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Application of Rescaled Adjusted Partial Sums (RAPS) Method in Validation of Traffic Management Risk Analysis Data in Large Cities in Indonesia

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Abstract

This study examines the application of the Rescaled Adjusted Partial Sums (RAPS) method in validating traffic management risk analysis data in the category of large cities in Indonesia. The RAPS method is used to test the consistency and reliability of data that is the basis for traffic management risk analysis, so that it can ensure the validity of the risk assessment results. Data validation is very crucial in traffic management risk analysis to ensure the accuracy and reliability of the analysis results that are the basis for decision making. In order for the implementation of traffic management to be in accordance with the goals and objectives, traffic management analysis is needed to minimize the risk of failure of the implementation. Traffic management risk analysis in this study uses the Failure Modes, Effects and Criticality Analysis (FMECA) method. The data used are based on the results of filling out questionnaires from respondents, in the form of an assessment of three components, namely severity, occurrence, and detection for four indicators (road capacity, side obstacles, traffic conflicts, and traffic signs/markings) which have sub-indicators of the existing negative impacts. The data were validated to see the consistency of the data provided by respondents using the RAPS method. The results of the validation test using the RAPS method show that the data from the assessment of three components for four indicators that have sub-indicators of negative impacts are valid. And the test results show that the RAPS method is effective in identifying consistent and inconsistent data, thereby improving the quality of risk analysis data validation. With better validation, traffic management risk analysis can be carried out more precisely and efficiently.

Keywords: Traffic Management, FMECA, Validation, RAPS, Risk.

1. Introduction

Several applications of traffic management in Indonesia have failed, for example the implementation of even odd in Jakarta, the operation of Trans Binjai (Binjai) and Trans Sarbagita (Bali). It is considered unable to unravel traffic congestion, and even suffers economic losses because people are reluctant to use it for various reasons that should have been anticipated earlier [1]. Not all traffic problems require solutions in a complicated and costly way, sometimes a simple policy has solved the traffic problem, but it is not uncommon for a traffic problem not to be unraveled despite all the efforts, plans, analysis and even a lot of money. In anticipation of this, it is worth thinking about estimating the risks and impacts of traffic management before it is implemented.

Traffic management is a series of efforts and activities that include planning, procurement, installation, regulation, supervision, and maintenance of road facilities and equipment with the aim of realizing, supporting, and maintaining security, safety, order, and smooth traffic [2]–[7]. It can also be interpreted as a process of activities in regulating and controlling traffic flow by optimizing the use of

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existing infrastructure to facilitate traffic to use road space efficiently and speed up the traffic system without the need to add or create new infrastructure.

Risk analysis is a systematic process for assessing risks that have been identified with the aim of estimating the likelihood of risk occurrence and the magnitude of its impact on achieving organizational goals [8]. Risk analysis in traffic management is an integral process that is a combination of identification, evaluation, and risk control to ensure the safety and smooth running of traffic in accordance with applicable standards and regulations [3], [9]–[11].

The traffic management risk analysis in this study is using the Failure Modes, Effects and Criticality Analysis (FMECA) method. The developed method focuses on qualitative and quantitative risk identification to prevent failure. The FMECA method is a method of evaluating the likelihood of a failure of a system, design, process or service to make steps to handle it [12]–[20].

In this study, the data used in the analysis of traffic management risks using the FMECA method based on the results of filling out questionnaires from respondents, were subjected to validation tests. Data validation is carried out to see the consistency of the data provided by respondents. This data validation uses statistical tests, namely using the Rescaled Adjusted Partial Sums (RAPS) method. The RAPS method is one method that can be used in validity testing with a small amount of data (limited) [21], [22]. The purpose of this study is to apply the RAPS method in the validation test of traffic management risk analysis data.

The application of the Rescaled Adjusted Partial Sums (RAPS) Method in the validation of traffic management risk analysis data for the category of large cities in Indonesia aims to test the consistency and reliability of the data used in the risk analysis. The RAPS method performs testing by calculating the cumulative deviation of data from the average value, so that it can ensure that the traffic data analyzed does not contain inconsistencies that can affect the results of the risk assessment. With accurate data validation through this method, traffic management risk analysis in large cities can be carried out more effectively and on target.

2. Method

This study used an instrument in the form of a questionnaire. The questionnaire was created based on initial research to obtain an overview of the negative impacts of implementing traffic management [23]. The indicators and sub-indicators that will provide the potential risks of traffic management to be implemented are based on regulations in traffic management [2], [3], [24]. There are four indicators that have a significant role in providing an overview of potential risks related to road operational characteristics, especially on road sections. These are road capacity, side barriers, traffic conflicts, and traffic signs/markings.

Dissemination of questionnaires to respondents with predetermined criteria, namely transportation experts to determine the effect of risk points. Respondents are transportation experts based on the qualifications of respondents who represent major cities in Indonesia, with the category of large cities according to the division of cities based on population [25] and population data according to the 2020 population census [26]. Determining the number of samples using purposive sampling technique, because it looks for samples that are in accordance with the criteria that have been determined specifically by the researcher. In this study, researchers determined the number of samples taken by five respondents according to predetermined qualifications, namely the cities of Bandung, Medan, Palembang, Semarang, and Lampung. The data obtained are the severity, occurrence and detection of each risk point. These three components are used to determine failure in risk analysis according to the FMECA method applied to traffic management risk analysis. The assessment of the three components uses a Likert scale (1 to 5), the end result of which is the risk priority number (RPN) value based on the multiplication of the three components. The Likert scale used in assessing severity, occurrence, and detection by respondents is in accordance with the indicators and sub-indicators as well as negative impacts based on the traffic management implemented, referring to the assessment contained in Table 1.

Table 1. Likert Scale Assessment of Severity, Occurrence, and Detection

Rating	Severity	Occurrence	Detection
1	Very Small	None	Very Easy

2	Small	Very Rare	Easy
3	Medium	Rare	Medium
4	Large	Often	Difficult
5	Very Large	Very Often	Very Difficult

The data of the three components for the four indicators, which are divided into sub-indicators, were validated to see the consistency of the data provided by respondents, so that the process of analyzing traffic management risks can be continued. The method used in this research data validation test is the Rescaled Adjusted Partial Sums (RAPS) method. The RAPS method is one method that can be used in validity testing with a small amount of data (limited) [21], [22]. The validity testing steps with the RAPS method [21], [22], are:

- Calculate the average value of the data for the value of each sub-indicator based on the specified negative impact ($\bar{X}$).

$$\bar{X} = \frac{\sum X}{n} \quad (1)$$

- Calculate the partial sum (S_k^*)

$$S_k^* = [X - \bar{X}] \quad (2)$$

- Calculate D_y^2

$$D_y^2 = S_k^{*2}/n \quad (3)$$

- Calculate S_k^{**}

$$S_k^{**} = S_k^*/\sqrt{\sum D_y^2} \quad (4)$$

- Calculate the Q value from the maximum value of S_k^{**}
- Calculate the R value from subtracting the maximum and minimum values of S_k^{**}
- Calculate $Q/\sqrt{n}$ and Calculate R/√n
- Compare with $Q/\sqrt{n}$ table and $R/\sqrt{n}$ table.
- If the values of $Q/\sqrt{n}$ count and $R/\sqrt{n}$ count are smaller than $Q/\sqrt{n}$ table and $R/\sqrt{n}$ table, then the data is still within consistent limits (valid).

  Description:

  Q/√n = A value for a normalized measure of data consistency, lower values indicate better consistency.

  R/√n = The value for measuring the normalized cumulative deviation range, gives an idea of how much variation there is in the data under test, with lower values indicating better consistency.

3. Results and Discussion

The indicators and sub-indicators in the research questionnaire used are in Table 2.

Table 2. Indicators and Sub Indicators of the Research Questionnaire

Indicator		Sub-Indicator	
Road capacity	(1)	Vehicle volume exceeds capacity	(1.1)
		There is a significant reduction in road width	(1.2)
		There are non-compliant road geometrics	(1.3)
Side Obstacles	(2)	There is a traditional market on the road	(2.1)
		There are traders on the shoulder of the road/trotoar	(2.2)
		There are pedestrians crossing carelessly	(2.3)
		There are pedestrians on the road	(2.4)
		There are fluctuating public transport passengers	(2.5)
		There are vehicles in and out of the access	(2.6)
		There are vehicles entering and exiting the land	(2.7)
		There is on-street parking	(2.8)
Traffic conflicts	(3)	There are vehicles turning around	(3.1)

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		There is merging traffic flow (marging)	(3.2)
		There are diverging traffic flows	(3.3)
		There are crossing traffic flows	(3.4)
		There is insufficient road length	(3.5)
Traffic signs/markings	(4)	There are unclear traffic signs	(4.1)
		There are misplaced/positioned traffic signs	(4.2)
		There are unclear road markings	(4.3)
		There are road markings that are misplaced/positioned	(4.4)

In each sub-indicator, the negative impacts on order, smoothness, socio-economic, waste of fuel oil, and pollution are examined. The results of data processing, which is a validation test using the RAPS method based on questionnaire data, obtained the values of $Q/\sqrt{n}$ count and $R/\sqrt{n}$ count and compared with the values of $Q/\sqrt{n}$ table and $R/\sqrt{n}$ table for each indicator and sub-indicator as well as the negative impact based on severity, occurrence and detection. In the Figure 1-4 for the x-axis (horizontal) is numbered $a.b.c$ which explains a = indicator, b = sub indicator, and c = negative impact, while for the y-axis explains the value of $Q/\sqrt{n}$ and $R/\sqrt{n}$.

3.1 Indicator 1 (Road Capacity)

The results of comparing $Q/\sqrt{n}$ table and $R/\sqrt{n}$ table with $Q/\sqrt{n}$ count and $R/\sqrt{n}$ count on road sections (Large Cities) for indicator 1 (Road Capacity) based on respondent data to assess the validity of severity, occurrence, and detection, can be seen in Table 3 and Figure 1.

Table 3. Comparison Results of $Q/\sqrt{n}$ Table and $R/\sqrt{n}$ Table with $Q/\sqrt{n}$ Calculated and $R/\sqrt{n}$ Calculated on Road Segments (Large Cities) for Indicator 1 (Road Capacity)

Indicator	Sub Indicator	Negative Effects	Q/√n Table	R/√n Table	Severity		Occurrence		Detection	
					Calculated Q/√n	Calculated R/√n	Calculated Q/√n	Calculated R/√n	Calculated Q/√n	Calculated R/√n
1	1.1	1.1.1	1.14	1.28	0	0	0.224	1.118	0	0
		1.1.2	1.14	1.28	0.224	1.118	0.894	1.118	0.894	1.118
		1.1.3	1.14	1.28	0.548	0.913	0	0	0.365	0.913
		1.1.4	1.14	1.28	0.5	1	0.548	0.913	0.5	1
		1.1.5	1.14	1.28	0.365	0.913	0.365	0.913	0.548	0.913
	1.2	1.2.1	1.14	1.28	0.335	1.118	0.365	0.913	0.717	1.195
		1.2.2	1.14	1.28	0	0	0.548	0.913	0.717	1.195
		1.2.3	1.14	1.28	0.894	1.118	0.365	0.913	0.894	1.118
		1.2.4	1.14	1.28	0.783	1.118	0.548	0.913	0.894	1.118
		1.2.5	1.14	1.28	0.408	1.225	0.548	0.913	0.365	0.913
	1.3	1.3.1	1.14	1.28	0.365	0.913	0.365	0.913	0.548	0.913
		1.3.2	1.14	1.28	0.365	0.913	0.5	1	0.5	1
		1.3.3	1.14	1.28	0.548	0.913	0.717	1.195	0.335	1.118
		1.3.4	1.14	1.28	0.894	1.118	0.478	1.195	0.478	1.195
		1.3.5	1.14	1.28	0.548	0.913	0.5	1	0.478	1.195

Table 3 shows that the Q/$\sqrt{n}$ table and $R/\sqrt{n}$ table values are greater than the calculated $Q/\sqrt{n}$ and calculated $R/\sqrt{n}$ values on the road section (Large Cities) for indicator 1 (road capacity), indicating that the data from the respondents is valid. This is also clarified in Figure 1 with the description of the Y axis stating the values of Q/$\sqrt{n}$ and $R/\sqrt{n}$, while the X axis states indicator 1 (road capacity) and its sub-indicators according to the explanation in Table 2. Figure 1 clearly shows the position of the Q/$\sqrt{n}$ table and $R/\sqrt{n}$ table values which are greater than the calculated $Q/\sqrt{n}$ and $R/\sqrt{n}$ calculated values on the road section (Large Cities) for indicator 1 (road capacity), so that the severity, occurrence, and detection data from respondents can be used for further data processing in assessing risk analysis in traffic management.

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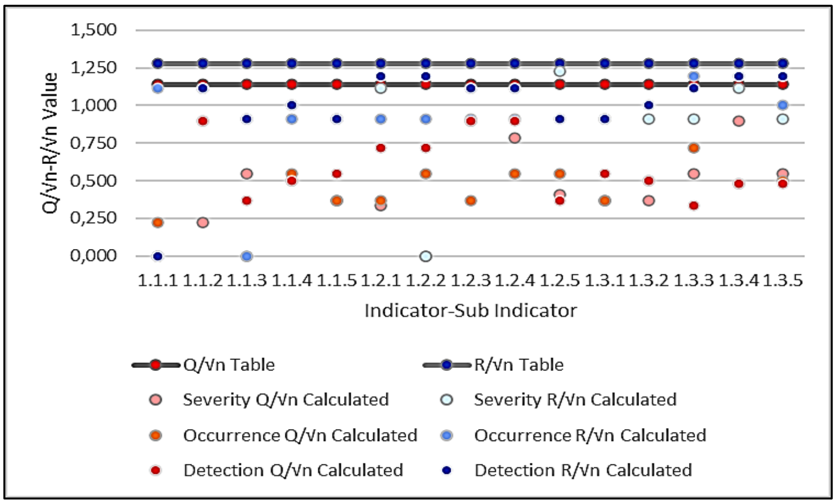

Figure 1. Comparison Results of $Q/\sqrt{n}$ Table and $R/\sqrt{n}$ Table with $Q/\sqrt{n}$ Calculated and $R/\sqrt{n}$ Calculated on Road Sections (Large Cities) for Indicator 1 (Road Capacity)

3.2 Indicator 2 (Side Obstacles)

The results of the comparison between the $Q/\sqrt{n}$ table and $R/\sqrt{n}$ table with the $Q/\sqrt{n}$ calculation and $R/\sqrt{n}$ calculation on the road section (Large Cities) for indicator 2 (side obstacles) based on respondent data to assess the validity of severity, occurrence, and detection, can be seen in Table 4 and Figure 2.

Table 4. Comparison Results of $Q/\sqrt{n}$ Table and $R/\sqrt{n}$ Table with $Q/\sqrt{n}$ Calculated and $R/\sqrt{n}$ Calculated on Road Sections (Large Cities) for Indicator 2 (Side Obstacles)

Indicator	Sub Indicator	Negative Effects	Q/√n Table	R/√n Table	Severity		Occurrence		Detection	
					Calculated Q/√n	Calculated R/√n	Calculated Q/√n	Calculated R/√n	Calculated Q/√n	Calculated R/√n
2	2.1	2.1.1	1.14	1.28	0	0	0.894	1.118	0.224	1.118
		2.1.2	1.14	1.28	0.224	1.118	0.224	1.118	0.365	0.913
		2.1.3	1.14	1.28	0.5	1	0.365	0.913	0.365	0.913
		2.1.4	1.14	1.28	0.548	0.913	0.365	0.913	0.335	1.118
		2.1.5	1.14	1.28	0.548	0.913	0.365	0.913	0.548	0.913
	2.2	2.2.1	1.14	1.28	0	0	0.548	0.913	0.365	0.913
		2.2.2	1.14	1.28	0.365	0.913	0.894	1.118	0.224	1.118
		2.2.3	1.14	1.28	0.548	0.913	0.365	0.913	0.478	1.195
		2.2.4	1.14	1.28	0.783	1.118	0.365	0.913	0.478	1.195
		2.2.5	1.14	1.28	0.783	1.118	0.717	1.195	0.478	1.195
	2.3	2.3.1	1.14	1.28	0.478	1.195	0.365	0.913	0.717	1.195
		2.3.2	1.14	1.28	0.717	1.195	0.548	0.913	0.894	1.118
		2.3.3	1.14	1.28	0.894	1.118	0.5	1	0.478	1.195
		2.3.4	1.14	1.28	0.548	0.913	0.548	0.913	0.548	0.913
		2.3.5	1.14	1.28	0.548	0.913	0.548	0.913	0.783	1.118
	2.4	2.4.1	1.14	1.28	0.548	0.913	0.478	1.195	0.717	1.195
		2.4.2	1.14	1.28	0.717	1.195	0.224	1.118	0.894	1.118
		2.4.3	1.14	1.28	0.224	1.118	0.548	0.913	0.335	1.118
		2.4.4	1.14	1.28	0.894	1.118	0.365	0.913	0.783	1.118
		2.4.5	1.14	1.28	0.548	0.913	0.365	0.913	0.783	1.118
	2.5	2.5.1	1.14	1.28	0.224	1.118	0.548	0.913	0.548	0.913
		2.5.2	1.14	1.28	0.894	1.118	0.894	1.118	0.365	0.913
		2.5.3	1.14	1.28	0.717	1.195	0.783	1.118	0.478	1.195
		2.5.4	1.14	1.28	0.548	0.913	0.548	0.913	0.335	1.118

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		2.5.5	1.14	1.28	0.5	1	0.548	0.913	0.335	1.118
	2.6	2.6.1	1.14	1.28	0.224	1.118	0.894	1.118	0.224	1.118
		2.6.2	1.14	1.28	0.548	0.913	0	0	0.894	1.118
		2.6.3	1.14	1.28	0.224	1.118	0.365	0.913	0.5	1
		2.6.4	1.14	1.28	0.548	0.913	0.548	0.913	0.365	0.913
		2.6.5	1.14	1.28	0.365	0.913	0.548	0.913	0.548	0.913
	2.7	2.7.1	1.14	1.28	0.365	0.913	0.894	1.118	0.224	1.118
		2.7.2	1.14	1.28	0.548	0.913	0.894	1.118	0.894	1.118
		2.7.3	1.14	1.28	0.548	0.913	0.335	1.118	0.717	1.195
		2.7.4	1.14	1.28	0.365	0.913	0.365	0.913	0.365	0.913
		2.7.5	1.14	1.28	0.548	0.913	0.365	0.913	0.5	1
	2.8	2.8.1	1.14	1.28	0.224	1.118	0.548	0.913	0.548	0.913
		2.8.2	1.14	1.28	0.365	0.913	0.548	0.913	0.365	0.913
		2.8.3	1.14	1.28	0.548	0.913	0.894	1.118	0.365	0.913
		2.8.4	1.14	1.28	0.548	0.913	0.365	0.913	0.478	1.195
		2.8.5	1.14	1.28	0.548	0.913	0.717	1.195	0.5	1

Table 4 shows that the Q/√n table and $R/\sqrt{n}$ table values are greater than the calculated $Q/\sqrt{n}$ and $R/\sqrt{n}$ calculated values on the road section (Large Cities) for indicator 2 (Side Obstacles), indicating that the data from the respondents is valid. This is also clarified in Figure 2 with the Y-axis stating the values of Q/√n and $R/\sqrt{n}$, while the X-axis stating indicator 2 (Side Obstacles) and its sub-indicators according to the explanation in Table 2. Figure 2 clearly shows the position of the Q/√n table and $R/\sqrt{n}$ table values which are greater than the calculated $Q/\sqrt{n}$ and $R/\sqrt{n}$ calculated values on the road section (Large Cities) for indicator 2 (Side Obstacles), so that the severity, occurrence, and detection data from respondents can be used for further data processing in assessing risk analysis in traffic management.

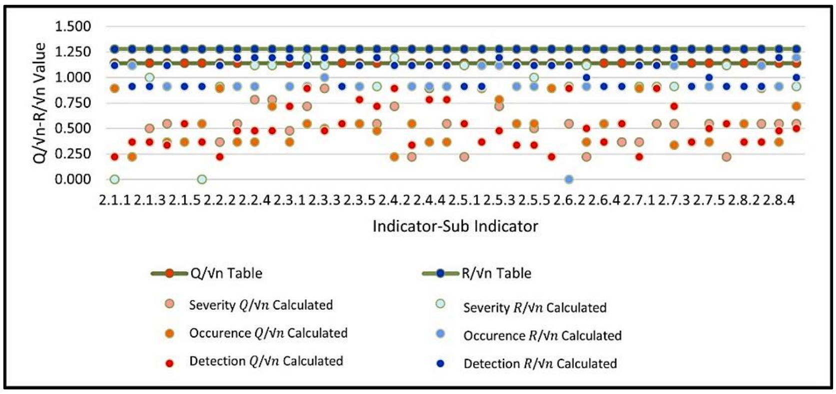

Figure 2. Comparison Results between Table $Q/\sqrt{n}$ and Table $R/\sqrt{n}$ with Calculated $Q/\sqrt{n}$ and Calculated $R/\sqrt{n}$ on Road Segments (Large Cities) for Indicator 2 (Side Obstacles)

3.3 Indicator 3 (Traffic Conflicts)

The results of comparisons between the $Q/\sqrt{n}$ table and $R/\sqrt{n}$ table with the Calculated $Q/\sqrt{n}$ and Calculated $R/\sqrt{n}$ on road sections (Large Cities) for indicator 3 (traffic conflicts) based on respondent data to assess the validity of severity, occurrence, and detection, can be seen in Table 5 and Figure 3.

Table 5. Comparison Results of $Q/\sqrt{n}$ Table and $R/\sqrt{n}$ Table with Calculated $Q/\sqrt{n}$ and Calculated $R/\sqrt{n}$ on Road Segments (Large Cities) for Indicator 3 (Traffic Conflicts)

Indicator	Sub Indicator	Negative Effects	Q/√n Table	R/√n Table	Severity		Occurrence		Detection	
					Calculated Q/√n	Calculated R/√n	Calculated Q/√n	Calculated R/√n	Calculated Q/√n	Calculated R/√n
3	3.1	3.1.1	1.140	1.280	0.365	0.913	0.224	1.118	0.365	0.913
		3.1.2	1.140	1.280	0.224	1.118	0.335	1.118	0.365	0.913
		3.1.3	1.140	1.280	0.548	0.913	0.478	1.195	0.783	1.118

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	3.1.4	1.140	1.280	0.548	0.913	0.478	1.195	0.717	1.195
	3.1.5	1.140	1.280	0.500	1.000	0.478	1.195	0.717	1.195
3.2	3.2.1	1.140	1.280	0.548	0.913	0.478	1.195	0.548	0.913
	3.2.2	1.140	1.280	0.224	1.118	0.224	1.118	0.894	1.118
	3.2.3	1.140	1.280	0.548	0.913	0.365	0.913	0.500	1.000
	3.2.4	1.140	1.280	0.894	1.118	0.335	1.118	0.783	1.118
	3.2.5	1.140	1.280	0.365	0.913	0.335	1.118	0.500	1.000
3.3	3.3.1	1.140	1.280	0.365	0.913	0.894	1.118	0.365	0.913
	3.3.2	1.140	1.280	0.365	0.913	0.717	1.195	0.717	1.195
	3.3.3	1.140	1.280	0.894	1.118	0.548	0.913	0.365	0.913
	3.3.4	1.140	1.280	0.365	0.913	0.335	1.118	0.783	1.118
	3.3.5	1.140	1.280	0.548	0.913	0.478	1.195	0.783	1.118
3.4	3.4.1	1.140	1.280	0.224	1.118	0.548	0.913	0.548	0.913
	3.4.2	1.140	1.280	0.000	0.000	0.224	1.118	0.365	0.913
	3.4.3	1.140	1.280	0.894	1.118	0.365	0.913	0.365	0.913
	3.4.4	1.140	1.280	0.548	0.913	0.548	0.913	0.783	1.118
	3.4.5	1.140	1.280	0.548	0.913	0.478	1.195	0.783	1.118
3.5	3.5.1	1.140	1.280	0.365	0.913	0.548	0.913	0.365	0.913
	3.5.2	1.140	1.280	0.548	0.913	0.548	0.913	0.717	1.195
	3.5.3	1.140	1.280	0.894	1.118	0.500	1.000	0.500	1.000
	3.5.4	1.140	1.280	0.224	1.118	0.224	1.118	0.783	1.118
	3.5.5	1.140	1.280	0.365	0.913	0.335	1.118	0.783	1.118

Table 5 shows that the Q/$\sqrt{n}$ table and $R/\sqrt{n}$ table values are greater than the calculated $Q/\sqrt{n}$ and $R/\sqrt{n}$ calculated values on the road section (Large Cities) for indicator 3 (Traffic Conflicts), indicating that the data from the respondents is valid. This is also clarified in Figure 3 with the Y-axis stating the values of Q/$\sqrt{n}$ and $R/\sqrt{n}$, while the X-axis stating indicator 3 (Traffic Conflicts) and its sub-indicators according to the explanation in Table 2. Figure 3 clearly shows the position of the Q/$\sqrt{n}$ table and $R/\sqrt{n}$ table values which are greater than the calculated $Q/\sqrt{n}$ and $R/\sqrt{n}$ calculated values on the road section (Large Cities) for indicator 3 (Traffic Conflicts), so that the severity, occurrence, and detection data from respondents can be used for further data processing in assessing risk analysis in traffic management.

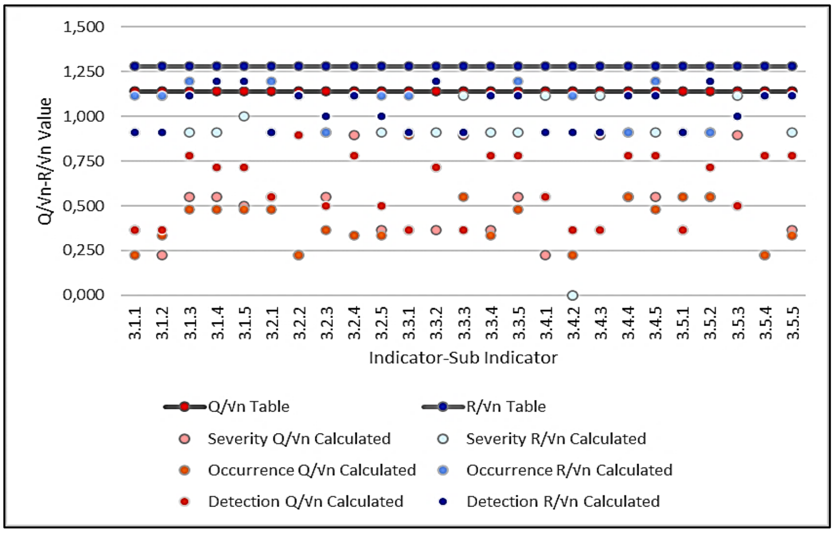

Figure 3. Comparison Results of $Q/\sqrt{n}$ Table and $R/\sqrt{n}$ Table with $Q/\sqrt{n}$ Calculation and $R/\sqrt{n}$ Calculation on Road Segments (Large Cities) for Indicator 3 (Traffic Conflicts)

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3.4 Indicator 4 (Traffic Signs/Markings)

The comparison results of the $Q/\sqrt{n}$ table and $R/\sqrt{n}$ table with the calculated $Q/\sqrt{n}$ and calculated $R/\sqrt{n}$ values on the road section (Large Cities) for indicator 4 (traffic signs/markings) based on respondent data to assess the validity of severity, occurrence, and detection, can be seen in Table 6 and Figure 4.

Table 6. Comparison Results of $Q/\sqrt{n}$ Table and $R/\sqrt{n}$ Table with Calculated $Q/\sqrt{n}$ and Calculated $R/\sqrt{n}$ on Road Segments (Large Cities) for Indicator 4 (Traffic Signs/Markings)

Indicator	Sub Indicator	Negative Effects	Q/√n Table	R/√n Table	Severity		Occurrence		Detection	
					Calculated Q/√n	Calculated R/√n	Calculated Q/√n	Calculated R/√n	Calculated Q/√n	Calculated R/√n
4	4.1	4.1.1	1.140	1.280	0.548	0.913	0.894	1.118	0.478	1.195
		4.1.2	1.140	1.280	0.365	0.913	0.548	0.913	0.335	1.118
		4.1.3	1.140	1.280	0.548	0.913	0.224	1.118	0.717	1.195
		4.1.4	1.140	1.280	0.548	0.913	0.478	1.195	0.717	1.195
		4.1.5	1.140	1.280	0.548	0.913	0.478	1.195	0.717	1.195
	4.2	4.2.1	1.140	1.280	0.894	1.118	0.548	0.913	0.500	1.000
		4.2.2	1.140	1.280	0.500	1.000	0.548	0.913	0.500	1.000
		4.2.3	1.140	1.280	0.365	0.913	0.478	1.195	0.717	1.195
		4.2.4	1.140	1.280	0.365	0.913	0.478	1.195	0.702	1.316
		4.2.5	1.140	1.280	0.365	0.913	0.365	0.913	0.717	1.195
	4.3	4.3.1	1.140	1.280	0.365	0.913	0.548	0.913	0.500	1.000
		4.3.2	1.140	1.280	0.548	0.913	0.548	0.913	0.500	1.000
		4.3.3	1.140	1.280	0.548	0.913	0.500	1.000	0.500	1.000
		4.3.4	1.140	1.280	0.365	0.913	0.478	1.195	0.717	1.195
		4.3.5	1.140	1.280	0.548	0.913	0.500	1.000	0.690	1.150
	4.4	4.4.1	1.140	1.280	0.365	0.913	0.894	1.118	0.478	1.195
		4.4.2	1.140	1.280	0.548	0.913	0.548	0.913	0.478	1.195
		4.4.3	1.140	1.280	0.548	0.913	0.500	1.000	0.500	1.000
		4.4.4	1.140	1.280	0.365	0.913	0.717	1.195	0.717	1.195
		4.4.5	1.140	1.280	0.365	0.913	0.224	1.118	0.500	1.000

Table 6 shows that the Q/$\sqrt{n}$ table and $R/\sqrt{n}$ table values are greater than the calculated $Q/\sqrt{n}$ and $R/\sqrt{n}$ calculated values on the road section (Large Cities) for indicator 4 (Traffic Signs/Markings), indicating that the data from the respondents is valid.

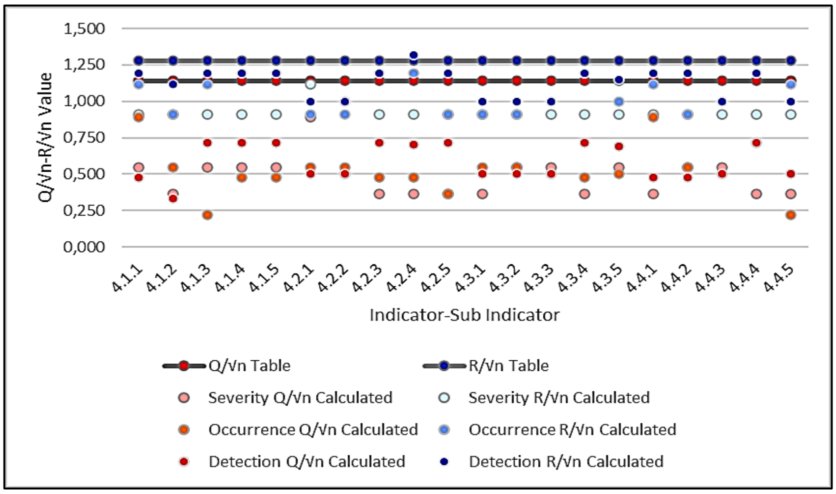

Figure 4. Comparison Results of $Q/\sqrt{n}$ Table and $R/\sqrt{n}$ Table with Calculated $Q/\sqrt{n}$ and Calculated $R/\sqrt{n}$ on Road Segments (Large Cities) for Indicator 4 (Traffic Signs/Markings)

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This is also clarified in Figure 4 with the Y-axis stating the values of $Q/\sqrt{n}$ and $R/\sqrt{n}$, while the X-axis stating indicator 4 (Traffic Signs/Markings) and its sub-indicators according to the explanation in Table 2. Figure 4 clearly shows the position of the $Q/\sqrt{n}$ table and $R/\sqrt{n}$ table values which are greater than the calculated $Q/\sqrt{n}$ and $R/\sqrt{n}$ calculated values on the road section (Large Cities) for indicator 4 (Traffic Signs/Markings), so that the severity, occurrence, and detection data from respondents can be used for further data processing in assessing risk analysis in traffic management.

4. Conclusion

Based on data processing and analysis, it can be concluded that the RAPS method can be used as a method in data validation for traffic management risk analysis, as it can describe the validation of data to be used for further traffic management analysis. This is evident from the $Q/\sqrt{n}$ table and $R/\sqrt{n}$ table values being greater than the calculated $Q/\sqrt{n}$ and calculated $R/\sqrt{n}$ values for all four indicators across each sub-indicator, particularly in the context of the negative impacts resulting from high severity values, event occurence, and event detection on road sections in large cities. The shortcomings of this study are in the sample size and data distribution, although it can be used for a small amount of data, it would be better if the amount of data was greater. Another thing is that the RAPS method emphasizes quantitative data so that a combination with other methods is needed for validation to be more comprehensive because traffic management risk analysis is also related to qualitative factors, for example road user perceptions. It also needs to be done periodically to ensure that the data remains consistent and relevant for traffic management risk analysis.

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