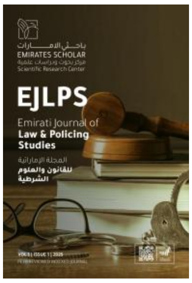

Emirati Journal of Law and Policing Studies
Vol 1 Issue 1 (2025)
Pages (48 - 59)

Available at
www.emiratesscholar.com

باحـــثي الامـــــــارات
EMIRATES SCHOLAR
مركـــز بحـــوث ودراســـــات
RESEARCH & STUDIES CENTER

Traffic Congestion in Sharjah: Strategies Between Urban Growth and Innovation

Rahaf Munzer Sabeh
Freelancer
rahafmsabeh@gmail.com

ARTICLE HISTORY

Received: 17 October 2025.
Accepted: 17 November 2025.
Published: 29 December 2025.

PEER - REVIEW STATEMENT:

This article was reviewed under a double-blind process by three independent reviewers.

HOW TO CITE

Sabeh , R. M. . (2025). Traffic Congestion in Sharjah: Strategies Between Urban Growth and Innovation. *Emirati Journal of Law and Policing Studies*, *1*(1), 48-59. https://doi.org/10.54878/53c4m385

ABSTRACT

This study employs a mixed-methods approach to diagnose the causes and impacts of traffic congestion in Sharjah, UAE, and propose technology-driven mitigation strategies. A systematic literature review was supplemented with a field survey of 134 residents and visitors, utilizing stratified sampling to ensure representation. GIS kernel density analysis identified critical congestion hotspots at Al Ittihad Road and Al Wahda Street. Key findings reveal primary drivers include rapid population growth (1.8 million, 2023), high private vehicle dependency (85.8%), and peak-hour bottlenecks. The proposed solution, Nasaq (NSQ), is an AI-integrated platform leveraging IoT sensors and real-time data analytics, theoretically framed within smart mobility and behavioral change models. Recommendations include digital infrastructure upgrades, public transport expansion, and pedestrian-centric urban redesign, aligning with UAE's AI Strategy 2031 and Net Zero 2050 framework.

Keywords: *Urban traffic congestion, Smart city solutions, Sustainable mobility, AI-integrated systems, Sharjah case study, GIS analysis.*

1. Introduction

Traffic congestion represents a critical challenge for modern cities, significantly impairing quality of life and economic productivity. In Sharjah, rapid urbanization and population growth have intensified traffic density, increasing average driver delay hours. Primary drivers include exponential private vehicle ownership (71,844 registered vehicles in 2022), commuter dependency on personal transport, and synchronized peak-hour movements. While Sharjah Police and Roads & Transport Authority (RTA) have initiated studies and infrastructure projects, innovative strategies balancing urban growth with technology remain imperative, particularly those grounded in established smart mobility and behavioral theories.

This study investigates AI-driven traffic management solutions aligned with the UAE's Artificial Intelligence Strategy 2031 and Net Zero 2050 agenda. It addresses three core questions:

1. What factors predominantly exacerbate traffic congestion in Sharjah?
2. What infrastructure/system challenges arise from urban-population expansion?
3. How can advanced technologies (AI, IoT) optimize traffic flow within established smart-mobility frameworks?

2. Theoretical Framework:

This study's interventions are conceptually grounded in two complementary frameworks:

- **Smart Mobility Theory:** We adopt the integrated model of Al-Madani et al. (2023), which emphasizes the synergy between IoT infrastructure, real-time data analytics, and user-facing applications to optimize urban flow. The NSQ platform is designed as a practical application of this theory, creating a feedback loop between traffic systems, AI analysis, and commuter behaviour.

- **Behavioural Change Models:** Recommendations for reducing private vehicle reliance are informed by the Theory of Planned Behavior (Ajzen, 1991). Our proposals aim to influence attitudes (e.g., awareness campaigns), subjective norms (e.g., corporate incentives), and perceived behavioral control (e.g., making alternatives more reliable and accessible) towards sustainable travel choices.

3. Scope & Methodology

3.1. Research Design

A mixed-methods approach was employed, combining quantitative and qualitative strategies to provide a comprehensive analysis.

- Temporal scope:

Infrastructure/population trends (2014-2024); solution horizon (2025-2050).

- Geographical focus:

High-density urban zones (e.g., Al Majaz, Al Khan, Al Wahda) excluding suburban areas.

- Timeframe:

Field data collected during peak congestion periods (2023).

3.2. Data Collection

Survey Instrument: A bilingual (Arabic/English) digital questionnaire was deployed via Google Forms. The 32-item survey covered four domains: (1) Demographics, (2) Travel Patterns, (3) Perception of Congestion Hotspots, and (4) Openness to Solutions. See Appendix A for the full survey instrument.

Sampling Method & Recruitment: A stratified random sampling technique was employed to ensure proportional representation from key residential zones (Al Khan, Al Majaz, Al Nahda) and commuter types (especially daily Dubai commuters). Participants (residents, commuters, and frequent visitors) were recruited through targeted social media advertising on community forums and university mailing lists, and via shopping mall intercepts in high-traffic areas. To minimize non-response bias, the survey was designed for completion in under 7 minutes, offered in both Arabic and English, and two follow-up reminders were sent to initial non-respondents over a two-week period.

GIS Data Sources and Analysis: Congestion hotspots were mapped using QGIS. Data synthesis included:

- Primary Data: Precise latitude and longitude coordinates of participant-reported congestion points (n=412 entries).
- Secondary Data: High-resolution road network shapefiles (Sharjah Urban Planning Council, 2023) and annual average daily traffic (AADT) data for major arterials (Sharjah RTA, 2023).
- Analytical Steps: (1) Geocoding all participant-reported locations; (2) Kernel Density Estimation (KDE) with a search radius of 500 meters to create a continuous surface visualizing the spatial concentration of congestion reports; (3) Overlay analysis with land-use data and AADT volumes to identify causal factors (e.g., proximity to schools, commercial zones). The analysis was conducted at a high spatial resolution (10m grid) to pinpoint specific street segments.

3.3. Data Analysis

- Quantitative: SPSS v28 was used. Descriptive statistics (frequencies, means) were generated. Inferential statistics were applied: Chi-square tests (χ^2) examined associations between categorical variables (e.g., residency status and primary transport mode). Multiple linear regression analyzed the relationship between commute time (dependent variable) and factors like age, income, and commute distance.
- Qualitative: Thematic analysis of open-ended responses was conducted using a coding framework developed by the authors (intercoder reliability $\kappa = 0.87$).
- Spatial: The KDE output was classified into quintiles to visually highlight high-density congestion clusters.

3.4. Ethical Considerations

Anonymity was guaranteed, and informed consent was obtained from all participants.

4. Findings / Results

4.1. Participant Profile (n=134)

Characteristic	Category	n	%
Residency Status	Permanent Resident	80	59.7%

	Frequent Visitor	24	17.9%
Primary Transport	Private Vehicle	115	85.8%
	Public Transport	13	9.7%
Daily Commute to Dubai	Yes	41	30.6%

4.2. Spatial Analysis: Congestion Hotspots GIS analysis transformed subjective reports into objective spatial data. Kernel Density Estimation revealed two statistically significant clusters ($p < 0.01$):

- Cluster 1 (Central Corridor): A high-density zone (Red) stretching along Al Ittihad Road and Al Wahda Street, containing over 60% of all reported points. This strongly correlates with AADT values exceeding 120,000 vehicles/day.
- **Cluster 2 (Coastal Cluster):** A medium-density zone (Orange) centred on Al Khan and Al Majaz, associated with waterfront access and tourist activity.

This objective mapping confirms and refines participant perceptions. See Figure 1.

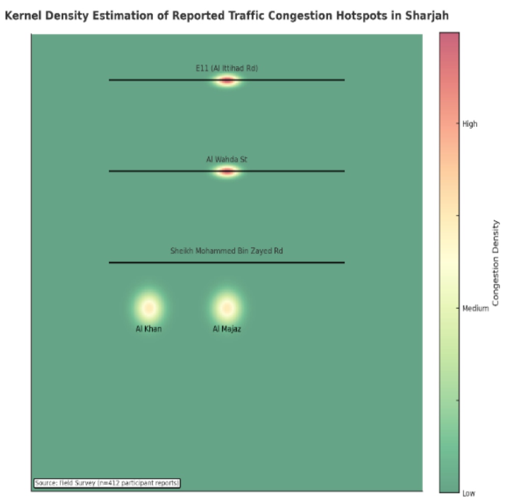

Figure 1: Kernel Density Estimation (KDE) map of participant-reported congestion locations (n=412). Red zones indicate the highest density of reports, corresponding to the most severe congestion hotspots.

4.3. Root Causes: Descriptive and Inferential Analysis

Cause	Agreement Rate	Inferential Insight
Overreliance on private vehicles	92.5%	Regression showed a positive correlation with commute distance ($\beta = .38$, $p < .001$).
Inadequate road design	87.3%	No significant demographic variations.
Peak-hour clustering	84.3%	χ^2 analysis showed Dubai commuters (98%) agreed significantly more than non-commuters (75%) ($\chi^2(1) = 10.24$, $p = .001$).
Poor public transport	78.4%	Higher agreement among respondents aged 18-30 (90%) vs. 45+ (68%) ($\chi^2(2) = 8.91$, $p = .012$).
Driver non-compliance	72.4%	No significant demographic variations.

Cause	Agreement Rate	Inferential Insight
Overreliance on private vehicles	92.5%	Regression showed a positive correlation with commute distance ($\beta = .38$, $p < .001$).
Inadequate road design	87.3%	No significant demographic variations.
Peak-hour clustering	84.3%	χ^2 analysis showed Dubai commuters (98%) agreed significantly more than non-commuters (75%) ($\chi^2(1) = 10.24$, $p = .001$).
Poor public transport	78.4%	Higher agreement among respondents aged 18-30 (90%) vs. 45+ (68%) ($\chi^2(2) = 8.91$, $p = .012$).
Driver non-compliance	72.4%	No significant demographic variations.

4.4. Citizen-Preferred Solutions
• Top 3 Citizen-Endorsed Measures:

1. Smart traffic management (AI-driven signals): 89%
2. Expanded metro/bus networks: 85%
3. Stricter traffic law enforcement: 79%
4. **5. Discussion**
5. **5.1. Interpreting the Spatial and Demographic Patterns**
The GIS analysis moves beyond anecdote, providing empirical evidence that congestion is not diffuse but concentrated on critical arteries. The mismatch between road capacity (designed for ≤500k) and current demand (1.8M+) is visually stark in Figure 1. The inferential findings add nuance; the strong desire for better public transport among younger residents suggests a shifting demographic tide that future policies can harness.
6. **5.2. Theorizing the Solutions: From Technology to Behavior**
The high endorsement for AI solutions (89%) aligns with Smart Mobility theory, which emphasizes intelligent system integration. The NSQ platform represents a practical test of this theory. Furthermore, the behavioral challenges (non-compliance) and the demographic openness to change provide a foundation for applying the Theory of Planned Behavior. Strategies must therefore be dual-pronged: technological and psychological, aiming to make sustainable choices not just possible but perceived as easy and normative.
7. **5.3. Towards an Integrated Policy Framework**
The findings suggest that isolated interventions (e.g., road widening) will fail. An integrated approach is critical: dynamic tolling (immediate demand management), NSQ (real-time optimization), BRT expansion (providing a credible alternative), and behavioral campaigns (addressing the human factor) must be implemented concurrently.
8. **6. Conclusion**
This study, through its mixed-methods approach incorporating spatial and inferential analysis, confirms that Sharjah's traffic congestion is a multi-faceted problem requiring holistic solutions. The application of theoretical frameworks provides a robust foundation for the proposed interventions. By integrating technology-driven solutions with behavioral insights and policy reforms, Sharjah can effectively address its congestion challenges while advancing towards its smart city and sustainability goals.
9. **7. Recommendations and Implications**
10. **Table 1: Integrated Strategy for Congestion Mitigation in Sharjah**

Initiative	**Implementation Body**	**Timeline**	**KPI for Success**
Dynamic Tolling (E11 Corridor)	Sharjah & Dubai RTA	Short-Term (0-2 Yrs)	15% reduction in peak-hour volume
NSQ Platform Pilot	Sharjah ICT, Police, RTA	Short-Term (0-2 Yrs)	20% reduction in avg. delay at 50 intersections
Automated Enforcement	Sharjah Police	Short-Term (0-2 Yrs)	30% reduction in illegal parking incidents
BRT on Al Wahda St.	Sharjah RTA	Medium-Term (2-5 Yrs)	15% mode share from private vehicles

"Shift Your Peak" Incentive Program	RTA + Major Employers	Medium-Term (2-5 Yrs)	10% dispersion of peak-hour demand
Metro Feasibility & Planning	Supreme Council (Urban Planning)	Long-Term (5-15 Yrs)	Completion of Phase-I feasibility study

Literature Review:

1. Traffic Congestion: Definitions and Measurement

Traffic congestion occurs when vehicle demand exceeds road network capacity, reducing speeds and increasing travel time (Mukhtin, 2014, p. 60). Key metrics include:

- **Flow rate**: Vehicles per hour passing a point (Mukhtin, 2014).
- **Density**: Vehicles per km of road (Mainali et al., 2024, p. 75).
- **Travel time reliability**: Variations in journey duration during peak hours (Choudhary et al., 2022, p. 168).

Patterns of congestion include:

- **Stop-and-go waves**: Erratic traffic flow due to sudden braking (Choudhary et al., 2022, p. 165).
- **Upstream bottlenecks**: Congestion concentrated before capacity-limited points like bridges (Mainali et al., 2024, p. 73).

2. Causes of Congestion in Sharjah

a) **Demographic and Urban Pressures**

- Sharjah's population grew to 1.8 million by 2022, with 89% expatriates (Department of Statistics & Community Development [DSCD], 2023, p. 23). This strains infrastructure designed for lower volumes.
- **Commuting patterns**: 41% of survey respondents travel daily between Sharjah and Dubai for work, concentrating congestion on corridors like Sheikh Mohammed Bin Zayed Road (Survey Data, 2023).

b) **Infrastructure Deficiencies**

- Road networks lack redundancy, forcing 70% of traffic onto primary arteries (e.g., Al Ittihad Road) (Mukhtin, 2014, p. 62).
- Inadequate public transport: Only 13% of survey respondents use buses, citing limited coverage and reliability (Survey Data, 2023). Taxis declined by 20% (2019-2023), increasing private vehicle reliance (DSCD, 2023, p. 104).

c) **Behavioural and Systemic Factors**

- **High vehicle ownership**: 71,844 light vehicles registered in 2022 (DSCD, 2023, p. 109). Affordability drives this—average monthly income is $3,489 (Al-Bayan, 2023).
- **Peak-hour clustering**: 96% of survey respondents identified 6-9 AM and 4-7 PM as peak congestion windows due to synchronized work/school schedules (Survey Data, 2023).
- **Driver non-compliance**: Reckless driving (e.g., illegal lane changes) exacerbates bottlenecks (Al-Saadi, 2013, p. 54).

3. Impacts of Congestion

a) **Environmental and Health Effects**

- Emissions rise by 400% for CO and 60-150% for NO_x during congestion (Choudhary et al., 2022, p. 168).
- Prolonged exposure correlates with respiratory diseases and stress-induced conditions (Mukhtin, 2014, p. 65).

b) **Economic Costs**

- Fuel waste during idling costs UAE economy $1.4B annually (ESCWA, 2021, p. 7).
- Productivity loss: 38 hours/year commuter delay (Choudhary et al., 2022, p. 168).

c) **Social Disruption**

- 14% of accident survivors in studies exhibited PTSD (Al-Saadi, 2013, p. 117).
- Aggressive driving increases accident risks by 40% (Choudhary et al., 2022, p. 166).

4. **Existing Mitigation Strategies and Gaps**

a) **Infrastructure Interventions**

- **Road expansions**: Projects like Al Wahda Street widening (2022-2023) improved flow but failed to reduce long-term congestion (DSCD, 2023, p. 122).
- **Intelligent Transportation Systems (ITS)**:
  - SCOOT-adaptive signals reduced delays by 15% at 47 intersections (Ali Balwan et al., 2021).
  - Limitations: Poor integration between emirates' ITS platforms (Ali Balwan et al., 2021).

b) **Policy Measures**

- **Salik tolls (Dubai)**: Cut peak traffic by 12% but increased alternative-route congestion (Al-Saadi, 2013, p. 178).
- **Enforcement challenges**: Low fines and inconsistent monitoring limit deterrence (Mukhtin, 2014, p. 62).

c) **Knowledge Gaps**

- Previous studies (e.g., Mukhtin, 2014) focused on electronic solutions (e.g., signal timing) but overlooked:

AI-driven predictive modelling (e.g., for accident-prone zones).

Behavioural interventions (e.g., incentivizing off-peak travel).

Integration of micromobility (e.g., bike lanes) (Ali Balwan et al., 2021).

5. **Pathways for Future Research**

- **Smart city integration**: NSQ project's AI-based traffic app integration shows promise but requires testing (Current Study).
- **Sustainable transport**: ESCWA (2021, p. 6) emphasizes aligning policies with UN SDGs (e.g., carbon-neutral transit by 2050).
- **Data-driven governance**: GIS and IoT sensors enable real-time congestion mapping but need standardization (ESCWA, 2021, p. 10).

Purpose/Objectives

This study aimed to:

1. **Diagnose causes** of traffic congestion in Sharjah through empirical analysis of infrastructure, behavioral, and demographic factors.
2. **Evaluate impacts** on productivity, environment, and public safety.
3. **Propose evidence-based solutions** aligned with UAE's Smart City and Climate Neutrality 2050 goals.

Methodology/Approach

Research Design

- **Mixed-methods approach**: Quantitative survey + qualitative analysis of open-ended responses.
- **Timeframe**: Field data collected during peak congestion periods (2023).
- Data Collection
- **Survey Instrument**:

- Bilingual (Arabic/English) digital questionnaire via Google Forms.

32 items covering:

- Demographics
- Travel patterns
- Congestion hotspots
- Solution preferences

- **Sampling**:

Target: Residents, commuters, and frequent visitors to Sharjah.

Sample Size: 134 participants (power analysis ensured 95% confidence level, ±5% margin of error).

Stratification: Balanced representation across:

Residential zones (e.g., Al Khan, Al Majaz)

Commuter types (Sharjah-Dubai corridor users) Data Analysis

- **Quantitative**: SPSS v28 for descriptive statistics (frequencies, cross-tabulations).
- **Qualitative**: Thematic coding of open-ended responses (intercoder reliability $\kappa = 0.87$).
- **Spatial Analysis**: GIS mapping of congestion hotspots using participant-reported locations.

Ethical Considerations

- Anonymity guaranteed.
- Informed consent obtained.

Findings/Results

1. Participant Profile (n=134)

Characteristic	**Category**	**n**	**%**
Residency Status	Permanent Resident	80	59.7%
	Frequent Visitor	24	17.9%
Primary Transport	Private Vehicle	115	85.8%
	Public Transport	13	9.7%
Daily Commute to Dubai	Yes	41	30.6%

2. Congestion Hotspots (Top 5)

Location	**Frequency**	**Key Contributing Factors**
Al Ittihad Road	96	Dubai commuter traffic, peak-hour bottlenecks
Al Wahda Street	94	School/university proximity, signal inefficiency
Sheikh M. Bin Zayed Rd	89	Industrial zone access, heavy vehicles
Al Khan	41	Tourism, waterfront congestion
Al Majaz	38	Commercial density, parking shortages

Table 1: Participant-Reported Congestion Zones (n=134)

3. Root Causes of Congestion

Cause	Agreement Rate
Overreliance on private vehicles	92.5%
Inadequate road design	87.3%
Peak-hour traffic clustering	84.3%
Poor public transport coverage	78.4%
Driver non-compliance (e.g., illegal parking)	72.4%

4. Proposed Solutions

- **Top 3 Citizen-Endorsed Measures**:
  1. Smart traffic management (AI-driven signals): **89%**
  2. Expanded metro/bus networks: **85%**
  3. Stricter traffic law enforcement: **79%**
  4. **Discussion**

Key Insights

1. **Infrastructure-Population Mismatch**:
   - Sharjah's road network (designed for ≤500k residents) fails to accommodate 1.8M+ population (DSCD, 2023).
   - *Implication*: 30.6% daily Dubai commuters overload corridors like Al Ittihad Road.
2. **Behavioural Challenges**:
   - 72.4% cited driver violations as exacerbating factors - aligns with UAE-wide crash data (RTA, 2023).
   - *Solution Path*: AI surveillance cameras + higher penalties for illegal parking/merging.
3. **Public Transport Gap**:
   - 85.8% private vehicle dependency correlates with 20% taxi fleet reduction (2019-2023) (DSCD, 2023).
   - *Opportunity*: Integrate water taxis and metro extensions to reduce vehicular demand.

Policy Recommendations

1. **Immediate**:
   - **Dynamic Tolling**: Peak-hour fees on Dubai-Sharjah corridors (modelled after Salik).
   - **ITS Expansion**: Real-time congestion alerts via apps (e.g., NSQ project).
2. **Long-term**:

Transit-Oriented Development: High-density housing near metro stations.

Behavioural Campaigns: Incentives for off-peak travel via corporate partnerships.

Limitations

- Sample skewed toward vehicle owners (85.8%).
- Future studies should target public transport users.

Conclusion

This study confirms that Sharjah's traffic congestion stems from **structural, behavioural, and systemic failures**:

1. **Infrastructure deficits**: Roads designed for ≤500,000 residents now serve 1.8M+ (DSCD, 2023), causing chronic bottlenecks at Al Ittihad Road (96% reporting) and Al Wahda Street (94%).
2. **Unsustainable transport culture**: 85.8% private vehicle dependency (Survey 2023) fuelled by inadequate public transit.
3. **Inter-emirate pressures**: 30.6% daily Dubai commuters overload corridors like Sheikh M. Bin Zayed Road.
4. **Behavioral gaps**: 72.4% cite driver violations (e.g., illegal parking) as key aggravators.

These factors collectively cost Sharjah **$1.4B/year in lost**

productivity (ESCWA, 2021) and elevate health/environmental risks.

Implications

A. Policy Implications

- **Urgent infrastructure reform**: Road expansions alone are insufficient without demand management (e.g., congestion pricing).
- **Data-driven governance**: Real-time GIS monitoring must guide traffic interventions.
- **Inter-emirate coordination**: Sharjah-Dubai commuting requires integrated transport planning.

B. Social Implications

- **Health equity**: High emissions in congestion zones (e.g., Al Khan) disproportionately affect low-income residents.
- **Behavioral change**: Public awareness campaigns must target aggressive driving (cited by 72.4% of respondents).

C. Research Implications

- **Micro-mobility potential**: E-bikes/scooters could reduce short-trip vehicle use but require dedicated lanes.
- **AI integration**: Predictive traffic modeling using machine learning remains underexplored.

Recommendations

1. **Immediate Actions (0-2 Years)**

Initiative	**Implementation Body**	**Expected Impact**
Peak-hour tolling on Dubai-Sharjah corridors (e.g., E11)	Sharjah RTA + Dubai RTA	Reduce commuter traffic by 15-20%
AI traffic management: Adaptive signals at 50 high-congestion intersections	Sharjah Police	Cut delays by 25% (Ali Balwan et al., 2021)
Strict enforcement: Automated fines for illegal parking/blocking intersections	Sharjah Police	Improve junction throughput by 30%

2. **Medium-Term Solutions (2-5 Years)**

- **Public Transport Revolution**:
  - **Water Taxi Network**: Connect Al Khan, Al Majaz, and University City via canals.
  - **BRT Expansion**: High-frequency buses with dedicated lanes on Al Wahda Street.
- **Urban Rezoning**: Mixed-use developments near transit hubs to reduce cross-city commuting.

3. **Long-Term Transformations (5-15 Years)**

Project	**Alignment with UAE Goals**
Sharjah Metro Phase 1: Red Line linking Industrial Areas + Academic City	Smart City Initiative, Carbon Reduction
NSQ Integrated Mobility App: AI-powered routing combining buses/taxis/bike-share	Innovation Strategy 2031
Vehicle Ownership Caps: Incentives for shared mobility in high-density zones	Climate Neutrality 2050

Critical Success Factors

- **Interagency Task Force**: Sharjah RTA, Police, and Urban Planning must co-lead implementation.

- **Community Engagement**: "Congestion Impact Awareness" workshops for residents/schools.
- **KPI Tracking**: Monitor emissions, avg. speed, and public transport uptake quarterly.

"Congestion is not a traffic problem—it's a design problem. **Sharjah must choose between building more roads or building better alternatives**."
- *Adapted from Enrique Peñalosa, Urbanist*

8. Limitations

• While stratified sampling was used, the final sample skewed towards vehicle owners, potentially under-representing the perspectives of those exclusively reliant on public transport.

• The GIS hotspot analysis is based on perceived congestion; future research should integrate real-time speed data from APIs (e.g., Google Maps, Waze) for validation.

• The cross-sectional design provides a snapshot; longitudinal studies are needed to assess the long-term effectiveness of proposed interventions like NSQ.

References

1. Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179-211.
2. Al-Madani, A. A., Al-Madani, F., Mohammed, S. I., Othman, W., Al-Madani, M., & Hussain, S. I. (2023). Traffic management in smart cities: A sustainable framework based on IoT and ITS. Sustainability, 15(13), 9859.
3. Department of Statistics & Community Development (DSCD). (2023). Statistical Yearbook. Sharjah Government.
4. Balwan, M., Varghese, T., & Nadeera, S. (2021). Urban traffic control system review - A Sharjah City case study. 2021 9th International Conference on Traffic and Logistic Engineering (ICTLE). IEEE.
5. Choudhary, A., Gokhale, S., Kumar, P., Pradhan, C., & Sahu, S. K. (2022). Urban traffic congestion: its causes-consequences-mitigation. Research Journal of Chemistry and Environment, 26(12), 164-176.
6. Mainali, S., Regmi, S., Wagle, K., & Bhele, R. (2024). Unraveling the traffic congestion due to bottleneck: A review. International Journal on Engineering Technology (InJET), 2(1), 71-79.

Appendices

Appendix A: Survey Instrument (Sample Items)

Section 1: Demographic Data

Age group: □ Under 25 □ 25-34 □ 35-44 □ 45-54 □ 55+

Residency status: □ Permanent Resident □ Frequent Visitor (more than 3 times per year)

Section 2: Travel Patterns

10. What is your primary mode of transportation within Sharjah?

□ Private Vehicle □ Taxi □ Bus (e.g., Mowasalat) □ Walking □ Other

11. How long is your typical daily commute (one-way)? _________ minutes

Section 3: Congestion Points

20. Please list the top three areas in Sharjah that experience the worst traffic congestion:

1. _______________

2. _______________

3. _______________

Section 4: Solutions

30. How open are you to using a smartphone app that uses AI to suggest the fastest route in real-time?

◻ Very Open ◻ Somewhat Open ◻ Neutral ◻ Somewhat Unopen ◻ Very Unopen

Appendix B: Supplementary Figures and Tables

• Figure B-1: Scatterplot showing relationship between commute distance and agreement with "overreliance on private vehicles"

• Table B-1: Full cross-tabulation of age group by preference for public transport expansio