Modeling trip attributes and feasibility study of co-ordinated bus for school trips of children

S. M. Dave\textsuperscript{a}, D. P. Raykundaliyab, S. N. Shah\textsuperscript{a,*}

\textsuperscript{a}Department of Civil Engineering, Faculty of Technology & Engineering, M. S. University, Baroda - 390001, Gujarat, India
\textsuperscript{b}Department of Statistics, S. P. University, Vallabh Vidyanagar - 388120, Gujarat, India

Abstract

This paper reports the results of a self-reporting survey (N = 821) that was conducted to examine the travel behaviour of primary school children in the study area of Vadodara city. In many Indian cities including metropolis, auto-rickshaw and van are the main modes opted by the parents for the school trips of children. The issues related to driver’s behaviour, safety, comfort and over occupancy of children in vehicles were analysed regarding these current travel modes. An alternative in the form of proposed co-ordinated bus mode providing service to two or more schools and working simultaneously was offered to the school children and the response to this service was modelled by using logit models. The survey result indicates the complaints of more than 60\% respondents for the current travel modes. Most effective reasons for choosing the current travel modes of auto-rickshaw and van are door to door service (>50\%) and regularity of service (>40\%). As about 83\% respondents agreed for decision to travel in co-ordinated bus, so this indicates higher probability regarding acceptance of bus service for school trips. Family income and fare relationship seems to be significant for above response. The probability of shifting to co-ordinated bus mode increases if reductions in travel distance and cost can be achieved. Also the significant parameters are age of child, number of persons in family, expected walk time, number of employed persons in family and car ownership in family at 90\% confidence level. Bus routes and the number of buses have been estimated based on the study. The proposed co-ordinated bus service is found to be economically viable.

Keywords: Children; Travel behaviour; Mode choice; Current travel modes; Co-ordinated bus; Logit model

1. Introduction

Understanding the thoughts of contemporary children and parents about travel and their opinions on different travel modes of transport may provide important answers for policy-makers on how to respond to current and

* Corresponding author. Tel.: +91-0265-2434188 ; fax: +91-0265-2423898
E-mail address: saurabh_shah1911@yahoo.co.in
future transport needs of children. In most of the urban trip generation scenario, school trips share secondary contribution after the work trips. In many Indian cities including metropolis, auto-rickshaw and van are the main modes opted by the parents for school trips of children. There are various issues related to driver’s behaviour, safety, comfort and over occupancy of children regarding these current travel modes. Traffic blocks especially at the entrances of school and congestion by illegal parking of vehicles during peak hours are the other problems due to van and auto-rickshaw.

![Fig. 1. Current scenario for travel mode; (a) auto-rickshaw, (b) van](image)

Because of non-availability of the school bus facility for many primary school children, the parents have to resort to other service providers or they themselves have to spare time for school trips of their children. There is necessity to change this current scenario and to find the satisfactory solution for travel modes of school trips. An alternative in the form of co-ordinated bus providing service to two or more schools and working simultaneously was offered to school children and the response to this service was modelled by using logistic regression technique.

1.1 Previous research

Ewing, Schroer and Greene (2004) concluded that students with shorter walk or bike times to school proved significantly more likely to walk or bike, students traveling through areas with sidewalks on main roads were also more likely to walk, school enrollment was not significant after controlling for travel time between home and school, larger schools may draw students from larger areas and thereby indirectly affect mode choices, school size does not appear to have a direct effect on mode choices and land use variables such as density and mix also were not significant.

Merom, Tudor- Locke, Bauman and Rissel (2006) examined the frequency, duration and correlates of school active commuting for primary school children. The research revealed that walking/cycling -only and in combination with bus/car were of short duration (median 7 or 4 min, respectively) and their frequency dropped within a short distance (>0.75 km) from school. Apart from distance, child’s age, school affiliation and perceived safety, regular walking/cycling was associated with parents’ travel mode to work and with father taking the child to school. Also frequent walking/cycling was associated with child’s level of independence and the perceived benefits of active commuting.

The analysis by Emond and Handy (2012) points to individual, social-environment and physical-environment factors as important in explaining bicycling to school for high school students. Parental encouragement and student’s comfort with bicycling are key factors, and perceived distance is more strongly associated with bicycling than actual distance. These results suggest the need for multi-pronged efforts to increase bicycling among high school students. The significance of bicycling was much greater for students who agreed that their parents encourage them to bicycle.

Sidharthan, Bhat, Pendyala, and Goulias (2011) have suggested that public policy programs aimed at enhancing the use of bicycle and walk modes may have a greater impact if directed toward the local
neighborhood level as opposed to a more diffuse regional level. It was found that the spatial correlation, arising from interactions among households that are geographically clustered, is statistically significant.

The study results by McDonald (2008) from a binary logit model show that the commute patterns of the mother is significantly associated with walking and biking to school for children aged 5–14. He has also suggested that household interactions are important because children make nearly half of their school trips with a family member and policymakers may therefore want to create programs that allow parents to share chaperoning responsibilities for the school trip to address parental time constraints.

The results by Roya Shokoohi, Noor Rosly Hanif and Melasutra Md Dali (2012) reveal that parents and children with negative perceptions of neighbourhood safety tended to use motor vehicles or to escort their children while walking to and from school. The results also reveal that low-income children had a higher rate of walking to and from school, because they would like to avoid travel costs. The findings highlighted although children’s travel mode to school varied across different areas, parental perception of safety in the neighbourhood did not vary within different income groups.

The study results by Mark P. DE GUZMAN and Crispin Emmanuel DIAZ (2005) show that a program of ride-sharing appears viable and improvement in public transport system is needed for the traffic situation in Metro Manila. The study explored the economics of carpooling with respect to the nature of participation (whether they would participate as a donor-allow other people to share in the use of their vehicle, or as passengers-ride share with other car owners, for a fee.).

2. Study area and data analysis

Vadodara, formerly known as Baroda, is the third largest and most populated city in the Indian state of Gujarat, after Ahmedabad and Surat. Vadodara is one of four cities in the state with a population of over 1 million. There are 410 primary schools with total 181815 students in Vadodara city of Gujarat state. Total six schools were selected in Vadodara city for study in such a way that the distance between them is in the vicinity of 1.0–1.5 kilometres. The school bus service is not provided to the children of selected schools in the study area at present. A self-reporting survey (N = 821) was conducted to examine the travel behaviour of primary school children in the study area. The respondents have been surveyed by means of Quota Sampling. The survey questionnaire was structured in two parts. The first contained questions on household and socio-economic information. The second part was on the travel information for school trip and this part also asked the respondents to consider policy tools in choosing the co-ordinated bus mode. The pilot survey of one hundred respondents was conducted to finalise the survey questionnaire. From table 1 it is indicated that S1 to S4 schools are of morning timing but S5 and S6 schools are of after-noon timing.

Table 1. Selected primary schools for survey

| School no. | Name of school with address | Timings of school | Standard of students | No. of students surveyed |
|------------|-----------------------------|-------------------|----------------------|--------------------------|
| S1         | Bright School, VIP Road     | 7:25 To 12:30     | V, VI, VII           | 150                      |
| S2         | Bright School, Ambalal Park, Karelibaug | 7:25 To 12:30 | VII, VIII           | 102                      |
| S3         | Vidhya Mandir School, Near Kishan Wadi, Harni -Warasia Road | 7:20 To 12:30 | I, II, III, IV       | 87                       |
| S4         | Shree Jalaram School, Near Sadhana nagar, Karelibaug | 7:30 To 12:30 | I, II, III, IV, V, VI, VII, VIII | 144                      |
| S5         | Ambe School , VIP Road      | 12:20 To 5:20     | I, II, III, IV, V, VI, VII, VIII | 200                      |
| S6         | Saradar Vinay Mandir School, Near Sadhana nagar, Karelibaug | 12:15 To 5:15 | III, V, VI, VII, VIII | 138                      |
| **Total**  |                             |                   |                      | **821**                  |
The proportions for current travel modes of auto-rickshaw and van are about 44.09 % and 40.80 % respectively in the survey data. Gender for children was categorized and its proportions are 58.34 % and 41.66 % for boys and girls respectively. Monthly family income (`) was divided into six categories starting with first category of less than ` 20000 to last category of greater than ` 60000. The proportion decreased with higher category. The proportion of employment of child’s mother in family is 24.60 %. The proportions for one employed person in family, two employed persons in family and three employed persons in family are 63.22 %, 29.84 % and 5.12 % respectively. Age wise distribution of sample indicates that children with age of 12 years are in highest proportion of travellers. In age group, more than 50 % children are belonging to 10-12 years but more than 20 % children are belonging to 7-9 years and 13-15 years. The proportion for car ownership in family is 29.60 %. The proportions for one number of two-wheeler ownership in family, two numbers of two-wheeler ownership in family and no ownership of two-wheeler in family are 61.63 %, 21.07 % and 10.23 % respectively. The proportions are 48.23 %, 40.19 % and 10.00 % for no ownership of bicycle in family, one number of bicycle ownership in family and two numbers of bicycle ownership in family respectively. The complaints for the current travel modes were categorized as congestion, harassment from others, safety, seating arrangement and comfort level. The survey result indicates the complaints by 61.60 % and 65.70 % respondents for the current travel mode auto-rickshaw and van respectively. It is observed that 80 % of the respondents have objection to over occupancy of children in current travel modes and nearly 40 % of the respondents have dissatisfaction with driver’s behaviour. The reasons for choosing the current travel mode were categorized as comfort, convenience, safety, regularity of service, cheapness, reliability of service and door to door service. Most effective reasons for choosing the current travel modes of auto-rickshaw and van are door to door service (> 50 %) and regularity of service (> 40 %). Average trip length is 2.5 km (maximum 10 km) and 4.5 km (maximum 22 km) for auto-rickshaw and van modes respectively.
3. Analysis of co-ordinated bus service

An attempt is made through co-ordinated bus mode offering service for the school trips of children to respond to transport needs of children. As about 83% respondents agreed for decision to travel in co-ordinated bus, so this indicates higher probability regarding acceptance of this bus service for school trips. Nearly 70% respondents have given positive response regarding agreement to allow children from other schools to use this bus service. The response about expected maximum values for different bus transport parameters (walk time from home up to the pickup point, waiting time at the pickup point, increase in in-vehicle time compared to current travel mode and departure time earlier compared to current travel mode) indicates that expected maximum time of the said parameters is significant at 5 minutes (>30%) and 10 minutes (>20%) for co-ordinated bus mode. Fig. 4 indicates that the response for ‘Can’t Say’ choice in the given options is from 15% to 20% with increasing order from option 1 to option 4. The statistical analysis is done in SPSS 20.0 for the policy regarding decision to travel in co-ordinated bus.

![Policy Regarding Decision to Travel in Co-ordinated Bus](image)

| Option 1: | Option 2: | Option 3: | Option 4: |
|----------|----------|----------|----------|
| (WD (km) 0.2-0.6, WT (min.) 5-10, IVT (min.) increases by 5-10, DT (min.) earlier by 5-10, Fare remains same) | (WD (km) 0.2-0.6, WT (min.) 2-5, IVT (min.) remains same, DT (min.) earlier by 5-10, Fare increases by 10%) | (WD (km) 0.7-1.1, WT (min.) 5-10, IVT (min.) increases by 5-10, DT (min.) earlier by 10-15, Fare reduces by 15%) | (WD (km) 0.7-1.1, WT (min.) 2-5, IVT (min.) increases by 2-5, DT (min.) earlier by 10-15, Fare remains same) |

1. No  
2. Yes  
3. Can’t Say

WD: Walking distance from home to pick-up point  
WT: Waiting time at the pick-up point  
IVT: In-vehicle travel time  
DT: Departure time from home

Here; IVT, DT and Fare parameters are suggested with reference to current travel mode of children.

Fig. 3. Policy regarding decision to travel in co-ordinated bus

![Decision to travel in co-ordinated bus for option 1 of the policy](image)

![Decision to travel in co-ordinated bus for option 2 of the policy](image)
3.1 Logistic regression analysis

The main objective of the analysis is to study the effect of policy tools on mode shift utility values of a proposed mode. Maximum Likelihood (ML) method is adopted for estimation of binary logit models. To construct the models, only two choices (‘No’ and ‘Yes’) are considered for the options in policy regarding decision to travel in co-ordinated bus. The cases concerned to ‘Can’t Say’ choice are removed from the list because they are not concerned with exact decision. The models for ‘Yes’ choice are developed with reference to ‘No’ choice. The variables included in the analysis are age and gender of child, household size and employment, monthly family income, vehicle ownership in family, travel distance, travel time, travel cost, distance from home up to the main road, expected walk time, expected waiting time, expected increase in in-vehicle travel time compared to current travel mode and expected earlier departure time compared to current travel mode. Solely car ownership in family is found significant in the analysis but bicycle and two-wheeler ownership in family are found insignificant. Only the significant variables are listed in tables at 90 % confidence level. The inclusion and exclusion of the variables are dependent on their significance test. Validation of the model results is done by unselected cases out of total number of observations in the analysis. The significant variables are age of child, number of persons in family, expected walk time, monthly family income, number of employed persons in family, travel distance, travel cost and car ownership in family at 90 % confidence level. The constant term indicates its positive impact for all four options in the utility functions. The table numbers from 2 to 5 represent the logit models for the policy regarding decision to travel in co-ordinated bus mode. It is observed that the models developed are valid and statistical parameters related to models for all the options of the policy are satisfactory and acceptable.
### Table 2. Binary logit model for option 1 of the policy

| Variable Name          | Coeff. | Wald    | Sig. | Odds ratio |
|------------------------|--------|---------|------|------------|
| Persons in Family      | -.158  | 5.978   | .014 | .854       |
| Travel Cost            | -.002  | 6.623   | .010 | .998       |
| Expected Departure Time| .048   | 3.568   | .068 | 1.050      |
| Age of child           | -.089  | 2.792   | .095 | .915       |
| Constant               | 3.359  | 19.979  | .000 | 28.748     |
| Chi-square             | 1.679  | (Sig.: .989) |
| Cox & Snell R²         | .038   |         |      |            |
| Nagelkerke R²          | .059   |         |      |            |
| Valid N                | 484    | (Out of total: 690) |
| Classification (%)     | 80.0   |         |      |            |

#### Notes
- Coefficient
- Significance value
- Reference category

### Table 3. Binary logit model for option 2 of the policy

| Variable Name          | Coeff. | Wald    | Sig. | Odds ratio |
|------------------------|--------|---------|------|------------|
| Persons in Family      | -.150  | 5.565   | .018 | .861       |
| Age of Child           | -.106  | 5.060   | .024 | .899       |
| Monthly Income (≤ 20,000) | 23.452 | .000   |      |            |
| Monthly Income (20,000 ≤ 30,000) | .810   | 10.973  | .001 | 2.248      |
| Monthly Income (31,000 ≤ 40,000) | 1.205  | 11.497  | .001 | 3.336      |
| Monthly Income (41,000 ≤ 50,000) | 1.114  | 5.054   | .025 | 3.046      |
| Monthly Income (> 50,000) | 1.796  | 5.140   | .023 | 6.027      |
| Travel Distance        | -.099  | 5.700   | .017 | .906       |
| Expected Walk Time     | .056   | 5.602   | .018 | 1.058      |
| Constant               | 1.605  | 3.830   | .050 | 4.980      |
| Chi-square             | 9.812  | (Sig.: .278) |
| Cox & Snell R²         | .097   |         |      |            |
| Nagelkerke R²          | .134   |         |      |            |
| Valid N                | 480    | (Out of total: 677) |
| Classification (%)     | 67.9   |         |      |            |

#### Notes
- Coefficient
- Significance value
- Reference category

### Table 4. Binary logit model for option 3 of the policy

| Variable Name          | Coeff. | Wald    | Sig. | Odds ratio |
|------------------------|--------|---------|------|------------|
| Employment of Child's Mother | -.542  | 6.010   | .015 | .582       |
| Age of Child           | -.082  | 3.625   | .078 | .921       |
| Car Ownership          | -.571  | 7.655   | .005 | .565       |
| Expected Walk Time     | .046   | 4.094   | .046 | 1.047      |
| Constant               | .740   | 12.790  | .000 | 2.097      |
| Chi-square             | 11.602 | (Sig.: .170) |
| Cox & Snell R²         | .041   |         |      |            |
| Nagelkerke R²          | .066   |         |      |            |
| Valid N                | 466    | (Out of total: 656) |
| Classification (%)     | 70.8   |         |      |            |

#### Notes
- Coefficient
- Significance value
- Reference category

### Table 5. Binary logit model for option 4 of the policy

| Variable Name          | Coeff. | Wald    | Sig. | Odds ratio |
|------------------------|--------|---------|------|------------|
| Persons in Family      | -.140  | 4.915   | .025 | .870       |
| Employed persons in Family | .268  | 2.803   | .097 | 1.307      |
| Car Ownership          | -.580  | 7.127   | .007 | .560       |
| Travel Distance        | -.093  | 5.167   | .023 | .911       |
| Expected Walk Time     | .105   | 15.104  | .000 | 1.110      |
| Constant               | 1.242  | 9.648   | .002 | 3.462      |
| Chi-square             | 12.993 | (Sig.: .112) |
| Cox & Snell R²         | .073   |         |      |            |
| Nagelkerke R²          | .102   |         |      |            |
| Valid N                | 475    | (Out of total: 654) |
| Classification (%)     | 71.2   |         |      |            |

#### Notes
- Coefficient
- Significance value
- Reference category

3.2 Feasibility study for the proposed routes of co-ordinated bus

Transit systems consist of medium capacity vehicles which ply on fixed routes and follow fixed schedules. Generally, vehicles on such services operate on routes with predefined stops within an urban area. Along the route there can be many stops where the transit units halt to let passengers alight and board. The data collected by survey can serve the objective to study demand and supply positions with respect to passengers’ demand and supply of facilities in terms of number of routes and buses for different routes of co-ordinated bus. An estimate of profit or loss can be made by computation of total revenue and cost amounts to deduce about feasibility of coordinated bus service. The 50 seat capacity bus and 30 seat capacity bus are considered in present study.
Table 6. Area wise distribution for children who are willing to travel in co-ordinated bus

| Sr. no. | Residential area                                      | Average monthly fare for current travel mode (’\) | Total no. of students |
|---------|-------------------------------------------------------|--------------------------------------------------|-----------------------|
|         |                                                       | Morning Timing | Afternoon Timing     |                       |
| 1       | Chhani                                                | 500            | 7                     | 9                     |
| 2       | Ajwa Road                                             | 425            | 23                    | 5                     |
| 3       | Fatehganj                                             | 400            | 5                     | 6                     |
| 4       | Fatehpura                                             | 300            | 8                     | 13                    |
| 5       | Harni Road                                            | 325            | 25                    | 29                    |
| 6       | New VIP Road                                          | 325            | 16                    | 20                    |
| 7       | VIP Road                                              | 300            | 6                     | 21                    |
| 8       | Nizampura                                             | 450            | 9                     | 5                     |
| 9       | Raopura                                               | 325            | 26                    | 8                     |
| 10      | New Sama Road and Sama Road                          | 450            | 17                    | 11                    |
| 11      | Waghadia Road                                         | 500            | 43                    | 8                     |
| 12      | Warasia Road                                          | 400            | 64                    | 19                    |
| 13      | Bahucharaji Road, Bhutadi Zampa, Anandnagar Road, Jubeelibaug, Nagarwada, Salatwada, Hathikhana, Water Tank Road | 300            | 85                    | 111                   |
| 14      | Panigate                                              | 475            | 8                     | 1                     |
| 15      | Subhanpura                                            | 500            | 3                     | 1                     |
| 16      | Sardar Estate                                         | 300            | 3                     | 0                     |
| 17      | Wadi                                                  | 500            | 3                     | 0                     |
| 18      | Gorwa and Gotri                                       | 600            | 3                     | 3                     |
| 19      | Dandia Bazar                                          | 400            | 2                     | 2                     |
|         | Total                                                  | 356            | 272                   |                       |

Table 7. Vehicle Operation Cost ‘ per kilometre (km) of co-ordinated bus [Source: Cost analysis of a division, Gujarat State Road Transport Corporation and Regional Transport Office (R.T.O.), Vadodara]

| Sr. No. | Cost component                                      | Cost per km (’\) |
|---------|-----------------------------------------------------|------------------|
| 1       | Compressed Natural Gas (C.N.G.) fuel (Rate = ` 50 /kg and average mileage = 6 km/kg) | 8.33             |
| 2       | Lubricants (Oil rate = ` 200 /lit. and grease rate = ` 150 /kg) | 0.12             |
| 3       | Tyre (Rate = ` 11000 /tyre)                         | 0.69             |
| 4       | Spare parts                                          | 0.11             |
| 5       | Maintenance labour cost                              | 0.92             |
| 6       | Depreciation                                         | 1.57             |
| 7       | Interest on capital                                  | 1.95             |
| 8       | Insurance                                            | 1.49             |
| 9       | R.T.O. tax (` 200 /seat/year)                        | 0.50             |
| 10      | Registration fees and permit charges (` 1200 /year)  | 0.07             |
| 11      | Crew (driver, helper and cleaner)                    | 6.03             |
| 12      | Overhead and miscellaneous charges                   | 0.22             |
|         | Total                                                | 22.00            |
Table 8. Proposed routes with total no. of buses required for co-ordinated bus service

| Route no. | Route                                                                 | Route length* (to and fro) | School no. to be covered under the route | Total no. of buses required Morning Timing | Total no. of buses required Afternoon Timing | Total no. of seats/students Morning Timing | Total no. of seats/students Afternoon Timing |
|-----------|----------------------------------------------------------------------|----------------------------|------------------------------------------|-------------------------------------------|---------------------------------------------|------------------------------------------|---------------------------------------------|
| R1        | Waghodia Road- Ring Road Cross Roads to Pani Gate- Ajwa Road- Harni Warasia Ring Road- Harni Road to Karelibaug | 17 km                      | S1, S2, S3, S6                           | 2                                         | 1                                           | 100                                      | 50                                          |
| R2        | Chhani- Nizampura- Fateghanj- Karelibaug                              | 14 km                      | S1, S2, S4, S5, S6                       | 1                                         | 1                                           | 30                                      | 30                                          |
| R3        | Sama- Abhilasha Cross Roads to Harni-V.I.P. Road- Karelibaug         | 18 km                      | S1, S2, S4, S5, S6                       | 1                                         | 1                                           | 50                                      | 50                                          |
| R4        | Bapod Jakat Naka- Waghodia Road 120' Ring Road to Sardar Estate New VIP Road- Karelibaug | 15 km                      | S1, S2, S4, S5, S6                       | 1                                         | 1                                           | 50                                      | 30                                          |
| R5        | Hathikhana Road- Fatehpura- Arya Kanya Road- VIP Road - Karelibaug   | 10 km                      | S1, S2, S4, S5, S6                       | 1                                         | 2                                           | 50                                      | 80                                          |
| R6        | Raopura Machhipith- Nagarwada- Bahucharaji Road- Atmaram Road- Karelibaug | 8 km                       | S1, S2, S4, S5, S6                       | 1                                         | 1                                           | 50                                      | 50                                          |
| **Total** |                                                                      |                            |                                          | 7                                         | 7                                           | 330                                     | 290                                         |

* Route length = (actual travel length + dead travel length).

Table 9. Comparison between yearly revenue and yearly cost for co-ordinated bus routes

| Route no. | Yearly Revenue (`) based on current travel fare Morning Timing | Yearly Revenue (`) based on current travel fare Afternoon Timing | Yearly Cost (`) based on current travel fare reduced by 15 % Morning Timing | Yearly Cost (`) based on current travel fare reduced by 15 % Afternoon Timing |
|-----------|---------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|
| R1        | 500100                                                        | 195000                                                       | 369512                                                         | 184756                                                         |
| R2        | 132600                                                        | 115800                                                       | 132152                                                        | 152152                                                        |
| R3        | 210900                                                        | 193500                                                       | 195624                                                        | 217360                                                        |
| R4        | 301200                                                        | 108000                                                       | 163020                                                        | 163020                                                        |
| R5        | 180000                                                        | 284400                                                       | 108680                                                        | 217360                                                        |
| R6        | 256200                                                        | 193200                                                       | 86944                                                         | 86944                                                         |
| **Total** | 1581000                                                      | 1089900                                                     | 1075932                                                       | 999856                                                        |
| **Total Profit** | `2670900-2075788 = `595112                                 | `2270265-2075788 = `194477                                  |                                                                  |                                                                  |

As per normal practice of the school bus services, the fare in school vacation period is also considered for revenue calculation but total 9.5 months in a year and total 26 days in a month are considered for cost calculation. The total number of children from the respective residential areas covering a route is multiplied with fare for current travel mode for computation of revenue amount of co-ordinated bus. Total kilometre value for a route is multiplied by 22 (i.e. vehicle operation cost ` per kilometre) for computation of cost amount of co-ordinated bus. The profit amount is definitely greater for option 2 in which fare increases by 10 % compared to current travel mode and for other options; the profit amount is shown in table 9. The travel demand is estimated through survey questionnaire and children who willing to travel in co-ordinated bus are only considered in this feasibility study.
Conclusions

- Analysis results for current travel modes of auto-rickshaw and van indicate that there are problems and complaints related to safety, comfort, congestion and driver’s behavior to the children and the respondents are required to compromise with travel attributes of the mode. The rule of R.T.O. about maximum occupancy of children not to exceed double the capacity of vehicles is violated by these current travel modes. The patronage for auto-rickshaw and van modes for school trips is mainly due to non-availability of school bus as a travel mode for children. The utilization of bicycle is found less in the study.

- Mode choice behaviour is a fundamental element of travel behaviour that has significant implications for transportation planning. The probability of shifting to co-ordinated bus mode increases if reductions in travel distance and cost can be achieved. In terms of age of child, older children are less likely to use co-ordinated bus mode. The estimated coefficients for household size and car ownership are negative, implying that an increase in household size and car ownership is likely to decrease the probability to choose co-ordinated bus mode as the preferred travel mode. If the pickup point from home is located along the route with respect to expected walk time of 5 minutes and maximum up to 10 minutes then willingness to choose this mode increases because expected walk time variable is found significant in the analysis.

- To attract people from different monthly income groups (\$20,000 to \$60,000) for co-ordinated bus mode, the importance to bus transport parameters suggested in option 2 of the policy should be given. The odds ratio increases from 2.25 to 6.03 compared to monthly income of less than \$20,000; which indicates willingness to choose the co-ordinated bus mode with increase in income. The utility of co-ordinated bus for option 3 of the policy decreases if child’s mother in the family is employed as the bus transport parameters are suggested with higher values except fare in this option but, utility of co-ordinated bus for option 4 of the policy increases with more numbers of employed persons in the family.

- The goodness-of-fit statistic indicates that all models adequately fit the data as significance values of chi-square are greater than 0.1.

- The computation of revenue and cost analysis for the co-ordinated bus mode indicates that the service is economically viable for morning and afternoon timing of schools among the proposed routes in selected study area and also for all the four suggested options of the policy. This analysis reveals that the private operator can also get appropriate return if interested in initiating this service.

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