TEXAS DEPARTMENT OF TRANSPORTATION

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

ITE HOUSTON CHAPTER
JULY 2021

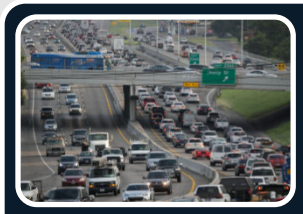
by

Khalid Jamil, P.E. – Design Division

Agenda

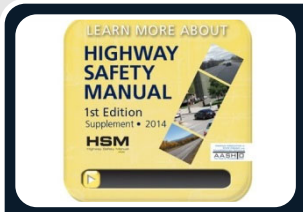
- TSSA Program Overview
- IAJR SOP Overview
- Traffic Simulation/ Analysis
- Safety Analysis
- Current Initiatives

TSSA Program - Background



Advancements in Traffic Analysis Procedures/Tools

- Limitations of HCM
- Microsimulations/MOEs



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 MANAGENT

- 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

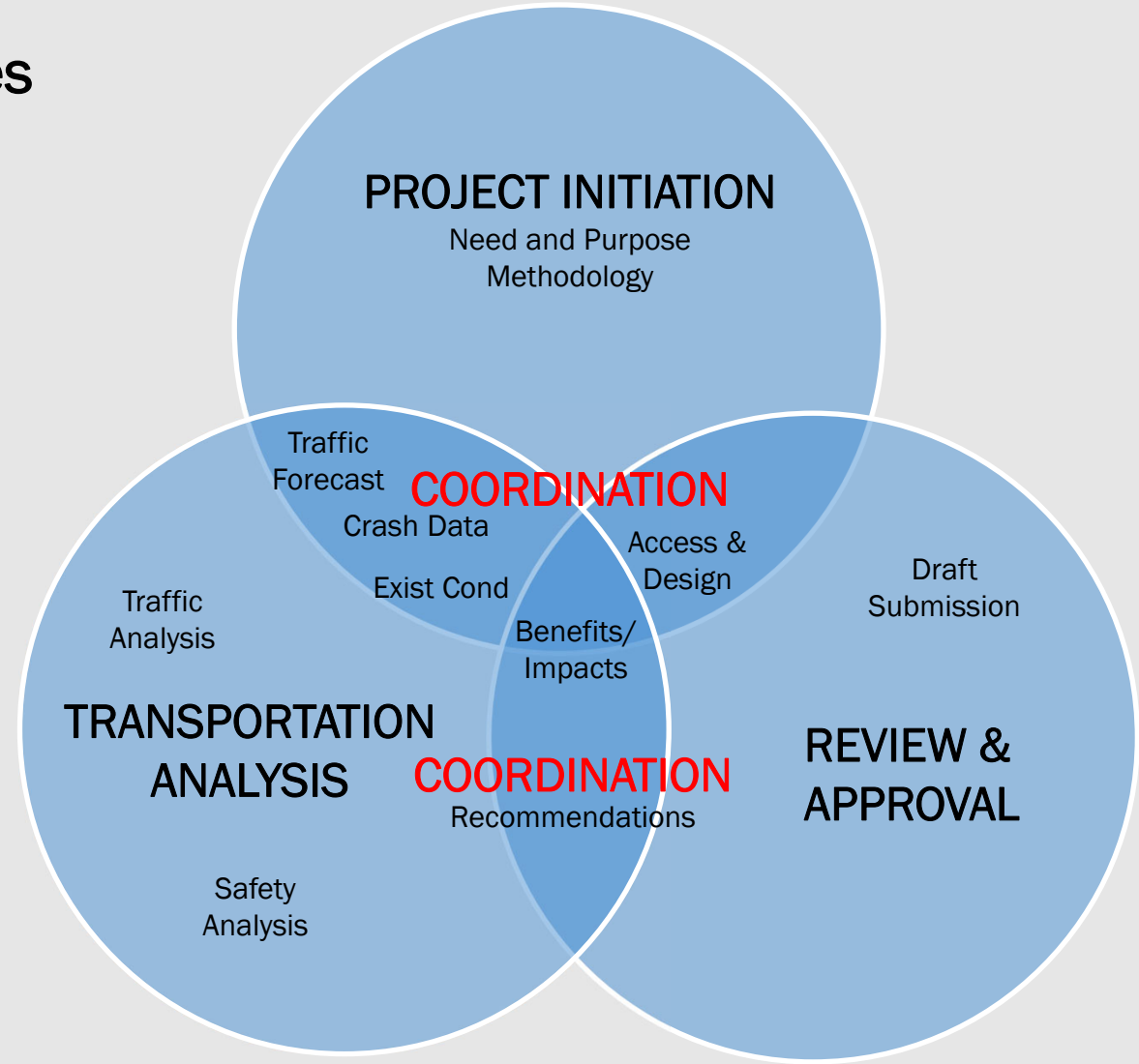
TxDOT's Policy for IAJRs

TxDOT's Policy for IAJRs

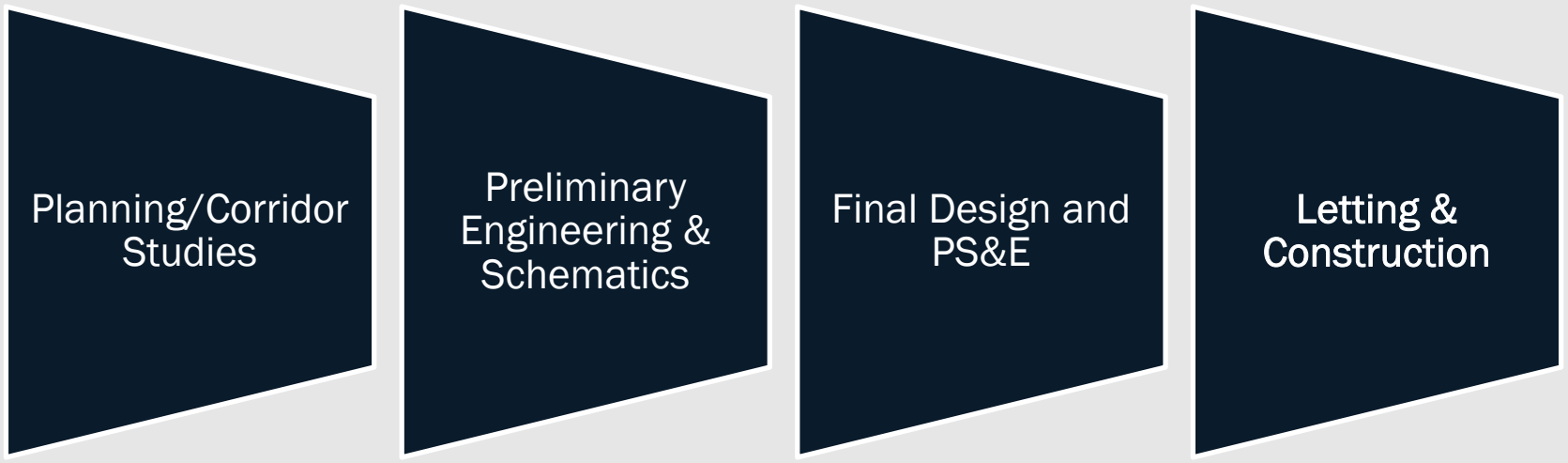
- Incorporates the two updated points in the FHWA May 2017 Policy
  - Effects of revised access on Safety and Operations
  - Access, Connection and Design
- Retains the six points in the FHWA August 2009 Policy
  - Need
  - Alternatives
  - Consistency w/Local and Regional Plans
  - Potential future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

IAJR Process

Key Stages



Project Development & IAJR Timeline

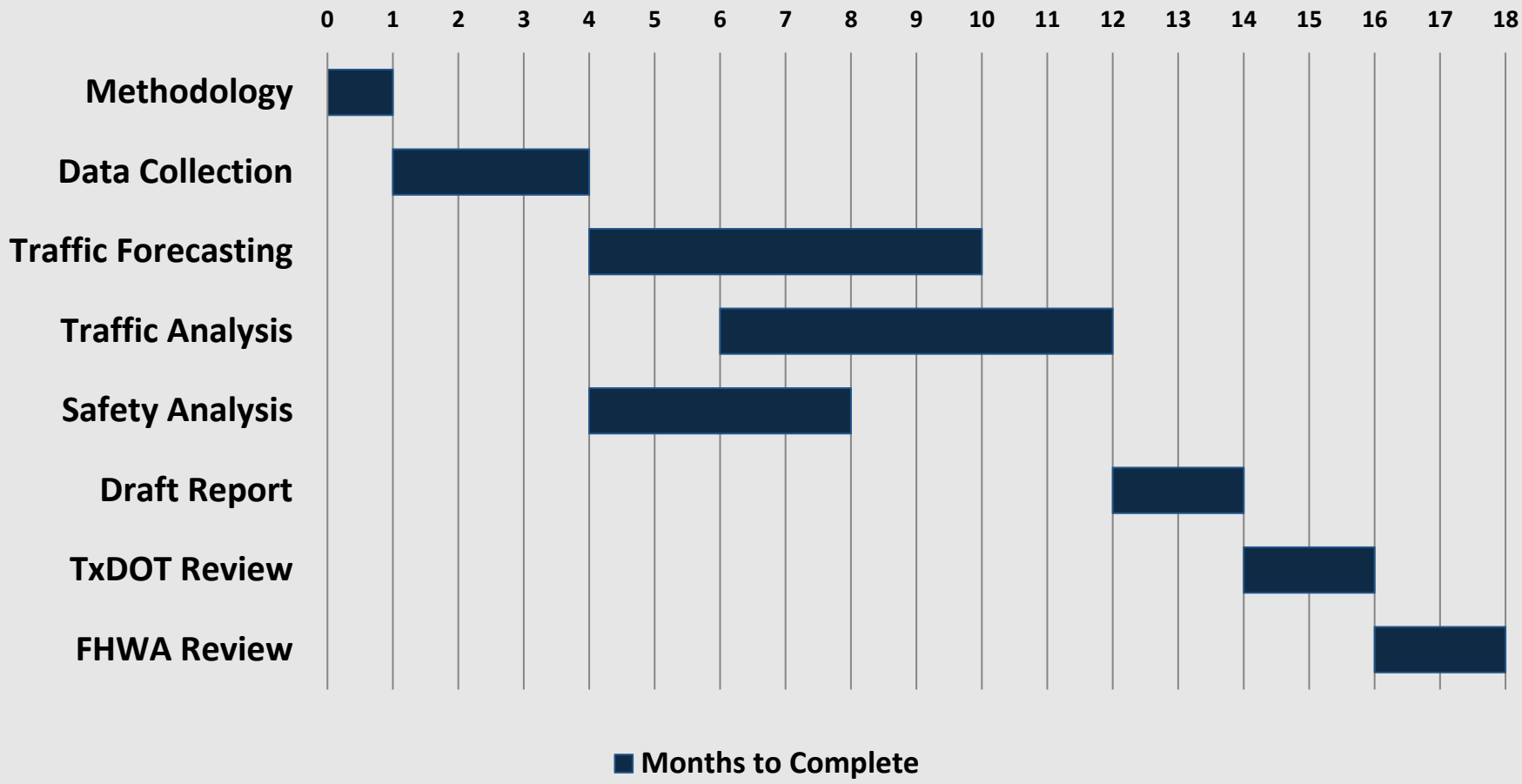


IAJR

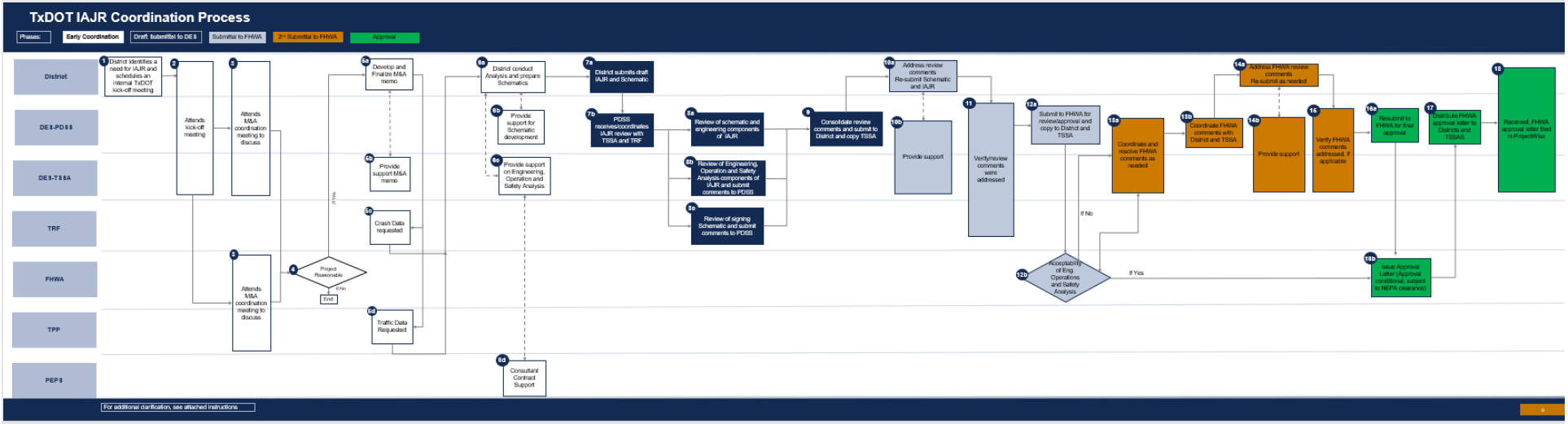
< 1 Years | 12 – 24 Months | < 3 Years

IAJR Schedule

Typical Average Schedule



TxDOT IAJR Process



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

IAJR Methodology – Early Coordination Meeting

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

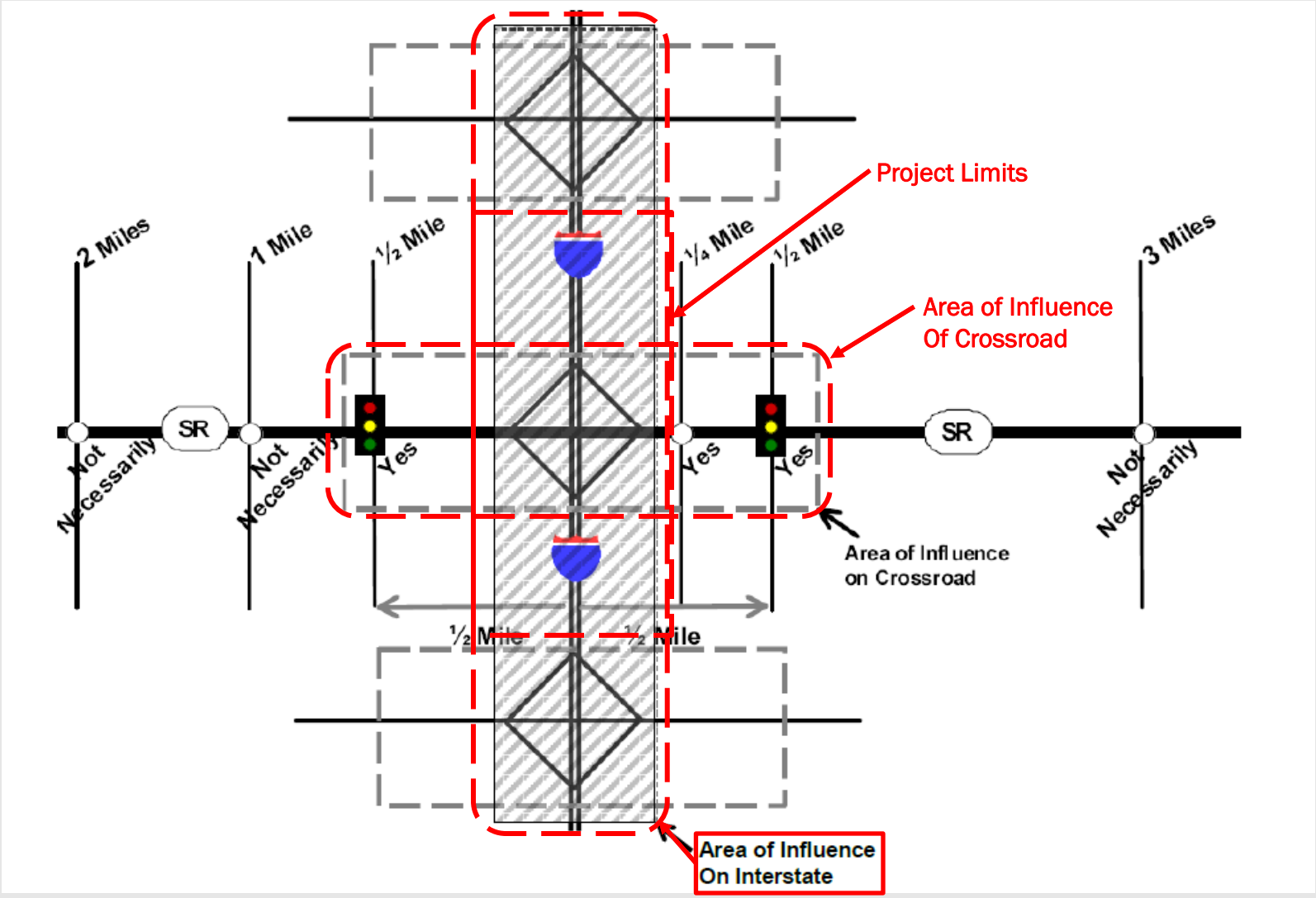
IAJR Methodology

- 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)



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
Engineering Operations and Safety Analysis
TxDOT Standard Operating Procedures (SOP)

DRAFT

Attachment F
Interstate Access Justification Report (IAJR)
Quality Control Checklist

No	ITEM	Review	
		Checked By	Date
	Methodology Coordination		
1	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		
	Traffic Volume		
7	Existing traffic count data collected		
8	Traffic forecasts are developed per TPP guidelines and approved by TxDOT		
9	Traffic forecast methodology and assumptions memo is included		
10	If Travel demand model (TDM) used for traffic forecasting , TDM is latest/approved model		
11	Traffic forecasts are checked for reasonableness		
	Traffic Analysis		
12	Traffic analysis tools selected per MCM		
13	Latest guidelines/standards have been used		
14	Study area type is Central Business District		
15	Existing and/or expected future traffic conditions is saturated		
16	If microsimulation tool was used, the report includes the calibration memo		
17	Measure of Effectiveness (MOEs) are consistent with analysis tools and project settings		
18	The results of traffic analysis been reviewed for reasonableness		
19	The results of build year analysis show better or equal operational conditions		
20	The traffic analysis software files checked to verify input, and parameters		
	Safety Analysis		
21	The safety analysis study area selected per MCM		
22	The historical crash data and analysis conducted for latest 4 years		
23	The safety analysis includes predicted crash frequency or evaluation of CMF		
	Report		
24	Design schematic is included		
25	Signing plan is included		
26	The proposed project is consistent with State/MPO/local plan and documentation included		

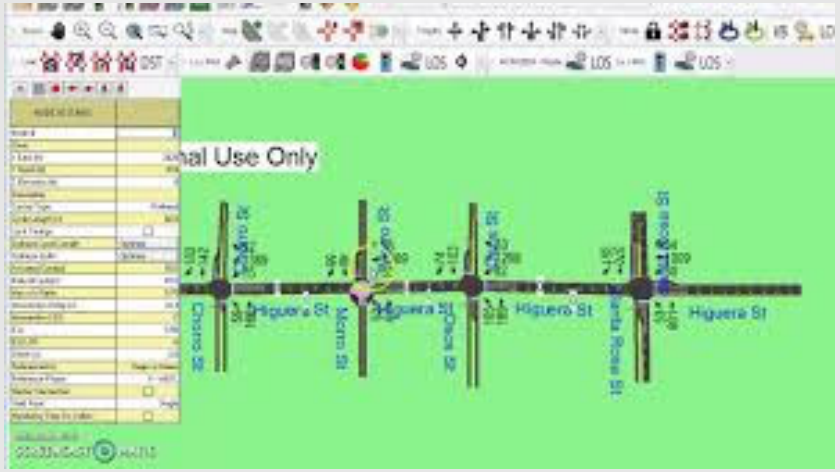
Traffic Simulation/ Analysis

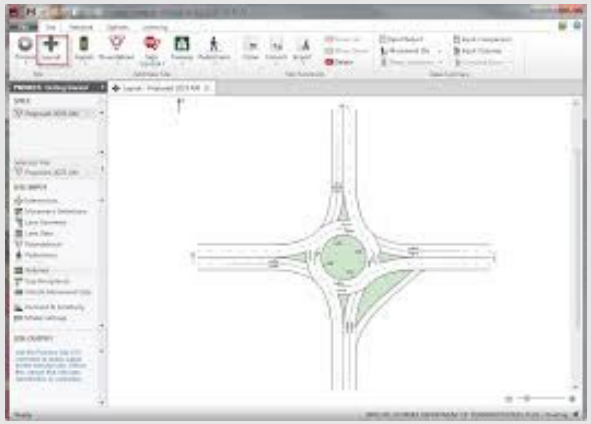
Scope and Approach depend on

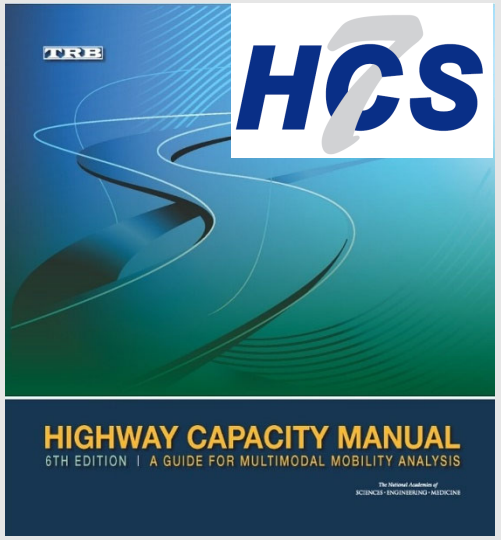
- Area Type
  - Urban/Suburban/Rural
- Traffic conditions
  - Congested/un-congested
- Complexity of Project/Analysis Tools
  - Isolated /System interchange
- Selection of Analysis Tools
  - Measures of Effectiveness (MOEs)
  - Cost Effectiveness
  - FHWA Traffic Analysis Toolbox

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



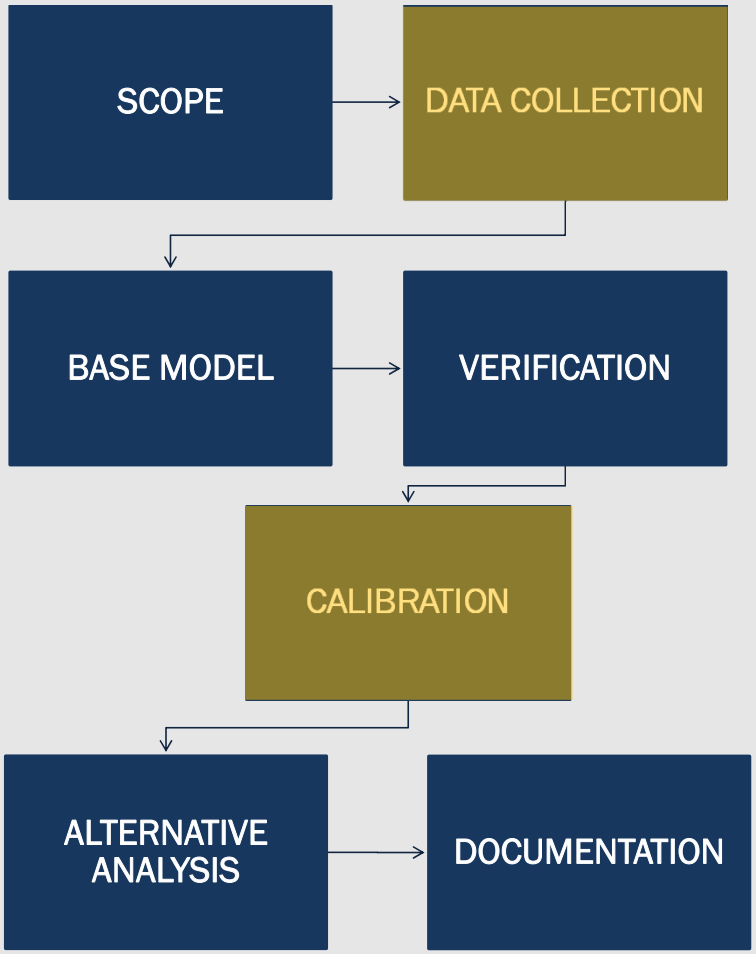




Traffic Simulation/Analysis

- 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



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

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

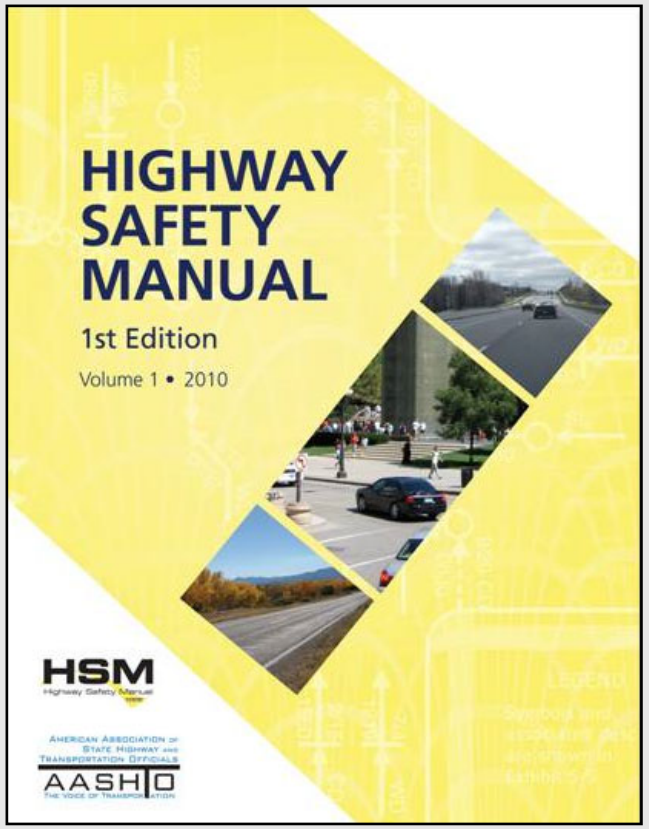
Historical Crash Analysis

- 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

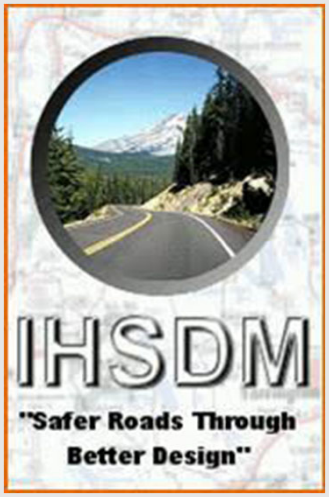
Part A	Human Factors
Part B	Safety Management Process
Part C	Predictive Method
Part D	Crash Modification Factors (CMF)



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

CMF
CRASH MODIFICATION FACTORS CLEARINGHOUSE



HCS

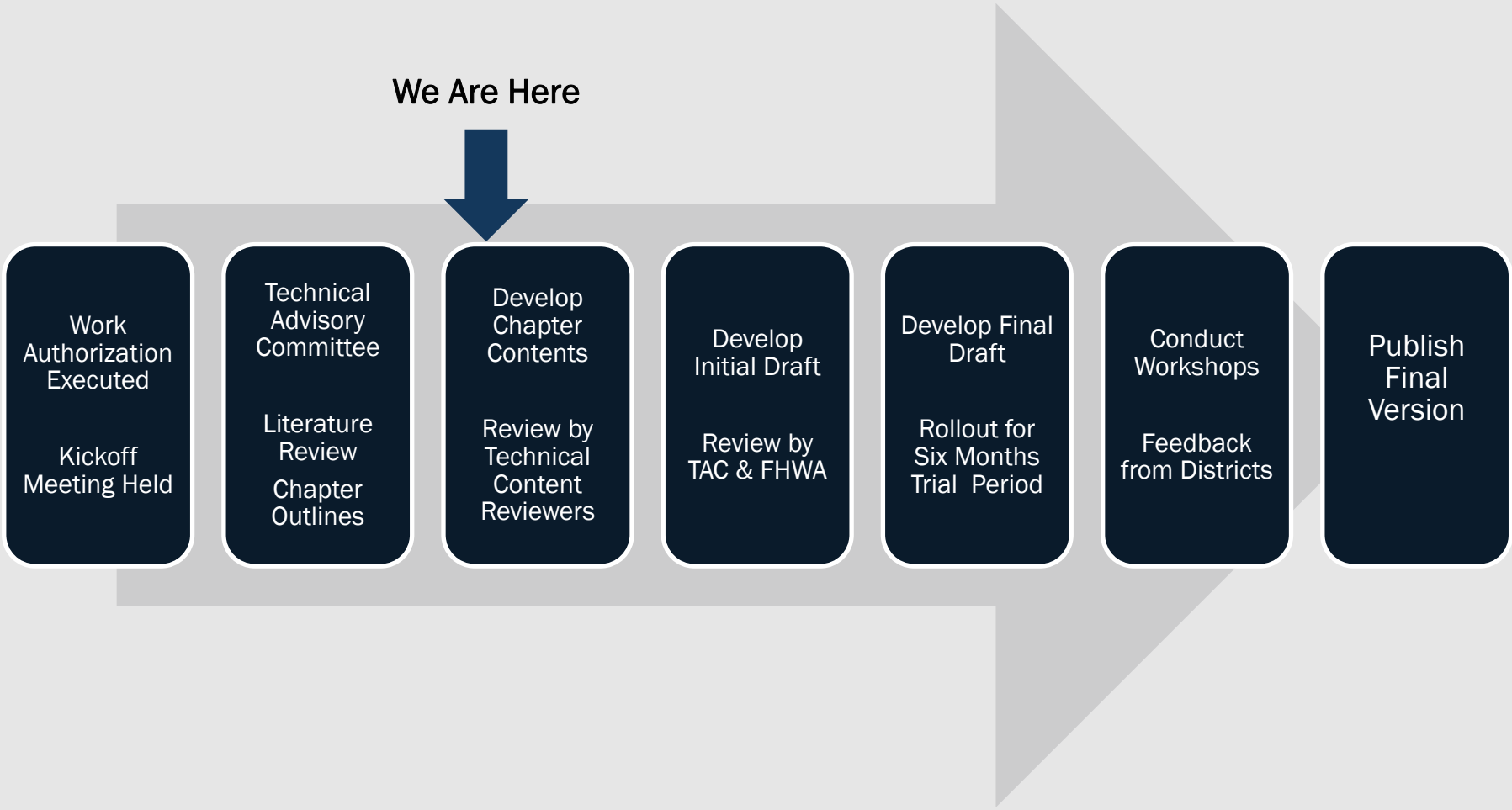
Safety Analysis Study Area

- 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



Safety Scoring Tool

- 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

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

**RTZ projects are reported separately*

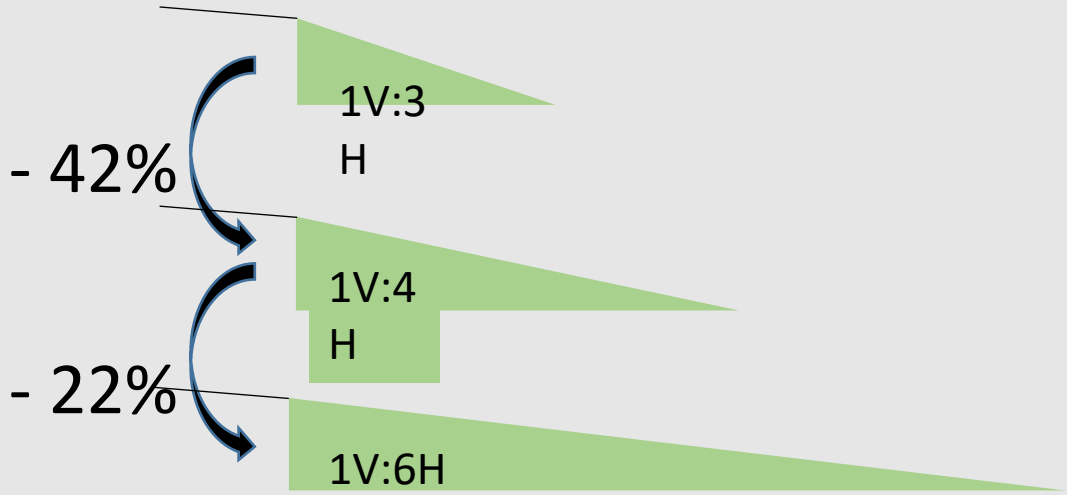
Safety Analysis and Design

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

CRASH MODIFICATION FACTORS CLEARINGHOUSE

Purpose of Safety Scoring Tool

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

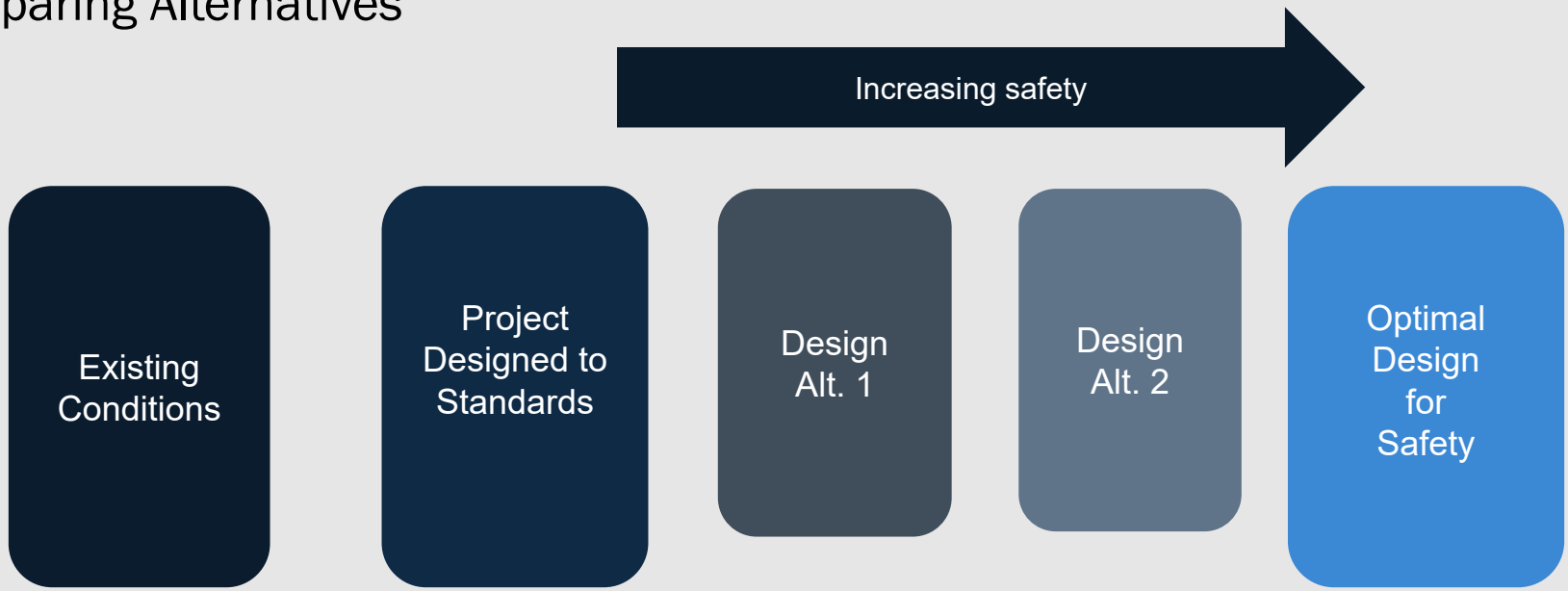


Safety Scoring Tool Approach

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

Safety Scoring Tool Approach

- Basic Approach
- Comparing Alternatives



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

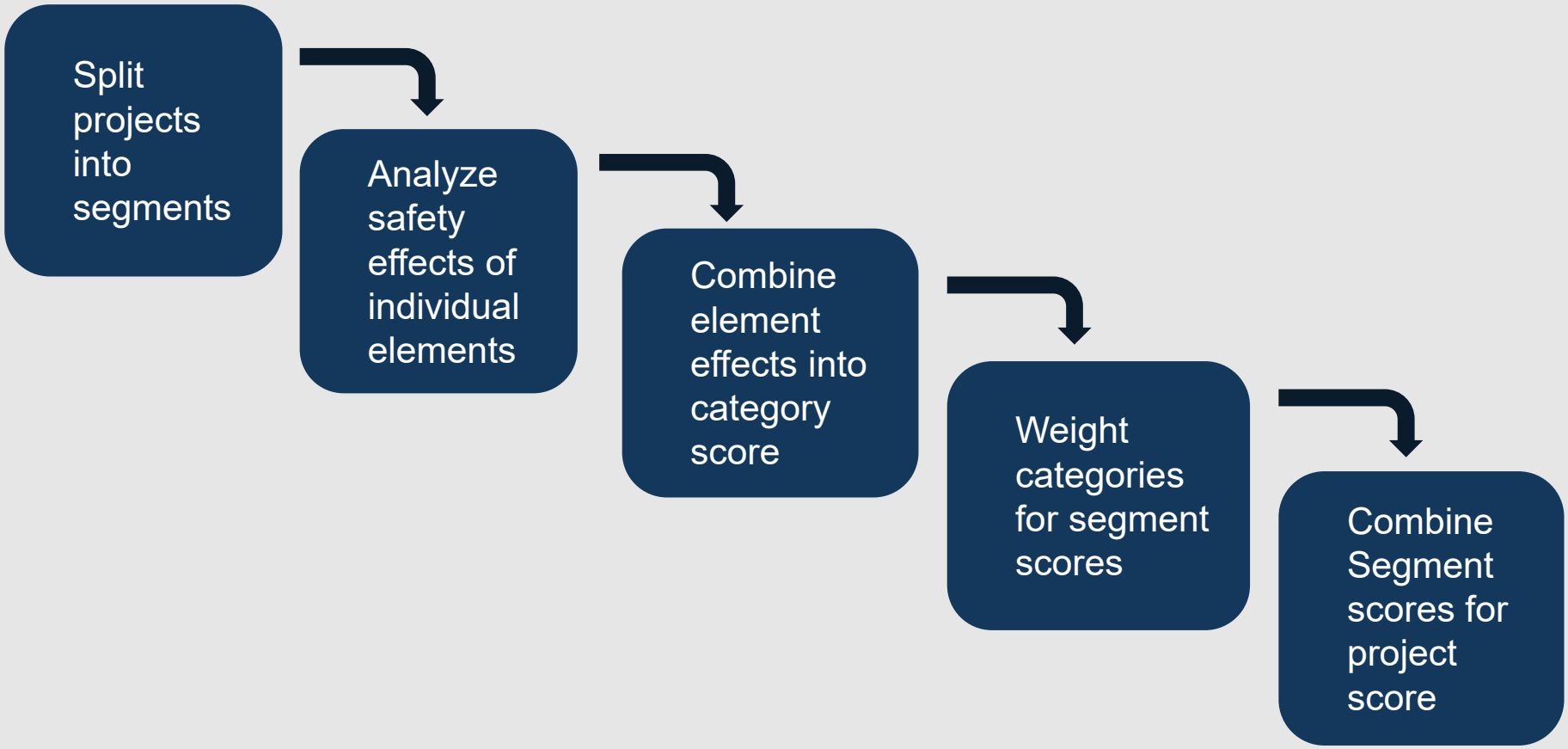
Roadside
40 points

e.g.,
Clear Zone
Sideslope
Barriers

Mitigate consequences of departing the road

Based on a maximum total score of 100

Summary of Scoring Procedure



Questions?
Feedback

Contact

Khalid Jamil, P.E.

(512) 486-5171

Khalid.jamil@txdot.gov