**Arizona Department of Transportation**
**Multimodal Planning Division**

AECOM

# Southcentral District I-10 Corridor Ramp Operations Study
# Project Work Plan

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## PROJECT UNDERSTANDING AND OBJECTIVES

Interstate 10 within the Southcentral District has undergone a number of changes over the past 10 years. Between Twin Peaks Road and 22nd Street, there are several reconstruction projects along the corridor, including I-10 mainline reconstruction from 29th Street to Prince Road and newly reconstructed traffic interchanges including Twin Peaks Road, Prince Road, and Ina Road (underway). In the near future, Ruthrauff Road interchange will also be reconstructed, along with Mainline I-10 in between Ina Road and Ruthrauff Road. This section of I-10 has been reviewed individually but not as a system particularly with regard to ramp metering and frontage road operations. A similar study was completed in 2003 but predated the major reconstruction of I-10 in 2009. The traffic operations of these facilities have changed significantly due to the change in roadway geometrics and increased traffic volumes.

Most interchanges have ramp metering conduit installed but the system hardware is not installed. Traffic volumes and dual left-turn crossroads are increasingly causing dense platoons of merging traffic which may benefit from metering.

The primary goal of this study is to determine current and future traffic control needs for the I-10 corridor between Twin Peaks Road and 22nd Street. This study will determine if and when the ramp metering infrastructure should be utilized and how it would operate. In addition, this study will re-evaluate the traffic control at the frontage road junctions to determine if the systematic “yield” control is appropriate or if “stop” control should be provided. The result of this study will provide the basis for future ramp metering design projects and provide operational insight and direction on the frontage road operational controls.

## PROJECT WORK PLAN

The study area includes a total of approximately 14 miles of the I-10 corridor from Twin Peaks Road to 22nd Street. Traffic Interchanges within the project limits include:

- Twin Peaks Road
- Cortaro Road
- Ina Road
- Orange Grove Rd
- Sunset Road (not currently signalized, so analysis would be limited)
- Ruthrauff Road
- Prince Road
- Miracle Mile
- Grant Road
- Speedway Boulevard
- Congress Street/Broadway Boulevard
- 22nd Street

Working papers and other study documents will be circulated to the Technical Advisory Committee for review and comment. The Working Papers will not be revised/updated and will remain as 'Draft'.

**OVERVIEW OF DELIVERABLES**

Task 1: Kick-Off Meeting
Task 2: Working Paper 1: Existing Conditions
Task 3: Working Paper 2: Analysis of Existing Conditions
Task 4: Working Paper 3: Cost Estimates/Benefit Analysis
Task 5: Draft Final Report
Task 6: Final Report
Task 7: TAC Meetings
Task 8: GIS Data (required for State Highway System) and Project Close-Out File

**WORK TASKS**

**Task 1, Kick-Off Meeting**

I. Schedule a Kick-Off Meeting with all agency stakeholders
II. Prepare presentation with relevant materials to discuss the goals, scope, schedule, and data collection
III. Coordinate with the Project Manager to determine responsibilities

**Task 2, Existing Conditions**

*Task 2.1 Previous Studies*

The purpose of this task is to collect and document all available information regarding the traffic interchanges within the project limits. The CONSULTANT will review and document the results of all recent studies/projects conducted by Pima Association of Governments (PAG) and ADOT affecting the I-10 corridor. With assistance from the Technical Advisory Committee (TAC), the CONSULTANT will identify and obtain copies of all relevant reports, including:

- I-10 Corridor Frontage Roads Between Cortaro Road and 22nd Street (2003)
- ADOT Interchange Studies
- PAG 2045 Regional Mobility and Accessibility Plan
- Traffic Analysis Reports prepared for freeway design and construction projects
- Ina to Ruthrauff DCR (HDR, 2013)
- Tangerine to Ina DCR (AECOM, 2014)
- ADOT Ramp Metering Design Guide (UCG, 2013)
- ADOT System-Wide Ramp Metering Evaluation (UCG, 2013)

A summary of recommended/programmed improvements in the corridor will be prepared and will include:

- Status of recommended/programmed projects
- Purpose of project
- Implementation status

*Task 2.2 Geometric Data*

The purpose of this task is to gather data on corridor physical features and conditions to complete a high-level geometric analysis. The following characteristics for each site will be identified based on Google Earth and record drawings:

- Origin – describe the interface between the local road and the entrance ramp/frontage road
- Number of origins – describe number of turn lanes from local road onto the entrance ramp/frontage road
- Type of entrance ramp – describe if the entrance ramp is a taper-type ramp (no lane added to freeway), a parallel-type (lane added and then dropped), or an auxiliary lane (lane addition extends from entrance ramp to next downstream exit ramp)
- Length of lane addition – distance along freeway (feet) from the nose of the striped entrance gore to the end of the lane line (for parallel ramps) or the striped gore for next downstream exit ramp (for auxiliary lane)
- Lane drop on entrance ramp – record whether the number of lanes on the entrance ramp reduces along its length
- Number of freeway lanes upstream of the entrance ramp merge
- Number of freeway lanes downstream of the entrance ramp merge
- Entrance ramp length to the tip of the nose – both the length of the main section of the ramp location from the frontage road gore to the back of the freeway physical gore, and the length of the striped gore (from back of freeway gore to the end of the striped gore)
- Entrance ramp curve – record whether the ramp is straight, slightly curved or tightly curved
- Entrance ramp grade – Identify whether the entrance ramp is level, uphill or downhill (in direction of travel)
- Entrance ramp shoulder – identify whether there is shoulder, discontinuous shoulder, or no shoulder on the entrance ramp
- Freeway shoulder - identify whether there is shoulder, discontinuous shoulder, or no shoulder on the freeway
- Inventory of current Ramp Metering Infrastructure for entrance ramps based on record drawings
- Inventory (geometric plan layout) of current traffic control devices for the frontage road and exit-ramp nodes
- Observations – any noteworthy observations on the ramp layouts

*Task 2.3 Crash Data*

Assemble crash data for the most recent five (5) years for the mainline (in the vicinity of each entrance ramp) and for the frontage roads (in the vicinity of each exit ramp). Crash data will not be collected for the crossroads or frontage road/crossroad intersections. The data will be analyzed to identify % of rear-end crashes and sideswipe crashes where both vehicles are traveling in the same direction.

*Task 2.4 Traffic Count Data*
Collect available traffic count data from ADOT Planning Division and Freeway Management System (FMS), PAG, and the City of Tucson. Traffic counts will be assembled and documented for the freeway mainline, ramps, frontage roads, and crossroads. Intersection turning movements will be assembled and documents for the crossroad/ramp (frontage road) intersections. Based on the exiting count data, K, T and D factors will be calculated.

Additional supplemental traffic counts will be collected at the Twin Peaks Road traffic interchange and will include 48-hour eastbound and westbound counts on Twin Peaks Road west of the interchange and peak hour intersection turning movements at the frontage road/Twin Peaks Road intersections during 6:30-8:30 AM and 4:00-6:00 PM on one day. Existing 2018 volumes will be derived from all of the count data collected.

2040 daily and peak hour travel demand will be provided by PAG. The 2040 projections and a current year PAG model will be compared to calculate the annual growth rate based on the PAG model. This growth rate will be applied to the existing traffic counts to estimate the 2025 and 2030 traffic volumes.

Graphics/figures will be prepared to show the existing and projected (2025 and 2030) traffic data.

*Task 2.5 Traffic Signal Timing and Phasing*
Provide a signalization overview (in the form of a graphic and/or table) of the nearest upstream traffic signal and signal timing at the cross street and a signage overview for stop/yield control operations at the frontage road at each site.

*Task 2.6 Task 2 Deliverable*
The Existing Data Working Paper documenting all relevant previous studies and recommended projects, physical features and conditions, crash data, traffic count and projection data and traffic signal timing and phasing collected in this task will be prepared and submitted (PDF version only) through the ADOT Project Manager to the TAC for review and comment. The consultant will use a comment matrix form to document all comment responses.

**Task 3, Analysis of Existing and Future Conditions**

*Task 3.1 Existing and No-Build Traffic Analysis*
Conduct an operational analysis of the existing conditions at the 12 entrance ramp sites for both the AM and PM peak hours. A VISSIM model will be developed for the existing conditions for the study area and will include the crossroads and ramps at each interchange. Field measured travel times and queuing will be used to calibrate the existing conditions model. A 2030 No-Build model will also be prepared for both peak hours. The existing and future No-Build conditions analysis will report the mainline level of service at each entrance ramp location for both peak hours based on the simulated speeds and densities along the mainline.

*Task 3.2 Screening Analysis*
The VISSIM models and site characteristics will be reviewed to determine if congestion is attributable to influences other than traffic volumes or that a site is upstream of another site whereby the downstream site could be the primary source of congestion.

*Task 3.3 Crash Data Analysis*
Summarize the five years of crash data referenced in Task 2.3 as a number and percentage of overall, rear end and sideswipe accidents at each site and compare the crash rates and frequencies against the corridor average to determine if there are "hot spots" near the entrance ramp merge/weave locations.

*Task 3.4 Geometric Analysis*
Identify any physical issues that may exist at each site such as:

- Pavement width if the ramp metering deployment requires two lanes
- Adequate acceleration distance based on the ADOT Ramp Metering Design Guidelines
- Pavement conditions
- Sight distance issues
- Physical constraints if ramp widening is needed

Identify if any issues can be rectified and any other useful factors that may influence the site's suitability for ramp metering.

*Task 3.5 Ramp Meter Strategy Comparison*
Identify and describe various ramp meter strategies for the study area. Compare typical/expected capacities for the different strategies against the existing and 2030 travel demand. This comparison is expected to be presented in table format.

*Task 3.6 Ramp Meter Traffic Analysis*
The 2030 No-Build VISSIM model will be revised to include two different ramp metering strategies to create two Build options. The two different Build options will be simulated in VISSIM for the AM and PM peak hours for the 2030 conditions (total of four simulations).

For each option, the queue length will be calculated using the ADOT Ramp Meter Design Guidelines at each entrance ramp based on the demand volume and the identified ramp meter strategies. In addition the mainline level of service will be reported at each entrance amp based on simulated speeds and densities.

*Task 3.7 Preliminary Recommendations*
Based on the traffic and geometric analysis, the recommended ramp metering strategy and traffic control at exit ramp/frontage road junctions will be identified. Reasons for not recommending ramp metering at specific locations will also be documented. An additional horizon year (2025) will be analyzed in VISSIM using the recommended strategy. The Build

Condition analysis results for the two years (2025 and 2030) and the traffic volumes will be used to estimate the timeframe for implementation of ramp metering.

*Task 3.8 Task 3 Deliverable*
The Analysis of Existing and Future Conditions Working Paper will document all activities in Task 3 and will be prepared and submitted (PDF version only) through the ADOT Project Manager to the TAC for review and comment. The consultant will use a comment matrix form to document all comment responses.

**Task 4, Cost Estimates/Benefit Analysis**

*Task 4.1 Cost Estimates*
Develop planning level capital and annual O&M costs for implementing the recommended ramp metering strategies. Estimates should include site-specific costs for geometric construction, signal displays and supports, detection, controllers, signing, pavement markings, traffic control and contingencies.

*Task 4.2 Benefit Analysis*
A benefit-cost analysis will be conducted based on monetized benefits from mainline travel time savings, mainline emission reduction, and mainline crash reduction.

*Task 4.3 Task 3 Deliverable*
The Cost Estimates/Benefit Analysis Working Paper will document all activities in Task 4 and will be prepared and submitted (PDF version only) through the ADOT Project Manager to the TAC for review and comment. The consultant will use a comment matrix form to document all comment responses.

**Task 5, Draft Final Report**

All working Papers will be consolidated into a Draft Final Report and be submitted (PDF version only) through the ADOT Project Manager to the TAC for review and comment. The consultant will use a comment matrix form to document all comment responses.

**Task 6, Final Report**

Prepare a Final Report based on TAC comments received on the Draft Report. A total of five hard copies will be provided to the TAC along with CD's (or flash drives) containing a PDF version of the report.

**Task 7, TAC Meetings**

A Technical Advisory Committee will be created to provide input and to review the deliverables. It is anticipated that the TAC will include a total of approximately five people from the ADOT Southcentral District, PAG, and ADOT TSMO. A total of three TAC meetings will be conducted in

Tucson. The first TAC meeting (in Tucson) will be the Kick-Off Meeting (see Task 1). The second TAC meeting (phone/WebEx) will occur following the delivery of Working Paper 1. The third TAC meeting (in Tucson) will occur following Task 3.1 and prior to the start of Task 3.6. The fourth TAC meeting (n Tucson) will occur following the delivery of Working Paper 3.

**MPD 0020-18: Southcentral District I-10 Corridor Ramp Operations Study**