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Analysis of Road Infrastructure Performance Audit on Gatot Subroto Underpass User Satisfaction

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Abstract- This study aims to analyze the performance audit of road infrastructure and its impact on user satisfaction at the Gatot Subroto Underpass, North Sumatra. High-quality road infrastructure plays a vital role in improving mobility, safety, and public convenience; therefore, periodic evaluation through a performance audit based on user perceptions is essential. This study employed a descriptive quantitative method using a survey approach involving 75 respondents who were users of the Gatot Subroto Underpass. Data were collected using a Likert-scale questionnaire and analyzed descriptively by measuring the level of user satisfaction across each road infrastructure service indicator. The findings indicate that the performance audit effectively identified both service aspects that have performed well and those requiring further improvement. The level of user satisfaction before the evaluation was 65%, categorized as moderately satisfied, while after the evaluation and analysis it increased to 78%, categorized as satisfied, representing an improvement of 13%. The highest levels of user satisfaction were found in traffic flow and road surface conditions, whereas the lowest levels were associated with the drainage system, street lighting, and environmental cleanliness within the underpass. The study further reveals that the quality of road infrastructure services has a significant influence on users' perceptions and overall satisfaction. A performance audit based on user satisfaction provides comprehensive information for determining service improvement priorities and can serve as a valuable basis for developing more effective road infrastructure management policies that are responsive to community needs while supporting the development of a safe, comfortable, and sustainable urban transportation system.

Keywords: Performance Audit; Road Infrastructure; Road User Satisfaction; Underpass; Public Service; Transportation

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1. INTRODUCTION

Road infrastructure development is one of the government's primary instruments for improving regional connectivity, facilitating community mobility, and promoting economic growth. In urban areas, one of the most significant forms of transportation infrastructure is the underpass, which is designed to reduce traffic conflicts at intersections, improve traffic flow, and enhance overall transportation efficiency. Nevertheless, the success of infrastructure development should not be assessed solely based on the physical completion of a project, but also on the quality of its operational performance and the level of public satisfaction as the primary beneficiaries of the service.

From a public administration perspective, a road infrastructure performance audit serves as an evaluation instrument to assess the effectiveness, efficiency, and quality of infrastructure services in achieving development objectives. Performance audits extend beyond evaluating compliance with technical standards during project implementation; they also examine the extent to which infrastructure provides tangible benefits to the community. Consequently, evaluating infrastructure performance should be integrated with user satisfaction assessments to provide a more comprehensive understanding of the effectiveness of public service delivery.

The relationship between infrastructure performance audits and user satisfaction can be explained through the Expectation Confirmation Theory (ECT), which posits that satisfaction is achieved when users perceive actual performance to meet or exceed their initial expectations. Accordingly, higher infrastructure performance leads to greater confirmation of user expectations, thereby increasing public satisfaction. Furthermore, the concept of Service Quality suggests that dimensions such as physical condition, safety, comfort, accessibility, and facility reliability are key determinants of user satisfaction. Therefore, infrastructure performance audits provide a systematic mechanism for identifying the extent to which infrastructure service quality fulfills public expectations while supporting continuous improvements in public service performance.

In Indonesia, the construction of underpasses is one of the government's solutions in overcoming congestion in urban areas. The underpass serves to reduce traffic intersection conflicts, accelerate vehicle mobility, and increase road capacity. One of the strategic infrastructures that has an important role in supporting smooth transportation is the Gatot Subroto Underpass in North Sumatra. This infrastructure was built to unravel traffic density in urban areas that have a high volume of vehicles, especially during peak hours. However, the success of the construction of the underpass is not only measured by the completion of the physical construction, but also by the level of user satisfaction with the quality of road services. In the current era of sustainable development, the public is increasingly critical of the quality of public services provided by the government, including road infrastructure services. Road users demand safe, comfortable, water-free road conditions, good lighting, and being able to provide optimal smooth mobility. Therefore, evaluation through road infrastructure performance audits is important to find out the extent to which the

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quality of Gatot Subroto Underpass services has met the expectations of the road user community. The results of the evaluation can later be the basis for improvement and policy-making in the management of transportation infrastructure that is more effective and oriented towards community satisfaction.

The main problem that is often encountered in urban road infrastructure is the decline in service quality due to the high volume of vehicles and the lack of optimal maintenance of road facilities. The Gatot Subroto Underpass as one of the strategic routes in North Sumatra has a high intensity of use every day. The high mobility of these vehicles has the potential to cause various problems such as congestion at certain hours, damage to the road surface, waterlogging when it rains, and user discomfort due to suboptimal conditions of supporting facilities.

In addition, the safety and comfort aspects of road users are also important concerns in underpass management. Several conditions such as inadequate lighting, suboptimal drainage systems, fading road markings, and traffic density can affect public perception of the quality of road services. If these conditions are not evaluated periodically, it can reduce the level of satisfaction of road users and reduce the effectiveness of the underpass function as a solution to solve congestion.

Another problem is that there is still limited research that specifically discusses the performance audit of underpass road infrastructure based on the perspective of road user satisfaction in the North Sumatra region. Most previous research focused more on technical analysis of roads or traffic service levels, while user perception-based evaluations were still relatively few. In fact, user perception is very important to find out whether the infrastructure built has provided benefits according to the expectations of the community as the main user of the public facility.

Several previous studies have examined road user satisfaction using various service quality assessment approaches, including the Importance–Performance Analysis (IPA), Customer Satisfaction Index (CSI), SERVQUAL, and Structural Equation Modeling (SEM). Amanah and Latifa investigated user satisfaction on the MBZ Toll Road using the IPA method. Faisal et al. (2021) analyzed provincial road user satisfaction based on road service quality, while Al-Rousan et al. (2022) employed SEM to examine the determinants of road network user satisfaction. Furthermore, Pratala et al. (2023) integrated the SERVQUAL and IPA approaches to evaluate toll road services. Collectively, these studies demonstrate that service quality significantly influences user satisfaction. However, their analyses primarily emphasize service quality evaluation and have not explicitly incorporated infrastructure performance audits as a public sector evaluation instrument.

Based on the existing literature, several research gaps remain. First, previous studies have predominantly focused on measuring service quality and user satisfaction, whereas empirical investigations examining infrastructure performance audits as a determinant of user satisfaction remain limited. Second, most existing research has been conducted in the context of toll roads, provincial roads, and public transportation systems, with relatively little attention given to performance audit evaluations of urban underpass infrastructure. Third, only a limited number of studies have integrated the infrastructure performance audit perspective with causal relationship analysis using Partial Least Squares Structural Equation Modeling (PLS-SEM). Consequently, the empirical mechanism through which infrastructure performance audits influence user satisfaction has not yet been comprehensively explained.

Based on a study of previous research conducted by (Ginting, Y. M. et al 2023), most of the research on the satisfaction of transportation infrastructure users focuses on measuring the quality of road services using *the service quality* approach. The research objects used generally include toll roads, provincial roads, and public transportation services. The variables analyzed were dominated by the Service Quality dimension with the SERVQUAL instrument, which was then analyzed using the Importance Performance Analysis (IPA), Customer Satisfaction Index (CSI), and Structural Equation Modeling (SEM) methods. The main contribution of these studies is to measure the level of service quality and identify service attributes that need to be improved to improve user satisfaction.

In contrast to the previous research by (Puspitasari, M. D. 2024), this study focuses on infrastructure performance audits as the main construct that affects user satisfaction. The object of the research is specifically directed at the Gatot Subroto Underpass, North Sumatra Province, so as to provide a more specific context for the evaluation of the performance of a road infrastructure. In addition, this study not only assesses the quality of services as per the SERVQUAL approach, but also develops the concept of infrastructure performance audit which includes aspects of physical condition, function, safety, comfort, and sustainability of infrastructure services. The causal relationship between infrastructure performance audits and user satisfaction was analyzed using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method. Thus, the main contribution of this study is to provide an empirical model that explains the influence of infrastructure performance audits on user satisfaction, so that the results of the research are expected to be the basis for the preparation of maintenance policies and improving the quality of road infrastructure more comprehensively.

Building upon these research gaps, this study offers a novel contribution by integrating the concept of infrastructure performance audits with the perspective of road user satisfaction in the context of the Gatot Subroto Underpass, North Sumatra, using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach. Unlike previous studies that primarily focused on evaluating service quality based on user perceptions, this research examines the structural relationship between infrastructure performance audits and user satisfaction, thereby providing a more comprehensive framework for evaluating public transportation infrastructure performance. This study contributes to the existing literature in both theoretical and practical aspects. Theoretically, it extends public sector performance audit research by integrating the concepts of infrastructure performance, Service Quality, and Expectation Confirmation Theory (ECT) within the context of urban transportation infrastructure. Practically, the

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findings are expected to provide evidence-based recommendations for local governments and road management authorities in establishing priorities for service quality improvements based on infrastructure performance audit indicators that have the greatest influence on public satisfaction. Accordingly, the primary objective of this study is to examine the effect of road infrastructure performance audits on user satisfaction with the Gatot Subroto Underpass in North Sumatra using the SEM-PLS approach. The findings are expected to produce an empirical model that can serve as a reference for evaluating infrastructure performance and formulating strategies to improve the quality, effectiveness, and sustainability of public transportation services.

2. RESEARCH METHODS

This study uses a quantitative approach with a descriptive-evaluative research design. The quantitative approach was chosen because it aims to measure road users' perception of the quality of service on the Gatot Subroto North Sumatra Underpass objectively through statistical analysis. Descriptive-evaluative design is used to describe the actual condition of infrastructure services while evaluating the level of importance and performance level of each service attribute based on the perception of road users. This approach is in accordance with the characteristics of public service research that emphasizes the measurement of user satisfaction as the basis for the preparation of recommendations for improving service quality.

The research was carried out at the Gatot Subroto Underpass, North Sumatra. The location was chosen purposively because it is one of the strategic transportation infrastructures that has a high traffic volume and functions as a link between various economic activity areas and settlements. The high mobility of vehicles causes the quality of underpass services to be an important factor in supporting the safety, comfort, and smooth travel of road users.

The research population is all users of the Gatot Subroto Underpass who cross the research site during the data collection period. Given that the number of populations cannot be known for sure (infinite population), the study used a non-probability sampling technique with a purposive sampling method. This technique was chosen because respondents must meet certain criteria in order to be able to provide an assessment that is in accordance with the research objectives. The respondents' criteria include: (1) at least 17 years old, (2) have crossed the Gatot Subroto Underpass at least twice in the past month, (3) are two-wheeled or four-wheeled vehicle drivers, and (4) are willing to fill out a complete questionnaire. Based on these criteria, 75 respondents were obtained. This number is considered adequate because the Importance Performance Analysis (IPA) and Customer Satisfaction Index (CSI) analysis do not require a very large sample size, but rather emphasize the quality of information obtained from respondents who truly understand the object of the research.

Data collection was carried out through field observations, questionnaire distribution, documentation, and literature studies. Observation is used to identify the physical condition of the underpass, such as the condition of the road surface, drainage, lighting, road markings, and smooth traffic flow. Furthermore, primary data was obtained through the distribution of questionnaires using a five-level Likert scale, namely 1 (very unimportant/very dissatisfied) to 5 (very important/very satisfied). Secondary data was obtained from relevant agencies, technical reports, government documents, and various scientific publications relevant to the evaluation of transportation infrastructure performance.

The operationalization of research variables is compiled based on the dimension of the quality of road infrastructure services that are widely used in transportation research. The research variables consisted of the importance and performance level of the underpass service attributes, which included road surface conditions, driving safety, traffic smoothness, drainage systems, lighting, environmental cleanliness, completeness of road signs and markings, and user comfort. All indicators were measured using a five-point Likert scale so that it was possible to calculate the average value of interests and performance in each service attribute.

Before the analysis is carried out, the research instrument is tested for validity and reliability. The validity test was carried out using Pearson Product Moment correlation by comparing the value of the correlation coefficient to the r-table value at a significance level of 5%, while the reliability of the instrument was tested using Cronbach's Alpha coefficient with a minimum value of 0.70 as the limit at which the instrument was declared reliable.

Data analysis was carried out using the Importance Performance Analysis (IPA) and Customer Satisfaction Index (CSI) methods. The selection of the IPA method is based on its ability to map the gap between the level of importance and the level of performance of each service attribute so that it can be known which attributes are the main priority for improvement. The results of the IPA are visualized in a Cartesian diagram that divides the attributes of service into four quadrants, namely top priority, maintain achievement, low priority, and excessive. Meanwhile, the CSI method is used to calculate the overall level of user satisfaction through weighting the level of importance and performance level of each service attribute. The combination of the two methods was chosen because it provides more comprehensive information, which not only shows the level of user satisfaction, but also produces improvement priorities that can be used as a basis for decision-making by road infrastructure managers.

Methodological studies show that the IPA and CSI methods have been widely applied in public service evaluation research, transportation, and road infrastructure because they are able to produce information that is easy to interpret by policy makers. The IPA is effective in identifying service attributes that need immediate improvement, while the CSI provides a quantitative measure of the overall level of user satisfaction. Therefore, the combination of

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the two methods is considered appropriate to be used to comprehensively evaluate the quality of Gatot Subroto Underpass services and produce recommendations for service improvement based on user perception.

The literature review in this study focuses on the theory of road infrastructure performance audit, public service quality, and road user satisfaction as the conceptual basis for the research. An infrastructure performance audit is an evaluation process that is carried out to assess the level of effectiveness, efficiency, and quality of a public facility in fulfilling the purpose of service to the community. In the context of road transportation, performance audits not only assess the physical condition of the road, but also evaluate the level of comfort, safety, smooth traffic, and benefits felt by road users. Performance audit theory is important because the development of transportation infrastructure basically aims to improve the quality of public services and support community mobility optimally. Road infrastructure that has good service quality will have a positive impact on economic, social, and distribution of goods and services. Therefore, evaluation of road performance needs to be carried out periodically so that the quality of service can continue to be improved according to the needs of the community. This theoretical study is used as a basis to understand the relationship between the quality of road infrastructure and the level of satisfaction of road users.

In addition to performance audit theory, this study also uses the service quality theory developed by Parasuraman, Zeithaml, and Berry through the SERVQUAL model. The theory explains that user satisfaction is influenced by the compatibility between user expectations and services received in real terms in the field. In the road transportation sector, the quality of service can be seen from various aspects such as road surface conditions, driving safety, lighting, completeness of road markings, drainage, environmental cleanliness, and smooth traffic flow. If the service received meets or exceeds the expectations of users, then the level of community satisfaction will increase. On the other hand, if the service conditions do not meet the expectations of users, it will cause dissatisfaction with the available road facilities. The concept of SERVQUAL is very relevant to be used in this study because it is able to measure road users' perception of the quality of service on the Gatot Subroto Underpass in North Sumatra. This approach also helps researchers in identifying service aspects that still need to be improved by road infrastructure managers.

Recent literature review shows that the Importance Performance Analysis (IPA) and Customer Satisfaction Index (CSI) methods are widely used in transportation research to measure the level of satisfaction of road users. The IPA method is used to determine the level of importance and performance level of a service based on user perception. Through this method, researchers can identify service attributes that are the top priorities in the repair and development of road infrastructure. Meanwhile, the CSI method is used to determine the overall level of user satisfaction with the services provided. The use of these two methods is considered effective because it is able to provide a comprehensive picture of the quality of road services from the perspective of the user community. Previous research has also shown that the IPA and CSI approaches are able to assist the government in determining policies to improve the quality of transportation services in a more targeted manner. Therefore, this study uses this approach as an analytical tool in evaluating the performance of the Gatot Subroto Underpass in North Sumatra.

The current development of transportation research also emphasizes the importance of a user-oriented approach or user oriented infrastructure evaluation in road infrastructure management. This approach places the road user community as the main indicator in assessing the success of an infrastructure development. Good infrastructure is not only judged from the technical aspect of construction, but also from the extent to which the facilities are able to provide a sense of security, comfort, and efficiency for road users. In the urban context, the underpass is one of the strategic infrastructures that has an important role in reducing congestion and improving the smooth mobility of vehicles. However, the existence of the underpass also requires continuous evaluation because the high volume of vehicles can affect the quality of road services over time. Therefore, the study of theory based on user satisfaction is very important so that the management of road infrastructure can run effectively and is oriented to the needs of the community. This research is expected to contribute to the development of the concept of road infrastructure performance evaluation based on user satisfaction in Indonesia.

This research activity was carried out on the Gatot Subroto Underpass in the North Sumatra region. The selection of the research location was based on the consideration that the underpass is one of the strategic transportation infrastructures that has a fairly high level of vehicle mobility every day. The Gatot Subroto Underpass functions as the main route that connects several important areas in urban areas so that it has a big role in supporting the smooth flow of community traffic. The high intensity of road use in this area makes the underpass very relevant to be researched in relation to the quality of service and the level of satisfaction of road users. In addition, this location also often experiences traffic congestion at certain hours, so an evaluation of its infrastructure performance is needed. This condition is an important reason why research on road performance audits needs to be carried out at this location. By choosing the Gatot Subroto Underpass as the object of research, it is hoped that the results of the research can provide a real picture of the quality of road infrastructure services in urban areas of North Sumatra.

The research was carried out directly in the field by involving road users as the main respondents of the study. Data collection is carried out at several road operational times, both during peak hours and normal hours, so that the data obtained can objectively describe road service conditions. In addition to conducting direct observation of the physical condition of the underpass, this study also distributed questionnaires to road users who passed through the research site. The road users who are respondents consist of two-wheeled vehicle drivers, four-wheelers, and people who often use the lane as daily mobility access. The determination of respondents was carried out by purposive sampling by considering the user's experience in using underpass facilities. Methodologically, the use of SEM-PLS is

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generally based on several considerations, such as relatively small sample size, predictive research models, the presence of latent variables measured using several indicators, and the absence of demands for strict data normality assumptions as in Covariance-Based SEM (CB-SEM). Therefore, the author needs to explain whether the use of SEM-PLS was chosen because the number of respondents was only 75 people, because the research model involves the latent construct of the Infrastructure Performance Audit and Road User Satisfaction, or because the research objectives are more oriented towards predicting the relationship between variables. In addition to primary data, this study also utilizes secondary data obtained from related agencies such as the Transportation Agency and road management agencies in North Sumatra. With the combination of primary and secondary data, the research is expected to be able to produce a more accurate and comprehensive analysis of the performance of the Gatot Subroto Underpass.

The first stage in the implementation of this research is to identify problems and conduct preliminary studies on the condition of the Gatot Subroto Underpass in North Sumatra. At this stage, the researcher conducts preliminary observations to find out the general condition of road infrastructure and various problems that are often experienced by road users. Observations were carried out by looking at the physical condition of the road, smooth traffic flow, drainage system, lighting, environmental cleanliness, and other supporting facilities contained in the underpass. In addition to field observations, the researcher also collected information from various scientific literature and previous research relevant to the topic of road infrastructure performance audits and road user satisfaction. This stage is important to do so that the researcher gains a deeper understanding of the research problem to be studied. The results of problem identification are then used as a basis for compiling research instruments in the form of questionnaires and road service assessment indicators. Thus, the research process can run in a more directed and systematic manner according to the predetermined research objectives.

The second stage is the process of collecting research data which is carried out through field observation, distribution of questionnaires, and documentation. Field observations were carried out to obtain data on the actual condition of the Gatot Subroto Underpass and traffic activities that occurred at the research site. Furthermore, questionnaires were distributed to road users to find out their perception of the quality of underpass services. The questionnaire was compiled based on road service indicators such as comfort, security, smooth traffic, physical condition of the road, lighting, and drainage system. Data collection is carried out directly to respondents so that the information obtained is more valid and in accordance with the experience of road users. In addition, documentation in the form of photos and field notes was also carried out to support the results of research observations. This stage of data collection is an important part because the quality of the data obtained will affect the results of the overall research analysis.

The third stage is to process and analyze research data using predetermined methods. The data from the questionnaire results was first tested for validity

and its reliability to ensure that research instruments are feasible to use. After the data is declared valid and reliable, the analysis is then carried out using the Importance Performance Analysis (IPA) and Customer Satisfaction Index (CSI) methods. The IPA method is used to determine the level of importance and performance level of underpass services based on the perception of road users. Through this analysis, the researcher can find out which service attributes need to be prioritized to be improved. Meanwhile, the CSI method was used to measure the overall level of satisfaction of road users with the quality of Gatot Subroto Underpass service. The results of data analysis were then interpreted to determine the relationship between road infrastructure performance and the level of satisfaction of road users. With this approach, the research can provide a more comprehensive picture of the quality of underpass services.

The last stage in this study is the preparation of research report and submission of recommendations. After all the data is analyzed, the researcher compiles the results of the research in the form of a systematic scientific report in accordance with the rules of academic writing. The results of the study will explain the condition of road infrastructure performance, the level of road user satisfaction, and the factors that affect the quality of Gatot Subroto Underpass services. In addition, this study also provides recommendations to related parties regarding service aspects that need to be improved to increase road user satisfaction. The recommendations are expected to be evaluation materials for local governments and road management agencies in repairing and developing transportation infrastructure. The stages of preparing the report are carried out carefully so that the research results can be understood well and provide practical and academic benefits. Thus, this research is expected to be able to make a real contribution in supporting the improvement of the quality of road infrastructure services in North Sumatra.

The hypothesis analysis in this study was compiled based on the relationship between road infrastructure performance variables as independent variables and road user satisfaction as dependent variables. The performance variables of road infrastructure are measured through several main indicators, namely the physical condition of the road, smooth traffic, drainage system, road lighting, driving safety, environmental cleanliness, and completeness of road support facilities. Meanwhile, the variable of road user satisfaction is measured based on public perception of comfort, safety, service effectiveness, and benefits of using the Gatot Subroto North Sumatra Underpass. The relationship between the two variables is based on the theory of service quality which states that the better the quality of service provided, the higher the level of user satisfaction with the service. In the context of this study, the quality of service is realized through the performance of road infrastructure that is able to provide a sense of security, comfort, smoothness, and efficiency for road users. Therefore, this study seeks to analyze the extent to which the performance of road infrastructure affects the level of community satisfaction of underpass users. Hypothesis analysis is carried out so that the research has a clear direction in testing the relationship between the variables studied.

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The first hypothesis in this study states that the performance of road infrastructure has a positive and significant effect on the satisfaction of road users on the Gatot Subroto Underpass, North Sumatra. This hypothesis is built on the assumption that good road infrastructure conditions will provide a more comfortable and safe driving experience for the community. Roads that have a good surface, free of inundation, adequate lighting, and smooth traffic will increase users' positive perception of the road service. On the other hand, if the road conditions are damaged, congestion, or supporting facilities do not function optimally, the level of user satisfaction will decrease. This positive influence is also supported by previous research that shows that the quality of road services has a close relationship with the satisfaction of the transportation user community. In this study, the hypothesis was tested using statistical analysis based on questionnaire results obtained from road users. The test results will later show whether the quality of the performance of the Gatot Subroto Underpass really has a significant influence on the level of road user satisfaction.

In addition to the main hypothesis, this study also analyzes the influence of each road infrastructure performance indicator on road user satisfaction. The physical condition of the road is suspected to be the dominant factor that affects user comfort because it is directly related to safety and smooth driving. A good drainage system is also expected to have an important influence because the underpass is an infrastructure that is vulnerable to waterlogging when it rains. In addition, lighting and road safety aspects are expected to affect users' sense of safety when passing, especially at night. The completeness of road markings, environmental cleanliness, and traffic regulation are also suspected to have influenced public perception of the quality of underpass services. Based on the relationship between these indicators, this study formulates a hypothesis that each road infrastructure performance indicator has a positive influence on the level of satisfaction of road users. This hypothesis analysis was carried out to find out which service indicators are the most dominant influencing community satisfaction so that it can be used as a basis for determining priorities for road infrastructure improvement and development in the future.

3. RESULTS AND DISCUSSION

3.1 Test Results

The implementation of this research activity began with direct observation in the Gatot Subroto Underpass area, North Sumatra, to find out the actual condition of road infrastructure and problems faced by road users. Observations are carried out during morning, noon, and evening rush hours to obtain a comprehensive picture of traffic conditions. The observation results show that the underpass has a very high level of vehicle mobility because it is one of the main routes connecting urban areas. The high volume of vehicles causes several conditions such as slowing down traffic flow, vehicle density at certain times, and increasing pressure on the physical quality of the road. In addition, several conditions were found such as waterlogging at certain points when it rained heavily and suboptimal lighting in some areas of the underpass. This condition causes some road users to feel uncomfortable when passing, especially at night or when the weather is bad. This research was carried out to provide an objective evaluation of the quality of road infrastructure services based on direct perceptions from the road user community. The main purpose of the research activity is to find out the level of satisfaction of road users with the Gatot Subroto Underpass service so that it can be known the aspects of services that still need improvement. This research also aims to provide recommendations to relevant agencies so that the quality of road services can be improved in a sustainable manner. Thus, the results of the research are expected to be able to help the government in improving the effectiveness of urban transportation infrastructure management.

In the initial stage of the implementation of research activities, the researcher coordinated with related parties to obtain information about the operational conditions of the Gatot Subroto Underpass. The information includes daily traffic volume, road maintenance schedules, drainage conditions, and road support facility management systems. Based on the results of the coordination, it is known that the underpass has an important role in reducing congestion at major intersections in urban areas of North Sumatra. However, the increase in the number of vehicles every year causes the burden of road services to be greater so that periodic evaluation of the quality of infrastructure is needed. This research is then directed to identify the extent to which road services have met the expectations of the road user community. The identification process is carried out by compiling service indicators that include comfort, security, smooth traffic, physical condition of the road, lighting, and drainage systems. Each of these indicators is compiled based on service quality theory and previous research that is relevant to road infrastructure performance audits. This approach is carried out so that the results of the research are able to provide a more comprehensive picture of the quality of underpass services. With this initial analysis, the research can be focused on the main problems that are really felt by the road user community. Therefore, this research activity has an important role in helping to identify solutions to existing road service problems.

In the implementation of the research, the researcher also distributed questionnaires to road users who passed through the Gatot Subroto Underpass. The distribution of questionnaires is carried out directly so that respondents can provide assessments based on real experiences while using the road facilities. The road users who became respondents consisted of motorcyclists, private cars, public vehicles, and light logistics vehicles. Each respondent was asked to provide an assessment of the condition of road services based on a certain satisfaction scale. Preliminary results show that most road users find the underpass to be quite helpful in reducing travel time compared to before the underpass was built. However, there are still some complaints related to the drainage system, vehicle density during peak hours,

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and the quality of street lighting. The complaint shows that although the underpass provides significant benefits to the smooth flow of traffic, the quality of service still needs to be improved in certain aspects. This research was then directed to find out which service factors most affect the level of satisfaction of road users. By understanding these dominant factors, improvement recommendations can be prepared in a more targeted manner. Therefore, the initial analysis of research activities is an important basis in determining the direction of road infrastructure service evaluation.

In addition to observing and distributing questionnaires, the researcher also documented the physical condition of the underpass as part of the road infrastructure performance audit process. Documentation is carried out at several points that are considered to have a great influence on the comfort and safety of road users. The results of the documentation show that in general the physical condition of the road is still in the good category, but there are several points that require attention in terms of routine maintenance. The drainage system in some areas looks less than optimal when there is high-intensity rain, causing temporary waterlogging. These conditions can affect the comfort of road users and have the potential to increase the risk of traffic accidents. In addition, some road markings began to experience a decrease in quality due to the high intensity of vehicles that pass by every day. This research then places safety and comfort aspects as the main focus in the evaluation of underpass services. The purpose of the evaluation is to find out whether the available road facilities have provided a sense of safety and comfort for road users to the maximum. The results of the analysis are expected to be the basis for more effective infrastructure improvements in the future. Thus, this research activity not only functions as an academic evaluation, but also as a form of contribution to improving the quality of public services.

Overall, the implementation of the study shows that the Gatot Subroto Underpass has a major contribution in supporting the smooth mobility of urban communities in North Sumatra. The infrastructure has helped reduce congestion points at major intersections and speed up road users' travel times. However, the research found that the quality of road services still needs to be improved on certain indicators so that user satisfaction can be more optimal. Aspects such as drainage, lighting, environmental cleanliness, and traffic management are the most frequently stated factors by users in the research questionnaire. This condition shows that the success of infrastructure development is not only measured by the physical existence of the road, but also by the quality of service felt by the community directly. This study is able to provide a real picture of the condition of underpass services based on the perception of road users as parties who feel the benefits of infrastructure every day. The results of the study also show that a user satisfaction-based performance audit approach is very important in supporting a more objective evaluation of public services. With this research, related agencies are expected to be able to determine the priorities for infrastructure improvement based on the needs of the road user community. This research is also the basis for encouraging the continuous improvement of the quality of urban road transportation services. Therefore, research activities have a strategic role in supporting the development of transportation infrastructure that is safer, more comfortable, and effective for the community.

Before the research activity is carried out, the researcher first identifies the characteristics of the respondents who are research participants. The number of respondents involved in this study was 75 road users who routinely pass through the Gatot Subroto Underpass, North Sumatra. Respondents consisted of a variety of occupational backgrounds and types of vehicles used in daily activities. Most of the respondents were two-wheeled vehicle users because these vehicles dominated urban traffic in the study area. In addition, there are also respondents who use private cars, public vehicles, and light operational vehicles who use the underpass as the main access for daily mobility. The characteristics of respondents are important to analyze because they can provide an overview of the group of road users who most often feel the quality of underpass services. Before the research activities were carried out, most of the respondents stated that they often experienced traffic congestion during morning and evening rush hours. Some respondents also expressed concern about the condition of waterlogging when heavy rain occurred in the underpass area. These initial conditions are an important basis for evaluating the quality of road services based on the direct experience of road users. By understanding the condition of the respondents before the study, the results of the analysis can describe the perception of the public more objectively and accurately.

Based on the respondent data obtained, the age group of road users is dominated by productive age between 20 and 45 years. This age group is a group of people who have high mobility in work, education, and other economic activities. The high mobility of road users of productive age causes the Gatot Subroto Underpass to be one of the important lanes used every day. In addition to the age factor, the level of frequency of road use is also an important indicator in this study. Most respondents use the underpass more than twice a day so they have enough experience to assess the quality of road services. Before the research activities were carried out, the majority of respondents assessed that the underpass was enough to speed up travel time compared to other alternative routes. However, there are still some respondents who consider that the comfort and safety of the road are not fully optimal, especially at night and during rainy conditions. This perception shows that although the main function of the underpass is already running well, there are several aspects of service that still need to be considered. This initial data is an important basis for analyzing changes in satisfaction levels after research evaluation. Therefore, identifying the characteristics of participants before the activity is very helpful in understanding the initial condition of road services felt by the community.

Respondent data also shows that most road users have a high level of dependence on the existence of the Gatot Subroto Underpass. The line is considered more efficient in reducing travel time and avoiding congestion at major

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urban intersections. Before the research activity took place, road users said that the traffic flow conditions were relatively smooth during normal hours, but experienced an increase in density at certain times. In addition, some road users consider that the lighting system and environmental cleanliness of the underpass still need to be improved in order to provide a better sense of security and comfort. This study then tried to measure in more detail the level of interest and level of user satisfaction with each road service indicator. The initial data shows that road users have quite high expectations for the quality of public infrastructure services. The community not only wants roads that can be passed smoothly, but also facilities that are safe, comfortable, and well-maintained. This condition shows that the quality of road services is an important factor that affects public satisfaction with public services. Therefore, analysis of the participants' conditions before the activity is an important part of the research evaluation process. By understanding these initial conditions, researchers can compare changes in user perception after road service analysis is carried out.

Visualization of respondent data before the research activity can be seen based on the type of road user vehicle involved in the study. Of the total 75 respondents, as many as 45 people used two-wheeled vehicles, 20 people used private cars, 5 people used public transportation, and 5 people used light operational vehicles. The data shows that two-wheeled vehicles are the dominant users of the Gatot Subroto Underpass every day. The high number of two-wheeled vehicles shows that road accessibility and comfort are very important for the mobility of urban communities. In addition, the dominance of two-wheeled vehicles also affects the perception of the quality of road services, especially in terms of safety and driving comfort. The following is a visualization of respondent data before the research activity is carried out.

The visualization shows that the majority of underpass users come from the group of users of private vehicles and two-wheeled vehicles. This condition shows that the quality of road services has a great influence on people's daily mobility activities. Therefore, improving the quality of underpass services is an important need to support the comfort of road users in urban areas of North Sumatra. The evaluation of *the outer model* is carried out to ensure that the measuring instrument used is valid and reliable in measuring its latent variables. The first stage is to look at the *Loading Factor* value on the *Convergent Validity* test. An indicator is declared valid if it has a *Loading Factor value* greater than 0.70. The results of data processing using SMART-PLS are presented in the following :

Table 1. Value of Loading Factor Research Construct

Variable Leave	Indicator	Loading Factor	Remarks
Infrastructure Performance Audit (X)	X1 (Physical Condition)	0.845	Valid
	X2 (Fluency)	0.891	Valid
	X3 (drainage)	0.712	Valid
	X4 (Lighting)	0.734	Valid
	X5 (Security)	0.81	Valid
Road User Satisfaction (Y)	Y1 (Comfort)	0.865	Valid
	Y2 (Security)	0.822	Valid
	Y3 (Effectiveness)	0.884	Valid
	Y4 (Benefits)	0.851	Valid

Based on the data exposure in Table 1 above, it is known that all indicators for the variables of Infrastructure Performance Audit (X) and Road User Satisfaction (Y) have a *Loading Factor* value above 0.70. The X2 (Smooth Traffic Flow) indicator recorded the highest value of 0.891, followed by Y3 (Time Effectiveness) of 0.884. This shows that smooth mobility is the main reflection that is directly felt by underpass users. Since no indicator has a value below 0.70, all indicators are declared valid and can be used for further analysis.

After testing the validity of each indicator, the next stage is to test the overall reliability of the model through the *Average Variance Extracted* (AVE), *Composite Reliability* (CR), and *Cronbach's Alpha values*. The model is said to be eligible if the AVE value > 0.50, the CR value > 0.70, and *Cronbach's Alpha* > 0.70. The results of the construct reliability test can be seen in Table 2:

Table 2. Reliability and Validity Model Test Results

Variable Leave	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)	Remarks
Infrastructure Performance Audit (X)	0,875	0,904	0,652	Reliable & Valid
Road User Satisfaction (Y)	0,881	0,91	0,731	Reliable & Valid

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Referring to Table 2, the results show that the AVE value for both variables is above the minimum limit of 0.50, which is 0.652 for variable X and 0.731 for variable Y. In addition, the *value of Composite Reliability* and *Cronbach's Alpha*in both constructs has exceeded 0.70. Thus, it can be concluded that the construct of this study has excellent internal consistency and reliability, so that the questionnaire measuring tool has proven to be resilient in measuring the perception of road users.

An internal model *analysis* was carried out to find out how much variation of exogenous variables was able to explain the endogenous variables. The predictive power of the model is judged from the acquisition of the determination coefficient or *the R-Square* value (R2). The results of the measurement of the R2 value for the road user satisfaction model are illustrated in Table 3 below:

Table 3. R-Square Value of Endogenous Construct

Variable endogenous	R-Square (R2)	R-Square Adjusted	Model Strength
Road User Satisfaction (Y)	0,618	0,613	Strong Moderate

Table 3 shows the *R-Square* value of 0.618. This value indicates that the variable of Road User Satisfaction (Y) can be explained by the variable of the Road Infrastructure Performance Audit (X) of 61.8%. Meanwhile, the remaining 38.2% was influenced by other variables outside of this research model (e.g. accessibility of alternative lanes, behavior of other motorists, or electronic signage facilities). A value of 61.8% indicates that infrastructure performance has a relatively strong and substantial contribution in shaping public satisfaction.

The final and most crucial stage in SEM-PLS is to conduct hypothesis tests (*Path Coefficients*) through the *bootstrapping process*. This test aims to see the direction of the relationship and the degree of significance of the influence between variables. The relationship is stated to be significant if *the T-Statistics* value is > 1.96 (at a significance level of 5% or α=0.05) and *the P-Values* value is < 0.05. The results of the hypothesis test are summarized in Table 4:

Table 4. Structural Pathway Hypothesis Test Results

Path Relationships	Line Coefficient (Original Sample)	T-Statistics	P-Values	Conclusion
Infrastructure Performance Audit (X) on Road User Satisfaction (Y)	0,786	12,451	0	Accepted Hypothesis (Significant)

Based on the structural data in Table 4, the path coefficient value (*Original Sample*) was obtained of 0.786 with a positive sign. This means that there is a unidirectional influence, where every improvement in the quality of road infrastructure performance audits will be followed by an increase in road user satisfaction by 78.6%. The *T-Statistics* value was observed to be very high, namely 12.451 (> 1.96) with *a P-Values* value of 0.000 (< 0.05). The results of this statistic empirically accept the research hypothesis that the Road Infrastructure Performance Audit has a positive and significant effect on the Satisfaction of Gatot Subroto Underpass Road Users in North Sumatra. The findings of SEM-PLS are in line with real conditions on the ground, where physical repairs and decomposition of traffic jams through the underpass project have been proven to increase the happiness and comfort of daily mobility of urban communities.

The results of the study show that the existence of the Gatot Subroto Underpass has a positive impact on the smooth mobility of people in urban areas of North Sumatra. Most respondents stated that the underpass was able to reduce travel time and help avoid the main congestion points at crossroads. The impact is felt directly by road users who cross the underpass area every day for work, education, and other economic activities. In addition to increasing travel efficiency, the existence of the underpass also has an impact on driving comfort because the traffic flow has become more regular than before infrastructure development was carried out. However, the results of the study also show that there are still several aspects of services that require further attention, such as drainage systems, lighting, and cleanliness of the road environment. Some road users said that the condition of waterlogging in the rainy season is still an obstacle that reduces driving comfort. In addition, suboptimal lighting at some underpass points causes some users to feel less safe when crossing at night. Despite some shortcomings, the majority of respondents still gave a positive assessment of the benefits of the existence of the underpass for community mobility activities. This shows that in general the quality of underpass services has had a fairly good impact on road users.

Analysis of participant satisfaction responses showed that the satisfaction level of road users was in the satisfied category with an average satisfaction score of 78%. This percentage was obtained from the results of processing questionnaire data using the Customer Satisfaction Index (CSI) approach. Most of the respondents expressed satisfaction with the smooth traffic aspect and the relatively good physical condition of the road. In addition, road users also gave a positive assessment of the effectiveness of the underpass in reducing congestion during peak hours. However, there are several service indicators that obtain lower satisfaction scores than other indicators. The drainage and lighting aspects are the indicators that receive the most criticism from road users. This shows that although the main function of the underpass has been running well, the quality of supporting facilities still needs to be improved

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so that road services can be more optimal. This study also shows that road user satisfaction is greatly influenced by the direct experience of the community when using road facilities every day. The better the quality of service felt by users, the higher the level of satisfaction given to the road infrastructure. Therefore, evaluation based on user perception is very important in the management of public transportation infrastructure.

The visualization of the impact and response of participant satisfaction showed that most respondents gave a positive assessment of the Gatot Subroto Underpass service. Of the total 75 respondents, 58 respondents stated that they were satisfied, 10 respondents stated that they were very satisfied, 5 respondents stated that they were quite satisfied, and 2 respondents stated that they were not satisfied with the quality of road services. The data shows that the level of public acceptance of the existence of the underpass is in the good category. Although there are still some complaints related to road support facilities, the majority of users still feel significant benefits from the existence of this infrastructure. The following is a visualization of the impact and satisfaction response of research participants.

The visualization shows that more than half of the respondents gave a satisfied rating of the underpass service. This condition shows that the construction of the underpass has had a positive impact on the quality of mobility of urban communities. Therefore, it is necessary to continuously improve the quality of service so that the level of satisfaction of road users can continue to increase in the future.

The results of the study showed that there was a change in the perception of road users after an evaluation of the quality of Gatot Subroto Underpass services. Before the research activities were carried out, most respondents assessed that road services still had some shortcomings in terms of comfort and supporting facilities. Road users often complain about drainage conditions when it rains, suboptimal lighting, and vehicle density at certain hours. However, after evaluation and submission of the results of the analysis to related parties, road users began to see attention to improving the quality of road services. Public awareness of the importance of public service evaluation also increased after the research was conducted. Respondents feel that their aspirations regarding the quality of road services are starting to be noticed as part of the development of urban transportation infrastructure. In addition, this study provides a clearer picture of the service indicators that most affect the level of satisfaction of road users. With this evaluation, road users can understand that improving the quality of service requires a continuous management and maintenance process. Therefore, this study has a positive impact on public perception of the importance of road infrastructure performance audits.

A comparison of conditions before and after the research activity was also seen in the level of satisfaction of road users with the underpass service. Before the research activity was carried out, the user satisfaction level was at an average of 65% with the category of quite satisfied. After analyzing and evaluating road services, the satisfaction rate increased to 78% with the satisfied category. This increase shows that road users increasingly understand the benefits of the existence of underpasses in supporting smooth urban mobility. In addition, this study also provides information to related parties regarding service aspects that need to be prioritized in improving road infrastructure. Factors such as lighting, drainage, and environmental cleanliness are the main indicators that need further attention. The results of the study show that the quality of good service has a great influence on the perception and satisfaction of the road user community. The better the services provided, the higher the level of public trust in public infrastructure management. This condition shows that road performance audits are very important in supporting the improvement of the quality of urban transportation services. Therefore, this research makes a real contribution in helping the evaluation of road services based on community satisfaction.

Comparative visualization before and after the research activity showed an increase in the level of road user satisfaction with the Gatot Subroto Underpass service. Before the study was conducted, the user satisfaction rate was at 65%, while after the study it increased to 78%. The data shows a 13% increase in the perception of road service quality. The increase was influenced by the public's understanding of the benefits of underpasses and the evaluation of the quality of services provided. The following is a comparative visualization of satisfaction levels before and after research activities.

The visualization shows that the research has a positive impact on the evaluation of road services and public perception of the quality of transportation infrastructure. With the increase in the level of satisfaction, this research can be the basis for the development of policies to improve the quality of urban road services in North Sumatra.

3.2 Discussion

The results of the study show that the quality of road infrastructure performance has a significant influence on the level of road user satisfaction on the Gatot Subroto Underpass, North Sumatra. This condition is in line with the theory of service quality which states that user satisfaction is influenced by the conformity between expectations and services received in real terms. In this study, the smooth traffic aspect was the service indicator that received the highest rating from the respondents. Road users feel that the existence of the underpass is able to reduce travel time and help avoid major congestion points in urban areas. The results of this study are in line with the research of Amanah and Latifa (2024) which states that the quality of road services has a positive relationship with the satisfaction of toll road users. In addition, research by Faisal et al. (2021) also shows that the quality of provincial road services affects public perception of public transportation services. The similarity of the results of the study shows that the quality of road infrastructure is an important factor in supporting the comfort and satisfaction of road users. In the context of this study, the Gatot Subroto Underpass is considered to have provided significant benefits to the smooth mobility of urban

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communities. Therefore, it is necessary to continue to improve the quality of services so that the benefits of infrastructure can be felt more optimally by the community.

Although the results of the study show a fairly good level of satisfaction, there are still some aspects of service that need further attention. The drainage system is one of the indicators that obtains the lowest satisfaction score from road users. This condition occurs because some road users still find puddles of water during high-intensity rain. In addition, the lighting at several underpass points is also considered not optimal, affecting the safety of road users at night. The results of this study are in line with the research of Gumelar et al. (2023) which states that the physical condition of roads and supporting facilities has a great influence on the comfort of road users. Research by Putri et al. (2025) also shows that the quality of road support facilities is an important factor in shaping public perception of public transportation services. Based on these results, it can be understood that the success of infrastructure development is not only measured by the physical existence of the road, but also by the quality of supporting services felt by the community. Therefore, improving road support facilities needs to be a priority in the management of the Gatot Subroto Underpass. With continuous improvements, the quality of road services can improve and have a positive impact on community satisfaction.

This study also shows that the user satisfaction-based performance audit approach is very effective in evaluating the quality of road infrastructure services. Through this approach, researchers can directly find out the public's perception of the service conditions they feel every day. The results of the study show that the public has high expectations for the quality of urban road services. Road users not only want smooth traffic, but also safety, comfort, cleanliness, and well-maintained road facilities. These findings are in line with the research of Tjitrohartoko and Saraswati (2020) who stated that the level of public satisfaction with transportation is greatly influenced by the quality of service as a whole. In addition, the research of Rodriguez-Valencia et al. (2019) explains that the Importance Performance Analysis method is very effective in identifying service indicators that need to be prioritized in improvement. In this study, drainage and lighting indicators are the main priorities that need to be improved based on the perception of road users. These results provide an idea that user-based evaluation is essential in supporting more effective management of public infrastructure. Therefore, a performance audit approach based on user satisfaction needs to be continuously developed in the evaluation of transportation services in Indonesia.

Overall, the results of the study show that the implementation of the road infrastructure performance audit on the Gatot Subroto Underpass is able to provide a real picture of the quality of road services based on the user's perspective. This study succeeded in identifying the main factors that affect the level of public satisfaction with urban road services. Compared to some previous studies, this study has the advantage of combining the evaluation of road performance audits with the analysis of user satisfaction directly on urban underpass facilities. This approach provides more comprehensive results because it not only assesses the technical aspects of the road, but also the perception of the public as the main user of public facilities. This study also shows that the quality of road services has a very close relationship with the level of comfort and public trust in the management of public infrastructure. With this research, related agencies are expected to be able to determine policies to improve road services in a more targeted manner based on the needs of the road user community. In addition to making practical contributions, this research also makes an academic contribution to the development of a study on transportation infrastructure performance audits based on user satisfaction. The results of the study are expected to be a reference for future research that discusses the evaluation of road and urban transportation services in Indonesia. Therefore, this research has an important role in supporting the development of a safer, more comfortable, and sustainable road transportation system for the community.

4. CONCLUSION

Based on the results of the study, it can be concluded that the road infrastructure performance audit has a positive and significant effect on the satisfaction of users of the Gatot Subroto Underpass Road in North Sumatra. The results of the analysis show that the quality of infrastructure performance is able to explain the variation in user satisfaction substantially, with indicators of smooth traffic flow and physical condition of the road as the aspects that obtain the highest rating. On the other hand, the drainage system, lighting, and environmental cleanliness are still indicators that require priority improvement to improve the quality of services as a whole. Practically, the findings of this study provide implications for local governments and road infrastructure management agencies that performance evaluation is not sufficiently oriented to the technical aspects of development, but also needs to consider user perception and satisfaction as the basis for the preparation of maintenance priorities, improvement of supporting facilities, and policy making for more effective, responsive, and sustainable transportation infrastructure management. Theoretically, this study strengthens the relationship between the concept of public sector performance audit, service quality, and user satisfaction (Expectation Confirmation Theory) in the context of urban transportation infrastructure. In addition, this research contributes in the form of an infrastructure performance audit evaluation model that integrates the perspective of user satisfaction so as to enrich the study of public sector performance audits which have been more oriented towards technical and administrative aspects. This study still has limitations because it was only conducted at one research location with a relatively limited number of respondents and has not included external factors such as transportation policies, traffic characteristics, and other environmental variables that have the potential to affect user satisfaction. Therefore, further research is recommended to expand the coverage of the area, increase the sample size,

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and develop a research model by adding other variables, such as service quality, road safety, infrastructure sustainability, or the effectiveness of transportation policies in order to obtain a more comprehensive model.

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