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# Development of a Road Infrastructure Index Model Integrating Disaster Parameters: A Case Study of Solok Regency

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**Abstract:** The road network is a crucial infrastructure that supports mobility and economic activity in a region. In Solok Regency, various issues related to the quality and equity of road network services remain a major challenge, primarily due to the lack of road performance evaluation that considers efficiency, effectiveness, and the impact of natural disasters. This study aims to develop a Road Infrastructure Index (RII) integrated with disaster parameters and predict future RII values. The research method used is a quantitative approach with primary data collection through questionnaires and interviews with stakeholders in the road infrastructure sector, as well as secondary data from relevant agencies. Reliability and validity tests were conducted to verify the consistency and accuracy of the questionnaire. Regression analysis was conducted to determine the model constants. The results of the study obtained a model that can be used to calculate and predict the value of the Road Infrastructure Index. Based on the predicted RII value results in Solok Regency, it was found that the RII value in the coming year will experience a decline.

**Keywords:** Development; Road Infrastructure Index; RII; Disaster Parameters; Solok Regency

## 1. Introduction

The road network is one of the primary infrastructures supporting mobility and economic activities within a region. Solok Regency, as one of the developing regions, faces challenges in providing an adequate road network to support community mobility, accessibility, and economic growth. Solok Regency covers an area of 3,738 km² and has a population of 408,424 [1], with a population density of 109 inhabitants per km². The regency consists of 14 sub-districts and 74 nagari connected by a road network.

The condition of the road network in Solok Regency plays a crucial role in supporting various daily activities of the community. Therefore, the performance of the existing road network must be capable of accommodating the increasing traffic load each year. To assess the performance of the road network, an instrument that is easy for users to apply is required. The Road Infrastructure Index (RII) is one of the simple and commonly used assessment models for evaluating road network performance [2]. Solok Regency is one of the regions in West Sumatra that frequently experiences various types of disasters, such as floods, landslides, and earthquakes [1]. Disaster events often disrupt the performance of the road network. Therefore, it is necessary to incorporate disaster parameters into the evaluation of road network performance [3][4][5].

This study aims to develop the Road Infrastructure Index (RII) by integrating disaster parameters that can be used to assess road network performance and predict its future performance. This research was conducted in Solok Regency.

The dimensions of each variable within the Road Infrastructure Index (RII) differ; therefore, to calculate the RII using the above formulation, the variable values must first undergo qualification through a scoring process. The scoring results produce a standardized assessment platform across all RII variables, enabling the weighting process to be conducted [3][6]. The qualification assessment applied in this study uses a scoring system with a rating scale ranging from 1 (very poor condition) to 5 (very high condition) [5][7].

## 2. Literature Review

### 2.1 Road Infrastructure and Road Network Systems

Road infrastructure constitutes a fundamental component of regional transportation systems and plays a pivotal role in supporting spatial integration, economic productivity, and social mobility [8]. Within the framework of regional development, roads are not merely physical corridors for vehicular movement but are strategic assets that facilitate connectivity between production centers, service areas, and residential zones [6]. The adequacy, continuity, and functional reliability of road infrastructure therefore represent essential preconditions for sustainable regional growth.

Legally, the definition of roads in Indonesia is stipulated in Undang-Undang Nomor 38 Tahun 2004 tentang Jalan, which characterizes roads as land transportation infrastructure comprising all structural and complementary elements intended for public use [9]. This definition underscores that road performance cannot be evaluated solely on the basis of pavement condition; rather, it must be assessed as part of an integrated network system. A road network consists of interconnected road segments operating hierarchically and functionally, where the performance of individual links collectively determines overall system efficiency. Disruptions or deficiencies in critical segments may compromise connectivity, increase travel time, and reduce service reliability across the network. Consequently, the evaluation of road infrastructure requires a systemic and multidimensional approach.

### 2.2 Road Network Performance

Road network performance refers to the capacity of a transportation system to provide adequate mobility services in accordance with its designated function and traffic demand [8]. In transportation engineering, performance is commonly associated with indicators such as serviceability, structural condition, traffic capacity, and operational efficiency [2]. However, in the context of regional infrastructure management, performance assessment must also consider proportional adequacy relative to territorial extent, population size, and socio-economic dynamics [6].

The concept of road network performance is inherently multidimensional. It encompasses infrastructure availability, reflecting the sufficiency of road length relative to the geographic area; structural and functional condition, representing the proportion of roads classified as stable or serviceable; traffic load intensity, indicating the level of demand imposed on the network; and service provision, describing the extent to which infrastructure meets population needs [6]. Because these dimensions are measured in different units and scales, an aggregate evaluative mechanism is required to synthesize them into a unified analytical framework. This need has led to the development of composite indices designed to capture overall infrastructure performance in a comprehensive and comparable manner.

## 2.3 Road Infrastructure Index (RII)

The Road Infrastructure Index (RII) was developed as an analytical instrument to evaluate the overall provision and performance of road infrastructure at the regional level [10]. The conceptual foundation of RII is grounded in the premise that infrastructure performance should be assessed not only in terms of physical condition but also in relation to spatial coverage, traffic demand, and population characteristics [11]. RII therefore integrates several performance-related ratios into a single composite score through a structured process of normalization and weighting.

In its conventional formulation, RII is calculated as a weighted aggregation of four principal variables: road availability, defined as the ratio of total road length to regional area; network condition performance, measured by the proportion of roads in stable or maintainable condition relative to total network length; traffic load, expressed as the ratio of total road length to the number of vehicles; and service provision, defined as the ratio of road length to population size [12][13][14]. In this study, the analytical model extends the conventional formulation by incorporating a disaster-related variable, thereby acknowledging the influence of environmental vulnerability on infrastructure sustainability. The resulting composite index reflects not only supply-side characteristics of infrastructure provision but also demand-side pressures and external risk factors affecting network performance.

The RII framework employs a scoring system to convert dimensional variables into standardized, dimensionless scores, enabling cross-variable comparison [15]. Subsequently, weighting coefficients are applied to represent the relative importance of each variable. The final index value serves as an indicator of overall road infrastructure adequacy and provides a basis for identifying policy priorities in construction, maintenance, and capacity enhancement.

## 2.4 Minimum Service Standards (SPM) in Road Infrastructure

While RII functions as an analytical and comparative performance measure, the concept of Minimum Service Standards (SPM) represents a normative benchmark that must be fulfilled by local governments. The obligation to achieve minimum service standards in road provision is mandated under Undang-Undang Nomor 38 Tahun 2004 about highway, which stipulates that road management outcomes must comply with established minimum service criteria.

Technical guidance for SPM in the road sector is provided in Keputusan Menteri Permukiman dan Prasarana Wilayah Nomor 534/KPTS/M/2001. Within this framework, road service performance is evaluated based on three principal aspects: accessibility, mobility, and safety. Accessibility refers to the ease with which communities can reach activity centers and is typically measured by the ratio of road length to area. Mobility reflects the capacity of the network to accommodate population movement and is commonly expressed as road length per capita. Safety is assessed through accident-related indicators, representing the network's ability to provide secure transportation services.

Unlike RII, which emphasizes comparative assessment and performance ranking, SPM establishes threshold values that define the minimum acceptable level of infrastructure provision. Therefore, while RII identifies relative performance among regions, SPM ensures that essential service obligations are met in accordance with national standards.

## 2.5 Road Stability and Service Condition

The concept of road stability constitutes a critical dimension of network performance evaluation. Although no single formal document provides a universally accepted definition, prevailing technical interpretations describe stable roads as those whose structural and operational conditions fall within acceptable service corridors. According to Peraturan Menteri Pekerjaan

Umum Nomor 13/PRT/M/2011, roads classified as serviceable are those in good or fair condition consistent with their design life and applicable technical standards.

Road stability encompasses both construction stability and service stability. Construction stability relates to the structural adequacy of pavement layers and supporting components, while service stability pertains to the operational capacity of the road to accommodate traffic demand without requiring capacity expansion. Roads classified as stable generally require routine or periodic maintenance rather than major rehabilitation or reconstruction. Consequently, the proportion of stable roads within a network serves as a fundamental indicator of infrastructure quality and long-term sustainability.

### 2.6 Efficiency and Effectiveness in Road Network Management

Performance evaluation of road infrastructure is incomplete without consideration of efficiency and effectiveness dimensions. Effectiveness refers to the extent to which road infrastructure achieves its intended objectives, including improved accessibility, enhanced mobility, reduced travel time, and support for economic activity. In empirical analysis, improvements in composite performance indices and compliance with minimum service standards may serve as proxies for effectiveness.

Efficiency, in contrast, concerns the relationship between resource inputs and measurable outputs. In the context of road management, efficiency evaluates whether financial allocations and technical resources generate proportional improvements in network condition and service performance. An infrastructure system may be considered inefficient if increased budgetary expenditure does not correspond to measurable enhancement in performance indicators. Therefore, examining the relationship between public spending, socio-economic growth variables such as per capita income, and infrastructure indices provides a basis for assessing the managerial performance of road sector governance.

### 2.7 Disaster Risk and Infrastructure Resilience

In regions characterized by exposure to natural hazards, infrastructure performance must also be analyzed from a resilience perspective. Natural disasters such as floods, landslides, and earthquakes may significantly affect structural integrity, interrupt connectivity, and accelerate deterioration processes. The integration of a disaster-related variable within the RII framework reflects an expanded understanding of infrastructure evaluation that incorporates environmental vulnerability.

From a resilience standpoint, a robust road network is not solely defined by its physical adequacy under normal conditions but also by its capacity to withstand, absorb, and recover from external shocks. Incorporating disaster exposure into performance measurement provides a more realistic and dynamic representation of infrastructure sustainability, particularly in geographically vulnerable regions.

## 3. Research Method

The object of this study is the road network in Solok Regency. The analysis was conducted using the Road Infrastructure Index (RII) method, which considers the variables of road availability (Ktj), road network performance (Knj), traffic load (Bln), road infrastructure service (Pyp), and incorporates natural disaster factors (Bcn). The formulation of the Road Infrastructure Index variables used in this study is based on Depkimpraswil 2004, as presented in Eq. 1.

$$RII = a \times Ktj + b \times Knj + c \times Bln + d \times Pyp + e \times Bcn \quad (1)$$

With the following description:

| | |
|---|---|
| Ktj | : road availability variable |
| Knj | : road network performance variable |
| Bln | : road traffic load variable |
| Pyp | : road infrastructure service variable |
| Bcn | : road disaster vulnerability variable |
| a, b, c, d, e | : weight of the importance level of the Ktj, Knj, Bln, Pyp, and Bcn variable |

The data required in this study consist of Primary and secondary data. Primary data obtained through interviews and questionnaire surveys to capture perceptions regarding the qualification of the RII variables and the relative importance weights among the RII variables used in the RII estimation. The respondents were personnel who possess knowledge and understanding of road conditions and meet the minimum qualification of a Bachelor's degree (S1) in Civil Engineering, including structural officials in the Bina Marga division, first-level/junior experts in road and bridge engineering, and individuals with more than five years of professional experience in the road sector. Secondary data, defined as data previously collected and made available, typically having been used by researchers or relevant agencies. The required secondary data include regional data of Solok Regency, population statistics, number of vehicles, road network data of Solok Regency, Regional Gross Domestic Product (GRDP), and road infrastructure budget allocations.

## 4. Result and Discuss

### 4.1. Data Adequacy Test

The data adequacy test for questionnaires is generally based on sample size determination. One of the commonly used methods for questionnaires or interviews is Cochran's formula. In Cochran's formula, the proportion used is P = 0.5 with a confidence level of 95% or a significance level (α) of 5%. The calculation of the sample adequacy test is presented in Eq. 2.

$$n_0 = \frac{Z^2 \times p \times q}{e^2} \qquad \text{(2)}$$

$$n_0 = \frac{1.96^2 \times 0.5 \times (1 - 0.5)}{0.1^2}$$

$$n_0 = 96.04$$

With the following description:

| | |
|---|---|
| Z | : confidence level of 95% (Z = 1.96) |
| p | : proportion (p = 0.5) |
| q | : 1-p |
| e | : margin of error (10% or 0.1α) |

After calculating the sample adequacy using Cochran's formula, the minimum required sample size was found to be 96.04 respondents. Subsequently, the value of *n* was recalculated for a finite population (N = 30), as presented in Eq. 3.

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}} \qquad \text{(3)}$$

$$n = \frac{96.04}{1 + \frac{(96.04 - 1)}{30}}$$

$$n = 23 \text{ respondents}$$

Based on Cochran's formula for a finite population, the minimum sample size required for this study was 23 respondents from a total population of 30 eligible personnel. During the data collection process, questionnaires were distributed to all eligible respondents, and 25 valid questionnaires were successfully returned and met the study's inclusion criteria. Since the number of valid responses exceeded the minimum sample size requirement, all subsequent analyses, including the validity test, reliability test, and Road Infrastructure Index (RII) analysis, were conducted using data from 25 respondents.

### 4.2. Data Validity Test

The validity test aims to determine the validity of the questionnaire used by the researcher to measure and obtain research data from respondents. This study employed the Pearson validity test, a statistical method used to assess the validity of an instrument/questionnaire by calculating the Pearson correlation between each item score and the total score. An indicator is considered valid if R_calculated > R_table. The results of the validity test for each RII variable, calculated using the Pearson Correlation formula in Microsoft Excel, are presented in Table 1 and Table 2.

**Table 1.** Validity Test of Variable Importance

| | Variable | | | | |
|---|---|---|---|---|---|
| | Ktj | Knj | Bln | Pyp | Bcn |
| R calculated | 0.411 | 0.558 | 0.823 | 0.878 | 0.725 |
| R Table (n=25) | 0.396 | 0.396 | 0.396 | 0.396 | 0.396 |
| Remarks | Valid | Valid | Valid | Valid | Valid |

**Table 2.** Validity Test of Variable Importance Ratings

| | Variable | | | | |
|---|---|---|---|---|---|
| | Ktj | Knj | Bln | Pyp | Bcn |
| R calculated | 0.860 | 0.772 | 0.741 | 0.776 | 0.596 |
| R Table (n=25) | 0.369 | 0.369 | 0.369 | 0.369 | 0.369 |
| Remarks | Valid | Valid | Valid | Valid | Valid |

Based on the validity testing results, the data for each variable in the questionnaire are considered valid.

### 4.3. Data Reliability Test

The reliability test aims to determine the level of consistency of the questionnaire used, ensuring that the instrument is dependable, even if the study is conducted repeatedly at different times using the same questionnaire. In this study, the reliability test was performed using the Cronbach's Alpha method. The Cronbach's Alpha formula is presented in Eq. 4.

$$r_{11} = \left[\frac{k}{(k-1)}\right]\left[1 - \frac{\sigma_b^2}{\sigma_t^2}\right] \quad \text{..........................................} \quad (4)$$

With :

$r_{11}$ : reliability coefficient of the instrument (total test)

$k$ : number of valid items

$\sigma_b^2$ : sum of item variances

$\sigma_t^2$ : total score variance

The results of the reliability test for each RII variable, calculated using the Cronbach's Alpha formula in Microsoft Excel, are presented in Table 3 and Table 4. An indicator is considered reliable if the Cronbach's Alpha value is greater than 0.6.

**Table 3.** Reliability Test of Variable Importance

| | Variable | | | | | |
|---|---|---|---|---|---|---|
| | Ktj | Knj | Bln | Pyp | Bcn | Total |
| Total Variance | | | | | | 7.207 |
| Item Variance | 0.340 | 0.427 | 1.000 | 0.667 | 0.557 | 2.990 |
| Cronbach's Alpha | | | 0.731 | | | |
| Remarks | | | 0.731 > 0.6 = Reliable | | | |

**Table 4.** Reliability Test of Variable Importance Ratings

| | Variable | | | | | |
|---|---|---|---|---|---|---|
| | Ktj | Knj | Bln | Pyp | Bcn | Total |
| Total Variance | | | | | | 7.207 |
| Item Variance | 2.973 | 2.073 | 1.277 | 0.667 | 0.557 | 2.990 |
| Cronbach's Alpha | | | 0.800 | | | |
| Remarks | | | 0.800 > 0.6 = Reliabel | | | |

The total variance ($\sigma_t^2$) presented in Table 3 and 4 was obtained from the variance of the respondents' total questionnaire scores calculated in Microsoft Excel. This value is used in the Cronbach's Alpha formula and does not represent the sum of the variances of each individual item. Based on the reliability test results shown in Table 3 and 4, the data for each variable in the questionnaire are considered reliable.

### 4.4. Road Infrastructure Index (RII) Analysis

The qualification and weighting of the RII variables were obtained from the analysis of respondents' perceptions regarding the qualification and importance level of each variable, namely: Road Infrastructure Availability (Ktj), Road Infrastructure Performance (Knj), Traffic Load (Bln), Road Infrastructure Service (Pyp), and Natural Disaster Factor (Bcn). For the qualification of each RII variable, respondents were provided with several RII variable values to be rated on a qualification scale of 1–5. Meanwhile, for the weighting among variables, respondents were asked to assess the level of importance of each variable (Ktj, Knj, Bln, Pyp, Bcn).

### 4.5. Qualification of the Road Infrastructure Availability Variable (Ktj)

In the RII formulation used in this study, the road infrastructure availability variable (Ktj) is defined as the total length of the road network per unit area, expressed in km/km². Mathematically, the value of Ktj is presented in Eq. 5.

$$Ktj = \frac{\text{Road Length (km)}}{\text{Regional Area (km}^2\text{)}} \qquad \text{(5)}$$

$$Ktj = \frac{1152.99}{3738\ \text{km}^2}$$

$$Ktj = 0.31\ \text{km/km}^2$$

(1 km road serves 3.24 km² area)

### 4.6. Qualification of the Road Network Performance Variable (Knj)

In the RII formulation used in this study, the road network performance variable (Knj) is defined as the length of regency roads in good condition divided by the total length of the regency road network, expressed as the percentage (%) of roads in good condition. Mathematically, the value of Knj is presented in Eq. 6.

$$Knj = \frac{\text{Length of serviceable roads}(\text{km})}{\text{Total roads length (km)}} \quad \text{......} \quad (6)$$

$$Knj = \frac{722.06}{1152.99}$$

$$Knj = 0.626$$

### 4.7. Qualification of the Traffic Load Variable (Bln)

In the RII formulation used in this study, the Traffic Load variable (Bln) is defined as the total length of the regency road network divided by the number of vehicles, expressed in units of (km/1000 smp). Mathematically, the value of Bln is presented in Eq. 7.

$$Bln = \frac{\text{Road Length}(\text{km})}{\text{smp}/1000} \quad \text{......} \quad (7)$$

$$Bln = \frac{1152.99}{61.35/1000}$$

$$Bln = 18.80\ \frac{km}{1000}\text{smp}$$

(1 km road serves 53 vehicles)

### 4.8. Qualification of the Road Infrastructure Service Variable (Pyp)

In the RII formulation used in this study, the Road Infrastructure Service variable (Pyp) is defined as the total length of the regency road network divided by the population, expressed in units of (km/1,000 inhabitants). Mathematically, the value of Pyp is presented in Eq. 8.

$$Pyp = \frac{\text{Road Length}(\text{km})}{\text{total population } \frac{km}{1000}} \quad \text{......} \quad (8)$$

$$Pyp = \frac{1152.99}{408.42/1000}$$

$$Pyp = 2.823\ \frac{km}{1000}\text{person}$$

(1 km road serves 354 people)

### 4.9. Qualification of the Natural Disaster Variable (Bcn)

In the RII formulation used in this study, the Natural Disaster variable (Bcn) is defined as the total length of the road network divided by the number of disaster events that occurred. Mathematically, the value of Bcn is presented in Eq. 9.

$$Bcn = \frac{\text{Road Length(km)}}{\text{Number of disaster}} \quad \text{(9)}$$

$$Bcn = \frac{1152.99}{60}$$

$$Bcn = 19.43\,\frac{\text{km}}{\text{disaster}}$$

This result indicates that, on average, one disaster event is associated with approximately 19.43 km of the road network. In other words, the road infrastructure is exposed to one recorded disaster event for every 19.43 km of road. This indicator was subsequently used as the natural disaster (Bcn) variable in the RII analysis and questionnaire development.

### 4.10. Importance Weights of RII Variables

The results of the questionnaires completed by the respondents are presented in Table 5

**Table 5.** Ranking Distribution of RII Variables Importance

| RII Variable | Rank of Importance Levels (%) | | | | | Standard Deviation |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| Ktj | 0 | 0 | 16 | 32 | 52 | 0.76 |
| Knj | 0 | 4 | 44 | 48 | 4 | 0.65 |
| Bln | 40 | 36 | 12 | 12 | 0 | 1.02 |
| Pyp | 0 | 44 | 32 | 24 | 0 | 0.82 |
| Bcn | 0 | 20 | 44 | 36 | 0 | 0.75 |

To quantify the ranking of the importance levels of RII variables, the weighting scores assigned by the respondents were summed and averaged for each RII variable, as presented in Table 6.

**Table 6.** Importance Weights of RII Variables

| RII Variable | Importance Rank | Importance Weight | Standard Deviation |
|---|---|---|---|
| Ktj | 1 | 0.231 | 1.72 |
| Knj | 2 | 0.209 | 1.44 |
| Bln | 5 | 0.173 | 1.13 |
| Pyp | 4 | 0.183 | 1.12 |
| Bcn | 3 | 0.204 | 0.96 |
| Total | | 1.000 | |

### 4.11. Assessment of RII in Solok Regency

Based on the qualification of the RII variables described above, an RII estimation formula used in this study can be constructed using Eq. 1. Also, based on the available data of RII variables in Solok Regency, complete data were obtained up to 2023. Using this data, the RII values were calculated, and the results are presented in Tables 7.

**Table 7.** RII Constant Values for 2023 in Solok Regency

| Constant | | | | | Score | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *a* | *b* | *c* | *d* | *e* | Ktj (km/ km$^2$) | Knj - | Bln (km/ 1000 smp) | Pyp (km/ 1000 person) | Bcn Km/ disaster |
| 0.23 | 0.21 | 0.17 | 0.18 | 0.20 | 0.308 | 0.626 | 18.80 | 2.823 | 19.43 |

The qualification criteria used in this study employed a scoring system with a rating range from 1 to 9, with the qualifications presented in Table 8. Based on the criteria in Table 8, the calculated RII value for the latest year (2023) in Solok Regency is 7.926, indicating that the provision of the quantity/number and qualification/physical condition of road infrastructure can be classified as 'High'.

**Table 8.** Score Range and Qualification of RII Variables

| RII Score Range | RII Qualification |
|---|---|
| 1-2 | Extremely Low |
| 3-4 | Low |
| 5-6 | Moderate |
| 7-8 | High |
| 9-10 | Very High |

## 4.12. Prediction of the Road Infrastructure Index (2024–2028)

Using the historical data of the past five years for each RII indicator, the Road Infrastructure Index values were predicted. The predicted values for 2024–2028 are presented in Table 9.

**Table 9.** Predicted Road Infrastructure Index (RII) for 2024–2028

| Year | constant | | | | | Score Ktj | Score Knj | Score Bln | Score Pyp | Score Bcn | RII |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *a* | *b* | *c* | *d* | *e* | (km/ km$^2$) | - | (km/ 1000 smp) | (km/ 1000 person) | (km/ disaster) | |
| 2024 | 0.23 | 0.21 | 0.17 | 0.18 | 0.20 | 0.310 | 0.639 | 17.66 | 2.80 | 18.853 | 7.626 |
| 2025 | 0.23 | 0.21 | 0.17 | 0.18 | 0.20 | 0.311 | 0.648 | 16.40 | 2.77 | 18.389 | 7.310 |
| 2026 | 0.23 | 0.21 | 0.17 | 0.18 | 0.20 | 0.312 | 0.656 | 15.11 | 2.74 | 17.951 | 6.993 |
| 2027 | 0.23 | 0.21 | 0.17 | 0.18 | 0.20 | 0.313 | 0.664 | 13.84 | 2.71 | 17.536 | 6.686 |
| 2028 | 0.23 | 0.21 | 0.17 | 0.18 | 0.20 | 0.315 | 0.673 | 12.64 | 2.68 | 17.143 | 6.394 |

Fig. 1 shows a predicted decline in RII values in the coming years based on the trend of the available data. This indicates that the road infrastructure condition is expected to deteriorate over time and is projected to fall into the 'Medium' classification by 2029.

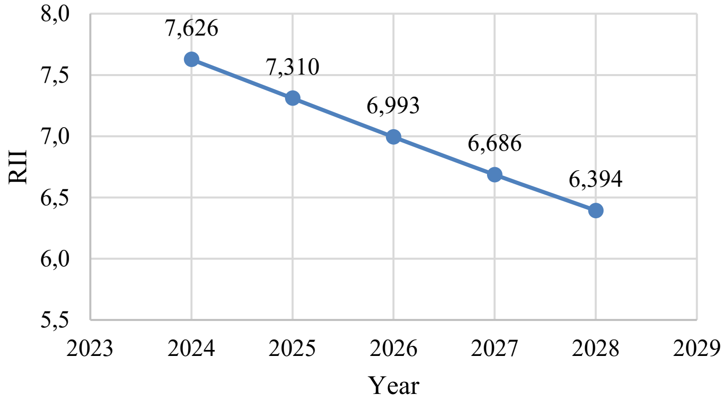


**Fig. 1.** Predicted RII Values for 2024–2028

### 4.13. Analysis of Efficiency and Effectiveness of Road Network Performance Based on RII

The results of the efficiency and effectiveness analysis of the road network performance in Solok Regency are shown in Fig. 2.

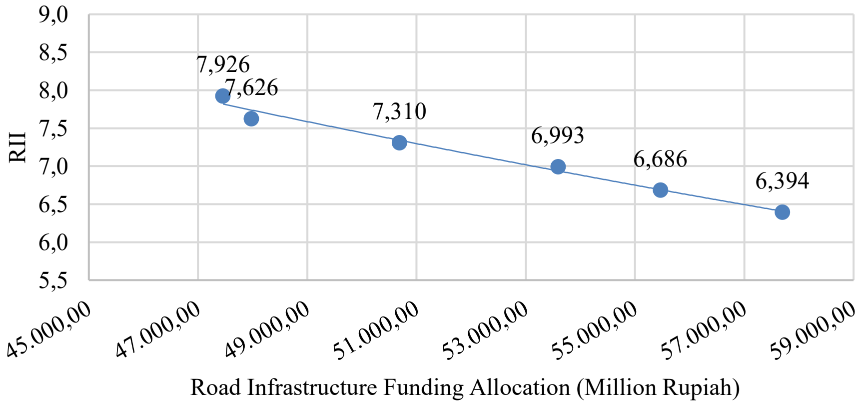


**Fig. 2.** Relationship between RII Values and Road Sector Fund Allocation

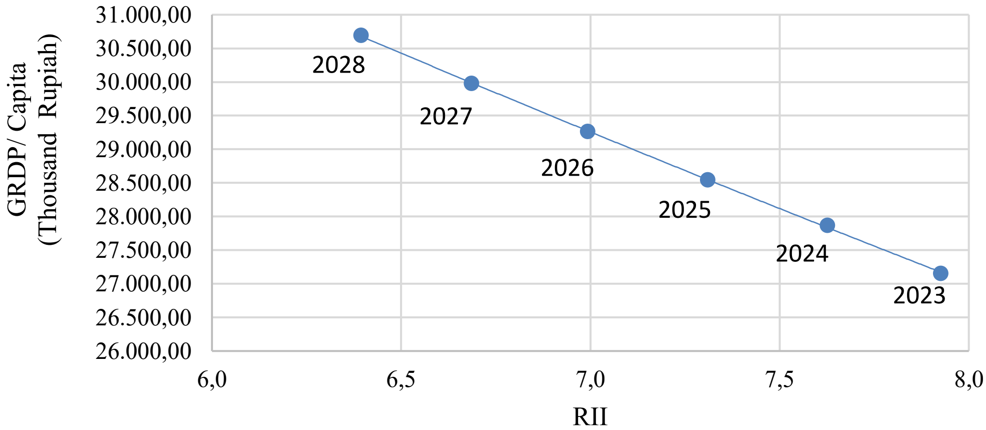


**Fig. 3.** Relationship between RII Values and Per Capita GRDP

The graph in Fig. 2 shows that an increase in government expenditure for the road subsector does not lead to a higher RII value. The relationship between RII values and per capita PDRP can be observed in Fig. 3. Based on the data in Fig. 3, by predicting an increase in GRDP in the coming years, it is shown that the RII value of Solok Regency is expected to decline during 2023–2028.

### 4.14. Recapitulation of Results and Discussion

Based on the discussion of the analysis results above, a summary is presented in Table 10.

**Tabel 10.** Recapitulation of Result and Discussion

| Aspect | Explanation |
|---|---|
| Data Validity and Reliability | The results of the statistical tests indicate that all Road Infrastructure Index variables are valid and reliable, and therefore can be used for further analysis. |
| Analysis of the Road Infrastructure Index (RII) | The Road Infrastructure Index (RII) value for Solok Regency in 2023 is 7.926 (classified as 'High'), indicating that the road network performance in Solok Regency is still able to accommodate the existing conditions. |
| RII Prediction for 2024–2028 | The RII trend is projected to decline without policy intervention, indicating an urgent need for improvement. The RII value in 2029 is expected to reach the 'Medium' classification. |
| Budget Efficiency and Effectiveness | The current increase in government budget allocation does not correspond to an increase in RII, indicating that the funds provided for road provision have not yet had an impact on improving RII values. This suggests that the current government budget increase has not been effective. |

### 4.15. Policy Recommendations

To improve the performance of the road network in Solok Regency, several policy recommendations are proposed to serve as a reference for planning, construction, and maintenance of road infrastructure. The recommended policies include: (a) prioritizing the maintenance and rehabilitation of existing roads; (b) increasing the capacity of the road network; (c) conducting regular evaluations of transportation policies; and (d) assessing the effectiveness of infrastructure spending. These policy recommendations are expected to provide a basis for the local government to manage the road network more effectively and efficiently, supporting sustainable development in Solok Regency.

## 5. Conclussion

Based on the analysis and discussion, it can be concluded that disaster indicators can be incorporated into the Road Infrastructure Index (RII) assessment model. The RII value for Solok Regency in 2023 is 7.926, classified as 'High'. The predicted RII values for Solok Regency from 2023 to 2028 show a declining trend, with the RII expected to reach the 'Medium' classification in 2029. The analysis of road budget allocation indicates that the funds have not had a direct impact on increasing the RII. Based on the RII assessment, road sector budgeting in Solok Regency is considered neither efficient nor effective, as each increase in government expenditure for the road subsector has not led to an increase in RII. Furthermore, the annual growth in per capita GRDP has not resulted in an improvement in RII values.

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