KTMP
KILLEEN-TEMPLE
metropolitan planning organization

Technical Advisory Committee Meeting

September 14, 2016
9:30 a.m.

Agenda

Killeen-Temple Metropolitan Planning Organization
Technical Advisory Committee (TAC)

Wednesday, September 14, 2016
Central Texas Council of Governments Building
2180 North Main Street, Belton, Texas 76513

Regular Meeting: 9:30 A.M.
AGENDA

1. Call to Order.
2. Opportunity for Public Comment.(1)
3. Staff Update.
4. **Action Item**: Approve minutes from August 3, 2016 meeting.
5. **Action Item:** Regarding recommendation for approval of the draft updated Congestion Management Process and initiation of the public involvement process.
6. **Discussion Item:** Status of Thoroughfare Plan updates and incorporation into 2040 Metropolitan Transportation Plan (MTP).
7. Member comments.
8. Adjourn.

Workshop - To Follow Regular Scheduled Meeting
AGENDA

1. Call to order.
2. **MTP Re-Prioritization Project Call: Opportunity for TAC members to ask and answer questions about projects submitted for scoring.**
3. Discussion on any of the following topics (if needed):
    a. Current or past KTMPO documents and plans to include Unified Planning Work Program, Transportation Improvement Program, By-Laws, Public Participation Plan, Regional Thoroughfare/Bicycle Pedestrian Plan, Metropolitan Transportation Plan, Congestion Management Process, Annual Performance Expenditure Report, Annual Project Listing, Texas Urban Mobility Plan, Unified Transportation Plan, Federal Certification Process
    b. Past or Future KTMPO Meeting processes or happenings
    c. KTMPO Current, Past or Future MPO Boundary Studies
    d. KTMPO Past or Future Annual Meetings
    e. Current, Past or Future KTMPO Budgets and funding conditions
    f. Rural Planning Organizations and/or Regional Mobility Authorities
    g. Special Funding for Projects
    h. Legislative Changes
    i. Status of MPO Projects
    j. Staff, TxDOT, Consultant, Guest presentations relating to transportation
    k. Meetings pertaining to any transportation related items/topics
3. Adjourn.

The Killeen-Temple Metropolitan Planning Organization is committed to compliance with the Americans with Disabilities Act (ADA). Reasonable accommodations and equal opportunity for effective communications will be provided upon request. Please contact the KTMPO office at 254-770-2200 24 hours in advance if accommodation is needed. (1)Citizens who desire to address the Board on any matter may sign up to do so prior to this meeting. Public comments will be received during this portion of the meeting. Comments are limited to 3 minutes maximum. No discussion or final action will be taken by the Board.

Item 4:

Meeting Minutes

KILLEEN-TEMPLE METROPOLITAN PLANNING ORGANIZATION (KTMPO)
TECHNICAL ADVISORY COMMITTEE (TAC) MEETING MINUTES

Wednesday August 3, 2016
9:30 a.m.

Central Texas Council of Governments (CTCOG)
2180 N. Main Street
Belton, TX 76513

Technical Advisory Committee Voting Members

Sam Listi for Erin Smith—City of Belton
Andrea Gardner—City of Copperas Cove
David Olson for Ann Farris—City of Killeen
Brian Chandler—City of Temple
Joseph Molis for David Mitchell—City of Harker Heights
Bryan Neaves—Bell County
Judge John Firth—Coryell County
Robert Ator for Carole Warlick—Hill Country Transit District (HCTD)
Liz Bullock for Michael Bolin—Texas Dept. of Transportation (TxDOT) Waco District
Jason Scantling—TxDOT Brownwood District

Technical Advisory Committee Non-Voting Members

Keith Fruge for Mary E. Himic—Ft. Hood
Kara Escajeda—City of Nolanville

Additional Attendees

Charlotte Hitchman—City of Copperas Cove
Dan Yancey—City of Copperas Cove
Jonathan Mosteiro—Alliance Transportation Group
Jim Harvey—Alliance Transportation Group
Janet Sheguit—BSP Engineers, Inc.
Jim Martin—KTMPO
Christina Demirs—KTMPO
Jason Deckman—KTMPO
Cheryl Maxwell—KTMPO
John Weber—KTMPO

Meeting Minutes

1. Call to Order: Cheryl Maxwell called the meeting to order at 9:35 a.m.

2. Opportunity for Public Comment: No comments were made from the public.

3. Staff Update: KTMPO staff provided an update on the following items:

--Jim Martin stated that KTMPO is still looking for members from private industries for the Freight Advisory Committee. The meeting date has not been decided yet.

--John Weber provided an update on the Bicycle and Pedestrian Advisory Committee (BPAC). The next BPAC meeting will be held on September 13, 2016 at 9:00 a.m. KTMPO staff is asking for members of BPAC to use the Bike/Ped web map to map out recommended locations for bike racks. This list will be sent to the Central Texas Air and Information Research (CTAIR) Advisory Committee as possible locations to purchase bike racks.

Mr. Weber provided an update on air quality readings for the month of July. The highest 8-hour average ozone reading at the Temple station was 58 parts per billion (ppb) and at the Killeen station was 57 ppb. The design value, if calculated to date, is 67 ppb at Temple and 66 ppb at Killeen.

Cheryl Maxwell stated that CTCOG has started the CTAIR Advisory Committee. This committee covers the seven county region. Ms. Maxwell stated that a survey is currently being developed and once it is completed, staff will ask the cities to post it to their website and social media pages.

4. Action Item: Approve meeting notes from July 6, 2016 meeting.

Sam Listi made a motion to approve July 6, 2016 meeting notes, seconded by Brian Chandler; the motion passed unanimously.

5. Action Item: Regarding recommendation for approval of amendment to the 2040 Metropolitan Transportation Plan (MTP) to add the Belton Loop 121 project from FM 436 to IH 35.

Christina Demirs stated that Belton's Loop 121 project has been approved for TxDOT development funds, however, the section from FM 436 to IH 35 is not currently in the MTP. This amendment will add the project to the unfunded portion of the MTP. A public comment period was held from June 25, 2016 to July 9, 2016 with a public hearing held on June 27, 2016. KTMPO received two comments in support of this amendment. Ms. Demirs provided TAC members with a tentative schedule anticipating Transportation Planning Policy Board (TPPB) approval on August 17, 2016.

Sam Listi made a motion to recommend approval of MTP amendment, seconded by David Olson; the motion passed unanimously.

6. Action Item: Regarding recommendation for approval of the Congestion Management Process Congested Segment Prioritization Tool and resulting congestion network.

Jonathan Mosteiro of Alliance Transportation Group provided TAC members with two prioritized lists based on slightly different weighted criteria. Option 1 was based on feedback from the TAC; Option 2 was based on feedback from the TAC, staff, and Alliance Transportation Group (referred to as "all feedback"). The TAC discussed possible revisions regarding the weight given to the congestion, public input and transit criteria and reviewed the resulting congestion network as each was adjusted.

Andrea Gardner made a motion to approve the prioritize list based on the weights from "all feedback" (Option 2) with adjustments to the public input weight from 10% to 5% and increase transit from 10% to 15%, seconded by Sam Listi; the motion passed unanimously.

Resulting weights are as follows: Congestion – 30%; Volume – 20%; Safety Crashes – 15%; Safety Rear-End - 10%; Transit – 15%; School – 5%; Public Input – 5%.

7. Discussion and Possible Action Item: Regarding MTP Re-Prioritization Project Call status and possible adjustments.

Cheryl Maxwell stated that since the opening of the project call, the question has come up regarding how to handle projects that are already in the MTP. From the approved scoring process, projects currently in the MTP must be resubmitted if an entity wants their project scored and ranked. This does mean that a city may have to submit many applications. KTMPO staff is seeking TAC input on how to proceed on this matter. Ms. Maxwell presented TAC with some possible scenarios.

These scenarios include submitting the top projects now for full evaluation and scoring and have an annual project call to submit the other projects for evaluation/scoring and merge into list of scored/ranked projects; or, wait for the 2045 MTP update to submit remaining projects for evaluation/scoring; or amend the project call now to allow designated projects to be unscored and placed in unfunded section; or after the deadline, request projects to be placed in the unfunded section of the MTP unscored and unranked. The floor was opened to discussion.

Many TAC members felt that an annual project call should occur to include projects that may not seem relevant now but in a few years, these projects may be top priority. Projects that are submitted before the deadline will be scored and ranked and projects submitted at a future project call will then be scored and ranked and merged with the existing list, provided the criteria has not changed.

Brian Chandler made a motion to move the Call for Project deadline to a minimum of two weeks with considerations from staff, TAC and TPPB members, seconded by David Olson; the motion passed unanimously.

Brian Chandler made a motion to recommend a Call for Projects with the same scoring criteria in one year, seconded by David Olson; the motion passed unanimously.

8. Member Comments: No comments were made.

9. Adjourn: The meeting adjourned at 10:30 a.m.

These notes were approved by the TAC members at their meeting on ____________________________.

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Cheryl Maxwell, KTMPO Director

Item 5:

Congestion Management Process Document

KTMPO
KILLEEN-TEMPLE
metropolitan planning organization

Technical Advisory Committee
September 14, 2016

Agenda Item No. 5

CMP Congested Segment Prioritization Tool and Congestion Network

Summary:
KTMPO adopted a Congestion Management Process (CMP) in October 2013 that provides a framework for identifying congestion problems and possible solutions for our region. KTMPO contracted with Alliance Transportation Group to further develop and implement the CMP by collecting data, monitoring system performance, identifying congestion problems and needs, identifying and evaluating strategies, updating the CMP with a prioritized list of policies, programs, and projects, and monitoring strategy effectiveness. The updated draft CMP is attached. Please note and review roadway segments for your jurisdiction in Tables 4-2 through 4-4 and provide feedback regarding the proposed strategy effectiveness.

Tentative Schedule:

- August 3, 2016—TAC recommendation for a final congestion network prioritization
- August 17, 2016—TPPB approval of final congestion network prioritization
- September 14, 2016—TAC recommendation to approve draft Congestion Management Process and initiate Public Involvement Process
- September 21, 2016—TPPB approves Congestion Management Process and initiate Public Involvement Process
- September 24-October 8, 2016—15-day Public Comment Period
- Public Hearing—TBD
- October 5, 2016—TAC recommendation to approve Congestion Management Process, subject to any comments received
- October 19, 2016—TPPB approves Congestion Management Process

Action Needed:

- TAC recommendation to approve draft Congestion Management Process and initiate Public Involvement Process

Introduction

This document is the 2016 Congestion Management Process CMP) Update Report for the Killeen Temple Metropolitan Planning Organization (KTMPO) planning area (see Figure 1-2). The report describes the assumptions, methodology, performance measures, and potential congestion mitigation strategies included in the updated CMP.

Congestion Management Process (CMP)

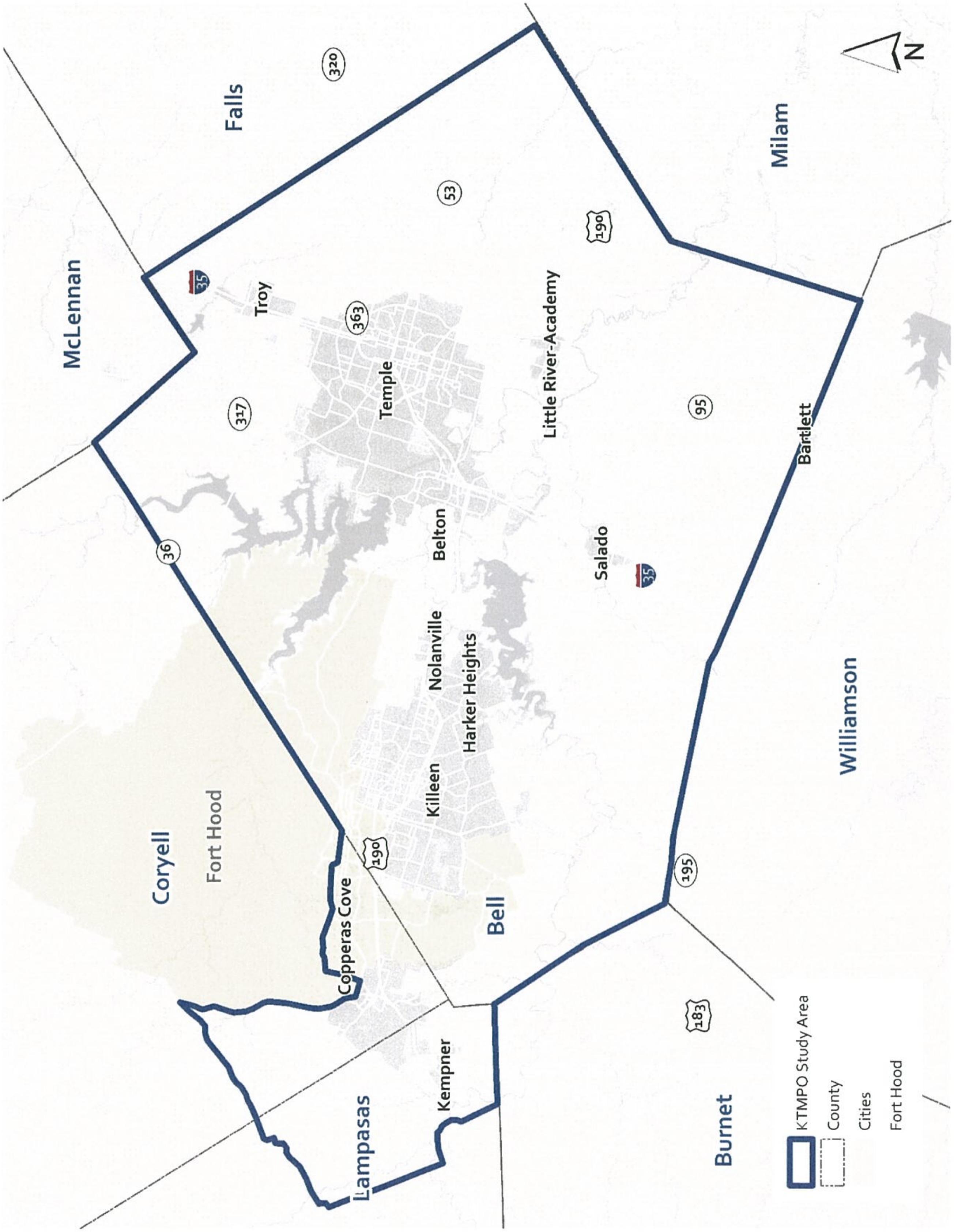
Congestion management is the application of strategies to improve transportation system performance and reliability by reducing the adverse impacts of congestion on the movement of people and goods. A congestion management process (CMP) is a systematic approach for managing congestion that provides accurate, up-to-date information on transportation system performance and assesses alternative strategies for congestion management that meet state and local needs. The CMP is intended to produce transportation system performance measures and congestion management strategies that can be reflected in the regional metropolitan transportation plan (MTP) and transportation improvement plan (TIP).

The CMP, as defined in federal regulation, is intended to serve as a systematic process that provides for safe and effective integrated management and operation of the multimodal transportation system. The process includes:

- Development of congestion management objectives;
- Establishment of measures of multimodal transportation system performance;
- Collection of data and system performance monitoring to define the extent and duration of congestion and determine the causes of congestion;
- Identification of congestion management strategies;
- Implementation activities, including identification of an implementation schedule and possible funding sources for each strategy; and
- Evaluation of the effectiveness of implemented strategies.

A CMP is required in metropolitan areas with population exceeding 200,000, these areas are known as Transportation Management Areas (TMAs). Federal requirements also state that all CMPs shall be developed and implemented as an integrated part of the metropolitan transportation planning process. The Congestion Management System (CMS) was first introduced by the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and was continued under successive transportation authorization laws, including the current law, Fixing America's Surface Transportation (FAST) Act. The CMP is intended to be an ongoing process, fully integrated into the metropolitan transportation planning process. The CMP is a "living" document, continually evolving to address the performance measure results, concerns of the community, new objectives and goals of the MPO, and up-to-date information on congestion issues.

Figure 1-2: KTMPO Planning Area



Congestion Management Data

Types of Congestion

- Recurring Congestion
  - Peak period
  - Freight
  - Intersection
  - Freeway corridor
  - Non freeway corridor
  - School related
  - Central Business District
  - Bottleneck or hot spot
  - Railroad crossing
  - Parking related
- Non-Recurring Congestion
  - Incident related
  - Special event traffic

Federal regulation 23 CFR 500.109 defines congestion as "the level at which transportation system performance is unacceptable due to excessive travel times and delays." According to the Federal Highway Administration (FHWA), roadway congestion is comprised of three key elements: severity, extent, and duration. However, congestion can have a different meaning depending on the context in which the congestion is experienced. Defining a CMP Network and developing performance measures to analyze congestion along the network are key steps in the CMP. These steps establish the foundation for the process, and are meant to define how congestion is perceived locally.

Congestion Data Sources

Before a CMP Network can be defined or performance measures can be determined, it is important to determine what data is available. The KTMPO CMP employs three main quantitative data sets, whose data coverage is shown in Figure 2-1, and one qualitative data set for analyzing congestion. The CMP also uses additional supplementary data from other sources that helps further the identification and analysis of congestion throughout the region.

National Performance Management Research Data Set (NPMRDS)

The NPMRDS is a vehicle probe-based data set developed by HERE and acquired by the FHWA to support the agency's Freight Performance Measures (FPM) and Urban Congestion Report (UCR) programs. The data set uses crowd-sourced GPS information, typically obtained from mobile phones, vehicles, and portable navigation devices, to provide monthly average travel times (in 5 minute intervals) along the National Highway System (NHS), Strategic Defense Network (STRAHNET), and principal arterials within five miles of a border crossing. The data is also packaged with a location referencing system, which is a network of segments called Traffic Message Channels (TMCs), which can be used in a geographic information system (GIS) to link travel time data to road segments. The data used in this CMP includes monthly data from 2014 for Bell, Coryell, and Lampasas Counties, and was obtained from TxDOT.

Although the NPMRDS separates probe data into passenger vehicle and freight vehicle data, this CMP Update uses the combined data to account for the effects of congestion on the movement of both people and goods throughout the region.

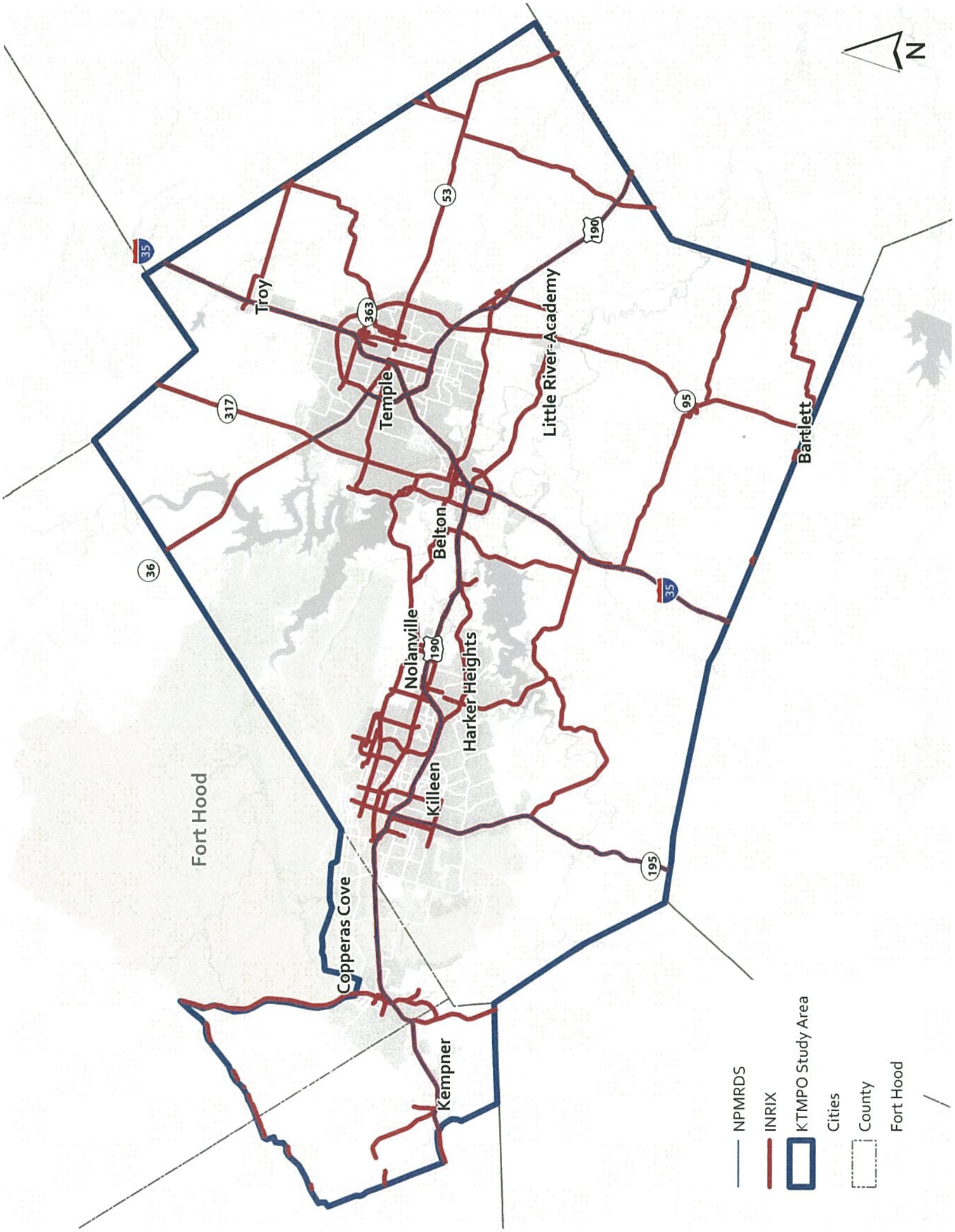
INRIX

The INRIX data set is similar to the NPMRDS in that it is a probe-based data set produced from GPS information taken from personal navigation devices. However, INRIX traffic data is presented in units of speed, instead of average travel time, averaged over 15 minute intervals. The INRIX speed data set used in this CMP is the 2013 version and was obtained from TxDOT, which packages the data with its Road-Highway Inventory Network (RHiNo) for location referencing and travel time calculation.

Regional Travel Demand Model (TDM)

A TDM is a representation of travel behavior throughout a transportation system network. The model uses roadway attributes and socioeconomic data such as population and employment to predict travel behavior. The latest KTMPO TDM uses 2010 and

Figure 2-1: Quantitative Congestion Data Coverage



CMP Network

Defining a CMP Network involves specifying the geographic boundaries and transportation system components that are the basis of analysis and foundation of the congestion management process. Efforts to improve traffic conditions in the region begin on the CMP Network, and the level of congestion on this network serves as a gauge for overall congestion in the region.

Defining the CMP Network

In May 2013, KTMPO held a series of public workshops to collect input from the community on various transportation topics, including congestion. The public provided feedback about proposed CMP goals and identified congestion locations throughout the area (Figure 2-3). KTMPO staff combined the results from the workshops with congested corridor information provided by the regional public transit provider Hill Country Transit District (HCTD) and Texas Department of Transportation (TxDOT), creating a consolidated list of congested roadways. KTMPO Staff presented this list of roadways to the KTMPO Technical Advisory Committee and Transportation Planning Policy Board where it was approved as the official CMP Network for the region.

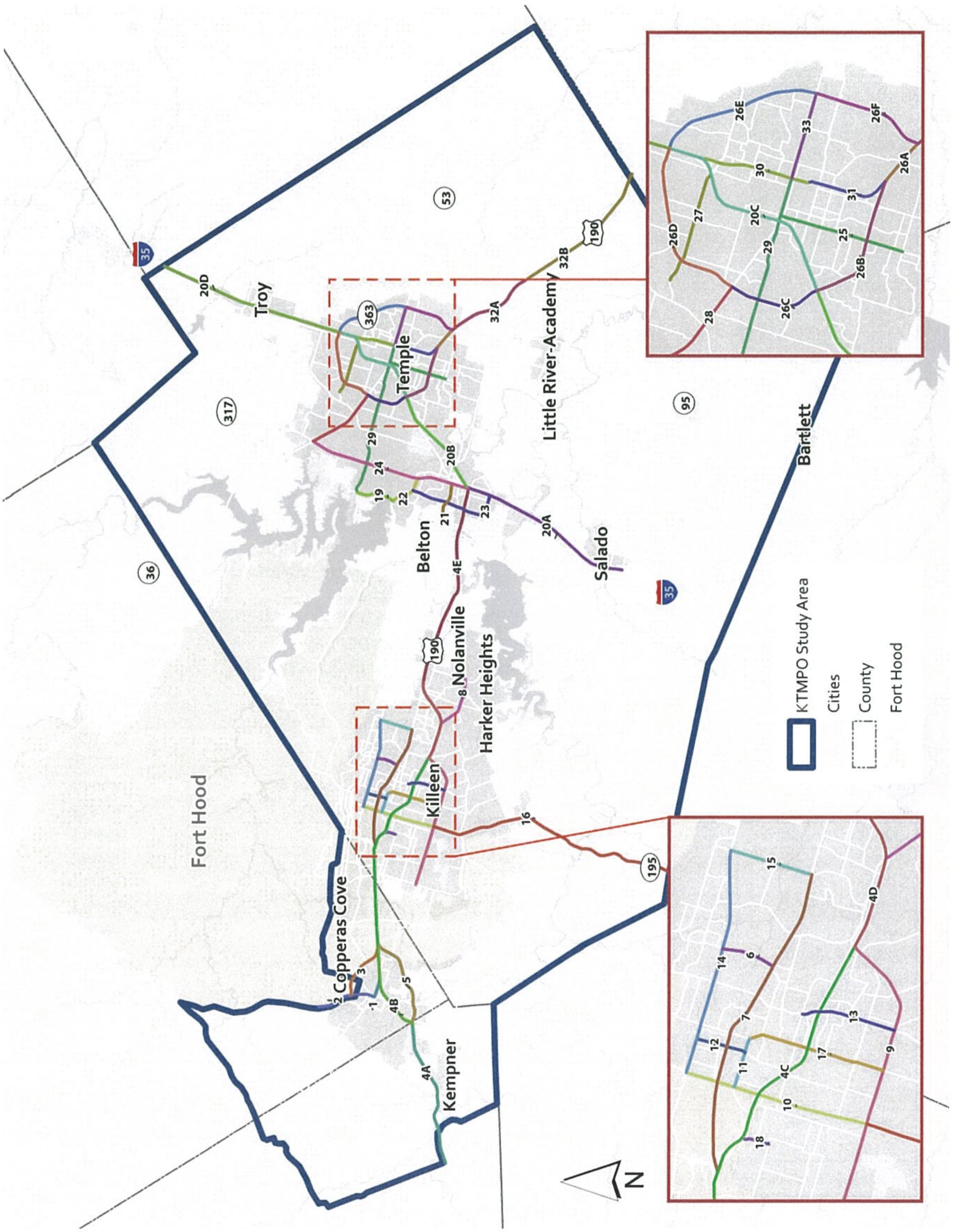
The 2013 CMP Network did not take into account quantitative data coverage. However, the 2016 CMP does use quantitative data. As a result of the analysis of this quantitative data, an expanded CMP Network was proposed for the 2016 CMP Update. The updated CMP Network (Figure 2-4) reflects the overlapping data coverage from the four congestion datasets mentioned previously, as well as information gathered from the congestion survey. The network is broken up into segments for analysis purposes, which are detailed in Table 2-2.

Performance Measures

Developing performance measures to identify, assess, and communicate to others about congestion is a critical element of the CMP. A performance measure is a quantifiable measure to assess how well the KTMPO region is meeting the established congestion management goals and objectives. Performance measures serve as indicators to better understand the usage of a transportation facility or the characteristics of travelers using the transportation system. Performance measures can also be assessed over time to indicate whether congestion management strategies are successful in meeting the establish goals and objectives of the CMP.

By monitoring performance and the outcomes from implemented improvement strategies, the quality of decision-making in the planning process can be improved and limited financial resources can be expended more wisely and effectively. The requirement for on-going assessment of the performance measures leads to the need to identify measures that are quantifiable, without placing a heavy burden on time, cost or training on KTMPO staff. This CMP establishes a set of performance measures that can be calculated from real world data on an annual basis and that provide KTMPO with useful information and trends to inform transportation investment decisions.

Figure 2-4: Updated CMP Network



Identifying Performance Measures

The Federal CMP requirements do not mandate specific performance measures that must be used during the process. Identifying appropriate congestion performance measures is up to each MPO. Although there are a wide range of performance measures available, it was determined by KTMPO that those selected for this 2016 CMP Update must be understandable, outcome-oriented, and supported by readily available data sources.

The 2013 CMP recommended several performance measures. The 2016 CMP Update evaluated the 213 performance measures to determine whether the old performance measures meet current standards and need for quantifiable measurement. The following questions were considered to assist in identifying appropriate congestion management performance measures:

- Is the measure easily understandable to both the general public and elected officials?
- Does the MPO have the ability and adequate funding to collect the data to track the measure on an on-going basis?
- Does the measure provide the ability to track roadway congestion for the region overall, as well as for individual transportation facilities?
- Do the measures reflect the local definition of congestion?

Table 2-3 highlights the different performance measures previously considered for inclusion in the CMP, and the following sections below explain the measures in more detail.

Volume-to-Capacity Ratios

In addition to being part of the LOS determination for a roadway, volume-to-capacity (V/C) ratios can be used separately as measure of congestion. V/C ratio is defined as the ratio of demand flow rate to capacity for a traffic facility. Using V/C ratios is popular because data on existing traffic volumes is relatively easy to obtain and the measures (traffic volumes and roadway capacities) can be forecasted by employing the area's TDM.

Travel Time Measures

Travel time measures focus on the time it takes to travel along a selected portion of a highway corridor. Common variations of travel time measures include the following:

- Travel time – the amount of time needed to traverse a corridor segment
- Travel speed – the length of a segment divided by the travel time
- Travel time index – ratio of observed travel speed to free-flow travel speed

These travel time measures can be used for specific roadway segments, intersections, or corridors. The 2016 CMP Update uses the Travel Time Index (TTI) because it allows for direct comparison between different types of roadways in the region.

Delay Measures

Delay measures calculate the additional travel time experienced by drivers due to varying traffic conditions. In other words, delay is the difference between observed travel time and free flow travel time. Delay measures are dependent on how free flow travel time is defined. Free flow travel time could be derived from the posted speed limit or could be defined as the maximum observed travel time. Depending on how free flow travel time is defined, measures of delay can vary.

The 2016 CMP Update proposes using average delay per vehicle as the primary delay measure, supplemented by aggregated delay information where available.

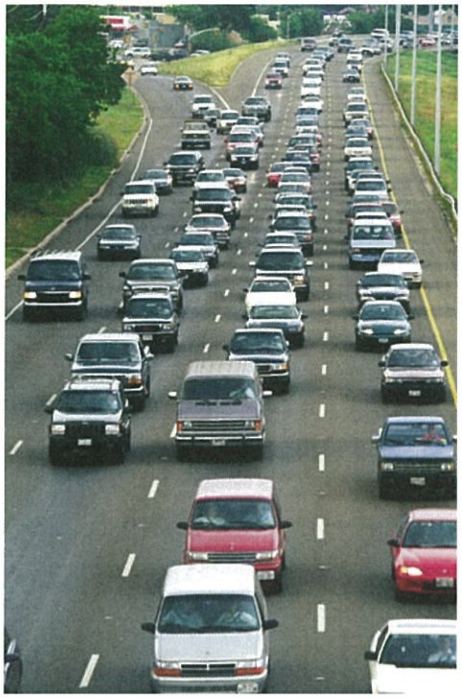
Crash Measures

Crash measures identify high concentrations of crashes at particular locations along a corridor or at a particular turning movement at an intersection or cross street. Crashes certainly impact travel conditions, and can be the cause of nonrecurring congestion along corridors and intersections. Identifying "hot spot" crash locations, and examining the location in the field can assist in identifying potential projects to improve the safety and function of the roadway corridor or intersection. Common improvements could include improving sight distance, adding turn lanes, adding traffic signals, implementing street calming devices, etc. Crash data measures in the KTMPO area could include the following:

- Number of crashes along a specified corridor
- Number of crashes at a particular intersection
- Type of crashes along a specified corridor
- Type of crashes at a particular intersection
- Number of crashes per million vehicle-miles over a section of roadway

There are some constraints to using crash measures to alleviate congestion. For instance, the type of crashes and how they are recorded can make it difficult to measure congestion from reviewing crash data. There may be reporting inconsistencies in the crash data that is documented by local enforcement agencies. Crashes may not be

Identification of Congestion Hotspots



Identifying congestion hotspots is part of determining specific congestion problems in the region. Part of the identification process also includes defining what levels of congestion are acceptable or unacceptable in the region. The process of congestion hotspot identification involves using the multiple available data sets to calculate performance measures along the CMP Network, and then aggregating those measures in a way that allows for easy comparison between segments. Finally, segments along the CMP Network are prioritized based on the results of the congestion data analysis, as well as other evaluation criteria, that support the goals and objectives of the CMP and ensure compatibility with other regional planning processes.

Data Analysis

There are many ways to analyze congestion, as reflected in the use of multiple performance measures and data sets throughout this CMP. By using these different measures in conjunction with one another, congestion hotspots can be identified with a relative degree of confidence. Using multiple performance measures and data sets also allows for flexibility in defining and identifying congestion, as certain measures from different sources can be weighted and presented differently to reflect congestion in a way that is specific to the region.

Before calculating congestion performance measures for the 2016 CMP Update, the data sets were first processed so that similar attributes or measures could be easily compared from one data set to the next. Using the three major quantitative congestion data sets (NPMRDS, INRIX, and the KTMPO TDM), performance measures were calculated depending on the data available within each data set. Table 3-1 shows how the quantitative congestion performance measures were calculated. Figures 3-1 through 3-4 show congestion in the region as measured through the Travel Time Index across the three quantitative datasets.

Figure 3-1: NPMRDS Travel Time Index

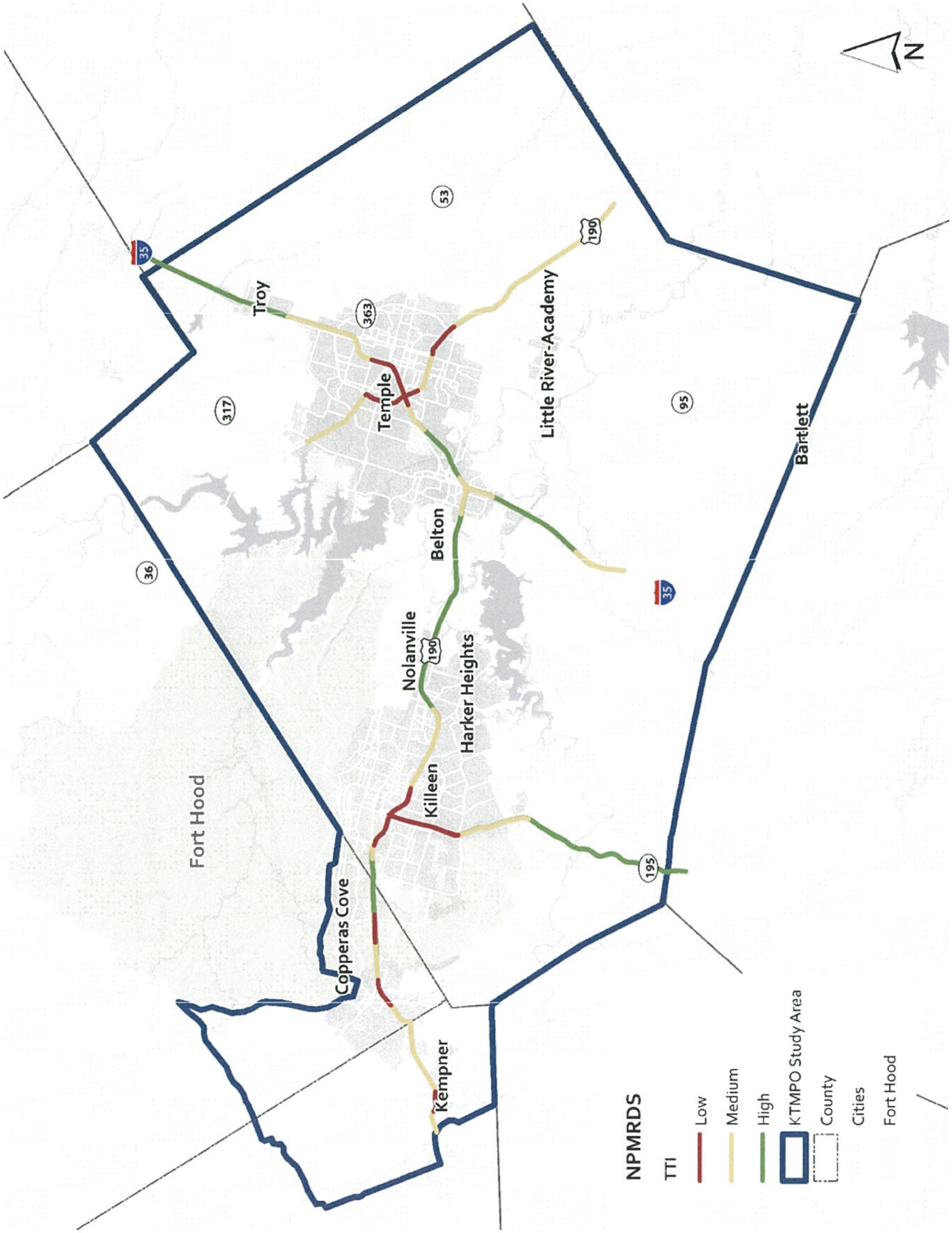
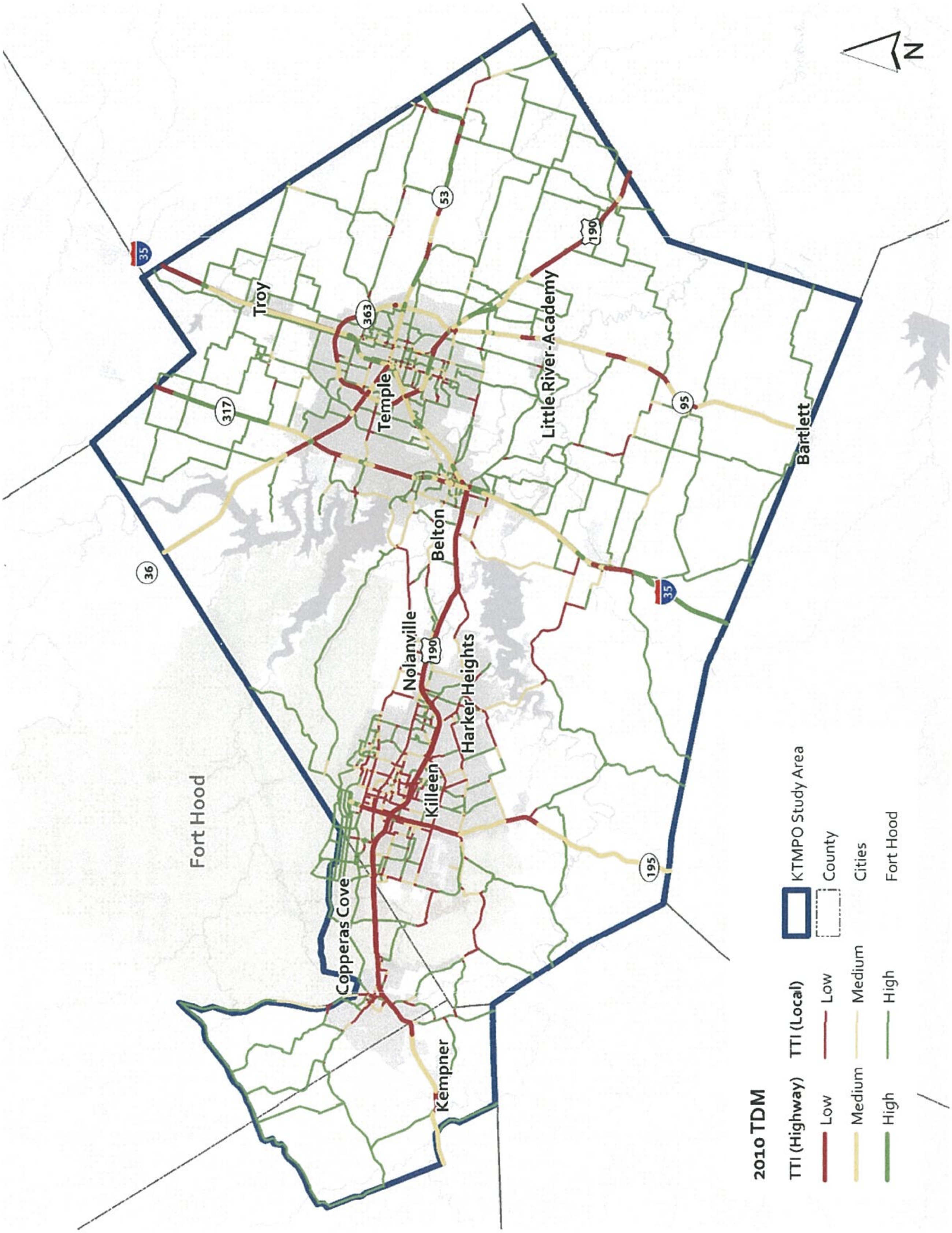


Figure 3-3: 2010 TDM Travel Time Index



Data Conflation

Data conflation is the process of combining the different quantitative congestion data sets that have dissimilar geographic extents. Because the geographic information included with each dataset originated from different sources, it was necessary to aggregate the data into one geographic layer to ensure the results for each segment of the CMP were directly comparable.

The conflation process involved generating a buffer region around each segment of the CMP Network, then using GIS geoprocessing tools to use the buffer as a "catchment area" to collect the segments from each data source. Once the quantitative data was collected on one layer, the previously computed performance measures from Table 3-1 were compared for each data source. The complete inventory of performance measures for each CMP segment can be found in Appendix X.

The final step in the conflation process was to apply weights to the quantitative congestion performance measures and qualitative congestion data (from Google Traffic) to create a composite congestion score. The weights assigned to the congestion data are shown in Table 3-2. This score represents a weighted measure of congestion generated from the various different data sets, both quantitative and qualitative, that identifies congestion hotspots within the region. Figure 3-5 displays congestion hotspots determined by the number of data sources which indicate there is congestion for a particular segment.

Table 3-2: Congestion Score Data Weighting

	Number of Sources	NPMRDS	INRIX	TDM	Google	Total
All Sources	5%	20%	50%	20%	5%	100%
TDM + INRIX	5%		60%	30%	5%	100%
TDM + NPMRDS	5%	50%		40%	5%	100%
TDM Only	25%			70%	5%	100%

Prioritization Process

The data conflation process results in a combined measure of congestion that can be used to rank the segments of the CMP Network to determine the "worst" performing segments in terms of vehicle travel speed. However, the goals and objectives of the KTMPO CMP do not focus solely on speed data as the only means to target congestion mitigation strategies. For that reason, this 2016 CMP Update introduces a more robust congestion hotspot prioritization process that considers other elements of the transportation system as evaluation criteria to determine which congested hotspots should be the primary focus of congestion mitigation strategies in the region. The following section describes the elements of the prioritization process.

Congestion Score

As described in the section about data conflation, each segment of the CMP Network was given a congestion score that represents a weighted measure of congestion as determined through the quantitative and qualitative congestion data collected for the network. The congestion score was the most heavily weighted evaluation criteria used in the prioritization process.

Other Evaluation Criteria

The CMP uses the other evaluation criteria described in the following section to prioritize congestion hotspots in the region. The full results of the prioritization process, including tables detailing the values assigned for the evaluation criteria for each segment, can be found in Appendix X.

Traffic Volume

Using traffic volumes in the prioritization process allows the CMP to consider not only the severity of congestion on each segment, but also the magnitude of the congestion (i.e. how many people are affected by congestion). The volume data used in the prioritization process was taken from the Travel Demand Model, and represents the average flow along all TDM links within a segment.

Safety

One of the primary goals of the CMP is to facilitate the movement of people and goods in a safe manner. Therefore, safety was a major consideration in the prioritization process for the 2016 CMP Update. There were two evaluation criteria related to safety that were used to rank the congested hotspots:

- **Crash Rate** – The prioritization process uses the number of crashes normalized by the volume of traffic along each roadway in the CMP Network to prioritize congestion hotspots. The goal of including the crash rate is that segments with higher occurrences of crashes will receive higher priority so that future projects aimed at addressing congestion on that segment may also reduce crash rates.
- **Rear End Crash Rate** – In addition to considering the overall crash rate, the prioritization process also considers the percentage of crashes that are rear-end collisions. Rear end crashes could correspond to a higher prevalence of congestion where motorists may unexpectedly encounter congestion-related queues.

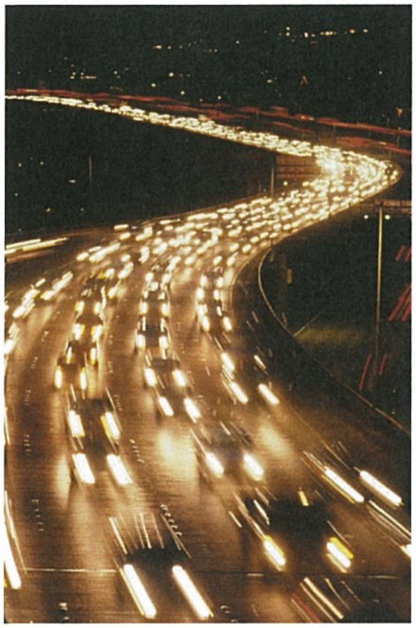
Prioritized Hotspot List

Table 3-4 and Table 3-5 show the congested segments of the CMP Network, ranked based on the results of the prioritization process. The list is separated into highway and arterial elements of the CMP Network. The list represents a snapshot of the highest priority congestion hotspots along the transportation network in Killeen-Temple based on the data available during the 2016 CMP Update. As KTMPO continues to acquire data and update other regional planning documents, the evaluation criteria and weights used to sort this list should be revisited to ensure that the CMP continues to reinforce current planning efforts in the region.

Table 3-4: Final Prioritized List of Congestion Hotspots – Highways

Segment ID	Description	Priority Rank
4C	US 190 - SH 9 TO FM 3470/STAN SCHLUETER LOOP	1
4D	US 190 - FM 3470/STAN SCHLUETER LOOP TO BUSINESS 190	2
4E	US 190 - BUSINESS 190 TO IH 35	3
20A	IH 35 - SALADO (FM 2268) TO US 190	4
20C	IH 35 - S LOOP 363 TO N LOOP 363	5
26B	LOOP 363 - SPUR 290 TO IH 35 S	6
20B	IH 35 - US 190 TO S LOOP 363	7
20D	IH 35 - N LOOP 363 TO FALLS COUNTY LINE	8
26C	LOOP 363 - IH 35 S TO SH 36	9
26A	LOOP 363 - US 190 TO SPUR 290	10
16	SH 195 - WILLIAMSON COUNTY LINE TO FM 3470/STAN SCHLUETER LOOP	11
32B	US 190 SE - PRITCHARD RD TO MILAM COUNTY LINE	12
4A	US 190 - FM 1715 TO BUSINESS 190	13
28	SH 36 - LOOP 363 TO SH 317	14
32A	US 190 SE - LOOP 363 TO PRITCHARD RD	15
26E	LOOP 363 - IH 35 N TO SH 53	16
26D	LOOP 363 - SH 36 TO IH 35 N	17
26F	LOOP 363 - SH 53 TO US 190	18

Congestion Mitigation Strategies



The CMP is a tool to be utilized in the KTMPO region to address persistent congestion problems and prioritize transportation investments. There are many congestion management strategies and these strategies differ in terms of effectiveness, cost, complexity, and difficulty of implementation. Congestion management strategies are not one size fits all. Congested roadways and intersections need to be properly examined to evaluate which congestion mitigation strategy will effectively improve the congestion related problems. The CMP framework identifies numerous congestion mitigation strategies that can individually or collectively improve the operational efficiency of the KTMPO transportation system. When suitable strategies are implemented, the improvements impact auto, transit, pedestrian, and bicycle usage. The following sections identify several proven congestion management strategies that can be used to mitigate congestion in the KTMPO region.

Identifying Strategies

The mitigation strategies presented in the following section were selected based on their appropriateness for the KTMPO region and address congestion from a variety of angles. New infrastructure, infrastructure optimization, technological efficiency improvement, non-motorized improvement, and non-infrastructure program strategies have been considered for this plan. These strategies confront congestion at multiple scales so as to address deficiencies at specific locations as well as region-wide. Some strategies are more appropriate for highway projects, while others are more appropriate for arterial road projects.

How well each strategy can effectively mitigate operational, intersection, and capacity deficiencies depends on the specifics of each situation. There is no single best strategy for mitigating congestion. Instead, areas prone to congestion need to be reviewed on a case-by-case basis, and the most appropriate strategies for each situation need to be selected. This plan provides a toolbox of strategies that are already being used in the KTMPO area, as well as additional strategies that are being implemented in similar areas.

New Infrastructure

New infrastructure strategies, such as building new roadways, are typically used to significantly increase capacity in areas with high congestion. New infrastructure strategies typically do not aid in relieving non-recurring congestion, which accounts for about half of all congestion (FHWA, 2015). Non-recurring congestion, such as construction work, weather, and special events should be addressed by other means. Building new infrastructure can also be much more cost-intensive than improving existing infrastructure or operations, especially if new right-of-way must be procured.

Constructing Park-and-Ride Facilities

Park-and-ride facilities allow easy integration of multiple transportation modes and help facilitate the use of alternative transportation to and from areas with high traffic volumes. Motorists can leave their cars at the facility, then use transit to complete their journey. This relieves the motorists from the burden of finding parking at the final destination and can provide a more pleasant commute experience compared to driving in congested traffic.

Right-of-Way Management

Maintaining and preserving existing right-of-way makes it easier to make future roadway improvements, as the region grows and roadway enhancements become more necessary.

Highway Geometric Improvements

Improvements to highway geometry can reduce crashes and improved traffic flows.

Wayfinding and Signage Improvements

Clearly marked streets and wayfinding can help maintain steady traffic flows and direct vehicles down the most appropriate routes.

Transit Fixed Route Operations

Fixed route transit services, such as additional bus routes, can provide a more predictable and reliable service to transit users and encourage others to begin using this service instead of driving. The presence of transit service has the effect of increasing total capacity of a roadway due to the more efficient utilization of space needed to move several people by a bus or transit vehicle compared to several single-occupant automobiles.

Intersection Turn Lanes

By separating turning traffic from through traffic, movement can be maintained and the number of vehicle conflicts can be reduced.

Grade Separated Railroad Crossings

Grade separation can improve safety and reduce the amount of queued traffic caused by long trains.

Roundabout Intersections

Roundabouts can help facilitate a continuous flow of traffic and reduce the number of conflicts in an intersection. By reducing the amount of stop and go traffic, roundabouts can also improve air quality and reduce noise.

Acceleration/Deceleration Lanes

Additional lanes for accelerating or decelerating allow for vehicles to safely match speeds with other vehicles before merging.

Hill-Climbing Lanes

Hill-climbing lanes allow for safe passing of slower vehicles while ascending hills.

Grade-Separated Intersection

The separation of grades at intersections can reduce vehicle conflicts where crashes are more likely to occur.

Designated Truck Routes

Diverting commercial and truck traffic to designated roads can limit congestion, air pollution, and noise along those roads, while potentially relieving congestion on other roads.

Traffic Signal Optimization

Optimizing timings and sensors for location specific needs can help maintain traffic flows.

Transit Signal Priority

By giving transit services priority at traffic signals, transit services can be improved and incentivized as a viable mode of transportation.

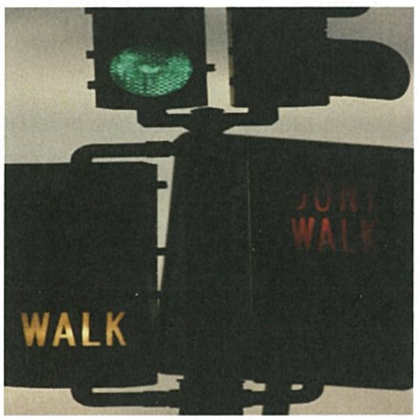
Demand-Responsive Signal System

Traffic signals modify timings based on traffic demand and help to maintain traffic flows when the transportation system is under heavy load.

Transit Vehicle Tracking

Tracking the exact locations and arrival times of transit vehicles can improve the user experience and incentivize transit use.

Non-Motorized Improvements



Non-motorized improvement strategies typically involve improving or creating new infrastructure that more effectively facilitates the use of active transportation. Active transportation includes modes such as walking or biking. Encouraging and facilitating active transportation can help reduce the number of trips made by single occupancy vehicles, thus reducing congestion on roadways. According to the National Travel Household Survey (2009), about half of all trips in metropolitan areas are three miles or less and about 28% of all trips are one mile or less. These distances can easily be made by bicycle or on foot, but 65% of trips one mile or less are made by automobile. Capacity improvements for non-motorized transportation often have no effect on motorized transportation capacity but can decrease the demand for motorized transportation. Non-motorized improvements can also improve safety conditions and reduce conflicts for people who currently already use active transportation.

Bicycle Paths/Lanes

Additional bicycle lanes/paths can improve safety for those who travel by bicycle and help to facilitate the use of bicycles to replace shorter trips usually taken by cars.

Sidewalks

Sidewalks along roadways can improve the safety conditions for pedestrians and help reduce conflicts between pedestrians and motorists.

Pedestrian Signals

Pedestrian signals can help to improve pedestrian safety as well as reduce conflicts at intersections.

Bicycle Racks

Secure, safe, and convenient bicycle parking options can encourage more cycling and reduce trips taken by car.

the transportation system as well as influence how commuters select their travel mode. Implementing land uses that contain a mix of residential, retail, and employment can improve the feasibility of conducting trips by walking or biking, therefore reducing automobile demand on congested corridors.

Commuter Choice Tax Benefits

Employers can provide incentives and discounted transit passes to encourage transit use in exchange for tax benefits.

HOV Toll Savings

Preferential pricing for multi-occupant vehicles on toll roads incentivizes ridesharing, which can again reduce the number of cars on the road at a particular time.

Parking Management

Preferential parking for vehicles that carry more than a single occupant can encourage ridesharing.

Driver Education

Driver education programs can inform drivers about choices that are available to avoid and reduce congestion.

CMP Strategy Toolbox

Table 4-1 displays the "toolbox" of strategies for the KTMPO region to consider when managing congestion. The toolbox includes several attributes for each strategy to help local policy-makers and transportation planners assess the applicability of each strategy to particular types of deficiencies/congestion in the region (columns 2 through 4). Columns 5 through 10 provide information about each strategy in terms of implementation period, inclusion in the 2013 CMP, and appropriate facility type for implementation: highway, arterial, or strategies that are not dependent on any particular location but are instead regional in extent (typically strategies that address demand management).

Evaluating Strategy Effectiveness

The 2016 CMP update provides KTMPO with a prioritized list of congested roadway segments in the region, as well as a list of strategies that can be considered in future planning studies that may address congestion in those hotspot locations. This update also takes the initial step of assessing the effectiveness of each of these strategies towards addressing the particular congestion problems identified during data analysis. The matrices in Tables 4-2 through Table 4-4 show whether a highway or arterial congestion mitigation strategy is likely to be effective, marginally effective, or not applicable to each segment of the CMP Network. As the priorities and travel patterns in the region continue to change, new projects are implemented, and new mitigation strategies are identified, these matrices will be updated to reflect the most up-to-date assessment of how the region can best address its congestion needs. It should also be noted that these recommendations are no substitute for detailed corridor-level analyses, which will be necessary to conduct before any specific projects can be advanced through the region's Metropolitan Transportation Plan (MTP) and Transportation Improvement Plan (TIP) planning and implementation processes.

Table 4-3: CMP Strategy Effectiveness (Arterials)

Segment ID	Description	Priority Rank	Operational Deficiency	Intersection Deficiency	Capacity Deficiency	Current Project	New SOV Lanes	New Location Roadways	Access Spacing	Driveway Spacing	Median Treatments	Right of Way Management	Highway Geometric Improvements	Transit Fixed Route Operations	Bus on Shoulder System (BOSS)	Bus Pullouts	Intersection Turn Lanes	Grade Separated Railroad Crossings	Roundabout Intersections	Acceleration/Deceleration Lanes	Grade-Separated Intersection	Bottleneck Removal	Hill-Climbing Lanes	Demand-Responsive Signal System	Traffic Signal Optimization	Electronic Commercial Vehicle Clearance and Tolls	Transit Signal Priority	Bicycle Paths/Lanes	Sidewalks	Pedestrian Signals
17	TRIMMIER RD - FM 3470/STAN SCHLUETER LOOP TO HALLMARK AVE	1	X	X	X	F	○	●	◐	◐	●	◐	○	●	○	◐	●	○	○	○	○	●	○	●	●	○	●	●	●	●
9	FM 3470/STAN SCHLUETER LOOP - SH 201/ CLEAR CREEK RD TO US 190	2	X	X	X	-	◐	●	◐	○	●	●	◐	●	◐	●	●	○	◐	◐	◐	●	○	●	●	◐	●	◐	●	●
4B	US 190 - US 190 BYPASS W TO US 190 BYPASS E	3	X	-	X	-	○	*	○	○	●	●	○	●	◐	●	●	○	◐	○	○	●	○	●	●	◐	●	◐	●	●
14	RANCIER AVE - FORT HOOD ST TO ROY REYNOLDS DR	4	X	-	-	-	○	●	○	○	●	◐	○	●	○	●	●	○	●	○	○	●	○	●	●	○	●	●	●	●
10	FORT HOOD ST - FM 3470/STAN SCHLUETER LOOP TO RANCIER AVE	5	X	-	X	-	◐	●	◐	○	●	●	○	●	○	●	●	●	◐	◐	◐	●	○	●	●	◐	●	◐	●	●
24	SH 317 - US 190 TO SH 36	6	X	-	-	✓	◐	●	◐	◐	◐	●	◐	●	◐	●	◐	○	●	◐	◐	●	○	●	●	◐	◐	◐	●	●
7	BUSINESS 190 - US 190 TO ROY REYNOLDS DR	7	X	-	X	-	◐	●	○	○	●	●	◐	●	◐	●	◐	○	◐	◐	◐	●	○	●	●	○	●	●	●	●
23	LOOP 121 - IH 35 TO LAKE RD	8	-	X	-	-	●	●	◐	◐	◐	●	◐	●	○	●	●	○	●	○	○	●	○	●	●	○	◐	●	●	●
13	WS YOUNG DR - ILLINOIS AVE TO FM 3470/STAN SCHLUETER LOOP	9	X	X	-	-	○	●	◐	◐	●	◐	○	●	○	◐	◐	○	●	○	○	●	○	●	●	○	●	●	●	●
1	AVE D - N 1ST ST TO BUSINESS 190	10	-	-	X	-	◐	●	◐	◐	◐	◐	○	●	○	◐	●	○	●	○	○	●	○	●	●	○	◐	●	●	●
29	SH 53/ADAMS AVE - FM 2271 TO 3RD ST	11	X	-	-	-	◐	●	◐	◐	●	●	◐	●	◐	●	◐	○	◐	◐	◐	●	○	●	●	◐	●	●	●	●
8	FM 2410 - US 190 TO WARRIORS PATH	12	X	X	-	-	◐	●	◐	◐	◐	●	◐	●	○	◐	●	○	◐	○	○	●	◐	●	●	○	◐	●	●	●
25	FM 1741/S 31ST ST - CANYON CREEK DR TO SH 53/ADAMS AVE	13	-	X	-	-	◐	◐	○	○	◐	●	●	●	○	●	◐	○	◐	○	○	●	○	●	●	○	●	●	●	●

Plan Monitoring and Performance Tracking

"...the most important element of the CMP is the Monitoring Plan..."

The Congestion Management Process is intended to be a dynamic guidebook for tracking progress towards the region's congestion management goals. As such, the most important element of the CMP is the Monitoring Plan, which guides the MPO through the process of tracking and reporting performance on the CMP Network and assessing progress made towards congestion reduction.

The general steps required to carry out an effective monitoring program for congestion management are:

1. Maintain and update the designated CMP network
    a. Evaluate available data sources to determine any expansion in coverage
2. Identify locations where CMP projects have been implemented and document these segments in the appropriate GIS layer
    a. Identify the strategy within the strategy matrix that each project implements
3. Obtain selected monitoring datasets from TxDOT or other available sources
4. Use the performance monitoring datasets to evaluate the CMP network performance
5. Document outcomes, particularly at locations where transportation investments have been made, to determine performance improvements or identify challenges remaining to be addressed

The first two steps in the monitoring plan are straightforward and are not expanded upon in this chapter. The following sections describe the data sources, processing, and outcome documentation that KTMPO should implement to monitor system performance.

Step 3: Obtain Performance Data

As discussed in Chapter 2, thanks in large part to the proliferation of smartphone data, there are now a number of travel time data sources available to KTMPO through its planning partners. In monitoring system performance, KTMPO should seek to acquire the following data sources:

- **National Performance Management Research Data Set (NPMRDS)** – The NPMRDS is readily available through TxDOT and delivered in a manner that is fairly user-friendly. As the official data source used by FHWA to calculate Federal performance measures, the NPMRDS also provides KTMPO with technical support from FHWA. Unfortunately, data coverage is limited to roadways on the National Highway System. At the time of the 2016 CMP Update, FHWA was in the process of re-procuring the NPMRDS, so in upcoming years there may be changes to the format of the data.
- **INRIX** – INRIX is a private travel data company that collects data and sells it to interested parties. In this case, TxDOT has partnered with the Texas A&M Transportation Institute (TTI) to purchase data from INRIX and have TTI process the data to produce the annual list of the top 100 congested roadway segments

- *Connect performance measure calculations to geographic data* – the process for joining the performance data to the shapefile is explained in detail by the guidebook provided by FHWA that accompanies the data.

INRIX

In the file format that TxDOT provides INRIX data to its planning partners, most of the data processing has already been accomplished. The data deliverable contains a spreadsheet that has 15-minute average travel speeds and freeflow travel speeds already computed for each RHiNo segment, and a shapefile with the RHiNo segments for all roadways in the region. The MPO can use the 15-minute and freeflow speed data to compute the TTI and Delay performance measures. Additional delay measures outlined in Chapter 3 are available in another spreadsheet, which contains the performance measures calculated by TTI for the Texas 100 Most Congested Roadways. Note that the Texas 100 roadway network may not contain performance data for as many roadways as may be available through the 15-minute spreadsheet. The data deliverable also contains a guidebook that the MPO may use to join the calculated performance data to the provided shapefiles, although some care is advised to ensure that the directionality of the speed data aligns with the directionality of the shapefile.

Google Traffic

The first step to collect congestion data from Google Traffic is to identify a reference network (e.g. CMP Network) to determine which roads to evaluate. The network as a whole is split into manageable sections or cells that should roughly reflect the scale to which Google Maps is being viewed during the data collection. The scale in Google Maps should be defined so that all roads are easily identified—that is, roads do not overlap others to the point that the level of congestion cannot be deciphered—but it should not be zoomed in so far that the traffic overlay shows data for small local roads not a part of the analysis. A half-mile to one-mile scale in Google Maps should be sufficient.

The next step is to set up a data log which records a unique ID, street name, direction, and extent identified by closest cross street. Extent of each segment is different and does not necessarily have to be from one major road to another. The log should also include the specified time periods and days for which data is being collected. Once the congestion log is set up, the next step is to work cell-by-cell screening for congested segments. This process involves observing the Google Traffic overlay for each specified time period and day, taking note of where there is reoccurring congestion. Then, focusing in on one of the identified congested segments, record the segment description information in the data log and work through the different time periods recording the magnitude of congestion, based on the scale provided in Google Traffic. Once this process is completed for a segment, the process is repeated for other segments along the reference network in that cell. Before moving on to the next cell, screenshots of the full extent of the cell in Google Maps should be taken as a QC measure.

After all congested segments have been identified for the reference network, the collected congestion information is aggregated and brought into GIS. This is done by either creating a new shapefile and manually drawing in the congested segments based on Google base maps and the descriptions provided in the data log or by using the data log to approximately match the congestion data to a current network. The final product should include congested segments with associated attributes that describe the

Step 5: Documenting Performance Outcomes

Once performance measures have been calculated from the appropriate datasets, KTMPO should note year-over-year changes in each metric for each reporting segment of the CMP Network. This should result in a re-prioritization of the segments to determine what changes (if any) have occurred to the list of highest priority congested roadway segments. The MPO may choose to expand upon or re-weight the evaluation criteria used in the prioritization process to best align the process with current metropolitan planning goals and objectives.

While documenting performance changes, KTMPO should note which segments of the CMP Network had congestion mitigation projects implemented during the time since the last performance update (this should have been accomplished in Step 2 of the monitoring plan). Noting correlations between the types of strategies that are implemented and the changes in congestion performance will allow the MPO to develop metrics that predict the expected performance impacts for strategies in the CMP Toolbox.

For example, if one of the region's municipalities implements a signal re-timing project along several roadway corridors on the CMP Network, the MPO can record the changes in the TTI and delay on those corridors before and after the signal re-timing and develop an average improvement value that can be expected on similar corridors for which signal re-timing is an appropriate congestion mitigation strategy. Once specific projects are implemented, performance improvement metrics can be directly compared to project costs to identify the most cost-effective congestion mitigation strategies that are tailored to conditions in the region.

Conclusion

An ongoing monitoring program is one of the key steps in implementing the FAST Act performance management strategy. It not only allows KTMPO to identify emerging problems on the transportation system, but it also allows the MPO to measure the outcomes of transportation investment decisions to determine if the planning process is being effective in addressing local transportation challenges. Learning what works and doesn't work provides a basis for continuous improvement in the outcomes of the metropolitan planning process.

Workshop

MTP Project Reprioritization

Summary of MTP Project Submittals and Fiscal Constraint

KTMPO received a total of 99 Projects as noted below:

Projects for scoring: 86 Total; Estimated Cost: $1.099 Billion

Roadway: 67 — Estimated Cost: $1.078 Billion

Livability: 19 — Estimated Cost: $21.3 Million

Future projects—unscored: 13

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*Fiscal Constraint: Total: $176.4 Million

Roadway:

Short Range: $18.1 Million — Long Range: $136.9 Million — Total: $155 Million

Livability:

Short Range: $5.9 Million — Long Range: $15.5 Million — Total: $21.4 Million

*Note:

1. Fiscal constraint is based upon forecasted revenue reflected in the 2040 MTP that was adopted in 2014. Figures have been revised to include additional funding the MPO has received to date that were not in the original forecast. Also, figures have been revised to subtract dollars for projects that have been funded to date. Therefore, the figures above represent the forecasted balance available as of this date that may be applied to the submitted projects.

2. Updated figures represented in the 2017 Unified Transportation Program have not been included at this point—approximately $272 million is anticipated for KTMPO for 2017 – 2026.

9/9/16

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KTMPO
KILLEEN-TEMPLE
metropolitan planning organization

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Commonly Used Transportation Related Acronyms and Terms

Organizations

KTMPO
Killeen – Temple Metropolitan Planning Organization

TPPB (KTMPO)
Transportation Planning Policy Board

TAC (KTMPO)
Technical Advisory Committee

FHWA
U.S. Department of Transportation Federal Highway Administration

FTA
U.S. Department of Transportation Federal Transit Administration

TxDOT
Texas Department of Transportation

TCEQ
Texas Commission on Environmental Quality

TTI
Texas A&M Transportation Institute

CTCOG
Central Texas Council of Governments

HCTD or "The HOP"
Hill Country Transit District

CTRTAG
Central Texas Regional Transportation Advisory Group

BPAC
Bicycle and Pedestrian Advisory Committee

Terms

TMA
Transportation Management Area

MAP - 21
Moving Ahead for Progress in the 21st Century (legislation replaced SAFETEA-LU in July 2012)

SAFETEA – LU
Safe, Accountable, Flexible, Efficient Transportation Equity Act

MPO
Metropolitan Planning Organization

UPWP
Unified Planning Work Program

MTP
Metropolitan Transportation Plan

TIP
Transportation Improvement Program

STIP
Statewide Transportation Improvement Program

STP-MM
Surface Transportation Program – Metropolitan Mobility

TAP
Transportation Alternatives Program

UTP
Unified Transportation Program

CMAQ
Congestion Mitigation and Air Quality Improvement Program

UA or UZA
Urbanized Area

EJ or "Title VI"
Environmental Justice

CMP
Congestion Management Process

ITS
Intelligent Transportation Systems

NAAQS
National Ambient Air Quality Standards

A comprehensive listing with definitions is available under Transportation Planning Resources at www.ktmpo.org. Pages 61-65 of the publication "The Transportation Planning Process… is a great resource for commonly used Transportation terms.

End of Packet