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Space Syntax and Mixed-Methods Evidence for Campus Open Space Redevelopment: A Conceptual Master Plan Approach

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Abstract

University campus redevelopment requires planning approaches that consider both user spatial experiences and the configurational characteristics of campus environments. This study examines campus open-space connectivity and redevelopment priorities through a mixed-methods case study combining a questionnaire completed by 120 students, interviews with nine faculty members and two Engineering Department staff, site observations, and Space Syntax analysis using DepthmapX. Axial connectivity, visual connectivity, and segment-based depth were examined across six campus zones. The questionnaire identified connectivity between faculties (80%), parking pedestrian conflicts (76%), demand for a centralized lecture complex (73%), and insufficient seating and gathering spaces (70%) as prominent concerns. Interview findings provided additional perspectives on circulation, open-space adequacy, and campus facilities. The spatial analysis described variations in connectivity, visibility, and depth across the campus, and these findings were considered alongside user-reported concerns to identify preliminary redevelopment priorities. The findings informed a zone-specific conceptual master plan addressing entrance organization, pedestrian connections, cafeteria location, gathering spaces, and potential uses of vacant parcels. However, the relationship between reported perceptions and configurational measures was not formally tested, and the proposed master plan was not re-modelled in DepthmapX. The study therefore presents a preliminary diagnostic and design framework rather than a validated assessment of post-intervention performance. Further spatial modelling and feasibility assessment are required to evaluate the proposed interventions.

Keywords: space syntax; campus planning; open-space connectivity; mixed-methods research; DepthmapX; spatial configuration

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1. Introduction

Similar to various rapidly expanded campuses of higher education in the region, there has been an incremental growth of Jordanian universities, and oftentimes individual buildings are prioritized over coherent spaces between them. This has resulted in constant complaints at Isra University, such as a confused arrival sequence, vehicle–pedestrian conflicts, a misdirected cafeteria, inadequate space of gathering, and prominent areas of open space with poor connection to pedestrian movement. Conventionally, campus planning depended in isolation on user consultation or spatial analysis, seldom both, and hardly led to an implementable redesign. This study directly addresses this gap, and aims

at (1) identifying principal spatial deficiencies of the campus by employing an interview study, a student questionnaire and interviews with faculty and Engineering Department staff; (2) applying Space Syntax analysis in DepthmapX 0.30 (axial connectivity, visual connectivity, segment depth) and verifying these deficiencies; (3) triangulating both streams of evidence at the scale of named campus zones; and (4) translating the diagnosis into a zone-specific master plan for open spaces in Isra University.

Research Questions

This study addresses four research questions:

1. What are the principal open-space and circulation problems reported by campus users?
2. What configurational patterns are identified through Space Syntax analysis across the selected campus zones?
3. How do user-reported concerns correspond descriptively to the configurational characteristics of the identified zones?
4. How can these findings inform the development of a conceptual, zone-specific campus redevelopment master plan?

1.1. Literature Review

Research on campus planning has used Space Syntax, user surveys, observations, and mixed-methods approaches to examine spatial configuration and user experience. However, the extent to which these evidence sources are systematically connected to specific redevelopment decisions varies across studies.

The social logic of space derives the treatment of spatial configuration as a measurable, predictive variable; Refs. [1–3] catalogued it into the formalized, axial, convex, and visibility-graph techniques [4]. The bibliometric review of 50 years of scholarship conducted by [5] demonstrated these measures as reliable predictors of space and movement flow, and most importantly, that before the construction begins, design changes can be forecasted.

This logic is applied to universities in two studies. Ordinal logistic regression was used by [6] on a campus in Turkey, revealing that the strongest predictor of pedestrian density is the axial integration. A parallel conclusion was drawn by [7] for Erbil architecture schools, using DepthmapX-based axial and justified-graph analysis. Both have been rigorous but they stop at the axial line, without the incorporation of user perception. This technique was extended by [8] into three dimensions, in which multilayered Space Syntax was combined with Wi-Fi log data in a multilevel Hong Kong campus, demonstrating that the predictive power is retained across vertical levels, showing evidence that the method scales beyond single-storey, flat campuses.

A second cluster turns from circulation to occupation: where people loiter, not merely how they move [9]. In Tanta University's Seberbay campus, Egypt, the integration and choice analysis in DepthmapX was applied by [10], suggesting a central pedestrian spine and gathering zones. A similar conclusion was drawn by [11] that only when surveys, observation, spatial analytics, and interviews are conducted together (an integrative approach) does it provide an explanation of how interaction and informal learning are fostered by spatial design, and this study adopts this argument. Ref. [12] conducted a related walkway study across campuses of the Middle East, distilling 10 success criteria, indicating that the most persistent failure remains the absence of a barrier-free environment.

Two large mixed-methods campus surveys are the clear precedents. DepthmapX analysis with a 398-respondent survey was combined by [13] at Trakya University's Balkan Campus, Turkey, revealing fragmented pedestrian axes and low-integration peripheral zones. At Hail University, Saudi Arabia, fieldwork, surveys, and interviews

were combined by [14] covering 1460 participants, revealing the surrounding city-based weak internal connectivity and disconnection. A comparable student-, resident-, and expert-interview dataset was applied by [15] at Ain Shams University, Cairo, revealing only neutral agreement to open the campus to its neighbouring city. However, for citing new urban services, DepthmapX connectivity metrics were used by [16,17], reminding us that the application of similar configuration tools for diagnosis can also inform where facilities, for instance, the proposed lecture complex, should be sited. In several of these studies, user evidence and spatial measures are reported side by side, and the link between them is described rather than examined place by place.

The legibility is directly addressed by a final group. All-line axis analysis and VGA was used in [18], a comparison of Qatar University and Education City, Doha, for deriving three campus models, namely, enclosed, edged, and scattered. They argue that elements of all three are typically required by large campuses. Through Space Syntax, surveys, and cognitive mapping in Eskişehir's historic core, Ref. [19] showed that the route choice is jointly determined by configuration and familiarity.

This logic was extended by [20] to green infrastructure, revealing that accessibility is shaped by the pathway network pattern, shown through convex-map analysis of Cairo parks. The strongest predictor of pedestrian volume was confirmed as integration by [21] in Varanasi, India, whereas Space Syntax's broad cross-context applicability was confirmed by [22,23], where the latter was linked with UN SDG 11 [24].

Space Syntax has been criticized on several grounds. Its topological representation can produce inconsistent results on regular layouts and gives little weight to land use [25], and correlations between syntactic measures and observed walking were found to weaken at finer grid resolutions [26]. Pedestrian flow also depends on functional attractors as well as street networks [27] and questions about the social meaning of space call for interpretive approaches beyond causal modelling [28].

Taken together, these studies show that spatial configuration can explain pedestrian movement and that user surveys can capture campus experience, but the two are usually reported side by side and rarely linked to specific places on a campus. Critiques of Space Syntax also caution that configuration alone does not explain behaviour. What is missing is a zone-based comparison of user reports and configurational measures that leads to a conceptual design response. This study addresses that gap for a single campus, without claiming to test causality.

1.2. Research Gap

The reviewed literature indicates that campus spatial configuration and user experience have been examined through several established approaches, including Space Syntax, questionnaires, interviews, and site observations. However, integrating these forms of evidence into a zone-specific planning process remains an important practical and methodological challenge. This study addresses that challenge by comparing reported user concerns with the available configurational analysis and using the combined findings to formulate preliminary redevelopment priorities. The contribution is the structured translation of these evidence sources into a conceptual master plan, rather than the introduction of a new Space Syntax method or a claim that previous studies have not proposed design interventions [29].

2. Methodology

2.1. Study Area: The Isra University Campus

The campus is located at approximately 31.79° N, 35.93° E in Amman Governorate, Jordan, south of the capital along the Queen Alia International Airport Highway (Figure 1). According to the Köppen–Geiger classification, the site falls within a cold semi-arid climate (BSk) [30] with hot dry summers and limited winter rainfall. Water availability is therefore a key constraint for any planting or water-based intervention [31].

A roughly trapezoidal, irregular plot of around 25 hectares (≈250,000 m²) was occupied by The Isra University campus, bounded by a major highway to the west and encircled to the north, east, and south by desert and agricultural land (Figure 1). The campus is concentrated across the western two-thirds: a dense cluster of administrative and academic buildings to the north–south, flanked by a west-side parking lot, a central spine landscape and a plaza to the east; the north–east area contains the formal entrance and presidency, and the south–east area houses a running track and sports field. There are two vacant large parcels in the west and south–west. Two more loosely developed edges are bridged through this linear academic spine that lies beneath much of the connectivity patterns analyzed through Space Syntax analysis below.

To cross-reference issues reported by users and structure fieldwork with specific locations, there were 6 zones in which the campus was divided (A–F, Figure 2, Table 1), where every zone corresponds to a unique functional condition identified through site observation and substantiated by interviews and questionnaire below.



Figure 1. Aerial image of the Isra University campus (Google Earth); the red outline marks the approximate site boundary (≈25 ha). (© Google/Maxar), accessed using Google Earth Pro (version [7.3]; Google LLC, Mountain View, CA, USA).

Table 1. Observed campus zones: description and current condition.

Zone	Location/Description	Current Condition & Issues
A	Main pedestrian entrance/arrival zone	Occupied by faculty parking; disrupts incoming students' wayfinding and connectivity immediately after arriving by bus or car
B	Student gathering plaza, fronting the main library	Seating, small fast-coffee kiosks, steps, and mature trees; heavily used despite ageing infrastructure—needs rehabilitation rather than replacement

C	Service Street & cafeteria precinct	A vehicular street used by cafeteria supply trucks bisects the pedestrian network; the adjacent cafeteria has a poor triangular footprint, incorrect orientation, and a constrained site wedged between buildings, forcing trucks to cross through the campus core
D	Presidency forecourt/landscape plaza	Shaded seating, landscaping; well-liked by students (confirmed in the questionnaire) but severed from the presidency building by an intervening street
E	Vacant land (south–west)	Undeveloped; no current use
F	Vacant land (west)	Undeveloped; no current use

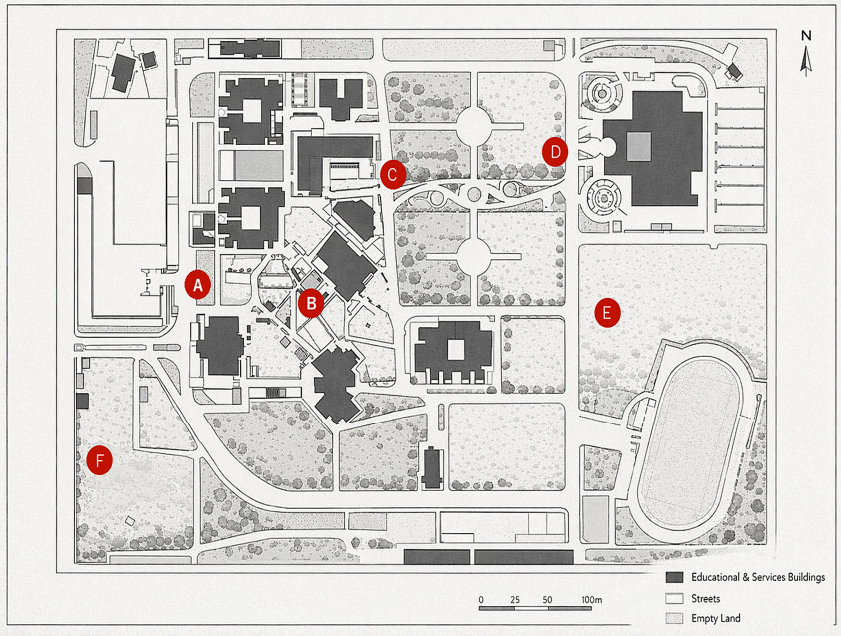


Figure 2. General site plan with the six observed zones (**A**–**F**) marked. Letters (**A**–**F**) mark the campus zones described in Table 1.

2.2. User Needs Assessment

A simple random sample of 120 students was drawn from enrolment records. At a 95% confidence level, the estimated margin of error was approximately ±8.9% under the assumption of maximum variability (p = 0.5). This estimate should be interpreted cautiously, particularly when comparing percentages that differ only slightly. The questionnaire findings are therefore presented primarily as descriptive evidence of students' reported concerns.

The questionnaire comprised five thematic sections covering connectivity and circulation, problematic areas, open-space adequacy, existing facilities, and future needs. The full questionnaire and the interview guides are provided in Appendix A. It included Likert-scale, multiple-choice, and open-ended questions. A preliminary pilot was conducted to assess question clarity and sequencing, and minor wording revisions were made. Formal internal-consistency testing was not conducted. Accordingly, the manuscript acknowledges limitations in the documented validation of the questionnaire and does not claim that its measurement properties have been fully established.

2.2.1. Questionnaire Survey

In users' lived spatial experience, the Space Syntax outputs are grounded in the questionnaire (n = 120). It is shown in Figure 3 that the most cited barriers that emerged were connectivity between faculties (80%) and parking–pedestrian conflict (76%). Then centralized lecture complex demand (73%) and insufficient seating/gathering provision (70%) followed. This is corroborated in Figure 4 (satisfaction data); pedestrian connectivity (62%), parking organization (63%), and seating (63%) were rated dissatisfying or very dissatisfying, and only 14–17% rated being satisfied with any facility (20–24% including very satisfied).

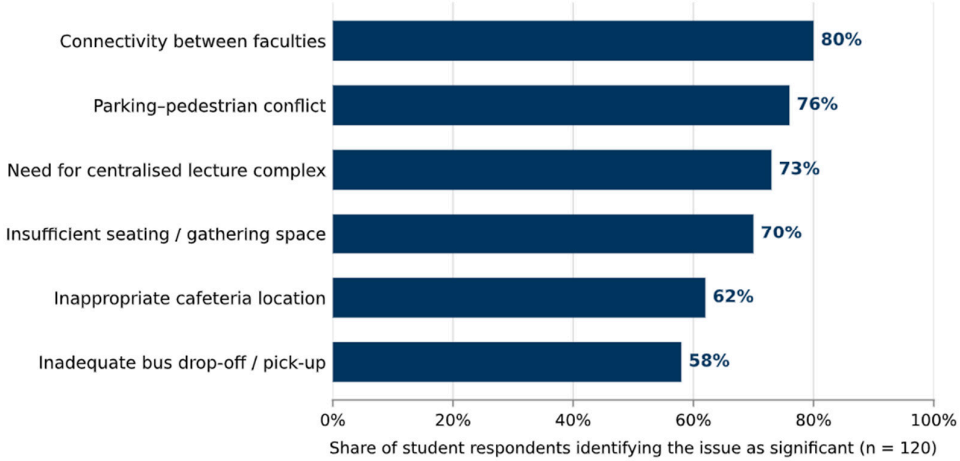


Figure 3. Share of student respondents identifying each issue as significant.

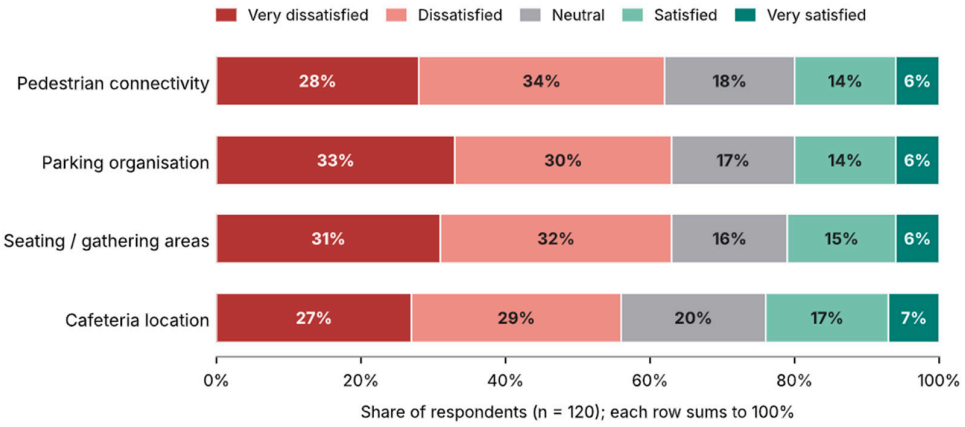


Figure 4. Distribution of user satisfaction ratings across four facility categories; each row sums to 100% of respondents.

2.2.2. In-Depth Interviews

These results are reinforced by the interview data. The sampling of interviewees was purposively done from different constituent colleges for capturing issues across campus instead of depending on convenience selection. The parking–pedestrian conflict was raised by all (9/9) among the nine faculty (n = 9), insufficient seating (8/9) followed, and then the absence of a centralized lecture facility (7/9), followed by cafeteria misplacement (6/9) (Figure 5), showing that circulation conflicts were perceived by experienced users even more acutely compared to the suggestion of students' aggregate ratings. The

interviews of the two Engineering Departments indicate priorities of institutions aligned with deficiencies reported by users; plaza renovation plan, plan for improved inter-faculty connectivity, and plan for an electric shuttle system were confirmed by both informants, whereas solar-powered EV charging (Figure 6) was confirmed by one. Due to the presence of only 2 informants, institutional intent is indicated in these results instead of statistical generalizability; however, it also recommends readiness to act.

Faculty were selected to represent different colleges and included members; they were approached directly and interviewed individually. The two Engineering Department staff were chosen because they are responsible for campus planning and maintenance.

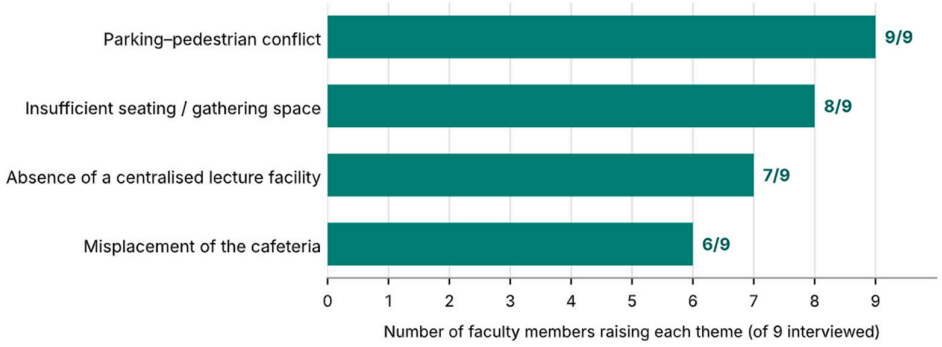


Figure 5. Number of faculty members (of 9 interviewed) raising each theme.

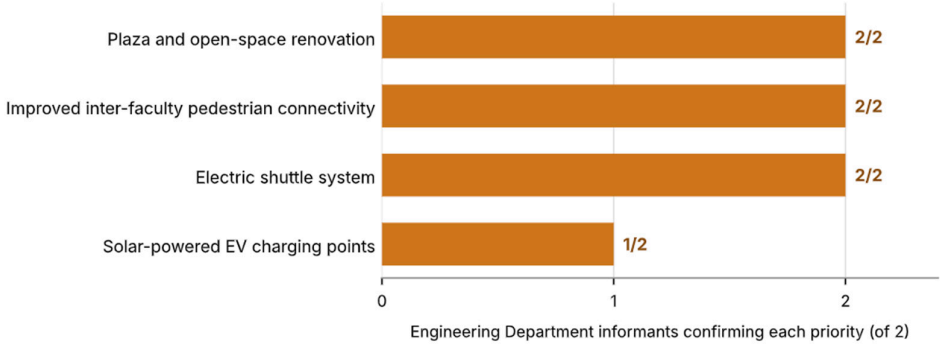


Figure 6. Number of Engineering Department informants (of 2 interviewed) confirming each planning priority.

The principal spatial deficiencies are synthesized in Table 2 across the 3 sources, namely students (n = 120), faculty (n = 9), and the Engineering Department (n = 2). Thematic emphasis is compared in Table 3a; issues of space-adequacy and circulation dominate faculty accounts, whereas the same deficiencies are framed as scheduled priorities of infrastructure and sustainability by the Engineering Department. Read alongside the Space Syntax analysis, this triangulation suggests that perceived disconnection corresponds, in several zones, to the configurational patterns described in Section 2.3; the correspondence is descriptive and was not tested statistically.

Table 2. Principal spatial deficiencies identified, by source and reporting frequency.

Issue	Students (%, *n* = 120)	Faculty (*n* = 9)	Engineering Dept. (*n* = 2)
Poor connectivity between faculties	80%	8/9	2/2
Parking–pedestrian route conflict	76%	9/9	2/2
Need for centralized lecture complex	73%	7/9	1/2
Insufficient seating/gathering space	70%	8/9	2/2
Inappropriate cafeteria location	62%	6/9	1/2
Inadequate bus drop-off/pick-up	58%	4/9	1/2
Plaza/open-space renovation	52%	7/9	2/2
Campus shuttle system (solar-charged)	45%	5/9	2/2

Table 3. (**a**). Comparative thematic emphasis: faculty vs. Engineering Department interviews. (**b**). One-sample proportion z-tests for key student questionnaire issues (*n* = 120).

(**a**)		
Theme	**Faculty (*n* = 9)**	**Engineering Dept. (*n* = 2)**
Circulation & parking conflict	9/9	2/2
Seating/open-space adequacy	8/9	2/2
Centralized lecture facility	7/9	1/2
Cafeteria relocation	6/9	1/2
Sustainable mobility (shuttle/solar EV)	5/9	2/2 shuttle; 1/2 solar

(**b**)			
Issue	**% (*n* = 120)**	**z**	***p*-Value**
Connectivity between faculties	80%	6.57	$p < 0.0001$
Parking–pedestrian route conflict	76%	5.70	$p < 0.0001$
Need for centralized lecture complex	73%	5.04	$p < 0.0001$
Insufficient seating/gathering space	70%	4.38	$p < 0.0001$
Inappropriate cafeteria location	62%	2.63	$p = 0.0086$
Inadequate bus drop-off/pick-up	58%	1.75	$p = 0.0797$ (n.s.)

To move beyond descriptive percentages alone, one-sample proportion z-tests were conducted on the questionnaire findings in Table 2, testing each reported proportion against a null hypothesis of no majority consensus (p0 = 0.5). As Table 3b shows, five of the six most frequently cited issues are statistically significant at $p < 0.05$, with the four leading issues at $p < 0.0001$. The sixth, inadequate bus drop-off (58%), is not significant ($p = 0.0797$), so it cannot be distinguished from an even split among students.

A baseline is established by the above user-needs findings for the subsequent configurational analysis, which applies DepthmapX-based Space Syntax methods for constructing campus axial and visibility-graph models, which generates integration, connectivity, and choice measures. When these outputs are overlayed onto the deficiencies of questionnaire/interview, it shifts the analysis from perceived to measured disconnection, forming the basis of the next master plan.

2.3. Spatial Configuration Analysis

The campus base plan was prepared as a CAD drawing (AutoCAD [2024]; Autodesk, San Francisco, CA, USA) and imported into DepthmapX (version 0.30; Space Syntax Laboratory, University College London, London, UK) as a CAD layer. Firstly, using DepthmapX's standard algorithm, an axial (all-line) map was produced, which draws the longest straight lines required for crossing each convex space and connecting each point of physical/visual access. The concept of connectivity from Ref. [2] was followed, where

the computation for every line (Figure 7) takes place for the number of directly intersecting axial lines. This highlighted the most connected corridors. Secondly, on a fine 5 m × 5 m grid, a Visibility Graph Analysis (VGA) was run for capturing pedestrian-scale visual connectivity. Figure 8 shows the number of other directly visible grid cells from each point, across courtyards and open spaces (Table 4a).

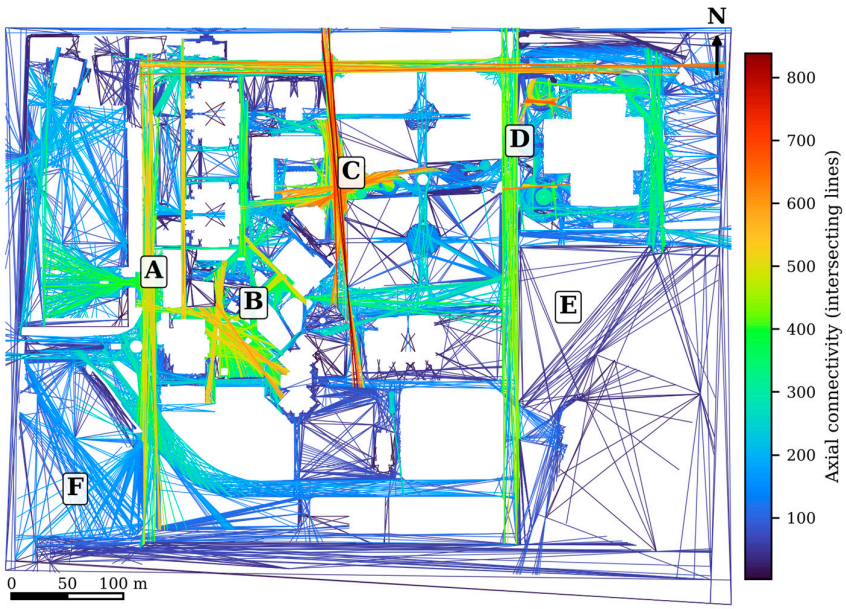


Figure 7. Connectivity values for the axial representation of the The Isra University campus (DepthmapX 0.30); warmer colours (red/orange) denote axial lines with the highest number of direct intersections, per the software's native colour scale (High–Low, right). Letters (**A**–**F**) mark the campus zones described in Table 1 and shown in Figure 2.

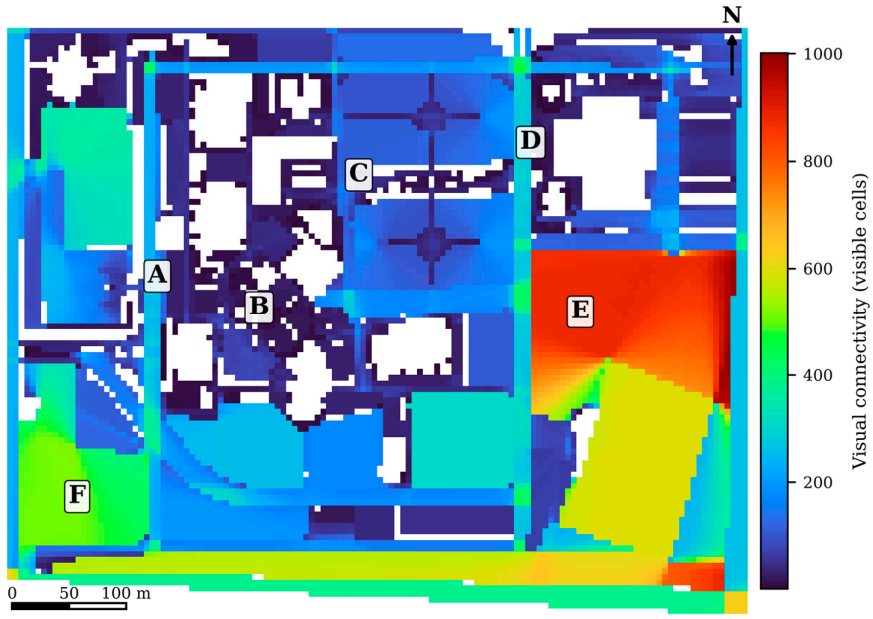


Figure 8. Visual connectivity from the grid-based VGA (5 m × 5 m cells) (DepthmapX 0.30); warmer colours (red/orange) indicate cells with the greatest number of directly visible neighbouring cells,

per the software's native colour scale (High–Low, right). Letters (**A**–**F**) mark the campus zones described in Table 1 and shown in Figure 2.

Table 4. (**a**). Summary statistics of visual connectivity (VGA) values, DepthmapX 0.30. Grid of approx. 5 m x 5 m cells; visual connectivity is the number of other cells directly visible from each cell. (**b**). Summary statistics of DepthmapX 0.30 outputs. (**c**). Space Syntax analysis parameters applied in DepthmapX. (**d**). Mean DepthmapX values per campus zone (A–F), existing condition, with the zones flagged in Table 1.

(**a**)

Attribute	Min	Max	Mean	Median	Std. Dev.	Cells (*n*)
Visual Connectivity (VGA)	1	1001	270.4	191	243.4	11,075

(**b**)

Analysis (Figure)	Attribute	Min	Max	Mean	Median	Std. Dev.	*n*
Axial map (Figure 7)	Connectivity	2	838	166.6	135	125.4	17,452 lines
VGA (Figure 8)	Visual Connectivity	1	1001	270.4	191	243.4	11,075 cells

(**c**)

Analysis Type	Scale/Radius	Key Measure(s)	Interpretive Purpose
Axial (All-Line) Map	Global	Connectivity	Identify physically most connected corridors
Visibility Graph Analysis (VGA)	Grid-based (isovist)	Visual Connectivity (visible-cell count) (5 m × 5 m cells)	Pedestrian-scale visibility of open spaces
Segment Angular Map	Metric R1000	Total Depth (visualized in Figure 9)	Global/whole-campus depth & movement catchment

(**d**)

Zone	Axial Connectivity, Mean (Lines)	VGA Visual Connectivity, Mean (Cells)	Total Depth R1000, Mean (Segments)
A	165.5 (373)	106.5 (194)	324,301 (394)
B	208.8 (713)	18.0 (85)	258,561 (607)
C	266.3 (1263)	96.4 (147)	239,629 (1353)
D	209.9 (3510)	129.1 (285)	255,297 (3870)
E	41.8 (12)	876.6 (211)	236,333 (12)
F	144.8 (63)	488.5 (199)	201,876 (57)
Whole campus	**166.6 (17,452)**	**270.4 (11,075)**	**236,546 (18,885)**

Note. Values are means; counts in parentheses. A line or segment is assigned to a zone when its midpoint falls inside the zone boundary, and a VGA cell when its centre does (5 m grid). Total Depth is the raw (unnormalised) angular sum; segments with undefined values are excluded. Exploratory Spearman rank correlation between zone flag (A, C, D = 1) and zone mean, $n = 6$: axial connectivity $\varrho = 0.68$ ($p = 0.13$); VGA visual connectivity $\varrho = -0.29$ ($p = 0.57$); Total Depth $\varrho = 0.49$ ($p = 0.33$).

Then the conversion of the axial map into a segment map occurred, and it was re-examined through angular segment analysis (metric radius up to 1000 m) for capturing local (building-cluster), intermediate (faculty-cluster), and global (whole-campus) depth, as in Table 4b (Table 4c). The Total Depth at the global radius (R1000) is shown in Figure 9; topologically shallow segments are marked in lower (blue) values that are reachable with fewer changes in direction; more segregated, deeper segments are marked in higher (red) values.

Table 4b summarizes the numerical values. Axial connectivity ranges from 2 to 838 across 17,452 lines (mean ≈ 167; median 135), and visual connectivity from 1 to 1001 across 11,075 grid cells (mean ≈ 270; median 191).

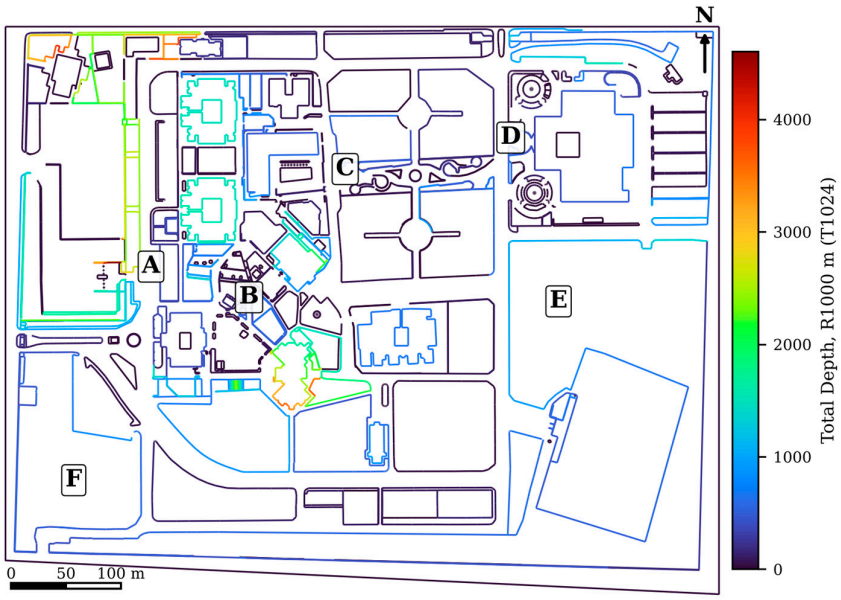


Figure 9. Total Depth of the segment map at the global metric radius (R1000); blue segments are the shallowest and most topologically accessible from the rest of the campus, while red segments are comparatively deep and segregated. Letters (**A**–**F**) mark the campus zones described in Table 1 and shown in Figure 2. Zones E and F contain no segments.

The highest axial connectivity (Figure 7; up to 838, Table 4b) is concentrated along the central north–south corridor and the routes linking the main courtyards. The greatest visual connectivity (Figure 8; up to 1001, Table 4b) occurs on the open, undeveloped parcels (Zones E and F), followed by large plazas and car parks, as expected since open land has few visual obstructions. Total Depth (Figure 9) is a raw sum that grows with the number of segments within the radius, so it is read here only as a complementary indicator. These patterns appear to coincide with the places where students and faculty reported parking–pedestrian conflict (76%; 9/9) and inadequate seating (70%; 8/9). The correspondence is descriptive; with six zones, only an exploratory rank comparison was possible (Table 4c).

To relate these outputs to the observed zones, mean values were computed for each zone (A–F) by assigning each axial line or segment to the zone containing its midpoint, and each grid cell to the zone containing its centre (Table 4d).

Zones E and F combine the highest mean visual connectivity (876.6 and 488.5) with the lowest mean axial connectivity (41.8 and 144.8) and Total Depth (236,333 and 201,876) (Table 4d). The correspondence with the reported problems is descriptive. With six zones, only an exploratory rank comparison was possible: the zones flagged in Table 1 (A, C, D) had higher mean axial connectivity (Spearman $\varrho = 0.68$, $n = 6$, $p = 0.13$) and Total Depth ($\varrho = 0.49$, $p = 0.33$) but lower mean visual connectivity ($\varrho = -0.29$, $p = 0.57$) than the other zones; none of these associations was statistically significant.

3. Discussion

From the questionnaire and interviews (Table 2, Table 3), and from the DepthmapX analysis (Figures 7–9), the evidence is consistent; Table 5 and Figure 10 show the proposal of a redevelopment master plan, which targets parking–pedestrian conflict, cafeteria misplacement, insufficient gathering space, and weak inter-faculty connectivity, when converting the Zones E and F (Table 1 (two vacant parcels)) into productive uses. Overall, at the level of the whole campus, the plan is characterized by:

- Enhanced open space connectivity and legibility of pedestrian route.
- Cafeteria relocation to a more accessible and spatially integrated position.
- Introducing a centralized lecture complex in a central, well-connected location.
- Designating adequate areas of seating and spaces of social gathering all across the campus.
- Reorganizing faculty parking and zones of bus drop-off for eliminating pedestrian–vehicle conflicts.
- Integrating an electric shuttle network (solar powered) with designated boarding and charging points where feasible

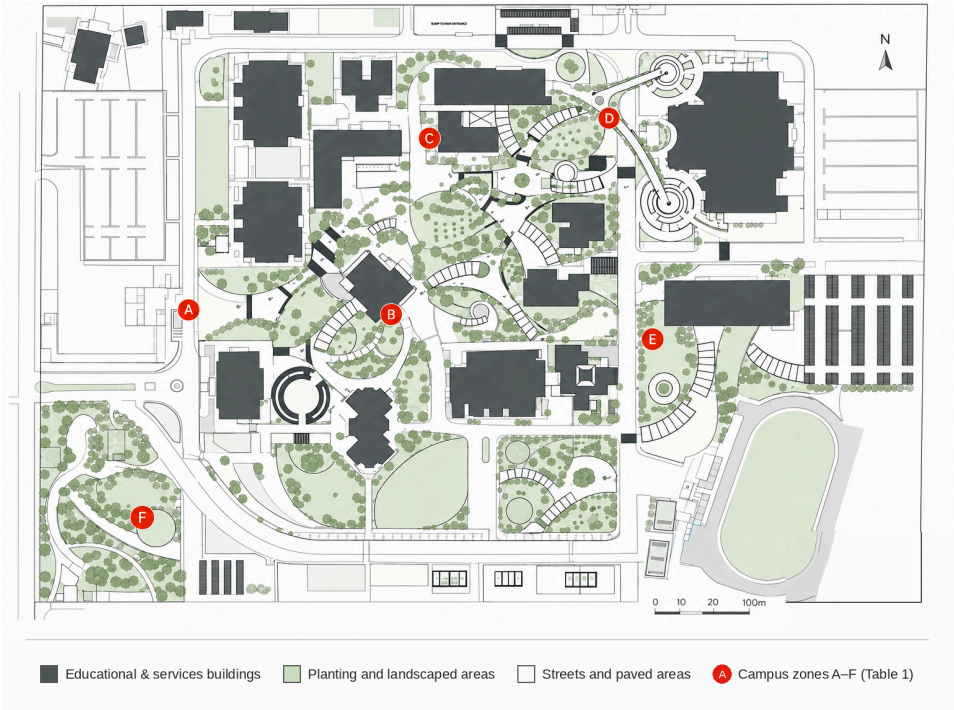


Figure 10. Proposed redevelopment master plan. Letters (**A–F**) mark the campus zones described in Table 1. Dark grey indicates buildings, and green indicates planting and landscaped areas.

Table 5. Zone-specific interventions proposed in the master plan.

Zone	Existing Condition (Table 1)	Proposed Intervention
A	Entrance blocked by faculty parking; disrupts student wayfinding	All parking obstacles removed; a new arrival node introduced as a legible dispersal point from which students orient toward different parts of campus.
B	Ageing but heavily used student gathering plaza fronting the library	Rehabilitated in place; shaded walkways added over the main seating routes (solar panels to be considered subject to feasibility).
C	Service street and poorly sited, truck-dependent cafeteria bisecting pedestrian movement	Street removed and cafeteria relocated; a new, easily accessible educational complex introduced in the northern part of the zone.
D	Well-liked landscape plaza severed from the university presidency by an intervening street	A pedestrian bridge with shaded planting spans the main street, linking the landscape plaza directly with the presidency and the admissions/registration building.
E	Vacant land	A scientific research and community-service centre, accessible from outside the campus and serving the university and surrounding community, with an

		adjacent low-water medicinal-plant garden of native, drought-tolerant species supporting the Faculty of Pharmacy.
F	Vacant land	A native-planting garden with shaded seating, an electric-shuttle charging and boarding station (subject to feasibility), and a post office and bank branch serving the university and surrounding area.

The priorities quantified earlier are directly answered in these interventions. The conflict reported by 76% of students and all faculty (9/9, Table 2) is responded by the Zone A arrival node; the cafeteria complaint (62% students, 6/9 faculty) is resolved by the Zone C relocation, whereas demand for a lecture facility (73% students, 7/9 faculty) is met by the new northern educational complex. A heavily used plaza is preserved by the Zone B rehabilitation while addressing the seating/gathering deficiency (70% students, 8/9 faculty), and the severance noted in Table 1 is resolved by the Zone D pedestrian bridge for a positively rated space by students. The mobility priority confirmed by both Engineering Department staff for the shuttle (2/2) and one for solar charging (1/2, Table 3) was operationalized by the Zone F shuttle-charging station, whereas the campus role is extended beyond its boundaries by the Zone E's research/community-service centre and Zone F's civic amenities, which converts the two vacant parcels into functions serving students, faculty, and the community.

The interventions in Table 5 are design concepts, not costed proposals. Space requirements, enrolment projections, budgets, and regulatory approvals were not assessed. Elements that depend on water or energy, such as planting, shaded walkways with solar panels, and the electric shuttle, would require studies of water supply, maintenance cost, solar yield, and charging capacity. Given the semi-arid setting, low-water native planting is assumed throughout.

3.1. Anticipated Configurational Impact of Proposed Interventions

The master plan interventions above target specific configurational deficiencies identified in Sections 2.2 and 2.3, and their expected direction of effect can be grounded in established Space Syntax principles even though the proposed layout has not yet been re-modelled in DepthmapX. Table 6 sets out this theoretically anticipated impact explicitly, distinguishing it clearly from the empirically measured baseline conditions reported in Figures 7–9. Formally re-modelling the proposed master plan in DepthmapX and comparing its Connectivity, Visual Connectivity, and Total Depth values against the existing-condition baseline reported here is identified as the necessary next step to convert this anticipated impact into empirically validated evidence, and is recommended as a priority direction for future work.

Table 6. Anticipated configurational impact of proposed interventions, based on Space Syntax theory; predictions pending formal DepthmapX re-analysis.

Zone	Intervention	Targeted Measure	Theoretically Anticipated Effect
A	Remove parking obstacles; introduce arrival node	Axial Connectivity	Removing physical obstructions and creating a legible node is expected to increase local connectivity at the entrance, per principle that permeability directly increases the number of intersecting sightlines and routes.
B	Rehabilitate plaza; add shaded walkways	Visual Connectivity	No change to spatial configuration is intended; the intervention preserves existing (already favourable) connectivity while improving physical comfort and use.

C	Remove service street; relocate cafeteria; add educational complex	Connectivity; Total Depth	Removing the vehicular street that bisects pedestrian movement is expected to reduce topological depth between the two halves of the zone, consistent with the general Space Syntax principle that removing barriers shortens paths and increases integration.
D	Pedestrian bridge over main street	Visual Connectivity	Bridging the severance identified in Table 1 is expected to increase visual and physical connectivity between the landscape plaza and the presidency building by directly linking two previously disconnected visibility fields.
E, F	Research centre (E); garden, shuttle station, and civic amenities (F)	Connectivity (network extension)	Development of previously vacant, undifferentiated parcels is expected to extend the pedestrian network and integrate these zones into the wider campus configuration, rather than altering the existing spine's measured values directly.

3.2. Limitations

This study has several limitations. It examines a single campus, so the findings are specific to this case and may not apply elsewhere. The questionnaire sample (n = 120) carries a margin of error of about ±8.9%, only nine faculty members and two Engineering Department staff were interviewed, and the interview findings are reported as counts rather than a full thematic analysis. The Space Syntax measures were compared with user reports descriptively; with six zones, only an exploratory rank comparison was possible, and no association was statistically significant. Pedestrian movement was not observed or counted, so the configurational measures were not validated against actual behaviour. Finally, the proposed master plan was not re-modelled in DepthmapX and was not assessed for cost, feasibility, or site conditions, so its effects remain anticipated rather than demonstrated.

4. Conclusions

This study shows that user-reported spatial problems and configurational analysis can point to the same places, and that combining them gives a firmer basis for campus redevelopment than either alone. For the case campus, the main weaknesses lie in how people arrive, how pedestrians and vehicles share routes, and how well-used open spaces connect to the buildings they serve, rather than in a general shortage of space. The proposed master plan should be read as an evidence-informed design concept. It has not been re-modelled, and it has not been tested for feasibility, cost, or site conditions such as climate and water supply.

Future work should therefore (i) re-run the Space Syntax analysis on the proposed layout and compare it with the baseline, (ii) test the link between survey responses and spatial metrics statistically, and (iii) assess technical and economic feasibility before any intervention is implemented. The approach is transferable to other campuses facing similar redevelopment decisions, particularly where incremental growth has left open spaces poorly connected.

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Institutional Review Board Statement: The study was approved by the Research Ethics Committee of Isra University, Amman, Jordan (approval number SREC/26/9/226).

Informed Consent Statement: Verbal informed consent was obtained from the participants. The rationale for utilizing verbal consent is that the study involved minimal risk, and a signed consent form could compromise participants' anonymity.

Data Availability Statement: The data presented in this study are available on request from the corresponding author, subject to restrictions protecting participant privacy.

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Appendix A. Research Instruments

Appendix A.1. Student Questionnaire

Dear participant,

My name is Diala Atiyat, and I am conducting a research study on open space connectivity and campus redevelopment at Isra University. This questionnaire asks about your experience of moving around the campus, its open spaces, and its facilities, and it will take about 5–10 min to complete. Your participation is voluntary and anonymous. No names or personal identifiers will be collected, you may skip any question or stop at any time without any consequences, and your responses will be used for research purposes only. By continuing to complete this questionnaire, you indicate your consent to participate. Thank you for your time and valuable input.

About you

1. Which faculty are you in? _____

2. Year of study:

□ First

□ Second

□ Third

□ Fourth or above

3. How do you usually get to the campus?

□ University bus

□ Private car

□ Public transport/taxi

□ On foot

Section 1—Connectivity and circulation

4. How much do you agree with the following?

Table A1. Student questionnaire: agreement with statements on connectivity and circulation (Question 4).

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Walking between the faculties is easy and direct.	□	□	□	□	□
It is easy to find my way when I first arrive at the campus.	□	□	□	□	□
Parked cars block the paths I walk on.	□	□	□	□	□
Delivery trucks get in the way of pedestrians inside the campus.	□	□	□	□	□
The bus drop-off/pick-up point is convenient and safe.	□	□	□	□	□

5. Where do cars or trucks conflict with pedestrians most? (tick all that apply)

□ Main entrance/arrival area (Zone A)

□ Service street by the cafeteria (Zone C)

□ Street between the landscape plaza and the presidency (Zone D)

□ Bus drop-off/pick-up area
□ Nowhere in particular
Section 2—Problem zones
6. Which zone is the most problematic for moving around or using? (one answer)
□ Zone A—entrance/arrival
□ Zone B—library plaza
□ Zone C—service street and cafeteria
□ Zone D—landscape plaza near the presidency
□ Zone E/F—vacant land
7. What is the main problem there?

8. Which zone do you like most or spend most of your free time in? (one answer)
□ Zone A
□ Zone B
□ Zone C
□ Zone D
□ None of them
Section 3—Open spaces
9. How much do you agree with the following?

Table A2. Student questionnaire: agreement with statements on open spaces (Question 9).

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
There is enough seating outdoors on campus.	□	□	□	□	□
There is a good place to meet and gather near my faculty.	□	□	□	□	□
The library plaza (Zone B) is a nice place but needs renovation.	□	□	□	□	□
The landscape plaza near the presidency (Zone D) is a pleasant place to spend time.	□	□	□	□	□
The landscape plaza (Zone D) is easy and safe to reach on foot.	□	□	□	□	□

Section 4—Existing facilities
10. How satisfied are you with each of the following?

Table A3. Student questionnaire: satisfaction with existing facilities (Question 10).

	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Pedestrian connectivity across the campus	□	□	□	□	□
Parking organization	□	□	□	□	□
Seating and gathering areas	□	□	□	□	□
Cafeteria location	□	□	□	□	□

11. Are the lecture halls you use in a single day spread across different buildings?
□ Yes, usually
□ Sometimes
□ No, they are in one building
Section 5—Future needs
12. How serious is each of these issues on campus today?

Table A4. Student questionnaire: seriousness of campus issues (Question 12).

	Not An Issue	Minor Issue	Significant Issue
Poor connectivity between the faculties	□	□	□
Conflict between parking/vehicles and pedestrians	□	□	□
No centralized lecture complex (lectures scattered across buildings)	□	□	□
Not enough seating and gathering space	□	□	□
Cafeteria in the wrong location	□	□	□
Bus drop-off/pick-up not well arranged	□	□	□
Plazas and open spaces need renovation	□	□	□
No shuttle service inside the campus	□	□	□

13. If the vacant land (Zones E and F) were developed, what would you like to see there? (tick up to three)

□ Gardens and green space
□ Research/community centre
□ Lecture halls
□ Shuttle station
□ Services (bank, post office)
□ Parking

14. If you could change one thing about the campus, what would it be?

Appendix A.2. Faculty Interview

Do you have any questions? Do you agree to participate in this interview?

1. Could you tell me about your role, your college, and how long you have been on this campus? How do you usually arrive and where do you park?
2. Walk me through a typical teaching day from arriving on campus to reaching your office and your lecture rooms. Where do you run into difficulties along the way?
3. How well connected are the faculties to one another? Are there parts of the campus that feel cut off from your college?
4. Where are the lecture halls you teach in, and what effect does their distribution have on teaching and on students getting to class on time?
5. Where do students spend their time between lectures? Is there enough seating and gathering space, and in what condition is it?
6. What do you think of the cafeteria's location and the way it is served by delivery trucks?
7. Looking at the map, how would you describe each zone A–F: its condition, its main problem, and what it could become? For E and F, what use would best serve the university?
8. How are the bus drop-off and pick-up arrangements working? Would an internal shuttle be useful, and what do you think of running it on electric/solar power?
9. If the university could do only three things to improve the campus open spaces and circulation, what would they be, in order?
10. Is there anything we haven't covered that you think matters?

Appendix A.3. Engineering Department Interview Guide

Hello, my name is Diala Atiyat, and I am conducting a research study on open space connectivity and campus redevelopment at Isra University. The interview will take about 15–20 min. Your participation is voluntary and confidential, and you may skip any question or withdraw at any time without any consequences. Your name will not appear in any publication, and the data will be used for research purposes only. Verbal informed consent is being used because the study involves minimal risk, and a signed consent form could compromise participants' anonymity. Do you have any questions? Do you agree to participate in this interview?

1. What is your department responsible for regarding the campus site and its open spaces? Is there an approved master plan, and when was it prepared?
2. How did the campus grow over the years by building, or according to a plan? How has that shaped the spaces between the buildings?
3. What complaints or requests do you receive most often about circulation, parking, open spaces or facilities?

Check: faculty parking at the entrance (A); the service street and truck access to the cafeteria (C); the street cutting the landscape plaza off from the presidency (D); the condition of the library plaza (B); the bus drop-off point.

4. Which of the following are currently planned, and at what stage—idea, studied, budgeted, scheduled, or under way?

Renovation of the plazas and open spaces · better pedestrian connections between the faculties · an electric shuttle system · solar-powered EV charging · relocating the cafeteria · a centralised lecture complex · reorganising parking and the bus stop · developing the vacant land (E and F).

5. What technical constraints affect these projects (utilities, service access, emergency routes, land, the highway frontage), and what budget or approval constraints apply?
6. Which of these could realistically be done in the next one to two years, and which are longer term?
7. From your side, what are the three highest-priority interventions, and why?

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