INVESTIGATION OF LEVEL OF SERVICE OF NH 503: A REVIEW

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Abstract: In developing countries like India, traffic being highly heterogeneous; speed ranges of LOS categories of highways are not well defined (HCM2010). LOS is the key factor for analyzing traffic & geometrical characteristics of highway as it affects planning, design, operational aspects. LOS determination of highways is quite different from rural roads. This paper reviewed various parameters that will affect LOS in NH.
Key words: Level of Service, Two lane highway, Peak Hour Volume, Travel Speed, Methodology.

I. INTRODUCTION

Roads and highways are a major part of the transportation infrastructure in India and play a substantial role in the local economy and community development. High quality of service of these facilities is essential to ensure safe, cost effective and daily traffic operations. There is a rapid growth in population of India which led to increase of demand in each and every aspect of our lives; therefore the increase of demand is directly proportional to increase of the usage of vehicles and the highway capacity. Two-lane highways are a very important element in the highway systems of most countries. They are used for a variety of functions, are located in all geographic areas, and serve a wide range of traffic. Any consideration of operating quality must account for these disparate functions. A two-lane highway is an undivided roadway with two lanes, one lane for use by traffic in each direction. As volumes and geometric restrictions increase, the ability to pass decreases and platoons forms. Motorists in platoons are subject to delay because they are unable to pass. Where with the growth number of vehicles led to decrease in the quality service and became necessary to study the causes as well as finds the solutions whether for the current or future conditions. Highway Capacity Manual (HCM) is the pioneer in management and evaluation for capacity and quality of service of various highway facilities including freeways, highways, arterial roads, roundabouts, signalized and signalized intersections, urban highways, and the effects of mass transit, pedestrians, and bicycles on the performance of these systems.

II. LEVEL OF SERVICE

The term ―Level of Service (L.O.S.) has been introduced by the Highway Capacity Manual (HCM) which represents the level of facility a user can derive from a road under various operating characteristics and traffic volumes. The Highway Capacity Manual (HCM 2010) designates six levels of service for each type of facility, from A to F, with LOS "A" representing the best operating conditions and LOS "F" the worst.

1. Level of Service A: Free-flow traffic with individual users virtually unaffected by the presence of others in the traffic stream.
2. Level of Service B: Stable traffic flow with a high degree of freedom to select speed and operating conditions but with some influence from other users.
3. Level of Service C: Restricted flow that remains stable but with significant interactions with others in the traffic stream. The general level of comfort and convenience declines noticeably at this level.
4. Level of Service D: High-density flow in which speed and freedom to maneuver are severely restricted and comfort and convenience have declined even though flow remains stable.
5. Level of Service E: Unstable flow at or near capacity levels with poor levels of comfort and convenience.
6. Level of Service F: Forced traffic flow in which the amount of traffic approaching a point exceeds the amount that can be served. LOS F is characterized by stop-and-go waves, poor travel times, low comfort and convenience, and increased accident exposure.

III. Area of the Study

Traffic Study will be carried out to estimate the level of service of the stretch identified on NH-503 'Mubarkpur to Mataur road, Himachal Pradesh'. It is a two-lane highway. A two-lane highway is an undivided roadway with two lanes, one for use by traffic in each direction. Passing a slower vehicle requires use of the opposing lane as sight distance and gaps in the opposing traffic stream permit. Traffic operations on two-lane, two-way highways differ from those on the run interrupted-flow facilities. Lane changing and passing are possible only in the face of oncoming traffic in the opposing lane. Passing demand increases rapidly as traffic volumes increase, and passing capacity in the opposing lane declines as volumes increase. Therefore, on two-lane highways, unlike other types of uninterrupted-flow facilities, normal traffic flow in one direction influences flow in the other direction. According to (H.C.M, 2010) L.O.S. is a quality measure describing operational conditions within a split, slow moving vehicles, pavement surface conditions and further proposed Adjustment Factor was applied.

The selected highway has an economical and cultural importance, where it connects the major agricultural, recreational and religious areas to the capital city. The reasons behind selecting this major highway were because of the military, agricultural and recreational importance as well as the service provided by some segments of this highway to the locals, where all these reasons reflect an economical importance.

IV. RESERCH METHODOLOGY:

Following are the steps referred to conduct the study, collect and analyze the data in order to determine the level of service. The flow chart below depicts the steps to determine LOS in NH.

1. Study of Geometric data
2. Study of traffic data

1. Study of Geometric data: Geometric data study includes determination of highway class, lane width, and shoulder width and access points density which are described below.

A) Highway Classes: As defined in the study area, the highway segment is two lane highway, HCM categorizes two lane highways into two classes

• Class I—These are two-lane highways on which motorists expect to travel at relatively high speeds. Two-lane highways that are major intercity routes, primary arterials and daily commuter routes.

• Class II—These are two-lane highways on which motorists do not necessarily expect to travel at high speeds including access routes, scenic or recreational routes, that are not primary arterials and routes through rugged terrain.

B) Base condition

The base conditions for a two-lane highway are the absence of restrictive geometric, traffic, or environmental factors. Base conditions are not the same as typical or default conditions. The base conditions include

- Lane widths greater than or equal to 3.6 m;
- Clear shoulders wider than or equal to 1.8 m;
- No no-passing zones;
- All passenger cars;
- No impediments to through traffic, such as traffic control or turning vehicles; and
- Level terrain.

2. Study of traffic data: The study of traffic data includes traffic volume count, free flow speed, base free flow speed, average travel speed, peak hour factor, traffic volume, traffic density and percentage of heavy vehicles.

A) Determine Traffic volume: Traffic volume count is to be done along the segment defined in study area. Traffic volume will be conducted for seven days on the both sides of two lane highway. Method used for the determination of traffic volume is manual count with a time period of 15 minutes as described in HCM: 2010.

B) Determining free-flow speed

The base FFS for a two-lane highway is observed at base conditions and ranges from 70 to 110 km/h, depending on the highway's characteristics. A key step in the assessment of the LOS of a two-lane highway is to determine the free-flow speed (FFS). The FFS is measured using the mean speed of traffic under low flow conditions (up to two-way flows of 200 pc/h).

$$FFS = SFM + 0.0125\ Vf/fHV$$

Where,

FFS = estimated free-flow speed (km/h),

S_{FM} = mean speed of traffic measured in the field (km/h),

V_f = observed flow rate for the period when field data were obtained (veh/h), and fHV = heavy-vehicle adjustment factor

C) Length of passing lanes: Passing lane on two-lane highways range in length from 0.3 to 3.6 km. Research has shown that the optimal lengths for passing lanes range from 0.6 to 2.4 km, depending on the traffic flow rate.

D) Determine peak hour factor: PHF represents the variation in traffic flow within an hour. Two-lane highway analysis is based on demand volumes for a peak 15-min period within the hour of interest—usually the peak hour. For operational analysis, the full-hour demand volumes must be converted to flow rates for the peak 15 min, when feasible, the PHF should be determined from local field data. If field data are not available, In general, lower PHFs are typical of rural or off-peak conditions, but higher PHFs are typical of urban or suburban peak-hour conditions. Default PHF values of 0.88 for rural areas and 0.92 for urban areas may be used in the absence of local data.

$$PHF = \frac{\text{Traffic count for one hour}}{(\text{mass traffic count for 15 Min})} \times 4$$

E) Directional Split, Directional distribution is defined as 50/50 for base conditions. Most directional distributions on rural two-lane highways range from 50/50 to 70/30. On recreational routes, the directional distribution may be as high as 80/20 or more during holiday or other peak periods.

F) Percentage of Heavy Vehicles, The local HPMS (Highway performance monitoring system) may be used to obtain local information on the percentage of heavy vehicles by facility and area type. When estimates of the traffic mix are not available, presents default values that may be used for primary routes.

Conclusion

Various study shows that LOS of Urban Roads and LOS of Rural Roads are completely different and depends upon types of traffic and volume of traffic. Free flow speed is observed in mid-block sections of various roads, based on which highway class is determined. Level of Service determination on the basis of travel speed and average travel speed. LOS is mainly depends upon volume to capacity ratio. Every streets should have minimum LOS of "C" for good service. "F" type LOS comes under worst category and Worst LOS comes during peak hours. Most of the Indian roads contain mixed traffic. Most of the studies conducted have taken Minimum of 3km street into account for LOS analysis. Capacity of the highway depends upon various characteristics and parameters like road geometry, and composition of traffic on that particular segment.

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