APPENDIX **B**

FREEWAY WORK ZONE SPEED MODEL DOCUMENTATION

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B.1 INTRODUCTION

This software can be used for predicting the speed of vehicles traveling through two types of construction work zones on four lane freeways: lane closures and median crossovers. The user enters the geometric roadway and traffic control features of the construction work zone, and the software interactively estimates and plots the 15th, mean and 85th percentile speeds based on the user defined geometric and traffic control conditions. Through menu choices, users make two choices: (1) to work on an existing file/spreadsheet or develop a new file, (2) use metric or U.S. Customary system of units. For each system of units, three separate worksheets are available: one each for all vehicles (ALL-Metric, ALL-USC), cars only (CARS-Metric, CARS-USC) and trucks only (TRUCKS-Metric, TRUCKS-USC). Data may only be entered in the ALL sheets. All three sheets provide speed prediction results for the respective vehicle categories.

B.2 HOW TO USE THIS SOFTWARE

1. Upon opening the software, the user is prompted to indicate whether a previously-created file will be used, or a new input file will be created. The selection is made using radio buttons.
2. If the user chooses to create a new file, a prompt will be generated for the user to select the metric or US customary system of measures and then save the workbook. If the user chooses to work with an existing file, the system of measures previously selected for the file will apply.
3. Enter the work zone configuration and an estimated upstream speed for the work zone of interest. Please see descriptions below.
4. Enter values for the variables WZ Location, Length [km (mi)], Posted Speed [km/hr (mph)], Roadway Type, R [m (ft)], VA, TWW [m (ft)], RSW [m (ft)], LSW [m (ft)], TPW [m (ft)], RSDL, Loffset [m (ft)], RSDR, and Roffset [m (ft)] for each point number where you wish to predict speed. Please see descriptions below. Anywhere from 1 to 20 points can be predicted based on the needs of the user. Typically, the number of points to predict is the same as the number of uniform roadway sections in relation to this particular set of input variables. The data should be entered in sequential order. In other words, point 2 should follow point 1 in the work zone.
5. The estimated 15th, mean and 85th percentile speeds are simultaneously displayed and plotted.

B.3 INPUT DESCRIPTIONS

Analysis/prediction points should be created at the midpoint of the taper and at all points where one or more of the variable changes significantly.

B.3.1 Work Zone Configuration

Work zone configuration is the category or type of configuration. This input can take on the values of "Lane Closure" or "Median Crossover" as selected from the drop-down menu. Application of the speed profile model is limited to these two typical work zone configurations. The input is entered in one field and applies to the entire work zone.

B.3.2 Upstream Speed [km/hr (mph)]

The Upstream Speed is the mean vehicle speed approaching the work zone (i.e., in advance of the influence of the work zone). This input can take on any value within the observed range, which is tabulated in section B.4. The input value may be measured or estimated.

B.3.3 Work Zone Location

Work Zone Location identifies the location of the prediction point relative to the lane-reduction taper that is part of both work zone categories. This input can take on the values of "Lane Taper" or "Within Work Zone" as selected from the drop-down menu. No speed prediction point can occur prior to the lane taper. Typically, the first speed prediction point will be at the lane taper and all subsequent points should then be classified as "Within Work Zone."

B.3.4 Distance [km (mi)]

Distance is the length of roadway from the midpoint of the taper to the speed prediction point. This input can take on any value within the observed range, which is tabulated in section B.4.

B.3.5 Posted Speed [km/hr (mph)]

Posted Speed is the posted work zone speed at the prediction point and may be different at various speed prediction points. This input can take on values of 80, 90, 100 or 110 km/h or 50, 55, 60, 65 or 70 mph as selected from the drop-down menu.

B.3.6 Roadway Type

Roadway Type refers to the roadway pavement structure. This input can take on the values of "Permanent" or "Temporary" as selected from the drop-down menu. For the types of work zones capable of being modeled, the most common example of a

Temporary type road are those connecting (permanent) directional roadways within a median crossover.

B.3.7 R [m (ft)]

Radius is the radius of the horizontal circular curve (the model cannot account for spiral curves). This value can take on any value within the observed range, which is tabulated in section B.4. If the speed prediction point is at a tangent section, the radius should be entered as 30500 m or 99999 feet.

B.3.8 VA

Vertical Alignment is a categorical description of the alignment. This input can take on the values of "Flat," "Upgrade," "Downgrade," "Crest," or "Sag" as selected from the drop-down menu. The "Flat" designation is appropriate for ascending and descending grades with absolute values of approximately 2 percent or less; for grades with greater absolute values, the Upgrade or Downgrade input should be selected.

B.3.9 TWW [m (ft)]

Traveled Way Width is the apparent width of the designated traveled way, as perceived by the typical driver. This input can take on any value within the observed range shown, which is tabulated in section B.4. Typically, traveled way edges are delineated by pavement markings, another traffic control feature, longitudinal barrier system or edge of roadway structure (pavement edge), with the feature closest to the travel lane controlling.

B.3.10 RSW [m (ft)]

Right Shoulder Width is the apparent total (paved and unpaved) width of the right shoulder, as perceived by the typical driver. This input can take on any value within the observed range, which is tabulated in section B.4. Where right shoulders exist, they are bounded by the traveled way one side; the other edge is typically the edge of the roadway structure or longitudinal barrier system.

B.3.11 LSW [m (ft)]

Left Shoulder Width is the apparent total (paved and unpaved) width of the left shoulder, as perceived by the typical driver. This input can take on any value within the observed range, which is tabulated in section B.4. Where left shoulders exist, they are bounded by the traveled way one side; the other edge is typically the edge of the roadway structure or longitudinal barrier system.

B.3.12 TPW [m (ft)]

Total Paved Width is the paved roadway width, including the traveled way and paved portions of left and right shoulders. This input can take on any value within the observed range, which is tabulated in section B.4.

B.3.13 RSDL

Roadside Device on Left are vertical traffic control devices located on the right-hand side of the roadway. This input can take on the values of "None," "Drum," "Vertical Panel," "Guardrail," "Barrier," or "Opposing Traffic w/ No Separation" as selected from the drop-down menu.

B.3.14 Loffset [m (ft)]

Left Offset is the distance from the left edge of the traveled way to the Roadside Device on Left. This input can take on any value within the observed range, which is tabulated in section B.4. If there is no roadside device on the left side of the road, then Loffset should be set to 99999, and the warning that comes up can be ignored.

B.3.15 RSDR

Roadside Device on Right are vertical traffic control devices located on the right-hand side of the roadway. This input can take on the values of "None," "Drum," "Vertical Panel," "Guardrail," or "Barrier" as selected from the drop-down menu.

B.3.16 Roffset [m (ft)]

Right Offset is the distance from the right edge of the traveled way to the Roadside Device on Right. This input can take on any value within the observed range, which is tabulated in section B.4. If there is no roadside device on the right side of the road, then Roffset should be set to 99999, and the warning that comes up can be ignored.

B.4 ADDITIONAL INFORMATION REGARDING INPUT DATA

The dimensional ranges for the field data used to develop this speed prediction model are shown in Exhibit B-1. Use of input values outside these ranges (except when R or Loffset or Roffset = 99999) is not recommended.

Variable	Metric			US Customary		
	Units	Minimum	Maximum	Units	Minimum	Maximum
Distance	km	0	17.12	mi	0	10.64
Posted	km/h	80	110	mph	50	70
Radius	m	582.44	30500	ft	1,911	99999
TWW	m	3.35	7.31	ft	11	24
RSW	m	0	4.88	ft	0	16
LSW	m	0	10.97	ft	0	36
TPW	m	3.66	14.63	ft	12	48
Loffset	m	0	14.63	ft	0	48
Roffset	m	0	7.31	ft	0	24

Exhibit B-1 Range of inputs for model

The speed variance predicted by this model has also been restricted to positive values.

Example

To clarify data entry and the relationship of certain features, consider the conditions shown in Exhibit B-2.

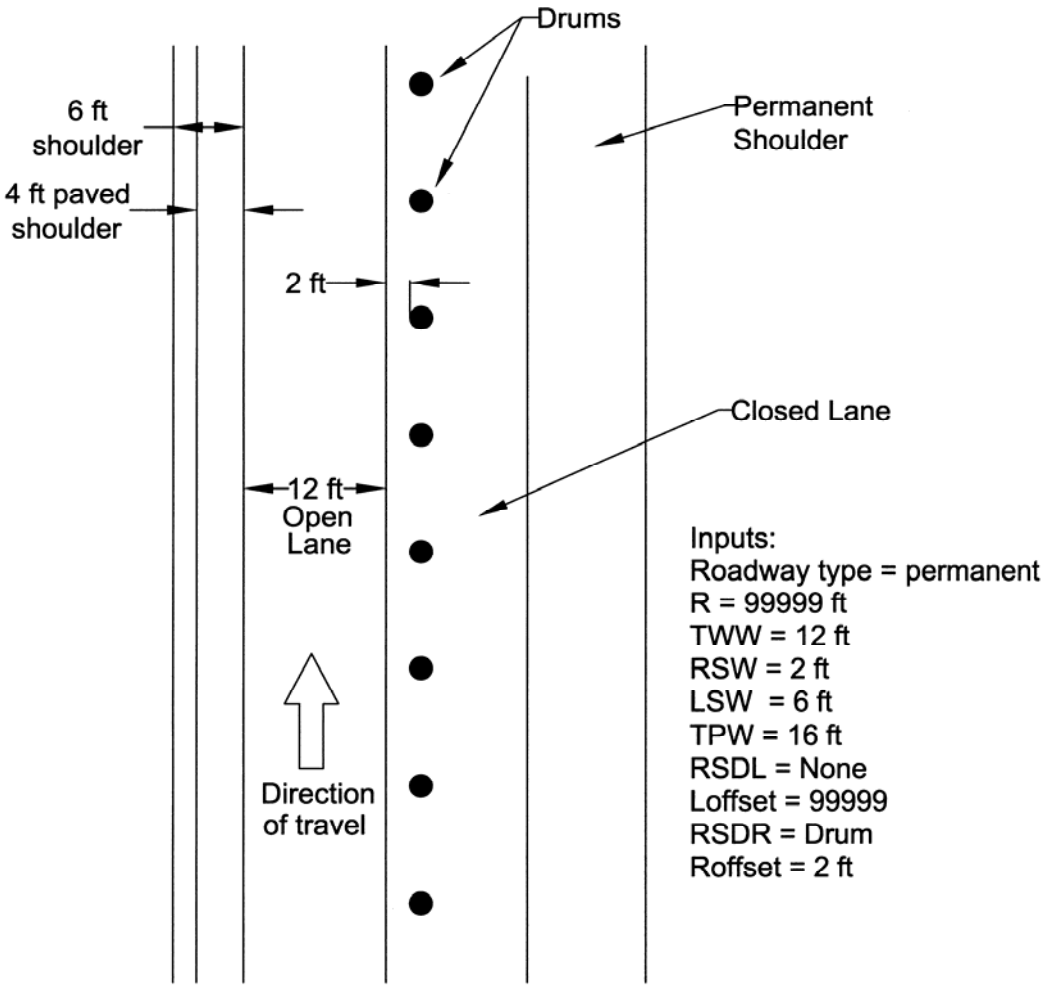

Exhibit B-2 Example Geometric Conditions

B.5 OUTPUT DESCRIPTIONS

As stated in the Introduction, each project work zone file includes three Excel worksheets corresponding to all vehicles (ALL-Metric, ALL-USC), cars only (CARS-Metric, CARS-USC) and trucks only (TRUCKS-Metric, TRUCKS-USC).

B.5.1 Predicted All Vehicle Speeds

The predicted 15th percentile, mean and 85th percentile speeds of ALL VEHICLES (passenger vehicles and trucks) are computed using a trained artificial neural network and displayed on one of the three Excel worksheets (ALL-Metric or ALL-USC).

B.5.2 Predicted Car Speeds

The predicted 15th percentile, mean and 85th percentile speeds of CARS (passenger vehicles) are computed using a trained artificial neural network and displayed on one of the three Excel worksheets (CARS-Metric or CARS-USC).

B.5.3 Predicted Truck Speeds

The predicted 15th percentile, mean and 85th percentile speeds of TRUCKS are computed using a trained artificial neural network and displayed on one of the three Excel worksheets (TRUCKS-Metric or TRUCKS-USC).