Interstate 90 Exit 32 to Exit 40 Corridor Study and Design Methods and Assumptions

Methods and Assumptions Document

South Dakota Department of Transportation
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and

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November 28, 2017

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Stakeholder Acceptance

The undersigned parties concur with Methods and Assumptions for the I-90 Exit 32 to Exit 40 Corridor Study and Design as presented in this document.

SDDOT	FHWA
Signature	Signature
Planning Engineer	Planning/Civil Rights Spec.
Title	Title
November 28, 2017	November 29, 2017
Date	Date

Amendment (If Needed)

SDDOT	FHWA
Signature	Signature
Title	Title
Date	Date

Participation of the Study Advisory Team and/or signing of this document do no constitute approval of the I-90 Exit 32 to Exit 40 Corridor Study and Design Final Report or its conclusions.

All members of the Study Advisory Team will accept this document as a guide and reference as the study progresses through the various stages of development. If there are any agreed upon changes to the assumptions in this document, a revision will be created, endorsed and signed by all the signatories.

INTERSTATE 90 EXIT 32 TO EXIT 40
CORRIDOR STUDY AND DESIGN
METHODS AND ASSUMPTIONS

1. INTRODUCTION AND PROJECT DESCRIPTION

Background Information

The SDDOT's pavement management system has identified the eastbound segment of I-90 from the Exit 32 to Exit 40 for a pavement replacement project within the next 8 years. Previous studies have indicated that this segment of I-90 may need capacity improvements sometime in the future. Most of the drainage structures in the corridor are also approaching the end of their service life and are coming due for either replacement or major rehabilitation. Interchanges within the corridor may need to be brought up to current standards when the mainline pavement is replaced, and may also need to be reconfigured to accommodate anticipated future needs. It is prudent to ensure that the correct typical section is provided for this segment of the I-90 corridor to accommodate the anticipated traffic volume for the duration of the service life of the rehabilitated or reconstructed mainline pavement. It is thought that this can be accomplished by identifying any future improvements needed to any of the bridges and interchanges along the corridor so that those improvements can be accommodated.

This planning and design combination project is expected to fulfill the following objectives for the I-90 corridor:

1. Corridor Study: The conducting of a study to determine the future traffic demand of the corridor, structure needs, and geometric deficiencies and then developing conceptual improvements for the I-90 corridor and the interchanges along the corridor necessary to accommodate the projected traffic demand. Performing a traffic evaluation analysis comparison for all of the options developed for the I-90 corridor to determine a recommended option.

2. Determination of Construction Projects: The determination of feasible construction projects within the corridor to implement the recommended option and the scheduling of those projects. Funding is available for the first project to be let to contract in FY2022.

3. Interchange Modification Justification Reports: The development of any (if needed) Interchange Modification Justification Reports (IMJR) for all interchanges determined to be modified by any of the construction projects developed and scheduled to be built before 2029 in Task 2.

4. Environmental Study: The development of all environmental documentation necessary for each of the construction projects developed in Task 2.

5. Construction Plans Development: The design necessary to develop a portion of the construction plan sets for each of the construction projects developed in Task 2. Portions of the construction plans are currently intended to be developed by the SDDOT.

Location and Affected Facilities

The primary project corridor for the I-90 Exit 32 to Exit 40 Corridor Study will include I-90 from the crossover east of Exit 32 (MRM 32.99 + 0.039) to the on-ramp junction of the Tilford Port of Entry (MRM 39.32), approximately 11.0 miles. Interchanges to be evaluated include Exits 34 and 37. The ramps for the Tilford Port of Entry also will be evaluated for compliance to current standards and storage capacity.

Need for Study

This study will be the first step in the process to identify deficiencies and needed improvements to I-90 and its service interchanges between Exits 32 and 40. The study will initiate the FHWA Interchange Modification Justification process for addressing the Interstate Access Modification Policy Points.

Study Schedule

The overall project schedule is shown in **Figure 1** below.

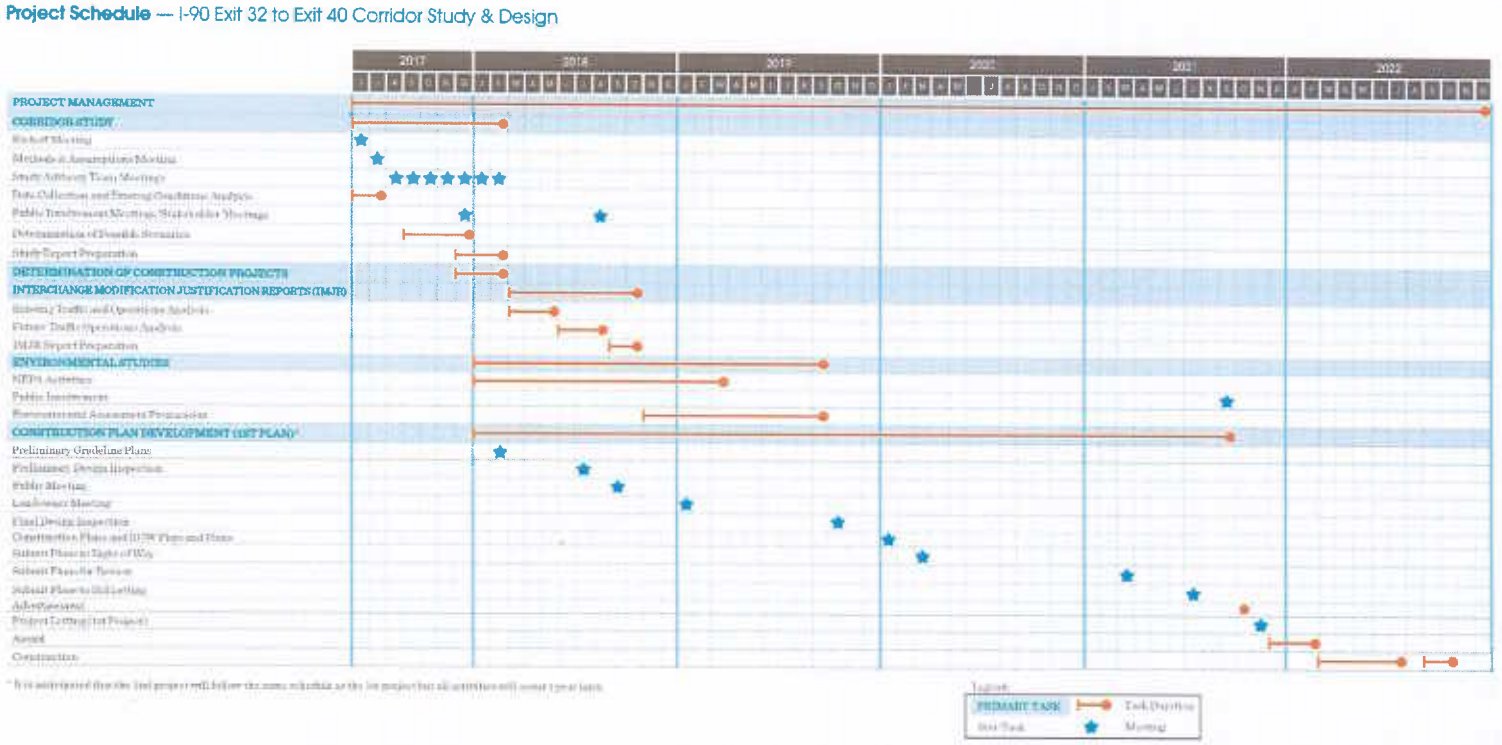

Figure 1. Project Schedule

Previous Studies

The following are known previous or ongoing studies that are relevant to this study:

- I-90, Exit 32, Junction Avenue, Sturgis (http://sddot.com/transportation/highways/planning/specialstudies/docs/I90Exit32justification.pdf)
- I-90, Exit 44, Bethlehem Road, Meade County (http://sddot.com/transportation/highways/planning/specialstudies/docs/I90Exit44IMJRFINAL.pdf)
- 2000 Interstate Corridor Study (Phase 1 report available at http://www.sddot.com/transportation/highways/planning/specialstudies/docs/Phase_I_Final_%20Report12_18.pdf).
- 2010 Decennial Interstate Corridor Study (Phase 1 report available at http://www.sddot.com/transportation/highways/planning/specialstudies/docs/09-104Phase1reportFINAL.pdf).
- Interstate 90 Black Hawk to Sturgis Corridor Preservation Study (report available at http://www.sddot.com/transportation/highways/planning/specialstudies/docs/03-241CorridorPreservReportfinal.pdf)
- EA for I-90 From Exit 40 to Exit 51 (Available at http://www.sddot.com/business/environmental/assessments/docs/MasterFinalEAandFONSISeptember292008.pdf)
- Meade County Master Transportation Plan (report available at http://www.sddot.com/transportation/highways/planning/specialstudies/docs/MeadeCountyTransportationPlanFinal.pdf)
- Black Hills National Forest Travel Management Plan (report available at http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/41877_FSPLT1_026126.pdf)

Study Advisory Team Members

Marion Barber	FHWA	Sam Gilkerson	SDDOT – Road Design
Jeff Brosz	SDDOT – Inventory Management	Steve Gramm	SDDOT - Project Development
Mike Carlson	SDDOT – Rapid City Area	Tom Horan	SDDOT – Rapid City Region
Kirk Chafee	Meade County - Planning & Zoning	Dave Huft	SDDOT – Research
Mark Hoines	FHWA	Tom Lehmkuhl	SDDOT - Environmental
Dave Coley	SDDOT – Bridge Design	Bill Rich	Meade County – Planning & Zoning
Wade Dahl	SDDOT - Administration	Kirk VanRoekel	FHWA
Sonia Downs	SDDOT – Project Development	Alice Whitebird	SDDOT – Environmental

Additional team members may be added as the project progresses.

2. STUDY AREA

The study area encompasses Interstate 90 from Exit 32 in Sturgis to Exit 40 at Tilford. A map of the study area is shown in **Figure 2**. The study area includes the following interchanges:

- Exit 32 at Junction Avenue (SD 79)
- Exit 34 at Pleasant Valley Drive/Blucksberg Drive/Old Stone Road
- Exit 37 at Pleasant Valley Road
- Exit 40 at 214th Street/Sturgis Road in Tilford

The study section also includes the Port of Entry facility located along I-90 eastbound between Exits 37 and 40.

3. ANALYSIS YEARS/PERIODS

Analysis Years

Analyses shall be conducted for the following years/scenarios:

- Existing (Base) Year 2017
- Opening Year (2023)
- Future No Build (2050)
- Design Year (2050)

Analysis Periods

Capacity and level-of-service analyses will be conducted for the following analysis periods:

- Weekday A.M. Peak (heaviest 60 minutes between 06:30 – 10:00)
- Weekday P.M. Peak (heaviest 60 minutes between 16:00 – 18:00)

4. DATA COLLECTION

- Intersection turning movement counts
- 24-hour directional volumes and vehicle classification counts along I-90
- Roadway geometry
- GIS/mapping
- Existing traffic signal timing plans
- Travel times/speeds

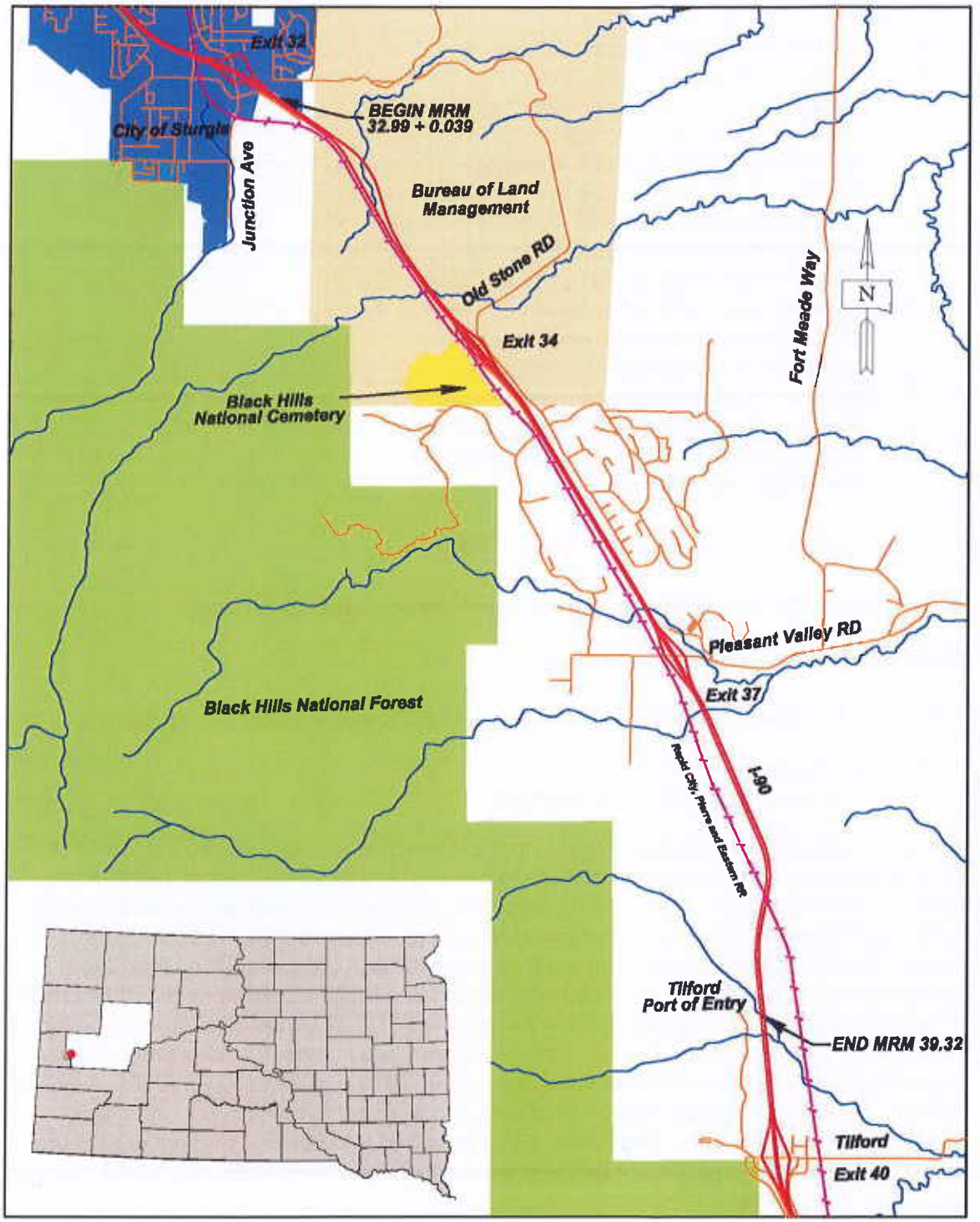

Figure 2. Study Area

Intersection turning movement counts will be collected at the following locations:

1. Junction Avenue at Vanocker Canyon Road
2. Junction Avenue at Dickson Drive
3. Junction Avenue at I-90 Eastbound Ramps (Exit 32)
4. Junction Avenue at I-90 Westbound Ramps (Exit 32)
5. Horse Soldier Road (Old Stone Road) at I-90 Eastbound Ramps (Exit 34)
6. Horse Soldier Road (Old Stone Road) at I-90 Westbound Ramps (Exit 34)
7. Horse Soldier Road (Old Stone Road) at Blucksberg Drive
8. Horse Soldier Road (Old Stone Road) at Pleasant Valley Drive
9. Pleasant Valley Road at I-90 Eastbound Ramps (Exit 37)
10. Pleasant Valley Road at I-90 Westbound Ramps (Exit 37)
11. Pleasant Valley Drive at Pleasant Valley Road
12. Pleasant Valley Road at Fort Meade Way
13. Sturgis Road-Tilford Road at Snyder Ranch Road
14. Tilford Road at I-90 Eastbound Ramps (Exit 40)
15. Tilford Road at I-90 Westbound Ramps (Exit 40)
16. Tilford Road at State Street

5. TRAFFIC OPERATIONS ANALYSIS

The following traffic operations analyses will be performed as part of this study:

Capacity and Level of Service

Methods in the Highway Capacity Manual (HCM) 6th Edition will be used to evaluate:

- I-90 mainline segments
- I-90 service interchange ramp terminals

The HCM methods will be implemented using the Highway Capacity Software Version 7.4. The HCM Freeway Facilities method will be used to perform directional analyses of the I-90 study sections between Exits 32 and 40. The method evaluates the individual freeway components – basic freeway segments, ramp merge and diverge segments, and weaving segments – as a system. Interchange cross-streets and roads will be evaluated using either the Urban Streets method (which includes both Signalized Intersections and Unsignalized Intersections) for urban areas and the Two-Lane Highway method for rural areas. Exit 32 and its cross-street, Junction Avenue, are within the Sturgis City Limit and considered to be urban. The HCM Urban Streets method will be used to evaluate Junction Avenue through the interchange area. The remaining section of I-90, which includes Exits 34, 37 and 40, is considered to be rural. For future year analyses, Meade County Planning Office will be consulted to determine whether or not areas currently designated as rural might become urbanized in the future (which may affect the type of analysis performed).

Input Variables and Default Values

The following HCM methods will be applied:

- Freeway Facilities and Reliability Analysis
- Urban Streets (including Signalized Intersections and Unsignalized Intersections)
- Two-Lane Highways

Most of the needed data for roadway geometry-related variables will be obtained from the "NSTRI" GIS layer that was provided by the SDDOT. These data include number of lanes, lane width, and shoulder width. For intersection analyses, turn lane storage lengths will be measured from satellite imagery. "Through-the-windshield" pictometry will be used to differentiate between "level" and "rolling" terrain types.

Sources for other input variables that apply to all methods include:

- Peak Hour Factor, PHF – will be determined from existing traffic counts. Peak Hour Factors computed from existing traffic counts also will be used for future year analyses.
- Free-flow speed – will be determined from NPMRDS data by computing average speeds during off-peak periods, or, in the event that NPMRDS data do not exist for a particular segment, assume to be the posted speed limit + 5 mph (per guidance from NCHRP Report 825, Planning and Preliminary Engineering Applications Guide to the Highway Capacity Manual).
- Heavy Vehicle Percentage – to be determined from traffic counts.
- Area Type
    - Urban – from western study area limit to Sturgis city limit, just east of Exit 32
    - Rural – from Sturgis city limit, just east of Exit 32, to eastern study area limit at Exit 40

Other variables and default values for the Freeway Facilities analysis include:

- Jam Density – 190 pc/hr/ln (HCM default)
- Density at capacity 45 pc/hr/ln (HCM default)
- Queue Discharge Capacity Drop – 7% (HCM default)
- Reliability analyses – HCM defaults for demand, capacity and speed adjustment factors for weather and work zones will be used.

For intersection analyses (signalized and Unsignalized) conducted as part of the Urban Streets method, an ideal saturation flow rate of 1,600 pc/hr will be used. This is the default value used by SDDOT for non-MPO areas.

Tilford Port of Entry Queuing Analysis

The Tilford Port of Entry is equipped with an electronic screening system to streamline commercial vehicle inspection operations. The facility can identify and weigh approaching trucks, electronically check credentials and safety records, and allow vehicles in compliance to bypass the port. Drivers enrolled in a program that provides electronic screening devices for vehicles are eligible. The weigh-in-motion (WIM) and truck screening devices are located approximately one mile upstream of the facility in the right-hand lane of the eastbound lanes of Interstate 90 (I-90). Drivers approaching the screening location are directed to move into this lane in advance. The percentage of eligible trucks containing the "e-screening" devices and thus eligible to bypass the facility is estimated to be in the 5% - 10% range. Of those trucks containing the devices, the SDHP (Motor Carrier) randomly samples about 10 percent of those eligible to bypass the facility by directing them into the station.

At certain times of day, there are more trucks than the facility can handle, and trucks begin to queue on the off ramp. At those times, the system is designed to automatically close the ramp (through advance notification to drivers upstream) to prevent truck queues from spilling back into the I-90 eastbound main lanes, allowing all trucks to bypass the port. The SDDOT currently maintains data regarding the frequency of this occurrence, times of day, and duration. Factors affecting the ramp closure situation include:

- Volume of trucks in the traffic stream
- Volume of trucks containing the e-screening devices
- Processing time for trucks in the facility

The SDDOT possesses existing data to sufficiently profile the facility operations and particularly the ramp closure scenarios. As travel demand and truck traffic volumes increase in the future, the impacts on the facility and particularly on ramp closures is unknown.

The objectives of the Tilford Port of Entry analysis are:

- Quantify the truck demand over time (24-hour period) on this facility.
- Identify times when truck demands are the highest and what proportion of the time the demand creates excessive queues that require closing the ramp.
- Estimate the number of trucks bypassing the facility during closure due to excessive queue lengths.
- Estimate these parameters based on future year traffic forecasts (Opening Year 2023, Design Year 2050).
- Identify potential strategies or improvements to minimize the queue spillback onto I-90.
- Evaluate existing ramp geometry to determine whether there is adequate deceleration and acceleration lengths for both the on and off ramps at the weigh station.
- Identify desired storage capacity in the off ramp to manage future truck queues.

A microscopic traffic simulation model using VISSIM will be developed to perform the analysis. Steps in the process are:

1. Obtain base year data from SDDOT, Stantec traffic count subconsultant, and field observation.
2. Examine base year data provided by SDDOT and identify peak periods where queue spillbacks trigger ramp closures most frequently occur.
3. Develop and calibrate base year microscopic simulation model replicate peak analysis periods identified in Step 2. The simulation model will be calibrated according to guidelines established in the FHWA *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software*. Model parameters will be calibrated within an 80% level of confidence.
4. Using traffic forecasting parameters established for the overall corridor study, develop opening year 2023 and design year 2050 traffic forecasts for those peak periods identified in Step 2.
5. Develop future year traffic simulation models and perform analyses, to include:
    - Replication of ramp queuing and queue spillback scenarios requiring ramp closure
    - Estimation of truck volumes bypassing the facility during ramp closures
    - Evaluation of strategies or improvements to improve facility operations (these will be developed jointly by SDDOT and Stantec)
6. Prepare a final report documenting the model development, analysis and conclusions.

Data to be provided by the SDDOT will include:

- 24-hour vehicle classification counts (at 15-minute intervals) for I-90 eastbound, upstream of the exit ramp to the Tilford Port of Entry facility
- 24-hour vehicle classification counts (at 15-minute intervals) on the exit ramp to the Tilford Port of Entry facility (for the same time period as the mainline data)
- Weigh station processing times (raw data will be collected by the South Dakota Highway Patrol for SDDOT and provided to Stantec). From these data, Stantec will develop sample statistics – mean and standard deviation.

Queue data and ramp closure data to be used in the analysis are not maintained by the SDDOT or Highway Patrol. These data will need to be obtained from the third-party vender responsible for the commercial vehicle permitting. Typically, these data are not stored longer than 24 hours, according to the SDDOT. Prior to initiating this analysis, a request to this vendor will be made to collect and store this information.

I-90 Travel Time Reliability Analysis

The HCM includes a methodology for evaluating travel time reliability over a multiday or multimonth reporting period. Travel time reliability reflects the distribution of travel times over an

extended period of time (e.g. one year). The distribution is created by the interaction of several factors that affect travel times:

- Recurring variations in travel demand by hour of day, day of week, and month of the year; within certain limitations, these variations are predictable;
- Severe weather that reduces speeds and capacities which in turn may influence demand;
- Incidents that reduce capacity;
- Work zones that reduce capacity and may reduce demand (if they are of longer duration); and
- Special events that temporarily intensify traffic demands.

As noted in the HCM 6th Edition, the methodology is implemented with the FREEVAL-2015E computational engine, although other software implementations (e.g. HCS 7) are available.

The travel time reliability analysis is an extension of the Freeway Facilities methodology that will be applied in the Traffic Operations analysis (see Section 5). Additional data needed include:

- Variations in travel demand by hour of day, day of week, and month of the year – From data collected for this study and from historical traffic count data maintained by the SDDOT, this distribution will be developed.

- Weather events – These are generated based on their probability of occurrence during a given month. Stantec will obtain historical weather data for the Rapid City-Sturgis, SD area and will develop a probability matrix of weather events over a 12-month period from the historical data.

- Traffic incidents – Stantec will develop expected incident frequencies based on the data collected and crash analysis that will be performed.

- Work zones – Stantec will work with the SDDOT to develop a history of work zone activities for the study section that includes calendar dates and durations of activities, facility segments and time periods affected, portions of the facility affected by closures, types of barriers used to separate traffic, regulatory speed limits during the activities, and lateral separation between traffic and the work zones. These data will be used to develop a work zone profile to be included in travel time reliability prediction for I-90 improvements.

- Special events – The Sturgis Motorcycle Rally and other area special events can be included in the reliability analysis, assuming traffic data are available for the I-90 segments. Should the SDDOT desire to include this specific event in the reliability analysis, it will be necessary to make adjustments for the heavy presence of motorcycles in the traffic stream. All methods in the HCM convert trucks in the traffic stream to equivalent passenger cars, but there is no such equivalency for motorcycles. To include the motorcycle rally in the analysis, it will be necessary to develop a passenger car equivalency for motorcycles.

The travel time reliability analysis as an extension of the Freeway Facilities method is documented in Chapters 11 and 25 in the HCM 6th Edition.

6. TRAVEL FORECASTS

While there is a regional travel demand model for the Rapid City area maintained by the Rapid City Area Metropolitan Planning Organization (MPO), it does not cover the project study area. Additionally, there is no South Dakota statewide travel model from which future year traffic forecasts can be based. The SDDOT Inventory Management Office have developed traffic growth rates per functional class and county that have been provided; these growth rates will be the primary basis for developing future year project traffic forecasts.

Future year (both Opening Year and Design Year) intersection turning movement forecasts will be developed based on methods described in *NCHRP Report 765, Analytical Travel Forecasting Approaches for Project-Level Planning and Design*.

7. SAFETY ISSUES

Stantec will perform an analysis of crash data for the most recent and complete five-year period (January 1, 2012 through December 31, 2016). Stantec will compute crash rates for individual roadway segments and intersections. These rates will be compared with statewide average rates for similar facility types. Those locations having crash rates higher than the statewide average rates will be identified. For those locations, crash types will be examined to identify potential causative factors and candidate improvements.

8. SELECTION OF MEASURES OF EFFECTIVENESS

The following measures of effectiveness

HCM Freeway Facilities

- Average travel speed
- Density
- Level of Service
- Demand volume-to-capacity ratio

HCM Urban Streets

- Average travel speed and comparison to Base Free Flow Speed
- Level of Service
- Intersection control delay
- 95th-percentile queue length
- Intersection demand volume-to-capacity ratio

The Urban Streets method includes procedures for the analysis of signalized intersections, two-way STOP-control, and all-way STOP control.

HCM Two-Lane Highways

- Average travel speed
- Percent time spent following
- Level of Service
- Demand volume-to-capacity ratio

Freeway Facilities Travel Time Reliability

- Travel Time Index (TTI) – ratio of actual travel time to free-flow travel time for a given analysis period
- 50th-percentile travel time
- 80th- percentile travel time
- 95th-percentile travel time (Planning Time Index, or PTI)

9. FHWA INTERSTATE ACCESS MODIFICATION POLICY POINTS

Interchange Modification Justification Studies will be conducted in accordance with the Federal Highway Administration's *Policy on Access to the Interstate System*, dated May 22, 2017. Is it envisioned that separate studies will be conducted and subsequent reports prepared separately for Exits 34 and 37.

10. DEVIATIONS/JUSTIFICATIONS

None

11. ENVIRONMENTAL ANALYSIS

Once the build alternatives to be carried forward for further review are selected, detailed environmental studies and preparation of environmental reports and documents. Background data and studies anticipated include:

- Environmental Justice – Desktop review to identify EJ populations (USEPA mapping tool and US Census Data)
- Wetlands and Waterways – A desktop analysis (review of preliminary survey, aerial photography, U.S. Geological Survey (USGS) quadrangle maps, National Wetlands Inventory (NWI), Natural Resources Conservation Service (NRCS) soils and land cover maps). Desktop analysis will be followed by a field delineation for verification in accordance with the USACE1987 Wetlands Delineation Manual.
- Cultural Resources - Stantec will conduct pertinent documentary research associated with the project and along with a windshield survey. Consult will include: 1) South Dakota State Archaeological Research Center (SARC) Site and SD SHPO Structure Inventories, 2) Historic Maps and Aerial Photographs, and 3) established Historic Contexts. Additional resources may also be consulted.

- Noise Analysis – Analysis and report will be prepared that identifies noise impacts based on FHWA Noise Abatement Criteria (NAC).
- Floodplain - Local floodplain ordinances or County regulations will be reviewed to determine need for additional hydraulic modeling.
- Wildlife and T&E – Along with formal agency coordination, the USFWS Pierre Ecological Services Field Office website and SDDOT GIS layer and aerial photography will be reviewed.
- Regulated Materials – A Phase I ESA will be completed.
- Climate Change – A climate vulnerability assessment will be completed. Baseline information will include local City ordinances and guidelines along with local zoning regulations. Stantec will collect existing structure data including plans, Bridge Inspection Reports and AASHTOWare Bridge Management information, structure age and deficiencies, health ratings, and subsurface records. Other data sources will include utility maps, BML management plans, County development practices, traffic operations analysis, SDDOT Transportation Systems Management and Operations (TSM&O) Program Plan.
- 4(f) Properties – The project site will be reviewed for potential 4(f) properties using GIS layers, aerial photography, and PONTIS software. Properties identified in the Cultural Resources review will also be considered. No LAWCON properties are anticipated, but the list of properties will be reviewed once the project area is defined.

Following the development of project concepts, an evaluation process will be used to provide an objective, quantifiable and comprehensive approach to determining feasible build scenarios for the study corridor. Alternatives that are screened out will be supported by documentation in the form of reasoned arguments and matrices.

12. CONCLUSIONS

Ultimately this study will result in further studies, Interchange Modification Justification Reports, and plans for improvements to Interstate 90 between Exits 32 and 40.

13. REFERENCES

1) *Highway Capacity Manual Sixth Edition: A Guide for Multimodal Mobility Analysis*, Transportation Research Board, Washington, D.C., 2016

2) *NCHRP Report 825, Planning and Preliminary Engineering Applications Guide to the Highway Capacity Manual*, National Cooperative Highway Research Program, Transportation Research Board, Washington, D.C., 2016.

3) *Policy on Access to the Interstate System*, Federal Highway Administration, Washington, D.C., May 22, 2017.

4) *NCHRP Report 765, Analytical Travel Forecasting Approaches for Project-Level Planning and Design*, National Cooperative Highway Research Program, Transportation Research Board, Washington, D.C., 2014.

14. APPENDIX

Notes from the September 5, 2017 Methods and Assumptions meeting and October 2, 2017 follow-up meeting are included in the Appendix.

APPENDIX

Stantec Method & Assumptions Meeting Minutes

MEAD_IM 0901(195)32N_IM 0901(198)32N_I-90 Exit 32-40
Stantec WO: PD-03-17

Teleconference with Skype for Business
September 5, 2017, 10:30 – 12:00 CST

Attendees	Name	Organization	Phone	E-Mail
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Rapid City:	Mike Carlson	SDDOT	(605)394-2248	mike.carlson@state.sd.us

Distribution: Attendees

Meeting Action Items

#	Action / Due Date	Assigned To/Date	Done
1	SDDOT to provide Stantec available documentation for the I-90 variable speed limit project	Steve Gramm 09-05-2017	Completed 09-06-2017
2	SDDOT to provide Stantec with a list of previous studies	Steve Gramm 09-05-2017	Completed 09-05-2017
3	SDDOT to provide Stantec with any member additions to the Study Advisory Team	Steve Gramm 09-05-2017	Completed 09-20-2017
4	SDDOT to provide Stantec with MRM logs for the corridor.	Steve Gramm 09-05-2017	Completed 09-05-2017
5	SDDOT to provide Stantec with signal timing data	Steve Gramm 09-05-2017	Completed 09-06-2017
6	Stantec to review geodatabase information and will get with SDDOT if date decoder is needed or additional detail is needed for a particular crash	Aaron Cook 09-05-2017	Completed 09-18-2017

#	Action / Due Date	Assigned To/Date	Done
7	SDDOT to check with traffic section on how they would like crash analysis completed	Steve Gramm 09-05-2017	Completed 09-25-2017
8	SDDOT to forward Interchange Access Modification Policy released May 22, 2017 to Stantec	Steve Gramm 09-05-2017	Completed 09-20-2017

Meeting Agenda & Discussion Items

1. Welcome & Introductions – All

2. Safety Moment – Dale Grove
   - *Reviewed Safe Driving with Heavy Machinery on Roadways during the Harvest*

3. Project Description, History, & Background – Dale Grove

   The pavement in eastbound lanes of I-90 between Exits 32 and 40 has been identified in need of replacement in the next eight years. As part of this project we are also looking at drainage, design standards, and interchange operational needs. This project is a phased project beginning as a corridor planning study, then moving into environmental documentation, interchange modification access, and design plans. Ultimately, the plan is to accommodate 3 lanes in each direction even if they are not constructed within this project. We will work to see how this fits into the existing exits, interchange needs, and plans for the expansion of the Black Hills National Cemetery. There is an existing tunnel under the interstate that belongs to the Rapid City, Pierre & Eastern Railroad which will require coordination in extending the structure to fit the expanded facility. The operations need to handle daily traffic and need to consider peak tourist season traffic operations as well as consideration of the Sturgis Bike Rally.

   - We held a kick off meeting and work has begun on the transportation planning element.
   - One set of traffic counts during the Sturgis Rally have been completed and we have scheduled a second set of traffic counts to be completed this fall (to be collected the week of September 11).
   - (SDDOT): A special corridor study was completed in 2004 so this portion of the interstate has been on people's minds for some time now. We need to keep in the back of our minds that discussions on these corridor improvements began 20 years ago. So, keep in mind that what is new to the Stantec team may not be new to the public and other staff.
   - (SDDOT): A variable speed limit trial project is underway that will be influencing this corridor. The project is in the systems engineering phase. The plan is to establish variable speed between MRM 30 and MRM 40 that would be responsive to weather and traffic.

SDDOT: To provide currently available documentation for the ITS variable speed limit project so Stantec can account for it in this project.

4. Corridor Study – Tom Creasey

We would like to walk through our Rough Draft of the M&A Document.

a. Introduction and Project Description:

- Study Schedule – We will add updated project schedule
- Previous Studies – **SDDOT to provide Stantec a complete list of applicable studies.**
- The Study Advisory Team – Copied from the RFP. **SDDOT to provide Stantec with any updates to the list.**

b. Study areas:

- The map is currently from the RFP. The map will be updated to include Exits 32 and Exit 40.
- (SDDOT): Verified that for the study area map from the RFP shows the necessary level of detail for the document.

c. Analysis Years/Periods:

- Analysis Years – Base year will be 2017 as it is the year we are collecting traffic counts. We need to verify opening and design year and verify that the no build scenario is the same as the design year.
  - (SDDOT): Opening year – first project is scheduled for 2022 but since there will be multiple projects, we need to verify this as they will likely vary out many years past 2022. The IMJR may vary per interchange depending on the likely year of construction. We would look at a 2023 opening year likely with a design year of 2045 (usually 20 years out and then rounded up to the nearest 5). However, since some of the projects would occur in 2025 – the design year would need to be 2050. For this document use 2023 as the opening year and to be cautious of future project and maintaining our minimum of 20 years out, the design year should be 2050.
  - Based on meeting discussion following will be used:
    - Existing Year 2017
    - Opening Year 2023
    - Design and No-Build Year 2050
- Analysis Periods – Peak Hour Periods for AM and PM. We need the peak 60 minutes but will take data for a longer period to ensure we get the peak 60 minutes for the highest volume commuting periods during the week.
  - Verified that nothing will be needed for weekends.
  - Based on meeting discussion following will be used:

- AM Peak Period: 6:30 am to 10:00 am
- PM Peak Period: 4:00 pm to 6:00 pm

d. Data Collection:

- Stantec's sub consultant completed 12-hour intersection turning movement counts during the Sturgis Rally.
- Starting next week, Stantec's sub consultant will be collecting 12 hour counts from 7:00 am to 7:00 pm. These counts will be used in the analysis.
- SDDOT verified that they will be collecting the 24-hour directional daily traffic counts.
- Tom asked if there is there a straight-line diagram or linear referencing system for the MRP's for the interchanges?
  - **Yes – SDDOT will provide MRM logs to Stantec.**
- Existing signal timing plans –
  - **SDDOT will request from their traffic engineering group for the two signals at Exit 32.**
  - (SDDOT): The most updated timings may not be available but may be the original signal timings from installation with tweaks after installation (which do not usually get logged).
  - Stantec will field verify or observe the timings if necessary.
  - (SDDOT): The signals will be taken down shortly and stored for the winter as they are only used for the rally.
  - Since we are not evaluating for the Rally, we need to know what is being done outside of the rally. If it is stop-controlled outside of the rally, the timings will not be needed.
  - Stantec will need to know if signals are operating while counts are taken.
- Crash Data –
  - (SDDOT): The geodatabase includes the crash data, type, severity, codes, etc. If crash detail is needed on a particular crash, provide the crash number and we can get you the details.
  - **Stantec will review data and let SDDOT if the data decoder is needed.**

e. Traffic Operations Analysis: We agree that the methods in the Highway Capacity Manual (HCM) are the most appropriate approach for the project. The Freeway Facilities analysis will be done directionally for I-90 as a mainline segment just west of Exit 32 and just east of Exist 40 and the Urban Streets method for the interchange/cross streets. Any questions or comments on this proposal?

- (SDDOT): Exits 34, 37, and 40 are considered rural highways and they will need to be analyzed as rural 2-lane highways.
- (SDDOT): Varying LOS thresholds for urban v. rural interchanges within the design manual. Pay attention to this as some of the exits or ramp terminals are urban and some are rural. Need to consider their status (urban v. rural) and future status (urban v. rural). Discuss with Meade County Equalization/Planning to determine their future desires for the cross streets at the interchanges for the existing rural terminals.
- (SDDOT): Variables and default values should be listed in the traffic operations section of the document.
- Will Stantec need to evaluate outside of Exits 32 and 40?
  - (SDDOT): No – Because Exit 34 and 37 are being evaluated so by going to Exit 32 and 40 we are going to the next interchange as part of the project analysis.
- Discussion of reliability analysis for weather, special events or maintenance. Is it desired by SDDOT or FHWA to include a travel time reliability analysis?
  - (SDDOT): Yes – The variable speed limits are being driven by both weather and the rally. This project would be a guinea pig as we do not do a lot of reliability analysis.
  - To elaborate on what data is available. Specifically, weather events regarding average snowfall, intensity, duration, etc. If we can gather this information from a local weather station, we can pull this into our model. So instead of getting data for a representative morning peak period, we can get a distribution based on travel speed or for any specific performance measure.
  - SDDOT has records of observed road conditions for several years – travel advisories, closures, etc.
  - Stantec will include narrative in the M&A document regarding what would be involved for a reliability analysis and identify the data needed as well as default values for the different types of reliability analysis whether it be special events, weather or construction events.

f. Travel Forecasts: Will determine future travel projections for opening year 2023 and design year 2050. Because there is no MPO or statewide travel model, we will look to utilizing the growth rates provided by SDDOT to look at first a trend analysis with growth rates and comparing them to the historical. We will also look at other established methods from the NCHRP Report 765.

- (SDDOT): Please reword as there is a Rapid City MPO regional model but it just does not cover this corridor. Plan to include the growth factors and their source within this document.

g. Safety Issues: What is the desired crash analysis period?

- (SDDOT): We want an analysis for 5 years of data. SDDOT is good with using the calendar year of January 2012 through December 2016 for the 5 years of data. This was provided on the geodatabase.

Stantec will compute a crash rate, but would SDDOT also like a critical crash rate completed? Does SDDOT do this?

- (SDDOT): In previous studies, SDDOT has seen a critical crash rate but it isn't typically used. They can compare the crash rate to statewide crash rates by functional classification. Use the FHWA IHSDM (Interactive Highway Safety Design Model) methodology to determine the required crash analyses to be performed with this study.
- **SDDOT to check with their traffic section to verify how they want the crash analysis completed, we will abide by that.**

h. Selection of Measures of Effectiveness: Reviewed the service measures listed in the Draft M&A document.

- (SDDOT): For stop-controlled intersections – these are based on delays by leg and in pure HCM methodology, there is no weighted average delay for stop-controlled intersections. So, we have had it averaged out for the intersection instead of only reported for each stop-controlled leg.
  - Stantec will do this, one caveat – weighted average doesn't work well for two-way stop control but works well for all-way stop control. We will just add an additional column and explain how we get it.

- The queue analysis at the port of entry. You can do basic spreadsheet queuing analysis but the HCM freeway facilities method is not sensitive to having a backup onto the freeway.
  - (SDDOT): The ramp has queue detection in it so in theory you never back up onto the mainline.
    - Stantec can simulate this but not sure to what extent you want it included in the analysis. Maybe the metric is that given this demand, how often do we have to shut it down when the queue backs up to the detection. How less frequently would we have to shut it off given the "build" alternatives.
  - (SDDOT): The port of entry has electronic screening and we will need to know what percentage of the trucks are enrolled in the electronic screening program.
    - Stantec would need to rely on SDDOT to get us this information.
  - Stantec has the tools to do the analysis but need to give thought to what extent this is incorporated into the analysis.
    - (SDDOT): We would like to know how many vehicles are being bypassed around the port because of queue back up. We collect information based on the time periods that the queue is full. We might be able to get the truck bypass info during that time. The electronic

screening system knows when the queue is full and it may know how many trucks went by. That is data that we would have to acquire and I'm sure we could acquire it. In this document, we need to explain what analysis we are planning on doing for this issue.

- (Stantec): In theory, if we have the detection and we never let the queue spill back onto the mainline then we do not affect the flow and it is a non-factor for the mainline travel flow. In reality, it may cause a bit of turbulence at times, but how do we account for this. If we can determine the effect, we can simulate it, but do we need to?
  - (SDDOT): The reason we need this is to determine if we need a longer off ramp, for this reason we will need information regarding how often the queue is filled.
- How do we roll this into the IMJR?
  - (SDDOT): It shouldn't impact the IMJR unless it is long enough to impact Exit 37. Ultimately question is how long does the off ramp need to be to store what we need to store.
  - Stantec proposed simulation for this analysis.
    - (SDDOT): Concerned about cost of calibration required by FHWA.
    - Stantec has good relationships with FWHA so the calibration process could be streamlined.

i. Interstate Access Modification Policy: We need to use the new one released May 22, 2017.

- **SDDOT will send the new policy will be forwarded to Stantec.**
- Unlikely there has been any reports completed with the new policy to use as an example.
- Stantec will follow the new policy and understands that many of the points from the old document are covered within the Environmental Document which is referenced in the IMJR.

j. Conclusions: Will include results of the corridor study and two IMJRs.

k. Appendices: Will include notes from this meeting.

5. Other Issues?

(FHWA): The M&A document includes the corridor study through design. We should state that it is anticipated as a result of the study and design there will be two IMJRs – one each for Exit 34 and Exit 37. So we should revise the title of the M&A document to include study and design and be sure to include information from the RFP within the M&A document – the purpose and need and what will be accomplished: M&A for corridor study, the determining of construction projects, environmental document, two IMJR's, construction plans.

Stantec will make the edits as suggested during this discussion and resubmit the M&A document for review.

6. General Discussion / Next Steps

(SDDOT): For the environmental purpose and need Marion Barber with FHWA asked for a standard letter invite for cooperating agency, SDDOT doesn't have a standard letter so one will need to be developed.

Stantec Method & Assumptions Meeting Minutes

MEAD_IM 0901(195)32N_IM 0901(198)32N_I-90 Exit 32-40
Stantec WO: PD-03-17

Conference Call
October 2, 2017, 2:00 pm – 3:00 pm CST

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Distribution: Attendees

Meeting Action Items

21	SDDOT to provide port closure times to Stantec	Steve Gramm 10/2/2017	
22	SDDOT will determine if WIM's collection interval can be changed from 60 min to 15 min	Steve Gramm 10/2/2017	
23	SDDOT will provide ranges of penetration rates of E-screening devices	Steve Gramm 10/2/2017	
24	SDDOT is to contact WYDOT in regard to Sundance and Sheridan Prepass Share numbers	Dave Huft 10/2/2017	
25	SDDOT to request processing time at Tilford Port of Entry from State Patrol	Dave Huft	

		10/2/2017	
26	SDDOT to provide Stantec with simulation report from I-29 Jefferson St interchange as an example for Tilford Port of Entry	Steve Gramm 10/2/2017	
27	Stantec will include the simulation to be used in the M&A document	Tom Creasey 10/2/2017	
28	SDDOT to provide Stantec with past counts at Exit 40.	Steve Gramm 10/2/2017	Completed 10/2/2017

Meeting Agenda & Discussion Items

1. Introductions – All
2. Safety Moment – Dale Grove
   - *Reviewed Cell Phone Safe Driving Practices*
3. Schedule Update – Dale Grove
   - Turning movement data on track for October.
4. Tilford Port of Entry – Tom Creasey
   a. The following need to be identified to evaluate the Tilford Port of Entry
      - Demand over time
      - Times when demands are the highest
      - Strategies to avoid a full queue and trucks bypassing
      - existing geometrics for storage and acceleration/deceleration lengths
      - 24hr Directional Classification Counts for mainline lanes and ramp (summarized at 15-minute intervals)
      - Processing Time at Tilford Port of Entry
      - E-screening Data

   b. SDDOT's Weigh in Motion (WIM) upstream of the Tilford Port of Entry is capable of collecting traffic data needed.

c. SDDOT will be modifying the WIM's collection parameters to include times when the queue is full (trucks are being bypassed)

d. The port of entry is not always open, times when it is closed will have to be known for simulation. **SDDOT to relay port closure times to Stantec.**

e. **SDDOT will determine if the WIM's collection interval can be changed from 60 min to 15 min.**

f. **SDDOT will provide ranges of penetration rates of E-screening devices**

g. **SDDOT will talk with WYDOT for their Prepass share numbers at Sundance and Sheridan**

h. **SDDOT to request processing time at Tilford Port of Entry from State Patrol.** A study will be done in which sample processing times will be collected (by State Patrol). The survey will include approximately 100 observations.

i. Simulations developed in 2002 for the Jefferson I-29 ramp which used the same information that is being proposed to be used for the Tilford Port of Entry (reliability, 24hr classification counts). **SDDOT to provide Stantec with a copy of the report.**

j. South Dakota does not have any agreements with surrounding states dealing with truck bypassing of South Dakota's ports of entry.

k. Random screening is done with E-screening there is a 1:10 chance a register truck will be called in to the port of entry

l. Stantec proposed using 80% level of confidence with the Tilford Port of Entry. The confidence level to be used will be noted in M&A document to be review and approved by SDDOT before simulation work can commence.

m. Stantec will use real existing data collected from the SDDOT WIM to simulate the existing conditions and design year.

n. The M&A document will include how the data will be used, simulation approach, and any assumptions used.

o. The traffic patterns and distributions found in the existing data will be used to develop the "future" simulation.

p. SDDOT would prefer simulation done in CORSIM or VISSIM as they do not have access to TransModeler to be able to review or access later. **Stantec will include the simulation software to be used in M&A document.**

q. FHWA confirmed there would be no federal requirement for the simulation as the simulation would not be used for an Interchange modification.

5. Exit 40 Traffic Counts – Tom Creasey

Construction of PCN 5580 (I-90 Exit 40 to 44) was on going during turning movement counts. Westbound lanes completely closed from Exit 40 to Exit 44.

- Will additional counts be needed at Exit 40 at a later time? SDDOT and FHWA confirmed no; the interchange is only being included to satisfy IMJR requirements.
- SDDOT thought that while the volume of counts taken during the Sturgis Bike Rally would be higher, the turning movements would be similar to the typical turning movements that would be found. **SDDOT to provide past counts at this location to justify the use of rally counts.** Based on the available data, Stantec will estimate turning volumes at this interchange for which analyses can be performed and included in the IMJR.

6. Task 1 and Task 3 Overlap Items – Tom Creasey

   Stantec's take on the timing of items.

   - The work for items that overlap between tasks would be completed in Task 1 Corridor Study, but in development of the IMJRs work would need to be duplicated/separated between the two anticipated documents in Task 3 Interchange Modification Justification Reports. SDDOT agreed.

7. Other Issues?

   - Stantec will update the M&A document as suggested during this discussion. The M&A document will be resubmitted for review.
   - SDDOT and FHWA approval of M&A document is needed before Stantec can proceed with the traffic analysis.

8. Meeting Adjourned