Service Quality Evaluation of Public Transportation in Rajkot City by Using the RIDIT Scoring Method

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***Abstract*— This research assesses the quality of public transportation services in Rajkot City by employing the RIDIT scoring method, a statistical approach that is effective for analyzing ordinal data pertaining to user perceptions. The objective of the study is to pinpoint the primary factors influencing commuter satisfaction and to underscore significant deficiencies in the current transport services. Data were gathered through structured questionnaires that concentrated on aspects such as reliability, comfort, safety, punctuality, affordability, and accessibility. The RIDIT analysis facilitated the transformation of subjective feedback into comparable scores, enabling an objective evaluation across various service quality parameters. The results reveal considerable differences in levels of commuter satisfaction, with reliability and punctuality identified as critical areas requiring enhancement. This study offers practical recommendations for policymakers and transport authorities aimed at improving service efficiency, optimizing resource distribution, and enhancing the overall commuter experience within Rajkot's public transportation framework.**

***Key Words*— Service Quality Evaluation, Relative to an Identified Distribution Integral Transformation (RIDIT), Service Quality Attributes, Decision Making, Prioritizing Service Attributes**

I. INTRODUCTION

India's population roughly 1.03 billion in 2001 to an anticipated 1.46 billion by 2025, influenced by a growth rate that has significantly decreased since its peak in 2001. The decade from 2001 to 2011 experienced an increase of over 181 million individuals, with a decadal growth rate of 17.70%, marking a notable decline compared to the preceding decade. Projections for 2025 suggest the population will be approximately 1.463 billion, with an annual rise of about 12.86 million that year. Consequently, towns have expanded significantly in both size and population. While conditions vary greatly among Indian cities, certain fundamental trends affect the demand for transportation, such as a substantial rise in the urban population, household income, and commercial and industrial activities. Due to the considerable pressures these changes exerted on their urban transport systems, many Indian cities have struggled to meet these demands. Since the transportation infrastructure is unable to accommodate all origins and destinations, transfers may be required in urban transportation to modify a commuter's route and facilitate their arrival at their destination. Commuters typically prefer direct services over transfers, which can be time-consuming and inconvenient. The design and the authorities' ease of interchange are crucial for effective transfer. If the aforementioned factors are considered during the construction of interchanges, passengers may feel more at ease and spend less time waiting. Therefore, integration in urban transport is essential to simplify transfers and encourage public transport usage. Public transportation is critical for ensuring sustainable urban mobility, particularly in rapidly growing Tier-2 cities, where swift urbanization has heightened travel demand. However, the city's bus transit system faces challenges such as low frequency, limited coverage, poor reliability, and insufficient passenger amenities, resulting in decreased user satisfaction and a shift towards private and Para-transit modes. This trend exacerbates traffic congestion.

II. LITERATURE REVIEW

Previous studies have widely focused on evaluating public transport service quality using passenger perception, operational performance measures, and decision-making techniques. Pitale applied the RIDIT method to measure commuter perception and found that reliability and comfort significantly affect satisfaction [1]. Ismae highlighted the importance of safety and cleanliness in public transport service quality [2], while Ghafar emphasized combining qualitative and quantitative research methods [3]. In India, Patel and Padhya [4] and Saha [5] reported

that service frequency, accessibility, and travel time strongly influence public transport usage. Jadeja [6] evaluated Rajkot's RMTS routes using MCDM techniques and identified operational inefficiencies. Studies by Patel [8], Abojaradeh [9], and Diab and El-Geneidy [12] emphasized punctuality, travel time, and service reliability as key performance indicators. Researchers such as Grujičić [11], Gurjar. [17], and Amponsah and Adams [24] found that passenger comfort, safety, and customer service directly impact satisfaction. CEPT (2013) [13] provided standard service benchmarks for Indian urban transport systems. For decision-making, Saaty [19] introduced AHP, while Othman and Ku-Mahamud [22] applied fuzzy evaluation methods in transport performance studies. However, most previous studies evaluated either qualitative or quantitative factors separately. Therefore, this study integrates RIDIT scoring and Fuzzy AHP methods to evaluate and rank RMTS routes in Rajkot city.

III. OBJECTIVE OF STUDY

1. To determine aspects of the bus transit service, require improvement.
2. To use the RIDIT scoring system to prioritize service attributes for a bus transit network's quality improvement.
3. To rank the routes according to service quality in order to determine priority routes, and to re-adjust a service area of the current bus route network based on the opinions of public and Para transit users.

IV.SCOPE OF STUDY

1. Study is limited to Rajkot mass transport service (RMTS).
2. As of 2025, the RMTS has 80 operational routes.
3. Out of 80 routes 5 route are selected for the study in Rajkot city.
4. For bus route evaluation criteria are selected with combination of qualitative and quantitative attributes.

V. METHODOLOGY

In order to understand current research and methodologies, a thorough literature review is conducted after the problem statement has been identified. On the fundamentals of this, appropriate pathways are chosen for study, and pertinent assessment standards are established. After that, these criteria are divided into two categories: qualitative and quantitative. Data is then gathered from the chosen routes for both kinds of attributes. To aid in decision-making, the gathered data is examined utilizing the RIDIT method. The analysis of the findings and important conclusions brings the study to a close

VI. DATA COLLECTION

This study aims to gather both qualitative and quantitative data from bus commuters using a questionnaire and five specific routes in Rajkot: Route No 1: Saurastra University To Trikon Baug, Route No 8: Greenland Chokdi To Labhubhai Engineering College, Route No 14: Kothariya Gam To Navagam, Route No 18: Aji Dam To Gidc Gate No 3, Route No 28: Gujarat Housing quarters To JivrajPark. Attributes Is Included In Survey Form Is:

Sr. No.	Attributes
1	Information Available On Website & Application
2	Announcement & Display Panel On Bus
3	Bus Crowding
4	Comfort Of Seat
5	Comfort Of Ride
6	Level Of Noise At Bus
7	Cleanliness Of Bus
8	Leg Room On Bus
9	Security Against Crime In Bus & Bus Stop
10	Travelling Speed
11	Bus Driving Security
12	Road Condition
13	Origin To Destination Ticket Cost
14	Destination To Origin Ticket Cost
15	Ease Of Ticket Purchase
16	Issuing Ticket By Conductors
17	Behavior Of Bus Crew Members
18	Administration & Response To Complaint
19	Bus Stop Location
20	Numbers Of Bus Stop And Distance Between Stops
21	Ease Of Connection To Next Service
22	Route Schedule At Bus Stop
23	Cleanliness Of Bus Stop
24	Shelter Provided At Bus Stop
25	Seating Facility At Bus Stop
26	Frequency Of Bus Service
27	Reliability (On time Performance)
28	Accessibility

29	Operating Hours
30	Travel Time

VII. THE METHODS OF DATA ANALYSIS

1. RIDIT SCORING METHOD

RIDIT scoring is a statistical method used to analyze ordered qualitative measurements. RIDIT analysis first proposed by I. Bross. This analysis transforms ordinal data to a probability scale also called it a virtual continuous scale. The term stands for Relative to an Identified Distribution Integral Transformation and corresponding to Probit or Logit. RIDIT analysis is "distribution free" in the sense that it makes no assumption about the distribution of the population under study.

Assume that there are m items and n ordered categories listed from the most favored to the least favored in the scale, and then RIDIT analysis goes as follows: (Wu, 2007)

A. Select a population to serve as an allusion data set. For a Likert scale survey, the reference data set can be the total responses of the survey, if the population cannot easily recognize

B. Calculate frequency fj for each category of responses, where j = 1, 2, 3…, n.

C. Calculate mid-point accumulated frequency Fj for each category of responses.

$$F1 = \frac{1}{2} f1$$

$$Fj = \frac{1}{2} fj + \sum_{k=1}^{j-1} fk$$

D. Calculates ridit value Rj for each category of responses.

$$Rj = \frac{Fj}{N}$$

where j = 1,2,3…,n. N is the total number of responses from the Liker scale survey of interest.

E. Calculate ridit value rij for each category of scale items.

$$rij = \frac{Rj * \pi ij}{\pi i}$$

Where i = 1,2,3…,m.

F. πij is the frequency of category j for the i th scale item, and πi is a short form for the Summation of frequencies for scale item I across all categories, i.e.

$$\pi i = \sum_{k=1}^{n} \pi ik$$

G. Calculate mean ridit ρi for each Likert scale item.

$$\rho i = \sum_{k=1}^{n} rik$$

VIII. DATA ANALYSIS

[1] Qualitative Attributes of All Routes

Table 2 : Qualitative attributes of all routes

Route	Information provision	comfort	Safety	Customer service	Bus stop amenities
1	excellent	excellent	excellent	excellent	excellent
8	very good	very good	very good	very good	very good
14	excellent	excellent	excellent	excellent	excellent
18	good	good	good	good	good
28	good	very good	very good	excellent	very good

[2] Quantitative Attributes Of All Routes

Route	Bus stop spacing (m)	on time performance (min)	Avg. travel speed (km/hr)	Bus hour utilization	Avg. passengers per trip	fuel cost (rs/km)
1	600	5.68	17.28	0.16	48	14.3
8	582.61	2.6	17.86	0.25	18.11	14.8
14	425	4.72	10.2	0.25	79	14.6
18	642.1	5.82	20.91	0.19	89	14.1
28	211.54	8.99	8.25	0.15	57	15.5

IX. SELECTING BEST ROUTES

- Combined Scoring Of Ridit Scoring Method And Fuzzy Ahp Method:
- Steps:

1. Find The Combined Score Of Each Attributes For All Routes Using Both Methods.
   [Combined Score Of Attributes = Ridit Score * Fuzzy Ahp Score OF Attributes]
2. Calculate Total Of All Attributes Of Routes
3. This Total IS Overall Routes Score Based On This Score Give Priority Ranking Of Routes.

➢ Overall Route Score:

Sr. No.	ROUTE 1	ROUTE 8	ROUTE 14	ROUTE 18	ROUTE 28
1	0.015729	0.015796	0.016317	0.01728	0.018473
2	0.016838	0.016887	0.016397	0.017504	0.018493
3	0.016982	0.016492	0.016807	0.017745	0.016619
4	0.017271	0.017149	0.016552	0.017924	0.016162
5	0.016874	0.017006	0.016957	0.017902	0.015942
6	0.016707	0.016755	0.016709	0.017613	0.016368
7	0.017022	0.016897	0.016811	0.017768	0.01629
8	0.017033	0.016755	0.016845	0.017697	0.015867
9	0.016177	0.016165	0.016253	0.017039	0.015924
10	0.015856	0.016416	0.016259	0.016625	0.015845
11	0.016007	0.016443	0.017148	0.016319	0.015694
12	0.015903	0.015968	0.016732	0.016556	0.01588
13	0.017207	0.015786	0.017063	0.015529	0.016102
14	0.01758	0.015644	0.01686	0.01535	0.016203
15	0.015986	0.016362	0.016841	0.015588	0.015176
16	0.015984	0.01673	0.016948	0.015686	0.015189
17	0.016585	0.017002	0.01686	0.015751	0.015176
18	0.016435	0.016296	0.016823	0.015721	0.015271
19	0.016446	0.016297	0.016235	0.01542	0.016125
20	0.016688	0.016319	0.016918	0.016201	0.015916
21	0.015888	0.016597	0.016638	0.016012	0.015799
22	0.016162	0.016583	0.016543	0.015864	0.015732
23	0.016862	0.016847	0.016874	0.015783	0.015823
24	0.016948	0.016768	0.016704	0.016036	0.015705
25	0.01612	0.016642	0.016629	0.015861	0.015976
26	0.016528	0.017078	0.01605	0.016263	0.018398
27	0.016108	0.017339	0.016798	0.016169	0.018394
28	0.01659	0.017504	0.016817	0.016102	0.018536
29	0.016529	0.017557	0.016413	0.015393	0.01844
30	0.015977	0.017384	0.01608	0.015716	0.018357
total	0.495021	0.499464	0.499882	0.492415	0.493876

➢ Final Ranking OF All Routes:

Rank	Route	Overall Route Score
1	14	0.49988
2	8	0.49946
3	1	0.495021285
4	28	0.493875624
5	18	0.49242

X. CONCLUSION

The statistical analysis of five selected RMTS routes in Rajkot city was carried out using a combination of RIDIT scoring and Fuzzy AHP methods to evaluate both qualitative and quantitative service attributes. Based on responses collected for 30 service quality attributes, RIDIT converted passenger perception data into measurable scores, while Fuzzy AHP assigned relative importance weights to each attribute. The final combined score was obtained by multiplying RIDIT scores with Fuzzy AHP weights for each attribute.

The overall route scores indicate noticeable variation in service quality among the selected routes. Route 14 achieved the highest overall score of 0.49988, making it the best-performing route in terms of service quality. It was followed by Route 8 (0.49946) and Route 1 (0.49502), which showed satisfactory performance. On the other hand, Route 28 (0.49388) and Route 18 (0.49242) received lower scores and were ranked fourth and fifth respectively, indicating a greater need for service improvement.
The statistical findings also reveal that qualitative factors such as information availability, comfort, safety, customer service, and bus stop amenities, along with quantitative factors like travel speed, punctuality, passenger load, and operating efficiency, significantly influence overall service quality. Lower-ranked routes particularly showed poor performance in punctuality, accessibility, and operational efficiency.

Therefore, the statistical results confirm that integrating RIDIT and Fuzzy AHP is an effective approach for evaluating public transport service quality and ranking bus routes. The findings can help transport authorities prioritize weaker routes for improvement and support better planning for RMTS services in Rajkot city.

REFERENCES

[1] Mr aditya manish pitale , Mr shubhajit sadhukhan, and Mr manoranjan parida "RIDIT-ISA Approach to Investigate Commuter Perceptions of an Existing Regional Transit System: A Case Study in the National Capital Region, India" Transportation Research Record Journal of the Transportation Research Board (March 2023).

[2] Mr Karzan Ismael , Mr Domokos Esztergár-Kiss and Mr Szabolcs Duleba "Evaluating the quality of the public transport service during the COVID-19 pandemic from the perception of two user groups" European Transport Research Review (2023).

[3] Mr Zanyar Nathir Ghafar "Evaluation Research: A Comparative Analysis of Qualitative and Quantitative Research Methods" Middle East Research Journal of Linguistics and Literature(2023).

[4] Mr Viren N. Patel, Mr Himanshu J. Padhya "A Case Study on the Urban Mass Transit System and Sustainable Development in India" International Journal of Research in Engineering and Science (2021).

[5] Mr Ankabehari Saha, Mr Uma Sankar Malik, Mr Ankabehari Saha "Exploring passenger convenience using actual bus traffic data in Murshidabad District, West Bengal, India" Spatial Information Research/ Springer Science and Business Media LLC (2020).

[6] Mr Mayursinh Jadeja , Ms Patel Bindiya , Ms Monicaba Vala" Performance Evaluation of RMTS Bus Routes by using Multi Criteria Decision Making Method" International Journal for Scientific Research & Development| Vol. 4, Issue 03, (2016).

[7] Mr Pranav Jain, Mr Piyush Agarwal, Ms Nimisha Soni, Mr Parth Mandavgane, Mr Naman Shah "Improving the efficiency of public transportation in India using operations research" International Journal of Advanced Research, Ideas and Innovations in Technology (2021).

[8] Mr Mayank P. Patel, Mr H.K.Dave, Mr V. R. Gor, Mr V. M. Patel "Impact of Irregularity and Loss of Punctuality on the Performance of Public Transportation System" International Journal of Engineering Research / (July 2014).

[9] Mr Mohammad Abojaradeh "Travel Time and Delay study to improve public transit systems in Jordan" Journal of environment and earth sciences/(2013).

[10] Mr Ravekar V. P. , Mr Jain V. "A rational approach for evaluation of quality of service of public transport routes: case study of Bhopal" International Journal of Advance Engineering and Research Development Article · (August 2014).

[11] Mr Dragana Grujičić, Mr Ivan Ivanović, Mr Jadranka Jović, Mr Vladimir Đorić "Customer perception of service quality in public transport" TRANSPORT/Special Issue on Travel Demand Management /Volume 29(3): 285–295(2014).

[12] Mr Ehab I. Diab , Mr Ahmed M. El-Geneidy "Variation in bus transit service: understanding the impacts of various improvement strategies on transit service reliability" Public Transportation(2013) 4:209–231/Springer-Verlag Berlin Heidelberg (2013).

[13] Coe Urban Transport, CEPT University, Ahmadabad" Service level benchmark in Urban transport for Indian City" Ministry of Urban Development, GOI September/February, (2013).

[14] Mr Adris.A.Putra "Transportation system performance analysis urban area public transport" International Refereed Journal of Engineering and Science (IRJES) Volume 2, Issue 6 (June 2013).

[15] Mr M. Napiah, Mr I. Kamaruddin and Mr Suwardo "Punctuality index and expected average Waiting time of stage buses in mixed traffic" Research gate / 10.2495/UT110191 / (June 2011).

[16] Mr David A. Hensher and Ms Paola Prioni "A Service Quality Index for Area-wide Contract Performance Assessment" Journal of Transport Economics and Policy, Volume 36, Part 1, January 2002.

[17] Mr Jitendra Gurjar, Mr P. K. Agarwal, Mr P. K. Jain "Performance evaluation of public transport system from user point of view" International Journal of Advanced Information Science and Technology (IJAIST) ISSN: 2319:2682 Vol.5, No.7, (July 2016).

[18] Ms Maria Morfoulaki, Mr Yannis Tyrinopoulos, and Ms Georgia Aifadopoulou "Estimation of satisfied customers in public transport systems: A new methodological approach" Journal of the Transportation Research Forum, Vol. 46, No. 1 (Spring 2007), pp. 63-72.

[19] Mr Thomas L. Saaty "Decision making with the analytic hierarchy process" Int. J. Services Sciences,(2008).
[20] Mr Amit Kumar, Mr K. V. Krishna Rao "Study of impact of ITS enabled public transit system" 11th World Conference on Transport Research, (2007).
[21] Mr Mark Trompet, Mr Richard J. Anderson, and Mr Daniel J.Graham "Variability in Comparable Performance of Urban Bus Operations" Journal of the Transportation Research Board ,No. 2111, Transportation Research Board of the National Academies, Washington, D.c.(2009).
[22] Mr Mahmod Othman, Ms Ku Ruhana Ku-Mahamud "Fuzzy multi criteria evaluation for performance of bus companies" Computer and Information Science , Vol. 3, No. 2; (May 2010).
[23] Mr Barez Mohammed, Mr Salih Mahmood, Mr Hirsh M. Majid, Mr Chro H. Ahmed "A Case Study of Bus Line Passenger Volumes of Bakrajo Bus Lines in Sulaimani City" Journal of Engineering/Number 12 Volume 26/ (December 2020).
[24] Mr Christian Tabi Amponsah, Mr Samuel Adams "Service quality and customer satisfaction in public transport operations" Int. J. Services and Operations Management, Vol. 25, No. 4, (2016).
[25] Mr Joewono Prasetijo, Mr Wan Zahidah Musa , Mr Zaffan Farhana Zaina , Mr Kamarudin Ambakand Mohd Erwan Sanik "Level of Bus Performance Based On the Relationship between Distance and Travel Time of Universiti Tun Hussein Onn Malaysia (UTHM) Bus Services" ENCON 2016 / MATEC web of conference.
[26] Mr Danijela Barić, Mr Martin Starčević "Implementation of analytic Hierarchy process in solving Transport problems" International Journal of the Analytic Hierarchy Process (August 2015).
[27] Mr Mohamed M. Elhabiby, Mr Ahmed O. Fikry, Mr Hassan A. Mahdy and Mr Khaled A. Kandil "Influence of unscheduled random public bus stops on transit travel time" Journal of Traffic and Logistics Engineering, , 1, No.(1 June 2013).
[28] Mr Piotr Olszewski, Mr Piotr Krukowski "Quantitative assessment of public transport interchanges" Association for European Transport and Contributors (2012).