A Seminar On

DELAY ANALYSIS OF MOTORIZED THREE-WHEELERS AT ROUNDABOUTS IN URBAN INDIAN CONTEXT

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Introduction:

- In India user tend to choose three-wheelers as one of the pivotal para-transit modes in the urban, suburban as well as rural parts of the country.
- Average traffic growth rate of three-wheelers per year is 7 to 8 percent.
- Analysis of Delay in heterogeneous condition should be done with modal perspective.
- Various vehicular, traffic and environmental characteristics affects Delay and the flow characteristics of stream.

Critical Review:

- The amount of road space required to accommodate existing traffic may be far smaller than is presumed by the current traffic models.
- Delay of Three-wheelers need to analyzed, it being most important paratransit mode in India.
- Delay is influenced not only by travel time and speed but also by a group of auxiliary attributes like roadway geometry, vehicle composition, traffic operational, built- environmental conditions and mostly factors evolving because of presence of three-wheeelrs.

Variable selection using Spearman's Correlation Analysis:

- Provides the strength and direction (negative or positive) of the monotonic relation between two input variables.
- Database of this present research work incorporates both continuous and ordinal values.
- Spearman's Rho (ρ) as shown in equation (1), value is very close to 1 or -1, it implies strong correlation among variables.

$$\rho = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_i (x_i - \bar{x})^2 \sum_i (y_i - \bar{y})^2}} \quad (1)$$

Where, i = Paired score

x = Independent variable

y = Dependent variable

Statistical Modeling Approaches:

Multilinear Regression Analysis:

Equation in general

$$yi = {}_{\circ}+ \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \ldots \beta_p x_p + \epsilon \ldots\ldots (1)$$

Where,

yi = ith sample point of dependent variable

x = ith sample point of p number independent variable

ϵ = error term

$_{\circ}, \beta_1, \ldots \beta_p$ are the regression parameters

p is the number of independent variables and

i is the sample number which varies from 1 to n.

(2)

Stepwise Linear Regression Analysis:

- It works on the principle of minimization of prediction error using ordinary least square (OLS) method.
- The main advantage of this method is that it combines both the linear and non-linear nature of the input variables to develop an efficient predictive model. This method had ability to choose the best predictor variables from a set of independent variables

Study Area:

- Five Indian states namely Odisha (Rourkela), Gujarat (Ahmedabad and Gandhinagar), West Bengal (Bardhaman and Kolakata), Telangana (Hyderabad) and Kerala (Kazikode).

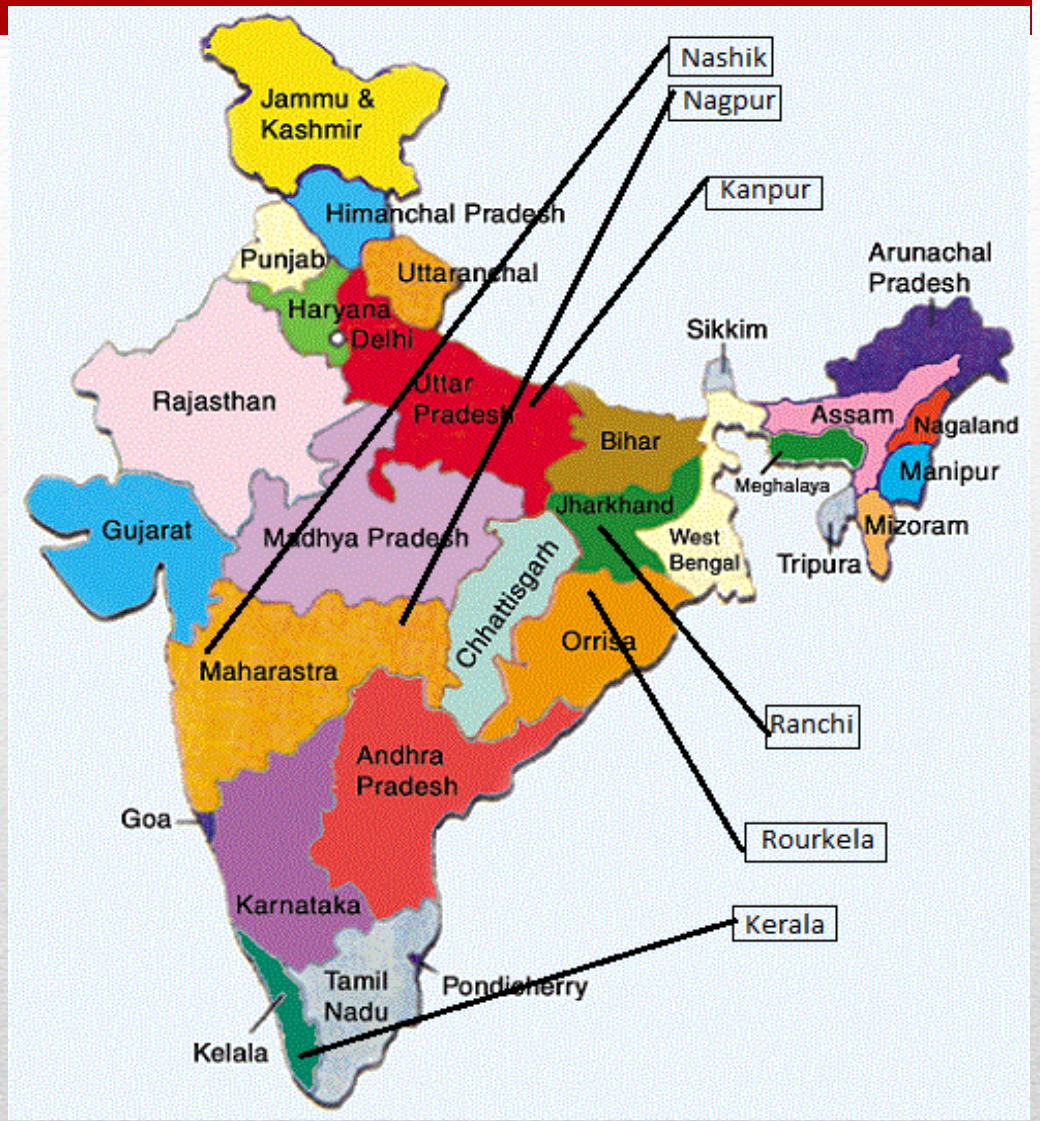

Fig.1:Location of the cities on Indian map where study has been conducted

Data Collection

Geometrical parameters:

- Number of Legs
- Number of Lanes
- Effective road width
- Shy distance
- Direction of Travel
- Presence of Median
- Existence of Camber
- Existence of separate bike lane
- Existence of grade separated sidewalk

Traffic flow parameters

- Peak hour volume for motorized traffic
- Peak hour volume for non-motorized traffic
- On-street pedestrian volume
- Critical gap
- Average speed of vehicle

Results:

Multilinear Regression Analysis:

$Delay$ = 4.403 + 1.574 (RCA) – 2.371(nCirLn) – 0.038(%MTW) - 0.042(%HMW) + 0.059(R-Dia) + 0.119(Wl) + 0.036(Ew) – 0.094(Wnw) + 0.004(CF)…… (1)

Where,
CA = Roadside commercial activity
nCirLn = No of circulating lanes
%MTW = Percentage of motorized two wheeler
%HMV = Percentage of heavy motor vehicles
R-Dia = Dia of central island in m
CF = circulating flow in PCU/hr
Wl = Weaving length in m
Wns = Width of non-weaving section in m
Ew = Entry width in m

Table 1: Analysis of variance of Multilinear Regression Analysis

Model		Sum of Squares	df	Mean square	F	Sig.
1	Regression	946.011	10	94.601	17.107	.00b
	Residual	348.389	63	5.53		
	Total	1294.401	73			
	Dependent variable: Delay					

- The R^2 value of this model is 0.83.

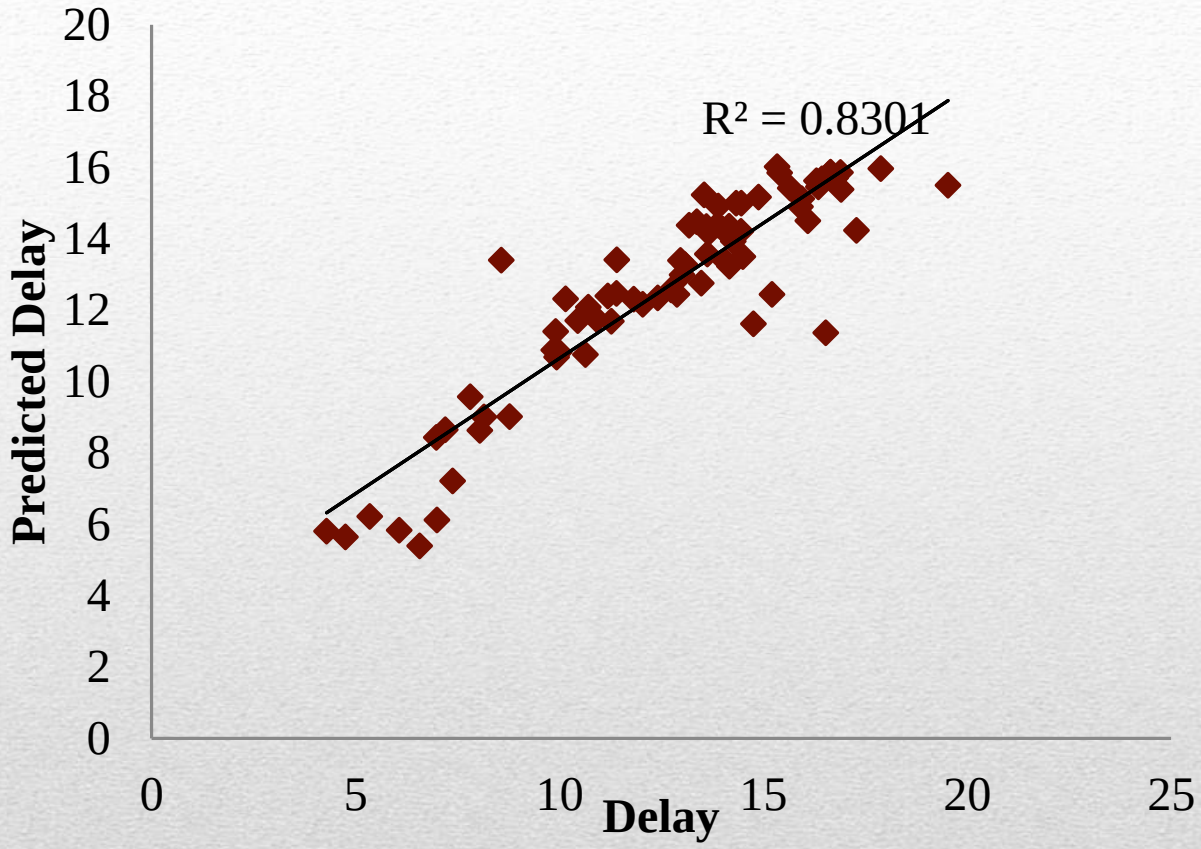

Fig. 2 :between predicted delay and actual delay for multilinear regressionanalysis for Roundabout

Stepwise Regression Analysis modelling approach:

Model Summary of Stepwise Regression is shown in table 2(a) and (b)

Table 2(a): Model Summary of Stepwise Regression for roundabout

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.739	0.546	0.539	2.85781
2	0.817	0.668	0.659	2.46017
3	0.838	0.702	0.689	2.34868
a. Predictors: (Constant), Circulating Flow (qc, PCU/hr)				
b. Predictors: (Constant), Circulating Flow (qc, PCU/hr), Roadside Commercial Activities				
c. Predictors: (Constant), Circulating Flow (qc, PCU/hr), Roadside Commercial Activities, % of Four-wheeler traffic				

Table 2(b): Coefficients of independent variables of Stepwise Regression

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.84	0.905		4.242	0
	Circulating Flow (qc, PCU/hr)	0.004	0	0.739	9.3	0
2	(Constant)	-1.797	1.35		-1.331	0.187
	Circulating Flow (qc, PCU/hr)	0.004	0	0.603	8.212	0
	Roadside Commercial Activities	2.847	0.557	0.375	5.114	0
3	(Constant)	1.665	1.783		0.934	0.353
	Circulating Flow (qc, PCU/hr)	0.004	0	0.631	8.915	0
	Roadside Commercial Activities	1.919	0.626	0.253	3.068	0.003
	% Light Motor Vehicles	-0.088	0.031	-0.217	-2.811	0.006
a. Dependent Variable: Delay						

The plot between predicted delay and actual delay for stepwise regression analysis is shown in figure:3 below.

The final delay equation (2) is given by

$$\boldsymbol{Delay = 1.665 + 0.004(CF) + 1.919(RCA) - 0.088(\%LMW)} \quad (2)$$

Where,
CF= circulating flow in PCU
RCA= Roadside Commercial Activity
% LMV = Percentage of Light Motor Vehicles

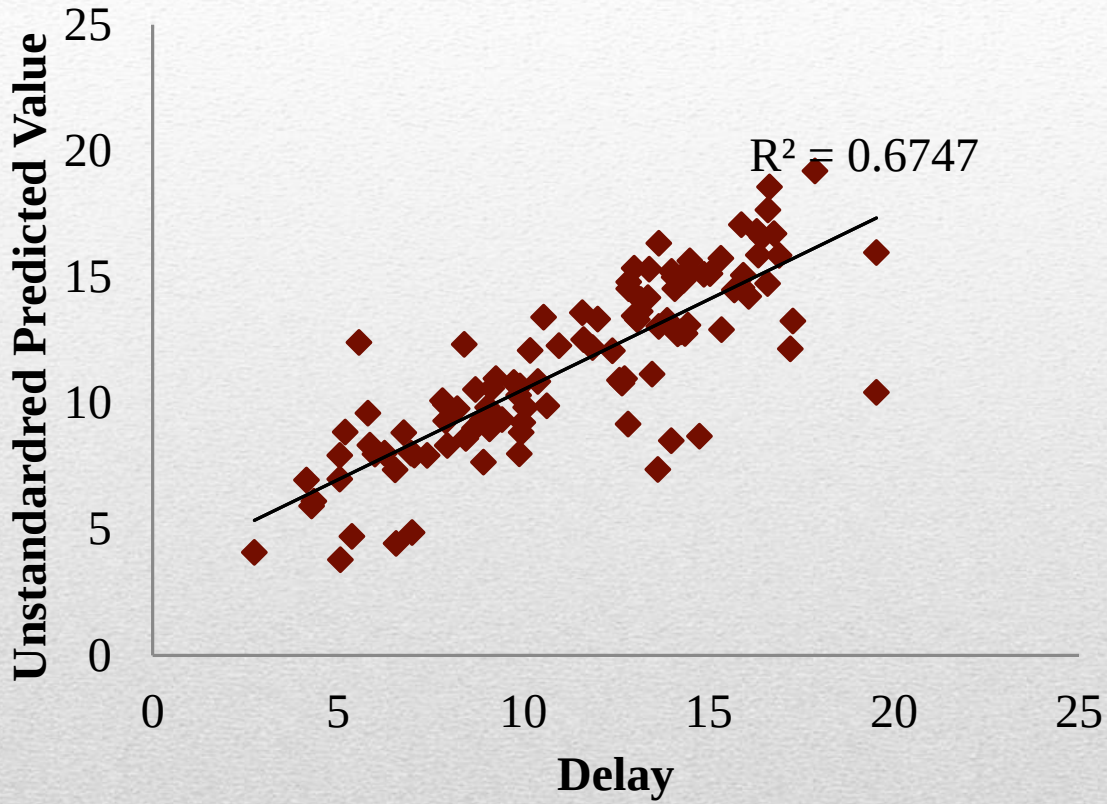

Fig 3: Predicted delay (second) vs actual delay (second) for stepwise regression for roundabout

Summary and conclusion:

- Among both the regression method, Multilinear regression method has given the best results in terms of goodness of fit R^2 value of 0.731 and 0.632 in training and testing data sets respectively.
- And step-wise regression approach provides goodness of fit R2 value of 0.702and 0.568 in training and testing data sets respectively.
- Circulation flow, road side commercial activity and weaving length shows good relation in non-linear function with delay.
- Coefficient of regression establishes from multilinear and stepwise regression is 0.73and 0.70 respectively. From multilinear regression analysis it is cleared that the only circulating flow and road side commercial activities has significance form determination of average three wheeler delay with significance value less than 0.05. Circulating flow, percentage of heavy motor vehicle and road side commercial activities places significant importance in stepwise regression analysis.

THANK YOU