Walking Globally: The Global Walkability Index in Amman, Jordan

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Walkability is an international issue. Amman is standing, as it always does, at a turning point. As that issue comes to a head, Amman lacks productive ways to talk about pedestrian infrastructure. Population growth is fast and motorization rate increase is even faster. The city is choking on automobile congestion. An under-construction BRT line, the first-ever centralized attempt to provide public transit, will incentivize alternate forms of transportation and will itself benefit from walkable neighborhoods. Middle-class residents consider walking for transport almost taboo, but much of the city is quite dense and the older neighborhoods boast a tight, coherent street network. Municipal government is embracing sustainability and is beginning to pursue walkability as a policy goal. However, the conversation about walkability in Amman will move slowly unless it is grounded in shared understanding. To provide that understanding, this paper will describe a case-study implementation of the Global Walkability Index in Amman. It will review walkability assessment, argue for the applicability of the Global Walkability Index to Amman, and describe several compelling results of the case study. The study shows that Amman is a relatively walkable city when compared to other Asian cities of similar sizes, indicating a strong foundation upon which to pursue pedestrian-oriented development. Amman's greatest strength in the provision of walkability is the narrow streets that, in certain older neighborhoods, limit the speed of cars. Its greatest weakness is the nearly city-wide absence or low quality of sidewalks and other pedestrian-only paths, with the exception of staircases.

Background: Amman, Jordan

Amman is a young city. A town of only 100,000 inhabitants at the time of its independence from Britain in 1946 (Abu-Dayeh 2004), it has since welcomed waves of refugees from Palestine, Lebanon, Kuwait, and Iraq, as well as domestic rural-to-urban migration that has caused it to swell to over four million today. Amman's growth, which has been intermittently extreme since Jordan's independence from Britain in 1950, shows no signs of slowing. In fact, an influx of Syrians fleeing their country's civil war has resulted in shockingly high levels of urban population growth. During the decade between the 2004 and 2015 censuses, the population of Amman more than doubled, from 1.78 million to 3.89 million (DoS 2004, DoS 2015).

Because of this rapid growth, almost all of the city was laid out in the past few decades. Attitudes toward planning have been dominated by Anglo-American auto-centric orthodoxies prescribing wide highways, parking minimums, separation of uses, and cul-de-sac residential neighborhoods. This neocolonial influence is often very direct: British planners Max Lock and Gerald King were responsible for Amman's first comprehensive plan in 1955 and their compatriot John Calder for another in 1988 (Abu-Dayeh 2004). Over fifteen Canadian planners worked closely on the most recent plan in 2008 (Momani 2017).

An American imagining an Arab capital may envision medieval alleys, covered markets, and grand plazas in front of mosques; such built forms comprise a fraction of a percentage point of Amman's urban land. The city is not so simple to visualize. Its older neighborhoods, most located in the steep hills of the poorer eastern areas, consist of 1-to-4-story houses and apartments tightly packed along narrow streets that follow the topology of the hills. They often boast pedestrian staircases, some of which have the character of dark alleys while others have been brightly repainted and host popular

cafes. Newer neighborhoods, regardless of social class, lie in flatter land farther from the historical center. These generally consist of boxy freestanding 4-story apartments with underground parking lying chaotically along wide curving streets or cul-de-sacs, interspersed with hulking malls and glassy office complexes. Throughout the city, multi-lane rapid thoroughfares wind along valleys (where they pass industrial sites) and hilltops (commercial centers), crossed by rare, narrow, pedestrian bridges.

Amman provides its citizens with poor pedestrian infrastructure: there are few parks or public spaces, poor public transit, and only intermittent sidewalks. Only 0.4% of Amman's land area is covered in parks (Tomah 2017), and the largest of these are 'destination parks' reached most often only by car. The most-accessed pedestrian spaces are malls, which are exclusive to some demographics (Hadeel 2015).

The city boasts a meager 470 full-size buses for its four million inhabitants (Imam 2014), and though over 3,000 shared fixed-route taxis bolster the transit network, they are extremely difficult to regulate and unreliable. Booming population, combined with a 6.5% yearly increase in motorization rate (Ibanez Prieto 2018), has led to crippling traffic. This traffic, known as "the crisis" in Jordanian colloquial Arabic, costs the city approximately 1.4 billion USD annually (Ghazal 2015).

Sidewalks are governed by regulations dictating width and flatness (Office of the Prime Minister of Jordan 2016), but sidewalk maintenance is the exclusive responsibility of the property owner and these regulations are often ignored. Piles of construction material, police booths, parked cars, high steps, and decorative trees often block sidewalk passage to the degree that Ammanis usually choose to walk in the street (fig. 1). Owners of vacant lots are not required to maintain their sidewalks, and so pedestrian paths are frequently interrupted in the middle of blocks (Al-Asad 2004). However, particularly in the older neighborhoods, a high density of pedestrian-only staircases provides a connected matrix (fig. 2).

Fig. 1: Amman Sidewalk Quality, North Station Area. Photo by Muna Bata

Amman is a young city, though, and may yet change rapidly. The most visible sign of that change is the Bus Rapid Transit system, currently under construction, that will link diverse quarters of the city at high throughput. It will be the first-ever centralized municipal effort to improve public transit in Amman. As public transit and walkability are closely linked (Tumlin 2003, Ramon 2010), perhaps this effort may spur initiatives to improve the situation for Amman's pedestrians. Municipal government has recently affirmed its commitment to sustainability and resilience, and in fact named the promotion of walkability as the second of its sixteen Resilience Goals (Amman Resilience Strategy 2017).

As Amman is moving forward to a more walkable future, it will confront problems that are uniquely Ammani and it will confront problems that are international and even universal. To discuss these issues, planners, practitioners, and politicians will need a shared language of walkability. This language should be sensitive to Amman's contextualities, so that Amman can realize its particular opportunities and take advantage of its unique strengths. It should also be international, so that Jordanians can learn from their peers across the Middle East, Asia, and the world. In this paper, we will show that the Global Walkability Index can be a step toward developing such a language - and that planners outside Amman, from San Francisco to Cairo to Beijing, can benefit just as greatly from such a way of thinking.

Choosing a Walkability Assessment

The past quarter-century of urban science has witnessed an increasingly sophisticated conversation on the assessment of walkability. Since 1993, a plethora of quantitative indices, toolkits, and algorithms to measure walkability have been proposed and tested. They have been motivated by concerns of public health, sustainability, and economy. They have ranged from highly subjective to highly objective. Many of these assessments have been locally-oriented, intended for evaluation of neighborhoods in a specific metropolitan area;

Fig. 2: Pedestrian Staircase, Al-Hashemi Al-Shameli Area. Photo by Nayrouz Abughosh

others have had ambitions to applicability across a nation, region, or the globe. They have run the gamut of complexity. In this section of the paper, we will briefly review trends in walkability analysis, discussing a few particularly popular techniques and their potential relevance to Amman. As we select an approach and implement it in the Ammani context, we seek a method that fulfills the following criteria:

- **International applicability**: The method should be practicable in cities anywhere on Earth. The literature is overflowing with approaches that are hyper-specialized and dedicated to a single city; these often lack any relevance to non-local readers.
- **Well-established status:** The method should have been used successfully in a variety of contexts and should be relatively well-known.
- **Contextual subjectivity:** Walkability is highly culturally determined and practices of walking vary; it is probably impossible to evaluate walkability in an entirely objective way (Huang 2016). However, the subjectivity of the researcher (in this case as in many a relatively wealthy Westerner with little life experience outside of the United States) should be minimized and local non-specialist subjectivities should be employed.
- **Supply-side:** The method should focus on "means or conditions by which walking is enabled," rather than "outcomes or performance" (Forsyth 2015).
- **Comparability:** Results should be directly comparable between neighborhoods, cities and between researchers. Quantitative results are helpful though not necessarily required.
- **Simplicity:** The method should be implementable with limited resources.

Before the 1990s, most quantitative evaluation of pedestrian infrastructure in the United States was guided by the type of 'Level of Service' standard applied by the Transportation Research Board to automobile highways in the 1950s. This standard, though, "reflects a gross lack of understanding about the difference between vehicles and people," and was rarely if ever effective for productive evaluation of walkability (Lo 2009). The 1993 publication of the "Pedestrian Environmental Factor," (Parsons Brinkerhoff Quade and Douglas 1993) in Portland, Ore., represented a paradigm shift. It aimed for the first time to quantitatively measure walkability as such, rather than applying vehicular concepts to pedestrians, and drew upon conceptual frameworks proposed by such venerated urban scholars as Jane Jacobs and Kevin Lynch (Jacobs 1961, Lynch 1960, Lo 2009).

Since 1993, approaches to measuring walkability have, for the most part, fallen into three distinct categories: measurements of access to destinations; measurements of pedestrian infrastructure quality; and measurements of path morphology.

The first approach, measurement of pedestrian access to destinations, is exemplified by the popular website WalkScore.com. Walk Score evaluates a given address on the basis of its network distance to a variety of daily destinations and amenities. It has been validated by independent academic researchers (Manaugh 2011, Lucas 2010, Duncan 2013). However, Walk Score has been criticized for reliance on a proprietary algorithm and for geographical limitation. WalkScore.com officially supports only the United States, Canada, and Australia (Walk Score Cities & Neighborhoods), and its algorithms are optimized for the built environments of these capitalist anglophone countries. While it can be used in other countries, it has not been rigorously validated for such application and results are unreliable. This presents a significant obstacle especially to those studying walkability in underdeveloped countries. Researchers have found that "many Asian cities can have high scores in walkscore.com… but this does not mean that these cities are easy to walk in" (Gota 2010). For that reason, it is not feasible to apply WalkScore.com's algorithm to the case study of Amman. Lacking digital information on the locations of amenities in Amman, it is similarly infeasible to design a comparable open-source algorithm.

The second approach, measurement of pedestrian infrastructure, attempts to assess the quality of the walking environment at the level of the street. It often includes measurements of elements like sidewalk width and crossing safety, and can vary in its level of subjectivity. At least 50 such audits have been proposed (Guo 2013), of which the Pedestrian Environment Data Scan (PEDS) (Clifton 2007) is among the most well-established. However, the vast majority of these audits, including PEDS, were designed with the context of the United States in mind; they are, like WalkScore.com, at best unreliable and at worst unusable internationally. Though PEDS has been adapted for use in Colombia (Rodríguez 2009), this adaptation renders the results unfriendly to international comparison. The Global Walkability Index (GWI) (Krambeck 2006), on the contrary, was explicitly developed for worldwide application. It is a simple audit administered by local volunteers. It was first designed and implemented in Washington, DC, USA, and in Ahmedabad, India. It relies on the context-sensitivity of these volunteers across nine generalized criteria to produce an imprecise and subjective yet usefully quantitative index. It has been applied worldwide, though especially in Asia, furnishing a thorough scholarship and facilitating comparison between cities (Krambeck 2006, Gota 2010, Leather 2011, Luadsakul 2013, Yusuf 2015, Winayanti 2015). For these reasons we choose the GWI as the basis for

our evaluation of walkability in Amman.

The third approach, measurement of path morphology, employs geospatial analysis tools like geographic information systems (GIS) to assess the suitability of the street network to pedestrian activity (Forsyth 2015). These assessments focus on measurements like block size, metric (or network) reach (Haynie 2017), and intersection density (Frank 2005, Leslie 2007, Duncan 2013, Stockton 2016), and can often be conducted entirely from behind a computer screen. It is worth noting, however, that some would contend "street connectivity may be relevant only if people have a range of places with complementary uses to visit—greater land use mix" (Stockton 2016). Often such assays may be supplemented by spatial data on residential density, zoning, building locations, and mixing of uses, but unfortunately this data is unavailable for Jordan as is the data that would enable Walk Score evaluation. Morphological geospatial analysis indeed shows great promise for Amman and has been previously used in Arab Middle Eastern contexts (Ledraa 2015). However, it lacks cultural sensitivity of any kind and will not satisfy our requirements for the desired approach. For the purposes of this paper, we will limit our assessment to the results of the Global Walkability Index. At the same time, we recognize the high potential of morphological studies that are culturally well-informed, and anticipate the synthesis of GWI findings with GIS results.

Case Study Methodology

Eleven locations of 1x1km in Amman were selected for study, either for representation of an archetypical Ammani urban typology or for location along the planned BRT line. These included:

1. The young, affluent, architecturally traditional Jabal Al-Luweibdeh neighborhood
2. The traditional downtown, Wasat al-Balad
3. The commercial Sweifieh district, including Wakalat street
4. The area around the Sweileh transit hub
5. The area facing the main gate of the University of Jordan (not including any of the University's campus)
6. The area around Sports City / Duwar al-Medina al-Riyadiyya
7. The area around the North Bus Station / Mujamma' al-Shamel
8. The area around the Prince Hamza Medical Center
9. The lower-class area of Al-Hashemi al-Shameli and the main bus station / Al-Mahatta
10. The area around the Arab Medical Center / Fifth Circle
11. The area around the Greater Amman Municipality (GAM) building in Ras al-Ain

(See Appendix A for precise information on study areas)

For each area, local volunteers assessed pedestrian conditions according to the Global Walkability Index (Krambeck 2006), following precisely the slightly modified criteria developed by Clean Air Asia (Gota 2010), most notably the replacement of "maintainance and cleanliness" with "walking path availability." Specifically, the nine criteria were as follows (more detailed descriptions and reference images provided in Appendix B):

1. **Walking Path Modal Conflict:** This criterion is intended to assess the level of mixing observed between pedestrians and vehicular traffic. Must pedestrians and vehicles share the same space? Or is these some degree of separation between the two? How clear, and how clearly enforced, is that separation?
2. **Availability of Walking Paths:** This category evaluates the extent to which sidewalks or other walking paths are present, and if present, their level of usefulness (as affected by congestion, maintenance, cleanliness).
3. **Availability of Crossings:** This category assesses the availability of signalized or above/under - grade crossings for those streets that require them. Note that a street may rate highly if it is narrow enough with slow enough traffic that it may be crossed easily at a non-designated crossing.
4. **Grade Crossing Safety:** This category assesses the safety of crossing the street, particularly at signalized crossings.
5. Motorist Behavior: This category evaluates the level of respect shown by drivers toward pedestrians and road laws.
6. **Pedestrian Amenities:** This category evaluates the presence or absence of small structures or modifications that enhance walkability: street lighting, benches, shade and protection from sunlight or rain, pedestrian-oriented signs, etc. This includes amenities constructed officially, as well as informal elements.
7. **Disability Infrastructure:** This category assesses the friendliness of the street toward people with disabilities - including blindness, mobility impairment, deafness, and other visible and invisible disabilities.
8. **Obstructions:** This category assesses the freedom of movement on the walking path or blockage by obstructions (dumpsters, trees, telephone poles, parked cars, etc).
9. **Security from Crime:** This category evaluates the perceived safety from crime - perceived by the surveyor at the time the survey is taken.

A team of ten local volunteers, mostly undergraduate architecture students (not urban planning students), were trained in audit application. All volunteers were bilingual and biliterate in Arabic and in English, with at least university-level literacy in the latter. Training was bilingual in Jordanian Arabic and in English, though reference materials were provided

only in English (see appendix B for full reference materials as provided to volunteers). The volunteers audited every street in each of the eleven study locations, with at least three volunteers present for each audit. All audits were conducted between 3:00pm and 5:30pm on business days during February and March of 2017. Findings were recorded with an implementation-built form and the EpiCollect5 smartphone application (EpiCollect5 v.1.1.7, Imperial College London, Android and iOS). Additionally, on each street, pedestrian activity was measured by counting the number of pedestrians to pass by on one side of the street in either direction over five minutes.

To compose an overall walkability score for each neighborhood, findings for each street in each of the GWI's nine criteria were weighted by street length. In contrast to Krambeck (2006), findings were not weighted by pedestrian counts: this study aims to examine supply-side factors of walkability (Forsyth 2015). A 1-5 score for each study location in each criterion was thereby produced. To produce a single composite score for each neighborhood, these criterion scores were weighted according to the importances described in Gota (2010), weightings that theoretically correspond to the writings of Alfonzo (2005), averaged, and scaled to result in a 1-100 score that could be compared to the "modified walkability ratings" of Gota (2010). To produce a single score

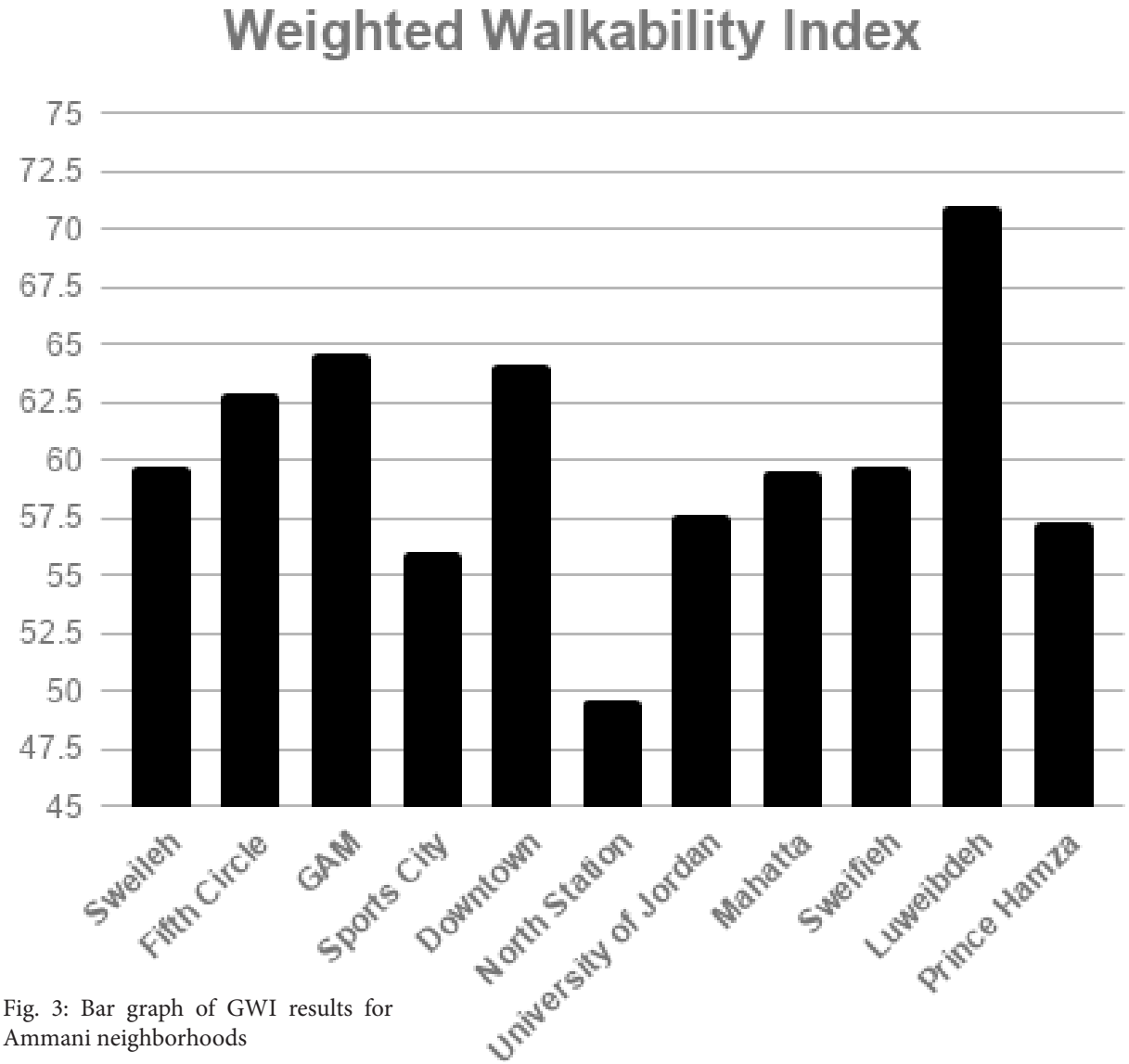

Fig. 3: Bar graph of GWI results for Ammani neighborhoods

for the entire city of Amman, the composite scores for the following four locations were averaged: the University of Jordan, Mahatta, Sweifeih, and the Prince Hamza Medical Center. These four locations most closely resemble the standards set in Krambeck (2006) and Gota (2010).

Results and Conclusions

Of the neighborhoods assessed with the GWI, the Luweibdeh neighborhood scored the highest - the most walkable - with an index of 71. The North Station neighborhood scored the lowest with an index of 49.6. All other study areas scored between 55 and 65 (fig. 3). These results may also be presented cartographically (fig. 4).

A major benefit of the GWI, as compared to other metrics, is the way in which it enables multidimensional comparison between study areas. By comparing not only the eleven locations' composite scores, but also their scores in each of the nine walkability criteria, we can identify the relative strengths and weaknesses of each neighborhood in providing walkability, and identify avenues for improvement.

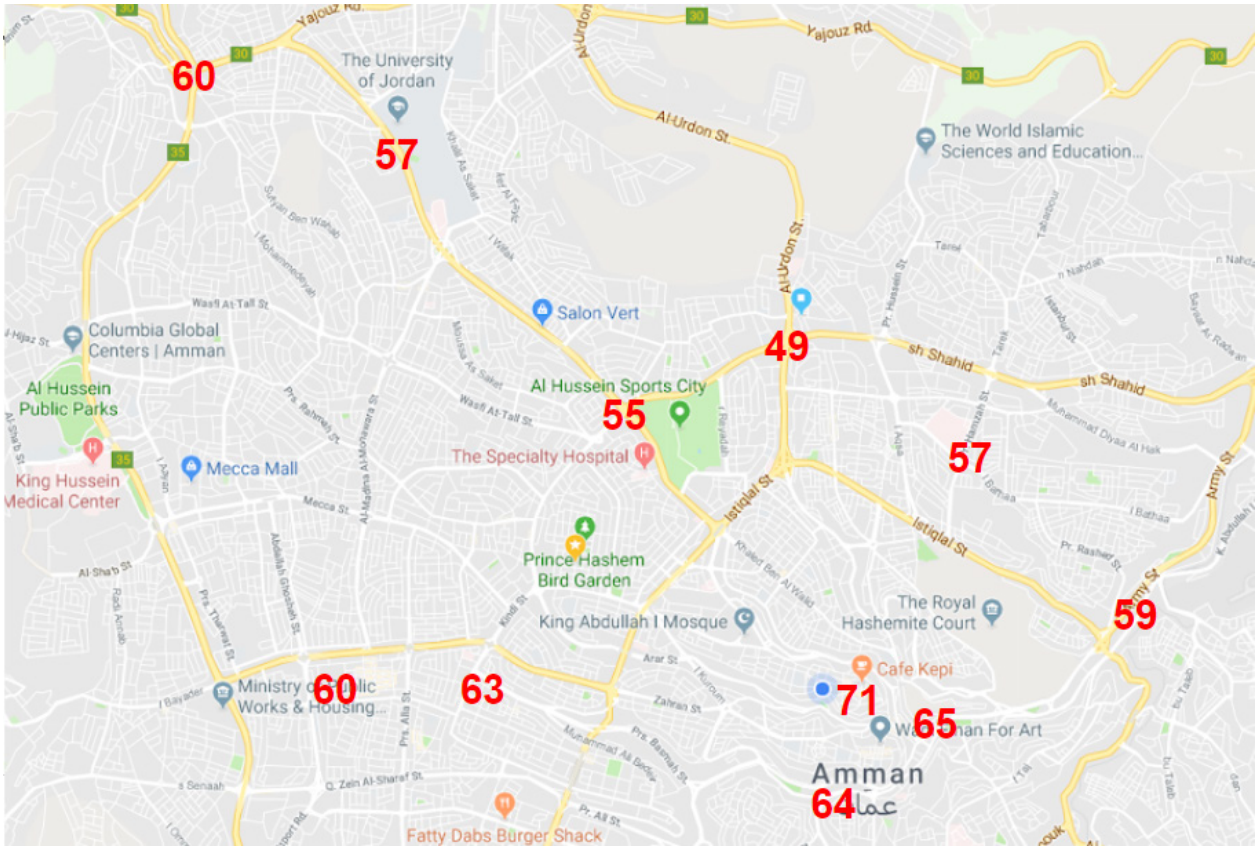

Fig. 4: Cartographic display of information presented in fig. 3

By presenting a chart that shows each neighborhood's score for each criterion (fig. 5), it becomes clear that certain neighborhoods could provide models to other neighborhoods in Amman. For example, although Luweibdeh scores highly in general, it scores relatively poorly in certain categories. For example, Luweibdeh scores lower than the downtown area in terms of pedestrian amenities and in terms of disability infrastructure, as well as scoring lower than the Greater Amman Municipality area in terms of pedestrian obstructions. With Luweibdeh soon to undergo redevelopment, perhaps designers could look to those other neighborhoods for inspiration. Similarly, the North Station and Sports City areas are very similar (both representing middle-class areas of similar urban design, with both study areas each including two major highways). Sports City scores equally or better on most criteria. However, the North Station area ranks significantly higher in terms of crossing availability. Sports City, too, will soon be redesigned; perhaps a lesson may be taken from North Station in this regard.

We can also use this chart (fig.5) to identify certain neighborhood's clear weaknesses. For example, the area of Mahatta / Main Bus Station / Al-Hashemi Al-Shameli, though it ranks quite highly in criteria like crossing availability and crossing safety, ranks very low in pedestrian amenities, disability infrastructure, and safety from crime. In such a case, planners could pursue the "low-hanging fruit" by installing benches, streetlights, curb cuts, and ramps. In these examples, as in others, the GWI enables decision-makers to pursue techniques for improvement that will provide the greatest return on investment.

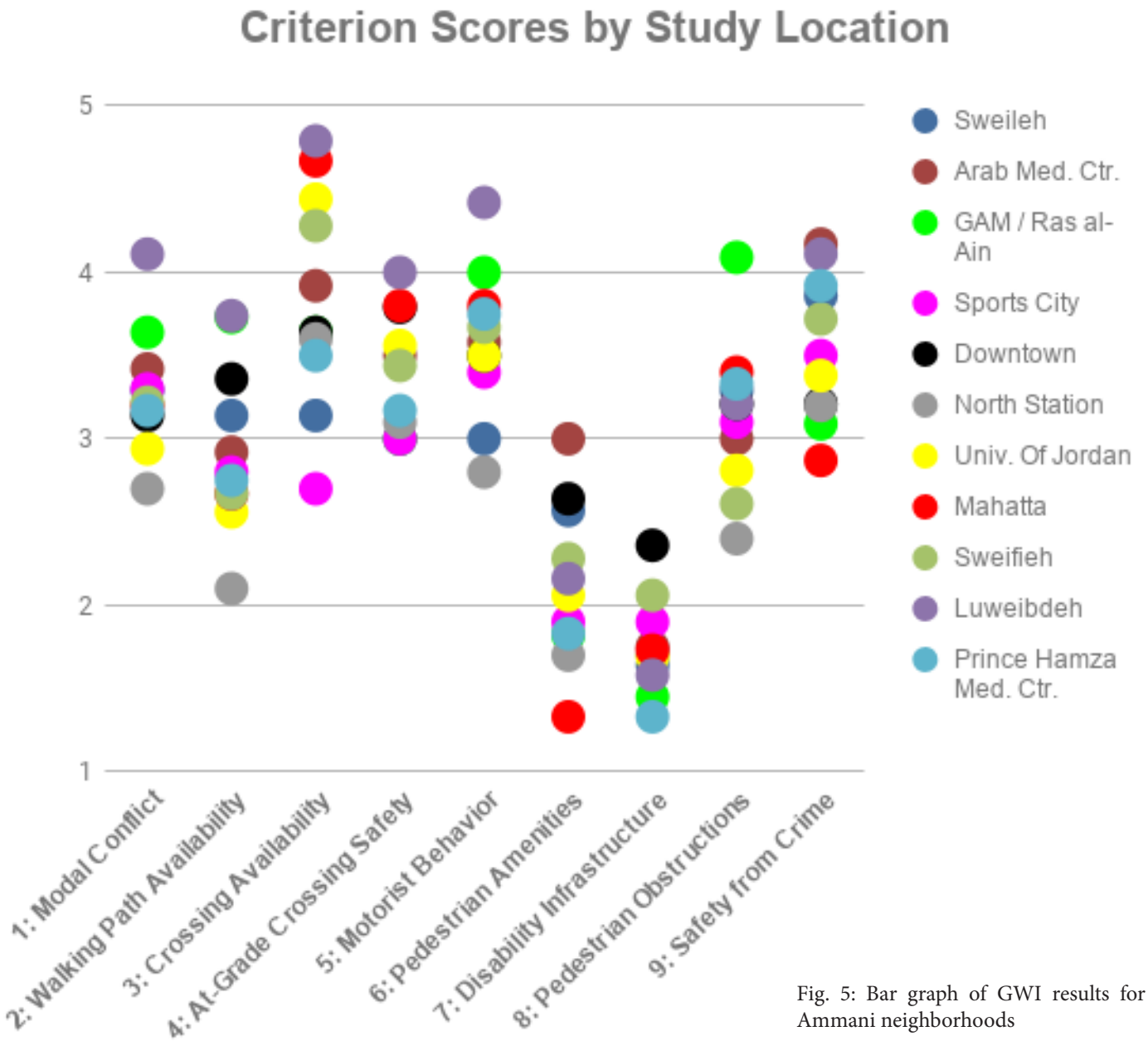

Fig. 5: Bar graph of GWI results for Ammani neighborhoods

Another benefit of the GWI is the way in which it enables international context-agnostic comparison between cities that might otherwise be difficult to directly compare. Though it might be technically possible to compare Amman to Jakarta in terms of, say, square meters of sidewalk per square kilometer, this quantitative and objective comparison would ultimately tell us very little about walkability because of the cultural differences in sidewalk utilization between Jordan and Indonesia. In contrast, the GWI with its reliance on local volunteers enables a more high-level, abstract, and culturally-sensitive comparison between cities. Furthermore, because the GWI is by now an established standard, results may be compared between uncoordinated researchers. For example, we can compare the overall results for Amman to results published by Gota (2010) for cities across eastern and southern Asia (fig. 6). We see that Amman ranks somewhere in the upper middle of the pack: it seems to be more walkable than many other cities, though it does not reach the level of Hong Kong or Manila. These findings should give some hope to the planners and citizens of Amman, who often despair, saying they live in a hopelessly-unwalkable city. From the perspective of the GWI, though Amman may have room for improvement, its situation is far from hopeless.

The GWI also allows us to compare Amman to other Asian cities, and to the Asian average, on a criterion-by-criterion basis (fig. 7). When it is compared to the Asian average, we are able to identify Amman's relative strengths and weaknesses, enabling Ammani planners to capitalize upon its strengths and attentively address its weaknesses. For example, Amman scores relatively well in criteria related to pedestrian street-crossing, and relatively poorly in modal conflict, walking path availability, pedestrian amenities, and disability infra-

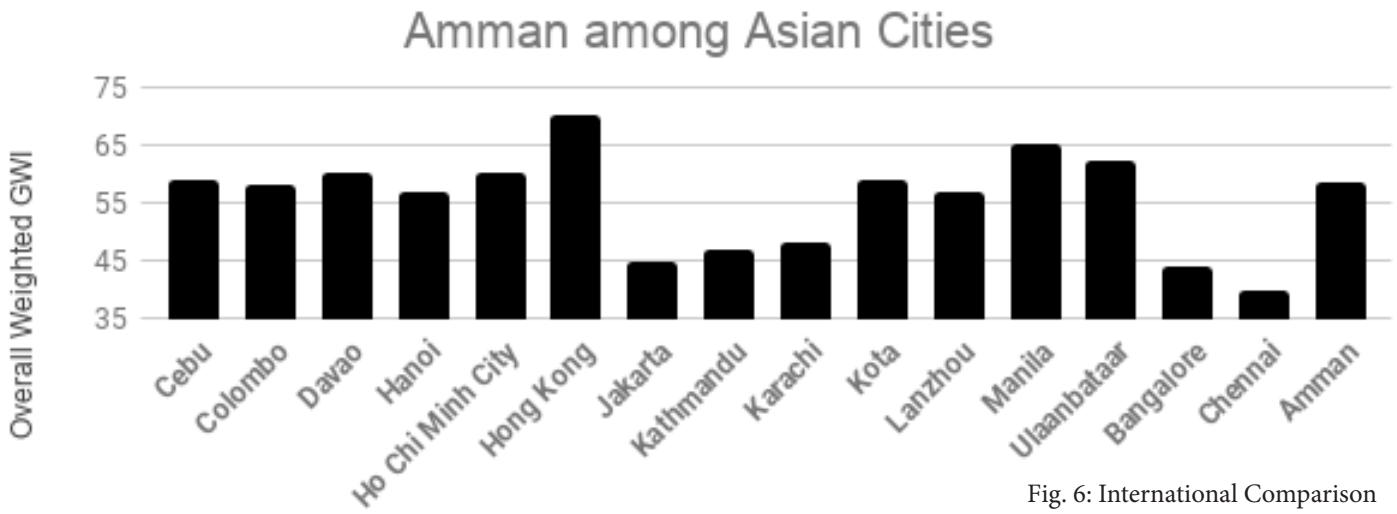

Fig. 6: International Comparison

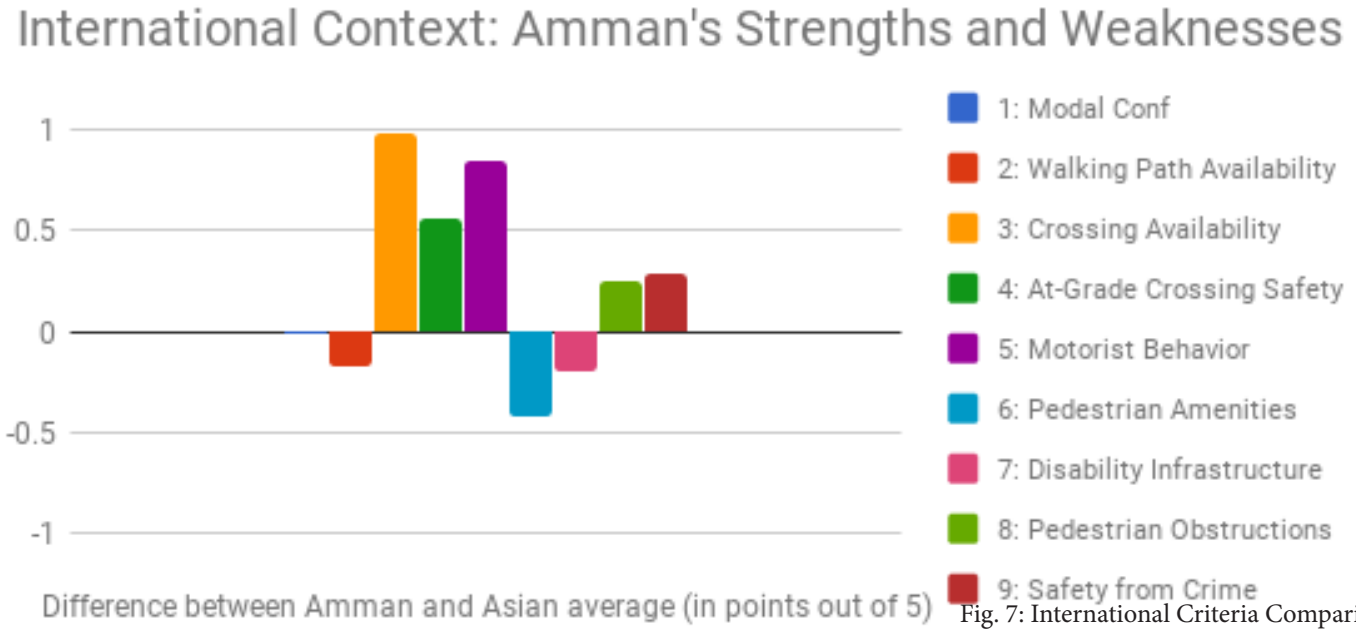

Fig. 7: International Criteria Comparison

structure.

We notice (cf fig. 4, fig.5) that a number of the neighborhoods that score most highly in these criteria related to pedestrian street-crossing are Amman's older, more central neighborhoods: areas like Luweibdeh, Ras al-Ain, Al-Hashemi Al-Shameli, and the Downtown. Many of these neighborhoods are characterized by narrow, crowded streets that, although they may lack sidewalks altogether, benefit from greatly restricted vehicle speeds. In these neighborhoods pedestrians and automobiles may safely share public space. They could be likened to a naturally-occuring version of the Dutch woonerf (shared street).

We also notice that Amman scores poorly in general with regards to modal conflict. This is the flipside of the coin of the previous observation: though in some cases it may be safe for pedestrians and vehicles to share the street, it is not always so. We notice that Amman's neighborhoods that are more modern, western (culturally and geographically), and host wider streets tend to score particularly poorly on modal conflict and walking path availability: neighborhoods like North Station, University of Jordan, and Sweifieh. In these cases, we conclude that the provision of safe, separated walking paths is a high priority for pedestrian safety - or that, in some cases, the street could be radically narrowed to create an environment more like that found in the older neighborhoods.

It is necessary to remember, when discussing international comparisons, that the GWI is a highly subjective assessment. This subjectivity is necessary and productive when discussing a practice as culturally determined as is pedestrian activity - without subjectivity, our standards will be as inhuman, and as ineffective, as the Level of Service metrics of the late-twentieth-century United States (Lo, 2009). At the same time as enabling direct international comparison between cities, though, this subjectivity complicates such comparison. Amman may score more highly on crossing availability than Manila, but that does not necessarily imply that a foreign third-party observer would find there to be more available street crossings in Amman. It means only that Ammanis find there to be more available crossings in Amman, based on the GWI's sparse instructions, than Manilans find to be present in Manila.

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