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Towards Sustainable Transportation in Egypt: An Analysis of Current Challenges and Future Opportunities

Mohamed H. Abdelati *

Automotive and Tractor Department, Faculty of Engineering, Minia University, Egypt.

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ABSTRACT

Transportation infrastructure has been the core function in enhancing economic growth, urban development, and social mobility. This paper gives an in-depth argument about Egypt's transport sector, covering road, rail, air, and water transport. In this study, an assessment of the existing conditions of these infrastructures has been made, outlining the major problems like traffic congestion, lack of proper maintenance, non-availability of funds, and impacts on the environment. The studies also pay attention to more recent developments, particularly high-speed railway projects, metro extensions, and sustainable transport initiatives, with a view to their influence on the overall transport network.

This paper draws on a comprehensive range of sources, including literature, government reports, and case studies, to provide a critical review of Egypt's transportation opportunities and challenges. Comparative analyses with other countries provide information cues on best practices and successful implementations that can be emulated in Egypt.

The recommendations in this paper are strategic in nature, aimed at guiding policymakers and other stakeholders at different levels. These recommendations concern upgrading traffic management systems, investments in infrastructural maintenance, expansion, and modernization of public transport facilities, and promotion of sustainable transport solutions. The paper emphasizes multimodal connectivity, private sector participation, policy reform, and community outreach, seeking to provide actionable insights and detailed recommendations for more efficient, sustainable, and resilient transportation infrastructure in Egypt.

These findings underscore the critical need for integrated planning, joined by novel solutions to the multifaceted challenges facing Egypt's transportation sector if this sector is to contribute to the country's economic prosperity and quality of life.

1. Introduction

Importance of Transportation

Transportation infrastructure aids economic growth, urbanization, and social mobility[1, 2]. Efficient transport eases trade and, therefore, connectivity and enhances the attendant standard of life, bridging gaps between jobs, education, and health. Thus, transportation in Egypt sustains tourism, one of its major economic sectors[3, 4]. Economic activities entail the movement of commodities and people from production sites to markets and consumers[5].

Overview of Egypt's Transportation Sector

Different modes of transport in the transport sector of Egypt include road, rail, air, and water. The extent of the road network is about 45,000 km, connecting all major towns and villages[6, 7]. The Egyptian National Railways has a railway network about 5,000 km long. The Cairo Metro, the first in Africa, transports millions daily[8, 9]. The air transport sector relies on significant airports—the biggest being Cairo International Airport—while a few major ports support water transport along the Nile River.

* Mohamed H. Abdelati, Automotive and Tractor Department, Faculty of Engineering, Minia University, Egypt, +201009652475, m.hilal@mu.edu.eg

These modes play different roles in the general transport system of Egypt, but all are important and respond to several needs of different population segments and the economy[10].

Research Significance

The importance of this study lies in its coverage of the problems limiting the effectiveness of transportation infrastructure in Egypt and gives strategic recommendations on how to improve it. The paper is designed to be of aid to policy decision-makers and other stakeholders in developing a more resilient, long-term, and thus more viable system of transportation[11, 12]. Precisely, this paper intends to provide a proper understanding of the existing transportation sector of Egypt through the examination of the current status, identification of key challenges, and assessment of new developments.

2. Scope of the Study

Modes of Transport Covered

The four main modes of transportation discussed here are roads, railways, air, and water. This means infrastructure, operations, and impact will all be assessed based on each of these modes, so a comprehensive profile of the transport sector in Egypt is projected. This assures due characterization of interconnectivity and interdependence between the different transport modes[13, 14].

Geographical and Temporal Focus

The research focuses on major urban centers, like Cairo and Alexandria, against national transportation policies and initiatives. The study analyzes data for the past decade to ensure an all-rounded understanding of the current trends and developments. This temporal focus allows for evaluating historical and recent changes in the transportation sector.

Key Stakeholders

The key stakeholders include government agencies, the private, and the public. Government agencies are responsible for planning, funding, and regulating transportation projects. Private sectors provide services and investments in infrastructure. The public is the primary beneficiary of improvements in transport. Understanding what these stakeholders do and their views is instrumental in developing sound transportation policies and initiatives[15, 16].

3. Objectives

Assessing Current State

The overall objective of the study is to take a complete review of the existing transportation infrastructure, pinpointing the various strengths and weaknesses of each mode of transport. This will, therefore, provide a baseline for understanding the current performance and capacity of the transportation network.

Identifying Key Challenges

It highlights the bottlenecks to efficiency and development in the transport sector, such as traffic congestion, maintenance of infrastructure, and funding gaps[17, 18]. Identifying these challenges is important in developing targeted solutions and strategizing[19].

Evaluating Recent Developments

This paper will examine the recent projects and initiatives taken up to improve transportation, especially with regard to high-speed rails, and other initiatives of sustainable transport[20]. It will mainly focus on the progress and impact of these developments in the overall system of transportation.

Providing Strategic Recommendations

Actionable recommendations are given to enhance the transport network for sustainability, efficiency, and multimodality. They want to respond to the identification of problems and seize opportunities for improvement[21, 22].

Table (1) explains recent transportation developments and their projected outcomes

Table 1

Project	Development Phase	Projected Outcome
High-Speed Rail	Ongoing	Reduced travel time by 50%
Metro Line Extensions	Planned	Increased passenger capacity by 30%
Electric Bus Fleet	Implemented	Reduction in emissions by 20%

4. Literature Review

Previous Studies

Previous research into transportation in Egypt, whether it focused on individual transport modes or specific challenges, has the potential to significantly impact the field. These findings have documented the problems contributing to congested traffic flow in Cairo, highlighted issues with deteriorated infrastructure, and emphasized the potential benefits of high-speed rail development. This section aims to summarize the key findings from existing literature and identify areas where further research could make a significant impact[23-25].

• Traffic Congestion: Most works include the research [26] [27] that focus on traffic congestion in Cairo and its causes and propose several mitigating strategies.

• Infrastructure Maintenance: A study [28] targeted the issues of road and rail infrastructure maintenance, underlining the need for a proactive maintenance strategy.

• High-Speed Rail: [29, 30] checked the economic viability of high-speed rail in Egypt on the Cairo-Alexandria line and its regional development effects.

Theoretical Frameworks and Models

Theories and relevant models in transportation research are discussed, for example network theory, urban planning models, sustainability frameworks. The applicability of these frameworks provides a practical underpinning for critically analyzing the present condition and proposing improvements. These theoretical models, while complex in theory, are practical in application and will increase an understanding of the dynamics of the transportation sector in Egypt, instilling a sense of reassurance and confidence in their effectiveness[31, 32].

• Network Theory: Practice of the same for connectivity and efficiency in transport networks[33].

• Urban Planning Models: Models such as the TOD framework facilitate better land use and transport integration planning[34].

• Sustainability Frameworks: the Sustainable Urban Mobility Plan framework outlines principles for developing inclusive and sustainable transport systems[35].

Comparative Analysis

This paper benchmarks Egypt's transport systems against countries with similar economies, notably Turkey and India, to draw on best practices and lessons learned. The comparative analysis will also help put challenges and opportunities in Egypt into a global framework, emphasizing the importance of learning from the experiences of other countries. This approach will make the audience feel the urgency of the research and its potential impact on Egypt's transport systems.

• Republic of Turkey: The investment in high-speed rail in Turkey and its influence on regional connectivity and growth[36-39].

• India: Its integrated approach to urban transport planning, together with the implementation of the BRT systems [40-42]

Research Gaps

This research identifies gaps, such as integrated studies covering all transport modes and their interconnectivity. The current study seeks to fill these lacunas by comprehensively analyzing the entire transportation sector. Addressing these gaps will contribute to the holistic understanding of the transportation system and let loose useful information toward more effective policy and planning decisions.

5. Methodology

Research Design and Approach

The research assumes a qualitative approach to develop an in-depth understanding of the complexities that characterize the transport sector in Egypt. Of course, the case studies, as a research design, go hand in hand with the analysis of the secondary data, which assisted in capturing different insights and information from various meaningful literature, government reports, and academic works[43].

Methods of Data Collection

Government reports academic studies and case studies are some of the data sources used in this study. Thus, The findings will be very robust and valid since there is a comprehensive overview of the transport sector from this multi-faceted data collection approach.

Government Reports: The Ministry of Transportation, Cairo Transport Authority, and other related organizations'

reports contain very important quantitative and qualitative data regarding transportation infrastructure and operations[44].

Academic Studies: The literature review of available academic studies gives access to theoretical frameworks and sets of empirical findings about transport challenges and solutions[45].

Case Studies: Detailed review of different transport projects and initiatives in Egypt and comparable countries provides practical insights and lessons learned into the practice[46].

Analytic Tools and Methods

The data that has been collected is analyzed using many analytic tools and methods. These tools allow for trend spotting, setting ratings, and assessing the recent developments that have taken place.

Statistical Analysis: This would involve reanalyzing quantitative data from government reports and academic studies to identify the main trends and correlations[47].

Literature Review: A general review of extant literature to synthesize findings from different studies and generate a theoretical platform for the research[48, 49].

Comparative Analysis: This will involve comparing Egypt's transportation infrastructure and policies with those of other countries to find out if there are any effective best practices and strategies that could be adopted[50].

Scope and Limitations

Thus, the research focuses on the most critical issues of transportation infrastructure while fully aware of some limitations, such as the availability of secondary data and some biases that might have occurred in the sources used. In this way, the scope and limitations of the study are well-defined, preserving transparency and realistic expectations from the results and recommendations.

6. Current State of Transportation Infrastructure

Road Transport

The domestic road network is spread across various cities and villages in Egypt. Such networks connect parts of the country. Among the central arteries within the country are the Cairo-Alexandria Desert Road and Cairo-Ismailia Desert Road, with arteries such as the Ring Road in Cairo accommodating significant traffic discharges. The greater Cairo public bus network transported about 2 million passengers daily using over 3,000 buses operated by the Transportation Authority of Cairo. Private companies like Go Bus and Blue Bus provide intercity services. Taxis and ride-sharing are widespread in urban areas and increasingly convenient, but they also contribute to congestion[50-52].

• Highway Network: This extensive network, about 45,000 km long, plays a crucial role in connecting major cities and interregional areas, fostering a sense of interconnectedness across the country and sustaining passenger and freight movements[53-55].

• Public and Private Bus Services: The public bus network covers extensive areas of the city and its suburbs, while private companies operate between cities and provide competitive services[56].

• Taxis and ride-sharing: Concentrated within cities, they provide convenience but contribute to congestion and air pollution[57].

Rail Transport

The Egyptian National Railways, or ENR, offers a rail network from Cairo to Alexandria, Luxor, and Aswan. It is approximately 5,000 kilometers in length, with 1,300 electrified. The Cairo Metro represents the first metro system in Africa, running three operational lines for an average of more than 3.5 million passengers per day. Expansions of the metro system are in progress, with a view to extent the existing lines and constructing new ones[58, 59].

• ENR Network: This is a vital carrier of intercity passenger and freight movements, the efficiency of whose operation and standard of service are questionable.

• Cairo Metro System: It provides reliable, efficient modes of urban transport, alleviating congestion and air pollution in Cairo[60, 61]. Its expansion plans also increase coverage and accessibility.

Air Transport

In Egypt, domestic and international travel are closely tied to major airports like Cairo International Airport, Alexandria Borg El Arab Airport, and Hurghada International Airport. Cairo International Airport is the busiest, serving more than 15 million passengers yearly. EgyptAir, the national carrier, operates a fleet of about 80 aircraft and serves 75 total destinations, including domestic and international routes[62, 63].

Major airports play a crucial role in supporting tourism and business through their aeronautical infrastructure[64]. However, these airports are grappling with congestion and quality-of-service issues.

Efficient air transport is vital for the growth of tourism and trade in Egypt. EgyptAir, as the national carrier, plays a key role in connecting Egypt to the global economic stage. The carrier's performance and competitiveness are closely intertwined with the efficiency and competitiveness of the air transport sector.• Major Airports: Characteristics of aeronautical infrastructure that enable tourism and business. Airports are experiencing congestion and quality-of-service issues[65].

Efficient Air transport is a convenience and a necessity for developing tourism and trade in Egypt.

EgyptAir, the national carrier, connects Egypt with the global economic world. The performance and competitiveness of the carrier are, therefore, closely linked with the efficiency and competitiveness of the air transport sector.

Water Transport

The Nile River is one of the essential waterways for passengers and freight. The ferries mainly run in Upper Egypt, carrying people and goods. Significant ports like the Port of Alexandria, where about 60% of the country's trade goes through, the ports of Suez and Port Said, also play an important key role in international trade[66].

• Nile River Transport: It offers a crucial means of transport, especially to those living on its banks. For this river to participate in transport, navigability, and infrastructure are vital[67].

• Major Ports: These are the windows through which international trade gains entry[68], with high cargo volumes. Therefore, efficiency and capacity at the ports are of paramount consideration in Egypt's trade competitiveness.

Table (2) Summarizes important statistics on transportation in Egypt.

Table 2

Transport Mode	**Total Length (km)**	**Key Statistics**
Roads	45,000	-
Railways	5,000	1,300 km electrified
Metro	78.9	3 lines, 77 stations
Air	-	Cairo Int. Airport: 15M passengers/year
Water	-	Port of Alexandria: 60% of trade

7. Key Challenges

Traffic Congestion

Traffic congestion in Cairo and Alexandria is very serious and costs the Egyptian economy around $8 billion every year in productivity losses and fuel wastage. High population density and large numbers of vehicles further exacerbate these problems. Effective traffic management and public transport improvement are some solutions that can help relieve this congestion. The development of alternative routes and promotion of non-motorized transport can also contribute to mitigating traffic congestion[69, 70].

Infrastructure Maintenance and Upgrades

The various processes for maintenance of these networks are extant, involving efforts ensuring safety and efficiency. Budgetary constraints, among the administrative inefficiencies, are mostly a cause of delayed maintenance and inadequate upkeep, which deteriorate infrastructure and disrupt services. Therefore, a multi-dimensional maintenance strategy is required, garnering infrastructure resilience through technology and predictive maintenance. A specific fund-backing arrangement assumes greater importance in this context for the long-term sustainability of infrastructure linked with maintenance-related activities[71].

Public Transport Inefficiencies

The transport systems are comprehensive, but the road and railways could be more relaxed, and timekeeping generally leaves much to be desired, especially during peak hours[72, 73]. However, an aging fleet of buses and trains breaks down frequently and mainly causes delayed services. Therefore, efficient public transport is of the essence in enhancing the service quality and having a larger capacity. The inclusion of modern technologies like real-time

tracking and digitalized ticketing can also raise service reliability and enhance passengers' experience.

Funding and Investment Gaps

Significant gaps in funding and investment make the proper upgrades and expansions in the transport sector reflective of a challenge. These financial challenges—relating to insufficient government budgeting and private sector investment—need to be surmounted to achieve the infrastructure development necessary for sustainability through creative financing mechanisms that can source funds needed for infrastructure projects[74].

Regulatory and Policy Barriers

Regulatory and policy bottlenecks often impede the development and management of transport infrastructure. Streamlining regulations and creating a supportive policy environment toward developing infrastructure projects and attracting investments are, therefore, very critical. Some elements that make regulatory frameworks efficient include transparency, bureaucracy reduction, and stakeholder collaboration[75, 76].

Environmental and Sustainability Concerns

The transport sector has a serious effect on the environment due to air pollution and GHG production[77, 78]. Reducing environmental impact from this sector must be related to the adoption of sustainable transport solutions, including electric vehicles and a revamped public transport system. If applied, transport planning and policy-making that factors in sustainability principles will ensure long-lasting improvements in this vital area.

8. Promoting Sustainable Transport Solutions

Reduce emissions and dependence on fossil fuels by encouraging electric vehicles, creating relevant infrastructure for charging points, expanding pedestrian areas, and increasing cycle paths to encourage healthier and more sustainable modes of transport[79, 80]. This will embody the feature of sustainable transport solutions in urban planning and policy frameworks, as their implementation takes time.

• Electric Vehicle Incentives: Provide subsidies in the form of tax breaks, etc., to encourage buying an electric vehicle[81];

• Charging Infrastructure: Offer charging infrastructure that allows long-term and massive coverage to support the uptake of Electric Vehicles[82, 83];

• Non-Motorized Transport: Extend pedestrian zones and cycle paths so that walking and cycling become both practical and resource-friendly transport modes[84, 85];

Enhancing Multimodal Connectivity

Improved integration of buses, trains, ferries, and other transport modes around hubs, tickets, and timely information can ensure a seamless passenger journey. Multimodal connectivity can be improved by developing intermodal transport hubs, integrated ticketing, and real-time passenger information services to provide efficient and convenient transport services.

• Intermodal Hubs: Development of transport hubs providing easy transfers between various modes of transport.

• Integrated Ticketing: Ticketing systems are implemented in which passengers can move with a single ticket by different modes.

• Real-Time Information Systems: These display adequate, real-time information on schedules, delays, and alternative route plans for better passenger convenience[86].

Encouraging Private Sector Participation

Through PPPs, additional resources and expertise in transportation can be mobilized. Encouraging private investments in infrastructure development, maintenance, and service operations increases efficiency and innovation. A supportive regulatory environment and incentive offers are needed to increase private sector participation in these PPPs.

• Public-Private Partnerships: These encourage collaboration between public agencies and private companies. They will ensure that transport projects benefit from private investment and expertise.

• Incentives to Private Investment: This will involve the provision of tax incentives, grants, and subsidies to imprison private investment in transport infrastructure.

• Regulatory Support: This involves simplifying the regulatory processes and providing clear guidelines on how the private sector can participate.

Policy Reforms and Regulatory Frameworks

S This can be successfully achieved through appropriate policy adjustments and streamlining the regulatory environment for transport infrastructure's fast-paced development and management. Coupling an integrated transport policy with harmonization and alignment of regulations between different levels of government to foster close collaboration among key stakeholders can help bring about sustainable transport outcomes. In the long term, policy checks will be necessary against changing requirements and technological developments.

• Comprehensive Transport Policies: playing a crucial role in addressing all aspects of transport infrastructure, including sustainability, safety, and accessibility. These policies involve tasks that relate to the formulation of policies and are essential for the development of a robust and sustainable transport system.

• Regulatory Alignment: It is crucial for successfully implementing infrastructure projects. It involves ensuring the compatibility of regulations with transport policies, which in turn facilitates the successful execution of these projects.

• Collaboration among Stakeholders: It's crucial to facilitate collaboration between government agencies, the private sector, and the public. By working together, we can realize comprehensive and responsive transport planning, ensuring that all voices are heard and considered.

Community Engagement and Public Awareness

Engaging the community and raising public awareness about transportation initiatives are essential for gaining public support and ensuring successful implementation. Conducting public consultations, providing transparent information, and promoting the benefits of sustainable transport can foster community involvement and ownership. Encouraging public participation in decision-making processes can also enhance the relevance and effectiveness of transport policies and projects.

• Public Consultations: Organizing consultations to gather feedback and input from the community on transport projects and policies.

• Transparent Communication: Providing clear and accessible information about transport initiatives and their benefits to the public.

• Public Participation: Encouraging active public participation in the planning and decision-making processes ensures that transport solutions meet the community's needs.

9. Strategic Recommendations

The Strategic Recommendations section provides action-oriented recommendations for improving transport connectivity within Egypt in terms of sustainability, efficiency, and multimodal connectivity. Such recommendations take note of the identified challenges and leverage opportunities for improvement.

Enhancing Traffic Management Systems

Intelligent traffic management systems are critical to ensuring that traffic flows as smoothly as possible and avoids congestion. Smoothening out traffic signals can actually enhance the flow of traffic considerably, resulting in more comfortable commutes with minimal delays[87].

Investing in infrastructure maintenance

Extensive and regular programs for road, bridge, and railway maintenance will definitely increase the life and safety of infrastructure. Advanced predictive maintenance technologies can be harnessed today to help avert infrastructure failures and reduce long-term costs.

Expanding and Modernizing Public Transport

Metro line extensions and the implementation of bus rapid transit systems increase public transport capacity, making it more attractive to people. Fleets are renewed with new, fuel-efficient vehicles, enhancing service quality and reducing environmental impact.

Promoting Sustainable Transport Solutions

Subsidies and incentives could be offered for adopting electric vehicles and developing supporting infrastructure that will help reduce emissions and reliance on fossil fuels. By providing a greater extent of pedestrian areas and cycling paths, healthier and cleaner modes of transportation—such as walking and cycling — will greatly improve livability and environmental sustainability in cities.

Enhancing Multimodal Connectivity

Generally, developing transport hubs that make it easy to change between different modes of transport is efficient transport-wise. Most integrated ticketing systems allow

passengers to travel using different modes of transport under the same ticket, thus enhancing convenience. Real-time information about the schedules, delays, and alternative routes improves the passenger experience.

Encouraging Private Sector Participation

PPPs mobilize some additional resources and expertise for transport. The more efficient and innovative private sector working on infrastructure development, maintenance, and service operation sets the base for encouraging private investment efforts. Supportive regulatory environments and those creating incentives among the private sector are, hence, one of the hallmarks of successful PPPs.

Policy Reforms and Regulatory Frameworks

The necessary policy changes and streamlining of regulations could lead to efficient development and management and the transport infrastructure. Comprehensive policies on transport need to be developed, considering all aspects of the concerned infrastructure: sustainability, safety, and accessibility. The regulatory framework needs to align itself with such policies and thus bring stakeholders on board through stakeholder engagement to make the formulation and implementation of transport policy effective.

Community Engagement and Public Awareness

Community and public awareness about transport initiatives are prerequisites to securing public support and ensuring implementation. The organization of public consultations to elicit community views and suggestions regarding transport projects and policies creates a spirit of ownership and involvement. Sharing transparent information on transport initiatives before their execution builds trust among the public. Active public involvement in the planning and decision-making processes may ensure the transport solution meets the community's requirements and expectations[88].

These strategic recommendations are notably toward a more efficient, sustainable, and resilient transport infrastructure in Egypt. Such strategic recommendations can, therefore, assist policymakers and other respective stakeholders in making very informed decisions for the development of the road transportation network in the country by pinpointing the challenges and opportunities that emerge[89, 90].

10. Discussion

Implications of Findings

These findings have significant implications for policymakers and the stakeholders involved in the transport sector. The challenges identified and the strategic recommendations proposed can help improve efficiency, sustainability, and resilience in Egypt's transportation network. From this research work, some holistic, inclusive approaches to transportation planning and management will be identified.

• Policy Implications: This requires integrated policies aimed at meeting the multifaceted nature of transport challenges, including congestion, sustainability, and infrastructure maintenance.

• Investment Priorities: Emphasized by areas where investment is urgently needed, such as in the construction and repairing of infrastructure, expansion of public transport, or even sustainable transport solutions.

Potential Impact on Economic and Urban Development

Better transport infrastructure has the potential to profoundly enhance economic and urban development. Higher connectivity, less congestion, better public transport, and an attractive environment will contribute to economic progress and improve citizens' quality of life. Sustainable transport solutions also help with environmental sustainability and human health.

• **Economic Growth**: Improved infrastructure in transport aids in productivity, attracting foreign investment and promoting tourism that eventually stimulates the economy.

• Urban Development: Efficient transport systems can drive urban expansion and development by providing access to housing, jobs, and services.

• Environmental Benefits: Facilitating sustainable transport solutions has the potential to cut emissions, clean up the air, and thus promote and protect public health.

Comparative Analysis with Other Countries

The comparisons between Egypt's transport systems and those of similar economies like Turkey and India inspire some valuable insights and good practices. These include the need for an integrated transport system, sustainable solutions, and relevant, effective policy frameworks. The

lessons derived from country experiences set the scene for Egypt's transport strategy design.

• Turkey: The investment in high-speed rail in Turkey and how that has improved inter-regional connectivity and economic growth.

• India: The integrated approach to urban transport planning taken by any country, as well as the execution of the BRT systems.

Long-Term Vision for Egypt's Transportation Sector

The long-term vision to be presented for the transport sector in Egypt is one of a resilient, low-carbon, efficient network that will sustain future economic growth and urban development. This is infrastructure expansion and modernization, promoting sustainable walking, cycling, and public transport solutions, better connectivity between modes, and innovation through innovative city initiatives. This kind of vision can be reached through close collaboration among the government agencies, private sector partners, and the community involved.

• Infrastructure Growth: Expansion and modernization of transport infrastructures to suit future demand.

• Sustainability Emphasis: Integrating sustainability into transport planning and developing projects that ensure reduced environmental impacts.

• Improved Multimodal Connectivity: Better linking of modes of transport to give seamless and efficient travel options.

• Boosting Innovation and Technologies: This initiative aims to improve efficiency and transport service quality through intelligent city initiatives and digital

11. Conclusion

This study comprehensively analyzes Egypt's transportation infrastructure, highlighting key challenges such as traffic congestion, infrastructure maintenance, public transport inefficiencies, and environmental impacts. Strategic recommendations emphasize the need for integrated and sustainable transport solutions to enhance efficiency and reliability.

Key steps include improving traffic management systems, regular infrastructure maintenance, and expanding and modernizing public transport. Promoting sustainable solutions like electric vehicles and non-motorized transport options will reduce environmental impacts. Enhancing multimodal connectivity through transport hubs, integrated ticketing, and real-time information services will improve system efficiency.

Encouraging private sector participation through public-private partnerships and providing incentives can mobilize additional resources. Implementing comprehensive transport policies and ensuring regulatory alignment are crucial. Engaging the community and raising public awareness are essential for successful project implementation.

These recommendations aim to create a more efficient, sustainable, and resilient transportation infrastructure in Egypt. By addressing challenges and leveraging opportunities, policymakers and stakeholders can make informed decisions to enhance the transportation network. Continued research and monitoring are vital for adapting to changing needs and technologies, ensuring long-term success. Ultimately, the study underscores the need for innovative solutions to address Egypt's transportation challenges, contributing to economic prosperity and quality of life.

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