



Integrating Commerce, Work and Public Life: A Sustainable Mixed-Use High-Rise Development Framework for Gazipur, Bangladesh

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ABSTRACT

Rapid urbanization, industrial expansion and increasing pressure on land are transforming Gazipur into a complex metropolitan-industrial landscape. This paper develops the earlier Gazipur Sky Center thesis and a subsequent research-paper draft into a more explicit design-research framework for a mixed-use high-rise that integrates commerce, work and public life. The study uses qualitative, case-based architectural research: evidence from the supplied thesis, published urban and environmental literature, functional programming, climate-responsive design principles, mobility hierarchy, life-safety logic and conceptual performance indicators are translated into an integrated architectural model. The thesis site at Rongilabazar, Mulaid, Sreepur, Gazipur is approximately 242,842 ft² (about 5.5 acres) and was originally programmed as a shopping mall and corporate-office development. Published evidence cited in the supplied draft reports that urban area in Gazipur Sadar increased from 61.3 km² in 1999 to 118.3 km² in 2024, while water bodies and vegetation declined and summer land-surface temperature increased. The developed framework therefore treats density, ecological performance, public space, mobility and adaptability as interdependent rather than separate design problems. The proposed model uses an active public ground plane, retail podium, shared transition floors, flexible office tower, separated service and emergency circulation, shaded façades, green terraces, rainwater management and coordinated building systems. A mathematical assessment framework is provided for FAR, site coverage, green coverage, public-realm ratio, functional diversity, land-use efficiency, pedestrian accessibility, green-to-hardscape ratio and future energy-use intensity. Three conceptual heat maps demonstrate how thermal exposure, activity intensity and combined environmental-design priority can be used as decision-support layers. Because no georeferenced site thermal raster, pedestrian-count survey, traffic model or calibrated building simulation was supplied, the heat maps and design scores are explicitly conceptual rather than measured results. The paper concludes that sustainable vertical development in Gazipur should be judged by the coordination of land efficiency, public life, climate response, mobility, safety, resilience and long-term adaptability, not by building height alone.

Keywords: Gazipur; mixed-use development; high-rise architecture; vertical urbanism; sustainable architecture; public life; climate-responsive design; land-use efficiency; urban heat; Bangladesh.

INTRODUCTION

Bangladesh's continuing urban transition is increasing demand for workplaces, commercial services, transportation infrastructure and public facilities. In rapidly industrializing districts, outward expansion can convert agricultural and ecological land while lengthening daily travel. Compact and mixed-use urbanism offers a possible alternative by combining density, diversity and accessibility, but the literature also cautions that compactness is not automatically sustainable. Density must be accompanied by adequate infrastructure, environmental quality, public space and safe mobility (Jenks et al., 1996; Neuman, 2005; Bibri, 2020). Gazipur is a particularly important setting for this debate. The supplied thesis describes the district as a rapidly urbanizing industrial and residential center whose commercial and corporate infrastructure has not developed at the same pace as population and economic activity. The project site is identified at Rongilabazar, Mulaid, Sreepur, Gazipur, with an approximate area of 242,842 ft² (5.5 acres). The thesis proposes a multi-level shopping mall combined with a corporate office tower, supported by parking, services, public space, environmental systems and a high-rise structural core. This paper retains that architectural basis but reframes it



as a research model rather than a project description. The second supplied paper strengthens the need for this reframing by citing recent remote-sensing evidence. Sojib et al. (2025) reported an increase in urban area in Gazipur Sadar from 61.3 km² in 1999 to 118.3 km² in 2024, alongside loss of water bodies and vegetation and an increase in summer land-surface temperature. These trends suggest that land efficiency cannot be discussed separately from heat, vegetation, drainage and public-space provision. The architectural problem is therefore not simply how to place more floor area on a site, but how to organize additional density so that commerce, work, movement and public life support one another without creating excessive environmental or operational burdens. Mixed-use architecture can create shorter internal trips, extended periods of activity and shared infrastructure. Yet it can also produce conflicts between public and controlled uses, pedestrian and service movement, retail visibility and office security, or high occupancy and emergency egress. A successful mixed-use high-rise must therefore operate as a coordinated vertical district. The lower levels must connect to the street and accommodate high public intensity; the tower must provide secure, flexible and daylit workplaces; transition zones must mediate between them; and structural, fire, MEP and environmental systems must remain legible across the whole building. This study develops an integrated framework for that coordination. It does not claim a completed building-performance simulation or field experiment. Instead, it uses design research to translate contextual evidence and literature into architectural criteria, spatial organization and testable indicators. This approach is appropriate to the current stage of the Gazipur Sky Center proposal because the original thesis itself identifies detailed geotechnical, traffic, energy, fire-engineering, authority-approval and feasibility studies as future requirements.

Research gap and contribution

Existing literature provides strong but often separate bodies of knowledge on compact cities, mixed-use development, public life, high-rise environmental design and building performance. The Gazipur-specific literature increasingly documents land-cover change and urban heat. The gap addressed here is the architectural translation between these scales: how can urban evidence about land pressure, heat and mobility be converted into a coherent mixed-use high-rise design logic? The contribution of this paper is therefore a reproducible research-to-design framework that links contextual evidence to vertical programming, public-realm design, climate response, circulation separation and measurable indicators. It also demonstrates how conceptual heat mapping can structure design decisions while clearly distinguishing author-generated scenarios from measured geospatial results.

AIM, OBJECTIVES AND RESEARCH QUESTIONS

The aim is to develop a sustainable mixed-use high-rise development framework for Gazipur that integrates commerce, work and public life while improving land-use efficiency, environmental responsiveness, accessibility and long-term adaptability.

Objective	Research task	Expected output
O1	Identify urban and environmental conditions relevant to high-rise mixed use in Gazipur.	Context profile and design constraints
O2	Establish functional zoning for retail, public, shared, office and service uses.	Vertical stacking and adjacency model
O3	Integrate pedestrian, transit, vehicle, service and emergency movement.	Mobility hierarchy and separated circulation
O4	Embed passive/active environmental strategies at concept stage.	Climate, landscape, water and energy framework
O5	Define indicators and equations for later quantitative testing.	Conceptual performance assessment framework

O6	Synthesize a transferable design process.	Framework applicable to comparable Bangladeshi cities
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Research questions

RQ1—How can vertical mixed-use development respond to land-use pressure in Gazipur?

RQ2—How can commerce, work and public life be connected without creating avoidable functional conflict?

RQ3—Which environmental and mobility strategies should be embedded at concept stage?

RQ4—How can the building remain adaptable, safe and operationally resilient over its life cycle?

GAZIPUR CONTEXT AND PROJECT BASIS

Figures 8–10 translate the thesis location, surrounding land-use context and site observations into the contextual evidence used in this paper. The Gazipur Sky Center thesis locates the project at Rongilabazar, Mulaid, Sreepur, Gazipur and identifies Ayesha Group as the client. The proposed use is a shopping mall and corporate-office mixed-use complex on approximately 5.5 acres. The thesis emphasizes visibility, regional road connections, growing industrial employment and the need for organized commercial and office space. These project facts provide the architectural basis of the present study; they should not be interpreted as a substitute for a verified cadastral, topographic or traffic survey.



Figure 1-6. Project location within Gazipur and the greater Dhaka region, reproduced from the original thesis and Site and surrounding land-use context of the proposed Gazipur Sky Center, reproduced from the thesis.

The reported 93% increase in urban area provides an empirical reason to investigate compact forms, but it does not justify unrestricted densification. High-rise intensification is sustainable only where road capacity, public transport, drainage, utilities, fire access and environmental infrastructure can support it. The supplied thesis makes a similar distinction by treating the Gazipur Sky Center as an academic proposal and recommending

detailed technical studies before implementation. Environmental change adds another layer. The supplied draft reports a 45% decline in water bodies, a 9% decline in vegetation and a 5.7°C increase in summer land-surface temperature over the cited study period (Sojib et al., 2025). These values are contextual evidence rather than measurements made for the thesis site. Nevertheless, they justify design priorities such as tree canopy, shaded pedestrian space, permeable landscape, rainwater retention, solar control and reduced heat-absorbing hardscape.

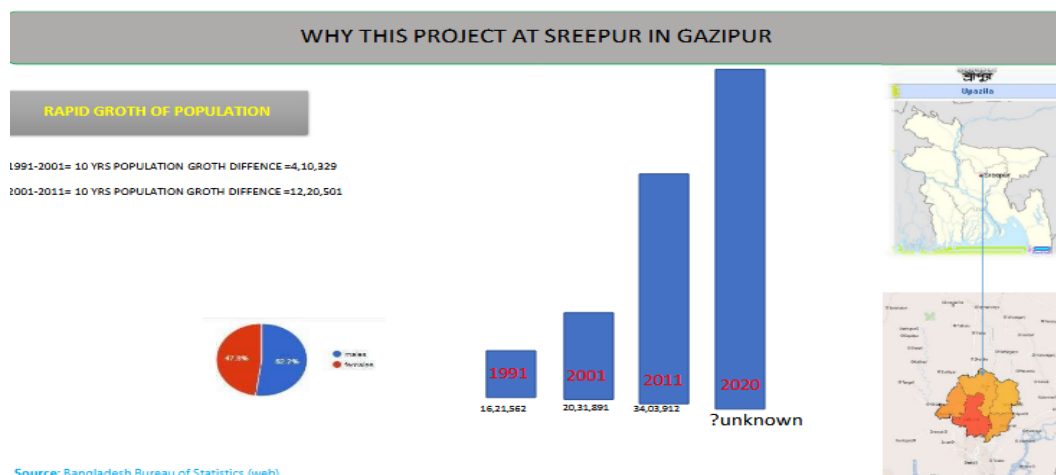


Figure 7-9. Site characteristics and environmental observations used in the thesis design process.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Compact urbanism and mixed-use development

Compact-city theory links urban density with mixed land use, shorter travel distances and more efficient infrastructure, but the relationship is conditional. Jenks et al. (1996), Burton (2002), Jabareen (2006), Bibri (2020) and Bibri and Krogstie (2020) describe compactness as a combination of density, diversity, accessibility and sustainable transport rather than height alone. Neuman (2005) warns that the compact-city idea can become a fallacy when urban form is treated as a sufficient condition for sustainability. This caution is highly relevant to Gazipur, where rapid land conversion can place additional pressure on already constrained roads, drainage and services. Mixed-use research similarly presents both benefits and trade-offs. Grant (2002), Rowley (1996), Hoppenbrouwer and Louw (2005), Coupland (1997) and Geyer (2024) show that combining uses can support vitality and accessibility, but incompatible functions can create noise, servicing and management conflicts. For the Gazipur Sky Center, this means that integration must be spatially selective: public retail uses should connect strongly to the ground plane, while offices, service areas and emergency systems require controlled access and dedicated circulation.

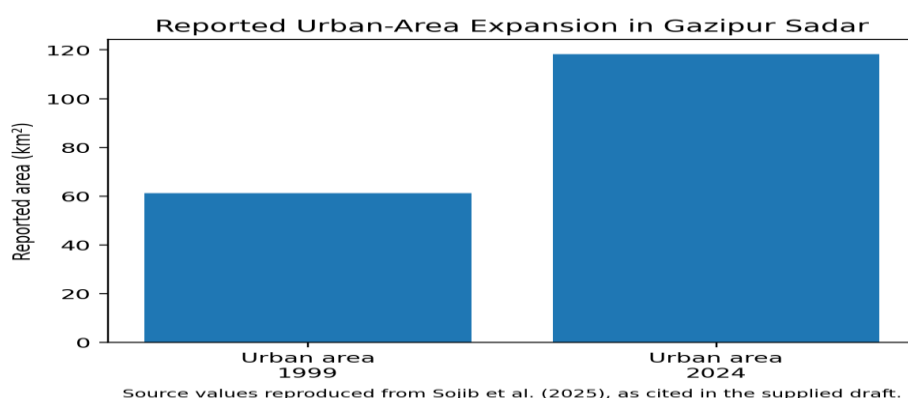


Figure 10. Reported urban-area expansion in Gazipur Sadar, 1999–2024. Values follow Sojib et al. (2025) as cited in the supplied research draft.

Public life, legibility and the ground plane

Jacobs (1961), Whyte (1980), Gehl (2010, 2011), Lynch (1960) and Montgomery (1998) establish the importance of mixed activity, human-scale edges, seating, shade, visibility and legible movement. A high-rise can contribute to public life only if its base behaves as part of the city rather than as a sealed object. The thesis concept of a retail podium and central atrium is therefore developed here into a public-to-private gradient: street → shaded forecourt → active frontage → atrium → shared amenities → controlled office zone. This sequence also improves wayfinding by making changes in access and function spatially understandable.

Climate-responsive high-rise design

High-rise sustainability depends on early decisions about orientation, floor-plate depth, façade geometry, shading, glazing, ventilation, landscape and mechanical systems. Yeang (1999, 2008), Oldfield et al. (2009), Raji (2018), Rafiei and Adeli (2016), Lechner (2015) and Wood and Salib (2013) argue for integrated environmental design rather than technology added after form-making. Research on tropical shading further demonstrates that external devices must balance solar protection and daylight (Al-Masrani et al., 2018; Jayaweera et al., 2021). The Gazipur proposal therefore favors recessed glazing, horizontal and vertical fins, green terraces and mixed-mode opportunities in suitable semi-open zones rather than an undifferentiated glass curtain wall.

Adaptability, structure and life safety

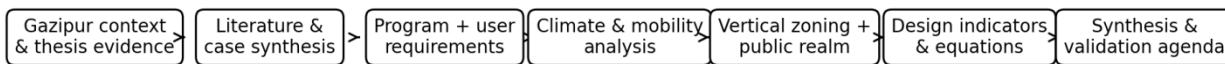
Long-term sustainability also depends on the ability of a building to change. Habraken (1972) and Duffy (1997) support spatial systems that separate long-life structure and services from shorter-life fit-out. For a mixed-use tower, regular structural bays, accessible service zones and modular office planning can reduce the cost of future reconfiguration. At the same time, flexibility cannot compromise life safety. BNBC 2020, NFPA 101 and high-rise structural literature emphasize protected egress, fire separation, robust cores, emergency access and appropriate lateral-load resistance. The original thesis proposes a reinforced-concrete core and high-rise grid system; this paper treats that as a conceptual direction subject to geotechnical, wind, seismic and detailed structural verification.

Literature synthesis

Theme	Key literature	Design implication
Compactness	Jenks et al.; Neuman; Bibri	Density must be matched by access, services and environmental quality.
Mixed use	Grant; Geyer; Rowley	Connect complementary uses; separate conflicting operations.
Public life	Jacobs; Whyte; Gehl	Active, shaded, legible ground plane with dwell spaces.
Climate	Yeang; Raji; Al-Masrani et al.	Form, façade, landscape and systems should be co-designed.
Adaptability	Habraken; Duffy	Regular grids and serviceable floor plates enable change.
Safety	BNBC 2020; NFPA 101; Ali & Moon	Core, egress, compartmentation and structure are early design drivers.

RESEARCH METHODOLOGY

The study adopts qualitative case-based architectural design research. The primary project evidence is the supplied Gazipur Sky Center thesis and its subsequent research-paper draft. These are combined with literature on mixed use, public life, compact urbanism, environmental design, mobility, structural systems and life safety. The methodology is deliberately transparent about evidence levels: project facts and published Gazipur findings are treated as source-derived information; proposed program percentages, evaluation priorities and heat maps are author-generated conceptual tools; and no unperformed simulation is reported as measured performance.



Evidence → criteria → architectural translation → conceptual evaluation

Figure 11. Research methodology flow chart developed for the expanded study.

Stage	Input	Analytical task	Output
1	Gazipur evidence + thesis	Urban/environmental review	Context profile
2	Literature	Mixed-use/high-rise synthesis	Design criteria
3	Users + program	Adjacency and zoning analysis	Functional matrix
4	Sun, heat, rain, landscape	Climate-response analysis	Environmental strategy
5	Pedestrian/transit/vehicle/service	Mobility hierarchy	Access framework
6	Stacking/core/public realm	Architectural translation	Conceptual model
7	Indicators + equations	Conceptual evaluation	Assessment framework
8	Limitations + future testing	Validation planning	Research agenda

Analytical validity and evidence levels

The methodology does not include a new questionnaire, measured pedestrian count, thermal-camera survey, CFD analysis, calibrated energy model, structural finite-element model or post-occupancy evaluation. Accordingly, the Results section reports design synthesis and conceptual spatial analysis rather than causal performance claims. Project facts and published Gazipur findings are treated as source-derived evidence; program shares, heat maps and design priorities are author-generated conceptual tools. This separation is essential so that a visually persuasive diagram is not mistaken for a measured result.

FUNCTIONAL PROGRAMMING AND VERTICAL ORGANIZATION

Figures 12-14 show how the thesis concept evolved from an urban-response idea into a vertically organized podium-and-tower system with integrated planning and three-dimensional massing. The building is treated as a vertically connected urban district. The thesis establishes a podium-and-tower logic: high-footfall retail and entertainment functions occupy lower levels, while office uses occupy upper floors. The developed model adds

transition floors between these domains for co-working, meetings, events and shared amenities. This mediates between highly public retail space and controlled office space and supports cross-use interaction without removing necessary security.

CONCEPT DEVELOPMENT: FROM URBAN NEED TO ARCHITECTURAL FORM



Outcome: a legible vertical urban hub that balances commercial vitality, workplace efficiency, safety and environmental performance.

Figure 12. Thesis concept-development sequence translating urban need into architectural form.

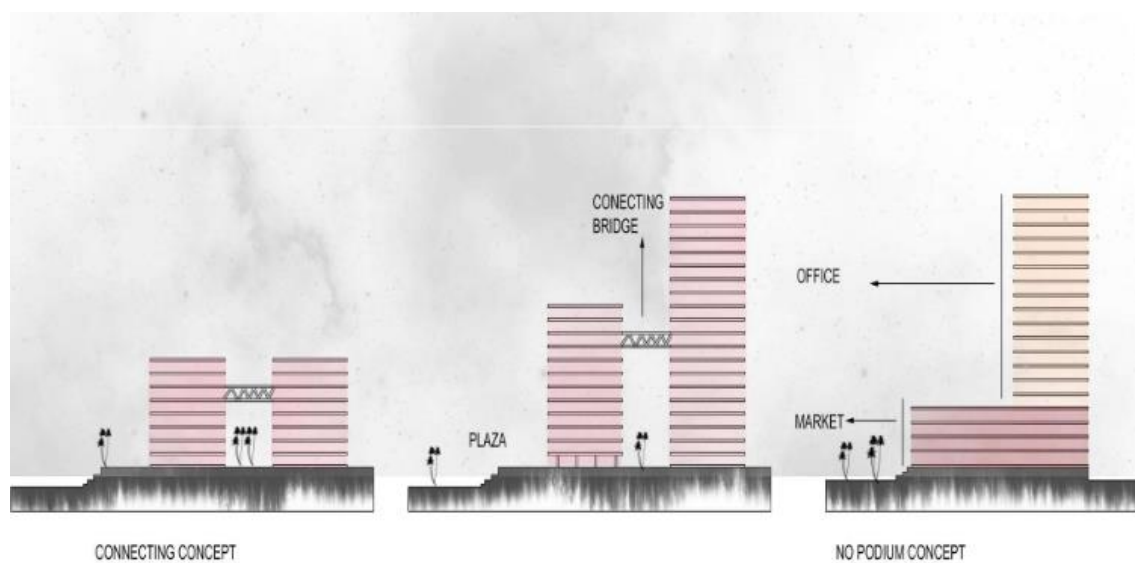


Figure 13. Gazipur Sky Center conceptualization as a vertical urban hub.

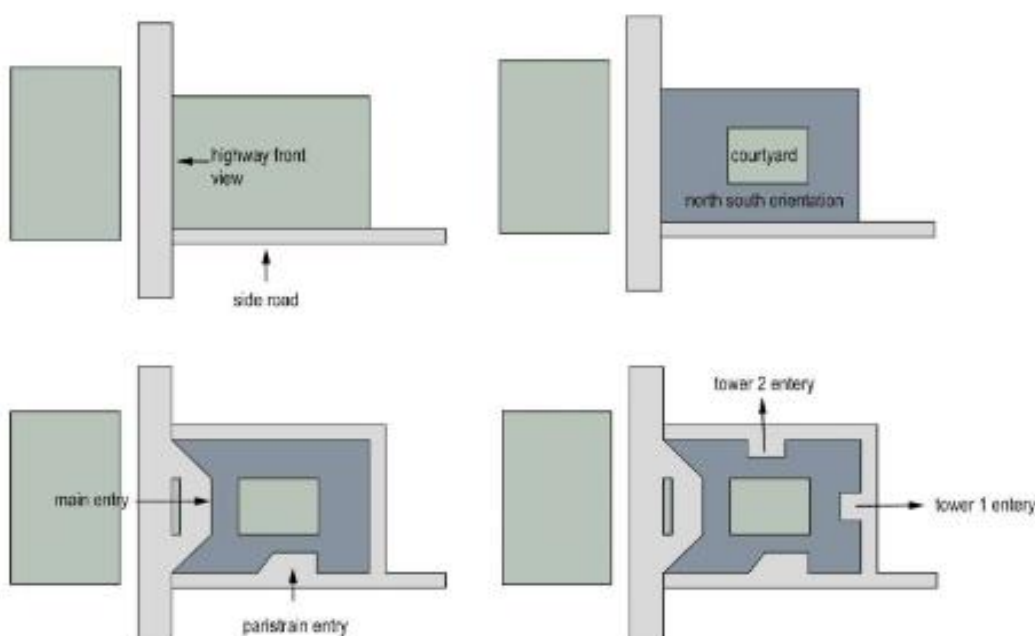


Figure 14-17. Integrated building planning, circulation and functional relationships from the thesis.

Zone	Primary functions	Publicness	Principal design requirement
Ground	Plaza, lobby, retail, café	High	Pedestrian interface, shade, clear entries
Lower podium	Retail, dining, entertainment	High	Visibility, intuitive circulation, servicing
Transition	Co-working, meeting, event, shared amenity	Medium	Social connection + access control
Upper tower	Corporate/flexible offices	Controlled	Efficient floor plates, daylight, privacy
Roof/terraces	Greenery, amenity, PV/services	Medium/controlled	Safety, microclimate, maintenance
Basement/service	Parking, loading, waste, plant	Restricted	Separated logistics and fire-safe access

The earlier draft's indicative distribution—45% office/work, 35% retail/commercial, 10% public/community and 10% service/circulation—is retained only as a conceptual assumption. It should be recalibrated after statutory FAR and ground-coverage controls, market demand, parking strategy, fire occupancy, lift analysis and tenant requirements are verified. The more transferable finding is the relational structure: public uses below, controlled uses above, shared functions at the interface, and service movement kept out of the principal pedestrian network.

PUBLIC REALM, MOBILITY AND ACCESSIBILITY

Figures 15–18 connect the mobility argument to the thesis plans by showing the public ground floor, transition level, typical office floor and separated circulation systems. The ground plane is the principal interface between the high-rise and Gazipur's public realm. The proposed design therefore avoids a purely defensive podium. A shaded forecourt, active frontage, visible entrances, landscape, seating and an atrium form a sequence of public and semi-public spaces. This follows Jacobs (1961), Whyte (1980) and Gehl (2010, 2011), while responding to Gazipur's hot, wet climate through shade and rain protection.

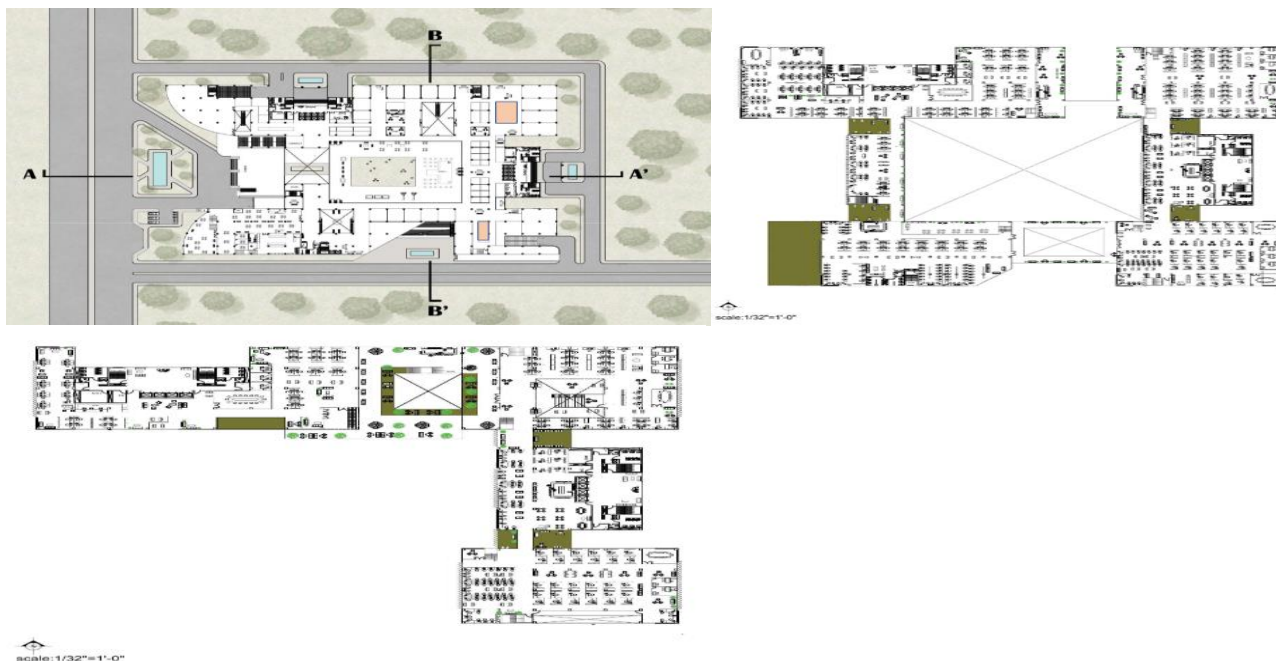
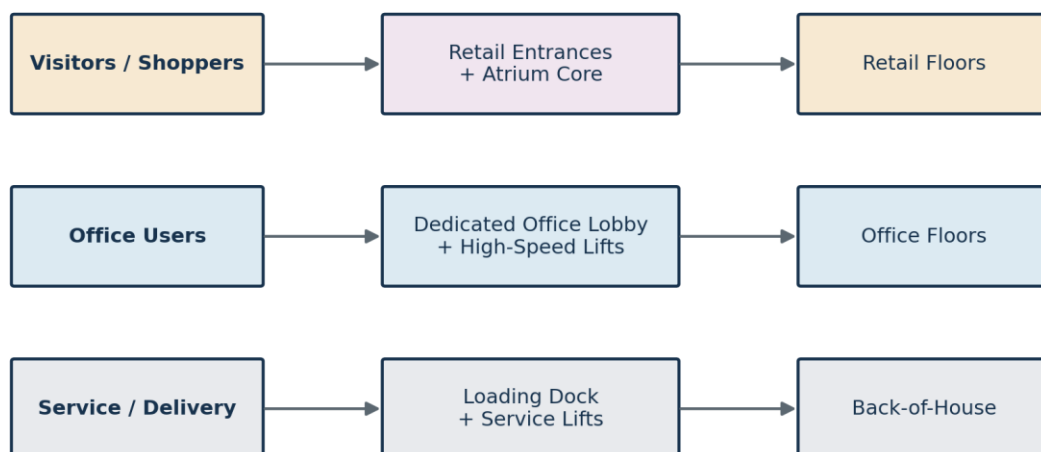


Figure 18-20. Ground-floor plan showing public arrival organization and principal spatial relationships and Sixth-floor transition/amenity plan illustrating the interface between podium and tower functions and Typical upper office-floor plan illustrating flexible workplace organization.

CIRCULATION AND ACCESS SEPARATION



Cross-connections occur only at controlled shared zones, improving security, wayfinding and operational efficiency.

Figure 21. Separation of visitor, office, service and emergency circulation systems.

Movement is organized by hierarchy rather than by a single shared route. Pedestrians receive the most direct connection between street, transit interface and principal entrances. Private-vehicle drop-off is controlled so that it does not cut through the main pedestrian path. Loading, waste and maintenance use a separate service route where site geometry permits. Office users may share the public arrival zone but transition to controlled lifts and lobbies. Emergency routes remain independent and code-compliant.

Movement layer	Primary users	Design response
Pedestrian	Shoppers, workers, visitors	Continuous shaded paths, universal access, clear wayfinding
Public transport	Employees and visitors	Direct connection to arrival/public realm
Private vehicle	Visitors and tenants	Controlled drop-off and parking
Service	Retail, waste, maintenance	Separated loading/service circulation
Office vertical circulation	Tenants and staff	Controlled lift lobby and access
Emergency	All occupants + fire/rescue	Protected stairs, fire access, assembly logic

CLIMATE-RESPONSIVE AND ENVIRONMENTAL DESIGN

Figure 21 summarizes the thesis sustainability strategy as an integrated combination of passive design, active systems, water management, landscape and controls. Gazipur's reported land-cover and temperature changes make climate response a core design requirement. The envelope is treated as an environmental control layer. Orientation, glazing ratio, external shading, façade depth and landscape should be evaluated together. Deep overhangs and horizontal fins can be effective where high-angle sun dominates; vertical fins or combined devices may be required on low-angle east and west exposures. Atrium daylight should be controlled to avoid

excessive solar gain, and office floor-plate depth should remain compatible with useful daylight and flexible planning. Green infrastructure operates at several scales: shade trees at the public realm, planted setbacks and permeable surfaces at grade, terrace planting at transition levels and roof greenery where structurally and operationally feasible. Rainwater harvesting can support irrigation and non-potable uses after appropriate treatment and code review. Efficient fixtures, LED lighting, demand-responsive controls and high-efficiency HVAC reduce operational loads. Rooftop photovoltaic panels may offset a portion of electricity demand, but their contribution must be established through a site-specific solar and energy model rather than assumed.

INTEGRATED SUSTAINABILITY STRATEGY

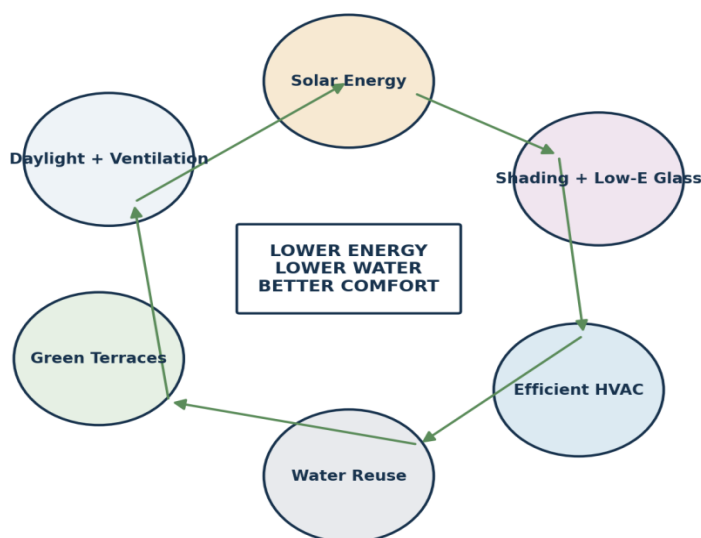


Figure 22. Integrated sustainability strategy linking passive, active, water, landscape and control systems.

Strategy	Design action	Expected contribution	Future verification
Solar control	Recessed glazing; horizontal/vertical fins	Lower direct solar gain	Solar/shading simulation
Daylight	Atrium + controlled glazing + suitable floor depth	Lower lighting demand; visual quality	Daylight model
Ventilation	Mixed-mode in suitable semi-open zones	Comfort when climate permits	CFD + comfort analysis
Green infrastructure	Trees, terraces, roof planting	Shade, microclimate, biodiversity	Landscape + thermal study
Water	Rainwater capture + efficient fixtures	Lower potable demand and runoff	Water balance
Energy	Efficient HVAC/lighting + controls + PV	Lower operational energy	Whole-building energy model
Materials	Durable, maintainable, lower-impact systems	Life-cycle resilience	LCA + maintenance plan

STRUCTURAL, FIRE AND BUILDING-SYSTEMS INTEGRATION

Figures 19, 20 and 22 relate the technical discussion to the thesis section, exterior massing and coordinated MEP/smart-building framework. The original thesis proposes a reinforced-concrete core combined with a high-rise grid system. Conceptually, the core can organize lifts, stairs and major shafts while contributing to lateral stability. The retail podium and office tower may, however, have different preferred structural grids. Any transfer structure should therefore be minimized and rationalized because deep transfer elements can increase material use, cost, construction complexity and service coordination. Final foundation and lateral systems require geotechnical investigation and detailed wind and seismic analysis.

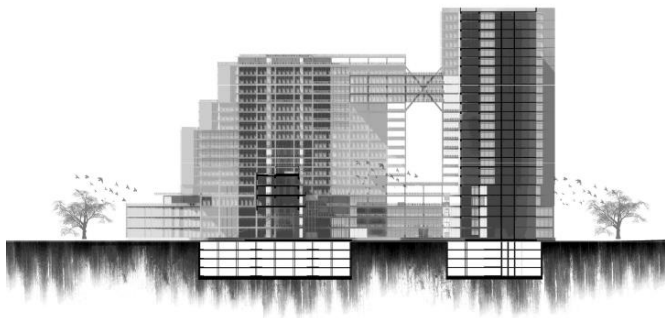
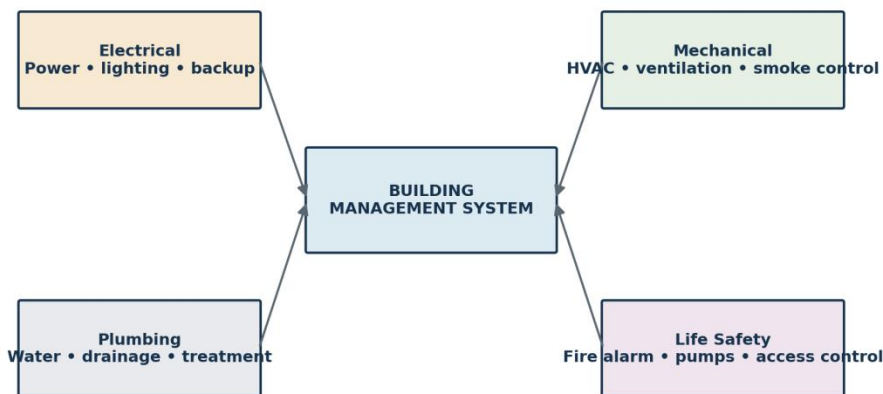


Figure 23. Building section through the retail podium and office tower.

INTEGRATED MEP AND SMART-BUILDING COORDINATION



Shared shafts, coordinated plant rooms, metering, sensors and commissioning reduce clashes and improve maintainability.

Figure 24. Integrated MEP and smart-building coordination framework from the thesis.



Figure 25-26. Three-dimensional visualization of the proposed Gazipur Sky Center. Exterior architectural perspective showing the proposed high-rise massing and podium relationship.



Fire strategy is not a late-stage overlay. Mixed occupancy requires coordinated compartmentation, protected stairs, smoke management, detection and suppression, fire-fighting access, occupant-load calculations and accessible evacuation provisions. Building services must align with these zones. Electrical rooms, generators, water tanks, pumps, HVAC plant, shafts, data systems and building-management controls should be arranged for safe maintenance and operational continuity. Flood-sensitive equipment should be located with regard to verified local drainage and flood risk.

MATHEMATICAL AND QUANTITATIVE ASSESSMENT FRAMEWORK

The following indicators convert the conceptual model into variables that can be tested in later site-specific studies. They are equations and assessment tools, not reported project performance values.

Indicator	Equation / definition
Floor Area Ratio (FAR)	$FAR = \text{Total Gross Floor Area} / \text{Plot Area}$
Site Coverage (%)	$SC = (\text{Ground-floor building footprint} / \text{Plot area}) \times 100$
Green Coverage (%)	$GC = (\text{Permeable} + \text{planted area} / \text{Site area}) \times 100$
Public-Realm Ratio (%)	$PRR = (\text{Public} + \text{semi-public accessible area} / \text{Site area}) \times 100$
Functional Diversity Index	$FDI = 1 - \sum(p_i^2)$, where p_i is the floor-area share of function i
Land-Use Efficiency	$LUE = \text{Total usable floor area} / \text{Site area}$
Pedestrian Accessibility Ratio	$PAR = \text{Accessible pedestrian frontage} / \text{Total active frontage}$
Green-to-Hardscape Ratio	$GHR = \text{Planted/permeable surface} / \text{Impervious surface}$
Energy Use Intensity	$EUI = \text{Annual building energy use} / \text{Conditioned floor area (kWh/m}^2 \cdot \text{year)}$

For illustration only, if a hypothetical 5,000 m² plot contains 20,000 m² gross floor area, FAR = 4.0. This is not presented as the statutory or proposed FAR for the Gazipur site. If a required gross floor area A is distributed over n occupied floors, the approximate average floor plate is $F = A/n$. Increasing n can reduce footprint for a fixed floor-area requirement, but only where planning controls, fire safety, structural feasibility, transport capacity and environmental performance support the increase. A multi-criteria design score can also support iterative design: $S = \sum(w_j x_j)$, where x_j is a normalized score for criterion j and w_j is its weight, with $\sum w_j = 1$. Suggested criteria include land efficiency, public-realm quality, pedestrian accessibility, thermal response, water management, life safety and adaptability. Weights should be established by a multidisciplinary review team; the present study does not assign empirical weights.

INTEGRATED DESIGN FRAMEWORK

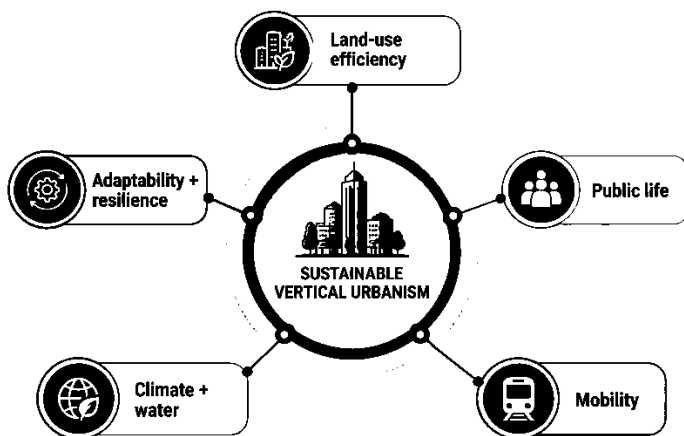


Figure 27. Integrated framework linking land efficiency, public life, mobility, climate/water and adaptability/resilience.

The framework expresses the central proposition of the study: sustainability is a system of relationships. Land efficiency without mobility can intensify congestion. Commercial intensity without public space can reduce civic quality. High-rise density without solar control and landscape can worsen heat exposure. Advanced building services without maintainability can create long-term operational burdens. Adaptability without structural and fire discipline can compromise safety. The architectural task is therefore to optimize interfaces rather than maximize any single variable.

RESULTS AND DESIGN SYNTHESIS

Spatial heat-map analysis

Three spatial heat maps were developed as design-decision tools. They are explicitly conceptual because the supplied materials do not contain a georeferenced thermal raster, a measured pedestrian-count grid or a site-level GIS multi-criteria dataset. The diagrams therefore show how such data can be structured, not what the actual site currently measures. This distinction preserves the empirical boundary of the study while demonstrating a reproducible analytical method.

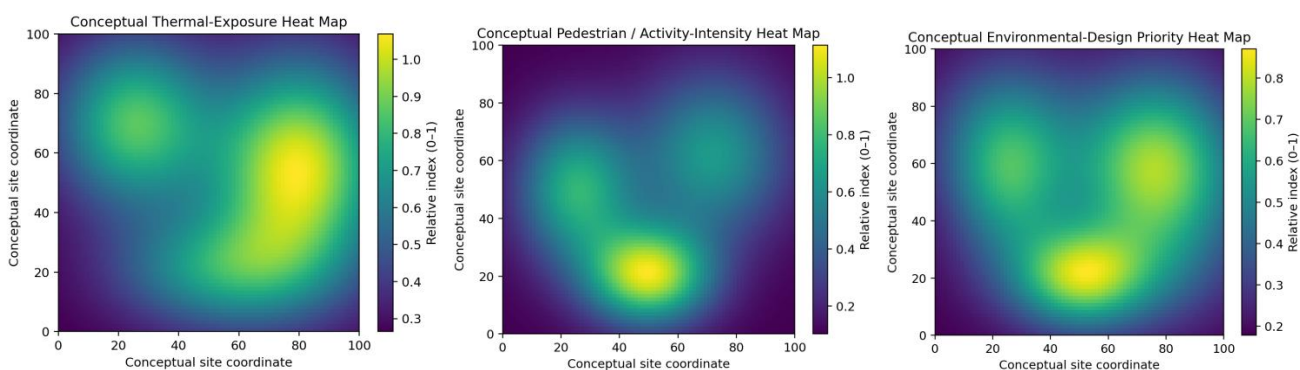


Figure 28-30. Conceptual thermal-exposure heat map. Higher values indicate zones that would receive stronger shading, landscape and envelope attention; this is not a measured LST raster. Conceptual pedestrian/activity-intensity heat map. Higher values represent anticipated concentrations around entrances, retail anchors, transit interfaces and social spaces and Conceptual environmental-design priority heat map combining thermal and activity layers.

The thermal-exposure map represents relative design priority based on a hypothetical concentration of exposed hardscape and solar load. In an empirical follow-up, this layer should be replaced by Landsat- or drone-derived surface-temperature data and, ideally, calibrated microclimate measurements. The design response to high-exposure zones would include deeper shade, canopy trees, permeable or lower-absorptance surfaces, façade solar control and reduced waiting time in unshaded outdoor areas. The activity map translates programming into expected spatial intensity. High-intensity zones require wider clear paths, weather protection, seating, wayfinding, barrier-free movement and direct connections to vertical circulation. Loading and waste movement should remain outside these zones. Future validation should use pedestrian counts by time of day, entrance data, tenant attraction patterns and public-transport boarding/alighting information. The combined priority map identifies locations where environmental and public-realm interventions should receive the greatest attention. In a later GIS-based multi-criteria analysis, the combined layer could incorporate measured LST, NDVI, impervious-surface ratio, shade availability, pedestrian counts, road hierarchy, drainage constraints and proximity to entrances. The method is relevant to Gazipur because the cited remote-sensing literature already demonstrates the value of LULC, LST and vegetation indices for identifying environmental stress at the urban scale.

Design synthesis matrix

Research issue	Evidence / principle	Architectural response	Expected qualitative outcome
Rapid urban expansion	Gazipur land-cover evidence	Vertical land-use strategy	More floor area with controlled footprint
Vegetation/water loss	Remote-sensing context	Green infrastructure + rainwater management	Reduced ecological pressure
Urban heat	LST evidence + climate literature	Shading + landscape + façade control	Lower heat exposure
Functional conflict	Mixed-use literature	Transition zones + access control	Connected but operationally legible uses
Public-space deficit	Public-life theory	Plaza + atrium + terraces	More opportunities for interaction
Mobility pressure	Compact-city literature	Transit + pedestrian hierarchy	Better access management
Changing workplaces	Adaptability literature	Regular modular floor plates	Longer functional life
High-rise risk	BNBC/life-safety principles	Core + protected egress + compartmentation	Improved resilience

Design-performance propositions

The synthesis produces six propositions for later testing. First, vertical integration can improve land-use efficiency only if transport and infrastructure capacity are adequate. Second, a transition zone between podium and tower can reduce conflict between public retail and controlled office uses. Third, the public realm should be evaluated as functional area rather than residual landscaping. Fourth, solar control and greenery should be concentrated where exposure and activity overlap. Fifth, regular structure and serviceable floor plates improve



adaptability. Sixth, fire, structure and MEP coordination should be used as form-generating constraints from the beginning of design development rather than checked after architectural form is fixed.

DISCUSSION

The developed framework changes the interpretation of the Gazipur Sky Center from a single mixed-use object to a vertical piece of city. This changes the role of circulation, edges and public space. Streets become internal movement spines; the atrium becomes an orientation device; transition floors become social infrastructure; and the façade becomes a climate-control system rather than a visual skin. The first implication concerns density. Gazipur's reported urban expansion provides a strong reason to examine compact development, but it cannot establish the suitability of every site for high-rise construction. The proposed 5.5-acre site must therefore be evaluated through current planning controls, road capacity, public-transport access, flood/drainage conditions, utilities and emergency access. The framework supports evidence-based intensification rather than height as an end in itself. The second implication concerns public life. Retail development can produce privately controlled interiors with weak relationships to surrounding streets. The present model counters this tendency by placing a shaded plaza, active frontage and visible entrances at the base and extending publicness into the atrium and selected terraces. Its climatic expression must be local: shade, rain protection, air movement and durable landscape are as important as seating and visibility. The third implication concerns environmental performance. Gazipur heat evidence supports a performance-oriented process. Shading, glazing, floor depth and landscape should be tested before expensive active systems are optimized. The conceptual heat maps demonstrate how spatial evidence can direct this effort, but also why future empirical work is necessary. Without measured site data, a visually convincing heat map can easily be mistaken for evidence; all three maps are therefore labelled conceptual. The fourth implication concerns adaptability. Retail formats, office layouts and working practices change faster than structural frames. A building that can accommodate new tenant subdivisions, co-working arrangements, meeting clusters and service requirements may avoid premature renovation or obsolescence. Regular bays, rational cores, accessible services and neutral floor plates are therefore sustainability measures as much as planning conveniences. Finally, the framework emphasizes coordination. Mixed-use high-rises concentrate different occupancy types, peak periods, service requirements and safety demands. Their success depends on interfaces: street-to-lobby, retail-to-office, podium-to-tower, public-to-service circulation, façade-to-HVAC and structure-to-MEP. These interfaces are where design research converts broad sustainability principles into architectural decisions.

PRACTICAL DESIGN GUIDELINES FOR THE GAZIPUR SKY CENTER

Design domain	Recommended next-stage direction
Site planning	Verify setbacks, FAR/MGC, road access, flood/drainage, fire access and transit interface using current approvals.
Ground plane	Prioritize shaded pedestrian arrival, active frontage, universal access and landscape rather than vehicle dominance.
Podium	Use clear retail loops, visible vertical circulation, service separation and controlled atrium solar gain.
Transition floors	Locate co-working, meeting, event and shared amenities between retail and office zones.
Office tower	Use flexible floor plates, efficient core-to-net ratio, daylight access and adaptable service



	distribution.
Façade	Develop orientation-specific shading and glazing rather than a uniform curtain wall.
Landscape/water	Increase planted/permeable area; test rainwater harvesting and detention through a water balance.
Structure	Coordinate retail and office grids; minimize transfer complexity; verify wind/seismic/foundation systems.
Fire/life safety	Undertake code-based occupant load, egress, compartmentation, smoke and fire-fighting analysis.
MEP/BMS	Coordinate plant, shafts, metering, controls, maintenance access and operational resilience.
Performance	Run daylight, energy, thermal comfort, CFD, lift, traffic and life-cycle analyses before design freeze.

LIMITATIONS AND FUTURE RESEARCH

The study remains conceptual. It does not include a verified boundary survey, detailed topography, geotechnical investigation, traffic-impact assessment, market study, measured pedestrian counts, CFD, daylight simulation, calibrated energy model, structural calculation, lift-traffic analysis, fire-engineering model or post-occupancy evaluation. The program shares, heat maps and illustrative equations must therefore not be interpreted as approved, measured or predicted project performance. The Gazipur environmental statistics are taken from published sources cited in the supplied draft and apply to the reported study areas and periods, not necessarily to the exact project parcel. Future research should proceed in five linked packages. A GIS package should map LST, NDVI, NDBI, imperviousness, drainage and accessibility for the actual site. A mobility package should measure pedestrian and vehicle flows and test arrival/service scenarios. A building-performance package should compare massing and façade alternatives through daylight, solar, energy and thermal-comfort simulation. A technical package should complete geotechnical, structural, fire, lift and MEP analysis. Finally, a stakeholder package should test user preferences, tenant needs, public-realm usability and local economic effects. Comparative evaluation against a conventional low-rise commercial scheme would help quantify the land-use and mobility consequences of vertical integration.

CONCLUSION

Gazipur's rapid transformation creates a need for development strategies that accommodate economic growth without treating land, public space, mobility and environmental systems as unlimited resources. Building on the Gazipur Sky Center thesis, this research develops a mixed-use high-rise framework that integrates commerce, work and public life through vertical zoning, transition spaces, pedestrian-oriented public realm, climate-responsive envelopes, green and water infrastructure, separated circulation, structural and fire-safety logic, and adaptable workplaces. The central conclusion is that verticality alone is not sustainability. A high-rise becomes a credible urban response only when density is coordinated with access, public life, environmental performance, safety, resilience and long-term adaptability. The three conceptual heat maps demonstrate a method for translating thermal and activity priorities into spatial design attention, while the mathematical indicators establish variables that can be measured in a future empirical phase. The value of the framework lies not in prescribing a fixed form but in establishing a repeatable process: urban evidence →



design criteria → spatial organization → conceptual evaluation → quantitative validation. With site-specific testing and current statutory review, the approach can inform the further development of the Gazipur Sky Center and comparable mixed-use projects in rapidly urbanizing Bangladeshi cities.

REFERENCES

1. ACI Committee 318. (2019). Building code requirements for structural concrete (ACI 318-19) and commentary. American Concrete Institute.
2. Al-Masrani, S. M., Al-Obaidi, K. M., Zalin, N. A., & Isma, M. I. A. (2018). Design optimization of solar shading systems for tropical office buildings: Challenges and future trends. *Solar Energy*, 170, 849–872.
3. Ali, M. M., & Armstrong, P. J. (2008). Overview of sustainable design factors in high-rise buildings. CTBUH 8th World Congress Proceedings.
4. Ali, M. M., & Moon, K. S. (2007). Structural developments in tall buildings: Current trends and future prospects. *Architectural Science Review*, 50(3), 205–223.
5. ASHRAE. (2022). ANSI/ASHRAE Standard 62.1-2022: Ventilation and acceptable indoor air quality.
6. Bangladesh Bureau of Statistics. (2023). Population and housing census 2022: National report, Volume 1.
7. Beatley, T. (2011). *Biophilic cities: Integrating nature into urban design and planning*. Island Press.
8. Bibri, S. E. (2020). Compact urbanism and the synergic potential of its integration with data-driven smart urbanism. *Land Use Policy*, 97, 104703.
9. Bibri, S. E., & Krogstie, J. (2020). Compact city planning and development. *Developments in the Built Environment*, 4, 100021.
10. Burton, E. (2002). Measuring urban compactness in UK towns and cities. *Environment and Planning B*, 29(2), 219–250.
11. Cervero, R., & Kockelman, K. (1997). Travel demand and the 3Ds: Density, diversity, and design. *Transportation Research Part D*, 2(3), 199–219.
12. Ching, F. D. K. (2014). *Architecture: Form, space, and order* (4th ed.). Wiley.
13. Coupland, A. (Ed.). (1997). *Reclaiming the city: Mixed use development*. E & FN Spon.
14. Dempsey, N., Bramley, G., Power, S., & Brown, C. (2010). The social dimension of sustainable development. *Sustainable Development*, 19(5), 289–300.
15. Duffy, F. (1997). *The new office*. Conran Octopus.
16. Ewing, R., & Cervero, R. (2010). Travel and the built environment: A meta-analysis. *Journal of the American Planning Association*, 76(3), 265–294.
17. Gehl, J. (2010). *Cities for people*. Island Press.
18. Gehl, J. (2011). *Life between buildings: Using public space*. Island Press.
19. Geyer, H. S. (2024). The theory and praxis of mixed-use development: An integrative literature review. *Cities*, 147, 104774.
20. Government of the People's Republic of Bangladesh. (2020). *Bangladesh National Building Code 2020*. Ministry of Housing and Public Works.
21. Grant, J. (2002). Mixed use in theory and practice. *Journal of the American Planning Association*, 68(1), 71–84.
22. Habraken, N. J. (1972). *Supports: An alternative to mass housing*. Architectural Press.
23. Hoppenbrouwer, E., & Louw, E. (2005). Mixed-use development: Theory and practice in Amsterdam's Eastern Docklands. *European Planning Studies*, 13(7), 967–983.
24. Jacobs, J. (1961). *The death and life of great American cities*. Random House.
25. Jabareen, Y. R. (2006). Sustainable urban forms: Their typologies, models, and concepts. *Journal of Planning Education and Research*, 26(1), 38–52.
26. Jayaweera, N., Rajapaksha, U., & Manthilake, I. (2021). Enhancing daylight and energy performance of external shading devices in dense urban tropics. *Journal of Green Building*, 16(3), 87–108.
27. Jenks, M., Burton, E., & Williams, K. (Eds.). (1996). *The compact city: A sustainable urban form?* E & FN Spon.
28. Lechner, N. (2015). *Heating, cooling, lighting: Sustainable design methods for architects* (4th ed.). Wiley.



29. Lynch, K. (1960). *The image of the city*. MIT Press.
30. Montgomery, J. (1998). Making a city: Urbanity, vitality and urban design. *Journal of Urban Design*, 3(1), 93–116.
31. National Fire Protection Association. (2021). NFPA 101: Life safety code.
32. Neuman, M. (2005). The compact city fallacy. *Journal of Planning Education and Research*, 25(1), 11–26.
33. Newman, P., & Kenworthy, J. (1999). *Sustainability and cities: Overcoming automobile dependence*. Island Press.
34. Oke, T. R. (1988). Street design and urban canopy layer climate. *Energy and Buildings*, 11(1–3), 103–113.
35. Oldfield, P., Trabucco, D., & Wood, A. (2009). Five energy generations of tall buildings. *Journal of Architecture*, 14(5), 591–613.
36. Parvin, M. A., Haque, M. I., Hossain, M. A., & Bashar, A. (2023). Index-based change detection, spatial zoning and environmental criticality of urban land cover: Gazipur Sadar Upazila. *Journal of Geography, Environment and Earth Science International*, 27(10), 145–163.
37. Rafiei, M. H., & Adeli, H. (2016). Sustainability in highrise building design and construction. *The Structural Design of Tall and Special Buildings*, 25(13), 643–658.
38. Raji, B. (2018). Sustainable high-rises: Design strategies for energy-efficient and comfortable tall office buildings in various climates. *A+BE*, 8(19).
39. Reinhart, C. F., & Wienold, J. (2011). The daylighting dashboard. *Building and Environment*, 46(2), 386–396.
40. Rowley, A. (1996). Mixed-use development: Ambiguous concept, simplistic analysis and wishful thinking? *Planning Practice & Research*, 11(1), 85–98.
41. Sojib, M. R. H., et al. (2025). Land use land cover transformation and seasonal variations in land surface temperature with environmental implications in Gazipur Sadar Upazila, Bangladesh. *Urban Climate*, 59, 102662.
42. Turok, I., & McGranahan, G. (2013). Urbanization and economic growth: The arguments and evidence for Africa and Asia. *Environment and Urbanization*, 25(2), 465–482.
43. UN-Habitat. (2020). *World cities report 2020: The value of sustainable urbanization*.
44. UN-Habitat. (2022). *World cities report 2022: Envisaging the future of cities*.
45. Whyte, W. H. (1980). *The social life of small urban spaces*. Conservation Foundation.
46. Wood, A., & Salib, R. (2013). *Guide to natural ventilation in high rise office buildings*. Routledge/CTBUH.
47. Yeang, K. (1999). *The green skyscraper*. Prestel.
48. Yeang, K. (2008). *Eco skyscrapers*. Images Publishing.
49. Yudelson, J. (2009). *Green building through integrated design*. McGraw-Hill.