Assessing the Determinants Affect for Hambantota District Public Transportation Users when Selecting a Travel Route [A Contemporary Survey Based on Southern Expressway (E001) and Normal Route (A02)]

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Abstract— **This study has focused to identify the factors effects to Hambantota district public transportation users when selecting travel route. Principally the travel experience on Southern expressway (E01) and normal route Colombo-Hambantota (A02) journeys are considered in this study. It provides a framework for understanding the passenger satisfaction levels and then the requirements while travelling from Southern province to Western province by using expressway and normal route. An exploratory factor analysis was carried out using 09 independent variables for both expressway and normal route journey. It was concluded with 03 factors for route journey: (Nature of Travel, Passenger requirement and Convenience of travel) and 04 factors: (Passenger requirement, Convenience of Travel, Operational Factors and Passenger Expectation) for the expressway journey, which determined the perception of commuters. Amongst, the nature of travel and the passenger requirements were having a correlation for the passenger satisfaction of normal route journey, besides, operational factors having a correlation towards the journey satisfaction**

Keywords— ***Expressway, Factor Analysis, Passenger Satisfaction, Public Transportation***

I. INTRODUCTION

A. *Background of the Study*

Presently transportation plays a vital role in the development of a country in terms of every aspect, henceforth it is essential to have an improved, faster, efficient and economical transport network.

The historical development of the road network in Sri Lanka dates to the colonial eras, primarily when roads were constructed to transport agricultural products of Tea and Coffee from plantation areas in the hill countries to the port of Colombo and were used for civil administration and defence. At the status, it is divided into three categories: National Roads, Provincial Roads and roads governed by Local Authorities, being SLRDA (Sri Lanka Road Development Authority) the responsible arm. The National Road Network consists of 12,210.36 km of Trunk (A class) and Main (B class) roads and about 4,662 bridges that span of more than 3m.

The Southern Expressway (E001) is the 1st Expressway experience for Sri Lanka, proceeding with Outer-Circular Highway (E002) and Colombo – Katunayeka Expressway (E003) that totally accounts for 169.845 km. This contemporary study focuses on the ongoing Extension of the Southern Expressway Project (ESEP) from Matara to Hambantota under 04 sections: Matara to Beliatta, Beliatta to Wetiya, Wetiya to Andarawewa and Hambantota to Mattala via Andaraweva.

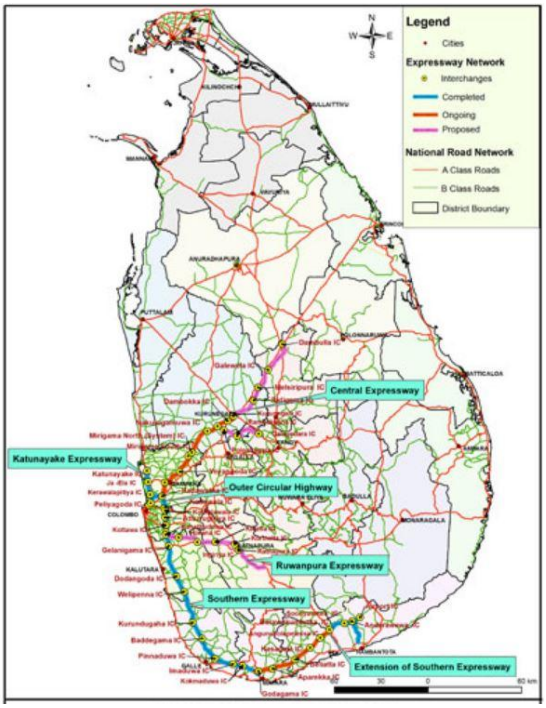

Fig. 1 Expressway Network in Sri Lanka

Source: Sri Lanka Road Development Authority

B. *Significance and Aim of the Study*

People in Hambantota must come to Matara to get an expressway bus starts from Matara, either travel from Hambantota to Colombo using Trunk road (A02) / normal route, which takes approximately additional 2.5 hours per trip. Thus, the research aims to study and asses the factors affect for users when selecting a travel route from ESEP and A02. Findings of the study are critical when influencing authorities to improve the services to attract more passengers, to increase income of the expressways, to improve the quality of transportation service in the country by addressing customer demands and finally to expand the capacities of convenience.

C. *Objectives of the Study*

The objective of the research is to:

- Assess the determinants affect for passenger satisfaction level from expressway journey and normal route journey.

II. LITERATURE SURVEY

D. *Public Transportation*

If transport is known as a facilitator to the economy, public transportation plays a major role in maximizing productivity and the competitiveness. Economic benefits of public transport can be divided in to 03 main parts: Efficient connectivity between labour to the marketplace, helps to reduce productivity bottlenecks and maximize the opportunity for individuals and businesses. Public transportation helps to achieve economic connectivity between major trade centres also provides social cohesion between diverse demographics in societies.

In every country expressway encourages the volumes of traffic when traffic congestion is high. But to move for public transportation, attractive transport facilities should be provided to passengers. Public transportation creates a lot of advantages to the passengers and as a socio-economic factor, to uplift the quality of life of the citizens.

E. *Customer Satisfaction on Bus Transportation*

Customer satisfaction has been identified one of the major drivers in revenue generation of public/private passenger transportation sector. Studies with similar panoramas have taken as guidance to develop the variables which has used in research. The main variables have categorized under waiting time, accessibility, charges, safety, and security, driving aids for safe driving, service quality.

Passengers who spend longer waiting time, it will also tend to be more stressed. Long wait times are caused due to services not running according to flexible time schedule, which, in turn, induces stress due to lack of insufficient capacity and crowding are the major causes of stress among commuters. (Olio, Ibeas, & Cecin, 2011). A case study (2000) has recommended operating the newly built expressways as controlled access expressway with optimum road condition (Dandekar & Mahajan, 2001) In the study, it has been indicated expressway charges as a factor finding effected to the customer satisfaction (Limited, Limlight, 2012) Himachal Pradesh Road and Other Infrastructure Development Corporation Ltd (HPRIDC) (2007) has diagnoses the key factors affection road users' satisfaction in their survey and the safety had included as a key factor that effect the customer satisfaction. A study on National Road Users Satisfaction Survey has stated that "Higher proportions had been aware of road network's in advance of their trip (65% compared with just 54% in 2011/12) with more findings out via road signs" (Alkaabi, 2014). In the empirical study carried on "customer satisfaction measurement within the road sector" by (Shaaban & Khalil, 2013) has stated that the service level quality had been a major influence in customer perception on road networks.

III. METHODOLOGY AND EXPERIMENTAL DESIGN

F. Population and Sample

The target population was considered as commuters in Hambantota district and to extract the sample, it is used: Simple Random Sampling (SRS). The most applicable data type was categorical data that had being obtained through a structured questionnaire. The questionnaire was distributed: web based and the printed form. The basic objective of the questionnaire was to identify the factors which are considered when selecting the travel route either expressway of normal route. Respondents were given the chance to reflect their experiences after completing the questionnaire.

G. Identified Variables and Questionnaire

The dependent variables are identified as the level of satisfaction on expressway journey (E001) and normal route journey (A02) of public transportation users'. The independent variable for the normal route journey were identified as: Travel time, Ticket price, Connectivity, Punctuality, Comfortability, Traffic density, Safe driving, Bus speed, Frequency of operation, Passenger crowd, Mobility, passenger queue length, Cleanliness (Interior/Exterior), Bus brand, Adequate space on board, Travel schedule flexibility, Distance from origin to entrance, Distance from exit to destination. And the independent variables for the Expressway journey was identified as Travel time, Mobility, Traffic density, Passenger queue length, Bus speed, Seat comfortability, Cleanliness (Interior/Exterior), Safe driving, Bus brand, Adequate space on board, Bus availability rate, Travel schedule flexibility, Distance from origin to entrance, Distance from exit to destination and Ticket price.

The questionnaire was designed in three sections: Part A: to collect the demographic factors and passenger travel purpose, part B: to collect data related to passenger perception on Colombo-Hambantota normal route bus journey, part C: to collect data related to the passenger perception on Colombo-Hambantota Southern Expressway public bus journey. The five-point Likert scale is used in questionnaire preparation.

H. Data Collection and Analysis

The structured questionnaire was distributed among 237 respondents in Google form & printed format and collected the primary data. Secondary data were used mainly for conceptualization of the study. Data collected from various sources: journals, literature books, articles, conference papers, magazines, thesis papers, research papers. The collected primary and secondary data was analysed using SPSS (Statistical Package for Social Sciences)16.

I. Justification to the Theoretical Framework

The data analysis methods used for the study are: Cronbach's Alpha test to test the reliability, Kaiser-Meyer-Olkin value (KMO) has applied to test the adequateness of the sampling test to run a factor analysis Bartlett's statistics test has applied to the test the homogeneity of variance, descriptive statistics was used to explain the demographic factors, Factors extraction is explained using principal component analysis, Factor rotation is explained using varimax method and Factor scores are explained using regression method.

IV. DISCUSSION OF RESULTS

A. Demographic Analysis of Participants for the Normal Route Journey

Initially out of the respondents from the Hambantota district majority (51.1%) were males, and females accounted for the remained percentage. Considering the age factor, 44.3% of the respondents fallen under 15-25 years. It was also observed that there was comparatively a higher percentage (28.3%) of respondents from people within the age group of 26 to 35 years. According to the highest education level achieved, 56.1% of the respondents have studied up to Advanced Level which accounts for the majority and the minority of 1.7% having a master's degree. According to the current employment factor, 51.1% are currently employed which accounts for the majority and only 3.4% of the respondents were unemployed. The factor of monthly income was distributed with the majority of 40.1% of the respondents earning an income less than that of 25,000.00 LKR per month and 76% of the respondents are having an income of less than 50,000.00 LKR per month which depicts higher number of people living in average income conditions. When considering the factors of frequency of travel and commuting purpose, 59.5% of the commuter respondents travel occasionally, amongst majority visits their family /relatives. Only 11.5% of the commuters visits at a high frequency (monthly or weekly basis) while a least percentage (0.4%) of them travel for leisure purpose.

B. Analysis of the Variables in Normal Route Journey

The variables considered for the normal route journey consists of 10 independent variable and the Cronbach's alpha value of which at the initial stage were 0.813. If deleted the variable "ticket price on normal route journey" the alpha value can be increased up to 0.820 and to get maximum internal consistency between variables, ticket price of normal route journey has not been considered further.

The value of KMO Measure of Sampling Adequacy depicts 0.799 which is greater than that of 0.5, and it is evident that it is capable of analysing through 'exploratory factor analysis'.

Bartlett's test hypothesis:
H_0: Correlation matrix is an identity matrix
H_1: Correlation matrix is not an identity matrix

Since P-value (0.000) is less than that of the critical value α = 0.5, the test statistics is significant and reject H_0. it can be concluded with 95% confidence that there is an association between variables, hence suitable for the factor analysis.

C. Frequency Analysis for the Satisfaction Level

Respondents who commuted using public transport in the normal route were questioned on their views regarding certain aspects on normal route journey, punctuality, connectivity, travel time, frequency of operation, bus speed, safe driving, traffic density and passenger crowd. According to the analysis minimum number of respondents, (below 2%) are to be strongly satisfied, with the highest response for strongly satisfied respondents being 1.7% for connectivity, bus speed and safe driving. It can be observed that more respondents (18.6%) were strongly dissatisfied with the passenger crowd of normal route public transport than other factors. However, safe driving of mode and traffic density on normal route were with 12.2% and 11.0% of respondents stating respectively to be strongly dissatisfied with both those factors. When assessing the factors; connectivity, frequency of operation, bus speed, safe driving, traffic density and passenger crowd of normal route public transportation separately, majority of the respondents (43.0%, 49.8%, 44.7%, 43.0%, 43.9% and 40.5% respectively) reacted as neutral. However, when it came to punctuality, travel time, and comfortability higher number of responses (42.2%, 54.9%, and 59.1% respectively) were dissatisfied by these factors regarding normal route public transport journey. Hence, it can be concluded that most of the respondents either felt neutral or dissatisfied by the above-mentioned aspects of the normal route journey.

D. Descriptive Statistics Analysis of Dependent Variables

According to descriptive statistics, the highest mean is 3.69 which is for comfortability and passenger crowd while lowest mean is for the frequency of operation which is 3.27. Since, all variable values are with the range of 3-4 in Likert scale, it proves that majority of people are neutral and dissatisfied for the normal route journey. The standard deviation values depict 0.942 at the maximum for safe driving.

TABLE 1
COMMUNALITY TABLE FOR NORMAL ROUTE PUBLIC TRANSPORT

Variable	Initial	Extraction
Punctuality	1.000	.764
Connectivity	1.000	.752
Travel time	1.000	.519
Frequency of operation	1.000	.597
Bus speed	1.000	.743
Comfortability	1.000	.734
Safe driving	1.000	.556
Traffic density	1.000	.788
Passenger crowd	1.000	.628

According to table 1, 78.8% of variance of traffic density is explain in this model as the highest while, 51.9% of travel time is explained as the lowest in this factor analysis.

E. Factor Analysis

TABLE 2
TOTAL VARIANCE

	Initial Eigenvalues		
Component	**Total**	**% of Variance**	**Cumulative %**
1	3.750	41.667	41.667
2	1.282	14.244	55.911
3	1.048	11.642	67.553
4	.763	8.478	76.031
5	.565	6.283	82.341
6	.501	5.571	87.886
7	.406	4.506	92.392
8	.371	4.127	96.519
9	.313	3.481	100.000

adjusted

According to table 2, and considering the initial Eigenvalues there are 03 factors extracted representing a cumulative model variance of 67.55%. This further demonstrates with the scree plot depicted in fig. 2.

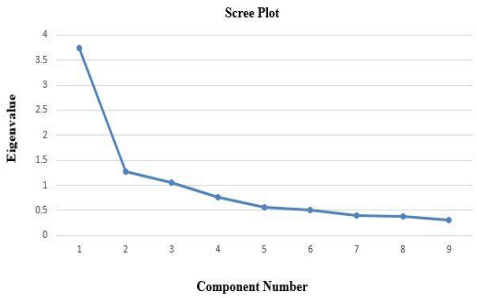

Fig. 2 Scree Plot-Normal Route Public Transport

According to the rotated component matrix and the component score coefficient matrix, the following results obtained:

Factor 01 includes 03 variables and collectively defined as "Nature of travel – F(x)".

I. Safe driving - a
II. Traffic density - b
III. Passenger crowd - c

Factor 02 includes 03 variables and collectively defined as "Passenger requirement – F(y)".

I. Frequency of operation - d
II. Bus speed - e
III. Comfortability - f

Factor 03 includes 03 variables and collectively defined as "Convenience of Travel – F(z)".

I. Punctuality - g
II. Connectivity - h
III. Travel time - i

Thus, it is evident that the perception of using normal route depends on nature of travel, passenger requirement and convenience of travel, with below coefficients.

$F(x) = (0.361)\ a + (0.505)\ b + (0.411)\ c$
$F(y) = (0.393)\ d + (0.521)\ e + (0.397)\ f$
$F(z) = (0.533)\ g + (0.586)\ h + (0.244)\ i$

F. Pearson Correlation Coefficient for Extracted Factors

H_0: There is no correlation between the i^{th} factor and the satisfaction level on normal route public transport journey
H_1: There is a correlation between the i^{th} factor and the satisfaction level on normal route public transport journey
(i = 1 - Nature of Travel, i = 2 – Passenger requirement, i = 3 – Convenience of travel)

Accordingly, the values significantly depict that there is a correlation between the nature of travel and passenger requirements with the satisfaction level of normal route journey, and there is no correlation between convenience of travel against the satisfaction level.

G. Demographic Analysis for Expressway Public Transport Journey

97% of the respondents were currently using the expressway for their transportation purposes and 98% of the respondents illustrated the willingness to complete their journey using expressways. The highest (46.8% and 40.9%) percentage of respondents could reach their destination within 2hrs to 2½hrs and 1½hrs to 2hrs respectively. It is evident that passengers will be able to reduce their travel time in a significant amount. According to the satisfaction level of expressway bus fare, 97% of the respondents were willing to pay 500-1500 LKR for the expressway public transport journey. According to the respondents, the facilities required for the expressway journey has mentioned with a higher percentage as: air conditions, seat reservation facilities and, sanitary facilities in the terminals.

H. Analysis of the Variables in Normal Route Journey

The variables considered for the normal route journey consists of 15 independent variable and the Cronbach's alpha value of which at the initial stage were 0.849. If deleted the variable "ticket price on expressway journey" the alpha value can be increased up to 0.852 and to get maximum internal consistency between variables, ticket price of expressway journey has not been considered further.

The value of KMO Measure of Sampling Adequacy depicts 0.766 which is greater than that of 0.5, and it is evident that it is capable of analysing through 'exploratory factor analysis'.

Bartlett's test hypothesis:
H_0: Correlation matrix is an identity matrix
H_1: Correlation matrix is not an identity matrix
Since P-value (0.000) is less than that of the critical value $\alpha = 0.5$, the test statistics is significant and reject H_0. It can be concluded with 95% confidence that there is an association between variables, hence suitable for the factor analysis.

I. Frequency Analysis for the Satisfaction Level

Respondents who were willing to use the Southern Expressway public transport were questioned and depicts the importance of these factors in relations to expressway public transportation. It can be observed that more respondents (84.4%) mentioned travel time is very important when selecting Expressway public transportation. Apart, they mentioned seat comfortability, cleanliness (interior/exterior), safe driving (53.6%, 59.1% and 69.6% percentages respectively) as the most important factors when selecting Expressway public transportation. Very few of respondents mentioned, any of these factors were not important.

When assessing the factors; mobility, traffic density, passenger queue length, bus speed, bus brand, adequate space on board, bus availability rate, travel schedule flexibility, distance from origin to entrance and distance from exit to destination separately, majority of respondents (45.6%, 57.0%, 59.5%, 46.8%, 33.8%, 46.0%, 38.0%, 42.2%, 43.9%, 42.6% respectively) mentioned as important factors when selecting Expressway public transportation. Significantly 37.1% and 39.2% of respondents were neutral with the importance of distance from origin to entrance and distance from exit destination respectively. Thus, it can be concluded that most of respondents consider these factors either very important or important when selecting Expressway public transportation.

J. Descriptive Statistics Analysis of Dependent Variables

According to descriptive statistics, all variable lies between the range of 3-5 in Likert scale, this also proves that most of

the respondents have mentioned that these factors are either very important or important when travelling in expressway.

TABLE 3
COMMUNALITY TABLE FOR EXPRESSWAY PUBLIC TRANSPORT

Variable	Initial	Extraction
Travel time	1.000	.372
Mobility	1.000	.608
Traffic density	1.000	.736
Passenger queue length	1.000	.639
Bus speed	1.000	.660
Seat comfortability	1.000	.798
Interior/Exterior cleanliness	1.000	.761
Safe driving	1.000	.716
Bus brand	1.000	.588
Adequate space on board	1.000	.789
Bus availability rate	1.000	.720
Travel schedule flexibility	1.000	.661
Distance from origin to expressway entrance	1.000	.747
Distance from expressway exit to destination	1.000	.685

According to the table 3, 79.8% of variance of 'seat comfortability' is explain in this model as the highest while, 37.2% of travel time is explained as the lowest values.

K. Factor Analysis

TABLE 4
TOTAL VARIANCE

	Initial Eigenvalues		
Component	Total	% of Variance	Cumulative %
1	4.943	35.304	35.304
2	1.863	13.308	48.613
3	1.657	11.833	60.446
4	1.018	7.268	67.714
5	.912	6.517	74.231
6	.798	5.698	79.928
7	.678	4.845	84.773
8	.430	3.073	87.846
9	.397	2.833	90.679
10	.384	2.745	93.423
11	.326	2.329	95.753
12	.246	1.755	97.508
13	.189	1.350	98.858
14	.160	1.142	100.00

According to table 4, and considering the initial Eigenvalues there are 04 factors extracted representing a cumulative model variance of 67.71%. This further demonstrates with the scree plot depicted in figure 3.

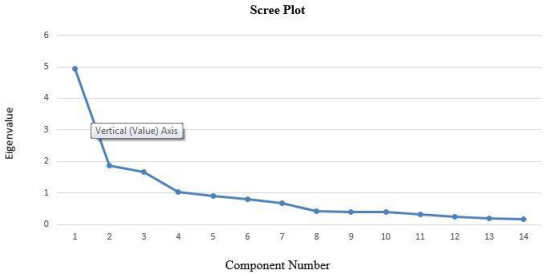

Fig. 3 Scree Plot-Expressway Journey

According to the rotated component matrix and the component score coefficient matrix, the following results obtained:

Factor 01 includes 04 variables and collectively defined as "Passenger requirement – F(a)".

I. Bus speed - j
II. Seat comfortability - k
III. Interior & Exterior cleanliness - l
IV. Safe driving - m

Factor 02 includes 03 variables collectively defined as "Operational factors – F(b)".

I. Travel schedule flexibility - n
II. Distance from origin to Expressway entrance - o
III. Distance from expressway exit to destination - p

Factor 03 includes 04 variables and collectively defined as "Convenience of travel – F(c)".

I. Travel time - q
II. Mobility - r
III. Traffic density - s
IV. Passenger queue length - t

Factor 04 includes 03 variables and collectively defined as "Passenger expectations – F(d)".

I. Bus brand - u
II. Adequate space on board - v
III. Bus availability rate - w

Thus, it is evident that perception on use of expressway depends on passenger requirement, operational factors, convenience of travel and passenger expectations.

F(a) = (0.291) j + (0.319) k + (0.306) l + (0.272) m
F(b) = (0.318) n + (0.407) o + (0.394) p
F(c) = (0.316) q + (0.386) r + (0.398) s + (0.295) t
F(d) = (0.370) u + (0.558) v + (0.475) w

L. Pearson Correlation Coefficient for Extracted Factors

H_0: There is no correlation between the j^{th} factor and the satisfaction level on normal route public transport journey

H_1: There is a correlation between the j^{th} factor and the satisfaction level on Expressway public transport journey
(j = 1 – Passenger requirement, j = 2 – Operational factors, j = 3 – Convenience of travel, j = 4 – Passenger Expectations)

Accordingly, the values significantly depict that there is no correlation between the passenger requirements, convenience of travel and the passenger expectations with the satisfaction level while there having a correlation between the operational factors with the satisfaction level of the expressway public transport.

V. CONCLUSION AND RECCOMENDATIONS

This study aimed to provide a cohesive and detailed assessment of the determinants which affect in Hambantota district public transportation users when selecting a travel route, and two routes as E001 and A02 was compared and studied.

In normal route (A02) journey, nine independent variables have been identified and those variables were extracted under 03 main factors respectively named as: nature of travel, passenger requirements and convenience of travel. By using correlation coefficient, 02 factors separated and identified (nature of travel and passenger requirements) effecting for passenger satisfaction on normal route journey. As per the Expressway Journey Analysis, 04 factors have been identified out of fourteen variables which directly affected to the passenger satisfaction when selecting expressway, namely passenger requirements, operational factors, convenience of travel, passenger expectations. Amongst, passengers were only correlated with the operational factor.

In conclusion, by analysing both normal route (A02) and expressway (E001), it can be stated that the factors named as nature of travel, passenger requirements and operational factors are the highly sensitive factors towards passenger satisfaction. Hence, a slight change in these factors will highly affect towards the passenger satisfaction. To increase the passenger satisfaction and to get more people attracted towards the expressway, the extracted factors could be considered.

It is further recommended, these findings are important when influencing policy makers, related authorities and regulatory bodies (Ministry of Highways, Ports and Shipping, Road Development Authority) to improve the services provided by public transportation in order to increase profit of the expressway by increasing income, and to improve the quality of country's transportation service by addressing customer requirements and finally to expand the capacity of convenience also by avoiding operational losses in order to attract more users to expressway public transportation.

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