TRAFFIC SIMULATION AND SAFETY ANALYSIS (TSSA) AND INTERSTATE ACCESS JUSTIFICATION REPORT (IAJR)

ITE HOUSTON CHAPTER
JULY 2021

by
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Agenda

- TSSA Program Overview
- IAJR SOP Overview
- Traffic Simulation/Analysis
- Safety Analysis
- Current Initiatives
TSSA Program - Background

Advancements in Traffic Analysis Procedures/Tools
- Limitations of HCM
- Microsimulations/MOE

AASHTO Highway Safety Manual
- Predictive Analysis
- Safety Analysis Tools

FHWA Review
- Quality of IAJR
- Quality of Design Exceptions

Need to Develop Expertise
- Traffic Simulation
- Safety Analysis
TSSA Program – Purpose/Functions

**GUIDANCE**
- Develop, interpret, and implement guidelines
- Coordinate, develop, and conduct training
- Provide technical expertise

**SUPPORT**
- Planning, scope, & traffic methodology
- Traffic simulation & safety analysis on select projects
- Review IAJRs & design exceptions

**COORDINATION**
- Meetings with FHWA
- Participate in District and Division Meetings

**CONSULTANT MANAGEMENT**
- Consultant contracts on selected projects
IAJR SOP Overview

- Introduction
- IAJR Process
- IAJR Methodology
- IAJR Report
- IAJR Re-evaluation
- Quality Control
### IAJR SOP Introduction

#### Purpose
- Provide TxDOT Guidance based on FHWA Access Guide
- Provide consistent point of reference for Districts, DES, and FHWA (Tx Div)
- Improve probability and ease of acceptance by FHWA
- Clarify importance of early coordination with DES and FHWA

#### Legal Background
- Title 23, United States Code, Highway Section 111
  - State will not add any point of access w/o approval of Secretary USDOT
- Title 49, Code of Federal Regulation (CFR), Section 1.48
  - Secretary delegated the authority to FHWA

#### Policy Evolution
- FHWA Policy
  - October 22, 1990
  - February 1998
  - August 2009
  - May 2017
- TxDOT Policy
  - October 19, 2018 Memo
  - April 2020 – SOP Issued superseding 2018 memo
TxDOT’s Policy for IAJRs

- Incorporates the two updated points in the FHWA May 2017 Policy
  - Effects of revised access on Safety and Operations
  - Access, Connection and Design
- Retains the six points in the FHWA August 2009 Policy
  - Need
  - Alternatives
  - Consistency w/Local and Regional Plans
  - Potential future multiple Interchange additions
  - Coordination w/ Local Development/Transportation
  - Environmental Review Status
IAJR Process

Key Stages

PROJECT INITIATION
Need and Purpose
Methodology

COORDINATION
Traffic Forecast
Crash Data
Exist Cond
Benefits/Impacts
Access & Design
Recommendations

TRANSPORTATION ANALYSIS
Traffic Analysis
Safety Analysis

COORDINATION

REVIEW & APPROVAL
Draft Submission
Typical Average Schedule

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Methodology
Data Collection
Traffic Forecasting
Traffic Analysis
Safety Analysis
Draft Report
TxDOT Review
FHWA Review

Months to Complete
IAJR SOP Methodology – Early Coordination Meeting

- For the purpose of developing a technical approach for IAJR development
- Required for all projects with potential for IAJR
- District, DES, and FHWA should attend
- Initial determination of project reasonableness
- Attachment D provides a typical meeting agenda
- Meeting notes should be documented and included in the IAJR
- Additional meetings may be required for major/complex projects
Common Issues in IAJR

- Poor Need
- Not considering other Alternatives
- Insufficient Area of Influence
- Ignoring crossroads
- Unreasonable design volume
- Inappropriate traffic analysis tools selection
- Weak safety analysis
- Phased project implementation but no interim year analysis
- Documentation missing or provided too much
- Skimming in re-evaluation
IAJR Methodology

- Need
- Alternatives
- Area of Influence
- Analysis Years
- Analysis Periods
- Data Collection
- Traffic Forecasting
- Traffic Operational Analysis
- Safety Analysis
Area of Influence

- Area of Influence is the area impacted by the proposed change
- Factors to be considered
  - Area type
  - Interchange spacing
  - Extent of congestion
  - Anticipated traffic impacts
- Along Mainlane
  - In urban area, at least one adjacent interchange in either direction
  - In rural area, depends upon the interchange spacing
- Along Crossroad
  - ½ mile in either direction of proposed change
  - Crossroad of adjacent interchange usually not included
- A figure showing Area of Influence will be included in the report
Area of Influence (FHWA Guide)

- Project Limits
- Area of Influence Of Crossroad
- Area of Influence on Crossroad
- Area of Influence On Interstate
IAJR - Analysis Years

- Existing, Opening and Design Years required for each project.
  - Existing year analysis will only include existing conditions.
  - Opening and Design years will include both no-build and build conditions.
- Existing Year
  - Should be start of IAJR Analysis or
  - Preferably within 1 to 3 years from IAJR approval
- Design Year
  - Minimum 20 years after approval of final plans
  - Preferably, Opening + 20 years
- Opening Year
  - First year at which project is opened to traffic
    - For Phase construction, opening year of first phase
- Interim Year
  - Opening year of different phases
  - when design year shows failure
IAJR - Analysis Periods

- 30th highest hourly volume (design hour volume) minimum
- AM and PM peak hour may be required
- Existing 24-hr volumes should be evaluated to verify
  - Peak periods versus peak hours
  - Design Hour or K-factor
  - Peak hour selection
- For oversaturated conditions
  - Multi-hour peak period may be needed
  - 24-hr volume profile shall be evaluated
IAJR - Data Collection

- Data Collection
  - Roadway Geometry, Traffic Control
  - Traffic Count, Travel Time, etc
  - Crash Data
  - Summary of data collection

- Traffic Count
  - Weekday min. 48-hr
  - Classification count
  - Weekend (if required)
  - Where Microsimulation is used, one week or more for calibration
  - Actual traffic counts within 1 to 3 yrs of IAJR approval
Traffic Forecasting

- Traffic forecasting is complex and requires understanding of:
  - Land use
  - Demographics
  - Project location

- TxDOT Transportation Planning & Programming Division (TP&P) provides guidance and approval requirements

- TP&P-Traffic Analysis Section (TPP-T) SOP

- Three approaches to develop traffic forecasts:
  - Pivot/Trend Line/Growth Method
    - Based on historic growth
  - Travel Demand Model (TDM)
    - Utilizing MPO TDM
    - Comparing TDM output with traffic counts, land use
  - Hybrid Approach
    - Combination of TDM and Growth Factor
    - Start with TDM and adjust with growth factor
Traffic Forecasting Approval

TP&P provides three options for approval

- **Option A: TPP-T Development**
  - TPP-T develops and signs & seals

- **Option B: District and TPP-T Joint Development**
  - District/Consultant develop
  - TPP reviews and signs & seals

- **Option C: District Development**
  - District/Consultants develop
  - District reviews and signs & seals

A traffic projections/forecast memo is required
Design Consideration

Proposed Design should:

- Meet or exceed current design standards
- Not include partial interchange
- Only include access to public road

Design Exception (if required)

- Should be noted in the IAJR
- Request should be submitted separately

IAJR will include

- Design schematics i/c signing layout
- DSR showing design criteria
# IAJR QC Checklist

## Interstate Access Justification Report (IAJR)

### Quality Control Checklist

<table>
<thead>
<tr>
<th>No</th>
<th>ITEM</th>
<th>Review</th>
</tr>
</thead>
</table>
| 1  | Methodology Coordination  
Methodology Coordination Meeting (MCM) conducted and meeting minutes documented |        |
| 2  | Report includes a project description along with a project location map |        |
| 3  | Need and Purpose supported by data and justifies the project         |        |
| 4  | Area of influence includes adjacent interchanges & intersections as per MCM |        |
| 5  | Analysis years per MCM                                             |        |
| 6  | If the project is to be implemented in phases                      |        |
| 7  | Traffic Volume                                                     |        |
| 8  | Existing traffic count data collected                               |        |
| 9  | Traffic forecasts are developed per TPP guidelines and approved by TxDOT |        |
| 10 | Traffic forecast methodology and assumptions memo is included       |        |
| 11 | If Travel demand model (TDM) used for traffic forecasting, TDM is latest/approved model |        |
| 12 | Traffic forecasts are checked for reasonableness                    |        |
| 13 | Traffic Analysis                                                   |        |
| 14 | Traffic analysis tools selected per MCM                            |        |
| 15 | Latest guidelines/standards have been used                         |        |
| 16 | Study area type is Central Business District                        |        |
| 17 | Existing and/or expected future traffic conditions is saturated     |        |
| 18 | A microsimulation tool was used, the report includes the calibration memo |        |
| 19 | Measure of Effectiveness (MOE) are consistent with analysis tools and project settings |        |
| 20 | The results of traffic analysis were reviewed for reasonableness    |        |
| 21 | The results of build year analysis show better or equal operational conditions |        |
| 22 | The traffic analysis software files checked to verify input, and parameters |        |
| 23 | Safety Analysis                                                    |        |
| 24 | The safety analysis study area selected per MCM                    |        |
| 25 | The historical crash data and analysis conducted for latest 4 years |        |
| 26 | The safety analysis includes predicted crash frequency or evaluation of CMF  |        |
| 27 | Report                                                              |        |
| 28 | Design schematic is included                                       |        |
| 29 | Signing plan is included                                            |        |
| 30 | The proposed project is consistent with State/MPO/local plan and documentation included |        |
Traffic Simulation/Analysis

Scope and Approach depend on

- Area Type
  - Urban/Suburban/Rural
- Traffic conditions
  - Congested/un-congested
- Complexity of Project/Analysis Tools
  - Isolated/System interchange
- Selection of Analysis Tools
  - Measures of Effectiveness (MOEs)
  - Cost Effectiveness
  - FHWA Traffic Analysis Toolbox
Traffic Simulation/Analysis

- HCM-based Analysis Tools
  - Macroscopic & deterministic
  - Good for under-saturated flow
- Highway Capacity Software
  - Quick & reliable
  - Good for traditional analysis
  - Freeway facilities
- Synchro
  - Good for arterials
  - Signal optimization
- Sidra
  - Commonly used for roundabouts
Traffic Simulation/Analysis

- Microsimulation Analysis Tools
- Warranted for complex scenarios
  - Pros
    - Good for longer congestion
    - Good for system effect
    - Good for presentation
  - Cons
    - Data requirement
    - Time consuming
- Common microsimulation tools
  - CORSIM
  - VISSIM
Traffic Modeling Process

1. SCOPE
2. DATA COLLECTION
3. BASE MODEL
4. VERIFICATION
5. CALIBRATION
6. ALTERNATIVE ANALYSIS
7. DOCUMENTATION
Traffic Simulation/Analysis

- Analysis must be done for:
  - Each scenario
  - All analysis periods
  - Each study area segment

- Analysis should Identify:
  - Segments/intersections with unacceptable MOEs
  - Reasons for failing
  - Potential mitigating measures
  - Needed improvements within the study area
  - The effect of failure on Interstate Operation
Safety Analysis

Scope and Methodology

- Project type and Location
- Complexity
- Crash History
- Need and Purpose
- Safety Analysis Study Area
- Option A (Preferred)
  - Historical Crash Analysis and HSM Predictive Method
- Option B
  - Historical Crash Analysis and CMF Evaluation
Historical Crash Analysis

- Latest 3 to 5 years (Determined during Coordination Meeting)
- To identify or confirm safety problems
- Analysis should include
  - Crash Frequency by facility type for each year
  - Crash Severity by facility type for each year
  - Crash rates (to be compared with Statewide Average)
  - Primary contributing factors
  - Manner of collision for each year by time of day
  - Crash Diagram/High Accident Location
  - Heat maps/Bar Charts/GIS
**Highway Safety Manual**

- Quantitative Safety Analysis
- Predict crash frequency
- Similar to HCM

**Part A**
- Human Factors

**Part B**
- Safety Management Process

**Part C**
- Predictive Method

**Part D**
- Crash Modification Factors (CMF)
Safety Analysis

Part C Predictive Method

- Anticipated change in crash frequency
  - Function of traffic volume
  - Roadway characteristics
  - Crash Modification Factor (CMF)
- Safety Performance Functions (SPF)
- Common safety tools
  - Interactive Highway Safety Design Model (IHSDM)
  - Highway Safety Software (HSS)
- Spreadsheet based tools
Safety Analysis Study Area

- Area impacted by the proposed project
- Traffic analysis study area is a good starting point
- Depends upon the safety impacts of the proposed project
- Along Mainlane
  - Minimum One adjacent interchange on either side of proposed change
- Along Crossroad
  - One-half mile from the ramp terminal
- Sample Area of Influence
Current Initiatives

- Traffic and Safety Analysis Manual (TSAP)
- Safety Scoring Tool
- Design Exception SOP
- Intersection Framework
- Highway safety manual implementation
  - Texas specific SPFs and calibration factors
  - Participation in FHWA DDSA EDC5
  - NCHRP panel
- Training
- Roadway Safety Assessment (RSA)
- Microsimulation toolbox (Future)
TSAP Manual Development Process

We Are Here

1. **Work Authorization Executed**
   - Kickoff Meeting Held

2. **Technical Advisory Committee**
   - Literature Review
   - Chapter Outlines

3. **Develop Chapter Contents**
   - Review by Technical Content Reviewers

4. **Develop Initial Draft**
   - Review by TAC & FHWA

5. **Develop Final Draft**
   - Rollout for Six Months Trial Period

6. **Conduct Workshops**
   - Feedback from Districts

7. **Publish Final Version**

Traffic Simulation & Safety Analysis Section (TSSAS)
Purpose is to assist designers in making safety-driven decisions during the project development and design process

- Rural 2-lane & Rural multi-lane tools available
- Intersection tool under development

The Rural scoring tools should be used on applicable projects

Districts are expected to submit the initial and final safety score on applicable projects - effective as of the April 2020 letting.

Scores are reported through Administration to Commission for each letting month

Tools, instructions, FAQ’s and videos are all posted on the DES Webpage
### Rural Scoring Tools - Eligibility Matrix as of May 2020

<table>
<thead>
<tr>
<th>Scope of Work</th>
<th>Scoring Tool Applies</th>
<th>Scoring Tool Currently Exempt</th>
<th>SII Applies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Added Capacity/Mobility</td>
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<tr>
<td>Major Rehab/widening</td>
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<tr>
<td>Super 2</td>
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<tr>
<td>Bridge Replacements (On System)</td>
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<tr>
<td>Bridge widening/major rehab</td>
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<tr>
<td>Seal Coats/Overlays</td>
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<tr>
<td>Full Depth Repair (Spot locations only)</td>
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<tr>
<td>Intersections/Intersection work</td>
<td></td>
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<tr>
<td>Traffic Signals</td>
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<tr>
<td>Replacing existing signs/striping</td>
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<tr>
<td>Any Urban facility</td>
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<tr>
<td>Rural Interstate, Freeway or Frontage Roads</td>
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<tr>
<td>Bridge Maintenance/Repair</td>
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<tr>
<td>Shared Use/Bike Path</td>
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<tr>
<td>Bridge Replacements (Off System)</td>
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<tr>
<td>Category 8 Widening projects (all)</td>
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<tr>
<td>Category 8 HSIP (non-widening)</td>
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</tbody>
</table>

*RTZ projects are reported separately*
Safety Analysis and Design

- Traditional or Nominal Safety
- DDSA or Substantive Safety
- Anticipated change in crash frequency
  - Function of traffic volume
  - Roadway characteristics
  - Crash Modification Factor (CMF)
Purpose of Safety Scoring Tool

- Incorporate Safety in the project design process
- Understand the Safety effect
- Simple and Straightforward

- 42%
  1V:3
  H

- 22%
  1V:4
  H
  1V:6H
Safety Scoring Tool Approach

- Basic Approach
- Comparing Alternates
- Roadway Element Categories
- Summary of Scoring Procedures
Safety Scoring Tool Approach

- Basic Approach
- Comparing Alternatives

Increasing safety

- Existing Conditions
- Project Designed to Standards
- Design Alt. 1
- Design Alt. 2
- Optimal Design for Safety
Roadway Element Categories

Geometric
40 points
- e.g., Shoulder and Lane Width
  Curvature

Baseline for Safety (e.g., sharp vs. flat curve)

Traffic
20 points
- e.g., Markings
  Signs
  Access Management

Improves Safety by helping drivers stay on the road

Access Management

Roadside
40 points
- e.g., Clear Zone
  Sideslope
  Barriers

Mitigate consequences of departing the road

Based on a maximum total score of 100
Summary of Scoring Procedure

1. **Split projects into segments**
2. **Analyze safety effects of individual elements**
3. **Combine element effects into category score**
4. **Weight categories for segment scores**
5. **Combine Segment scores for project score**
Questions?

Feedback

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