

# INFLUENCE OF PARAMETERS IN DEMAND RESPONSIVE TRANSPORT SERVICE

## 1. Introduction

Demand Responsive Transportation (DRT) provides a flexible transport service (time of operation and route) for sparsely inhabited areas where passenger demand is low and the other modes of transport are inefficient to cater the demand. Successful operation of a DRT system depends on identifying and optimizing the influential parameters of it and incorporating efficient communication between passenger and DRT control operations. The latter is viable with the recent advancements in electronics and communication technologies (Victor Pillac, 2013), while the former remains an area to explore.

Typically, the decision making parameters in a DRT system are travel time, travel cost, route, waiting time, accessibility, comfort of the service, fleet size, safety and punctuality. (Mahyar Amirgholy, 2015). By concurrently optimizing the above stated parameters, a flexible schedule of operation is designed. It is therefore, identifying the influential parameters and exploring their interrelationship is inevitable for a better DRT system design (R. Gomes, 2015).

Literatures have ample review on DRT system design and its solution algorithms (Chevrier, Liefoghe, Jourdan, & Dhaenens, 2012; M. E. Bruni, 2014; Victor Pillac, 2013). And also the feasibility of DRT system operation (Davison, Enoch, Ryley, Quddus, & Wang, 2014; R. Gomes, 2015). However, identifying influential parameters and their correlation remain less explored. This study intends to identify the influential parameters of a DRT system and their interrelationships.

## 2. Methodology

From a thorough literature survey and preliminary inquiries with the commuters and local bus service providers, we identified 10 potential parameters that could possibly influence a DRT system design which include age, education, income, vehicle ownership, public transport usage frequency, travel mode, places often visited, access/egress mode, distance to nearest public transport and comfort level.

In Kilinochchi, a sparsely populated district with average population density 88 people/ km<sup>2</sup>, 2 km each side of the 12 km stretch of A9 road between Paranthan and Murukandy, was considered for analysis (Figure 1). Presently, this area is served by local bus service from 6 am to 7 pm daily, buses operating every ten minutes. In addition, long-distanced through bus services are operating on this road, however,

they seldom pick passengers for short trips. The average income of the area is below 10,000 Rs. Para-transit service in this region is almost nil.



Figure 1 Study area and details of questionnaire surveyed locations

Through a questionnaire survey, 484 inhabitants from the area (10% of the population) were randomly inquired about the following: Personal details; Vehicle ownership; Public transport usage; Travel mode within Kilinochchi; Frequently visiting places; Utility of available public transport; and Opinion on introducing DRT service (willingness for extra cost, moderate waiting time and access to state-of-the-art communication).

Collected questionnaire data was fed into Statistical Package for the Social Sciences (SPSS), and Pearson correlation value and 5% confidence level values were

obtained from the analysis. The identified 10 possible DRT system influential parameters were checked for correlation against the DRT variables. The analysis was carried out under two major categories as follows

1. Distance from the nearest public transport (in m)
  - a. < 100
  - b. 100 – 500
  - c. 500 – 1,000
  - d. > 1,000
2. Monthly income (in Rs)
  - a. < 5,000
  - b. 5,000 – 15,000
  - c. 15,000 – 30,000
  - d. > 30,000

### 3. Results

The responses received under category 1a. showed no correlation which indicates that the people who have easy access to the present transport are not willing to switch to DRT. Similarly, the responses received under category 2d. revealed no correlation because most of the respondents have private vehicles and satisfied using it rather than switching to DRT. The correlations calculated from the responses under the other categories are tabulated in table 1a and 1b, and the summary of findings in table 2.

**Table 1a: Correlation between potential DRT system influential parameters and DRT system representation variables - categorized based on the distance from the nearest public transport**

		Monthly Income								
		< 5,000 Rs.			5,000 – 15,000 Rs.			15,000 – 30,000 Rs.		
		Willingness to pay extra cost	Moderate waiting time	Access to state-of-the-art communication	Willingness to pay extra cost	Moderate waiting time	Access to state-of-the-art communication	Willingness to pay extra cost	Moderate waiting time	Access to state-of-the-art communication
Age	05 - 40	0.25	0.41	0.31	0.16	0.20	0.29	0.15	0.15	0.45
	41 - 60	0.16	0.19	0.15	0.28	0.37	0.18	0.00	0.34	0.25
Education	≤ O/L	0.19	0.20	0.28	0.18	0.28	0.30	0.23	0.02	0.12
	≥ A/L	0.30	0.27	0.13	0.03	0.05	0.08	0.34	0.08	0.26
Monthly Income		0.15	0.25	0.31	0.21	0.42	0.16	0.53	-0.29	0.45
Vehicle Ownership	No Vehicle	0.25	0.13	0.23	0.32	0.35	0.29	-0.16	0.14	0.09
	Cycle/ M. cycle/ 3 Wheeler	0.33	0.18	0.22	0.16	0.19	0.18	0.08	0.06	0.16
Public Transport Usage Frequency		0.27	0.20	0.19	0.20	0.24	0.27	0.20	0.07	0.19
Mode of Travel within Kilinochchi	Own	0.26	0.24	0.25	0.10	0.14	0.32	-0.25	-0.11	0.22
	Others	0.20	0.15	0.24	0.25	0.21	0.19	0.39	0.12	0.09
Places that they Frequently Visit	Job/ Education	0.28	0.31	0.20	0.19	0.00	0.22	0.25	0.00	0.18
	Others	0.09	0.20	0.23	0.11	0.23	0.15	0.09	0.15	0.19
Access/ Egress Mode	Walk	0.21	0.15	0.31	0.35	0.52	0.25	0.19	0.29	0.32
	Others	0.21	0.27	0.22	0.19	0.14	0.29	0.08	0.08	0.15
Distance from the Nearest Public Transport Service		0.21	0.25	0.19	0.52	0.40	0.24	0.14	0.44	0.11
Comfort Level		0.09	0.11	0.12	0.22	0.18	0.20	0.15	0.20	0.15

**Table 1b: Correlation between potential DRT system influential parameters and DRT system representation variables - categorized based on monthly income of the respondents**

		Monthly Income								
		≤ 5,000 Rs.			5,000 – 15,000 Rs.			15,000 – 30,000 Rs.		
		Willingness to pay extra cost	Moderate waiting time	Access to state-of-the-art communication	Willingness to pay extra cost	Moderate waiting time	Access to state-of-the-art communication	Willingness to pay extra cost	Moderate waiting time	Access to state-of-the-art communication
Age	05 - 40	0.25	0.41	0.31	0.16	0.20	0.29	0.15	0.15	0.45
	41 - 60	0.16	0.19	0.15	0.28	0.37	0.18	0.00	0.34	0.25
Education	≤ O/L	0.19	0.20	0.28	0.18	0.28	0.30	0.23	0.02	0.12
	≥ A/L	0.30	0.27	0.13	0.03	0.05	0.08	0.34	0.08	0.26
Monthly Income		0.15	0.25	0.31	0.21	0.42	0.16	0.53	-0.29	0.45
Vehicle Ownership	No Vehicle	0.25	0.13	0.23	0.32	0.35	0.29	-0.16	0.14	0.09
	Cycle/ M. cycle/ 3 Wheeler	0.33	0.18	0.22	0.16	0.19	0.18	0.08	0.06	0.16
Public Transport Usage Frequency		0.27	0.20	0.19	0.20	0.24	0.27	0.20	0.07	0.19
Mode of Travel within Kilinochchi	Own	0.26	0.24	0.25	0.10	0.14	0.32	-0.25	-0.11	0.22
	Others	0.20	0.15	0.24	0.25	0.21	0.19	0.39	0.12	0.09
Places that they Frequently Visit	Job/ Education	0.28	0.31	0.20	0.19	0.00	0.22	0.25	0.00	0.18
	Others	0.09	0.20	0.23	0.11	0.23	0.15	0.09	0.15	0.19
Access/ Egress Mode	Walk	0.21	0.15	0.31	0.35	0.52	0.25	0.19	0.29	0.32
	Others	0.21	0.27	0.22	0.19	0.14	0.29	0.08	0.08	0.15
Distance from the Nearest Public Transport Service		0.21	0.25	0.19	0.52	0.40	0.24	0.14	0.44	0.11
Comfort Level		0.09	0.11	0.12	0.22	0.18	0.20	0.15	0.20	0.15

**Table 2: Summary of correlation between potential DRT system influential parameters and DRT system representation variables**

DRT variable	Correlation
Age	Weak
Education	Weak
Monthly Income	Moderate
Vehicle Ownership	Weak
Public Transport Usage Frequency	No
Mode of Travel within Kilinochchi	Weak - Moderate
Places that they Frequently Visit	Weak
Access/ Egress Mode	Moderate
Distance from the Nearest Public Transport Service	Moderate
Comfort Level	No

Correlation: < 0.3 – Weak; 0.3 – 0.6 –Moderate; > 0.6 - Strong

#### 4. Conclusion/Recommendation

The study reveals that Monthly Income, Access/ Egress Mode, Distance from the Nearest Public Transport Service and Mode of travel have moderate correlation with DRT system which could be considered as influential variables of the DRT system. Vehicle ownership and comfort level did not show any correlation because the inhabitants who own vehicles may be reluctant to switch to another transport system. And, during the questionnaire, we observed that the people wanted an advanced transportation service, however, suspect the possibility of getting a better transport service in the near future.

#### 5. References

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