this study has three main objectives: (1) to reconstruct the design process of a multi-storey parking facility through a comparative analysis of two design alternatives within the same project context; (2) to identify and analyze the stages of exploratory thinking, transformation, and evaluative thinking that shape architectural decisions during the design process; and (3) to examine how technical standards, site constraints, and design evaluations influence design outcomes in functional support buildings. The study focuses on understanding the relationship between design process stages, architectural decision-making, and the resulting spatial and operational characteristics of the final design.

METHOD

This study, drawing on the design process analysis approach in architectural studies (Lawson, 2020; Salama, 2015; Salama, 2021) and specifically operationalizing Plowright's (2014) triadic framework of exploratory thinking, transformation, and evaluative thinking, uses a qualitative research design with a comparative case study approach grounded in document analysis. This approach was chosen because the study focused on gaining an in-depth understanding of the design process rather than measuring the quantitative performance of buildings. Design products were treated as artifacts that represented the thought process, technical considerations, and a series of architectural decisions made during the design process.

The research was conducted on a multi-story parking building project on the campus of Sunan Kalijaga State Islamic University in Yogyakarta, specifically in the Faculty of Sharia and Law. Data collection and analysis were carried out during the period of practical work and report preparation within the same project implementation time frame so that the temporal context of the two documents was equivalent. The research population included all work practice documents related to the project, while the two design products analyzed as research objects were consistently referred to as Design Alternative 1 and Design Alternative 2, each representing the final design of two different work practice reports. The sample was purposively selected: two internship reports compiled by architecture students for the same project and consultant. This selection aimed to control location, function, and typology, so that the comparison focused on variations in the design process rather than differences in the external context (Lawson, 2020; Salama, 2015).

The data collected included site analysis, formulation of parking capacity requirements, vehicle circulation systems, application of technical standards for parking dimensions, floor plan and structure configuration, completeness of design drawings, and consistency between analysis, concept, and final product. All of these aspects are treated consistently as basic data that must be available in every architectural design process, so they are not used as indicators of quality assessment, but rather as descriptive material to compare the depth of description, completeness of documentation, and how each report explains the design process. These data categories are not treated as quality indicators but as evidence of how evaluative thinking operates, i.e., how technical standards (SNI 03-1733-2004, Pedoman No. 272/HK.105/DRJD/96) and site constraints (limited area, campus context, pedestrian interaction) are interpreted and applied to assess design feasibility and circulation efficiency.

Table 1. Analytical Categories based on Plowright (2014) (Author, 2026)

Design Stage	Data Identified
Exploratory Thinking	Site constraints, campus context, parking demand, technical standards (SNI, Pedoman No. 272)
Transformation	Concept development, circulation strategy, spatial configuration, structural integration, building massing
Evaluative Thinking	Efficiency considerations, operational performance, spatial effectiveness, design feasibility (assessed against standards)
Architectural Decisions	Final design choices (floor plan, section, elevation, structural system) and design outcomes (capacity, circulation safety)

The data analysis used descriptive-comparative methods to reconstruct the causal relationships among the design stages, the technical data produced, and their implications for the spatial configuration and operational quality of the final design. Each design alternative was mapped based on a set of design process data categories, then compared to identify patterns of similarity, differences, and dominant trends in the design process. These data categories include site and regional context analysis stages, formulation of parking needs and capacity, development of vehicle circulation systems, application of technical standards and parking dimensions, preparation of floor plan configurations and structural systems, completeness and readability of design drawings, and consistency between analysis, concept, and final product.

All categories are considered basic data for the design process and are not used as indicators in quality assessment. These categories serve as a descriptive framework for tracing the types of information generated at each stage and explaining how this information influences architectural decisions and the final form of the design in each design alternative.

The analysis process is designed to reconstruct the transformation pathway (Plowright, 2014) by chronologically tracing how initial data flows through exploratory and evaluative stages to become final design decisions. The analysis process focuses on a chronological reading of each stage of the design, from the identification of initial data to concept development and technical refinement, so that the flow of data transformation into design decisions can be traced systematically. Each piece of data is then linked to the architectural decisions made and their influence on the final product, including spatial configuration, structural systems, and building operational performance. The results of the comparison are interpreted qualitatively to

explain how differences in the depth of the process and data processing result in different architectural solution characteristics in the two design alternatives.

RESULTS

Exploratory Thinking

The exploratory thinking stage focused on the identification of site conditions, parking requirements, technical standards, and contextual constraints that served as the initial design inputs. Analysis of both internship reports showed that the two design alternatives originated from the same project context, namely a multi-storey motorcycle parking facility located within the Faculty of Sharia and Law, Sunan Kalijaga State Islamic University, Yogyakarta.



Figure 2. Site location and existing condition (Author, 2025)

The site occupies approximately 1,352 m² and was previously utilized as an open parking area (Figure 2). The location is directly adjacent to academic buildings and one of the main pedestrian corridors within the campus, resulting in frequent interaction between vehicles and pedestrians. Both reports identified parking demand as the primary design issue and estimated a required capacity of approximately ±150 motorcycles based on Parking Space Unit (SRP) calculations.

Several contextual constraints were documented during the exploratory stage, including limited site area, existing campus circulation patterns, pedestrian activity, existing access conditions, and the need to maintain accessibility to surrounding academic facilities. These constraints established the design boundary conditions and influenced subsequent design development.

Both reports referred to SNI 03-1733-2004 and Directorate General of Land Transportation Guideline No. 272/HK.105/DRJD/96 as the principal technical references for determining parking dimensions, circulation widths, ramp systems, parking capacity calculations, and operational requirements.

Although both alternatives were developed from the same project requirements, differences emerged in the extent of exploration documented in each report. Design Alternative 1 primarily focused on fulfilling parking

capacity requirements and regulatory compliance. The report documented a single floor-plan configuration adapted to the site geometry. Vehicle circulation was organized using a straightforward linear arrangement, and the selected ramp system was directly incorporated into the parking layout. Documentation of alternative circulation patterns, ramp configurations, or support-space integration was limited.

In contrast, Design Alternative 2 documented a broader range of exploratory activities. Two floor-plan alternatives were developed and compared before selecting the final layout. The report also documented the testing of two ramp configurations, namely a two-way ramp and a U-shaped ramp, to evaluate circulation efficiency and vehicle maneuverability. Multiple circulation arrangements were explored to improve movement patterns and safety within the campus environment. The report further documented the development of five façade alternatives, which were subsequently refined into two final options before selection. Additional support facilities, including a security post and storage room, were integrated into the design by utilizing residual space beneath the ramp structure. These findings indicate that while both alternatives addressed the same functional requirements and technical constraints, Alternative 2 documented a wider range of design explorations before final decisions were made.

Transformation

The transformation stage involved converting site information, technical standards, parking requirements, and contextual constraints into architectural proposals. This stage generated parking layouts, circulation systems, structural configurations, building massing, and façade development strategies.

In Design Alternative 1, the transformation process moved directly from site analysis and parking requirements to the development of a single floor-plan solution. Parking modules, circulation aisles, and parking capacity calculations were translated into a parking layout that accommodated the required number of motorcycles. The structural system was subsequently adjusted to fit the selected parking configuration. Building massing generally followed the geometry of the floor plan, and façade development occurred after the overall mass configuration had been established. Design Alternative 2 documented a more extensive transformation process. Site analysis findings were translated into concept diagrams that linked site constraints, circulation requirements, and parking capacity needs to specific design strategies. Multiple floor-plan configurations were tested before selecting the final arrangement. Circulation development included comparisons between alternative

ramp types and vehicle movement systems to determine the most effective circulation strategy.

Structural integration was documented concurrently with spatial development. The column grid was coordinated with parking modules to improve span efficiency and vehicle maneuverability. Building massing was developed through volumetric studies and three-dimensional modelling, allowing circulation systems, structural modules, and façade development to be examined simultaneously. The façade was refined alongside massing development rather than being introduced after the spatial configuration had been finalized.

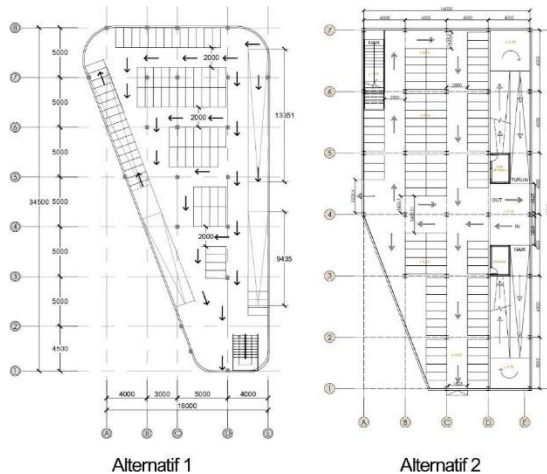


Figure 3. Comparative site-plan configuration of Design Alternative 1 and Alternative 2 showing the application of Parking Space Unit (SRP) standards, circulation layout, and structural module alignment (Author, 2025)

Both alternatives adopted a vertical development strategy consisting of a two-storey parking building intended to maximize parking capacity within the limited site area. The application of technical standards generated similar parking dimensions, circulation widths, and capacity targets in both alternatives. However, Alternative 2 documented a more comprehensive transformation sequence involving concept synthesis, alternative testing, structural coordination, and mass refinement before finalization.

Evaluative Thinking

The evaluative thinking stage involved assessing the effectiveness and feasibility of proposed design solutions before final architectural decisions were made. Analysis of the reports identified several evaluation criteria applied during the design process, including parking capacity achievement, circulation efficiency, operational performance, spatial

effectiveness, user safety, design feasibility, and compliance with applicable technical standards.

In Design Alternative 1, evaluation activities primarily focused on verifying compliance with technical requirements. Assessment included parking dimensions, circulation widths, parking-module arrangements, parking capacity calculations, and general accessibility requirements. Design revisions documented in the report were generally associated with technical corrections and supervisor feedback rather than systematic comparisons among alternative solutions. In Design Alternative 2, evaluation activities were more extensive and iterative. Alternative floor plans, ramp systems, circulation arrangements, and façade options were compared against multiple criteria. Circulation efficiency was assessed through vehicle movement patterns, maneuvering requirements, and inter-floor connectivity. Safety considerations included the separation of pedestrian and vehicular circulation routes. Spatial effectiveness was evaluated through the utilization of residual spaces and the integration of support facilities. Feasibility was assessed through structural coordination and constructability considerations.

Both reports utilized SNI 03-1733-2004 and Guideline No. 272/HK.105/DRJD/96 as evaluation references. However, Alternative 2 documented a broader application of evaluative procedures involving efficiency, safety, feasibility, operational performance, and design optimization in addition to regulatory compliance. The findings indicate that evaluative activities contributed to refining design proposals prior to final decision-making. While both alternatives satisfied minimum technical requirements, the extent and depth of evaluation documented in each report differed considerably.

Architectural Decisions

The final stage of the design process consisted of architectural decisions that synthesized exploratory findings, transformation activities, and evaluation results into complete design proposals. For both alternatives, architectural decisions were documented through site plans, floor plans, sections, elevations, structural layouts, and three-dimensional visualizations. These documents represented the final outcomes of the design process and demonstrated how site constraints, parking requirements, technical standards, and evaluation results were translated into architectural form. The principal architectural decisions identified in both reports included the adoption of a vertical parking strategy, determination of parking capacity based on SRP calculations, organization of vehicle circulation systems, selection of ramp configurations, arrangement of structural modules, development of building massing, and application of façade treatments.

In Design Alternative 1, architectural decisions reflected a direct translation of technical requirements into built form. The final proposal employed a single floor-plan configuration, a standard circulation arrangement, and a structural system adapted to the selected parking layout. Architectural development focused primarily on meeting parking capacity and regulatory requirements. In Design Alternative 2, architectural decisions resulted from a process of selecting and refining multiple alternatives developed during earlier stages. The final proposal adopted a U-shaped ramp system, separated pedestrian and vehicle circulation routes, integrated support spaces beneath the ramp structure, coordinated structural modules with parking layouts, and implemented a façade solution derived from iterative design testing. These decisions were documented through concept diagrams, circulation studies, structural coordination drawings, and refined architectural representations.



Figure 4. Final Design and Material use in Alternative Design 1 (Author, 2025)

The final design outputs demonstrate how site constraints, technical standards, parking requirements, exploratory activities, and evaluation procedures collectively influenced architectural decision-making throughout the design process. The comparative analysis demonstrates that both design alternatives fulfilled the functional objective of providing a multi-storey motorcycle parking facility within the constraints of a limited campus site. However, differences were evident in the application of design-process activities. Design Alternative 1 (Fig. 4) emphasized direct compliance with parking standards and technical requirements, resulting in a relatively linear design-development process. In contrast, Design Alternative 2 (Fig. 5) exhibited a more iterative and comprehensive approach characterized by broader exploration, systematic transformation of design concepts, extensive evaluation procedures, and refined architectural decision-making. These findings suggest that the depth of exploration, transformational, and evaluative activities influenced the complexity and integration of the final architectural outcomes.



Figure 5. Final Design and Material use in Alternative Design 2 (Author, 2025)

The final design outputs demonstrate how site constraints, technical standards, parking requirements, exploratory activities, and evaluation procedures collectively influenced architectural decision-making throughout the design process. Figures 6 summarise the complete design process for each alternative, mapping the sequence of exploratory thinking, transformation, evaluative thinking, and architectural decisions according to Plowright's (2014) framework.

Discussion

The discussion interprets the findings through Plowright's (2014) framework of exploratory thinking, transformation, and evaluative thinking. Rather than focusing solely on the technical characteristics of the final design products, the discussion examines how architectural decisions emerged throughout the design process and how these decisions influenced the spatial and operational performance of the multi-storey parking facility. Particular attention is given to the role of technical standards, site constraints, and design evaluations in shaping the final design outcomes.

Exploratory Thinking in the Design Process

Exploratory thinking, as defined by Plowright (2014), refers to the designer's capacity to generate multiple alternative responses to contextual information, such as site conditions, technical standards, and functional requirements, before converging on a final design solution. Using a qualitative comparative method grounded in document analysis (Lawson, 2020; Salama, 2015), this study examined two design project reports to identify evidence of exploratory thinking.

Exploratory thinking is characterized by repeated idea generation and the dynamic expansion of the design space (Casakin, Sopher, Gero, and Anidjar, 2024). Table 2 summarizes the comparative findings between the two design alternatives.



Figure 6. Architectural decision-making process of Design Alternative 1 & 2 (Author, 2026)

Transformation and Architectural Decision-Making

Transformation, according to Plowright (2014), is the process of converting raw data (such as site conditions, technical standards, and functional requirements) into spatial configurations, structural systems, and building mass. This study reconstructs the transformation pathway through chronological document analysis (Lawson, 2020; Salama, 2015). K m rc  & Ergen  (2017) model transformation as a sequence of

acquisition, synthesis, analysis, and evaluation. The fishbone diagram positions Design Concept Development (spatial configuration, structural integration, building mass development) and Circulation Efficiency as key transformation outputs before evaluative thinking. Table 3 summarizes how each design alternative transformed initial data into architectural decisions.

Table 2. Comparison of Exploratory Thinking Design Processes (Author, 2026).

Technical Aspects	Design Alternative 1	Design Alternative 2	Compliance Description
Floor plan alternatives	Only one curved floor plan was developed to follow the trapezoidal site	Two floor plan alternatives testing different ramp placements and parking module	Generating multiple spatial alternatives indicates richer exploratory thinking (Plowright, 2014).
Ramp type exploration	the design appears to adopt a default straight ramp without testing alternatives	Two ramp types (two-way and U-shaped) were tested before selecting the U-shaped ramp	Iterative idea generation expands the design space (Casakin et al., 2024).
Fa�ade exploration	Two fa�ade options were developed sequentially after the mass was fixed	Five fa�ade options were developed, evaluated, and narrowed down to two for structural integration	A wider range of explored alternatives reflects deeper exploratory thinking and dynamic expansion of the design space (Casakin et al., 2024).
Circulation pattern exploration	No alternative circulation patterns were documented; a basic linear scheme was used without separating vehicles from pedestrians.	Separated vehicle and pedestrian paths were explored and implemented to improve safety in the campus context	Exploring multiple circulation responses to site constraints (pedestrian safety) demonstrates systematic exploratory thinking (Plowright, 2014).
Integration of support spaces	Support spaces such as storage rooms or security posts were not explored or integrated into the design.	A storage room and a security post were integrated under the ramp, utilizing otherwise wasted space	Creative exploration of residual space generates additional functional value, a key characteristic of rich exploratory thinking (Plowright, 2014).

Technical Aspects	Design Alternative 1	Design Alternative 2	Compliance Description
Exploration method	Revisions were reactive to supervisor feedback rather than resulting from systematic comparison of alternatives.	Alternatives were systematically compared, evaluated against criteria (efficiency, safety, client preference), and revised based on evidence.	Document analysis reveals a systematic vs. reactive exploration process (Lawson, 2020).

The comparison of transformation pathways reveals that Design Alternative 1 followed a linear and passive process, converting site data directly into a single floor plan without explicit synthesis, alternative testing, or early integration of structure and façade. This approach aligns with what Kömürçü & Ergenç (2017) describe as an incomplete transformation sequence, where the absence of explicit synthesis and analysis stages limits the depth of design development and results in suboptimal spatial and structural outcomes.

Table 3. Comparison of Transformation and Architectural Decision-Making (Author, 2026)

Technical Aspects	Design Alternative 1	Design Alternative 2
Concept synthesis (from site to idea)	No explicit concept diagram; design moved directly from survey to floor plan.	A concept diagram linked site analysis to design strategy
Spatial configuration testing	Only one curved floor plan was developed.	Two floor plan alternatives were tested before selection
Structural integration	Structure follows parking layout without optimization.	Column grid aligns with parking modules for span efficiency.
Building mass development	Mass formed passively by following the floor plan outline.	Mass developed through volumetric testing and 3D modeling
Circulation efficiency	Basic linear scheme with no pedestrian separation.	U-shaped ramp plus separated pedestrian paths for safety
Façade integration	Façade added after mass was fixed, no structural coordination.	Façade developed concurrently with mass, structural integration early
Documentation	Minimal documentation and revisions reactive to feedback.	Chronological documentation showing full transformation pathway.

In contrast, Design Alternative 2 demonstrated an iterative and well-documented transformation, including concept synthesis, testing of multiple floor plans and ramp types, concurrent structural integration, and

chronological documentation of each decision stage. This systematic transformation pathway reflects Plowright's (2014) emphasis on deliberate transformation as a core design thinking mode, and it directly contributed to a more coherent, efficient, and context-responsive architectural solution.

Evaluative Thinking and Design Quality

Evaluative thinking, according to Plowright (2014), involves assessing potential solutions against explicit criteria before making final design decisions. However, Plowright does not prescribe a fixed set of criteria; instead, criteria emerge from the specific design context. For parking facilities, relevant evaluation criteria are derived from technical standards (SNI 03-1733-2004, Pedoman No. 272/HK.105/DRJD/96) and performance-oriented studies (Chu & Su, 2023; Herdiansyah et al., 2017). Based on these sources, this study evaluates design alternatives using six aspects: efficiency, operational performance, spatial effectiveness, feasibility, safety, and compliance with standards. Using document analysis (Lawson, 2020; Salama, 2015), Table 4 compares how each alternative applied these evaluation criteria.

Design Alternative 1 demonstrated minimal evaluative thinking. None of the six evaluation aspects were systematically assessed. Decisions relied on default assumptions and reactive supervisor feedback rather than explicit comparison of alternatives. This approach reflects what Plowright (2014) describes as evaluative thinking being treated as an implicit afterthought, which typically yields designs that meet minimum standards but lack performance optimization. Design Alternative 2 applied evaluative thinking systematically across all criteria. Efficiency and safety were tested through ramp and circulation alternatives; feasibility was confirmed through structural coordination; standards were used as benchmarks for optimization rather than mere compliance. As Harputlugil & Prins (2020) and Ogrodnik (2019) argue, such rigorous evaluation directly contributes to higher design quality. Consequently, Alternative 2 achieved better space utilization, improved pedestrian safety, and stronger contextual integration with the campus environment. Thus, while both alternatives technically satisfy regulatory requirements, the presence of systematic evaluative thinking in Alternative 2 directly translated into superior spatial, safety, and contextual outcomes. In contrast, Alternative 1's reliance on implicit, reactive evaluation produced a

compliant but suboptimal design, confirming that evaluative rigour—not merely meeting standards—is the critical differentiator in design quality for functional buildings like parking facilities.

Table 4. Comparison of Evaluative Thinking and Design Quality (Author, 2026)

Evaluation Aspect	Design Alternative 1	Design Alternative 2
Efficiency	No documented assessment of space or circulation efficiency.	Compared two floor plans and two ramp types; U-shaped ramp selected for better space use.
Operational performance	Assumed minimum standards would suffice without verification.	Tested ramp simulation and pedestrian-vehicle separation; safety concerns guided revisions.
Spatial effectiveness	Linear layout followed; no evaluation of user convenience or safety.	Compared parking module configurations; added dedicated pedestrian paths to reduce conflict.
Feasibility	Only basic SRP compliance considered; structural feasibility not discussed.	Coordinated façade options with structural engineers before finalizing.
Safety	No explicit safety evaluation; pedestrian-vehicle conflict not addressed.	Evaluated safety through separated paths and U-shaped ramp, responding to campus foot traffic.
Compliance with standards	Standards treated as minimum requirements, not performance benchmarks.	Used standards as optimization benchmarks (ramp slope, aisle width) to justify design choices.

Role of Technical Standards and Site Constraints

Both design alternatives operated under the same technical framework: SNI 03-1733-2004 and Directorate General of Land Transportation Guideline No. 272/HK.105/DRJD/96. These standards define minimum requirements for parking dimensions (SRP), circulation

widths, ramp slopes, and safety provisions. In addition, both projects faced identical site constraints: a limited trapezoidal area ($\approx 1,352 \text{ m}^2$), a campus context with heavy pedestrian traffic, and the need to maintain access to surrounding academic buildings.

The two design alternatives applied technical standards and responded to site constraints in markedly different ways. Design Alternative 1 treated technical standards as minimum compliance limits, adopting parking dimensions and circulation widths directly from the guidelines without further testing, while the trapezoidal site was addressed by curving the floor plan without documented exploration of alternative spatial organizations. Meanwhile, pedestrian-vehicle conflict as a key site constraint was not explicitly resolved, so the design retained a basic linear circulation scheme without separated pedestrian paths. In contrast, Design Alternative 2 used technical standards as performance benchmarks rather than mere limits, optimizing ramp slopes and aisle widths through testing of two ramp types (two-way versus U-shaped) and two floor plan alternatives. The limited site area was managed by integrating support spaces under the ramp and separating pedestrian routes from vehicle circulation, and campus safety concerns directly influenced the final layout, which includes dedicated pedestrian pathways.

As shown in Table 5, the same technical standards and site constraints produced different design outcomes depending on how they were interpreted and processed. Alternative 1's compliance-only approach yielded a functional but suboptimal building. Alternative 2's performance-oriented approach resulted in better space utilization, improved safety, and stronger contextual integration. This finding supports the argument that in functional support buildings, technical standards and site constraints should not be treated as fixed limits but as design drivers that can be explored and optimized through systematic analysis and evaluation (Plowright, 2014; Elvarsson, Martani, & Adey, 2021; Chu & Su, 2023).

Contributions, Limitations, and Future Directions

This study makes several contributions to the understanding of design processes in functional support buildings. First, it operationalizes Plowright's (2014) triadic framework (exploratory thinking, transformation, evaluative thinking) in a previously underexplored building typology, multi-storey parking facilities. Second, it demonstrates how document analysis of student internship reports can serve as a valid method for reconstructing architectural design processes, particularly when comparing two alternatives within the same project context. Third, the study provides empirical evidence that design quality is not solely determined by technical compliance but by the depth of exploration, transformation, and evaluation applied during the design process.

However, the study has several limitations. The analysis is based on only two design alternatives from a single project location, which limits the generalizability of the findings. Both alternatives were produced by architecture students in an internship setting; therefore, the design decisions may not fully represent professional practice. Additionally, the study relies on documented evidence; undocumented design thinking (e.g., informal discussions, unrecorded sketches) could not be captured. Future research should apply the same analytical framework to a larger number of design alternatives across different project types (e.g., commercial parking, urban parking structures) and professional practice settings. Longitudinal studies that follow design teams from project initiation to completion could capture more nuanced decision-making processes. Finally, incorporating quantitative performance metrics (e.g., circulation time, capacity utilization) alongside qualitative process analysis would strengthen the evaluation of design quality.

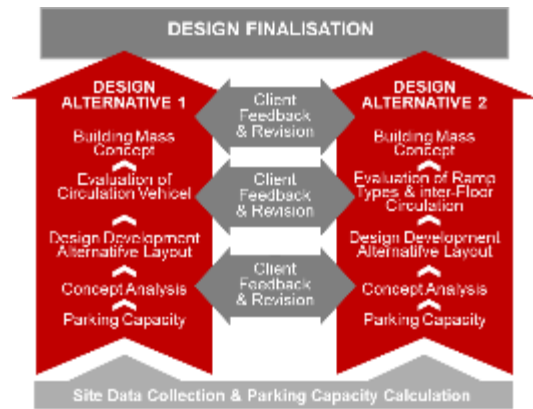
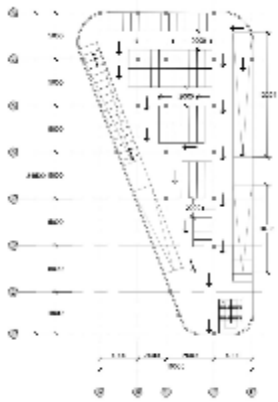
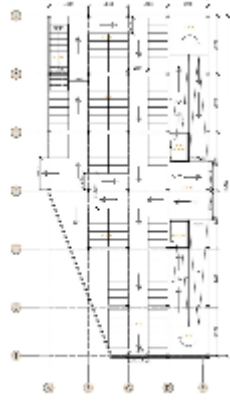
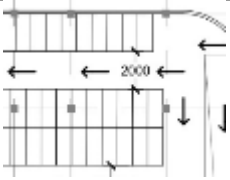

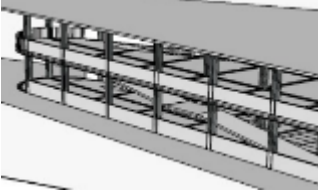


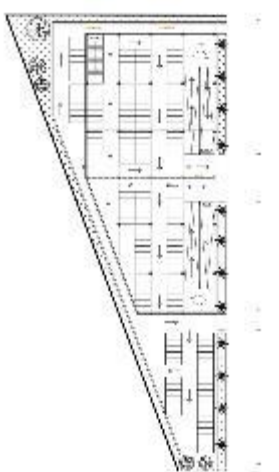




Figure 7. Analytical diagram illustrating the relationship between design process stages, technical data processing, and the resulting architectural configuration. (Author, 2026)

Table 5. Comparison of Design Responses to Technical Standards and Site Constraints (Author, 2026).

Factor	Design Alternative 1	Design Alternative 2	Standard Compliance
SRP dimensions			Alternative 2 is more compliant because SRP standards are not only met but also optimized for space efficiency.
Circulation width			Alternative 2 is more compliant because circulation width was tested and adjusted for maneuvering needs, not merely following minimum limits.
Ramp configuration			Alternative 2 is more compliant because ramp standards (slope, width) are used as benchmarks for safety optimization, not just minimum compliance.

Factor	Design Alternative 1	Design Alternative 2	Standard Compliance
Limited site area (trapezoidal)			Alternative 2 is more compliant because it utilizes the limited site area more efficiently while still meeting circulation and parking standards.
Campus context / pedestrian safety			Alternative 2 is more compliant because it explicitly responds to pedestrian safety standards.
Use of standards	SNI 03-1733-2004 and Directorate General of Land Transportation Guideline No. 272/HK.105/DRJD/96 as minimum compliance requirements without further testing or optimization	SNI 03-1733-2004 and Guideline No. 272/HK.105/DRJD/96 but used them as optimization benchmarks, testing SRP dimensions, circulation width, and ramp configurations to improve efficiency and safety	Alternative 2 is more compliant because standards are not only met but also used to enhance design performance.

CONCLUSION

This study systematically reconstructed and compared the architectural design processes of two multi-storey parking building alternatives developed for the same site, program, and technical standards at UIN Sunan Kalijaga Yogyakarta. By operationalising Plowright's (2014) triadic framework of exploratory thinking, transformation, and evaluative thinking, and using a qualitative comparative case study method grounded in document analysis (Lawson, 2020; Salama, 2015), the research addressed a clear gap in the literature: limited investigations of how design decisions evolve through exploratory, transformative, and evaluative stages in functional support buildings.

The results show that Design Alternative 2, which explored more options, documented iterative transformations, and applied systematic evaluation, produced a more efficient, safe, and contextually integrated design. Design Alternative 1, which followed

a linear, compliance-only process, met minimum standards but lacked performance optimisation.

The same technical standards led to different outcomes depending on how they were used: as fixed limits (Alternative 1) or as optimisation benchmarks (Alternative 2). Thus, design quality in functional support buildings is primarily determined by the depth and rigour of the design process, not by formal expression.

In summary, this study confirms that for multi-storey parking buildings as functional support structures, the quality of the final design is not determined by architectural style or formal gestures but by the depth and rigour of the design process—especially how well designers explore alternatives, transform data into spatial solutions, and evaluate options against multiple performance criteria. Plowright's (2014) framework provides a powerful lens for making this otherwise invisible process visible and comparable.

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