Study on Travel Time Reliability Parameters in Greater Noida

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ABSTRACT

This study is concerned with travel time reliability parameters, which is one of the most important aspects of transportation system in today's era. In this review paper we studied about parameters that affect the travel time reliability. Study focused on urban roads of Greater Noida with four road sections taken into account for calculation of travel time reliability parameter using vehicle License plate matching method. FHWA travel time reliability parameters and statistical parameter such as standard deviation and variance will be determined. In this we will get to know about travel time reliability parameters and we will come across the meaning of "travel time reliability". We will also quantitatively find out travel time reliability in Greater Noida city using different statistical methods, namely, 90th or 95th percentile travel time, buffer index & planning time index.

Keywords – *Federal Highway Authority, 90th or 95th percentile travel time, buffer index, planning time index, travel time reliability.*

I. INTRODUCTION

In Greater Noida city, drivers are used to congestion and they expect and plan for some delay, particularly during peak driving times. Many drivers either adjust their schedules or budget extra time to allow for traffic delays. But what happens when traffic delays are much worse than expected? Most travelers are less tolerant of unexpected delays because they cause travelers to be late for work or important meetings, miss appointments, or incur extra childcare fees. Shippers that face unexpected delay may lose money and disrupt just-in-time delivery and manufacturing processes.

Travel time reliability measures the extent of this unexpected delay. A formal definition for travel time reliability is: the consistency or dependability in travel times, as measured from day-to-day and/or across different times of the day.

1.1 RELIABILITY PARAMETERS

- ***Planning time*** – The total travel time, which includes buffer time (i.e., calculated as the 95th percentile travel time).
- ***Planning time index*** – How much larger the total travel time is than the ideal or free-flow travel time (i.e., calculated as the ratio of the 95th percentile to the ideal). In the example

route shown in Figure 5, the ideal travel time is 11.5 minutes, assuming that vehicles will travel at 60 miles per hour (mph) when no congestion is present.

- ***Buffer time*** – The extra time required (i.e., calculated as the difference between the 95th percentile travel time and the average travel time).
- ***Buffer index*** – The size of the buffer as a percentage of the average (i.e., calculated as the 95th percentile minus the average, divided by the average).

Equation 1

For a specific route / trip and time period

$$\boldsymbol{Buffer\ Index}\ (\%) = \frac{\boldsymbol{95^{th}\ Percentile\ travel\ time - Average\ travel\ time}}{\boldsymbol{Average\ travel\ time}} (\boldsymbol{minutes})$$

Equation 2

For a specific route / trip and time period:

$$\textbf{Planning Time Index} = \frac{\textbf{95}^{\textbf{th}}\ \textbf{Percentile time}}{\textbf{Free−flow travel time}}\ \textbf{(No units)}$$

Note that these equations are for a specific route/trip and time period. The average planning time or buffer index values (across several road sections, time periods, etc.) can be calculated by using the vehicle-miles of travel (VMT) as a weighting factor (Equation-3).

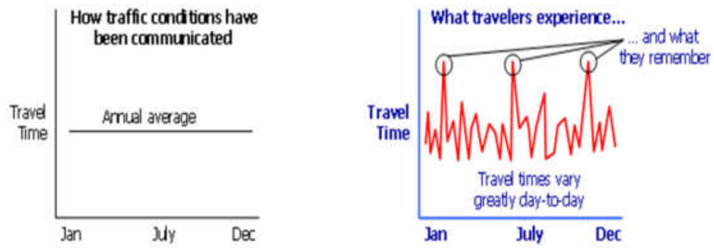
Equation 3

For several road sections and time periods:

$$\boldsymbol{Average\ Index\ Value} = \frac{\sum_{i=1}^{n}(\boldsymbol{index\ vaue_n} \times \boldsymbol{VMT_n})_{\boldsymbol{each\ section\ and\ time\ period}}}{\sum_{i=1}^{n}(\boldsymbol{VMT_n})_{\boldsymbol{each\ section\ and\ time\ period}}}$$

1.2 OBJECTIVE

In order to evaluate the performance on arterial, sub-arterial roads of Greater Noida city, we need to know about traffic volume, road capacity, travel time and incidents. Exiting technology in arterial roads of Greater Noida city provides less measure of speed and traffic volume. A relative area has facing no traffic measuring equipment installed on any intersection or fixed point to measure speed and volume during peak hours. In this study, travel time of individual vehicle is measured by the license plate matching method using video graphic at both ends of road section. Reliability parameters such as PTI, BTI, planning time, buffer time are known as FHWA reliability parameters and standard deviation, variance as statistical methods is calculated for selected road sections. These parameters are calculated by travel time distribution curve and mathematical equation.



1.3 IMPORTANCE

Travel time reliability is significant to many transportation system users, whether they are vehicle drivers, transit riders, freight shippers, or even air travelers. Personal and business travelers value reliability because it allows them to make better use of their own time. Shippers and freight carriers require predictable travel times to remain competitive. Reliability is a valuable service that can be provided on privately-financed or privately operated highways. Because reliability is so important for transportation system users, transportation planners and decision-makers should consider travel time reliability a key performance measure.

Traffic professionals recognize the importance of travel time reliability because it better quantifies the benefits of traffic management and operation activities than simple averages. For example, consider a typical before-and-after study that attempts to quantify the benefits of an incident management or ramp metering program.

2. LITERATURE REVIEW

The first approach consists of statistical range methods (Bates, Polak et al. 2001; Bates, Black et al. 2002; Chen, Skabardonis et al. 2003; Lomax, Schrank et al. 2003). These methods generally consider travel time windows in the form of expected travel time plus/minus a factor times the standard deviation (e.g.(Lomax, Schrank et al. 2003)). This “plus or minus” type expression indicates the possible spread of travel time around some expected value. Using one standard deviation (average travel time ± standard deviation) will encompass 68% of the days; peak periods or whatever time period is chosen for analysis. Clearly, the travel time window method is only suitable given a normal distribution for travel times is assumed. In (Van Lint, Tu et al. 2004) empirical evidence is provided that this is probably only the case in - trivial - time periods in which just free-flow conditions occur. Notably, (Bates, Polak et al. 2001) argue that percentile travel time would provide us with more robust estimates of how likely a specified travel time is a given certain circumstances (e.g. time of day values), while (Chen, Skabardonis et al. 2003) conclude that the 90th percentile travel time is a meaningful way of combining the effect of both average travel time and its variability.

The second approach considers so-called buffer time (Jackson 2000; Lomax, Schrank et al. 2003). (Lomax, Schrank et al. 2003) argue that the buffer time concept might relate particularly well to the way travelers make decisions, Conceptually, buffer time indices (introduced by (Jackson 2000)) could be explained as "the extra percentage travel time due to travel time variability on a trip that a traveler should take into account in order to arrive on time".

The third strand of approaches can be categorized as tardy trip methods (Lomax, Schrank et al. 2003). Tardy trip measures represent the travel time unreliability using the amount of trips that result in late arrivals. The misery index, for example, takes the difference between the average travel times of the 20% worst trips with the overall travel time average. This method thus focuses on the length of the delay of the worst trips.

The fourth class of approaches is probability-based methods. It expresses travel time reliability in terms of probabilistic measures (Asakura and Kashiwadani 1991; Asakura 1996; Du and Nicholson 1997; Bell, Cassir et al. 1999; Yang, Lo et al. 2000; Chen, Yang et al. 2002). These methods have in common that some probabilistic measure is used as measure for travel time unreliability. For example, Asakura and Kashiwadani propose the probability that a trip between a given OD pair can be made successful within a specified interval of time.

3. CONCLUSION

Travel time reliability measures are relatively new, but a few have proven effective. Most measures compare high-delay days to those with an average delay. The most effective methods of measuring travel time reliability are 90th or 95th percentile travel times, buffer index, and planning time index, explained in the following sections. Several statistical measures, such as standard deviation and coefficient of variation, have been used to quantify travel time reliability. However, they are not easy for a nontechnical audience to understand and would be less-effective communication tools. They also treat early and late arrivals with equal weight. But the public cares much more about late arrivals.

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