



MASS RAPID TRANSIT SYSTEM – AN EMERGING MODE OF PUBLIC TRANSPORT

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Introduction

Among the various important key inputs necessary for accelerating economic growth or development of any area , one of the main requirement is the improvement of transportation facility. The social transformation taking place in our country in respect of gradual movement of large segment of society from rural areas to urban area necessitates radical and immediate reforms in the transportation sector. The focus shall be on reducing cost of transportation and at the same increasing the facility and convenience in transportation. Over the last few years , new modes of transportation have been introduced for public transport system. The economic benefits arising out of such systems are manifold. For example, Delhi has been blessed with Metro rail system which is providing services to very large segment of society at reasonable cost, good hygienic environment, safe travelling, etc. Encouraged by the performance of Metro rail system in Delhi, gradually its presence is being expanded in other adjacent areas referred as NCR areas. The connectivity of one area with the other through this kind of transportation gradually brings both the areas at par in terms of all kind of services besides facilitating the life of millions of people who could not afford to live in cities like Delhi on account of higher rental charges but had to travel on daily basis for their job purpose. The mass rapid transit system is the need of the hours as it offers following benefits:

- a) It allows larger number of people to travel from one area to the other area in the predetermined time.
- b) Nowadays, pollution has become main concern for the Government as different ways are being explored to reduce the pollution problems. The provision of MRTS as means of public transport offers great opportunity in combating the pollution issues.
- c) The radical change in the social system has skewed the mindset of general public towards availing hygienic environment in all respects. In contrast to buses being used for public transport, MRTS offers clean and hygienic mode of transport for commuting from place of residence to their place of work.
- d) The security issues are also addressed to in case of MRTS to a large extent in comparison to other modes of transport.
- e) The present life style of upcoming generation assigns lot of value to time. The total travelling time including waiting time has been considerably reduced in case of MRTS as compared to other modes of transportation, particularly, road transport where chances of delay/time loss are very high due to frequent traffic jams.
- f) In the light of various services being provided by MRTS, the cost of travelling per kilometer appears to be economical in comparison various other modes of public transport.

Realizing the importance of transportation in transformation of social sector, Government under its twelfth five year plans has allocated funds for different type of transportation system such as Railway, Road, MRTS, Ports, etc. An analysis of the same reveals that though in absolute terms, the amount allocated towards MRTS appear to be relatively less than other modes, but the subsequent increase over five year period in percentage term is much larger as compared to other modes of transports. This clearly reflects success of MRTS over other means of transport. With the Government's initiative in promoting MRTS in comparison to other modes at the background, the present study aims to test statistically, if there is any difference in approach with regard to efforts of Government in focusing more emphasis on setting up MRTS under its proposed 12th five year plan. The study defines following null hypothesis :

Null Hypothesis : There is no significant difference between percentage increase in fund allocation for MRTS and other means of transport under 12th five year plan .

Research Methodology : In order to test the above hypothesis, the proposed plan expenditure for different mode of transport under 12th five year plan have been referred, as shown below in table 1.

Year	Road and Bridges	Railways	MRTS	Airports	Ports
2012-13	150466	64713	13555	7691	18661
2013-14	164490	78570	17148	10716	25537
2014-15	180415	96884	22298	15233	35260
2015-16	198166	121699	29836	21959	49066
2016-17	221000	157355	41322	32116	69256

Table 1: Amount (in Rs crores) allocated under 12th Five year Plan for various modes of transport.(Source: Planning Commission Report 2012-17)

In absolute terms, the amount allocated for Road and bridges appears to be relatively larger than other modes of transportation but the percentage increase in amount of allocated expenditure for different modes over each subsequent year shows greater thrust towards MRTS , Airports and Ports as can be observed from the percentage increase given below in table 2.

Year	Road and Bridges	Railways	MRTS	Airports	Ports
2012-13					
2013-14	9.320378026	21.41301	26.50682	39.33169	36.8469
2014-15	9.681439601	23.30915	30.03266	42.15192	38.07417
2015-16	9.838982346	25.6131	33.80572	44.15414	39.15485
2016-17	11.52266282	29.29852	38.49712	46.25438	41.14866

Table 2: Percentage increase in Amount allocated for various modes of transport

The data given in table 2 has been used to test the hypothesis under study with the help of ANOVA techniques.

Analysis of Data

The assumption of normality of data has been examined using one sample Kolmogorov-Smirnov test (K-S test) using SPSS. The result of the output are summarized below in table 3.

One-Sample Kolmogorov-Smirnov Test		
N		Mode
20	Mean	29.797814
	Normal Parameters ^{a,b}	

	Std. Deviation	12.2348742
Most Extreme Differences	Absolute	.168
	Positive	.132
	Negative	-.168
Kolmogorov-Smirnov Z		.750
Asymp. Sig. (2-tailed)		.627
a. Test distribution is Normal.		
b. Calculated from data.		

Table3: SPSS output of One sample Kolmogorov – Smirnov Test

As can be observed from above calculation , p-value (Asymp. Sig) is greater than .05 , therefore, we can concluded that our data complies with the condition of normality . In order to test the homogeneity of variances among return , Levene statistic has been calculated using SPSS , as shown below in table 4:

Test of Homogeneity of Variances			
Mode			
Levene Statistic	df1	df2	Sig.
2.563	4	15	.081

Table4: SPSS output of Levene statistic test

Since the Levene statistic is greater than 0.05 , therefore we can conclude that the variability among various figures under study are significantly different. This makes necessary to further employ usage of ANOVA test to find out if the percentage increase for different mode of transport are significantly different or not. The output obtained using SPSS on the data given under table 1 , with regard to ANOVA test, is given below in table 5.

ANOVA					
Mode					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2691.310	4	672.828	66.032	.000
Within Groups	152.840	15	10.189		
Total	2844.151	19			

Table 5: SPSS output of ANOVA test

It can be observed from the output that p value is less than .05 ,it implies our null hypothesis is rejected which implies there is significant difference between proposed percentage increase among different mode of transports. The difference among the returns being observed cannot be concluded to have occurred by chance and they can be interpreted as statistically significant differences.

Post Hoc Test and Analysis

The result obtained above shows that there is significant different among proposed percentage increase in expenditure during the period under study. In order to ascertain difference of each mode vis-à-vis other modes under study, multiple comparison test has been conducted and its output is given in table 6.

Multiple Comparisons						
Dependent Variable: Mode						
Tukey HSD						
(I) Type		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Roads and bridges	Railways	14.8175793*	2.2571398	.000	-21.787457	-7.847702
	MRTS	22.1197143*	2.2571398	.000	29.089592	15.149837
	Airports	32.8821668*	2.2571398	.000	39.852044	25.912289
	Ports	28.7152793*	2.2571398	.000	35.685157	21.745402
	Railways	14.8175793*	2.2571398	.000	7.847702	21.787457
Railways	Roads and bridges	-7.3021350*	2.2571398	.038	14.272012	-.332258
	MRTS	18.0645875*	2.2571398	.000	25.034465	11.094710
	Airports	13.8977000*	2.2571398	.000	20.867577	-6.927823
	Ports	22.1197143*	2.2571398	.000	15.149837	29.089592
	MRTS	7.3021350*	2.2571398	.038	.332258	14.272012
MRTS	Roads and bridges	10.7624525*	2.2571398	.002	17.732330	-3.792575
	Railways	10.7624525*	2.2571398	.002	17.732330	-3.792575
	Airports	10.7624525*	2.2571398	.002	17.732330	-3.792575
	Ports	-6.5955650	2.2571398	.068	13.565442	.374312
	Railways	-6.5955650	2.2571398	.068	13.565442	.374312

Airports	Roads and bridges	32.8821668*	2.2571398	.000	25.912289	39.852044
	Railways	18.0645875*	2.2571398	.000	11.094710	25.034465
	MRTS	10.7624525*	2.2571398	.002	3.792575	17.732330
	Ports	4.1668875	2.2571398	.385	-2.802990	11.136765
Ports	Roads and bridges	28.7152793*	2.2571398	.000	21.745402	35.685157
	Railways	13.8977000*	2.2571398	.000	6.927823	20.867577
	MRTS	6.5955650	2.2571398	.068	-3.74312	13.565442
	Airports	-4.1668875	2.2571398	.385	-	2.802990
						11.136765

*. The mean difference is significant at the 0.05 level.

Table 6: SPSS output of Multiple comparison test

As can be observed from the above table, the values under Road and bridges are significantly different from all the other modes of transport under study. This implies that the focus of Government on Road and bridges in the coming years would be relatively less as compared to development of other modes such as MRTS, Airports and Ports. The values of MRTS modes are significantly different from all other modes except Ports, where the value has been found to be 0.068 implying there is no significant difference at 5% significance level. The same behavior of the percentage increase in expenditure over different modes of transportation is also visible from the mean plot of the returns shown in figure 1

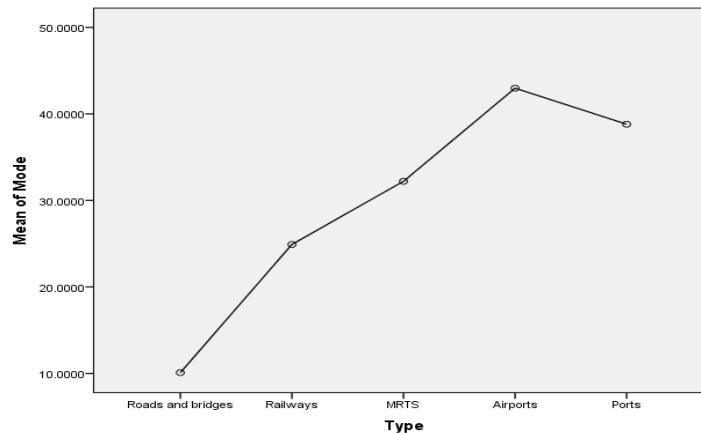


Figure 1: Mean Plot

Another observation made from the mean plot is that the mean percentage increase in plan expenditure for modes – MRTS, Airports and Ports is significantly higher level than Roads and

bridges and Railways. This clearly demonstrate the strength of MRTS in emerging as important means of transport for public transport and shifting of focus of the Government from development of Roads ,bridges and railways to Mass Rapid Transit system.

Conclusion and Suggestion

The above analysis statistically proves the increased attention of Government in development of MRTS on account of various benefits and advantages it command over other modes of existing public transport. The increased allocation of budget towards MRTS clearly signifies that it will be gradually having its presence in many urban and semi urban areas. However, the Government need to accordingly develop master plan of its new cities so that the problem being faced nowadays can be averted in future. In case of urban mass rapid transit system (MRTS), there are a number of options which depend on the current and future needs, geographical factors, funds available, etc. Metros can be underground, elevated or at surface. However, the cost and time involve in their construction varies considerably as can be observed from the table 7.

S.No.	Mode of Transport	Capacity (PHPD*)	Project time estimate	Approx. Cost (Rs cr. Per km)	Approx. user fee/km (Rs)
1	Metro-Underground	75000	5-6 years	500	3.50
2	Metro-Elevated	75000	4-5 years	250	3.50
3	Metro-Surface	75000	4-5 years	100	2.50
4	Monorail	25000	2 years	125	3.00

Table 7: Comparative analysis of Metro project at different levels

**PHPD: Per hour per direction at three- minute frequency*

(Source: **The Economic Times on 23 Feb,2012**)

As can be observed from the above table, the cost of construction in case of Metro rail on surface is significantly lower than Metro at elevated and surface level therefore the preference shall be given for this option and it will enable the government to provide more coverage at low budget. However, the main constraint being foreseen in this case is the availability of land. It is therefore essential for the Government to ensure availability of enough land space in their proposed master plans for the areas intended to be developed in future.

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