Highway Capacity Manual Methodologies for Corridors Involving Freeways and Surface Streets

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INTRODUCTION

- The Highway Capacity Manual (HCM) has been a historical reference on traffic engineering for planning and operational analysis;
- HCM is traditionally strong on facility-based measures, which is useful for agencies to identify critical points and bottlenecks;
- Lack of a methodology for performance of corridors comprising multiple adjacent facilities;
- HCM is traditionally strong on facility engineering for planning and operational analysis;

OBJECTIVES

- Develop a set of common performance measures to evaluate corridors with multiple different facilities;
- Integrate the existing HCM methodologies for different facilities;
- Provide methods to evaluate the quality of trip as perceived by the user;
- Evaluate how congestion propagates from one facility to another (queue spillback);

REVIEW OF HCM METHODS

- Different Level of Service (LOS) criteria for each facility:
  - Interface between adjacent facilities is not addressed by current method: how does congestion propagate from one facility to another?
    - Queue spillback from freeways into urban streets;
    - Queue spillback from urban streets into freeways.
  - Only one LOS range (F) is used to define congested conditions, which does not accurately represents how user evaluate the quality of trip.

RECOMMENDED PERFORMANCE MEASURES

- A mix of facility-based and trip-based measures must be considered for a full system analysis
- Travel-time based measures, including Travel Time Reliability, are considered the most suitable for evaluating the quality of trips:
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  \text{Travel Time Index} = \frac{\text{Actual travel time}}{\text{Free-flow travel time}}
  \]
- Lane speed variability must be considered, since the set of lanes used in a trip varies according to a series of factors, to be investigated during data collection:
  - Lane speed / flow variability
  - Facility length / user distance from entry/exit points
  - Presence of a queue spillback into freeway / work zones / lane closures

METHODOLOGY ADJUSTMENTS

IMPACT OF QUEUE SPILLBACK FROM URBAN STREETS INTO FREEWAYS

- Influence area of ramps is altered by the presence of a queue spillback;
- Capacity on diverge segments is reduced by an adjustment factor CAF, function of:
  - Number of lanes outside influence area
  - Queue length
  - Spillback regime
  - Driver aggressiveness
- Impacts of queue spillback are different for each freeway lane

CONCLUSIONS

- Trip-based measures are a logical step in evolution of HCM, and its relevance tends to grow rapidly as more data becomes accessible from the development of new technologies (GPS data, connected/autonomous vehicles, etc);
- An appropriate evaluation of how congestion propagates between adjacent facilities is essential for an effective corredor performance evaluation;
- Data will be collected to validate and calibrate the proposed adjustment to the methodology.

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