Ruban M

Enhancement of Tourist Island Connectivity in Rameswaram
(Analyze the role of safety perception in Transport medium choice)

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Master of Planning
(Transport Planning and Logistics Management)

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SCHOOL OF PLANNING AND ARCHITECTURE, BHOPAL
NEELBAD ROAD, BHAURI, BHOPAL (MP)-462030

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Thesis submitted in partial fulfillment of the requirements for the award of the degree of

Master of Planning
(Transport Planning and Logistics Management)

By

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Declaration

I **Ruban M**, Scholar No. **2022MTPLM009** hereby declare that the thesis titled **"Enhancement of Tourist Island Connectivity in Rameswaram (Analyze the role of safety perception in Transport medium choice)"** submitted by me in partial fulfilment for the award of **Master of Planning**, at School of Planning and Architecture, Bhopal, India, is a record of bonafide work carried out by me. The matter/result embodied in this thesis has not been submitted to any other University or Institute for the award of any degree or diploma.

Signature of the Student

Date: _____

Certificate

This is to certify that the declaration of **Ruban M** is true to the best of my knowledge and that the student has worked under my guidance in preparing this thesis.

RECOMMENDED

_____
Signature of the Guide
Dr. Mohit Dev

ACCEPTED

_____
Prof. Saurabh Popli
Head, Department of Transport Planning

May 2024

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Abstract

Islands play a significant role in the global tourism industry. Transport connectivity of Islands with other Islands or Mainland is more challenging because of High investment costs and seasonal variation of Transport demand. In seasonal times it is very difficult to handle high traffic because the bottleneck effect is created in a single Connectivity medium. To manage this situation, we should find some alternative Transport Mediums to distribute users. The alternate transport medium should not only serve as a means of connectivity but also function as a tourism-promoting transport service.

Travelers from all over the world come to Rameswaram (Pamban Island) which is situated at the southernmost point of India and has great cultural, religious and ecological significance. Krusadai island is an uninhabited island locating in the south side of Pamban Island. The charming island's connectivity infrastructure has however frequently been identified as a bottleneck preventing it from reaching its full tourism potential. To promote easier and more effective travel experiences this paper examines a number of initiatives and strategies targeted.

The study examines the capacity, effectiveness and accessibility of the nation's current transportation infrastructure including roads, trains and boats . The objective of this research is to investigate how locals and visitors alike perceive Rameswaram's current level of connectivity and to pinpoint the most important requirements and preferences for improving the Island connectivity transportation system. Data on transportation preferences, satisfaction levels and perceived shortcomings was gathered in Likert Scale and analysed through various Statistical methods including Central Tendency, Binomial Logit Regression, ANOVA.

The paper also looks into economic and environmental sustainability. In addition, the research examines successful case studies and best practices from other tourism hotspots dealing with comparable connectivity issues providing insights into creative approaches and tactics. To promote inclusive and sustainable tourism growth a range of strategies including public-private partnerships policy interventions infrastructure development and community engagement initiatives are included in the proposal. It will enhance connectivity between Mandapam Mainland & Rameswaram (Pampan Island) and Krusadi Island as a holistic tourism development strategy and traffic management activity.

Keywords: People Perception, Island Connectivity, Likert Scale, ANOVA, Central Tendency, Safety Perception, Transport Medium choice.

सारांश

वैश्विक पर्यटन उद्योग में द्वीप महत्वपूर्ण भूमिका निभाते हैं। उच्च निवेश लागत और परिवहन मांग की मौसमी भिन्नता के कारण अन्य द्वीपों या मुख्यभूमि के साथ द्वीपों की परिवहन कनेक्टिविटी अधिक चुनौतीपूर्ण है। मौसमी समय में उच्च यातायात को संभालना बहुत मुश्किल होता है क्योंकि बाधा प्रभाव एक ही कनेक्टिविटी माध्यम में पैदा होता है। इस स्थिति को प्रबंधित करने के लिए, हमें उपयोगकर्ताओं को वितरित करने के लिए कुछ वैकल्पिक परिवहन माध्यम खोजने चाहिए। वैकल्पिक परिवहन माध्यम को न केवल कनेक्टिविटी के साधन के रूप में काम करना चाहिए बल्कि पर्यटन को बढ़ावा देने वाली परिवहन सेवा के रूप में भी काम करना चाहिए। दुनिया भर से यात्री रामेश्वरम (पम्बन द्वीप) आते हैं जो भारत के सबसे दक्षिणी बिंदु पर स्थित है और इसका सांस्कृतिक, धार्मिक और पारिस्थितिक महत्व है। क्रुसादाई द्वीप पंबन द्वीप के दक्षिण में स्थित एक निर्जन द्वीप है। हालाँकि इस आकर्षक द्वीप की कनेक्टिविटी अवसंरचना को अक्सर एक बाधा के रूप में पहचाना गया है जो इसे अपनी पूर्ण पर्यटन क्षमता तक पहुँचने से रोकती है। आसान और अधिक प्रभावी यात्रा अनुभवों को बढ़ावा देने के लिए यह पेपर लक्षित कई पहलों और रणनीतियों की जांच करता है।

अध्ययन सड़कों, ट्रेनों और नावों सहित देश के वर्तमान परिवहन बुनियादी ढांचे की क्षमता, प्रभावशीलता और पहुंच की जांच करता है। इस शोध का उद्देश्य यह जांच करना है कि स्थानीय लोग और आगंतुक रामेश्वरम की कनेक्टिविटी के वर्तमान स्तर को कैसे समझते हैं और द्वीप कनेक्टिविटी परिवहन प्रणाली में सुधार के लिए सबसे महत्वपूर्ण आवश्यकताओं और प्राथमिकताओं को इंगित करना है। परिवहन प्राथमिकताओं, संतुष्टि के स्तर और कथित कमियों पर डेटा लिकर्ट स्केल में एकत्र किया गया था और केंद्रीय प्रवृत्ति, द्विपद लॉगिट रिग्रेशन, एनोवा सहित विभिन्न सांख्यिकीय तरीकों के माध्यम से विश्लेषण किया गया था।

यह पेपर आर्थिक और पर्यावरणीय स्थिरता पर भी गौर करता है। इसके अलावा, अनुसंधान रचनात्मक दृष्टिकोण और रणनीति में अंतर्दृष्टि प्रदान करने वाले तुलनीय कनेक्टिविटी मुद्दों से निपटने वाले अन्य पर्यटन हॉटस्पॉट से सफल केस अध्ययन और सर्वोत्तम प्रथाओं की जांच करता है। समावेशी और टिकाऊ पर्यटन विकास को बढ़ावा देने के लिए सार्वजनिक-निजी भागीदारी नीति हस्तक्षेप, बुनियादी ढांचे के विकास और सामुदायिक सहभागिता पहल सहित कई रणनीतियों को प्रस्ताव में शामिल किया गया है। यह एक समग्र पर्यटन विकास रणनीति और यातायात प्रबंधन गतिविधि के रूप में मंडपम मुख्यभूमि और रामेश्वरम (पम्पन द्वीप) और क्रुसादी द्वीप के बीच कनेक्टिविटी को बढ़ाएगा।

कीवर्ड: लोगों की धारणा, द्वीप कनेक्टिविटी, लिकर्ट स्केल, एनोवा, केंद्रीय प्रवृत्ति, सुरक्षा धारणा, परिवहन माध्यम का विकल्प।

Table of Contents

List of Tables

List of Figures

List of Equations

Abbreviations

TMP – Transport Medium Preference

LOS – Level of Safety

Los – Level of service

CHAPTER 1: INTRODUCTION

1.1 Background

In India, there are over 1382 islands, out of which 45 major tourist islands have been chosen for examining connectivity levels. Among these 45 islands, 36 are situated in the ocean, while 9 are situated in inland water bodies. Upon analysis, it has been observed that 53% of these islands lack regular transportation connections. Providing Transport connection between Tourist Islands & Mainland's is a complicated problem because of Seasonal demand and High cost of investments. Major Transport media for Island connectivity are Road, Railway, Water (Ferry), Floating Sea bridge & Air Tram.

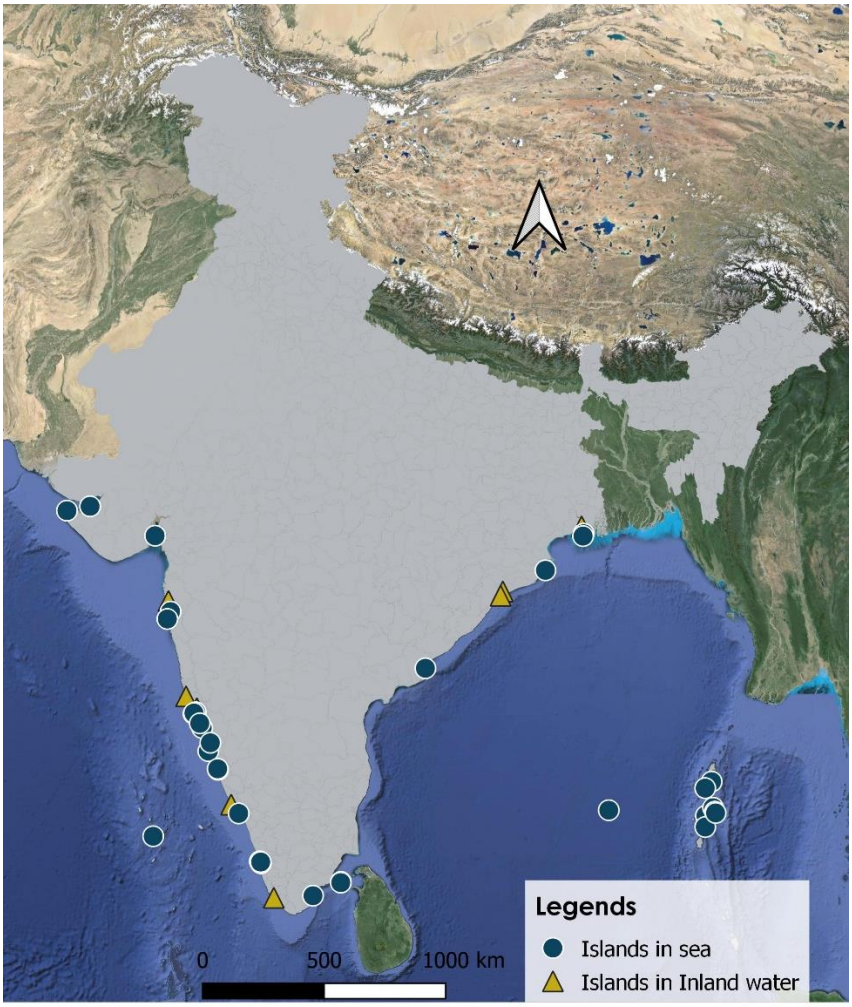


Figure 1 Location of 45 Tourist Islands chosen for Analysis
Source: Author Generated

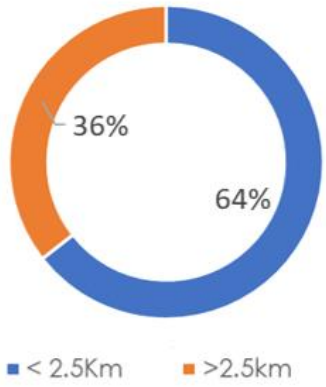


Figure 2 Distance between Islands and other landmass in 45 study Islands

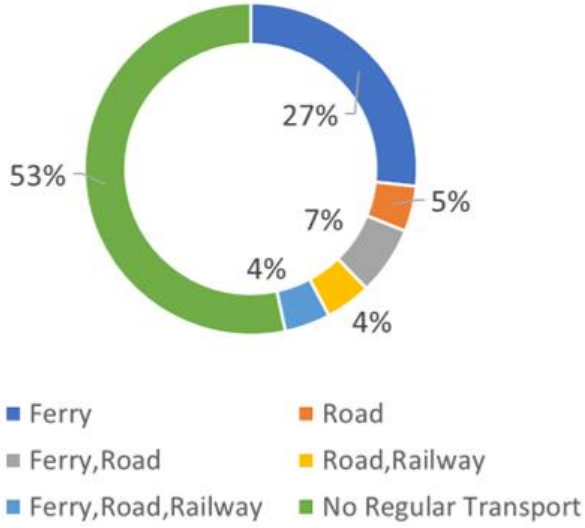


Figure 3 Type of Transport Medium connection in 45 study Islands
Source : Author Generated

People's perception plays a major role in medium choice of Transport. Emphasizing the perception of people is crucial for the success of infrastructure projects, as they are the ultimate users. Therefore, prioritizing their perceptions is vital for the project's success. People consider Road & Railway is a safety medium of connectivity. But actual data shows accidental death & Injured rate is less in water transport as compared to Road & Railway (National Crime Records Bureau of India, 2021).Tourists in making decisions about their destination are strongly influenced rather by perceptions than by reality (Sari Wulandari, 2019). perception can vary from person to person according to their background (experience and information) and how they deal with risks. (Márquez, 2015).Various models are used to find the relationship between Transport Medium choice and People perception. Studies shows some Indicators are used for the estimation of

perception in model. In case of safety perception Travel Behaviour, Condition of Mode, Safety Equipments are some of the Indicators define the perception of saftey. Perception can be measured using Likert scale, Hierarchy or Discrete choice.

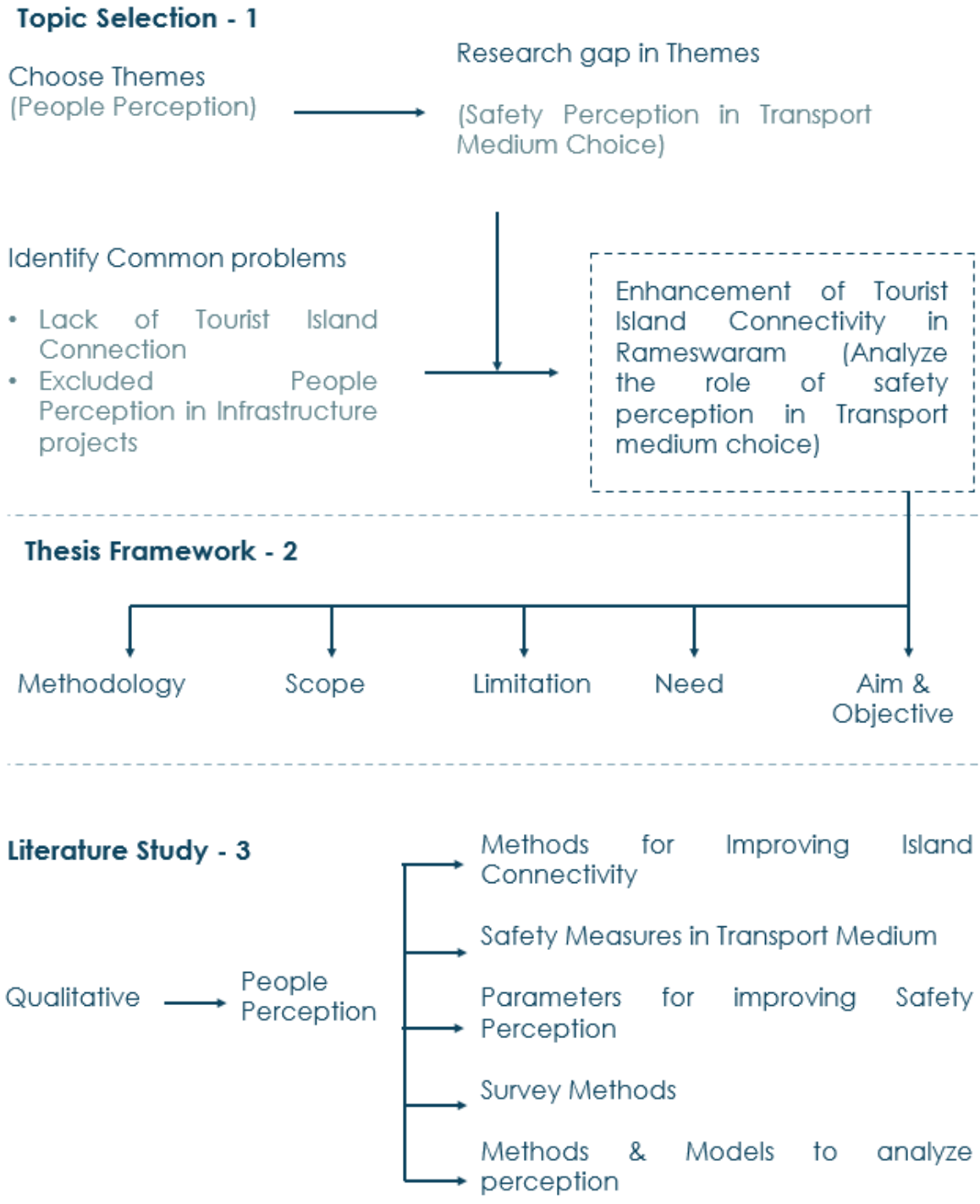
1.2 Aim and Objective

This study aims to propose strategies for enhancing tourist island connectivity in Rameswaram by improving accessibility, convenience, and overall visitor experience, with a particular focus on addressing people's perception of safety.

Objectives to achieve the aim are

- Evaluate the existing connectivity options & transportation infrastructure available in Rameswaram for tourists.
- Assess the current perception of their Needs & safety among visitors regarding various mediums of transportation to and from Rameswaram.
- Identify People Need & key factors influencing safety perception, including infrastructure conditions, past incidents, and traveler experiences.
- Develop and implement tailored strategies, to enhance transportation infrastructure and services in Rameswaram, with a focus Promoting Tourism.

1.3 Methodology



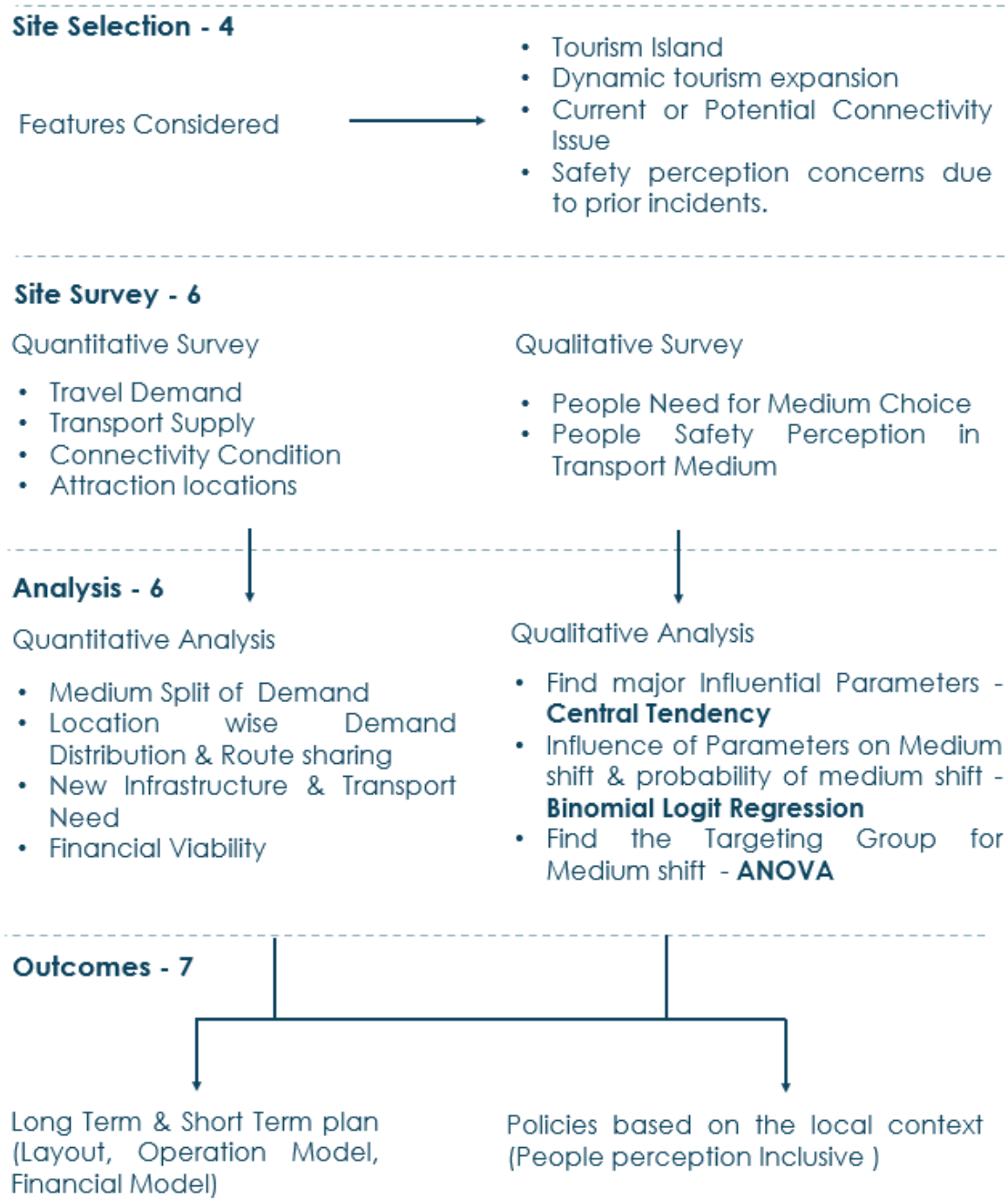


Figure 4 Thesis Methodology
Source : Author Generated

The diagram outlines a two-step methodology for identifying a research topic. In the first step, a general theme is chosen, focusing on people's perception, which is then narrowed down by identifying specific research gaps within this theme. Specifically, the focus is on safety perception in transportation medium choice.

In the second step, common problems in transportation planning are identified through various studies. It was observed that there is a lack of tourist island connections. Simultaneously, during the implementation of infrastructure projects, planners often neglect the importance of considering users' perceptions.

By combining a research gap with a planning gap, a new topic emerges, guiding us to develop solutions to address these issues. The resulting topic is "Enhancement of Tourist Island Connectivity in Rameswaram: Analysing the Role of Safety Perception in Transportation Medium Choice."

After selecting the topic, the next step involved developing a thesis framework. This framework includes the following components: Aim & Objectives: Clearly defining the purpose and specific goals of the research. Limitations: Identifying and outlining the constraints or boundaries within which the research will be conducted. Scope: Defining the extent and coverage of the research, including what will be included and excluded. Methodology: Describing the approach and methods that will be used to investigate and analyses the chosen topic. Need for Research: Justifying why this research is important and the potential impact it could have in addressing identified gaps or challenges. Each of these elements plays a crucial role in shaping the research direction and providing a structured framework for conducting the study effectively.

The next crucial step in research is conducting a literature review. Our study specifically focuses on papers that support qualitative analysis, as it yields better outcomes for studying people's perceptions and methods for improving island connectivity. This literature review encompasses areas such as methods for enhancing island connectivity, safety measures in transportation mediums, parameters for improving safety perception, survey methods for qualitative and quantitative analysis, as well as methods and models used to analyze people's perceptions. This thorough literature study serves as a guide for a thesis aiming to implement all objectives necessary to achieve a goal.

Several features are taken into consideration when selecting a suitable site for research. The chosen site ought to be an island experiencing dynamic tourism expansion. This growth results in connectivity issues between the mainland and the island, and/or between islands. Safety perception should be a significant concern when choosing the mode of transportation due to past incidents occurring in other forms of connectivity.

Following the selection of the site, a survey was conducted to gather qualitative and quantitative data. Qualitative samples were obtained from users to ascertain their perceptions. The quantitative data collection comprised primary surveys and secondary data collection, conducted both on-site and gathered from organizations. This data aims to assess travel demand, transport supply, connectivity conditions, and tourist attraction spots, providing valuable insights for analysing the infrastructure requirements of the site.

Qualitative data describing people's perceptions has been analyzed to identify priority needs and safety measures that enhance their perception towards shifting transportation mediums. Various strategies with a significant impact on the transportation medium shift of a large number of users have been identified. These findings inform the formulation of long and short-term policies, action plans, and necessary adjustments to proposed master plans.

1.4 Scope

The ongoing projects and government investments in tourist island connectivity, spanning from 2014-15 to 2024-25, offer a fertile ground for research on enhancing connectivity in tourist islands. With 76 projects and an investment of Rs. 5292.57 Crore over the past five years and a substantial budget allocation of Rs. 2,449.62 crore in 2024-25, there's a clear commitment to infrastructure development. Specifically, the Rs. 3,600-crore plus infrastructure upgrade for Lakshadweep islands and initiatives like the Atal Setu, Kochi Water Metro, and India-Sri Lanka Ferry Service underscore a shift towards water route connectivity. Moreover, landmark projects such as the Sudarshan Setu and the New Pamban Bridge emphasize the significance of bridge infrastructure. A comprehensive research study could assess the effectiveness of these investments, evaluate the impact on tourist inflow, and propose strategies to further enhance connectivity and tourism potential in these island destinations.

1.5 Limitation of Research

The primary limitation of this research lies in its reliance on a primary survey of commuters for data collection. Given the diverse nature of the population surveyed, there is inherent variability among variables such as demographic characteristics,

travel preferences, and socio-economic backgrounds. However, it's challenging to encompass all groups within variables for sampling purposes. Therefore, the survey is concentrated solely on major user groups.

This study exclusively centers on transportation links between two land masses separated by bodies of water. It does not address travel patterns within the internal areas of land masses.

1.6 Expected Outcome

The research outcomes propose a multifaceted approach to enhancing tourist island connectivity, encompassing both short-term and long-term strategies. Short-term proposals involve immediate policy adjustments to streamline transportation infrastructure and improve accessibility. Concurrently, long-term initiatives focus on sustainable project layouts, incorporating advanced technology and environmental considerations.

A comprehensive framework for qualitative analysis of people's perceptions is recommended, enabling continuous assessment and adaptation of connectivity projects based on community feedback, thereby ensuring alignment with local needs and preferences for sustainable tourism development.

CHAPTER 2: LITERATURE REVIEW

2.1 Island Connectivity

Islands, due to their isolation from the mainland, have unique characteristics that influence ecotourism development. Factors like peripherality, insularity, and remoteness can affect accessibility to these islands. Despite posing challenges, these characteristics also attract tourists and offer opportunities for tourism growth. To enhance their appeal for ecotourism, islands need sufficient accessibility. Improving connectivity has been identified as crucial for attracting more visitors and generating positive economic impacts. By enhancing existing services and making minor infrastructure upgrades, islands, especially those on the periphery, can turn challenges into opportunities by focusing on ecotourism development. A significant obstacle faced by islands is the irregularity and unreliability of sea transportation systems, often due to adverse weather conditions (Karl Agius, 2020)

Ndikom (2013) and Adejare et al. (2017) highlighted the overlooked and underestimated significance of water transportation in Lagos State. Meanwhile, Edelman (2015) concluded that simply integrating Bus Rapid Transit (BRT) with light rail schemes might not effectively address the congestion issue in Lagos metropolis unless it also integrates water transportation. (Aiyegbajeje, 2021)

2.2 Perception Study

For quite some time, researchers have identified latent variables like attitude and perception as crucial factors influencing travel behavior. Latent variable models gained traction following Walker's (2001) contributions. He introduced a comprehensive framework and methodology for integrating latent variables into choice models. (Partha Pratim Sarkar, 2017)

Exploring safety perceptions within the local context is imperative, despite existing studies in other domains. It's evident that both drivers and pedestrians exhibit distinct behaviours, warranting a deeper understanding. Such insight could significantly contribute to mitigating accident rates, particularly through the formulation and implementation of policies aimed at enhancing institutional coordination in road safety efforts. The national plan outlines general actions, yet optimizing them hinges on modelling shifts in individual attitudes towards safety

measures. In the realm of transportation, human behaviour plays a significant role, influencing not just users but also extending to service providers, business leaders, planners, policymakers, and even voters. These various stakeholders collectively shape transportation policies through their decisions and actions. Significant progress has been made in understanding perceptions within the realm of transportation, yet numerous gaps remain to be filled. Specifically, there is a pressing need to delve deeper into three key areas: determining the most suitable indicators for analysing perceptions, integrating objective factors into hybrid models for predictive analysis—particularly regarding safety-related policies—and exploring the impact of latent variables on perceptions.
Perceptions of safety are intricate, varying between cities and shifting according to factors such as the environment, individual characteristics, and chosen mode of transportation. Indicators have been developed by formulating questions related to the utilization of safety equipment. (Márquez, 2015)
Tourists' choices of travel are significantly influenced by their perceptions of safety and security, rather than solely by actual circumstances. Hence, it's crucial to differentiate between risk factors and how those risks are perceived. (Aiyegbajeje, 2021)

2.3 Survey Parameters

Stakeholder consultations were conducted throughout the entire study area to gather their perspectives on different aspects concerning ecotourism and connectivity for islands. The interviews addressed connectivity issues, focusing on the following aspects the price, frequency and reliability of the ferry, weather conditions on sea transport, The current transportation infrastructure, along with essential initiatives aimed at enhancing connectivity, and their implications for the advancement of ecotourism. (Karl Agius, 2020)
To study mode choice based on people perceptions. surveyors gathered information pertaining to trips and travel modes, including the origin, destination, purpose, mode, and duration of each trip. Additionally, data regarding socioeconomic characteristics such as age, gender, years of education, household size, household income, vehicle ownership, and the license status of the travelers were also collected during the survey. Respondents were required to indicate their level of agreement using a five-point Likert scale, ranging from complete

disagreement (rated as 1) to full agreement (rated as 5). Indicator variables were appropriately organized based on previous assumptions to form four latent variables: comfort, safety, flexibility, and reliability. (Partha Pratim Sarkar, 2017)

For Analysing Safety perceptions. certain indicators are established through individuals' reported actions, such as moderating speed or avoiding potentially hazardous situations. Furthermore, ratings provided regarding the condition of transport equipment used for the service also contribute to indicator construction (Márquez, 2015)

Indicators for assessing accident risk perception gleaned from literature research encompass a range of factors, including weather conditions, socio-economic traits, exposure levels, road infrastructure characteristics, occurrences of natural disasters, technological hazards, health-related risks, crime rates, probability evaluations of risk, personnel's familiarity with equipment, and equipment availability. (Sari Wulandari H. A., The Determinants of Accident Risk Perception, Travel Motivation, eWOM and Travel Intention on Island Tourism Destination, 2019)

Marine accidents have been attributed to several key factors, including deteriorating jetties, inadequately equipped marine police, non-operational vessels, and the presence of wrecks. Passenger perceptions regarding the safety of Lagos waterways are influenced by several factors, including the use of substandard life jackets, untrained personnel, inadequate monitoring of water routes, and the condition of water vehicles. These concerns were uncovered through a willingness survey conducted among passengers. While passengers opt for water transportation to escape road traffic congestion, they also acknowledge that it is not as safe as road transport. Despite this, they appreciate the speed and time-saving benefits of water transport, as well as the convenience it offers compared to bus mass transit. Additionally, passengers note the absence of the hustle and bustle typically experienced at bus stops when using jetties. (Aiyegbajeje, 2021)

2.4 Analysis Methodology

The study on tourists' perceptions of safety and security on Phuket Island utilized a quantitative research methodology. Data was collected from 399 international

tourists departing from Phuket International Airport during March-April, 2016. The questionnaire was designed based on the review of literature on destination image in tourism. The questionnaire items were structured to address independent variables in the first section and dependent variables in the second section. In the initial part, respondents were requested to provide personal information such as demographics (e.g., age, gender, nationality, companionship during travel, and the frequency of visits, including the current trip). The second section of the questionnaire focused on measuring tourist satisfaction and perceptions through variables. The purpose of the study was to evaluate how international tourists felt about safety and security while visiting Phuket Island. The research hypotheses were formulated to investigate the influence of national culture and the number of visits on tourists' perceptions of safety and security. To test these hypotheses, one-way ANOVA (analysis of variance) was used. This statistical analysis allowed the researchers to examine the differences in perceptions of safety and security among different cultural groups of tourists and based on the number of visits to Phuket.

The findings of the study revealed statistically significant differences in the perceptions of different nationalities and the number of visits of respondents influencing the perception of tourists on safety and security in Phuket. Specifically, tourists from Oceania and Europe countries felt safer with touristic activities than those from Asian countries. The majority of the participants were visiting Phuket for the first time, and with companions or family. Overall, the study employed a systematic approach to gather and analyze data, providing valuable insights into tourists' perceptions of safety and security on Phuket Island. (Wongsai, 2017)

The research conducted on travel intention and risk perception in island tourism destinations used qualitative research methods, including depth interviews and focus group discussions, as data collection tools. The objective of the research was to develop a travel intention model using travel motivation, accident risk perception (specifically the risk of accidents using water transportation to the island), and electronic word-of-mouth (eWOM) as variables that determine one’s desire to travel to the island. The data of literature study is used to confirm and complete the previous primary data obtained through depth interview. The model used in this study adopted the research model from the previous research by using travel motivation (push & pull motivation) eWOM, accident risk perception, and travel intention variable. (Sari Wulandari H. A., The Determinants of Accident Risk

Perception, Travel Motivation, eWOM and Travel Intention on Island Tourism Destination, 2019)

Relationship between population and sample size and margin of error can be expressed by the relation of Krejcie and Morgan formula as follows:

$$n = \frac{\chi^2 N p(1-p)}{e^2(N-1) + \chi^2 p(1-p)},$$

Equations 1 Krejcie and Morgan formula to find relationship between sample size & population

where n and N are the sample and population sizes, respectively, e is the margin of error, χ is the value of the chi-square distribution having a degree of freedom of one at a certain confidence level, and p is population proportion.

When conducting predictive analysis and dealing with an outcome variable that is measured on an ordinal scale (like "very high, high, medium, low, very low"), it's recommended to use an ordinal regression model. Ordinal regression models have been extensively utilized in past transportation research to gauge how predictor variables impact an ordinal outcome variable. (Akgün-Tanbay, Campisi, Tanbay, Tesoriere, & Dilum, 2024)

The Taro Yamane statistical technique was used to determine the sample size for this study using the formula below.

$$n = \frac{N}{1 + N(e^2)}..$$

Equations 2 Taro yamen formula to fix sample size

Where:

n = the sample size

N = population size

e = allowable error (0.05)

1 = constant

In multiple regression analysis, the primary predictor variable emerged as the most significant factor in explaining passengers' hesitancy to utilize water transportation. (Aiyegbajeje, 2021)

A survey methodology employed to discern road safety preferences influencing individuals' travel decisions is the revealed/stated preference survey. Its primary objectives include: Investigating the current travel behavior of the sampled population. Analysing how individuals make travel choices, factoring in their awareness of traffic safety. Assessing how concerns about traffic safety influence mode selection.

In the revealed preference segment, participants disclose their actual transportation mode selections (e.g., car driver, car passenger, public transportation, cycling, walking), considering trip purpose (e.g., work, childcare, shopping, leisure, social visits), and trip duration (short, medium, long).

In the stated preference section, participants are briefed on safety statistics and potential consequences of different mode choices. They are then presented with the same set of questions as in the revealed preference section, but within the framework of a stated preference survey. Here, participants are not constrained by their previous choices and are free to select modes based on their traffic safety awareness. After started an analysis aimed at creating advanced joint multinomial regression models to better understand the connections between revealed and stated preference responses. (Pirdavani)

CHAPTER 3: STUDY AREA

3.1 Introduction

Rameswaram is a town located in the Indian state of Tamil Nadu, on the island of Pamban, in the Gulf of Mannar. Pamban Island is divided into four administrative divisions: Okarisalkulam, Mahindi, Pamban, and Rameswaram. The primary towns situated on the island are Pamban and Rameswaram. At present, the population of Pamban Island stands at 69,500 residents. It is an important pilgrimage center for Hindus, as it is home to the famous Ramanathaswamy Temple, which is one of the twelve Jyotirlinga temples in India. Among these destinations are Agni Theertham, Kothandaramar Temple, and Gandhamathana Parvartham, also known as Ramar Paatham. These sacred locations offer visitors the opportunity to immerse themselves in the rich religious heritage and cultural significance of the island.

Dhanushkodi, nestled at the southern extremity of Rameswaram Island, is embraced by the Gulf of Mannar to one side and the Bay of Bengal to the other. Renowned for its unspoiled natural beauty, this locale has emerged as a prime destination for eco-tourism enthusiasts.

Krusadai Island is a pristine, uninhabited gem nestled to the west of the iconic Pamban Bridge at 4km. Encompassed by approximately 10,500 sq. km of marine expanse, this area forms a Marine Biosphere, offering a haven for marine biologists and enthusiasts of nature alike. The island boasts an abundance of coral reefs and diverse marine life, including colorful fish, playful dolphins, and the gentle sea-cows, known as Dugongs. Krusadai Island is renowned as an ideal destination for ecotourism, inviting visitors to immerse themselves in the wonders of the natural world and experience the serenity of untouched marine ecosystems.

3.2 Existing Transport Connectivity

The Pamban Bridge (Rail) , which connects Rameswaram to the mainland, is an engineering marvel. Historically, the bridge carried meter gauge trains, but as part of the Unigauge policy, it was upgraded to carry broad gauge trains. The bridge is a cantilever bridge, which is a type of bridge that is built using cantilevers, or horizontal beams that are supported on only one end. The Pamban Bridge is the

first cantilever bridge in India and is an important transportation link for the people of Rameswaram and the surrounding areas.

The decision to construct a new bridge alongside the aging Pamban Bridge was made by the Indian Railways due to concerns regarding its age and maintenance challenges. Reconstruction of the Pamban Bridge was approved in 2019, with a scheduled completion before the end of 2024. Spanning 2,070 meters, this forthcoming bridge will mark India's inaugural vertical lift sea bridge, with an estimated expenditure of Rs 550 crores.

The Annai Indira Gandhi Road Bridge links Mandapam on the mainland to Pamban Island and Rameswaram. In 1988, a road bridge was built alongside the railway bridge connects National Highway (NH 49) to Rameswaram Island.

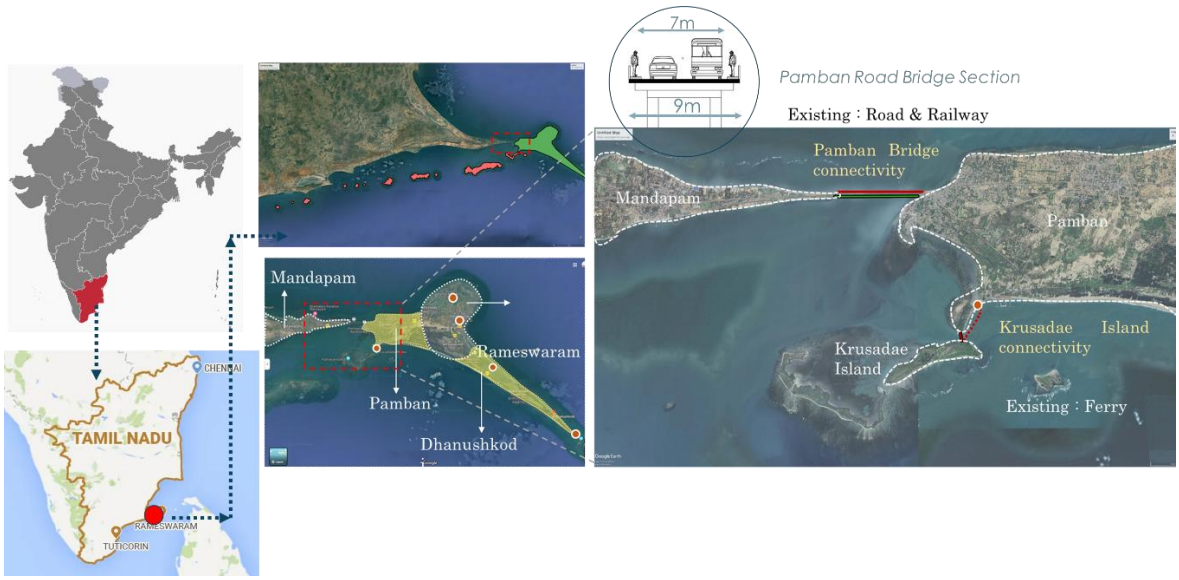


Figure 5 Geographical Location of Pamban Island
Source : Author Generated

3.3 Travel Demand & Supply through Pamban Bridge

The Pamban Road Bridge, also known as the Annai Indira Gandhi Road Bridge, serves as the vital link connecting Rameswaram Island to the Mandapam Mainland. This two-lane, two-way road bridge spans 7 meters wide with a right of way measuring 9 meters. Its significance lies not only in its structural importance but also in facilitating the movement of people and goods between these two

regions. Every day, approximately 250 government bus services traverse this bridge, facilitating transportation for locals and Tourists alike

In parallel, the Pamban Railway Bridge operates as another critical lifeline for connectivity in the region. With an average of 6 to 7 up and down trains passing through each day, including essential local services between Madurai and Rameswaram, its role in the transportation network cannot be overstated. However, recent construction work on the railway bridge has necessitated temporary halts in train services. As a result, trains are being halted at the preceding stations of Mandapam and Ramanathapuram

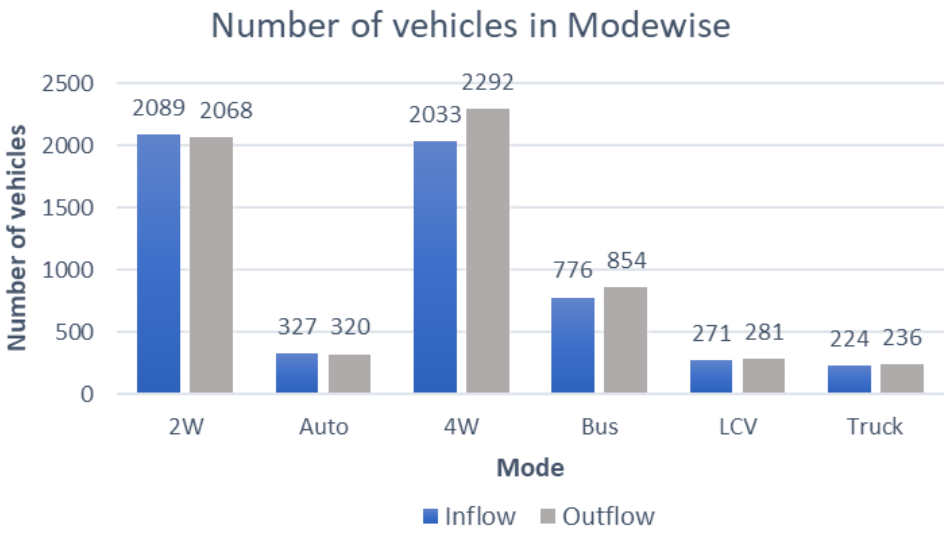


Figure 6 Modal split in Pamban Road Bridge for Peak days (Weekends)
Source : Author Collected Data

This chart explains number of vehicles traveling on the Pamban Bridge on a peak day (weekend) categorized by vehicle type and direction. The chart divides the traffic into two categories: inflow and outflow. Inflow refers to traffic traveling from the mainland to the island, and outflow refers to traffic traveling from the island to the mainland. The most common vehicle type on the bridge is two-wheeled vehicles (2W), followed by cars.

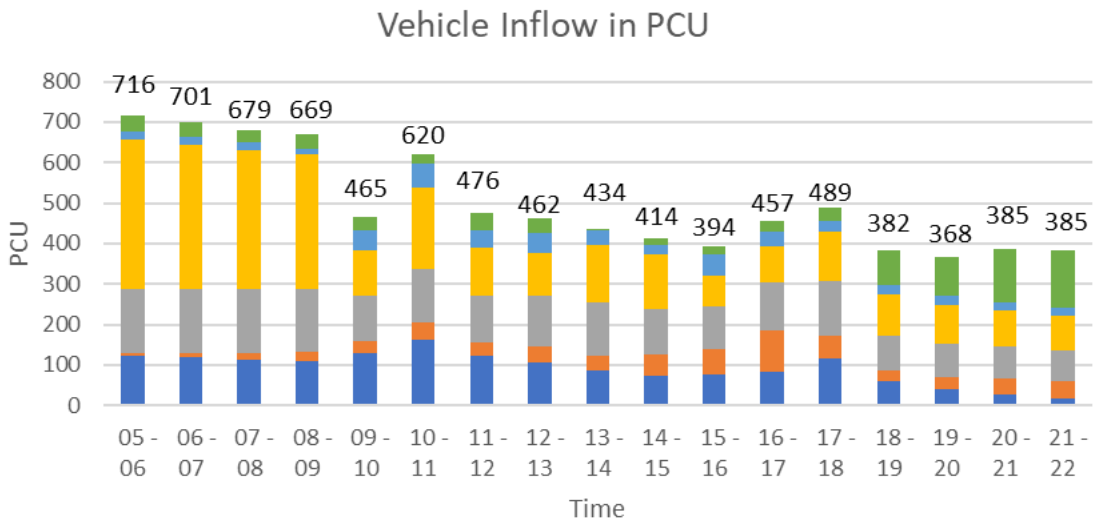


Figure 7 Vehicle Inflow Traffic volume in Pamban Road Bridge for Peak days (Weekends)
Source : Author Collected Data

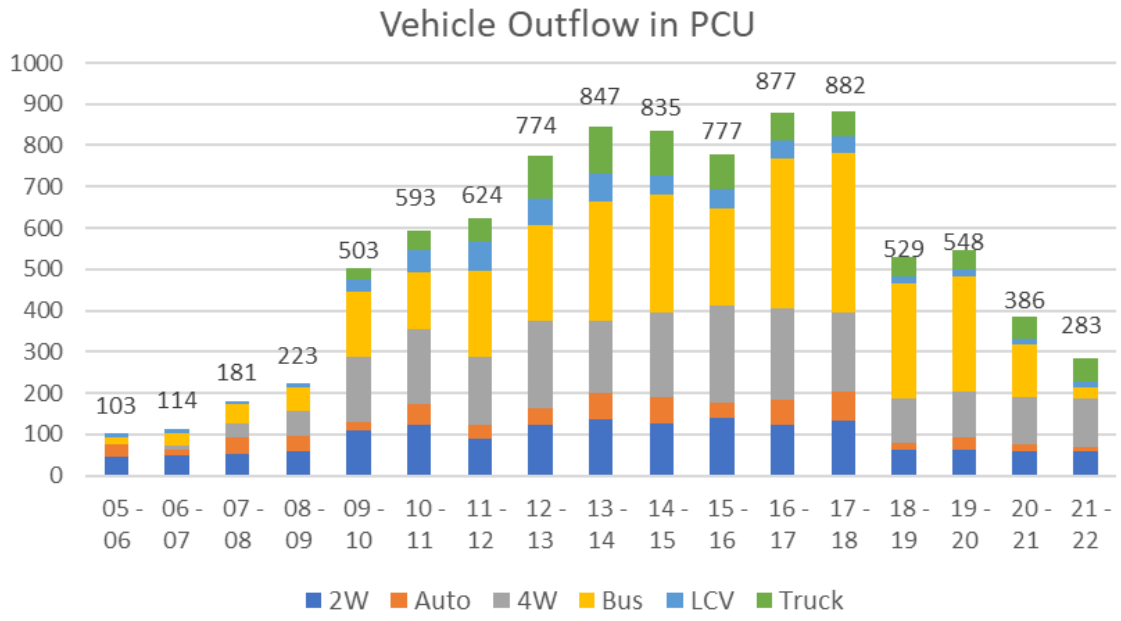


Figure 8 Vehicle Outflow Traffic volume in Pamban Road Bridge for Peak days (Weekends)
Source : Author Collected Data

Graphs 4 and 5 illustrate the inflow and outflow of vehicles, measured in Passenger Car Units (PCU), traversing through Pamban over a period of time. Notably, the data reveals that vehicle inflow peaks during the morning hours, specifically between 6:00 A.M. and 11:00 A.M. Conversely, the outflow of vehicles shows a

significant increase from 12:00 P.M. to 18:00 P.M., indicating higher traffic leaving the area during these hours. However, the most pronounced peak occurs between 16:46 and 17:45, with a Level of Service (LOS) of 0.82, categorizing the traffic flow at this time as LOS - D according to current traffic standards. This analysis underscores the temporal patterns of vehicle movement through Pamban, with morning hours witnessing high influxes and afternoon hours witnessing substantial outflows, culminating in a peak hour characterized by moderately congested conditions.

Table 1 People Flow through Pamban Bridge (on Weekend)

Time	Inflow People	Outflow People
4:00 – 11:00	23107	7498
11:00 – 17:00	10324	23293
17:00 – 22:00	7457	16088

Source : Author Collected Data

The Pamban Road Bridge operates actively from 4:00 AM to 10:00 PM, catering to the maximum flow of people during this timeframe. Typically, there is an influx of people towards the island during the early morning hours, with visitors leaving the island and starting their outflow in the afternoon and evening. During the evening and night, there is another inflow towards the island as people stay on the island to visit the temple and other attractions. Subsequently, they begin their outflow from the island during the early morning hours. This movement pattern characterizes the tourism flow on Pamban Island facilitated by the connectivity provided by the Pamban Road Bridge. The flow of people through the Pamban Bridge indicates significant movement throughout the day. From 4:00 AM to 10:00 PM, a total of 40,888 individuals enter the bridge, while 46,879 individuals exit. This data suggests active engagement throughout the daytime hours, with a substantial number of people traveling both to and from Pamban Island. However, the notable discrepancy between inflow and outflow also implies the possibility of people remaining on the island overnight. Additionally, the flow of individuals during late-night hours, from 10:00 PM to 4:00 AM, suggests ongoing movement even during these less conventional hours.

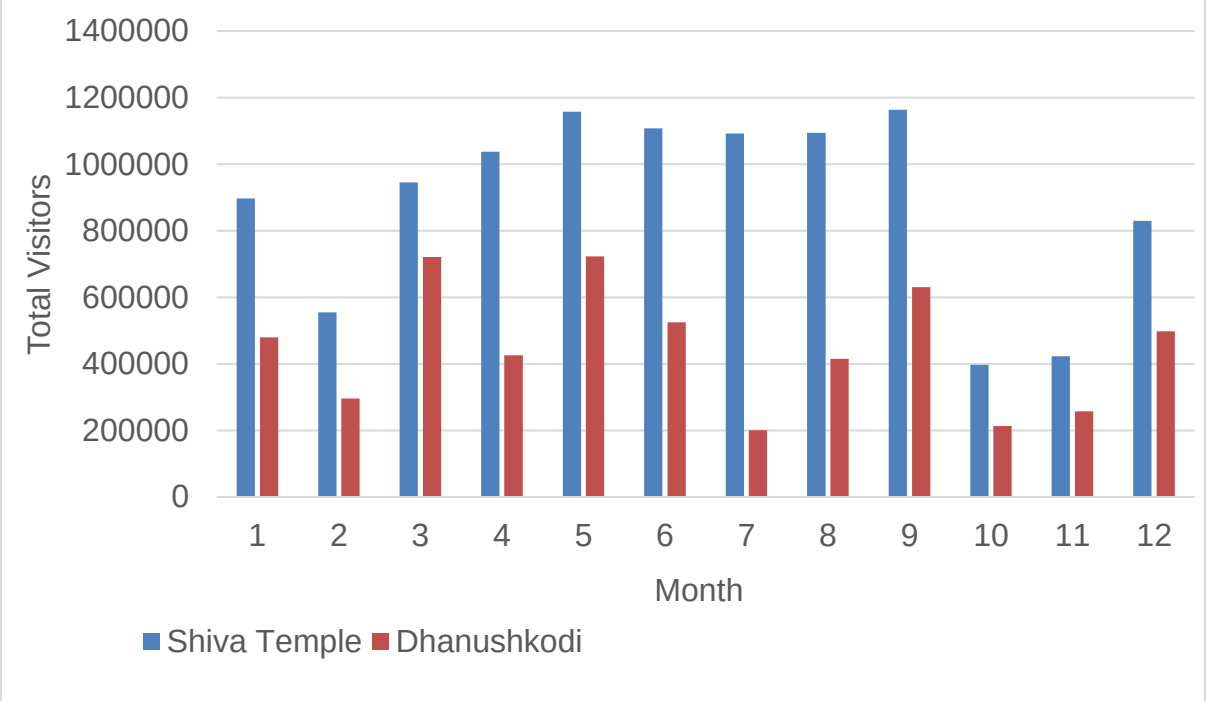


Figure 9 Month wise Tourist attraction for Tourist spots in 2023
Source : Author Generated based on data from Rameswaram Tourist centre

In the chart, the x-axis represents the months, with January indicated as "1" and December as "12". Meanwhile, the y-axis illustrates the number of visitors. It's notable that Ramanathaswamy Temple attracts more tourists than Dhanushkodi. Particularly, the peak months for Ramanathaswamy Temple are from April to September, during which it experiences an estimated influx of over 1 million visitors.

Table 2 Annual Tourists visits the major Destination of Rameswaram

Year	Ramanathaswamy Temple	Dhanushkodi Beach
2019	81,46,760	15,42,716
2022	70,65,959	42,29,554
2023	1,06,99,584	53,86,804
2033	2,21,34,273	1,10,99,226

Source : Author projected based on data from Rameswaram Tourist centre

According to the Tourist visiting data provided, there is a substantial projected growth in the number of visitors expected to visit both the Ramanathaswamy (Shiva) temple and Dhanushkodi beach by the year 2033. For the Ramanathaswamy (Shiva) temple, it is estimated that the number of visitors will reach 2,21,34,273 by 2033. This represents a significant increase compared to the

visitor numbers recorded in 2019, which stood at 81,46,760, and in 2022, which were 70,65,959. Similarly, for Dhanushkodi beach, the projected number of visitors by 2033 is 1,10,99,226, indicating a notable rise from the visitor count of 15,42,716 in 2019 and 42,29,554 in 2022. These projections suggest a promising trend of increasing tourism to both destinations over the coming years, indicating their growing popularity among visitors. The projected substantial growth in the number of visitors to both the Ramanathaswamy temple and Dhanushkodi beach by the year 2033 is likely to create congestion on the Pamban Bridge. As the number of tourists increases significantly, there will be a corresponding rise in the volume of vehicles and foot traffic traversing the bridge, especially during peak tourist seasons and holidays. With the anticipated surge in visitor numbers to these popular attractions, the existing infrastructure of the bridge may struggle to accommodate the increased demand. Congestion on the Pamban Bridge could result in several challenges. Firstly, traffic jams and delays may occur, leading to frustration among travellers and potential safety hazards.

3.4 Travel Demand & Supply through Krusadae Island ferry

Figure 10 Location of Krusade Island
Source : Author Generated

Kunthukal Beach acts as a hub for connecting to several nearby islands, facilitating boat transportation for visitors to discover the adjacent areas. In particular, tourists have the opportunity to reach Kurusadai Island through a Boarding Jetty situated in close proximity to the Vivekanatha Memorial. Starting in 2022, the Government Tourism Department initiated a project with two boats, one accommodating 30 persons and the other 12 persons, each priced at 300/person for a round trip.

Safety measures implemented include assigning one safety guard per boat, providing safety jackets for passengers, and ensuring the presence of fire extinguishers onboard. During the peak months of April and May, Krusadai Island attracts between 250 and 400 visitors per day on weekends (Saturday and Sunday) and weekdays. In other months, weekend visits typically range from 200 to 300 visitors per day, while weekdays see approximately 100 to 150 visitors daily.

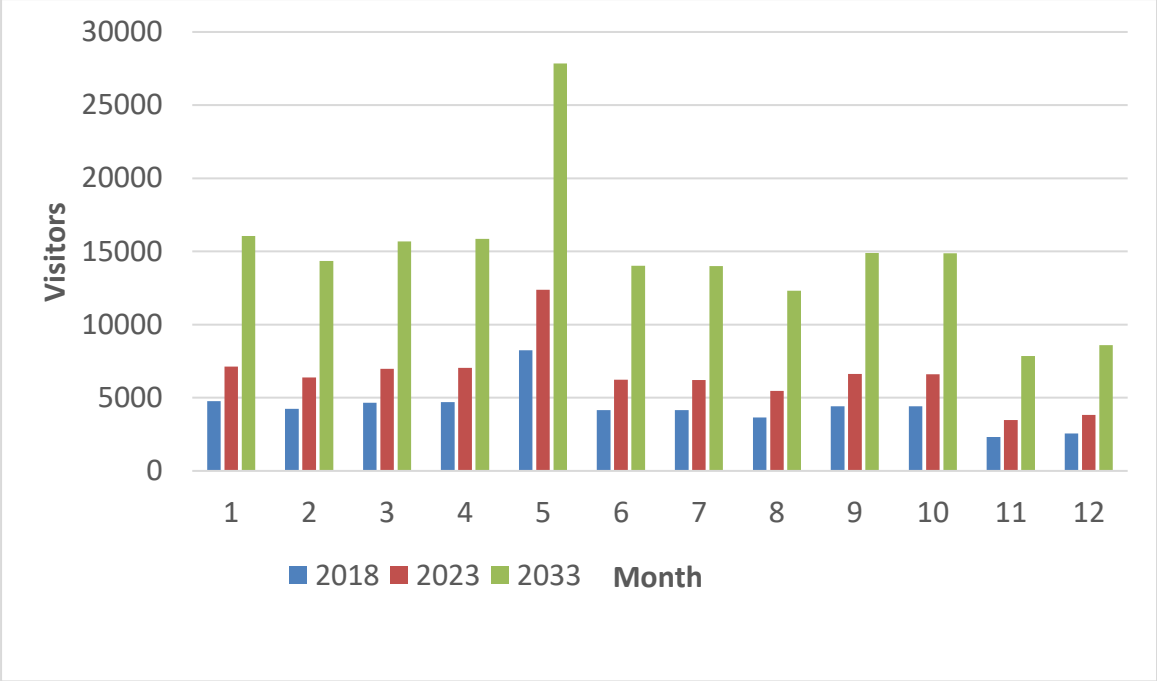


Figure 11 Existing & projected Growth of Annual Tourist Visits for Kunthukal Beach (Vivekanantha Memorial)
Source : Author Generated based on data from Rameswaram Tourist centre

In the chart, the x-axis represents the months, with January indicated as "1" and December as "12". Meanwhile, the y-axis illustrates the number of visitors. The number of tourist visits to Kunthukal Beach has been on an upward trajectory in recent years. This growth trend has become more pronounced following the introduction of boat connectivity to Kurusadai Island. It's evident that visitors to Kunthukal Beach are keen to explore Kurusadai Island, drawn by its allure and attractions. However, the limited supply of only two boats has resulted in delays and increased costs, discouraging some from pursuing their leisure trips to Kurusadai Island. Despite the rich coral reefs preventing the construction of a bridge between the islands, boating remains the optimal mode of connectivity. Nevertheless, there's a pressing need for the improvement of boat connectivity and its associated infrastructure to further promote tourism in the area

3.5 Safety Perception Problems in Alternative Mode

Safety-related incidents in the Rameswaram and Pamban Island region have raised concerns among tourists and pilgrims, affecting their perception of safety and influencing their choice of transportation. One significant event was the devastating cyclone in 1964, which caused the Pamban Bridge to collapse and resulted in the tragic loss of 115 passengers on a train traveling from Pamban to Dhanushkodi. This incident, where the train was washed away by high waves, has left a lasting impact on safety perceptions in the region. Another incident in 2010, where 13 people lost their lives in an unauthorized boat ride from the mainland to Pamban Island, further fueled concerns about transportation safety. These incidents collectively contribute to the perception of Rameswaram and Pamban Island as potentially unsafe for visitors. To address this perception and ensure the success of infrastructure projects aimed at enhancing island connectivity and promoting tourism, it's crucial to incorporate people's perceptions through surveys on safety and other needs. A relevant example highlighting the importance of considering public perception in infrastructure projects is the Kinzua Bridge Skywalk. This attraction faced challenges due to safety concerns and low visitor turnout, leading to its closure in 2017. Factors such as maintenance costs and risk perception associated with the glass-bottomed observation deck contributed to its decline. Efforts are underway by the DCNR to improve infrastructure and amenities, including the skywalk, to enhance the visitor experience and boost tourism in the region. Thus, conducting surveys to gauge public perception on safety and other aspects is essential for the success of projects aimed at enhancing island connectivity and promoting tourism

3.6 Need for Connectivity Development

To address the potential congestion on the Pamban Bridge resulting from the projected visitor growth, authorities may need to consider implementing various measures. These could include improving traffic management systems, enhancing public transportation options to reduce reliance on private vehicles, promoting off-peak visitation times, and investing in infrastructure upgrades to expand the bridge's capacity. By proactively addressing these challenges, the authorities can ensure a smoother and safer travel experience for tourists while preserving the

functionality and integrity of the Pamban Bridge. Enhancing connectivity isn't solely reliant on quantitative analysis but also hinges on qualitative analysis, particularly people's perceptions. Proposal timelines will be prioritized into short and long-term goals, taking into account user feedback and insights. Policies will be formulated based on these analyses, ensuring a comprehensive approach to improving connectivity. This strategy acknowledges the importance of qualitative factors, such as user experiences and preferences, alongside quantitative data in shaping effective and inclusive connectivity initiatives.

CHAPTER 4: SITE SURVEY AND DATA COLLECTION

4.1 Parameters chosen for survey

The volume of the Pamban Road Bridge (Annai Indira Gandhi Road Bridge) is currently insufficient to accommodate the projected increase in vehicle traffic in the future. Therefore, there is a need to redistribute road users to alternative transportation medium to alleviate potential traffic congestion. People have diverse preferences and requirements for transitioning to other medium of transportation, which serve as both push and pull factors influencing their choices. By addressing these needs, specific segments of the population can be encouraged to shift to alternative medium of transport. Analysing quantitative data allows for the identification of potential solutions for mode shift, although implementation may be constrained by financial and political considerations. Therefore, it is essential to prioritize people's needs based on their perceptions. Conducting perception surveys involves framing questions aligned with these needs and asking participants to rate their preferences on a 5-point Likert scale. Additionally, collecting socio-economic data enables the exploration of how people's responses vary based on their socio-economic characteristics. This approach facilitates the identification of target groups for promoting medium shift in transportation, ultimately contributing to more efficient and sustainable transportation systems

4.2 Socio Economic Characteristics

socio-economic characteristics are currently playing a crucial role in perception surveys for transport planning because they are providing valuable insights into how different segments of the population are perceiving and interacting with transportation options. Factors such as age, gender, travel origin and destinations, total travel distance, total travel cost, travel cost within the island, travel purpose, and the type of tourism if the purpose is tourism, as well as travel partners and the average number of travel partners, are being considered. Additionally, the major mode of transport and the preferred mode of transport for island connectivity, monthly income, and the frequency of using the road and rail bridge when both are in operation are being examined. These data points are currently being collected

to identify tourist groups and their segments within the overall visiting tourist population.

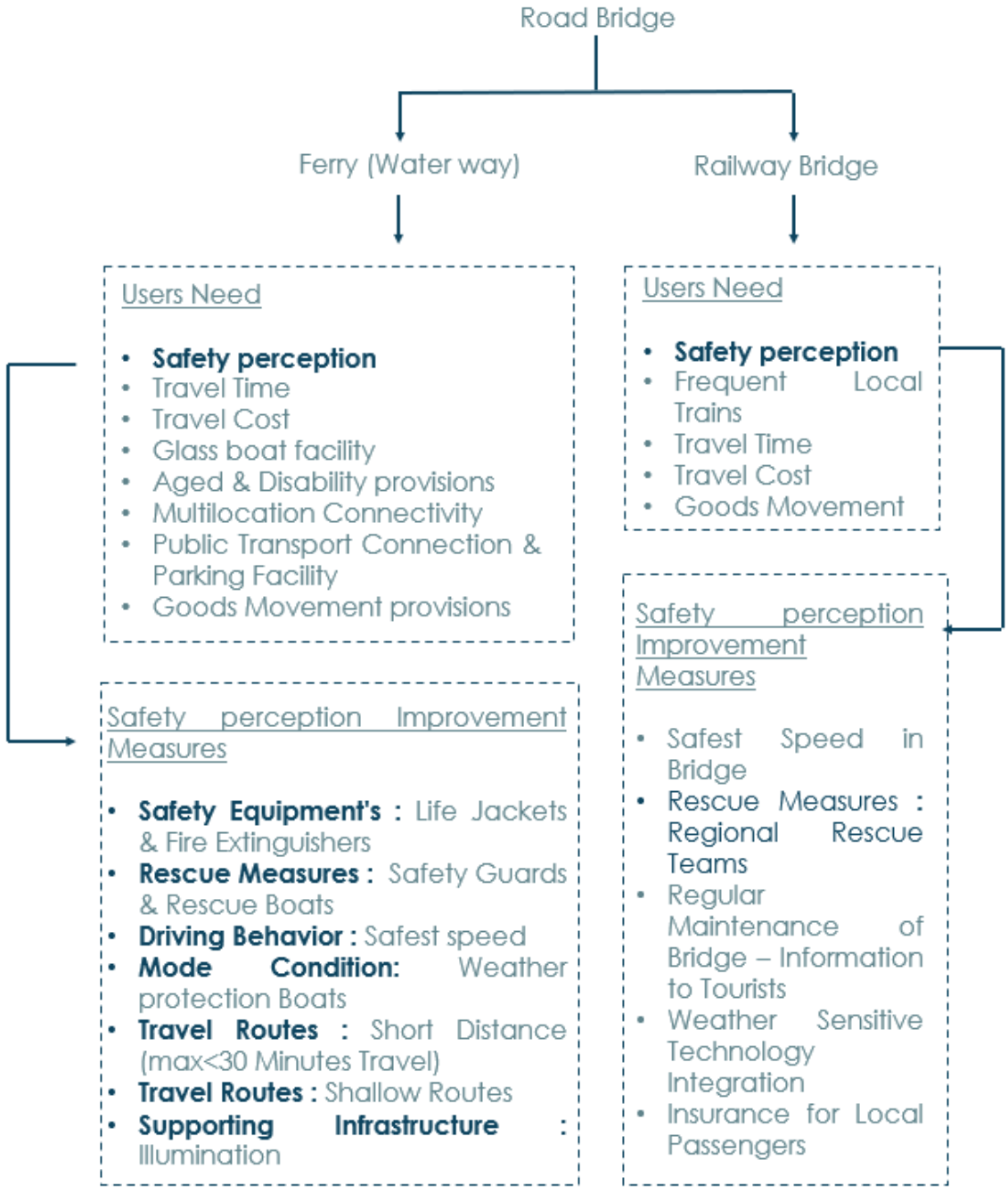


Figure 12 People perception parameters for Transport Medium shift
Source : Author Generated

4.3 Road to Water medium shifting parameters

The shift from road transport to waterway (ferry) transport is currently considered necessary as it is proving to be a more efficient and environmentally friendly mode of transportation, especially for connecting to nearby islands or coastal areas where road infrastructure may be limited or impractical. Additionally, water

transport is helping alleviate congestion on the bridge, particularly during peak tourist seasons, by providing an alternative means of travel for both tourists and locals, potentially boosting tourism and economic development through enhanced connectivity to various destinations. This transition is currently being pursued by addressing the needs of the people. Parameters are currently being selected based on the literature study of successful implementation of ferry services connecting various islands. Efforts are currently being made to enhance the safety perception of water transportation, ensuring the availability of glass-bottom boats for tourists interested in marine ecosystem scenic views, providing infrastructure supporting access for the elderly and disabled, reducing travel time and cost compared to road transport, establishing multilocation connectivity throughout important destinations on the island, providing parking facilities for private vehicle users, and ensuring the availability of public transport connectivity near boarding and deboarding jetties, along with offering special provisions for goods movement. Currently, people are being requested to rate these provisions on a 5-point Likert scale to assess the level of impact of those provisions on their selection of the waterway (ferry) mode. Project implementation agencies and organizations are currently providing safety measures for using waterway (Ferry) transportation. Additionally, planning measures are currently being implemented to positively impact people's perception of feeling safe. These measures include ensuring the availability of safety equipment, including fire extinguishers and life jackets for all passengers, appointing rescue guards with rescue boat facilities, ensuring safe driving behaviour of boat operators, using high-quality boats that protect passengers in all weather conditions, providing the shortest travel path of approximately 30 minutes from one destination to another, establishing shallow travel routes in the ocean, and providing illumination facilities for nighttime travel along a path. People are currently being asked to rate these safety perception improvement measures on a 5-point Likert scale to determine their importance in enhancing their perception of traveling by waterway mode.

4.4 Road to Railway medium shifting parameters

The shift from road transport to railway transport is currently deemed necessary as it proves to be more efficient and capable of accommodating a larger volume of

passengers and freight compared to road transport. This transition is being pursued by addressing the needs of the people. Parameters are being selected based on the analysis of the existing condition of railway connectivity in Pamban (Rameswaram) Island. Efforts are being made to enhance the safety perception of railway transportation, scheduling frequent local trains on peak days, providing reduced travel time and cost compared to road transport, and offering special provisions for goods movement. Currently, people are being requested to rate these provisions on a 5-point Likert scale to assess the level of impact of that provisions on their selection of the railway mode. People are currently being asked to rate the importance of choosing railway as an alternative mode of transportation. Project implementation agencies and organizations are currently providing safety measures for using railway transportation. Additionally, planning measures are being implemented to positively impact people's perception of feeling safe. These measures include operating trains at low speeds of approximately 20 km/hr, appointing regional rescue teams within a 50 km radius, ensuring the availability of an immediate communication team in Pamban, conducting regular maintenance of railway bridges and making information regarding the reliability of the bridges available to tourists. Furthermore, weather-sensitive technology is being integrated to take remedial actions, and railway trips are being pre-allotted. Insurance coverage is being ensured for local train passengers traveling on critical routes that have had unfortunate accidents. People are currently being asked to rate these safety perception improvement measures on a 5-point Likert scale to determine their importance in enhancing their perception of traveling by railway mode.

4.5 Survey Location

Public transport users are currently not causing any traffic congestions on the bridge. It is private transport users who are contributing to congestion, utilizing autos, two-wheelers, vans, and four-wheelers as their primary mode of transportation for bridge connectivity. These users typically halt their vehicles on the Pamban Road Bridge (Annai Indira Gandhi Road Bridge) to appreciate the picturesque scenery. Therefore, this location has been selected as the ideal spot for conducting perception surveys. Since perception is closely tied to feelings,

questioning individuals at the connectivity spot increases the likelihood of obtaining accurate responses.

4.6 Descriptive Survey outcomes

The socio-economic characteristics of the sample users in this study were determined through a sample size of 121 individuals, selected via simple random sampling. This approach ensures that each member of the population has an equal chance of being included in the sample, enhancing the representativeness of the data. The sample users were assessed across various socio-economic dimensions

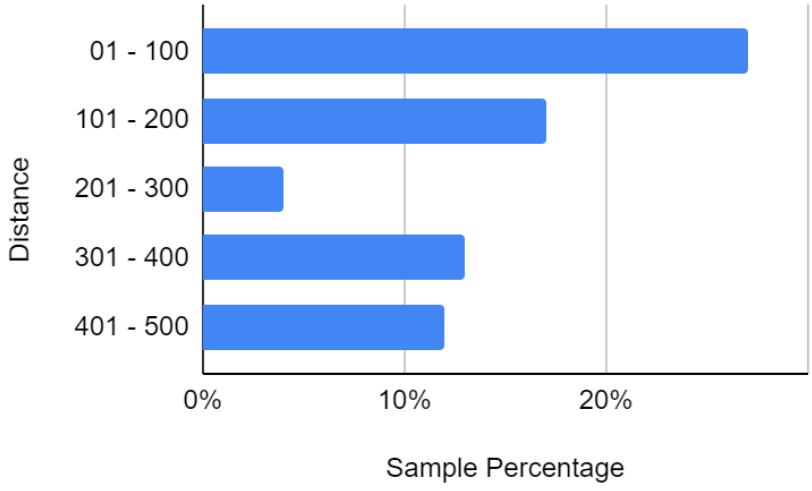
Table 3 Descriptive survey outcome of Age, Gender, Purpose & Origin of Samples

Socio Economic Parameters			Percentage
Age		18-30	35%
		30-50	45%
		50-70	18%
		above 70	2%
Gender		Male	66%
		Female	34%
Purpose		Education	2%
		Social	2%
		Tourism	82%
		Work	14%
Origin	Within District	Ramanathapuram	26%
	Within Tamil Nadu (Outside of District)	North Eastern District	7%
		North Western District	8%
		Western District	4%
		Central Delta Region	7%
		Southern District	19%
	Outside of State	Border Sharing states	19%
		North & Middle states	10%

Source : Author Generated based on survey Data

The descriptive survey outcome currently unveils the demographic composition of participants across various parameters, including age group, gender, purpose of travel, and origin of travel. Notably, the age group of 30 to 50 years emerges as the largest segment, presently constituting 45% of the surveyed population. Gender distribution reveals that males currently make up 66% of the surveyed

population, while females account for 34%. This gender distribution suggests a prevailing presence of males within the surveyed sample, potentially influencing response variations. In terms of the purpose of travel, tourism stands out as the predominant trend, with 82% of participants presently engaging in leisure activities and exploration. This inclination towards tourism underscores a strong preference for recreational pursuits among the surveyed population. Furthermore, a comprehensive representation of travel origins among participants continues to unfold. Presently, 26% of respondents originate from the district of Ramanathapuram, reflecting ongoing local engagement. Travel from within Tamil Nadu, but outside the district, persists across various regions, with participants presently originating from the North Eastern District (7%), North Western District (8%), Western District (4%), Central Delta Region (7%), and Southern District (19%). Additionally, travel from outside the state continues to contribute to the surveyed population, with 19% originating from border-sharing states and 10% representing travel from North and Middle states. This ongoing breakdown provides valuable insights into the diverse geographical origins of participants, highlighting the multi-faceted nature of travel patterns within the surveyed population



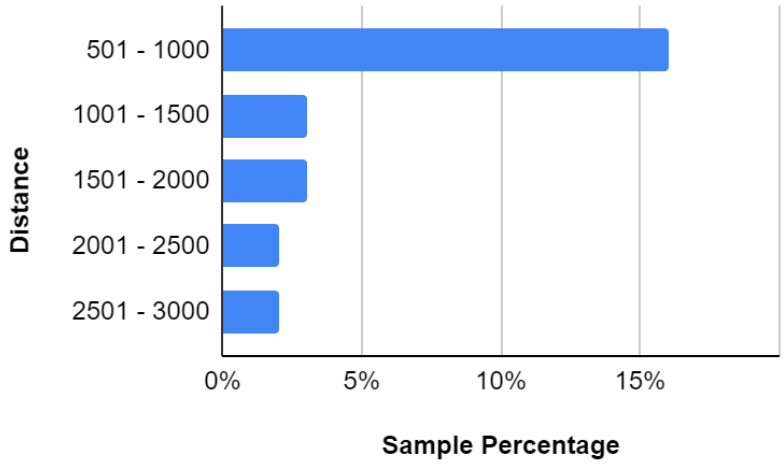


Figure 13 Travel Distance of Sample users
Source : Author Generated based on survey Data

within the sample group, 44% of respondents consist of both local residents and tourists hailing from border-sharing districts. Their travel distances fall within the range of less than 100 kilometers. Following this group, 17% of individuals are undertaking journeys spanning between 500 and 1000 kilometers. This breakdown provides insights into the varied travel distances undertaken by respondents, with a significant portion engaging in shorter trips within a localized radius, while a notable percentage embarks on longer journeys spanning several hundred kilometers.

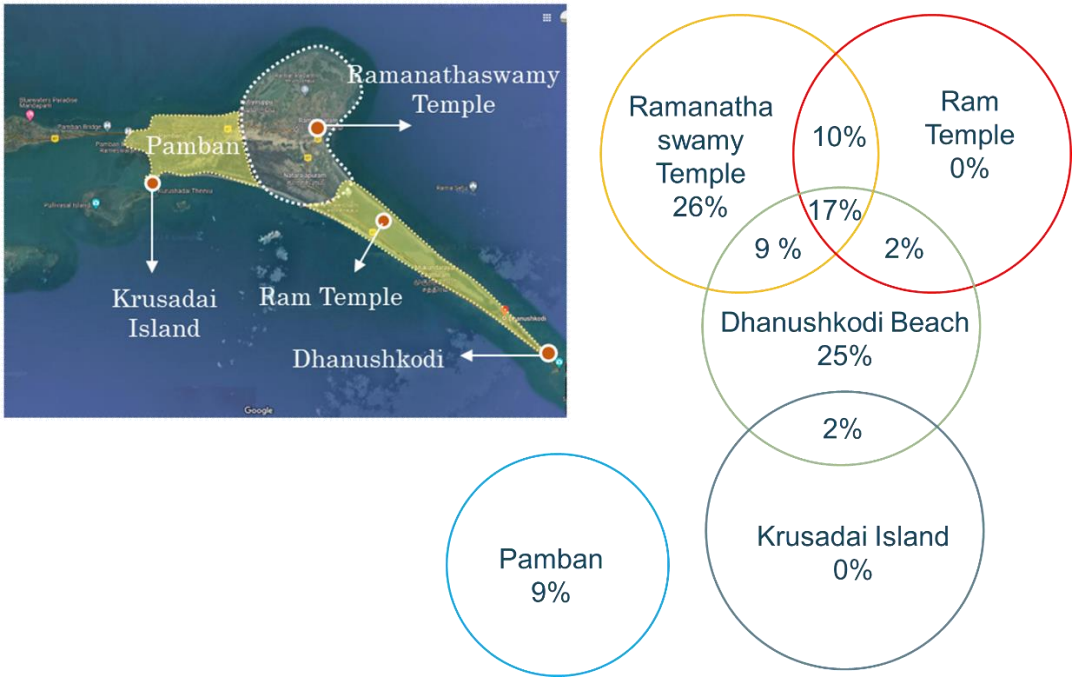


Figure 14 Major Tourist attraction Destination based on sample users Response
Source : Author Generated based on survey Data

Based on both primary survey data and secondary sources, several key tourist destinations have been identified on Pamban (Rameswaram) Island. These include the Ramanathaswamy Temple, Ram Temple, Kurusadai Island, and Dhanushkodi Beach. While these sites attract a significant number of visitors, additional insights from sample surveys reveal that people also undertake trips to Pamban for purposes beyond tourism, such as work and education. According to the sample survey, 26% of respondents exclusively visit the Ramanathaswamy Temple, while no respondents exclusively visit the Ram Temple or Kurusadai Island. However, 25% of respondents solely visit Dhanushkodi Beach, and 9% exclusively visit Pamban Village. Moreover, combinations of visits to multiple attractions are also common among respondents. For instance, 10% of people visit both the Ramanathaswamy Temple and Ram Temple, while 9% visit both the Ramanathaswamy Temple and Dhanushkodi Beach. Additionally, 2% of respondents visit both the Ram Temple and Dhanushkodi Beach, and another 2% visit both Kurusadai Island and Dhanushkodi Beach. Furthermore, a small percentage (2%) engage in trips that encompass all three major attractions—Ramanathaswamy Temple, Ram Temple, and Dhanushkodi Beach. These findings provide a detailed understanding of visitor preferences and behavior patterns, aiding in the development of targeted tourism strategies and infrastructure improvements to enhance the overall visitor experience on Pamban Island

Table 4 Modal Share of Sample users for Total Travel & Travel within Island

Mode	Major Mode of Transport	Transport within Island
Car	17%	17%
2W	39%	40%
Auto	7%	18%
Government Bus	13%	8%
Private Bus	10%	10%
Train	7%	0%
Van	7%	7%

Source: Author Generated based on survey Data

Based on the sample data, it is currently observed that up to a maximum of 39% of people utilize two-wheelers (2W) as their primary mode of transportation. This preference is notably influenced by the ongoing construction of the Pamban rail bridge, which impedes railway access to the island. Consequently, individuals who typically rely on trains for transportation are transitioning to road-based mediums for connectivity within the island. Specifically, 7% of sampled users who previously utilized trains as their primary mode of transport are now opting for auto-rickshaws and two-wheelers (2W). Similarly, a portion of the population previously reliant on government buses as their main mode of transport is also shifting towards auto-rickshaws and two-wheelers (2W) to reach their destinations within the island. Consequently, the proportion of individuals selecting trains and government buses as their major transportation mode has decreased, with 7% and 13% respectively, now falling to 0% and 8% for choosing modes to reach destinations within the island. These trends underscore the dynamic shifts in transportation preferences among the surveyed population.

CHAPTER 5: ANALYSIS

This analysis is currently underway to assess the current perception of needs and safety among visitors concerning various modes of transportation to and from Rameswaram. It aims to identify a targeting group for modal shift by analyzing the impact of specific measures aimed at improving needs and safety perceptions among users. Through ongoing data collection and evaluation, researchers are examining how socio-economic characteristics influence individuals' perceptions of transportation needs and safety. By continuously assessing these factors, the study aims to pinpoint key demographic groups that could benefit most from targeted interventions aimed at improving transportation modalities and enhancing safety perceptions. This ongoing analysis seeks to inform strategic planning and decision-making processes aimed at optimizing transportation infrastructure and services to better meet the needs and preferences of visitors to Rameswaram

5.1 Analysis Methodology

Central Tendency, Binomial Logit Regression & ANOVA (Analysis of Variance).This are the three methods use in this Research part to analyse the people perception data.

In statistical analysis, central tendency signifies a singular value serving as a representation of a dataset. It offers a concise measure indicating the central point or typical value within a distribution. The mean, median, and mode are the primary measures utilized to assess central tendency. These measures collectively aid in understanding the central or typical value of a dataset, regardless of its form, facilitating analysis across various disciplines

Binomial Logit Regression is a statistical method employed to examine the association between a binary outcome variable and one or more predictor variables. This analysis deals with categorical dependent variables having two potential outcomes, usually represented as 0 and 1. Within this framework, the model calculates coefficients for each predictor variable, elucidating both the direction and extent of their impact on the likelihood of the outcome.

ANOVA offers a statistical approach for assessing perceptions across various groups or conditions in a perception survey. It helping researchers identify

significant differences and understand the factors influencing perceptions in a perception survey

5.2 Existing Perception about Ferry Transport Medium for Island Connectivity

people are being requested to rate their preferences for various transport mediums and their perceived levels of safety. This ongoing initiative aims to gain insights into individuals' perceptions regarding their choice of transportation and their sense of safety while utilizing these mediums. By continually collecting and analysing this data, researchers seek to understand any evolving trends or shifts in preferences and safety perceptions among the surveyed population.

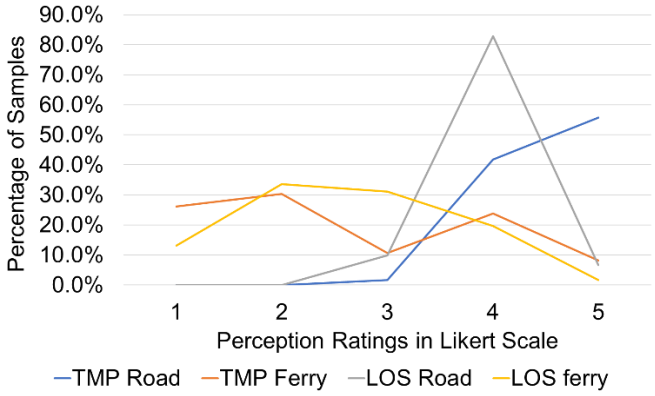


Figure 15 Comparison chart of Transport Medium preference & Level of safety for Road & Waterway medium based on Existing perception
Source : Author Generated based on survey Data

Table 5 Mean Value of TMP & Level of Safety perception

	Mean
TMP Road	4.5
TMP Ferry	2.5
SP Road	3.9
SP Ferry	2.6

Source : Author Generated based on survey Data

On the graph, the X-axis denotes people's ratings on a 5-point Likert scale, while the Y-axis represents the percentage of sample users assigning ratings to each Likert scale value. Notably, a substantial correlation is observed between the perceived level of safety and transport medium preference among respondents. However, there exists a noticeable gap between the perceived level of safety and

the preference for road transport. Despite not feeling highly safe, a significant proportion of respondents still prioritize roadways as their preferred mode of transportation. This indicates that factors beyond safety considerations influence people's choices when selecting a transportation medium. The data suggests that despite safety concerns, individuals are drawn to road transport due to other factors that contribute to its attractiveness as a primary mode of transportation

5.3 Perception Analysis: Road Bridge to Ferry Shift Based on Needs

Central Tendency, Binomial Logit Regression, and ANOVA (Analysis of Variance) are currently being employed to analyze people's perceptions regarding the need for a shift in transportation medium from road to ferry. These analytical methods are ongoing processes aimed at gaining insights into the collective opinions and preferences of individuals regarding transportation options. Central Tendency helps identify the typical or average perception among respondents, Binomial Logit Regression is utilized to model the probability of respondents favouring a shift to ferry transportation based on various factors, and ANOVA assesses the variance in perceptions across different demographic or categorical groups. Through continuous analysis, researchers seek to understand the underlying factors influencing people's attitudes towards transitioning from road-based transport to ferry services, thus informing decision-making processes regarding transportation infrastructure and service provision

5.3.1 Central Tendency

Table 6 Ranking of people Need parameters based on users Response(Ferry)

Needs	Mean	Rank
Improvement of safety perception	3.5	1
Less Travel Time	2.5	4
* Fixed Cost - Toll amount for Road bridge	1.7	6
Glass boats for Eco Tourism	3.2	3
Aged & Disability people provision	2.6	5
Multilocation connectivity	3.9	1
Public Transport connection & Parking Facility	3.9	2
* Goods Movement provisions	1.1	7

Source: Author Generated based on survey Data

Utilizing ranks to assess influential parameters, the mean values within the dataset are closely clustered, prompting the adoption of a rank-based evaluation approach. Each 0.5 increase in the mean value equates to a score of 1, while median and mode values are regarded as exact scores. Through the summation of all values, ranks are allocated in descending order of scores. Current analysis reveals that the highest number of respondents prioritize Multilocation Connectivity, Public Transport connection & parking Facility, and Glass Boat Facility for Ecotourism as crucial needs for shifting from road to waterway (ferry) transportation. Conversely, Fixed Minimum Cost and provision of facilities for Goods Movement receive notably lower ratings, scoring less than half of the total. This suggests that within the overall sample, these two needs for medium shift are receiving relatively less importance

5.3.2 Binomial Logit Regression

Utilizing Binomial Logit Regression, the probability of individuals choosing an alternative medium of transportation based on the provision of their needs is assessed. The Omnibus Tests of Model Coefficients indicate a significant relationship, with a Chi-square value of 165.8634 and a significance level of 0.000. The Cox & Snell's R-Squared value of 0.746 suggests that approximately 74.6% of the variance in the utilization of ferry services can be explained by the predictor variables included in the model.

Table 7 Binary Logit model Coefficients for ferry medium shift needs Parameters

Parameters	Coefficients
Safety Perception measures	56.978
Travel Time	9.328
Travel cost	0.594
Glass Boats	0.553
Aged and Disability provision	13.595
Multilocation Connection	15.715
Public Transport and Parking	66.133
Goods Movement	43.789
Constant	-680.096

Source: Author Generated based on SPSS Output

The formula for estimating the probability of utilizing ferry services is derived from the coefficients obtained from the regression analysis. It is calculated as follows:

Utilization of ferry=−680+56.97(Safety Perception measures)+9.328(Travel Time) +0.59(Travel cost)+0.55(Glass Boats)+13.59(Aged and Disability provision)+15.7 1(Multilocation Connection)+66.13(Public Transport and Parking)+43.78(Goods Movement)

The probability of utilization of ferry services is then calculated using the logistic function:

$$\text{Probability of Utilization of ferry} = \frac{e^{\text{Utilization of ferry}}}{1+e^{\text{Utilization of ferry}}}$$

Assuming a threshold of 50%, where probabilities above 0.5 indicate a readiness to shift to ferry services and probabilities below 0.5 indicate a reluctance to do so, the model predicts that approximately 43% of sampled road users are likely to shift to ferry services. This prediction is based on the estimated coefficients for various factors such as safety perception measures, travel time, travel cost, provision of amenities like glass boats, facilities for aged and disabled individuals, multilocation connectivity, public transport and parking, and goods movement. These findings offer valuable insights into the determinants influencing individuals' choices regarding transportation modes, aiding in the development of effective policies and infrastructure planning initiatives to enhance ferry utilization and address transportation needs effectively.

5.3.3 ANOVA

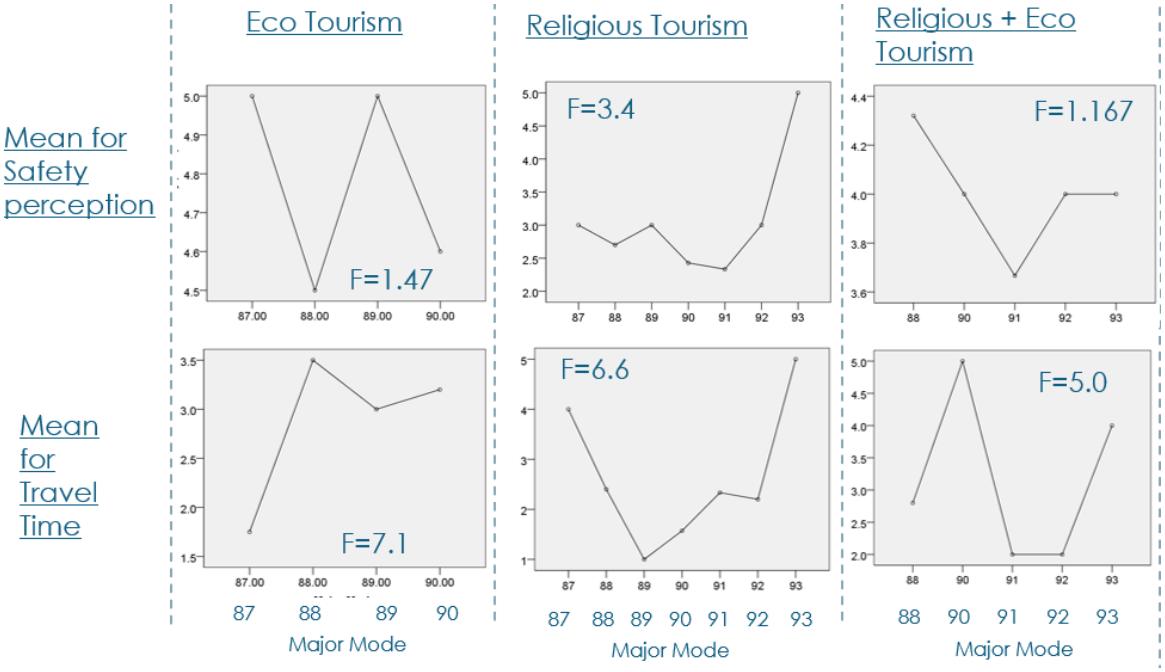
ANOVA, or Analysis of Variance, is a statistical technique used to analyze the differences in means among three or more groups. It assesses whether the means of different groups are significantly different from each other, based on the variation observed within and between groups.

In the context of finding the target group for modal shift from road to ferry transportation, ANOVA can be utilized to examine how various socio-economic characteristics, specifically the type of tourism and major mode of transport,

influence individuals' preferences and perceptions regarding the importance of different provisions (needs) for choosing to shift from road to ferry.

By conducting ANOVA analysis, researchers can compare the mean ratings of different provisions among individuals who use various major modes of transport and are involved in different types of tourism. For example, they can assess how individuals who primarily use private cars for transportation rate the importance of safety perception improvement measures compared to those who rely on public transport or two-wheelers. Similarly, they can compare the mean ratings of provisions such as travel time, travel cost, availability of amenities like glass boats, facilities for aged and disabled individuals, multilocation connectivity, public transport and parking, and goods movement across different groups of travelers based on their major mode of transport and type of tourism.

By examining the differences in mean ratings across various groups, ANOVA allows researchers to identify which socio-economic characteristics are associated with differing perceptions and preferences regarding the provisions considered important for modal shift from road to ferry transportation. This information can help policymakers and transportation planners target specific demographic groups or design tailored interventions to promote modal shift and enhance ferry utilization effectively.



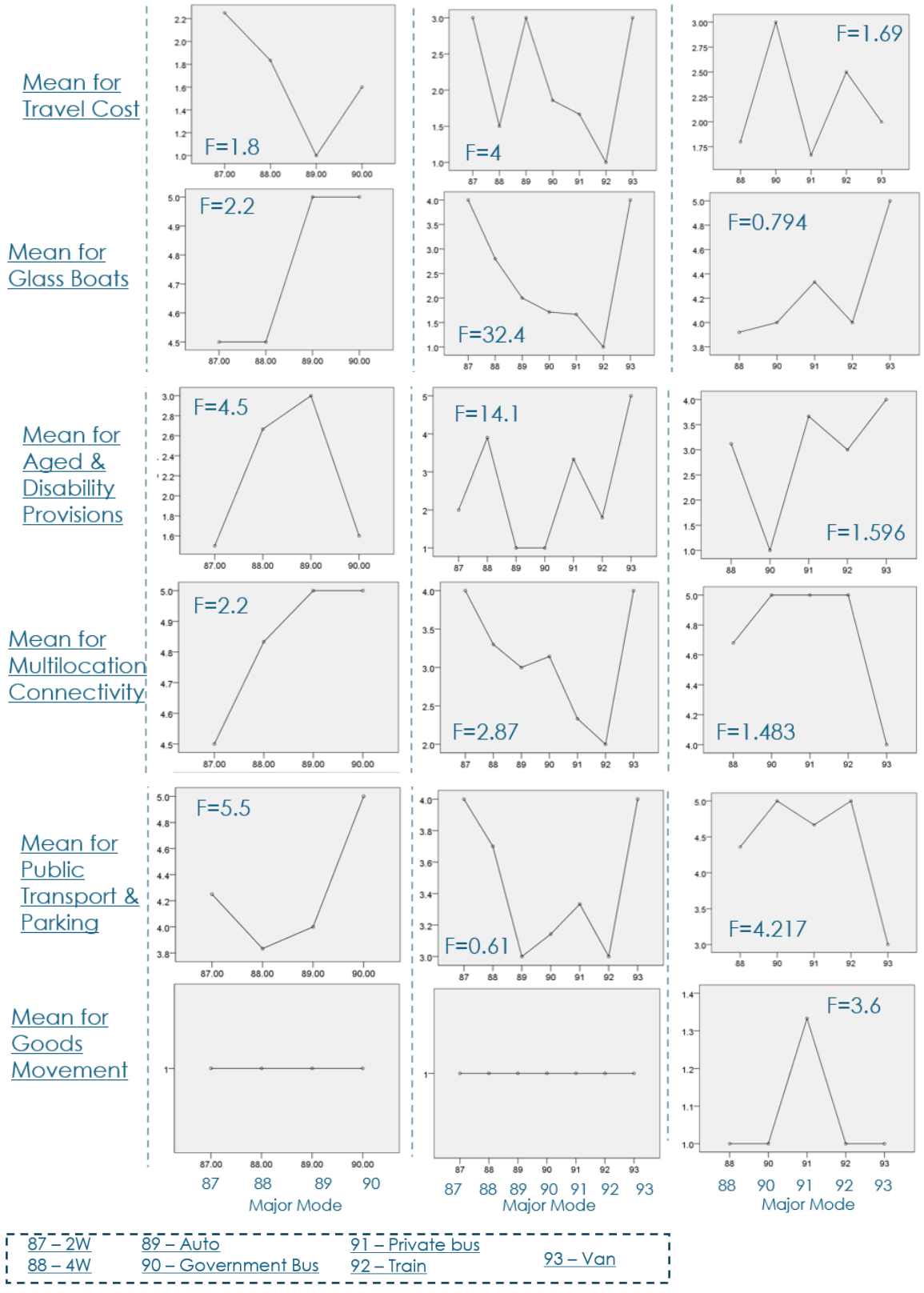


Figure 16 ANOVA for Different needs on ferry medium shift
Source: Author Generated based on SPSS Output

In ANOVA analysis, the F-statistic serves as a powerful tool for examining the presence of meaningful distinctions between groups, providing valuable insights

into the impact of various needs provision on medium shift from road to ferry across different types of tourism. The major mode of transport is categorized into 2Wheeler, 4Wheeler, Auto, Government bus, Private bus, Train, and Van. By comparing the mean values of people's responses, the analysis assesses the variance between these groups.

For the impact of safety perception improvement measures, the mean values for Eco tourism exhibit high levels across multiple modes of transport such as 2Wheeler, 4-Wheeler, Government bus and Auto, with an F-value of 1.47. In Religious Tourism, Vans demonstrate the highest mean value, yielding an F-value of 3.4, indicating substantial variance. Conversely, for Religious + Eco tourism, the highest mean value is observed for 4Wheeler, with an F-value of 1.167.

Similarly, the impact of optimal less travel time reveals that for Religious Tourism, Vans show the highest mean value, with an F-value of 6.6. In Religious + Eco tourism, Government Bus emerges with the highest mean value, exhibiting an F-value of 5.0.

Furthermore, for the provision of glass boat facilities, Religious Tourism displays the highest mean value across multiple modes of transport such as 2 wheeler, 4 Wheeler, Auto & Government Bus , resulting in an F-value of 2.2. Conversely, in Religious + Eco tourism, Private Bus and Van exhibit the highest mean value, with an F-value of 0.794.

The impact of aged and disability provision highlights Vans as the mode with the highest mean value for Religious Tourism, indicating significant variance with an F-value of 14.1.

Moreover, for multilocation connectivity, Eco Tourism portrays high mean values across various modes of transport 2-wheeler, 4-Wheeler, Auto & Government Bus, with an F-value of 2.2. In Religious + Eco tourism, 4 Wheeler, Government Bus, Private Bus, Train, and Van demonstrate the highest mean value, reflecting an F-value of 1.483.

Lastly, for public transport facility and parking provision near the boarding point, Eco Tourism exhibits high mean values for 2-Wheeler and Government Bus, with an F-value of 5.5. In Religious + Eco tourism, 4 Wheeler, Government Bus, Private Bus, and Train display the highest mean value, indicating notable variance with an F-value of 4.217.

5.4 Perception Analysis for using Ferry Based on safety Perception Improvement measures

5.4.1 Central Tendency

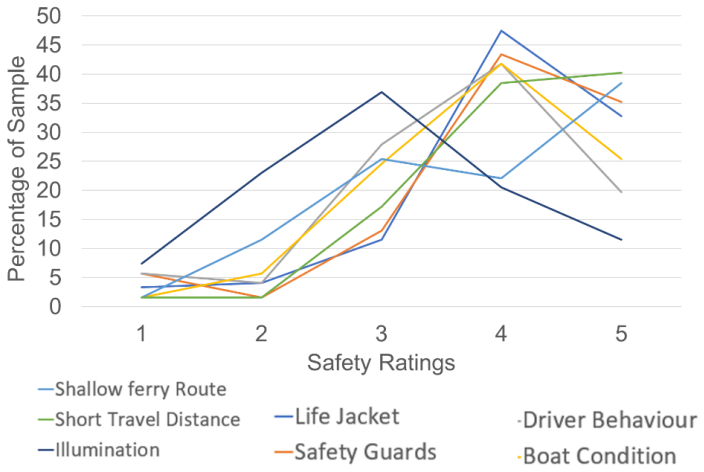


Figure 17 Users Response for Each safety parameters in Likert Scale
Source: Author Generated based on survey Data

Table 8 Ranking of safety perception parameters based on users Response

Safety Perception Parameters	Mean	Rank
Life Jacket & Fire extinguisher	4.0	2
Safety Guards & Rescue boats	4.0	2
Driver behavior – Safest speed	3.7	3
Boat condition – Weather protection	3.8	3
Shallow Ferry Route	3.9	2
Short Travel distance (<30 Min)	4.1	1
Illumination	3.1	4

Source: Author Generated based on survey Data

Based on the current analysis method, it is observed that the maximum number of people rate short travel distance with a score of 5 for feeling safe during ferry travel. Consequently, short travel distance emerges as the most influential factor for feeling safe during ferry travel. Following shallow ferry routes also holds significance, alongside the presence of safety equipment and effective rescue measures, all contributing significantly to passengers' sense of safety during ferry journeys.

5.4.2 Binomial Logit Regression

Table 9 Binary Logit model Coefficients for safety measures Parameters

Parameters	Coefficients
Life Jacket	19.946
Safety Guards	10.34
Driver Behaviour (Speed)	0.121
Boat condition (Weather)	0.513
Shallow Route	3.745
Short Distance Travel	24.612
Illumination	0.477
Constant	-210.845

Source: Author Generated based on SPSS Output

Using a binomial logit regression model, the probability of safety perception (PSP) on a ferry can be determined based on various safety measures. The model's omnibus tests indicate a significant relationship between the safety measures and safety perception, as evidenced by the Chi-square value of 150.634 ($p < 0.001$). Additionally, Cox & Snell's R-Squared value of 0.712 suggests that approximately 71.2% of the variability in safety perception can be explained by the included safety measures. The parameters and coefficients derived from the model indicate the influence of each safety measure on safety perception, with life jacket availability, safety guards, shallow route, and short distance travel showing notable positive coefficients, while driver behavior in speed, boat condition in weather, and illumination exhibit relatively smaller coefficients. To calculate the probability of feeling safe on a ferry (PSP_ferry), the formula utilizes the coefficients obtained from the regression model.

SPferry = -210.845 + 19.946(Life Jacket)+10.34 (Safety Guards) + 0 .121(Driver Behavior)+ 0 .513 (Boat Condition)+ 3.745(Shallow Route)+24.612(Short Distance Travel)+ 0.477(Illumination)

$$PSP = \frac{e^{SPferry}}{1+e^{SPferry}}$$

Where, PSP means probability of feeling safety in ferry

Considering a threshold of 50%, where a PSP_ferry greater than 0.5 indicates feeling safe to choose the ferry and a PSP_ferry less than 0.5 suggests not feeling

safe, the formula yields that 54.5% of the sampled road users are predicted to feel safe in choosing the ferry. This implies that a majority of the sampled individuals perceive ferry travel as a safe mode of transportation, influenced by factors such as the availability of safety equipment, route characteristics, and distance travelled.

5.5 Existing Perception about Railway Transport Medium for Island Connectivity

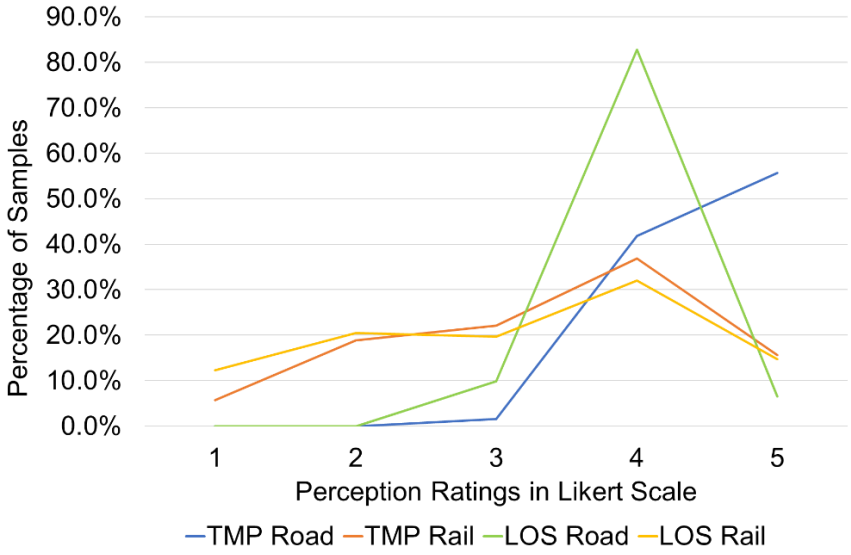


Figure 18 Comparison chart of Transport Medium preference & Level of safety for Road & Railway medium based on Existing perception
Source: Author Generated based on survey Data

Table 10 Mean Value of TMP & Level of Safety perception for Road & Railway

	Mean
TMP Road	4.5
TMP Railway	3.3
SP Road	3.9
SP Railway	3.2

Source : Author Generated based on survey Data

The graph illustrates respondents' ratings on a 5-point Likert scale (X-axis) and the percentage of sample users assigning ratings to each Likert scale value (Y-axis). Notably, a strong correlation emerges between perceived safety levels and transport medium preferences. However, a gap is evident between perceived safety and the preference for road transport. Despite safety concerns, a considerable proportion of respondents still favor roadways as their primary mode

of transportation, indicating that factors beyond safety influence their choices. This suggests that road transport's attractiveness as a primary mode is not solely determined by safety considerations. Conversely, there is a significant correlation between transport medium preference and perceived safety levels of railways

5.6 Perception Analysis: Road Bridge to Railway Shift Based on Needs

5.6.1 Central Tendency

Table 11 Ranking of people Need parameters based on users Response(Railway)

Users Need	Mean	Rank
Safety Perception	3.2	1
Frequency of Local Train	3.4	1
Travel cost	2.9	2
Travel Time	2.8	3
Goods Movement	1.2	4

Source: Author Generated based on survey Data

The latest analysis indicates that the majority of respondents place a high priority on enhancing safety perception in railway transportation and ensuring the availability of local trains at regular intervals as essential requirements for transitioning from road to railway travel. Conversely, the provision of facilities for goods movement is rated considerably lower, receiving less than half of the total score. This implies that, across the entire sample, the importance of this aspect for shifting mediums is relatively diminished.

5.6.2 Binomial Logit Regression

Utilizing Binomial Logit Regression, the probability of individuals choosing an alternative medium of transportation based on the provision of their needs is assessed. The Omnibus Tests of Model Coefficients indicate a significant relationship, with a Chi-square value of 125.6 and a significance level of 0.000. The Cox & Snell's R-Squared value of 0.646 suggests that approximately 64.6% of the variance in the utilization of Railway services can be explained by the predictor variables included in the model.

Table 12 Binary Logit model Coefficients for Railway medium shift needs Parameters

Variables in the Equation	Coefficients
Safety Perception	0.421
Frequency of Local Train	4.833
Travel cost	1.879
Travel Time	2.245
Goods Movement	0.936
Constant	-39.708

Source: Author Generated based on SPSS Output

The formula for estimating the probability of utilizing Railway services is derived from the coefficients obtained from the regression analysis. It is calculated as follows:

Utilization of Railway = −39.7+0.421(Safety perception)+ 4.833 (Frequency of Local Train)+ 1.879(Travel cost)+2.245(Travel Time)+ 0.936(Goods Movement)

The probability of utilization of Rail services is then calculated using the logistic function:

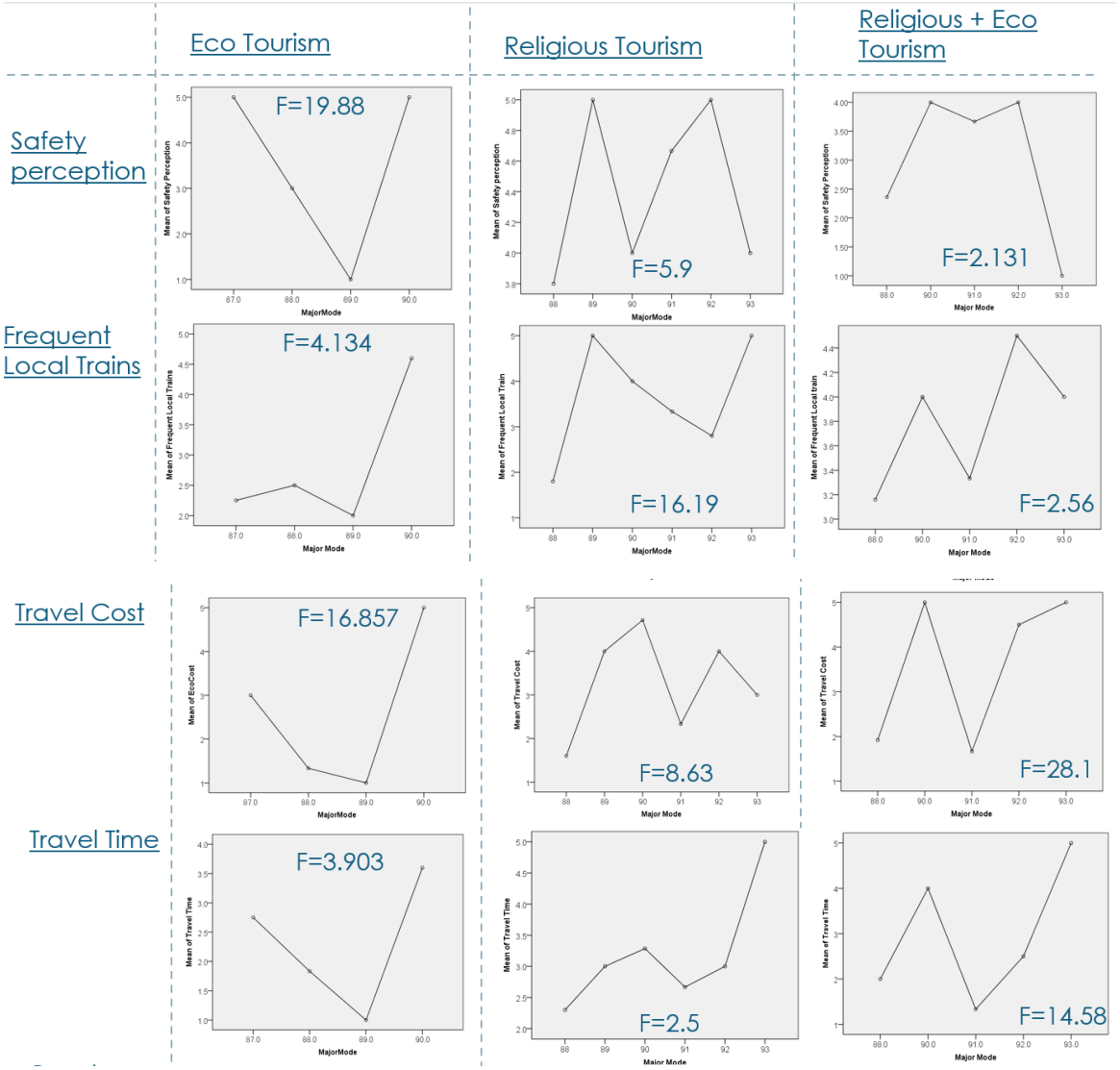
$$\text{Probability of Utilization Rail} = \frac{e^{U_{\text{Rail}}}}{1+e^{U_{\text{Rail}}}}$$

With a threshold set at 50%, where probabilities exceeding 0.5 signal a willingness to transition to Railway services and probabilities falling below 0.5 denote hesitancy to do so, the model projects that around 32% of the surveyed road users are inclined towards adopting Railway services. This forecast derives from the model's coefficients, encompassing factors like safety perception measures, the regular availability of local trains, travel time, travel cost, and goods movement. These insights shed light on the factors guiding individuals' transportation mode preferences, thereby guiding the formulation of policies and infrastructure development strategies to bolster Railway utilization and meet transportation demands more effectively.

5.6.3 ANOVA

In identifying the target group for modal shift from road to railway connectivity, ANOVA offers a valuable analytical approach to exploring how diverse socio-economic characteristics, particularly focusing on the type of tourism and major

mode of transport, influence individuals' preferences and perceptions concerning the significance of different provisions (needs) in selecting railway transportation over road alternatives. By employing ANOVA analysis, researchers can compare the mean ratings of various provisions among individuals utilizing different major modes of transport and participating in various types of tourism. For instance, they can investigate how individuals primarily using private cars for transportation perceive the importance of safety perception improvement measures compared to those reliant on public transport or two-wheelers. Similarly, researchers can assess the mean ratings of provisions such as the availability of local trains, travel time, travel cost, and facilities for goods movement across distinct groups of travellers based on their predominant mode of transport and type of tourism engagement.



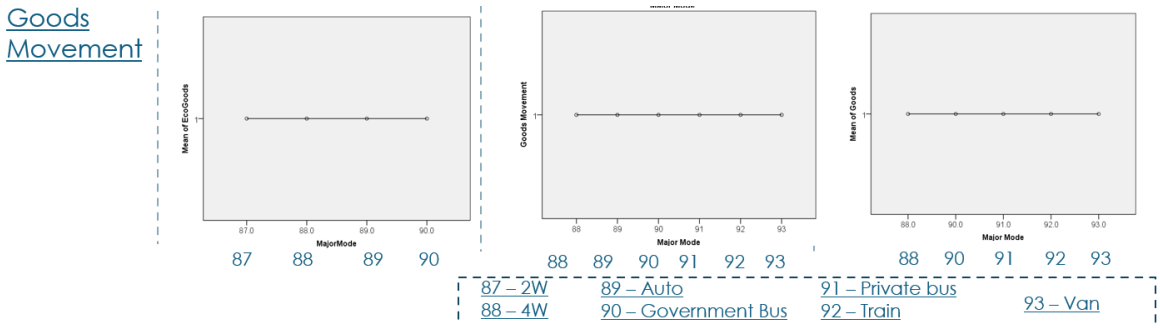


Figure 19 ANOVA for Different needs on Railway medium shift
Source: Author Generated based on SPSS Output

The analysis of the impact of safety perception improvement measures on various modes of transport reveals significant variations across different types of tourism. In Eco tourism, high mean values are observed for modes such as 2Wheeler and Van, indicating substantial variance with an F-value of 19.88. Conversely, in Religious Tourism, Auto, Private bus, and Train demonstrate the highest mean values, suggesting notable differences among these modes, with an F-value of 5.9. When considering the impact of Local Train provisions, Government Bus stands out with high mean values for Eco tourism, exhibiting considerable variance with an F-value of 8.63. In Religious Tourism, Auto and Van display the highest mean values, indicating substantial variance with an F-value of 5.9. Meanwhile, in Religious + Eco tourism, Train emerges with the highest mean value, demonstrating noteworthy differences with an F-value of 2.56.

Similarly, the analysis of optimal travel cost reveals significant findings. In Eco Tourism, Government Bus exhibits the highest mean value, showing considerable variance with an F-value of 16.857. Likewise, in Religious Tourism, Government Bus stands out with the highest mean value, demonstrating notable differences with an F-value of 8.63. Additionally, in Religious + Eco tourism, Government Bus, Train, and Van emerge with the highest mean value, indicating substantial variance with an F-value of 28.1.

Lastly, examining the impact of optimal travel time, Vans exhibit the highest mean value for Religious Tourism, suggesting significant differences with an F-value of 2.5. Similarly, in Religious + Eco tourism, Vans display the highest mean value, demonstrating noteworthy differences with an F-value of 14.58. These ongoing analyses provide valuable insights into the dynamics of transportation preferences within different tourism contexts.

5.7 Perception Analysis for using Railway Based on safety Perception Improvement measures

5.7.1 Central Tendency

Table 13 Ranking of safety perception parameters(Railways) based on users Response

Safety Perception Parameters	Mean	Rank
Speed in Bridge	4.1	1
Rescue Teams	3.2	3
Bridge Maintenance	4.2	1
Weather Sensitive Technology	3.3	2
Local Train Insurance	2.1	4

Source: Author Generated based on survey Data

According to the current analysis method, it is being observed that the maximum number of people are rating the operation of trains in slow speed over bridges and regular maintenance of bridges as the most influential factors for feeling safe during railway travel. They are considering these factors as crucial elements in ensuring their safety. Furthermore, the integration of weather-sensitive technology and the appointment of rescue teams are also being seen as significant contributors, both actively contributing to passengers' sense of safety during ferry journeys. The availability of local train insurance is not contributing significantly to people's feeling of safety when choosing railway mediums.

5.7.2 Binomial Logit Regression

Table 14 Binary Logit model Coefficients for safety measures Parameters (Railway)

Variables in the Equation	
	Co efficients
Speed in Bridge	2.208
Rescue Teams	0.663
Bridge Maintenance	2.693
Weather Sensitive Technology	0.816
Local Train Insurance	0.371
Constant	-25.708

Source: Author Generated based on SPSS Output

Using a binomial logit regression model, the probability of safety perception (PSP) on a Railway can be determined based on various safety measures. The model's

omnibus tests indicate a significant relationship between the safety measures and safety perception, as evidenced by the Chi-square value of 79 ($p < 0.001$). Additionally, Cox & Snell's R-Squared value of 0.48 suggests that approximately 48% of the variability in safety perception can be explained by the included safety measures. The parameters and coefficients derived from the model indicate the influence of each safety measure on safety perception, operating Train in slow speed Speed over Bridge, Facilities for immediate availability of Rescue Teams, Regular Maintenace of Bridge , Integration of weather sensitive Technology & make sure Information available to the passengers and operators, providing insurance for local passengers .

To calculate the probability of feeling safe on a Railway (PSP Rail), the formula utilizes the coefficients obtained from the regression model.

Safety Perception of Rail = -24.678 + 2.2 (Speed in Bridge)+0.613 (Rescue Teams) +2.627(Bridge Maintenance) + 0.887 (Weather Sensitive technology)+ 0.003 (Insurance)

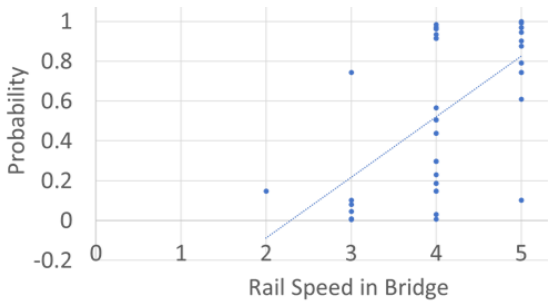
$$PSPRail = \frac{e^{SPRail}}{1+e^{SPRail}}$$

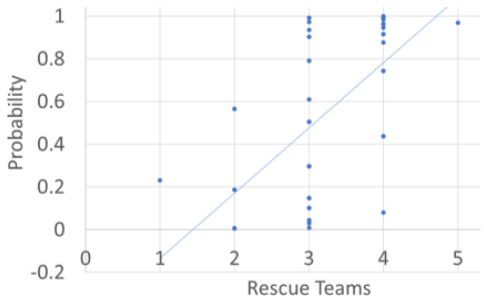
Where,

PSPRail represents the Probability of Safety Perception for Rail,

SPRail represents the Safety Perception for Rail.

Considering a threshold of 50%, where a PSP_Rail greater than 0.5 indicates feeling safe to choose the Railway and a PSP_ferry less than 0.5 suggests not feeling safe, the formula yields that 56% of the sampled road users are predicted to feel safe in choosing the ferry.





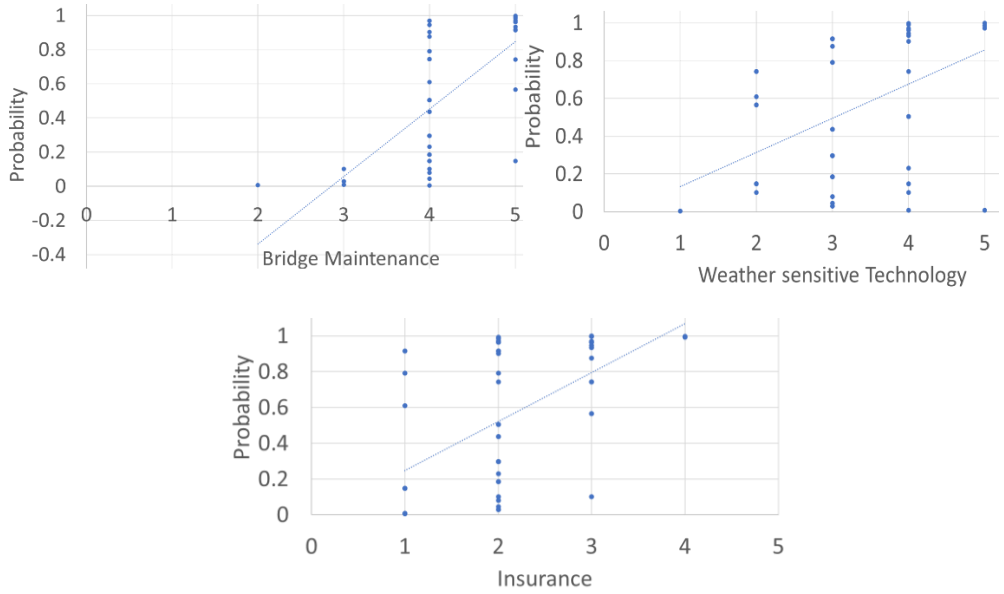


Figure 20 Relationship Between Rating of safety perception parameters & probability of feeling safe in Railway
Source: Author Generated based on survey Data

The chart depicts a compelling relationship between users' ratings of safety perception parameters and the probability of feeling safe while utilizing railways as a mode of transportation. Notably, individuals who rate various safety parameters highly demonstrate a strong correlation with feeling safe, particularly concerning two significant factors: rail speed on bridges and the maintenance of bridges. It is evident that there exists a substantial proportion of sampled individuals who perceive railway travel as a safe option, a sentiment largely influenced by the operation of trains at slower speeds over bridges and the regular maintenance of these critical infrastructures.

CHAPTER 6: CONCLUSIONS, RECOMMENDATIONS AND PROPOSALS

Traffic congestion in Connectivity is being created by the inefficient use of transport modes. The occupancy of vehicles on roads is being calculated using PCU. If the PCU needed for the movement of a person is higher in a particular mode, it means that mode is creating traffic congestion due to high occupancy of the road and inefficiencies in passenger movement. For instance, during peak days, from 5:00 AM to 10:00 PM, the inflow of people through two-wheelers is currently standing at 3170. The number of PCUs needed is 2089. This indicates that for the transport of one person through a two-wheeler, 0.6 PCU is required. When we calculate other modes in the same manner, we find that the PCU per person is higher in two-wheelers, auto-rickshaws, and four-wheelers compared to buses and vans. Therefore, special attention is currently being given to those modes to facilitate shifting and alleviate congestion

6.1 Recommendations for Road to Ferry medium shift based on people perceptions

Table 15Classification of People needs for Transport medium shift from Road to ferry according to Mode & Type of Tourism

Mode/ Tourism type	Eco Tourism	Religious Tourism	Religious + Eco Tourism
2 wheeler	Safety Perception Multilocation Connectivity Public Transport & parking	Glass boat Facilities	
4 Wheeler	Safety Perception Multilocation Connectivity	Glass boat Facilities	Safety Perception Multilocation Connectivity Public Transport & parking
Auto	Safety Perception Multilocation Connectivity	Glass boat Facilities	

Source: Author Generated

This chart is illustrating the priority needs of individuals considering ferry usage as an alternative to road transport. It elucidates that tourists opting for eco-tourism, using various modes like two-wheelers, four-wheelers, and autos, are willing to transition to ferries given certain conditions. These conditions include enhancing safety perception measures, establishing multi-location connectivity, ensuring

public transport linkage, and providing parking facilities near boarding jetties. Moreover, four-wheeler users, engaging in diverse forms of tourism, are also inclined towards ferry adoption, driven by similar needs along with the desire for glass-bottom boat facilities.

Central tendency and binomial logit regression analysis indicate that enhancing safety perception can be achieved through the provision of safety equipment such as life jackets and fire extinguishers on boats, the deployment of safety guards and boats, planning ferry routes in shallow oceanic areas, and limiting travel distances to a maximum of 30 minutes continuously. By integrating these identified needs and safety perception improvement measures, the successful implementation of ferry transport services becomes feasible, attracting specific groups of individuals away from roadway connectivity.

6.2 Recommendations for Road to Railway medium shift based on people perceptions

Improving safety perceptions in the railway medium is currently exerting a significant influence on users of two-wheelers and autos, particularly those engaging in religious and eco-tourism activities. Meanwhile, bus and van users are displaying a notable inclination towards transitioning to railway transportation, contingent upon the availability of local train services. Through ongoing central tendency and binomial logit regression analyses, it is continuously being demonstrated that augmenting safety perceptions is achievable primarily by implementing strategies such as operating trains at reduced speeds over bridges and ensuring regular maintenance of these crucial infrastructures.

6.3 Conclusion

The analysis continues to reveal that the expansion of railway connectivity alone may not be sufficient to significantly alter travel behaviours or preferences. This underscores the importance of diversifying transportation options and catering to the diverse needs and preferences of travellers. In contrast, the introduction or improvement of ferry services emerges as a potent strategy for attracting individuals towards alternative modes of travel. The allure of ferry services extends

beyond mere transportation, often incorporating elements of leisure, scenic travel, and tourism experiences, which resonate strongly with travellers.

ongoing efforts to develop ferry services must be accompanied by a thorough understanding of people's perceptions and preferences. By continuously analysing and incorporating feedback from stakeholders and potential users, projects can be tailored to meet the evolving needs of communities and travellers. This iterative approach ensures that ferry services are not only developed but also optimized for success, maximizing their potential to transform transportation landscapes and enhance overall mobility and tourism experiences.

ANNEXURE 1: SURVEY FORMATS

Perception Analysis

SOCIO ECONOMIC CHARACTERISTICS

1. Name

2. Age

Mark only one oval.

- ◯ 10 - 18
- ◯ 18 - 30
- ◯ 30 - 50
- ◯ 50 - 70
- ◯ Above 70

3. Gender

Mark only one oval.

- ◯ Male
- ◯ Female

4. Travel Origin

5. Travel Destination

6. Travel Distance

7. Total Travel Cost

8. Travel cost within Island

9. Purpose of Travel

Mark only one oval.

- ◯ Tourism
- ◯ Education
- ◯ Work
- ◯ Social

10. Tourism Type

Check all that apply.

- ☐ Religious
- ☐ Eco Tourism

11. Travel Partners

Mark only one oval.

- ◯ Single
- ◯ Family
- ◯ Friends

12. Average Number of people

13. Major Mode of Transport

Mark only one oval.

- ◯ Walk
- ◯ 2W
- ◯ 4W
- ◯ Van
- ◯ Auto
- ◯ Private Bus
- ◯ Government Bus
- ◯ Train
- ◯ Boat

14. Mode of Transport within Island

Mark only one oval.

- Walk
- 2W
- 4W
- Van
- Auto
- Private Bus
- Government Bus
- Train
- Boat

15. Frequency of using Road bridge

Mark only one oval.

- Daily
- Weekly
- Monthly
- Yearly

16. Frequency - How many Times

17. Frequency of using Rail bridge

Mark only one oval.

- Daily
- Weekly
- Monthly
- Yearly

18. Frequency - How many Times

19. Monthly Income

Mark only one oval.

- Less than 10,000
- 10,000 - 25,000
- 25,000 - 50,000
- 50,000 - 75,000
- 75,000 - 1 Lakh
- More than 1 Lakh

GENERAL PERCEPTION

20. Transport medium preference - Road

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

21. Transport medium preference - Rail

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

22. Transport medium preference - Ferry

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

23. Level of Safety - Road

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Safe

24. Level of Safety - Rail

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Safe

25. Level of Safety - Ferry

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Safe

SAFETY MEASURES

Road to Ferry

26. How likely people are feel safety in the ferry if Life Jackets are provided

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

27. How likely people are feel safety in the ferry if Safety Guards are appointed

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

28. How likely people are feel safety in the ferry if Drivers follow the rules & drive at the safest speed

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

29. How likely people are feel safety in the ferry if Boats are in good condition & protect passengers from all weather

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

30. How likely people are feel safety in the ferry if Ferry routes are planned in shallow areas of the ocean

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

31. How likely people are feel safety in the ferry if Shortest Travel distance (approx. less than 2.5 km)

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

32. How likely people are feel safety in the ferry if Light Illumination is provided on Ferry Route at night time

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

33. How likely people are ready to shift to ferry if all the above safety measures are provided

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

34. What is your expectation to Improve the perception of safety to shift to Ferry

Road to Rail

35. How likely people are feel safety in the Rail if Loco pilot drives the train at the lowest speed above the sea bridge

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

36. How likely people are feel safety in the Rail if Rescue Teams are appointed

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

37. How likely people are feel safety in the Rail if the bridge has undergone Regular Maintenance

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

38. How likely people are feel safety in the Rail if Weather-sensitive Technology Integration

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

39. How likely people are feel safety in the Rail if Insurance applicable to local passengers

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme safe

40. How likely people are ready to shift to Rail if all the above safety measures are provided

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

41. What is your expectation to Improve the perception of safety to shift to Rail

Strategy for Medium shifting

Road to Ferry

42. Road bridge Travel time for 2km is more than 15 minutes but Ferry Travel is less than 15 minutes

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

43. If the road bridge collects Toll amounts for tourist vehicles (Rs.50/hr – 2w, Rs.100/hr – 4w, Rs.200/hr – Bus) In seasonal times but ferry services are available with fixed optimum amounts for passengers.

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

44. The road bridge imposes a fine for parking vehicles in the Bridge for Scenic View but Glass boat facilities are available to explore eco-tourism

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

45. Boarding Jetty is provided with Aged & Disability people Provisions

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

46. Ferry from Mainland connect with Multilocation in Island

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

47. Boarding Jetty are provided with better Public Transport connection & Parking Facility

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

48. Ferry has the Facilities for Goods movement with Optimum Rate.

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

49. What is your expectation to shift to Ferry

Road to Railway

50. Local Trains services are provided with a Frequency of every 1 Hour

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

51. Travel costs for local Trains are less than half the amount of Road mode

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

52. Travel Time for local Trains is less than travel time for Road Modes

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

53. Rail has the Facilities for Goods movement with an Optimum Rate

Mark only one oval.

	1	2	3	4	5	
Extr	◯	◯	◯	◯	◯	Extreme Likely

54. What is your expectation to shift to Railway

ANNEXURE 2: SHEETS

List of Sheets

Sheet 1: Introduction

Sheet 2: Thesis Framework

Sheet 3: Literature Study

Sheet 4: Site Selection & Site survey

Sheet 5: Descriptive Sample overview

Sheet 6: Quantitative Analysis of Pamban Bridge

Sheet 7: Qualitative analysis methodology

Sheet 8: Qualitative Analysis – Road to Ferry Safety perception

Sheet 9: Qualitative Analysis –Road to Ferry shift Needs

Sheet 10: Qualitative Analysis – Road to Railway Safety perception

Sheet 11: Qualitative Analysis –Road to Railway shift Needs

Sheet 12: Way forward, Outcome & Proposals

Background

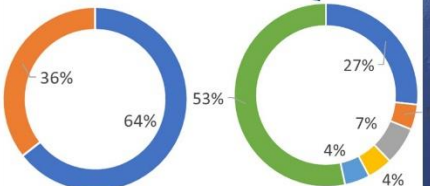
Need for Enhancement of Tourist Island Connectivity

Total islands in India = 1382

Major Tourist Islands - 45

9 Inland water

36 Ocean

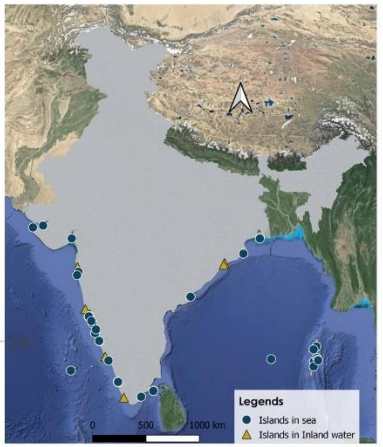


Graph : Distance between Islands & Mainland

< 2.5Km >2.5km

Transport service between Islands & Mainland

Ferry, Ferry,Road, Ferry,Road,Railway, Road, Road,Railway, No Regular Transport



Map : Major Tourist Attraction Islands in India

Scope

Government Initiation for Promoting Tourism & Improvement of Transport Connections

Water Connections : Atal Setu , Kochi water Metro, India - Sri Lanka Ferry service, Sudarshan Setu , New Pamban Bridge

2014 2019

Ministry of Tourism
76 Projects
Rs. 5292 Crore Investment

2023 ..... 2024 2025

2024-2025 Finance Budget
Rs 2,449.62 crore (44.7 % more than 2023-24)
Rs 3,600-croreplus infrastructure upgradation - Lakshadweep islands

Thesis Framework

Aim

This study aims to propose strategies for enhancing tourist island connectivity in Rameswaram by improving accessibility, convenience, and overall visitor experience, with a particular focus on addressing people's perception.

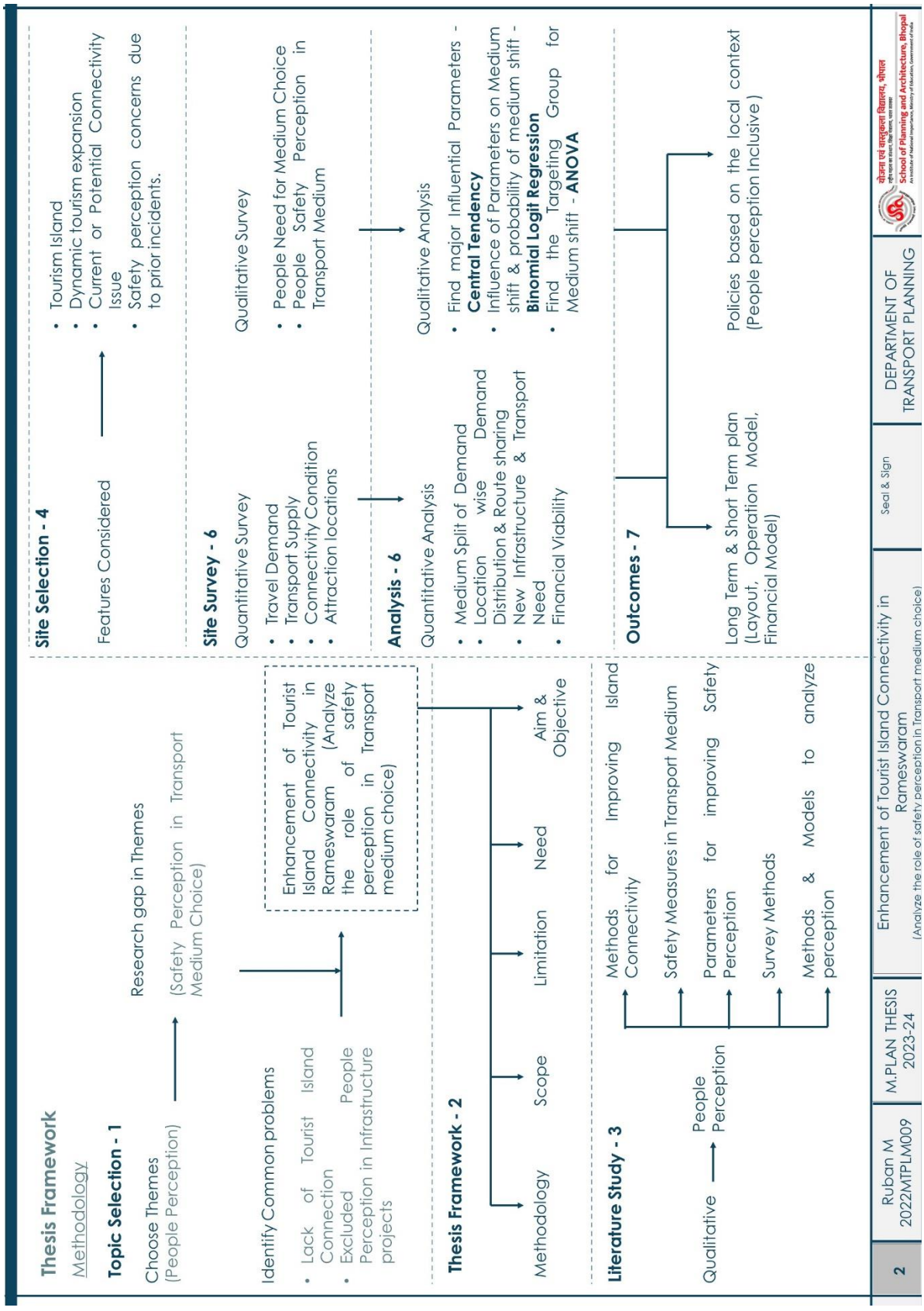
Objective

1. Evaluate the existing connectivity options & transportation infrastructure available in Rameswaram for tourists.
2. Assess the current perception of their Needs & safety among visitors regarding various mediums of transportation to and from Rameswaram.
3. Identify People Need & key factors influencing safety perception, including infrastructure conditions, past incidents, and traveler experiences.
4. Develop and implement tailored strategies, to enhance transportation infrastructure and services in Rameswaram, with a focus Promoting Tourism.

Limitation

1. The thesis exclusively focuses on improving connectivity across water bodies from external to internal and internal to internal locations, without addressing traffic flow within the landmass
2. The study will primarily focus on tourists, specifically targeting the major user groups among this diverse population

1	Ruban M 2022MTPLM009	M.PLAN THESIS 2023-24	Enhancement of Tourist Island Connectivity in Rameswaram (Analyze the role of safety perception in Transport medium choice)	Seal & Sign	DEPARTMENT OF TRANSPORT PLANNING	योजना एवं वास्तुकला विद्यालय, भोपाल School of Planning and Architecture, Bhopal An Institute of National Importance, Ministry of Education, Government of India


Thesis Framework
Methodology
Topic Selection - 1
Choose Themes
(People Perception)
Research gap in Themes
(Safety Perception in Transport Medium Choice)
Identify Common problems
Lack of Tourist Island Connection
Excluded People Perception in Infrastructure projects
Enhancement of Tourist Island Connectivity in Rameswaram (Analyze the role of safety perception in Transport medium choice)
Thesis Framework - 2
Methodology
Scope
Limitation
Need
Aim & Objective
Literature Study - 3
Qualitative
People Perception
Methods for Improving Island Connectivity
Safety Measures in Transport Medium
Parameters for improving Safety Perception
Survey Methods
Methods & Models to analyze perception
Site Selection - 4
Features Considered
Tourism Island
Dynamic tourism expansion
Current or Potential Connectivity Issue
Safety perception concerns due to prior incidents.
Site Survey - 6
Quantitative Survey
Travel Demand
Transport Supply
Connectivity Condition
Attraction locations
Qualitative Survey
People Need for Medium Choice
People Safety Perception in Transport Medium
Analysis - 6
Quantitative Analysis
Medium Split of Demand
Location wise Demand Distribution & Route sharing
New Infrastructure & Transport Need
Financial Viability
Qualitative Analysis
Find major Influential Parameters - Central Tendency
Influence of Parameters on Medium shift & probability of medium shift - Binomial Logit Regression
Find the Targeting Group for Medium shift - ANOVA
Outcomes - 7
Long Term & Short Term plan (Layout, Operation Model, Financial Model)
Policies based on the local context (People perception Inclusive)
2
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Enhancement of Tourist Island Connectivity in Rameswaram
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Seal & Sign
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योजना एवं वास्तुकला विद्यालय, भोपाल
School of Planning and Architecture, Bhopal

Literature Study

Reference Papers

Paper Name	Keywords	Outcomes
Safety perception in transportation choices: progress and research lines	Safety perception Indicators, Travel Behaviors, Likert Scale, Hierarchy or Discrete choice	Perceptions Should include in Transportation Choice
The Determinants of Accident Risk Perception, Travel Motivation, eWOM and Travel Intention on Island Tourism Destination	Focus Group Discussion, Accident Risk Perception variables, Travel Motivation Indicators	identification of indicator of research variables through Literature & site discussion
Modelling road user perceptions towards safety, comfort, and chaos at shared space	Krejcie and Morgan formula, Ordered Logit Model, Descriptive statistics of variables,	Ordered logit models were built to predict road user behaviours , Safety, comfort, and chaos Perceptions analysed byimpacts of perception of infrastructure sociodemographic characteristics, and frequency of active travel.
Assessment of commuters' perception of water transportation safety and patronage in Lagos Metropolis, Nigeria	Perception on water Transport, Safety Measures , people Need	equation for estimating perception of water transportation safety
Tourists' perceptions on safety and security: a case study of Phuket Island of Thailand	Tourist behaviour; destination image , Perceptions of Tourists of Safety and Security in Phuket , five-point Likert perceived Scale	AOVA test used for Finding the Perceived Tourism Impacts with Different Variance of Respondents

Enhancement Measures in Island Connectivity

- Integrating transportation within the tourism sector.
- Transport Infrastructure Development
- Tourism-Focused Transport Services.
- Infrastructure Upgrades for Accessibility
- Multi-Modal Transport Integration

Qualitative parameters – Safety perception

- Drivers Behavior
- Infrastructure condition
- Transport Medium condition
- Transport Mode condition
- Travel Information
- Safety Equipment's
- Rescue Measures
- Crime
- Hygiene
- Illumination
- People Provisions
- Weather Information
- Time (Travel & Waiting)

Analysis Methods

- Choice modelling
- hybrid modelling
- Central Tendency
- Multinomial Logit Regression
- Correlation
- Binomial Logit Regression
- ANOVA (F Test)
- T Test
- Ordered Logit Model

Site Selection

Pamban Road Bridge Section

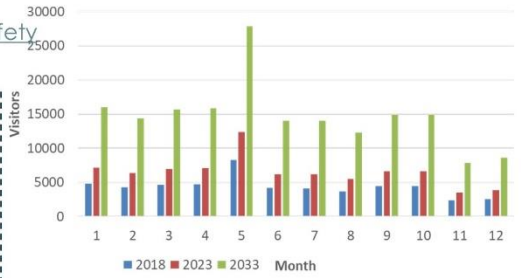
Existing : Road & Railway

Rameswaram Island Site Location Map

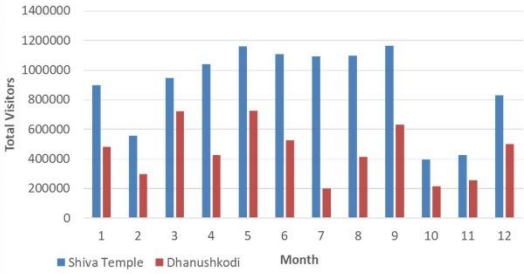
Events that Influence people safety perception

"115 Passengers lives lost on Pamban - Dhanushkodi Train - Tragic Storm – Tragedy - 1964

Unauthorized Boat Ride to Island Claiming 13 Lives - 2010



Number of Visitors to Kunthukal Beach (Month-wise)



Number of Visitors to Rameswaram in 2023 (Month-wise)

Site Survey

Quantitative Survey

Primary Survey

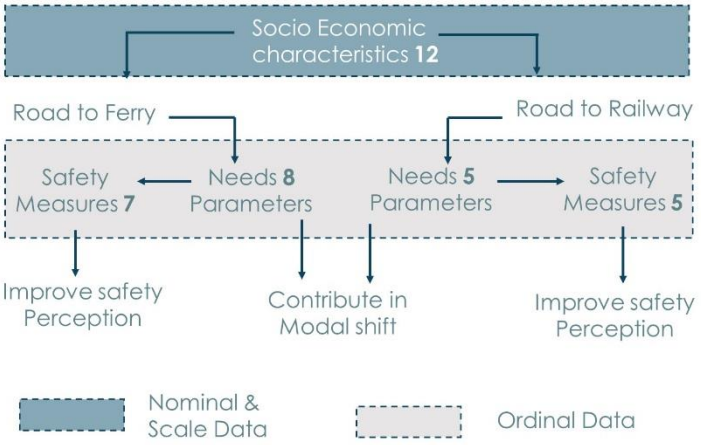
- Pamban Bridge TVC – 9 Hrs Peak Day - Sunday
- Number Plate & Occupancy Survey – 1200 Vehicles
- Ferry Operators Discussion

Secondary Data Collection

- Public Transport Frequency Data for Road & Rail – (Transport Dept)
- Number of visitors for each Tourist Spot (Tourism Dept)

Qualitative Survey

Survey Location– Pamban Bridge
No of Samples : 121
Random Sampling – Majorly covers Tourists



Nominal & Scale Data

Ordinal Data

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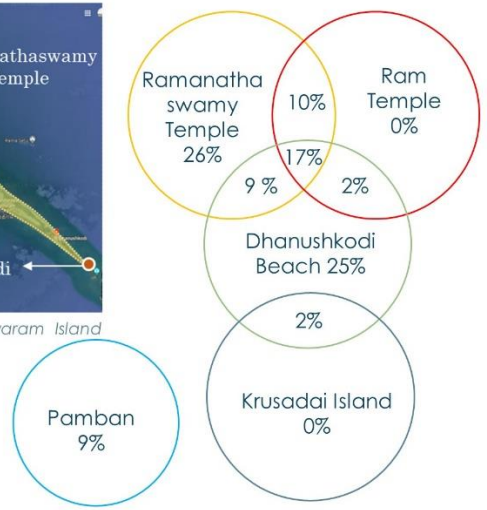
Descriptive Analysis of Samples

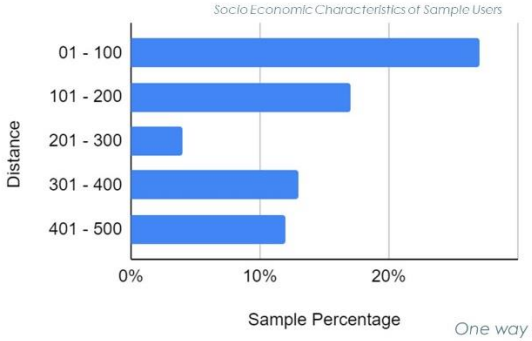
Socio Economic Parameters			Percentage
Age		18-30	35%
		30-50	45%
		50-70	18%
		above 70	2%
Gender		Male	66%
		Female	34%
Purpose		Education	2%
		Social	2%
		Tourism	82%
		Work	14%
Origin	Within District	Ramanathapuram	26%
	Within Tamil Nadu (Outside of District)	North Eastern District	7%
		North Western District	8%
		Western District	4%
		Central Delta Region	7%
		Southern District	19%
	Outside of State	Border Sharing states	19%
		North & Middle states	10%

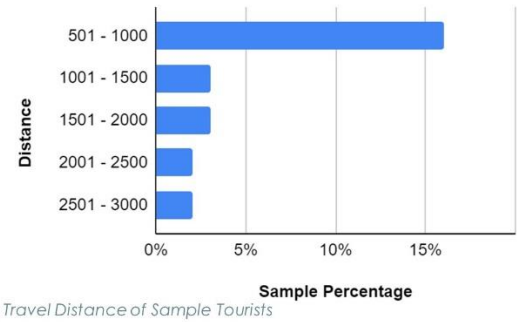
Major Tourist Attraction spot in Rameswaram Island

Sample size 121 (Simple Random Sampling)



Tourist Distribution for Various Destinations





One way Travel Distance of Sample Tourists

Mode	Major Mode of Transport	Transport within Island
Car	17%	17%
2W	39%	40%
Auto	7%	18%
Government Bus	13%	8%
Private Bus	10%	10%
Train	7%	0%
Van	7%	7%

Quantitative Analysis – Pamban Road Bridge

Growth of Tourism

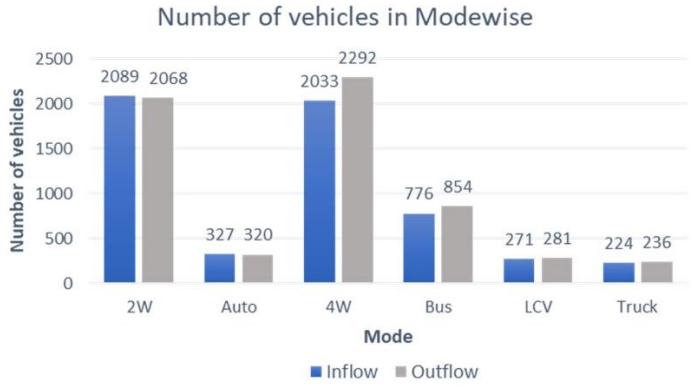
Year	Ramanathaswamy Temple	Dhanushkodi Beach
2019	81,46,760	15,42,716
2022	70,65,959	42,29,554
2023	1,06,99,584	53,86,804
2033	2,21,34,273	1,10,99,226

- Peak Days in Month : Saturday & Sunday , Government Holidays, Full Moon Day
- Approx 120 Days/ Year

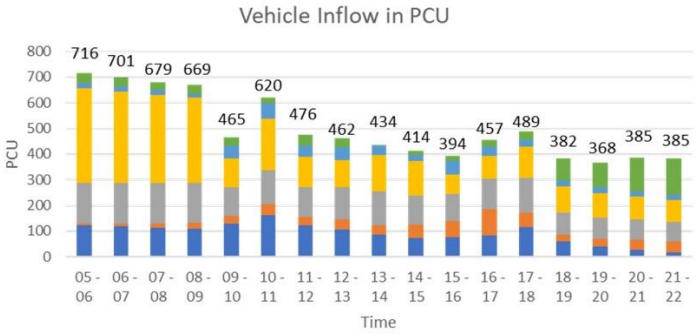
Existing Public Transport Supply

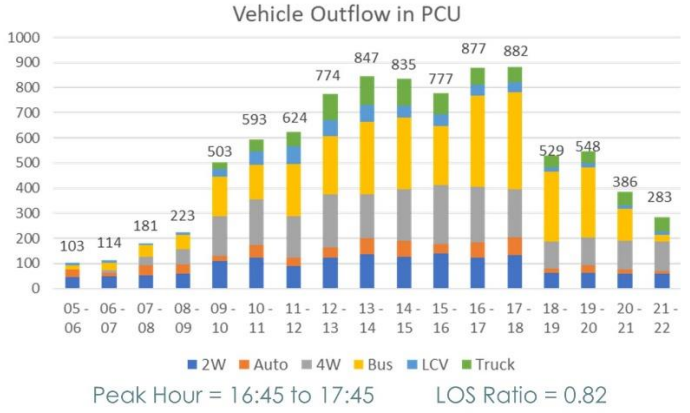
- Number of Government Bus services = 250 Buses/Day
- No of Train services = 6-7 Up Trains/Day (2 Madurai – Local Train) (Railway Bridge Under Construction)

Modal Split



Traffic Flow TVC

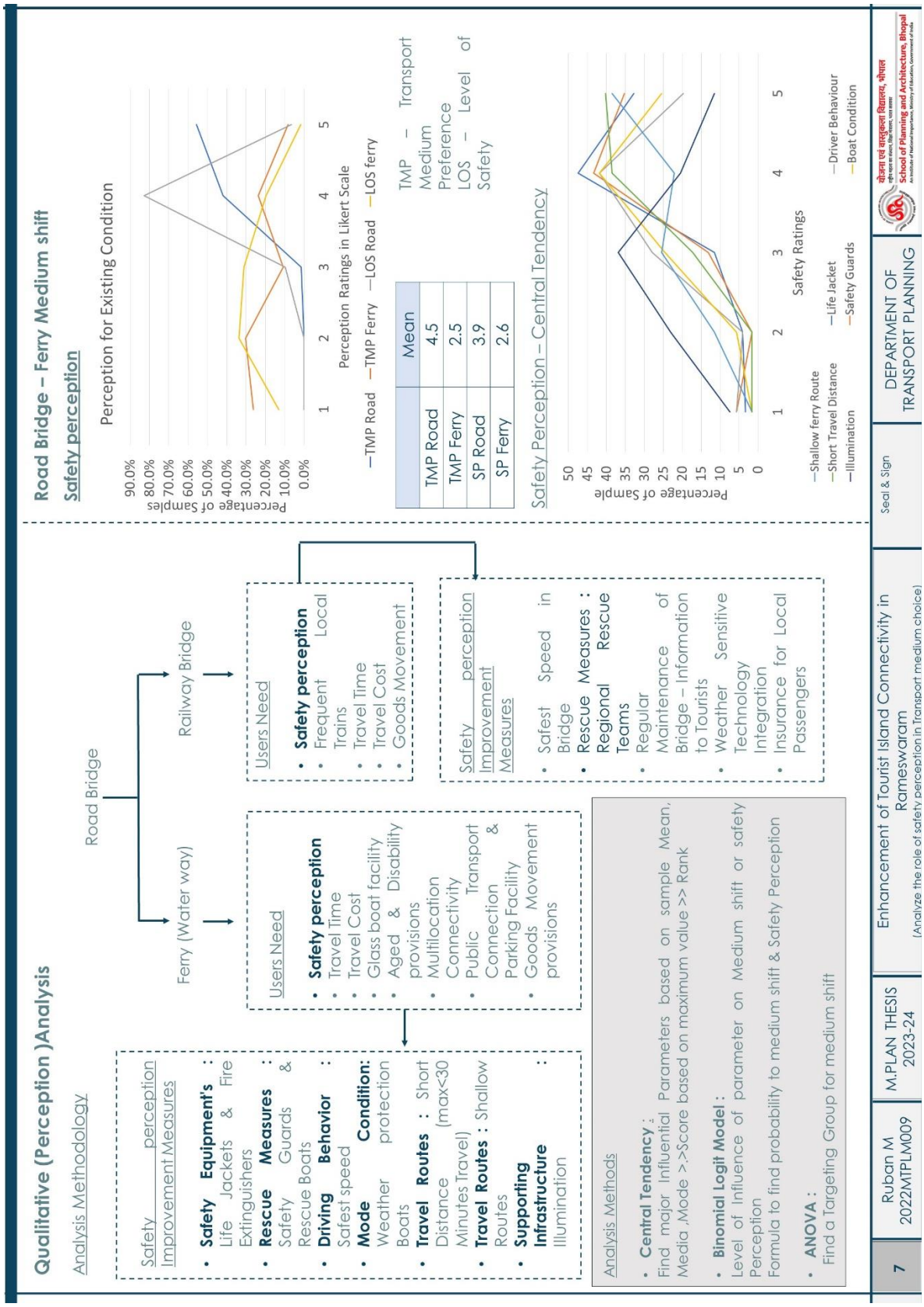




Peak Hour = 16:45 to 17:45 LOS Ratio = 0.82

People Flow

Time	Inflow People	Outflow People
4:00 – 11:00	23107	7498
11:00 – 17:00	10324	23293
17:00 – 22:00	7457	16088


Qualitative (Perception)Analysis
Analysis Methodology
Safety perception Improvement Measures
Safety Equipment's : Life Jackets & Fire Exfinguishers
Rescue Measures : Safety Guards & Rescue Boats
Driving Behavior : Safest speed
Mode Condition: Weather protection Boats
Travel Routes : Short Distance (max<30 Minutes Travel)
Travel Routes : Shallow Routes
Supporting Infrastructure : Illumination
Road Bridge
Ferry (Water way)
Railway Bridge
Users Need
Safety perception
Travel Time
Travel Cost
Glass boat facility
Aged & Disability provisions
Multilocation Connectivity
Public Transport Connection & Parking Facility
Goods Movement provisions
Users Need
Safety perception
Frequent Local Trains
Travel Time
Travel Cost
Goods Movement
Safety perception Improvement Measures
Safest Speed in Bridge
Rescue Measures : Regional Rescue Teams
Regular Maintenance of Bridge – Information to Tourists
Weather Sensitive Technology Integration
Insurance for Local Passengers
Analysis Methods
Central Tendency : Find major Influential Parameters based on sample Mean, Media ,Mode >>Score based on maximum value >> Rank
Binomial Logit Model : Level of Influence of parameter on Medium shift or safety Perception Formula to find probability to medium shift & Safety Perception
ANOVA : Find a Targeting Group for medium shift
Road Bridge – Ferry Medium shift
Safety perception
Perception for Existing Condition
Percentage of Samples
Perception Ratings in Likert Scale
TMP Road
TMP Ferry
LOS Road
LOS ferry
Mean
TMP Road 4.5
TMP Ferry 2.5
SP Road 3.9
SP Ferry 2.6
TMP – Transport Medium Preference
LOS – Level of Safety
Safety Perception – Central Tendency
Percentage of Sample
Safety Ratings
Shallow ferry Route
Short Travel Distance
Illumination
Life Jacket
Safety Guards
Driver Behaviour
Boat Condition
Seal & Sign
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7
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(Analyze the role of safety perception in Transport medium choice)

Qualitative (Perception)Analysis

Safety Perception Parameters	Mean	Rank
Life Jacket & Fire extinguisher	4.0	2
Safety Guards & Rescue boats	4.0	2
Driver behavior – Safest speed	3.7	3
Boat condition – Weather protection	3.8	3
Shallow Ferry Route	3.9	2
Short Travel distance (<30 Min)	4.1	1
Illumination	3.1	4

Likert Scale _Safety perception Measures

1 = Extremely Unsafe
2 = Unsafe
3 = Neutral
4 = Safe
5 = Extremely Safe

Method To Rank the parameters

High Rank = Large overall Score

Overall score = sum of (Mean Score + Median score + Mode score)

Mean score

1.0 - 1.49 = 1
1.5 – 1.99 = 2
2.0 - 2.49 = 3
2.5 - 2.99 = 4
3.0 - 3.49 = 5
3.5 - 3.99 = 6
4.0 - 4.49 = 7
4.5 – 5.0 = 8

Median & Mode

1 = 1,
2 = 2,
3 = 3,
4 = 4,
5 = 5

Safety Perception - Binomial Logit Regression

Omnibus Tests of Model Coefficients

Chi square = 150.634
Significant = 0.000

Cox & Snell's R-Squared value =0.712

Parameters	Coefficients
Life Jacket	19.946
Safety Guards	10.34
Driver Behaviour (Speed)	0.121
Boat condition (Weather)	0.513
Shallow Route	3.745
Short Distance Travel	24.612
Illumination	0.477
Constant	-210.845

SPferry = -210.845 + 19.946(Life Jacket)+10.34 (Safety Guards) + 0 .121(Driver Behavior)+ 0 .513 (Boat Condition)+ 3.745(Shallow Route)+24.612(Short Distance Travel)+ 0.477(Illumination)

PSP = e SPferry / (1+ e SPferry)

Assume Threshold 50% , if PSPferry is
> 0.5 = people will feel safe to choose ferry
< 0.5 = people will not feel safe to choose ferry

As per this formula & Assumption

54.5% of sample road users (Sample) will feel safe to choose ferry .

Need perception

Need – Central Tendency

Needs	Mean	Rank
Improvement of safety perception	3.5	1
Less Travel Time	2.5	4
*** Fixed Cost - Toll amount for Road bridge**	**1.7**	**6**
Glass boats for Eco Tourism	3.2	3
Aged & Disability people provision	2.6	5
Multilocation connectivity	3.9	1
Public Transport connection & Parking Facility	3.9	2
*** Goods Movement provisions**	**1.1**	**7**

* Less than 50% in Total score value

Likert Scale _Need for Ferry shift

1 = Extremely Unimportant
2 = Unimportant
3 = Neutral
4 = Important
5 = Extremely Important

Need – Binomial Logit Regression

Omnibus Tests of Model Coefficients

Chi square = 165.8.634
Significant = 0.000

Cox & Snell's R-Squared = 0.746

Qualitative (Perception)Analysis

Parameters	Coefficients
Safety Perception measures	56.978
Travel Time	9.328
Travel cost	0.594
Glass Boats	0.553
Aged and Disability provision	13.595
Multilocation Connection	15.715
Public Transport and Parking	66.133
Goods Movement	43.789
Constant	-680.096

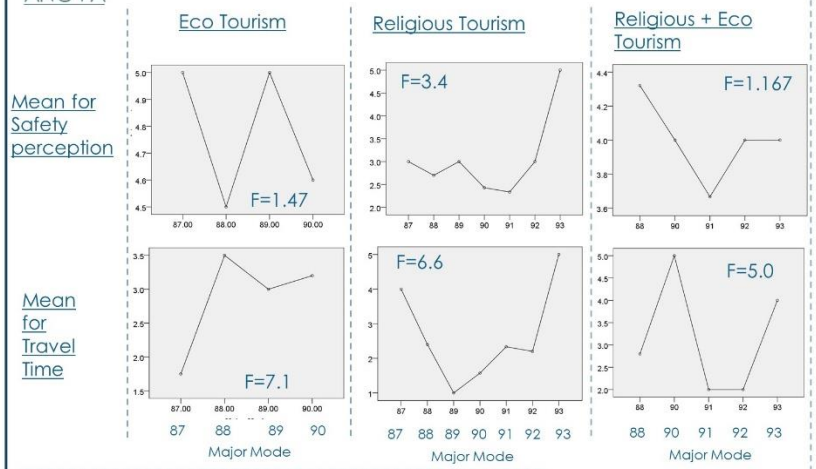
Utility of ferry = -680 + 56.97 (Safety Perception measures) + 9.328 (Travel Time) 0.59 (Travel cost) +0.55 (Glass Boats)+ 13.59 (Aged and Disability provision)+ 15.71 (Multilocation Connection) + 66.13 (Public Transport and Parking) + 43.78 (Goods Movement)

PU ferry = e Uferry / (1+ e U ferry)

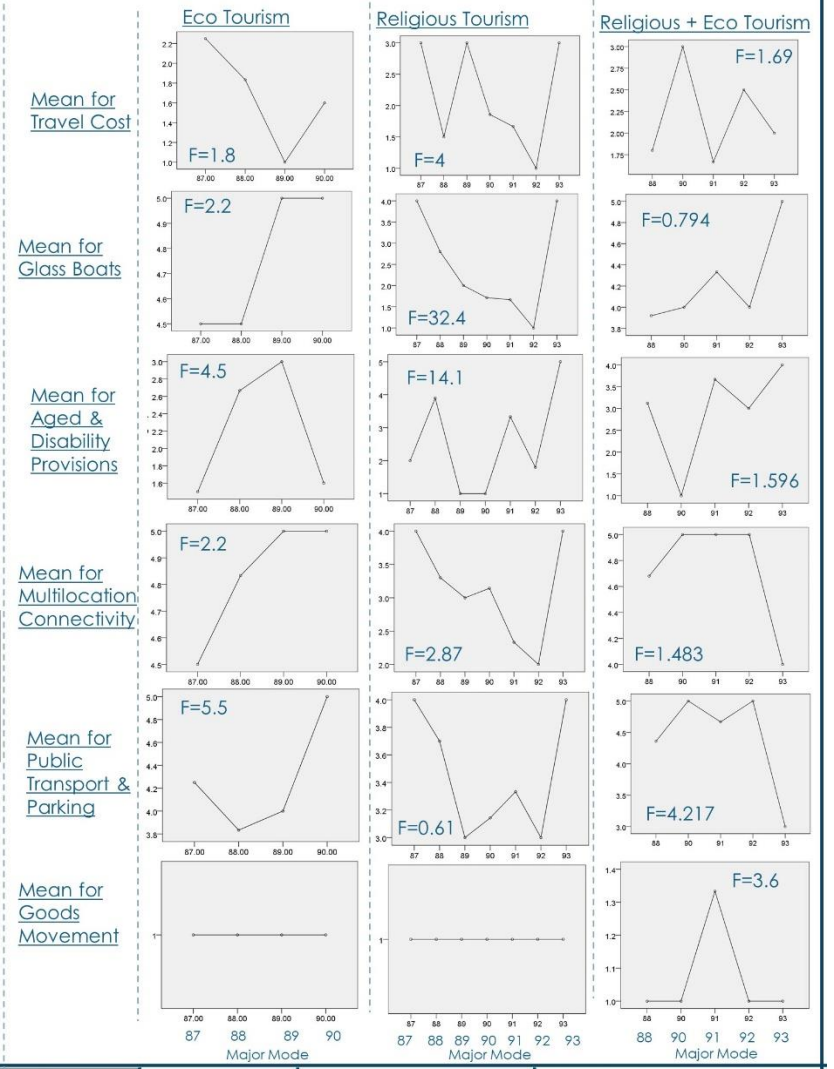
Assume Threshold 50% , if PUferry is
> 0.5 = people will ready to shift Ferry
< 0.5 = people will not ready to shift Ferry

As per this formula & Assumption **43 %** of sample road users (Sample) will shift to ferry.

ANOVA



87 – 2W | 88 – 4W | 89 – Auto | 90 – Government Bus | 91 – Private bus | 92 – Train | 93 – Van

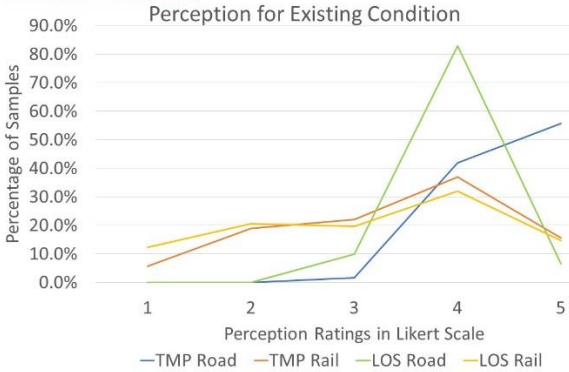


9	Ruban M 2022MTPLM009	M.PLAN THESIS 2023-24	Enhancement of Tourist Island Connectivity in Rameswaram (Analyze the role of safety perception in Transport medium choice)	Seal & Sign	DEPARTMENT OF TRANSPORT PLANNING	योजना एवं वास्तुकला विद्यालय, भोपाल School of Planning and Architecture, Bhopal

Qualitative (Perception)Analysis

Road Bridge – Railway Medium shift

Safety perception



	Mean
TMP Road	4.5
TMP Railway	3.3
SP Road	3.9
SP Railway	3.2

TMP – Transport Medium Preference
LOS – Level of Safety

Safety Perception – Central Tendency

Safety Perception Parameters	Mean	Rank
Speed in Bridge	4.1	1
Rescue Teams	3.2	3
Bridge Maintenance	4.2	1
Weather Sensitive Technology	3.3	2
Local Train Insurance	2.1	4

Likert Scale _Safety perception Measures

1 = Extremely Unsafe
2 = Unsafe
3 = Neutral
4 = Safe
5 = Extremely Safe

Binomial Logit Regression

Omnibus Test of model Coefficients
Chi square = 79
Significant = 0.000

Cox & Snell R square = 0.48

Variables in the Equation			
	B	Sig.	Exp(B)
Speed in Bridge	2.208	.000	9.094
Rescue Teams	.663	.096	1.941
Bridge Maintenance	2.693	.000	14.770
Weather Sensitive Technology	.816	.047	2.261
Local Train Insurance	.371	.261	1.450
Constant	-25.708	.000	.000

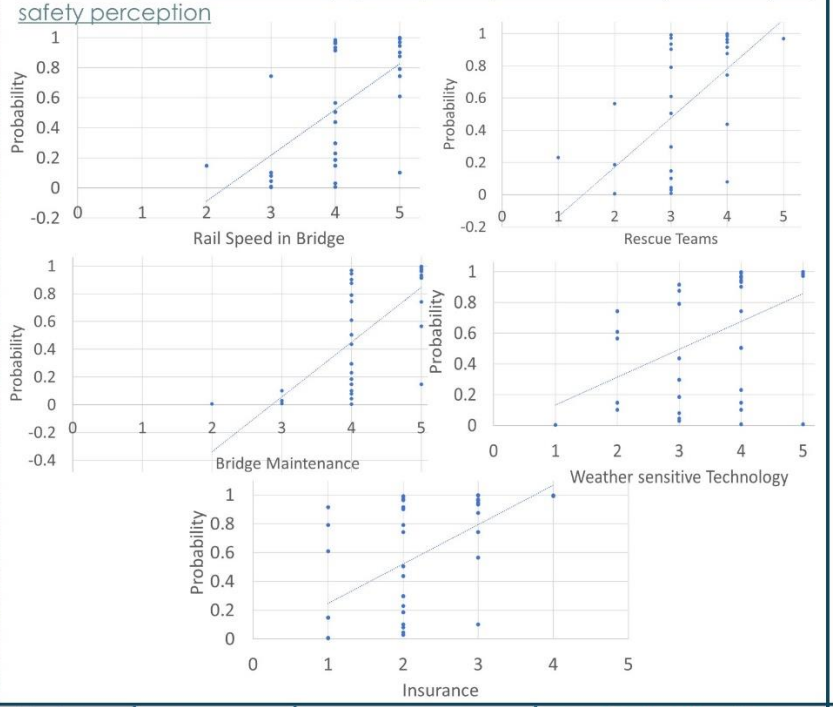
Safety Perception of Rail = -24.678 + 2.2 (Speed in Bridge)+0.613 (Rescue Teams) +2.627(Bridge Maintenance) + 0.887 (Weather Sensitive technology)+ 0.003 (Insurance)

$P_{SP\ Rail} = e^{SP\ Rail} / (1 + e^{SP\ Rail})$

Assume Threshold 50% , if $P_{SP\ Rail}$ is
> 0.5 = people will feel safe to choose Railway
< 0.5 = people will not feel safe to choose Railway

As per this formula & Assumption
56 % of sample road users (Sample) will feel safe to choose Railway.
% of people safety perception Increase = 8 %

Relationship Between safety perception parameters & probability of safety perception



Qualitative (Perception)Analysis

Need Perception

Safety Perception – Central Tendency

Users Need	Mean	Rank
Safety Perception	3.2	1
Frequency of Local Train	3.4	1
Travel cost	2.9	2
Travel Time	2.8	3
Goods Movement	1.2	4

Likert Scale _ Need for Railway medium shift
1 = Extremely Unnecessary
2 = Unnecessary
3 = Neutral
4 = Necessary
5 = Extremely Necessary

Binomial Logit Regression

Omnibus Test of model Coefficients
Chi square – 125.6
Significant = 0.000

Cox & Snell R square = 0.646

Variables in the Equation	Coefficients
Safety Perception	.421
Frequency of Local Train	4.833
Travel cost	1.879
Travel Time	2.245
Goods Movement	.936
Constant	-39.708

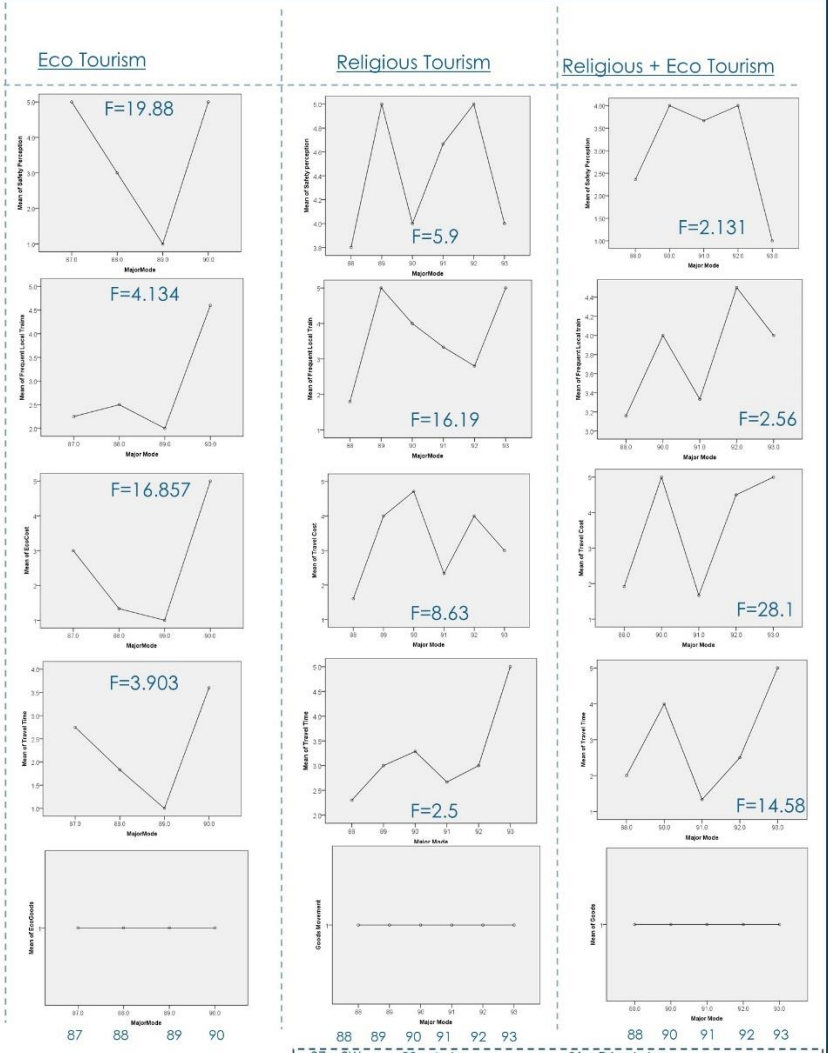
Utility of Rail = -39.7+0.421(Safety perception)+ 4.833 (Frequency of Local Train)+ 1.879(Travel cost)+2.245(Travel Time)+ 0.936(Goods Movement)

$P_{U\ Rail} = e^{U\ Rail} / (1+ e^{U\ Rail})$

Assume Threshold 50% , if $P_{U\ Rail}$ is
> 0.5 = people will feel safe to choose Railway
< 0.5 = people will not feel safe to choose Railway

As per this formula & Assumption
32 % of sample road users (Sample) will ready to shift to Railway.

ANOVA



Recommendations & Way forward

Medium Shift From Road - Ferry

Safety perception Measures

For Improving Safety perception among visitors These are necessary steps

- Planning Routes in Short Distance & shallow area
- Make sure available of Life Jacket & Fire extinguisher
- Appointment of safety Guards & Rescue boats

By providing this safety Measures 54.5 % of sample users will feel Safe in Ferry

People Needs for medium shift

- Multilocation connectivity
- Safety Perception Improvements
- Public Transportation Connection & Parking Area near Boarding & Deboarding points
- Glass boats for Eco Tourism

By providing this needs 43 % of sample road users (Sample) will shift to ferry

Medium Shift From Road - Railway

Safety perception Measures

For Improving Safety perception among visitors These are necessary steps

- Operating Trai in slow speed over Bridge
- Regular Maintenance of Bridge & it should be aware for people

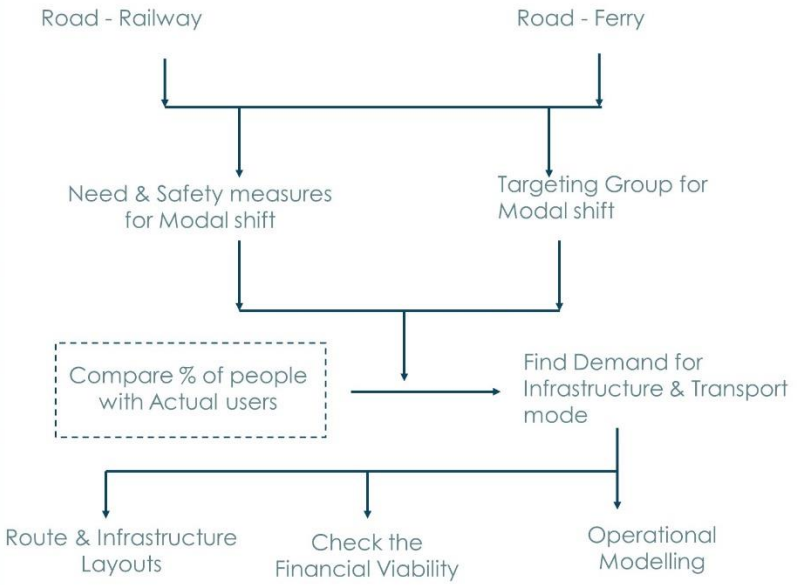
By providing this safety Measures 56 % of sample users will feel Safe in Railway

People Needs for medium shift

- Make sure the availability of Frequent Local Trains by Increasing the Numbers during peak days & Peak hours
- Less Travel Time & less Travel cost in compare with using Road Modes

By providing this needs 32 % of sample road users (Sample) will shift to ferry

Way forward



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