

# Applying the 15-Minute City Concept in the Ramallah Metropolitan Area: Opportunities and Challenges"

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**Abstract—** The 15-Minute City concept promotes access to daily services within a 15-minute walk or bike ride to reduce car dependence and environmental impact. This study applies the model to Ramallah Metropolitan Area using GIS to analyze service distribution and community needs. Surveys captured residents' perspectives, and interventions were proposed to address service gaps and improve public transport. GIS findings guided equitable service placement across neighborhoods.

This concept addresses urban sprawl, reduces car dependency, and promotes sustainability and quality of life (Khavarian-Garmsir et al., 2023b; Balletto et al., 2021).

Originally proposed to reduce greenhouse gas emissions, the model gained momentum as a post-COVID-19 recovery strategy, highlighting the importance of localized access to services for health resilience and economic recovery (Khavarian-Garmsir et al., 2023a; Moreno et al., 2021).

## I. INTRODUCTION

The Ramallah Metropolitan Area (RMA), including Ramallah, Al-Bireh, and Beitunya, lies in the central West Bank on the watershed between the Jordan Valley and the coastal plain. It spans 855.2 km<sup>2</sup> with around 358,902 residents (PCBS, 2022) and serves as the de facto administrative capital of the Palestinian Authority, holding key cultural, political, and economic roles (Thawaba & Natour, 2021) (see Figure 1).

Recently, Ramallah, Al-Bireh, and Beitunya face growing traffic and environmental problems due to population growth, increased car use, and lack of public transport. Political restrictions and movement closures worsen these issues, impacting sustainability and quality of life. These challenges call for innovative urban planning like the 15-Minute City concept, which focuses on accessibility and sustainability.

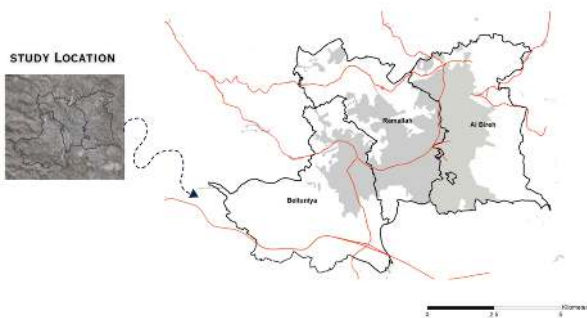


Figure 1: The Ramallah Metropolitan Area (RMA) Source: (MOLG,2019)

### 1- OVERVIEW OF THE 15-MINUTE CITY CONCEPT

The 15-Minute City is an innovative urban planning model advocating for human-centered design, where essential daily services such as housing, work, education, healthcare, and recreation are accessible within a 15-minute walk or bike ride.

#### 1.1 Principles

Four main principles underpin the 15-Minute City framework:

- **Proximity:** Ensuring services are spatially and temporally close to residents (Moreno, 2024).
- **Density:** Achieving sufficient population density to sustain local businesses and public transport (Khavarian-Garmsir et al., 2023a).
- **Diversity:** Integrating mixed land uses (residential, commercial, recreational) to foster vibrant neighborhoods (Fior et al., 2023).
- **Digitalization:** Leveraging technology to improve accessibility and service delivery regardless of socio-economic status (Pozoukidou & Angelidou, 2022).

#### 1.2 Benefits

Implementing the 15-Minute City enhances:

- **Quality of Life:** Shorter commutes free time for leisure and community engagement (Moreno, 2024).
- **Social Equity:** Equal access to services for all residents (Pozoukidou & Angelidou, 2022).
- **Environmental Sustainability:** Reduced emissions from decreased car use (EEA, 2024).
- **Health:** Improved air quality and physical activity reduce disease risks (Khavarian-Garmsir et al., 2023a).
- **Economic Resilience:** Support for local businesses and remote work opportunities (Moreno et al., 2021).
- **Community Bonds:** Enhanced social interaction and belonging (Pozoukidou & Angelidou, 2022).

### 1.3 Challenges

Key challenges include:

- Infrastructure upgrades requiring significant investment (Newman & Kenworthy, 2015).
- Resistance to lifestyle changes favoring vehicle use (Allam et al., 2024).
- Cultural diversity affecting acceptance of mixed-use developments.
- Need for tailored approaches respecting local context and ensuring equity (Moreno et al., 2021).

### 2- 15 Minute City: Post-COVID Recovery Strategy

The 15-Minute City gained prominence after COVID-19 as a strategy to improve urban resilience and health. It promotes access to essential services—like healthcare, shops, and green spaces—within walking or cycling distance. This model helps reduce car dependency, supports physical and mental well-being, and strengthens local economies during crisis recovery.

### 3- Approaches for Applying the 15-Minute City Concept

Implementing the 15-Minute City requires a structured approach focusing on accessibility, sustainability, and efficient land use. This starts with site analysis—assessing topography, land use, and mobility infrastructure (Moreno et al., 2021; Rhoads et al., 2023). Evaluating access to essential services like healthcare, education, and recreation is key (Jiang et al., 2022), along with community engagement to tailor solutions to local needs (Shoina et al., 2024). Urban planners should promote mixed-use development, green infrastructure, and supportive zoning (Gehl, 2022; Allam et al., 2022c).

Previous studies used spatial analysis, GIS mapping, and participatory methods to assess service proximity and livability (Barbara et al., 2021; Jiang et al., 2022; Pozoukidou & Angelidou, 2022). Given the RMA's challenges—car dependence, poor public transport, and rapid growth—this study explores how the 15-Minute City model can guide sustainable urban development in a complex, constrained context.

## II. METHODOLOGY

This research adopts a structured approach to apply the 15-Minute City principles to the Ramallah Metropolitan Area (RMA). It involves surveying residents to identify service needs, assessing existing services, and detecting gaps. The methodology, illustrated in Figure 3, supports a contextual and effective application of the concept.

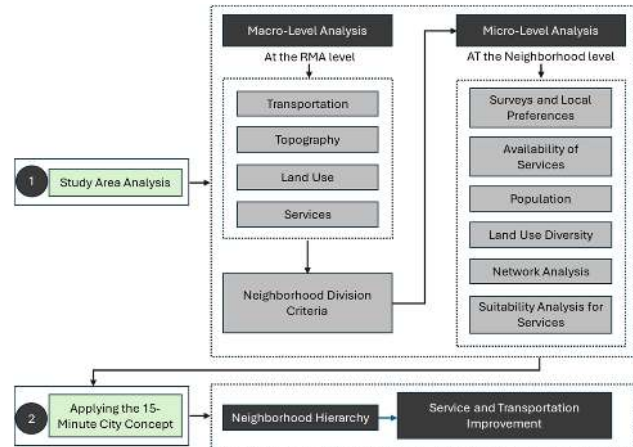


Figure 2: The methodology flowchart

#### 1) Study Area Analysis

The methodology involved a two-level analysis of the Ramallah Metropolitan Area to assess its needs and suitability for implementing the 15-Minute City concept. The **macro-level** analysis addressed topography, land use, main road networks, and existing services, followed by dividing the area into neighborhoods. The **macro-level** analysis addressed topography, land use, main road networks, and existing services, followed by dividing the area into neighborhoods. The **micro-level** focused on detailed neighborhood conditions, including service gaps, transportation, population, and resident preferences, supported by surveys and field interviews.

##### 1.1. Macro-Level Analysis

#### Transportation

The transportation network was classified into main, local, and internal streets to understand mobility and inter-neighborhood connectivity.

#### Topography

A topographic study using 5-meter contour intervals identified elevation challenges that impact accessibility, informing slope-sensitive planning.

#### Land Use

Land-use regulations and categories (e.g., residential, mixed-use, public buildings, commercial zones) were assessed for compatibility with the 15-Minute City model.

#### Services

Nine essential services were mapped and verified via Google Maps and field visits, reflecting both practical needs and local socio-cultural priorities.

#### Neighborhood Division Criteria

The area was divided into 14 neighborhoods using:

1. Maps of well-known streets from surveys;
2. Merging of municipal quarters with shared boundaries;

3. Resident perceptions collected through surveys;
4. Analysis of overlaps between street layouts and municipal zones;
5. Clear boundary definitions based on major streets.

## 1.2. Micro-Level Analysis

### Surveys and Local Preferences

A structured survey (100 responses) captured demographic data and service needs across age, gender, and location. Field interviews further explored resident satisfaction, mobility, and inter-neighborhood service use.

### Availability of Services

Using survey and field data, service availability was analyzed across neighborhoods to detect spatial gaps in essential service distribution.

### Population Estimation

Population was estimated using building counts, floor numbers, and an average household size of five, due to the lack of detailed official data.

### Land Use Diversity

Neighborhood-level land use diversity was assessed to understand its impact on equitable service distribution and spatial functionality.

### Network Analysis

Using GIS, walking accessibility was evaluated through 15-minute buffers. Naismith's Rule was applied in a selected case study to adjust walking distances based on terrain slope, providing slope-sensitive service coverage analysis.

### Suitability Analysis for Services

To identify optimal locations for services within a 15-minute walk, suitability analysis considered:

1. **Proximity to residents**
2. **Proximity to streets**
3. **Compatibility with existing services**
4. **Conformance to planning standards**, including Saudi standards due to the absence of local equivalents.

## 2) Applying the 15-Minute City Concept

Based on the analysis findings, this stage aimed to address service gaps by proposing optimal locations for new services and enhancing integration with existing ones. Site selection prioritized proximity to residential areas, accessibility via the street network, and compatibility with surrounding services. Public transport routes were adjusted to improve connectivity and promote walkability, with a focus on sustainability, reduced travel distances, and eco-friendly mobility options.

## III. RESULTS:

### A. Macro-Level Analysis

The macro-level analysis identified key challenges in the Ramallah Metropolitan Area (RMA), including uneven service distribution, varied land uses, and difficult access due to hilly topography. The analysis covered transportation, topography, services, land use, and neighborhood division:

- **Transportation:** *Neighborhoods are well connected, but public transportation is mostly limited to main roads. Formal transit stations are located in the city center, while many neighborhoods rely on informal stops created by residents. These informal stations reflect local habits and will be considered in future planning. (See Figure 3)*
- **Topography:** *The area's varied terrain affects accessibility. Contour lines at 5-meter intervals show significant elevation changes, which must be considered when planning service locations. (See Figures 4 and 5)*
- **Services:** *Services such as schools, parks, health centers, and markets were mapped and categorized into ten main types. The analysis showed uneven distribution across neighborhoods. (See Figure 6)*
- **Land Use:** *Residential areas dominate, with commercial activities clustered along main roads. Public spaces and green areas are unevenly distributed, and many neighborhoods lack sufficient access to parks. (See Figure 7)*
- **Neighborhood Division:** *The area was divided into 15 neighborhoods based on streets, municipal data, and residents' input. This helped assess service coverage more precisely and highlight gaps in certain areas. (See Figures 8 and 9)*

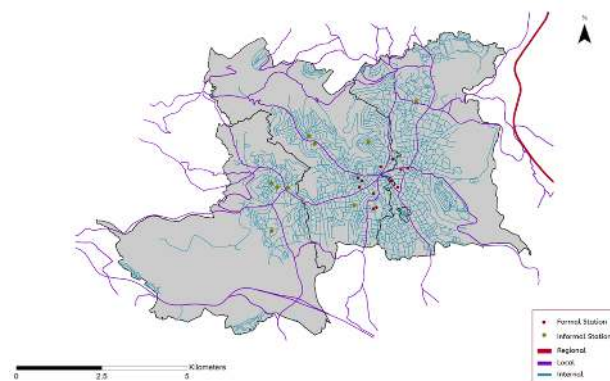


Figure 3: Transportation analysis of RMA

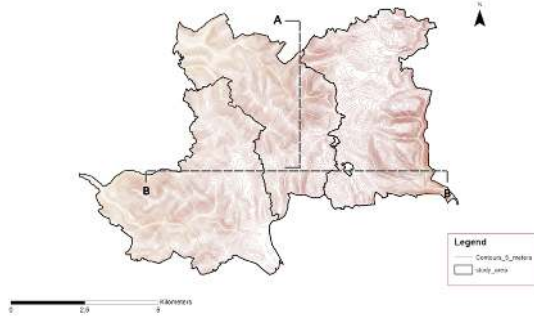
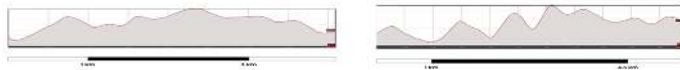


Figure 4: Topography in study area



Section A,A

Section B,B

Figure 5: Sections of the study area

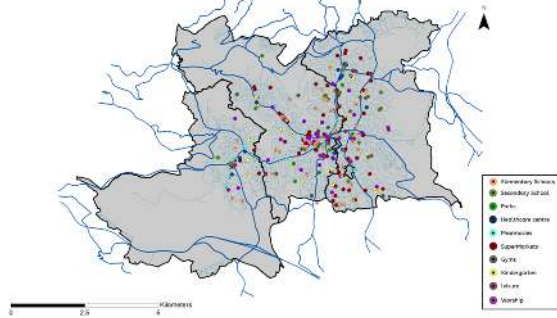


Figure 6: The locations of the existing services in the study area

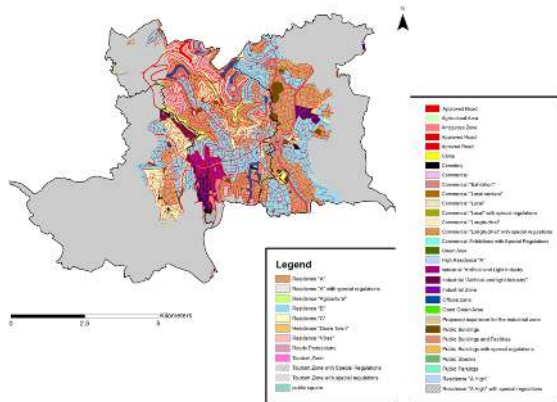


Figure 7: Land use in study area

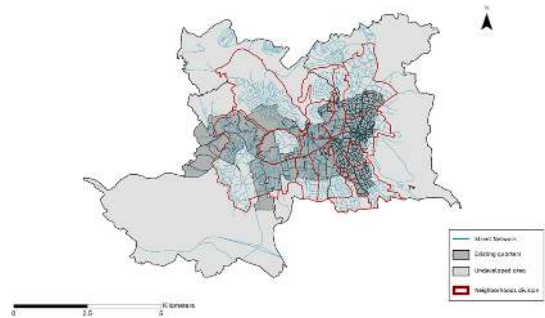


Figure 8: Established Neighborhood Boundaries in Relation to Street Networks, Existing Quarters, and Undeveloped Areas in the RMA.

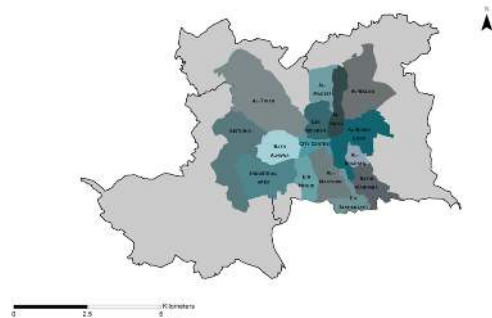


Figure 9: Neighborhood Divisions and their names.

## B. Micro-Level Analysis

### 1) survey Results and Resident Needs

Survey responses highlighted the top nine essential services needed by residents: places of worship, pharmacies, parks, health centers, schools (elementary and secondary), nurseries, supermarkets, and leisure centers. Many residents reported lacking key services in their neighborhoods, forcing them to travel to nearby areas. People also raised concerns about unsafe walking and biking conditions, and the lack of public transportation. These results support the need for applying the 15-Minute City model to improve service access, street safety, and transport.

### 2) Service Availability

Table 1 shows clear gaps in service coverage. Al-Tireh, the City Center, and Beitunia are the best served, while Em Alsharayet and the Industrial Area have the poorest access to essential services.

Table 1: The available services in the neighborhoods

| Neighbor<br>hood | Service  |          |      |        |            |           |         |             |         | # |
|------------------|----------|----------|------|--------|------------|-----------|---------|-------------|---------|---|
|                  | Worships | Pharmacy | Park | Health | Elementary | Secondary | Nursery | Supermarket | Leisure |   |
| Al-Tireh         | ✓        | ✓        | ✓    | ✓      | ✓          | ✓         | ✓       | ✓           | ✓       | 9 |
| Batin Alhawa     | ✓        | ✓        |      |        | ✓          |           |         | ✓           |         | 4 |
| Ein Minjid       | ✓        |          | ✓    |        | ✓          |           |         |             |         | 3 |
| City Center      | ✓        | ✓        | ✓    | ✓      | ✓          | ✓         | ✓       | ✓           | ✓       | 9 |
| Al-Masyoon       | ✓        |          | ✓    |        | ✓          |           | ✓       | ✓           | ✓       | 6 |
| Em Alsharayet    |          |          |      |        |            |           | ✓       | ✓           |         | 2 |
| Satih Marhaba    |          | ✓        |      |        |            |           | ✓       | ✓           |         | 3 |
| Al-Sharafa       | ✓        |          |      |        | ✓          | ✓         | ✓       | ✓           |         | 5 |
| Al-Baloo         | ✓        |          |      | ✓      | ✓          | ✓         | ✓       | ✓           | ✓       | 7 |
| Al-Bireh Core    | ✓        | ✓        | ✓    | ✓      | ✓          | ✓         | ✓       | ✓           | ✓       | 8 |
| Al-Irsal         | ✓        | ✓        | ✓    | ✓      | ✓          | ✓         | ✓       | ✓           | ✓       | 8 |
| Al Masayef       | ✓        | ✓        | ✓    | ✓      | ✓          | ✓         | ✓       | ✓           | ✓       | 8 |
| Ein Musbah       | ✓        |          |      |        | ✓          |           | ✓       | ✓           | ✓       | 5 |
| Beitunia         | ✓        | ✓        | ✓    | ✓      | ✓          | ✓         | ✓       | ✓           | ✓       | 9 |
| Industrial Area  |          |          |      |        |            |           | ✓       | ✓           |         | 2 |

3) Population and Density

Beitunia, Al-Tira, Al-Bireh, and Al-Masyoon have the largest populations. Al-Sharafa, Em Alsharayet, and Al-Bireh show the highest population densities. High population and density increase the need for more and better services.

Table 2: Population and Population Density of the Neighborhoods

| Neighborhood  | Population | Population Density (people/km <sup>2</sup> ) |
|---------------|------------|--|
| Al-Tireh      | 40,400     | 8623   |
| Batin Alhawa  | 9,940      | 7451   |
| Ein Minjid    | 21,740     | 24236  |
| City Center   | 13,100     | 26465  |
| Al-Masyoon    | 46,200     | 30098  |
| Em Alsharayet | 31,300     | 38690  |
| Satih Marhaba | 22,850     | 18853  |

|                 |        |       |
|-----------------|--------|-------|
| Al-Sharafa      | 17,361 | 40703 |
| Al-Baloo        | 31,650 | 11771 |
| Al-Bireh Core   | 65,450 | 30037 |
| Al-Irsal        | 24,215 | 23018 |
| Al Masayef      | 17,900 | 17179 |
| Ein Musbah      | 23,180 | 23629 |
| Beitunia        | 50,250 | 15552 |
| Industrial Area | 13,500 | 6241  |

4) Land Use Diversity

Figure 10 shows that neighborhoods like Al-Tira and Beitunia have a good mix of land uses, supporting diverse services. In contrast, areas like the Industrial Zone, Sateh Marhaba, and Al-Sharafa have limited land use variety, making it harder to meet local needs.

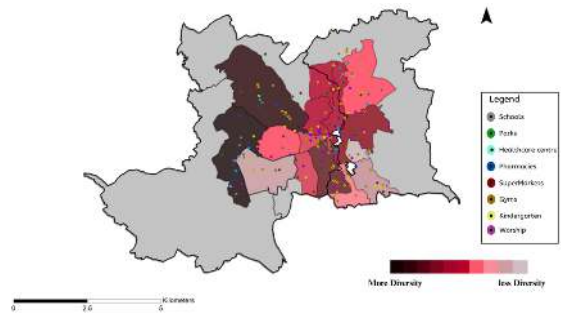
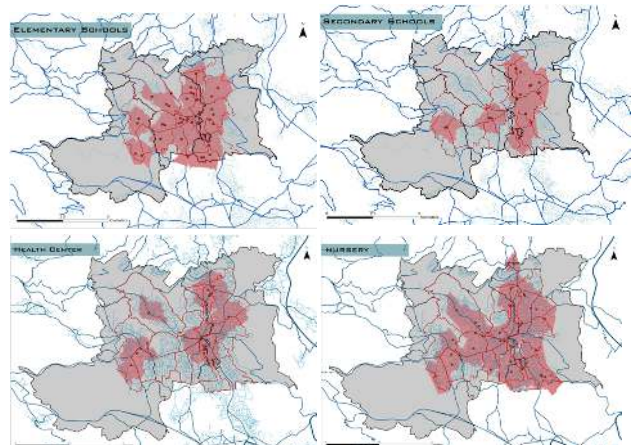


Figure 10: Land use diversity in neighborhoods.

5) Network Accessibility

Using 15-minute walking buffers (Figure 11), the study found that nurseries and supermarkets are accessible in many neighborhoods, but parks, healthcare centers, and secondary schools have limited reach. Figure 12 combines all services and shows areas that meet the 15-minute city standard. Some neighborhoods, like the City Center and Al-Irsal, are well-served, but others like Ein Minjid, Satih Marhaba, Al-Masayef, the Industrial Area, and Em Alsharayet fall short.



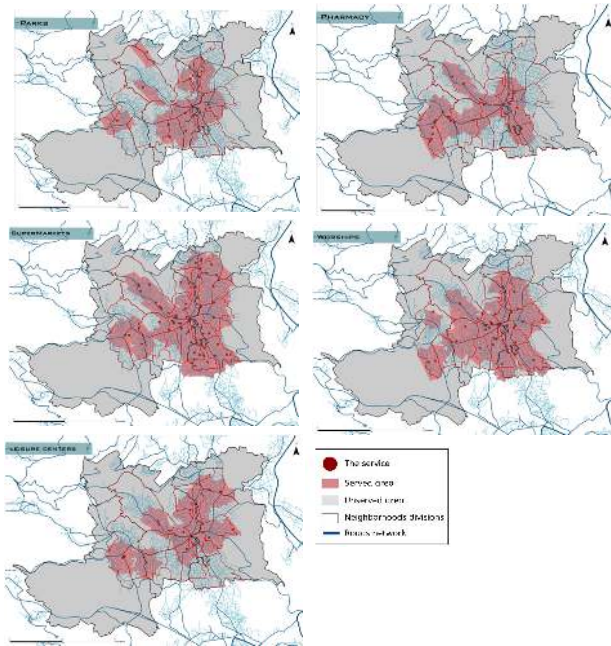


Figure 11: Service Coverage Buffers Based on Network Analysis in the RMA

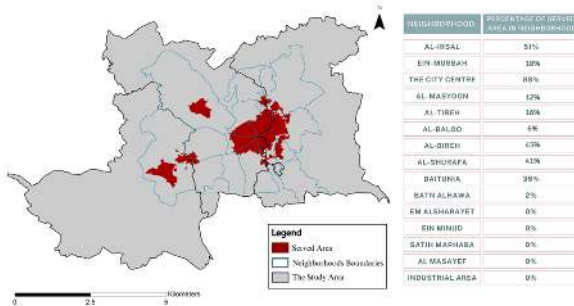


Figure 12: Intersection of 15-Minute Service Buffers in the RMA

### 6) Topography and Walking Access

Steep slopes reduce walking access to services. A case study in Al-Tireh (Figure 13) showed that accounting for terrain significantly reduces service coverage. According to slope maps (Figure 14), most neighborhoods have gentle terrain, except Al-Tireh, Al-Masyoon, and Ein Musbah, where steep slopes impact accessibility.

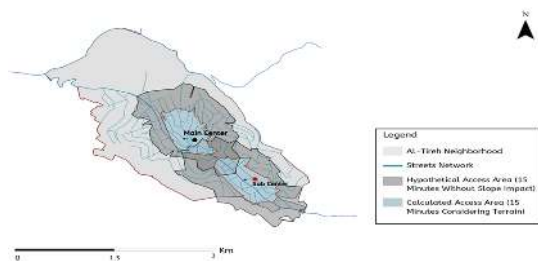


Figure 13: RMA slope map

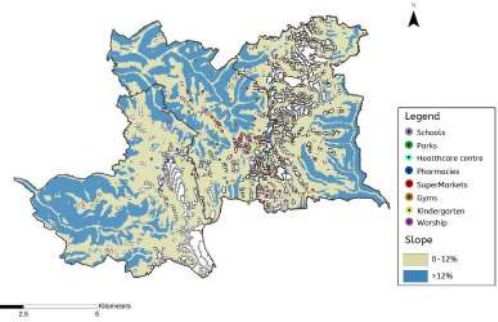
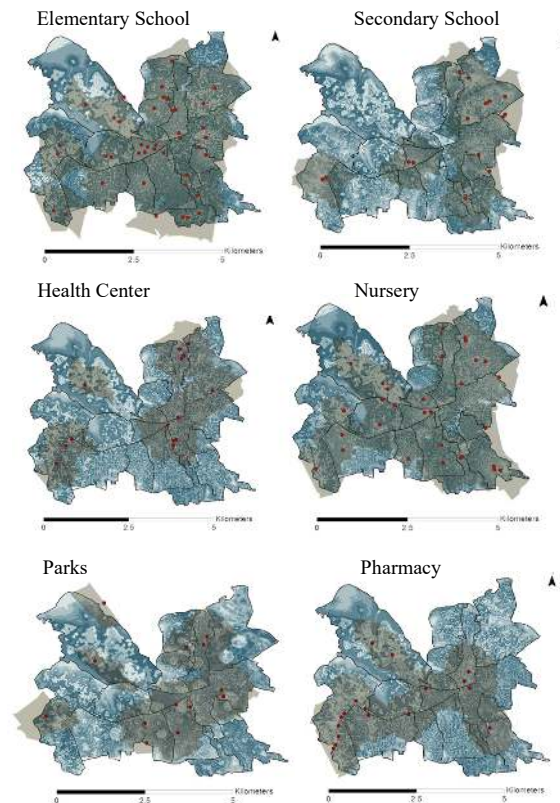


Figure 14: Slope map of the study area

### 7) Suitability for New Services

Suitability analysis identified the best areas for placing new services. Underserved areas like Batn Al-Hawa and Al-Baloo need targeted additions. Dense areas like Al-Tireh and Beitunia can support more services. New services should avoid overlapping with well-served zones like Al-Irsal. Figure 15 combines existing service coverage with suitability results, showing optimal areas for service placement using gradient maps. For example, the Western neighborhood lacks places of worship, and light blue areas on the map suggest the best new locations.



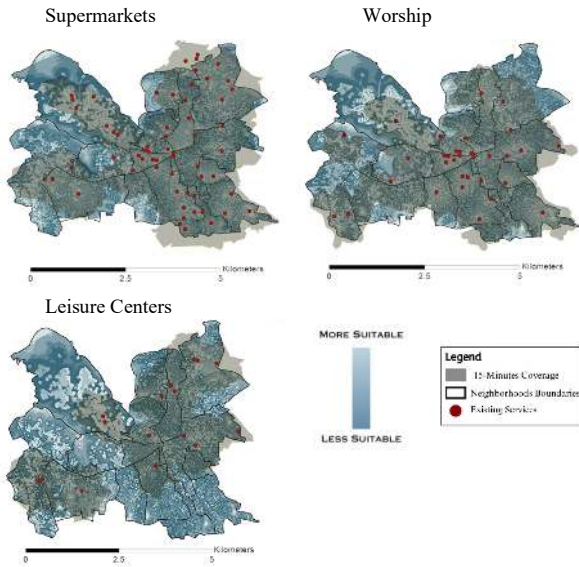


Figure 15: Suitability analysis for services in the RMA

### Applying the 15-Minute Concept

Transforming the RMA into a 15-Minute City was achieved by applying the 15-Minute City principles to each of its neighborhoods, as presented in the conceptual plan in Figure 16. This transformation seeks to achieve self-sufficiency in services by identifying and filling gaps, ensuring that residents have access to essential amenities within a reasonable distance.

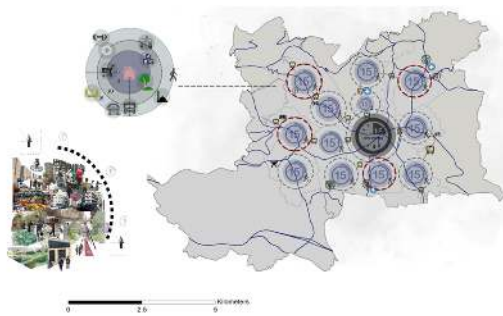


Figure 16: The conceptual plan of the RMA 15-Minute City

### Neighborhood Hierarchy

Neighborhoods were divided into two levels based on their size and population (Figure 17):

**Level 1:** Includes larger and more populated neighborhoods like Al-Tira, Beitunia, and Al-Balou. These areas will receive all nine essential services, including healthcare centers.

**Level 2:** Covers the remaining, less dense neighborhoods. These areas will also receive essential services, but not

dedicated healthcare centers. Instead, residents can access healthcare in nearby Level 1 areas.

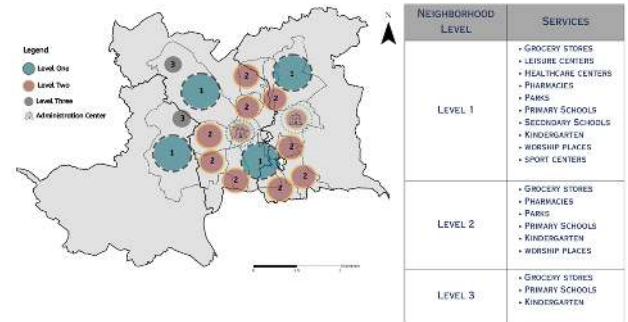


Figure 17: Neighborhood Hierarchy Map.

### Improving Services and Transportation

Missing services were mapped and placed in the most suitable locations based on the analysis. A new network analysis showed much better service coverage compared to current conditions (Figure 18).

For transportation, at least one new bus stop was added in each neighborhood (Figure 19) to improve public transport and reduce car use. Carpooling was also promoted to support sustainability.

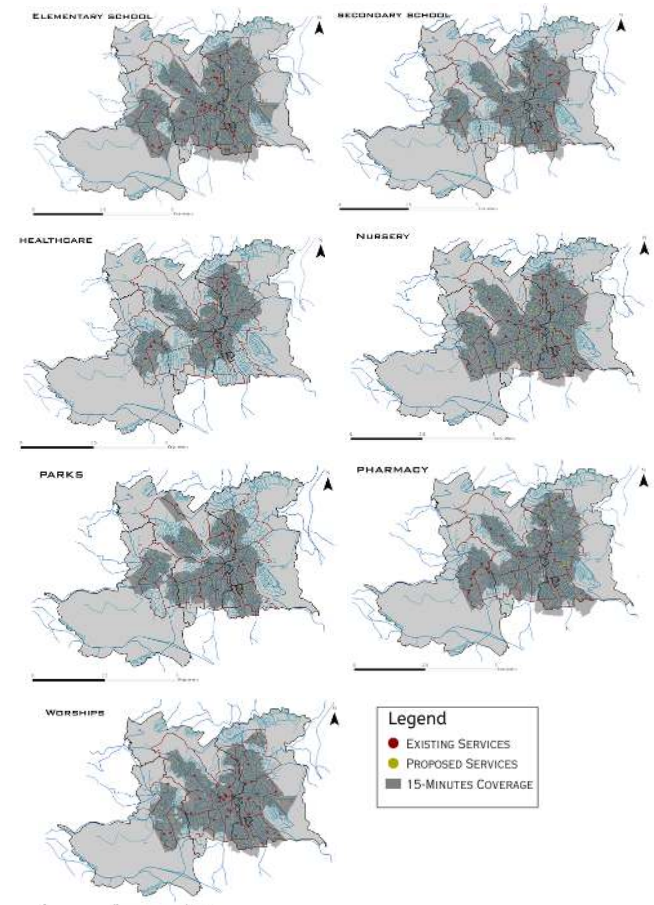


Figure 18: Application of Services in the Study Area.

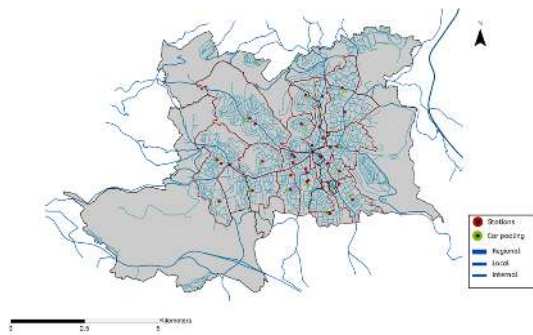


Figure 19: Transportation development map.

- **Achieving Self-Sufficiency**

A full map of all existing and proposed services (Figure 20) shows that most neighborhoods are now self-sufficient, with access to all essential services nearby.

To better visualize this transformation, a 3D model of Al-Tireh neighborhood was created (Figure 21). It shows how the new services fit into the existing layout, considering topography and street access.

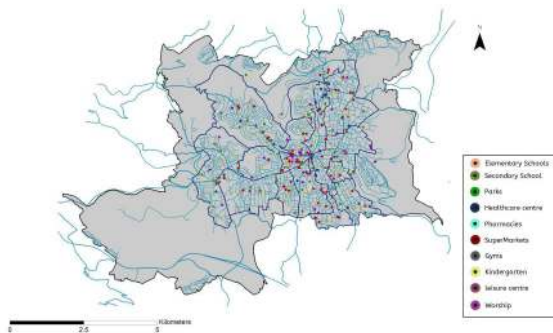


Figure 20: Comprehensive Master Plan: Service and Transportation Enhancements

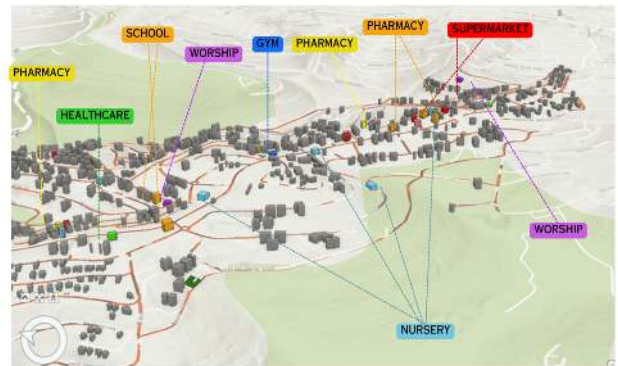
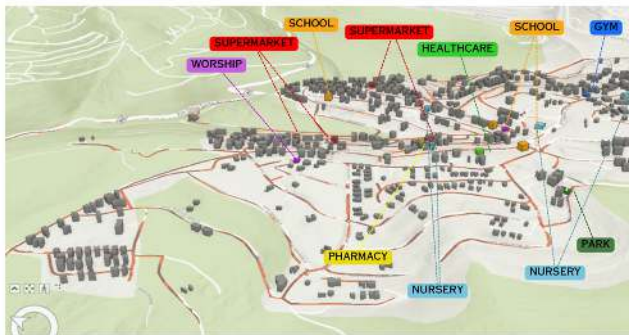


Figure 21: 3D map of services in Al-Tireh Neighborhood

#### IV. Discussion

This study provides valuable insights into how the 15-Minute City concept can be applied to the Ramallah Metropolitan Area (RMA). It highlights both the strengths and limitations of the area's current urban structure and evaluates how well the principles of the 15-Minute City—Density, Proximity, Diversity, and Digitalization—are being met.

- **Service Gaps and Accessibility Issues**

The analysis shows an unequal distribution of services across the RMA. Some areas, like the City Center and Al-Irsal, are well-served, while others—such as Ein Minjid and Sateh Marhaba—lack key services. The region's varied topography also makes accessibility more difficult, especially in hilly neighborhoods. Buffer maps show that services like parks and healthcare are not easily reachable in several areas.

- **Application of the 15-Minute City Principles:**

**Density:**

Densely populated neighborhoods like Al-Bireh and Beitunia can support a wider range of services. In contrast, low-density areas (e.g., the Industrial Zone and Batn Al-Hawa) make service provision more challenging. The proposed plan considers both population size and density to ensure fair service distribution.

**Proximity:**

New service placements based on suitability and network analysis improved accessibility. However, steep terrain in some areas still limits walkability, suggesting the need for better transit options or service locations along flatter roads.

**Diversity:**

Some neighborhoods (like Al-Tira and Beitunia) show good land use diversity, while others lack variety in services. The proposed plan helps ensure that each neighborhood gets all essential services to become

more self-sufficient.

### **Digitalization:**

While not directly covered in this study, digital tools—like real-time bus tracking or service locators—can improve accessibility. Future planning should integrate digital solutions into the 15-Minute City framework.

- **Enhancements in Service and Transportation Planning**

Classifying neighborhoods into two levels allowed for fair and efficient service distribution.

**Level 1** neighborhoods, with larger populations and higher density, were prioritized for full access to essential services.

**Level 2** neighborhoods, with lower densities, benefit from shared access to services in nearby areas.

Transportation improvements included adding at least one bus stop in each neighborhood and promoting carpooling. These steps reduce reliance on private vehicles, support sustainability, and align with the 15-Minute City's goals of accessibility and environmental responsibility.

- **Implications for Practice**

This study offers practical strategies to support the 15-Minute City in the RMA:

**Targeted Service Placement:** Focus on underserved areas like Batn Al-Hawa and Sateh Marhaba to ensure equal access.

**Supportive Zoning Policies:** Encourage mixed-use development in areas lacking service diversity.

**Topography-Responsive Design:** Account for terrain differences when locating services, especially in sloped areas.

- **Limitations and Future Research**

While the study provides a detailed overview of service access, some limitations remain.

-The analysis assumed a uniform slope, though actual topography varies and can affect walking distances. Areas like Al-Tireh, with slopes over 12%, need more accurate modeling.

-The role of digitalization was not deeply addressed. Tools like real-time public transit tracking and digital service maps could enhance access and planning.

Future research should explore:

- How digital tools can support the 15-Minute City concept.
- The long-term sustainability and effectiveness of the proposed interventions.

## **V. CONCLUSION**

The findings of this research provide a comprehensive understanding of the potential for applying the 15-Minute City concept in the Ramallah Metropolitan Area (RMA), as well as the challenges associated with its implementation. The study highlights the importance of conducting an integrated and detailed analysis to accurately assess the area's characteristics and the necessity of community involvement in identifying residents' needs, accessibility levels, and existing service gaps.

The research follows a structured and clear methodology that can be applied to studying the feasibility of the 15-Minute City concept in other areas. However, certain limitations remain, such as the need to incorporate terrain inclination when calculating walking distances and the importance of studying digital infrastructure to evaluate its role in service accessibility.

The study also reveals significant disparities in service distribution across neighborhoods, emphasizing the need for strategic planning interventions. Ultimately, implementing the 15-Minute City model presents an effective solution to many of the urban challenges in the region, promoting equitable service access, sustainable mobility, and improved urban living conditions.

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