DEVELOPMENT OF ROUTE CHOICE MODEL BY OPTIMISING TRAVELLERS BEHAVIOUR CHARACTERISTICS

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Abstract—Now-a-days traffic condition is a common problem in India. That’s why to minimise traffic congestion formed due to traveller’s tendency of selecting route with less difficulties, proper route choice model has to be developed. Route choice model is based on traveller behavioural characteristics. The model is essential to appraise traveller’s perceptions of route characteristics and describe ideas of route choice. The route choice model covers a set of daily choices on public road user; it may be habitual or may be deliberate.

In this work the development of route choice model by using Optimisation technique is done to predict the traveller behaviour attributes (e.g.: previous travel time, risk attitude, habitual attitude, attention of traveller, actual travel time, and traffic flow, travel cost). Those attributes reflect true situation of road network, in fact, it is helpful to predict changes of traffic network situation on those routes and the tendencies of the simulated traveller’s choices are reasonable and similar with that in reality. The model is able to reproduce traveller’s route choice with more behavioural characteristics and is very helpful indeed to solve traffic issues.

Keywords— Route choice model, Optimisation Technique, Travellers Behavioural Characteristics, Attributes

I. INTRODUCTION

Understanding human behavior and what drives people’s choices has been a subject of research in the field of economics, psychology, transport, and beyond. Many mathematical tools and analytical frameworks are used to prepare a model. Route choice access path between origins to destination. The traveller difficult to choose for the way of travel origin to destination because it depends on many parameters like travel time, traffic safety, congestion, environmental effect [4] on those places.

The study of travel behavior [1] is a broad topic that provides insights into the choices that individuals and households make about their travel needs. Within this broad area lie various sub-categories like study of mode choice, destination choice, and route choice. The focus of this thesis is understanding route choice behavior, especially from automobile drivers’ viewpoint. Although, understanding route choice
behavior is only a dimension to overall travel behavior analysis, it does provide very useful insights into travelers’ decision-making process [1], which can eventually be tied back to broad travel behavior assessment.

Route choice modeling is also essential in terms of transportation planning which requires predicting future traffic conditions on transportation networks and understanding travelers’ response and adaptation to sources of information.

II. STUDY STRETCH

The study stretch is with high volume of homogeneous traffic. This stretch connecting to several routes like Airport, Railway Station, offices and shopping markets etc. The study stretch origin power House Chowk to destination Master Canteen chowk having six several routes. Among six several routes the longest route having 4.90km long (Power House Chowk-Gopobandhu Marg-Sachibalay Marg-AG Square-Rajmahal Chowk-Master Canteen).

![Fig.1 Observed Study Stretch in Bhubaneswar](image)

These roads are having 2-lane divided carriageway according to the study. All the six routes are studied in the peak hours in morning as well as in evening time.

III. TRAVELLER’S DAY–TO–DAY ROUTE CHOICE

The day-to-day route choice is a process, which gives the information to the travellers about their route choice [2]. Information such as distance, travel time, travel cost, travel speed, pavement condition, traffic condition [1] etc. According to traveller’s behaviour, it is two types

- Deliberate Route Choice
- Habitual Route Choice.

A. Deliberate Route Choice

The deliberate route choice [3] is an individual characteristic of traveller’s. If a traveller chooses the deliberate route choice, they have think about these parameters experience, perception of actual travel time, risk attitude, habit, actual travel time, expected travel time.

B. Habitual Route Choice

In habitual route choice [3], means a traveller choose the same route in number of times. It is varying person to person. If a traveller chooses the specific route means for its comfort, travel time, travel cost and travel speed.

IV. ROUTE CHOICE MODEL

In these model [2] six routes are selected (R₁ to R₆) according to route distance and travel time.

<table>
<thead>
<tr>
<th>Routes</th>
<th>Route Name</th>
<th>Distance</th>
<th>Travel Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>R₁</td>
<td>Power House-Gopobandhu Square-Rabindra Mandap-PMG Square-Master Canteen</td>
<td>2.1 km</td>
<td>10 min</td>
</tr>
<tr>
<td>R₂</td>
<td>Power House Chowk-Odisha Secretariat-A.G Square-PMG Square-Master Canteen</td>
<td>2.8 km</td>
<td>12 min</td>
</tr>
<tr>
<td>R₃</td>
<td>Power House Chowk-Odisha Secretariat-AG Square-Rajmahal Square-Master Canteen</td>
<td>3.0 km</td>
<td>13 min</td>
</tr>
<tr>
<td>R₄</td>
<td>Power House Chowk-Raj Bhaban Chowk-AG Square-PMG Square-</td>
<td>3.0 km</td>
<td>15 min</td>
</tr>
</tbody>
</table>
The model is prepared to the present relevant parameters and their relations. The parameter such as distance, travel time, travel cost, risk attitude, actual travel time, etc.  
1) Travel Time ($T_t$): The travel time means the total time require reaching from origin to destination. In this model, there are six routes to reach the destination. The traveller chooses the route to reach destination gives the weightage to minimum travel time w.r.t. distance.

![Fig.2 Travel Time required with Respect to Distance](image)

2) Travel Cost ($T_c$): The travel cost is depending upon distance, type of vehicle and cost of fuel. The traveller chooses the shorter route to reach the destination to minimise the travel cost. If a traveller habitual to the route can manage to minimise the travel cost.

![Fig.3 Travel Costs on a Particular Routes](image)

3) Risk Attitude: Travellers risk attitude depends on both their inherent risk level and route choice. The risk attitude depends upon the speed of the vehicle and the travel time of the travellers on the route.

4) Actual Travel Time: It depending upon the perception of the travellers the actual travel time [1] required about the previous route choice to reach the destination. The traveller can only measure the actual travel time according to routes and distance vice versa. The actual travel time may differ Characteristics of a traveller and selection on route choice.

V. NUMERICAL EXPERIMENTS

In this experiment, six routes are selected from Power House Chowk (origin) to Master Canteen Chowk (Destination). Traffic volumes are counted for seven days on six different routes ($R_1$ to $R_6$) to reach from origin to destination.

<table>
<thead>
<tr>
<th>TABLE II</th>
<th>TOTAL NO OF TRAVELLERS ON ROUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days</td>
<td>$R_1$</td>
</tr>
<tr>
<td>1</td>
<td>30256</td>
</tr>
<tr>
<td>2</td>
<td>30569</td>
</tr>
<tr>
<td>3</td>
<td>31875</td>
</tr>
<tr>
<td>4</td>
<td>32236</td>
</tr>
<tr>
<td>5</td>
<td>32893</td>
</tr>
<tr>
<td>6</td>
<td>32568</td>
</tr>
<tr>
<td>7</td>
<td>34983</td>
</tr>
<tr>
<td>Total</td>
<td>226594</td>
</tr>
</tbody>
</table>

457
Fig. 4 Percentage of Travellers on observed Routes
Hence, the mean of the number of travellers choose the routes in seven day’s route (R1) are 226594 whereas route (R5) is 291237.

Fig. 5 Traffic Volume on Route 1

Fig. 6 Traffic Volume on Route 5

The above collected data and figure shows that the maximum number travellers are on route (R5) is 3.5 km long and take 16 minute to travel. There are five intersections in between Power House Chowk (Origin) to Master Canteen Chowk (Destination). So that the number of travellers in between the origin to destination. As the number of travellers chooses the route (R5) from day1. After that, the number of travellers goes on decreasing.

In route, (R1) Power House Chowk-Gopobandhu Square-Rabindra Mandap Chowk-PMG Square-Master Canteen Chowk is 2.1km long and takes 10 minutes to travel. The number of travellers in route (R1) less than any other routes in day1. The above figure shows that when the days are passes the travellers are habitual to the route (R1). The travellers are repeated choice of route (R1) increase their habit to continue choosing the same route and the travellers choose the shortest route at lower travel cost, travel time and risk attitude.

The above data shows that the travellers choose the shortest route for his daily route to reach from origin to destination. The travellers can realize that the route (R1) more convenient than any other route according to all parameters such as travel time, travel cost, risk attitude and actual travel time etc.

VI. CONCLUSIONS
This study analyses the traveller’s behavior Characteristics in day-to-day route choice travel. It is very difficult to knowing travellers choice for route selection. In this study first knowing the perception of travellers for their route selection. Because it is very difficult to fulfill all the parameters about their route choice. After studying the behavior of the travellers, a model is prepared in day –to-day route.

According to travellers behavior [4] Characteristics a day-to-day route choice model is prepared. In this model I select Power House Chowk (Origin) to Master Canteen Chowk (Destination) in between them I take six routes emphasis the travellers behavior parameters like travel cost, travel time, risk attitude, perception of
travellers about route selection, actual travel time etc. In this model the travellers are chooses the route \((R_3)\) is 43237 in day1 after that the days are passes its decrease to 39856 in day7 but the travellers are choose the route \((R_1)\) is 30256 in day 1 after that it increases to 34985 in day7. This above result shows that the travellers choose the shortest route w.r.t. distance, travel time and travel cost. The travellers are gradually habitual to the route and select the shortest route \((R_1)\) Power House Chowk-Gopobandhu Square-Rabindra Mandap Chowk-PMG Square-Master Canteen Chowk.

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REFERENCES


