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Challenges and Difficulties of Bridge Inspection in Baghdad: An Analytical Study

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ABSTRACT

Bridges are one of Baghdad's most important infrastructure elements, today they are not only for crossing the river and connecting Karkh and Rusafa, but serve as strategic tools to ease traffic congestion resulting from population density and rapid urbanization. With a population exceeding eight million and a growing number of vehicles, maintaining and sustaining bridges through continuous monitoring and inspection has become essential. Yet the current inspection process faces many challenges. This research aims to identify factors hindering optimal bridge inspection and to provide solutions for improved inspection performance. These challenges stem from managerial, technological, economic and environmental issues, reducing reliability and efficiency. The study used literature review, interviews and a questionnaire completed by 65 experts and academics, with 50 responses statistically analyzed (mean, standard deviation, Cronbach's alpha, Relative Importance Index). Findings show that the main managerial challenges are a lack of qualified technical leadership (RII = 91.2 %) and neglect of bridges for long periods (RII = 85.2 %). Technical constraints include a lack of analytical capacity, a shortage of competent inspectors and limited funds for modern inspection equipment. Further barriers include traffic congestion, poor coordination with stakeholders and environmental issues such as moisture-induced corrosion. Addressing these challenges requires strengthening management oversight, building inspection capacity, securing adequate funding, improving coordination with traffic management and incorporating environmental considerations to enhance inspection effectiveness and extend bridge life.

Keywords: Bridge inspection, Baghdad, Infrastructure management, Challenges, Relative importance index.

1. INTRODUCTION

Bridges are considered a fundamental component of public infrastructure, as they represent transportation efficiency and regional economic activity **(ASCE, 2021)**. Due to their importance, it is necessary to evaluate their condition regularly to ensure operational

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reliability and protect public safety. Bridge inspection aims to document observations regarding the condition of all bridge components by knowledgeable and skilled individuals as part of a progressive reporting system that forms the basis for logical conclusions and inferences related to the condition of the inspected bridge **(FHWA, 2002)**. Through organized inspection processes, engineers can detect early indicators of deterioration, set priorities for maintenance actions, and plan for long-term bridge management.

Bridge inspection achieves three main objectives **(Hüthwohl et al., 2016)**: The first one is the assurance of the security of the property to be used by the population; the second one is the identification of the damage and the identification of the need to have the maintenance; the third one is the gathering of inventory data, its verification and maintenance over long-term management of the bridge. These goals highlight the main importance of the inspection operations in the field of providing the population with safety and improving the serviceability of the bridge infrastructure. Although the bridge inspection activities are very essential, they experience numerous problems that may diminish their effectiveness. Such challenges are financial, administrative, technical, regulatory and environmental problems that could compromise the efficiency of the inspection processes. Thus, the primary aim of the current research is to examine the issues and problems of bridge inspection in Baghdad and to suggest some alternative options to improve the efficiency, reliability as well as sustainability of the inspection activities. One of the biggest parts of the national transport network in Iraq is the bridges network. Many bridges had been drawn and built in the 1970s and 1980s. With the passage of years, the significant part of the available structures has surpassed half of the planned lifespan of the edifices through the corrosion, inadequate maintenance budgets, wars, and environmental factors. In the reports of the Ministry of Construction and Housing, numerous bridges, particularly those in Baghdad and Southern Governorates, show symptoms of material decay under the effect of changing- and environment-induced factors. The last years have seen the implementation of major rehabilitation projects, one of them being several crucial crossings of the rivers Tigris and Euphrates. Nevertheless, still prevalence and regularity of inspection programs are limited to regular and planned programs. This fact leads to the necessity to create a well-organized national system of inspection and repair of bridges that would be appropriate to the level of the challenges posed to the infrastructure that Iraq currently has.

2. TYPES OF INSPECTION

Bridge inspection practices vary significantly between countries as a result of different national policies, available capabilities, and infrastructure management strategies. In some manuals, such as the **(VicRoads, 2014)**, inspections are classified into only three levels:

a) Level 1 inspections are standard examinations that are performed to verify a structure's overall serviceability and to guarantee road user safety. Regular road maintenance may be carried out in tandem with Level 1 inspections.

b) Level 2 inspections are condition inspections and are used to assess the condition of structures and their components. Level 2 inspections are managed on a statewide basis.

c) Level 3 inspections are comprehensive engineering studies and evaluations of specific constructions carried out when necessary.

This simplified approach provides a general framework for monitoring bridge safety and condition.

3. CURRENT PRACTICE IN BRIDGE INSPECTION AND ITS IDENTIFIED LIMITATIONS

Bridge inspection systems, procedures and techniques vary greatly from one country to another according to national policies, availability of technical resources and administrative capabilities. In developed countries, for example, the United States of America, National Bridge Inspection Standards (NBIS) specify requirements for inspector qualification and periodicity inspections and advanced bridge management systems **(FHWA, 2012; Ryan et al., 2012)**. However, the extensive use of traditional visual inspection is still a drawback since it's subjective and heavily relies on the inspector's expertise while not being capable of identifying sub-surface defects, i.e. internal corrosion or micro -cracks **(Kim et al., 2018)**. In addition, the periodic fixed interval of two years has been questioned in terms of cost-effectiveness, and many literature studies have recommended age- and condition-dependent inspection intervals **(Nasrollahi and Washer, 2015; Soliman and Frangopol, 2014)**.

Developing countries, on the other hand, are still grappling with wider and more severe headwinds. It has been reported from the previous literature that inadequate budget, lack of skilled staff and poor institutional structures are the main obstacles for successful bridge inspection systems **(Arshad et al., 2024).** For example, in Pakistan the yearly maintenance budget of over 5000 bridges is close to PKR (Pakistani Rupees) 500–600 million which has resulted in a large backlog of rehabilitation works and frequent bridge collapses as result of poor quality construction and irregular check-out schedule **(Ajwad et al., 2017; Inam et al., 2023).** For instance, in India, it is recorded that the mean age of collapsed bridges is a meagre 34.5 years (well below the recommended design life) attributed mainly to use of inferior materials, inadequate continuous scrutiny and fragility to manifestations of nature **(Garg et al., 2022)**. Many Bailey bridges in Bangladesh suffer from high deflections and structural instability due to poor supervision and neglect which makes them unsafe for use (Bailey Bridges of Bangladesh. Similarly, Indonesia and Thailand are modernizing their rule inspection methods by embracing unmanned aerial vehicles (UAVs) and structural health monitoring systems (SHMS). But the realistic application is scarce, and visual inspection is still prevalent in field **(Avelina et al., 2022; Puspitasari et al., 2023)**. Meanwhile Egypt is dealing with a distinct battle, (45%) of its bridges are more than half a century old. Not enough funds are the main reason to not setting up a good maintenance priority as well as poor quality of data from inspections **(Mansour et al., 2019)**.

Compared with these environments it is clear that Iraq faces similar issues to those of many developing countries; a lack of available funding, limited availability of well-trained inspectors and organizational challenges. Accordingly, learning from the other similar developing country experience is important for formulating a more sustainable and efficient national bridge inspection system.

4. QUALIFICATIONS AND DUTIES OF A BRIDGE INSPECTION TEAM LEADER

Bridges play a critical role in transportation networks, and the effectiveness of bridge inspection depends heavily on the leadership, qualifications, and duties of the inspection team leader. Below are the minimum qualifications and key responsibilities required for a Bridge Inspection Team Leader:

A. According to the Tennessee Department of Transportation **(TDOT, 2022)**, the duties of the Bridge Inspection Team Leader include the following:

1. Lead the team, train members, and assign tasks effectively.

2. Apply policies and procedures while ensuring the quality of reports and inspection outcomes.
3. Manage contracts with consultants, review invoices, and evaluate performance.
4. Contribute to defining the scope of inspection and repair projects.
5. Utilize modern technologies such as drones or rope-access methods.
6. Monitor updates to NBIS standards and integrate them into inspection manuals.
7. Communicate with stakeholders and maintain complete and accurate documentation.
8. Oversee budgets, schedules, and compliance with federal and state standards.

B. Inspection Team Leader – Minimum Qualifications **(Code of Federal Regulations, 2025):**

1. A team leader must, at a minimum, meet one of the following four options:

a) Professional Engineer Option: Be a registered Professional Engineer and have 6 months of bridge inspection experience.

b) Experience Option: Have 5 years of bridge inspection experience.

c) Bachelor's Degree Option:

- Hold a bachelor's degree in engineering or engineering technology from an ABET-accredited (or equivalent) program.
- Have successfully passed the Fundamentals of Engineering (FE) examination.
- Have 2 years of bridge inspection experience.

d) Associate Degree Option:

- Hold an associate degree in engineering or engineering technology from an ABET-accredited (or equivalent) program.
- Have 4 years of bridge inspection experience.

2. Complete an FHWA-approved comprehensive bridge inspection training course and achieve a score of 70% or higher on the end-of-course assessment.
3. Complete a total of 18 hours of FHWA-approved bridge inspection refresher training over every 60-month (5-year) period.
4. Provide documentation demonstrating completion of all qualifications and training to the program manager of the respective State, Federal, or Tribal agency.

5. REPORTING AND BRIDGE MANAGEMENT SYSTEMS

Inspection Reports are generally managed using Computer programs like the Bridge Management System (BMS). It provides the capacity to store, manipulate and organize bridge data including asset management and engineering and manpower planning **(UK Bridges Board, 2005)**. Field data capture can be made using electronic handheld screens. The e-inspection forms are dropdown feed, authorizing inspector type and simplify entry, minimizing errors and office rework. The majority of the systems are created in-house by an office engineer or purchased and customized **(Mirzaei et al., 2014).** Typical bridge management systems include Bridge Station or AMX in the United Kingdom. In the USA, a widely used BMS is Pontis, which now rebranded as AASHTOW are Bridge and deployed as part of an enterprise BMS. An adapted form is used in some other countries **(Mirzaei et al., 2014)**. Bridge management systems are created to assist in the use of inspection data for purposes of making unbiased decisions. Bells and whistles differ from one system to another. Some further features are for the calculation of a bridge condition index **(LoBEG, 2010)** or the prioritization of maintenance **(LoBEG, 2008)**. BMS's are a central component in the framework for modern asset management.

6. RESEARCH METHODOLOGIES

The study's methodology consists of two main components: The theoretical study and the field study. The theoretical part focuses on reviewing existing literature and developing research hypotheses, while the field study involves collecting data through interviews and questionnaires, finally leading to the conclusions.

6.1 Questionnaire Design

A questionnaire is one of the means of collecting data and information, and it includes a set of written questions and inquiries and requires individuals to answer them. The main advantages of using a questionnaire can be summarized as follows:
The possibility of obtaining abundant information, the possibility of applying it to a large number of individuals at one time, the lack of effort, time and costs compared to other methods, And the ease of reviewing, analyzing and statistically reviewing the data in the questionnaire.

6.2 Study Sample

An open-ended questionnaire was first prepared to identify the main items to be included in the closed-ended questionnaire, and the classified responses were then used in designing the final version. The questionnaire was distributed to professionals, including engineers, consultants, employers, and contractors from various engineering disciplines who are well-recognized in their professional fields related to road and bridge projects as well as academia. A total of 65 questionnaires were distributed to the targeted sample, both electronically via email and through direct in-person distribution. The researcher received 50 completed responses. The questionnaire included questions that allowed participants to share their experiences and identify the challenges they faced. A purposive sampling methodology was applied to reach managers from different Iraqi provinces. The data collection was further supported by a review of the literature and international experiences, in addition to direct interviews with experts from different sectors, academics providing governmental consultation, and consulting offices at Iraqi universities. The closed-ended questionnaire was analyzed using the Relative Importance Index (RII) along with other statistical methods, which enabled the transformation of qualitative insights into measurable variables.

6.3 Method of Analysis

The statistical analysis of the questionnaire was carried out using the statistical program (SPSS). The sample showed varying responses according to the results obtained, and the response rate of the questionnaire was 76.9%, which is statistically acceptable.

6.4 Statistical Methods and Equations Used in Data Analysis

- Calculating the Cronbach's Alpha **(Igbo, 2010; Vaske et al., 2016).**
- Calculating the Mean: The following formula was used for the purpose of determining the mean value **(Altaie and Dishar, 2024; Bluman, 2012)**:

$$\bar{X} = \frac{\sum X_i}{n} \tag{1}$$

Where:
$\overline{X} = Arithmetic\ mean$
$X_i = Value\ of\ each\ individual\ response$
$n = Total\ number\ of\ respondents$

- Calculating the standard deviation: The following formula was used for the purpose of determining the value standard deviation **(Altaie et al., 2023; Devore, 2012)**:

$$s = \sqrt{\frac{\sum(X - \bar{X})^2}{N}} \quad (2)$$

Where:
$s = Standard\ deviation$
$X = Individual\ response\ value$
$\overline{X} = Arithmetic\ mean$
N= Total number of respondents

- Calculating the Relative Importance Index RII: The following formula was used for the purpose of determining the value relative importance Index (RII**) (Mahjoob et al., 2016; Abd Alkreem and Breesam, 2025; Altaie and Onyelowe, 2024; Rooshdi et al., 2018)**:

$$RII = \frac{\Sigma\ w}{N \times A} \quad (3)$$

Where:
$RII = Relative\ Importance\ Index$
$w = Weight\ given\ to\ each\ response\ (e.g., 1\ to\ 5\ on\ a\ Likert\ scale)$
$A = Highest\ weight\ on\ the\ scale\ (e.g., 5)$
$N = Total\ number\ of\ respondents$

❖ The questionnaire sample included (50) experts from various engineering specialties, as shown in **Table 1**.

Table 1. Engineering specialization of the sample

Disciplines	Total	Percentage %
Civil	42	84
Architect	2	4
Mechanic	3	6
Electric	1	2
Others	2	4
Total	50	100

7. RESULTS AND DISCUSSION

Questionnaire responses were thoroughly reviewed to ensure reliable data were used in the analysis, excluding incomplete responses, abnormal values, and unreliable responses. After the filtering process, 50 responses were retained and analyzed in this study.

7.1 Reliability Statistics

Using the SPSS program to determine the reliability of the responses, Cronbach's alpha coefficient is one of the most prominent tools for measuring reliability and helps ensure the accuracy of the results, which amounted to (0.816), indicating a high level of reliability of the response

7.2 Respondents' Demography

According to **Fig. 1,** the majority of responders (84%) were civil engineers, with mechanical engineers coming in second at (6%), architects at (4%), others at (4%), and electrical engineers at (2%).

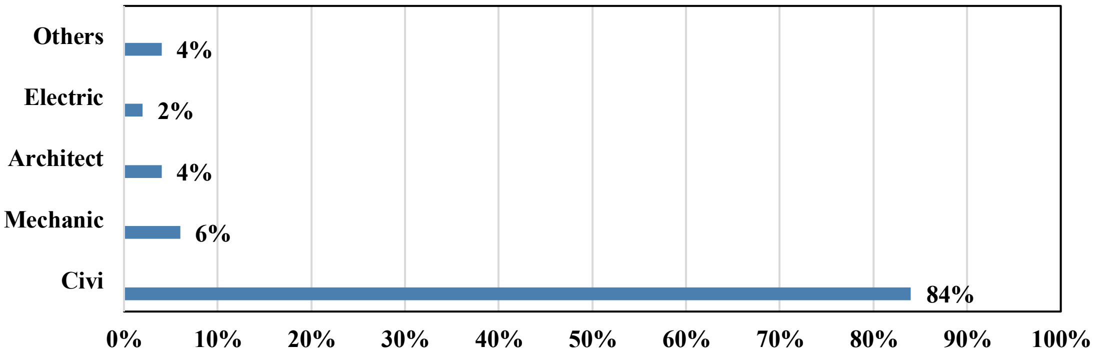

Figure 1. Qualifications of the respondents

And **Fig. 2**, represents the percentage of respondents according to the number of years of experience. 26% of the respondents had 11–15 years of experience, 24% had 6–10 years of experience, 22% had more than 20 years of experience, 14% had less than five years of experience, and 14% had 6–10 years of experience.

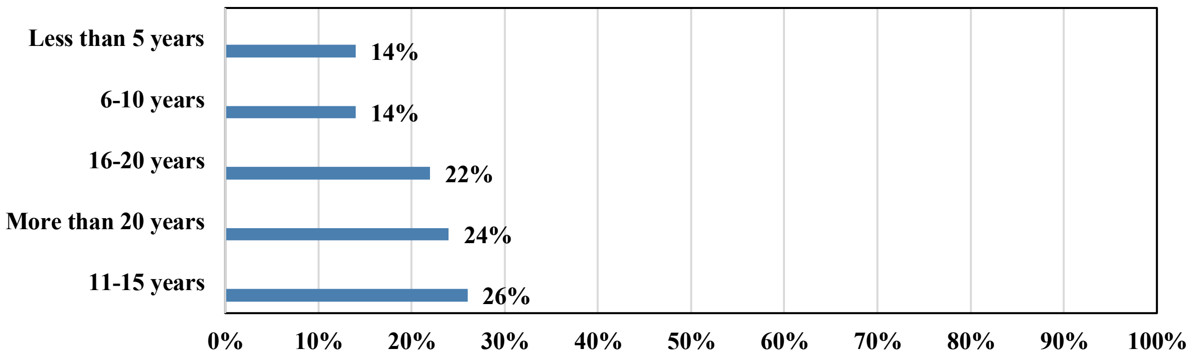

Figure 2. Experience years of the respondents

The statistical analysis was achieved through the SPSS program and the arithmetic mean and Relative Importance Index (RII) were calculated for each factor considering the challenges facing bridge inspection. A higher the RII value, the more significant the bridge inspection factors are. The interpretation of the RII values is performed by comparing them with the corresponding importance levels **(Boakye and Adanu, 2022; Sakhare and Chougule, 2020),** as shown in **Table 2.**

Table 2. Importance level criteria

RII values	Importance level	
0.8 ≤RII≤1	High	H
0.6 ≤RII≤0.8	High-medium	H-M
0.4 ≤RII≤0.6	Medium	M
0.2 ≤RII≤0.4	Medium-low	M-L
0 ≤RII≤0.2	Low	L

Table 3, shows the relative importance of each sub-factor for challenges and difficulties facing bridge inspection in Baghdad.

Table 3. The Relative Importance (RII)

Main Factor	Sub-Factor	Challenge Statement	Mean	Std.	RII%	Level
Financial/Cost side	Budget	Lack of funding leads to fewer field inspections.	4.020	0.820	80.4	H
		Failure to allocate sufficient budget prevents the purchase of modern inspection equipment.	4.100	0.886	82	H
	Access Equipment (ladders, scaffolding, cranes)	The cost of renting access equipment hinders the implementation of periodic inspections.	3.320	0.978	66.4	H-M
		Relying on alternative solutions reduces the quality of the inspection.	3.860	0.756	77.2	H-M
Administrative side	Inspection Negligence	Weak commitment to implementing inspection schedules and ignoring some bridges for long periods of time.	4.260	0.750	85.2	H
		There is no effective oversight to ensure that inspections are carried out as required.	4.200	0.832	84	H
	Team leader as a professional engineer	Lack of qualified technical leadership weakens final recommendations.	4.320	0.712	86.4	H
		Having an experienced engineer improves the accuracy of the assessment and minimizes errors.	4.560	0.577	91.2	H
Technical side	Lack of qualified inspectors	The number of current inspectors is insufficient and some of them lack the ability to use modern technologies.	3.980	0.820	79.6	H-M

	Bridge Classification / Age	Lack of analytical expertise leads to ignoring early signs of deterioration	4.320	0.652	86.4	H
		Older bridges are neglected despite their need for frequent inspection.	3.820	0.983	76.4	H-M
		Bridge classification is not always considered when scheduling inspections.	3.900	0.788	78	H-M
	Road Roughness	An uneven road hinders the fixation of ground inspection equipment and may damage it.	3.160	0.888	63.2	H-M
		Lack of top deck maintenance affects inspection efficiency and increases work hazards.	3.400	0.832	68	H-M
	Height	Preparing a plan to inspect elevated bridges requires additional time and resources.	3.720	0.833	74.4	H-M
		Difficult access increases job risk and reduces inspection accuracy.	3.940	0.793	78.8	H-M
Organizational side (Traffic during Inspections).		Vehicle traffic hinders accurate inspection and jeopardizes inspection teams.	4.020	0.844	80.4	H
		There are no effective mechanisms to coordinate with traffic authorities to facilitate the inspection	3.340	0.939	66.8	H-M
Environmental side		Exposure to moisture and stagnant water increases corrosion of structural elements and requires additional inspection.	4.360	0.562	87.2	H
		Inspection results are not always linked to the impact of the surrounding environment.	3.840	1.037	76.8	H-M
		The materials used in some bridges do not resist environmental corrosion well.	3.740	0.943	74.8	H-M

The results in **Table 3**, showed that the most critical challenge in Iraq is the lack of technical leadership (RII = 91.2%). This finding is consistent with **(Mansour et al., 2019)**, who reported that in Egypt the shortage of qualified experts and poor-quality inspection data hindered effective maintenance planning. Similarly**, (Ajwad et al., 2017)** highlighted in Pakistan that insufficient professional oversight was a major factor in bridge deterioration. On the other hand, **(Inam et al., 2023a)** proposed that automated and intelligent inspection tools, including the development of crack detection through deep learning, may serve to fill the gaps in the abilities and expertise of human beings and assist in improving the further state of bridge inspections in Iraq. The second- highest challenge was the lack of compliance with inspection schedules (RII = 85.2%). Similar results were also reported in India where bridges collapsed within an average age of 34.5 years which is much lower than the design life of the bridge because of the asymmetrical inspection and unsatisfactory scrutiny. **(Garg et al., 2022)**. Similarly, in Bangladesh, Lack of regular checkups and proper supervision in most of the Bailey bridges have resulted into severe deviation and instability Bailey Bridges of Bangladesh. Such incidences indicate that lack of regularity in inspection schedules is a common failure in the poor countries. The other major problem found in Iraq is the absence of funds to purchase advanced inspection equipment (RII = 82%). This is similar to what happens in Pakistan, where Pakistan has been seen to allocate PKR 500-600 million per year on more than 5,000 bridges, which is not felt to be sufficient to absorb the recurrent bridge failures. **(Ajwad et al., 2017; Inam et al., 2023)**. Similarly, **(Mansour et al., 2019)** noted that resource constraints in Egypt prevented the prioritization of maintenance and the adoption of advanced inspection techniques. The survey also highlighted a shortage of trained personnel and qualified inspectors (RII = 79.6%). This is in line with data from Indonesia and Thailand, where a shortage of personnel with the necessary training has hindered efforts to modernize inspection procedures using UAVs and SHMS. **(Avelina et al., 2022; Puspitasari et al., 2023)**. These findings emphasize that without strong investment in capacity building, technological adoption alone will not be sufficient. Practical challenges such as traffic congestion during inspections were also reported. Similar operational difficulties have been noted in other densely populated developing countries, where road closures or diversions during inspection are difficult to implement. Finally, environmental conditions – such as humidity, corrosion, and temperature variation – are important factors that affect the safety of bridges in Iraq. **(Kim et al., 2018)** affirmed that climatic deterioration increases deterioration and service life of the bridge. The same conclusions were made in Egypt and India where a combination of external degradation and lack of maintenance contributed to the premature deterioration of the bridge. **(Mansour et al., 2019; Garg et al., 2022)**. Conclusively, challenges of bridge inspection in Iraq are very similar to the challenges of bridge inspection in other developing countries particularly with regard to limited resources, unqualified personnel, non systemic inspection processes and environmental issues. Nevertheless, the literature underlines that implementation of sophisticated technologies, enhancing regulation and supporting and developing training programs are important instruments of dealing with these chronic issues.

8. LIMITATIONS OF THE STUDY

This study has a number of limitations that need to be taken into account. A group of engineers and academics from the public (34 participants) and private (16 participants) sectors were the target audience for the July 2025 implementation of the questionnaire, particularly those affiliated with the Roads and Bridges Directorate at the Ministry of Construction and Housing and the Projects Directorate at the Baghdad Municipality. Of the 65 questionnaires distributed, 50 valid questionnaires were received for analysis, with a response rate of 76.9%. Accordingly, the results of the study only reflect the opinions of respondents within the geographic scope of Baghdad. Therefore, the results should be interpreted within these temporal and spatial frameworks, Considering the potential for many situations in other regions of Iraq. The use of a purposive sampling method means that the results primarily reflect the views and experiences of a specific group of participating experts and professionals and should be treated as such.

9. CONCLUSIONS

This study identified the main problems that affect the quality of bridge inspection in Baghdad, focusing on financial, organizational, and environmental aspects, in addition to administrative and technical challenges, as the most significant. It also pointed out the necessity of developing a single plan that would help to enhance administrative control, to have more inspectors and their qualifications, to achieve the required amount of finances and enhance the cooperation with the traffic authorities. In order to solve these problems, the environmental sustainability in inspection procedures should also be taken into consideration. In this light, the paper offers some of the recommendations to the relevant authorities, like the Ministry of Construction and Housing and the Baghdad Municipality. The responsible agencies should also identify compulsory and recognized training on bridge inspectors, considering analytical skills and the use of modern inspection tools, and the certification has to be renewed every three years. Lastly, this research also creates the possibilities of future research, such as the creation of intelligent inspection systems that could fit the conditions of Iraq, and the discussion of the expenses of implementing the introduction of advanced technologies like drones in the process of bridge inspection. The scope of the area of study should be expanded to cover more provinces and combine the insights of funding agencies and urban planners to gain a better idea about the issues and extent of bridge inspection.

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Credit Authorship Contribution Statement

Khattab Omar Adel Al-Rawi: Writing original draft, review & editing, research and data collection. Meervat R. Altaie: Supervision, review & editing, validation, project management.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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التحديات والصعوبات التي تواجه فحص الجسور في بغداد: دراسة تحليلية

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الخلاصة

تُعدّ الجسور من أهم عناصر البنية التحتية في بغداد؛ فدورها اليوم لم يَعُد يقتصر على عبور النهر وربط جانبي الكرخ والرصافة، بل أصبحت أداة استراتيجية لتخفيف الازدحام المروري الناتج عن الكثافة السكانية والتوسع العمراني السريع. ومع تجاوز عدد السكان ثمانية ملايين وازدياد أعداد المركبات، أصبح الحفاظ على الجسور من خلال المراقبة والفحص المستمر أمرًا ضروريًا، إلا أنّ عملية الفحص الحالية تواجه تحديات عديدة. يهدف هذا البحث إلى تحديد العوامل التي تعيق الفحص الأمثل للجسور وتقديم حلول لتحسين أداء الفحص. تنبع هذه التحديات من جوانب إدارية وتقنية واقتصادية وبيئية، مما يقلل من موثوقية وكفاءة العملية. اعتمدت الدراسة على تحليل الأدبيات وإجراء مقابلات وتوزيع استبانة على 65 خبيرًا وأكاديميًا، حُلِّلت منها 50 استبانة إحصائيًا (المتوسط الحسابي، الانحراف المعياري، معامل كرونباخ ألفا، ومعامل الأهمية النسبية). أظهرت النتائج أن أبرز التحديات الإدارية هي غياب القيادة الفنية المؤهلة (RII = 91.2%) وإهمال بعض الجسور لفترات طويلة (RII = 85.2%). كما شملت التحديات التقنية ضعف القدرات التحليلية، ونقص المفتشين المؤهلين، وقلة التمويل المخصص للأجهزة الحديثة. وبرزت عقبات أخرى مثل الازدحام المروري وضعف التنسيق مع الجهات المعنية، بالإضافة إلى المشكلات البيئية مثل التآكل الناتج عن الرطوبة. وتؤكد الدراسة أن مواجهة هذه التحديات تتطلب تعزيز الرقابة الإدارية، وبناء قدرات المفتشين، وضمان التمويل المناسب، وتحسين التنسيق مع إدارة المرور، ودمج الاعتبارات البيئية لرفع فعالية الفحص وإطالة عمر الجسور.

الكلمات المفتاحية: التفتيش على الجسور، بغداد، إدارة البنية التحتية، التحديات، مؤشر الأهمية النسبية.