Memorandum

August 27, 2019

To:	Fresno Council of Governments	Project:	Fresno Triangle
From:	GHD Inc.	Ref/Job No.:	
CC:		File No.:	Fresno_MEM001.DOCX

Subject: Fresno Triangle: Congestion and Travel Time Reliability Assessment

1. Introduction

This memorandum details the Congestion Level and Travel Time Reliability analysis performed as part of the Fresno Triangle Analysis for the Fresno Council of Governments. This analysis supports FCOG's RCMP which recommends the incorporation of travel time reliability and speed-based congestion measures to support the quantification of both passenger vehicle as well as goods movement performance metrics. It is also consistent with new requirements for State DOTs and MPOs to assess the performance of the Interstate and non-Interstate National Highway System (NHS) per the National Highway Performance Program (NHPP). Specifically, this entails assessing freight movement on the Interstate System; and to assess traffic congestion and on-road mobile source emissions for the purpose of carrying out the Congestion Mitigation and Air Quality Improvement (CMAQ) Program.

As part of performance management, recipients of Federal-aid highway funds, such as FCOG, would make transportation investments to achieve performance targets that make progress toward the following national goals:

- Congestion reduction: to achieve a significant reduction in congestion on the NHS.
- System reliability: to improve the efficiency on the NHS.
- Freight movement and economic vitality: to improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.
- Environmental sustainability: to enhance the performance of the transportation system while protecting and enhancing the natural environment.

Data Source and Data Reduction

Per and the National Performance Management Measures Final Rule, the preferred data for complying with the National Highway Performance Program is the National Performance Management Research Data Set (NPMRDS) from FHWA. The NPMRDS provides average speed data (five-minute averaging time) for federally defined roadway segments designated as part of the National Highway System (NHS).

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NPMRDS data for January through December 2018 (12-months) was downloaded for analysis[1]. Given the desire to reflect annual average weekday conditions, the data was filtered to isolate average weekday conditions - Tues-Thurs AM/PM peak periods for passenger vehicles and heavy-duty truck vehicles separately. The AM/PM peak hours between 7:30 AM to 8:30 AM and 4:00 PM and 5:00 PM were analyzed for both passenger vehicles and truck.

A total of 975,597 individual data records were processed, and after filtering the data to isolate average peak hour conditions, 112,578 AM and 109,772 PM peak hour records were analyzed to yield 1120 averaged observations for 140 segments (reflecting both directions of travel) for both passenger vehicles and heavy duty trucks respectively. The only data "cleansing" applied was to filter/remove extreme high speed outliers (e.g., 90+ mph) from the free flow speed, congestion and reliability calculations. All data was processed and summarized based on the NPMRDS segmentation.

Overlay NHS and NPMRDS networks

To report and display the NPMRDS data graphically, NRMRDS segment coordinates were matched and overlaid with the NHS layer.

Performance Measure Definitions (Congestion and Reliability)

Federal definitions from the National Performance Management Measures Rule were used to define congestion and reliability. Both the 80th and 95th percentile travel times were computed. The 95th percentile travel time is consistent with the Highway Capacity Manual 6th Edition and NCHRP Research on Travel Time Reliability. Conversely, the Federal Rule proscribes the 80th percentile. For purposes of this analysis the 95th percentile travel time based BTI statistic was considered more representative and is reported herein. Thresholds reflect heavy congestion (with observed average speed less than 60 percent of the free-flow speed) and unreliable road segments (with an 95th percentile travel time more than 1.5 times longer than the 50th percentile travel time (Level of Travel Time Reliability or LOTTR). Given that Free Flow speed is a key variable for calculating both Congestion Level and LOTTR, free flow speed was empirically estimated for each individual segment using NPMRDS data between the hours of midnight and 3 AM.

Table 1. Congestion and Reliability Thresholds

Congested Conditions	Reliable Travel Time	Moderately Reliable Travel Time	Unreliable Travel Time
Travel Speed	BTI[1] < 0.25	BTI[1] 0.25 - <0.5	BTI[1] > = 0.5
Uncongested[2] (>= 60 % of free-flow)	Predictable and efficient	Not always predictable, but usually efficient	Unpredictable, but not often congested
Congested[2] (< 60% of free-flow)	Predictable and In-efficient	Not always predictable, but usually inefficient	Unpredictable, but often congested

[2] *.Level of Travel Time Reliability*
[3] *.Free flow speeds was estimated for each segment based on NPMRDS data during the hours of midnight and 3 AM*

Results

For a given segment, the direction of travel demonstrating the highest congestion or reliability was used as the basis for illustrating/reporting conditions for a given segment for each peak hour respectively. Maps displaying AM/PM peak hour Congestion and LOTTR results for Passenger Vehicles and Heavy-duty Trucks on the designated NHS in Fresno County is provided in Figure 1, Figure 2, Figure 3 and Figure 4 respectively. The congestion results are reflected by the width/thickness of a given segment and reliability by color. .

[1] The National Performance Measurement Rule recommends using 12 months of data to reflect a "true" annual average.

Figure 1. AM Peak Hour Passenger Vehicle Results

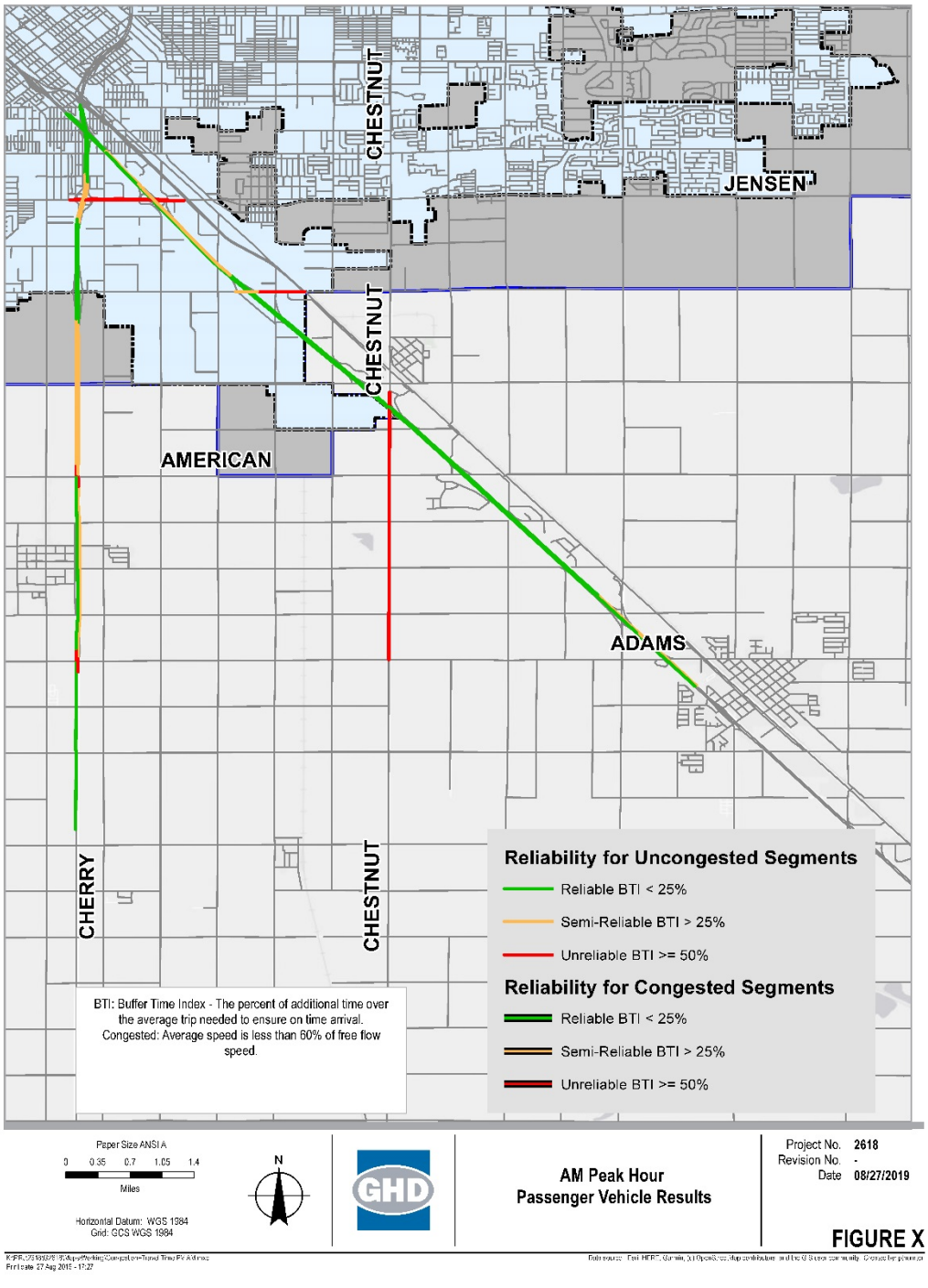

Figure 2. PM Peak Hour Passenger Vehicle Results

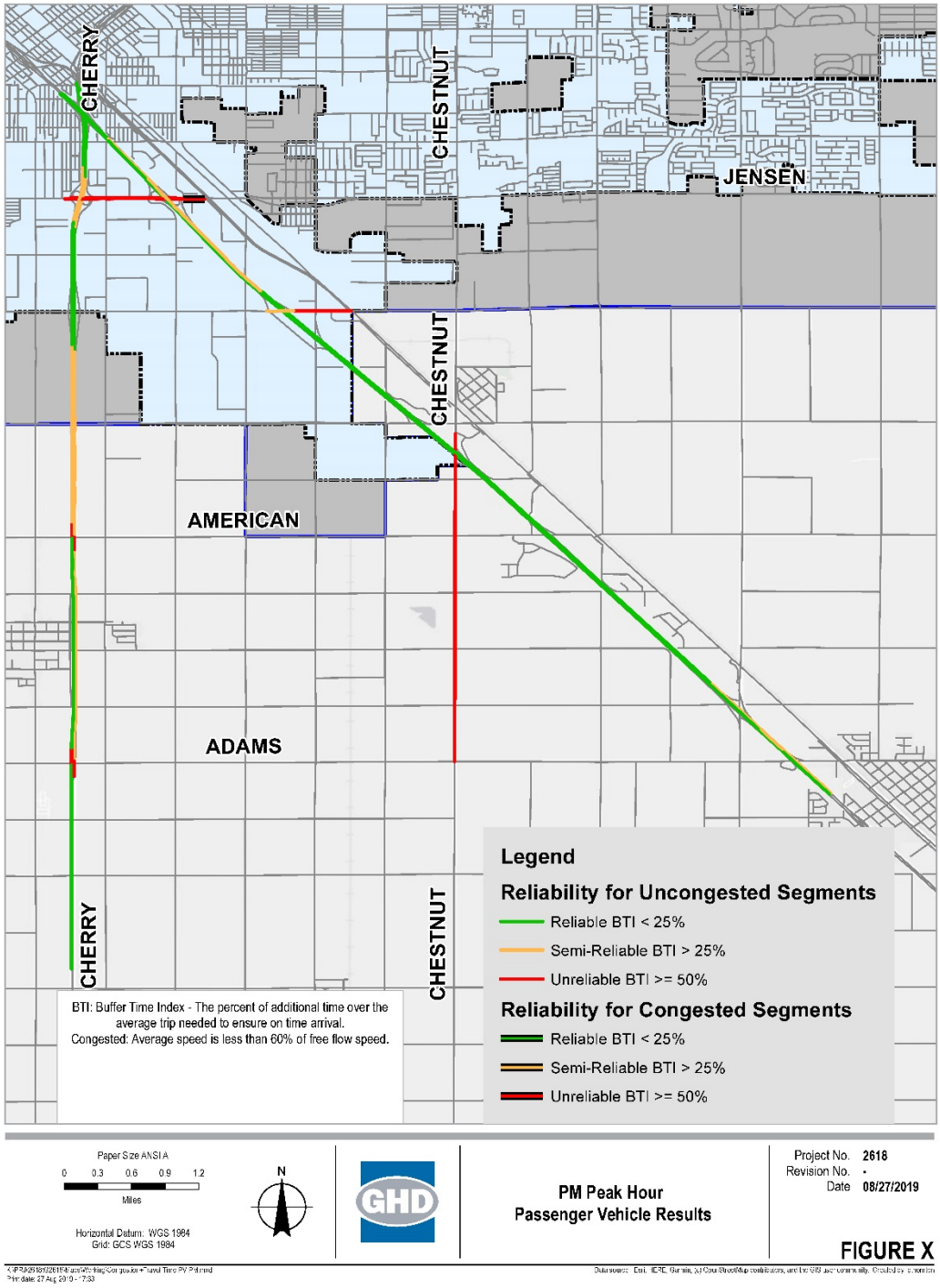

Figure 3. AM Peak Hour Heavy-Duty Truck Results

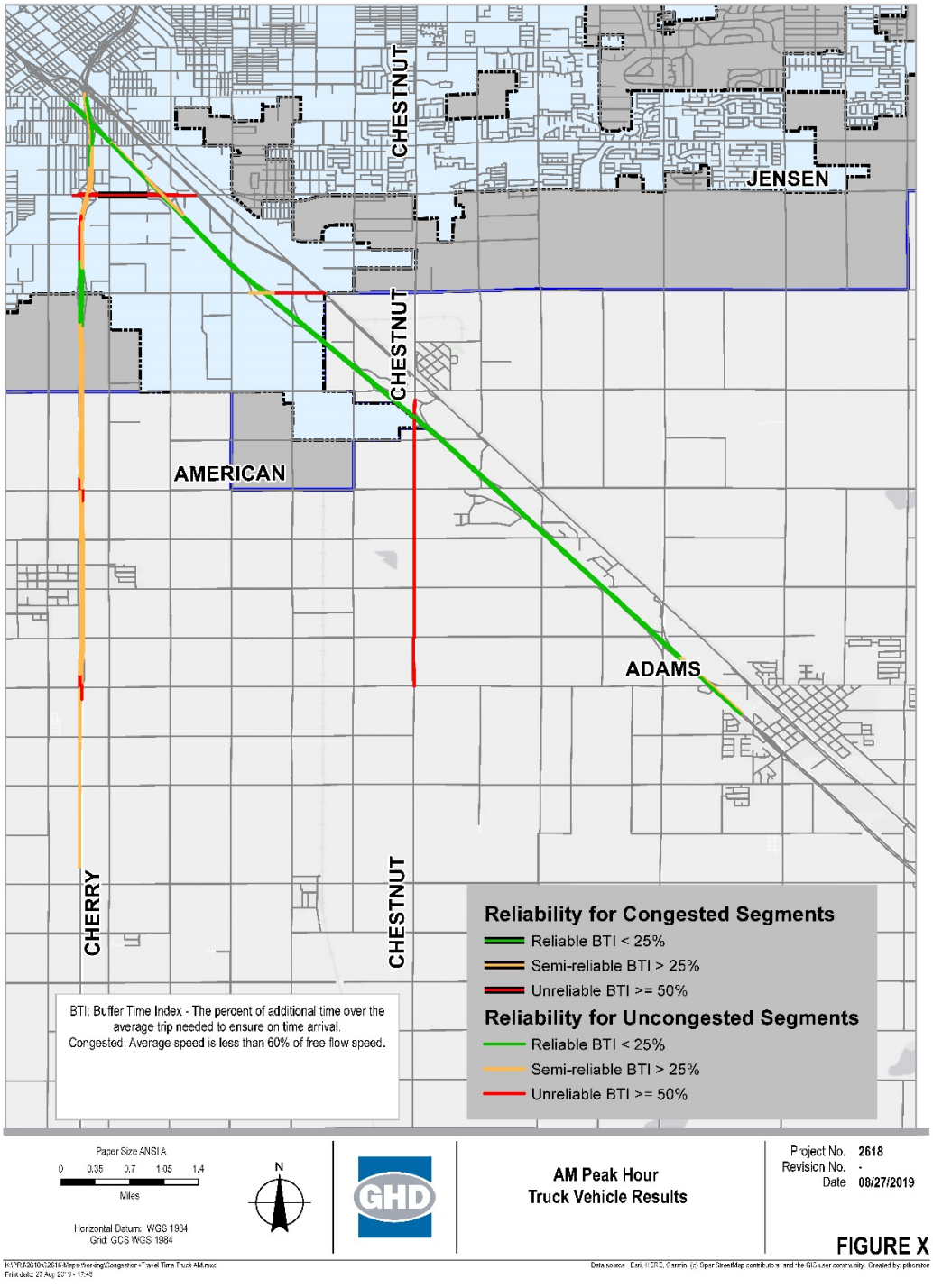

Figure 4. PM Peak Hour Heavy-Duty Truck Results