

**CITY OF SAN ANTONIO  
HUMAN RESOURCES DEPARTMENT  
INNOVATION GROUP**



**Review and Assessment of the Public Works Department's  
Traffic Signal Warrant Study Policies and Processes**

***Prepared for***

**Jelynn Burley**  
Deputy City Manager/Interim Public Works Director  
City Manager's Office

**AND**

**Jason Cosby, P.E.**  
Assistant Director  
Public Works Department

***Prepared by***

**Marc Castro**  
Organizational Performance Analyst  
Innovation Group

**OCTOBER 2007**



# CITY OF SAN ANTONIO

P. O. BOX 839966  
SAN ANTONIO TEXAS 78283-3966

October 17, 2007

Jason Cosby, P.E.  
Assistant Director  
Public Works Department  
City of San Antonio

**Re: Review and Assessment of the Public Works Department's Traffic Signal Warrant Study Policies and Processes**

Mr. Cosby:

The Innovation Group of the Human Resources (HR) Department is pleased to provide you with the attached Final Draft Report regarding the *Review and Assessment of the Public Works Department's Traffic Signal Warrant Study Policies and Processes*. **This Transmittal Letter/Executive Summary outlines the objectives, methods, and key issues, findings and recommendations resulting from the Review and Assessment.**

The objective of the Review and Assessment was to identify policy and process efficiencies to include those that might be gained by implementing industry-identified best practices and/or by reducing the number of Traffic Signal Warrant Studies (Warrant Studies) performed annually. To achieve the objectives, various research methods were utilized including:

- Reviewing literature, local and state government web sites, and authorizing legislation regarding Warrant Studies;
- Discussing policy and process issues with Public Works Transportation Group staff;
- Mapping detailed business processes for City of San Antonio (COSA) Warrant Studies;
- Analyzing Warrant Study work load data; and
- Surveying other cities across Texas and the United States.

As you are aware, due to a growing, unfunded need for new traffic signals, as well as related potential liability issues, City Council recently approved a traffic signal budget policy that sets out mechanisms and a timeline for funding the installation of warranted and recommended new traffic signals for which funding above the current base budget level (\$1,010,000) is required.

Base budget funding for new traffic signals is earmarked in the Rolling 5-Year Infrastructure Management Plan (IMP) through FY 2011, as approved by City Council in February 2007. Over the five-year period, 13 new traffic signals are scheduled to be installed: eight in FY 2007 and five in FY 2008. Residual funding in FY 2008 and all base budget funding in FY 2009 through 2011 is earmarked for traffic signal conversions (converting existing signals with wood poles to

metal poles). However, **because the traffic signal budget policy does not provide for the reallocation of IMP-earmarked conversion funds to cover the cost of the installation of new traffic signals, no base budget funding is available through FY 2011.** Consequently, short of implementing a moratorium on future Warrant Studies, there are no immediate remedies available to bridge the gap between new traffic signal needs and the lack of available base budget funding. However, the recommendations included herein do address and provide mechanisms for staff to better balance and manage future work load and related efforts, to include limiting the number of studies performed annually.

The following is a list of **key findings and recommendations** from this Review and Assessment:

1. **COSA's Warrant Studies incorporate limited use of engineering judgment, especially when compared with other cities.**
  - A. Short-Term Recommendation – Standardize the practice to not re-study duplicate requests falling within 12 months of the most recent prior study, unless engineering judgment deems it appropriate.
  - B. Pilot Recommendation – Implement a Pilot practice to streamline the review of intersections never before studied and certain duplicate requests received more than 12 months from the most recent prior study, and assess the practice after one year of implementation.

Implementation of these recommendations is anticipated to reduce overall Warrant Study work load and related work effort.

2. **COSA's Warrant Study work load is greater than all other surveyed cities both in terms of absolute figures and ratios.**
  - A. Mid-Term Recommendation – Limit the number of Warrant Studies performed annually to 30, based on an even distribution of requests studied (10 each) for citizens, councilmembers and staff. To effectively limit the number of studies, Recommendations 1-A and 1-B should be implemented in conjunction with this recommendation.

Implementation of this recommendation would reduce overall Warrant Study work load and related work efforts.

3. **System to identify and gather intersection-related vehicle crash data is antiquated, requiring unnecessary staff time.**
  - A. Short-Term Recommendation – Upgrade the existing CTAS mainframe system to provide for more accurate querying of police reports.
  - B. Mid to Long-Term Recommendation – Ensure the planned new CAD-based direct entry reporting system allows for necessary and sufficient on-line access to vehicle crash data.

Implementation of these recommendations is anticipated to reduce overall work efforts related to Warrant Studies.

**4. Current capacity to provide needed 24-hour traffic volume count data is limited, resulting in extended turnaround times.**

A. Short-Term Recommendation – Request through the Annual Budget Development Process one-time funding to outsource the collection of 24-hour traffic volume counts.

Implementation of this recommendation is anticipated to reduce the turnaround time for 24-hour traffic volume counts by four weeks or 66 percent.

**5. Existing systems and processes to manage new traffic signal service requests and related work load and efforts are insufficient.**

A. Long-Term Recommendation – Work with the Information Technology Services Department, the Office of Customer Service/311 and the Environmental Services Department, to identify and to implement technology solutions to better manage Warrant Studies and other related Service Requests.

Implementation of this recommendation is anticipated to reduce overall work efforts related to the collecting, tracking, querying and reporting of Warrant Study data, and to enhance management of these requests for service.

**6. Certain existing traffic signal communication tools need to be updated and augmented.**

A. Short-Term Recommendation – Update and enhance the Public Works Department's Traffic Management Division's web pages and existing traffic signal brochure.

Implementation of this recommendation will provide citizens, councilmembers and staff with improved access to comprehensive traffic signal information.

**7. Existing Traffic Signal Warrant Study program is request driven and reactive: outside of the City's development process, there is no proactive work plan to assess the need for new traffic signals prior to receiving a request.**

A. Long-Term Recommendation – Consider the design and implementation of a proactive program to assess new traffic signal needs throughout the City by 1) outsourcing a systematic traffic volume count program to cover the City by quadrant (or some other geographic unit); 2) studying internally the need for traffic signals or other traffic control devices based on the outsourced count program; 3) developing a program to handle requests above and beyond the annual work plan/recommended maximum number of Warrant Studies. It is strongly suggested that Recommendations 1-A, 1-B and 2-A be implemented in conjunction with this recommendation.

Implementation of this recommendation is anticipated to provide staff with the ability to better manage and balance Warrant Study work load and effort and to proactively and systematically identify new traffic signal needs, while continuing to maintain a process that allows citizens and councilmembers the ability to request Warrant Studies.

In addition to these key issues and related recommendations, it is important to briefly touch upon the installation of unwarranted/not recommended traffic signals and the absence of identifiable requirements to adjust staffing levels. During the Review and Assessment period, the City Auditor's Office released a report (AU07-003) that found City staff are not performing follow-up studies on the installation of unwarranted/not recommended traffic signals to determine if they have any effect on traffic flow or safety. The Center for Transportation Research at the University of Texas at Austin recently drafted a report entitled *Procedures for Applying MUTCD Warrants and Installing Speed Zones*, in which they identified San Antonio as the most likely city to install traffic signals that are unwarranted/not recommended. Precluding the installation of unwarranted/not recommended traffic signals would eliminate additional work load requirements, installation/removal costs, unknown liability issues, and, as identified by the City Auditor's Office, the need to perform follow-up studies.

Utilizing FY 2006 data as a comparison, COSA received more requests and conducted more Warrant Studies than all other surveyed cities. In addition, COSA staff had significantly more work load in terms of studies per recommended signal (6.0) and studies per FTE (78.5). It is unclear, however, what type of staffing adjustments may be justified, if any, given the very recent hiring actions to fill the vacant Sr. Engineering Tech and Engineering Tech positions, as well as the unknown impacts from the efficiency and programmatic recommendations included herein. In other words, at this time there are no identifiable "go-away" costs that could be redirected toward the installation of new traffic signals nor are there identifiable requirements to add new staff. Consequently, subsequent to the implementation of the work load-related recommendations included herein, it will be important for Public Works Department staff to assess the impact on work load and effort. This should be done when sufficient time has elapsed, preferably after 12 months of implementation.

Finally, while none of the recommendations is a panacea, and no immediate remedy exists to bridge the funding gap, it is believed that implementation of these recommendations will result in a more efficient and pro-active Warrant Study process that will provide staff with mechanisms to better balance and manage work load and related efforts.

Thank you for the opportunity to present this report to you. Should you have any questions or like to discuss this material in more detail, Human Resources Department staff are available at your convenience.

Sincerely,

---

Edward Belmares  
Director  
Human Resources Department  
City of San Antonio

## TABLE OF CONTENTS

<b>INTRODUCTION .....</b>	<b>3</b>
Project Objective, Scope and Research Methods.....	3
Background.....	3
<b>CITY OF SAN ANTONIO TRAFFIC SIGNAL WARRANT STUDIES.....</b>	<b>6</b>
Business Processes.....	6
Work Load Inputs and Outputs .....	10
Identified Issues .....	11
<b>SURVEY OF OTHER CITIES .....</b>	<b>13</b>
Overview of Survey Results.....	13
Summary of Other Cities' Traffic Signal Warrant Study Business Processes.....	16
<b>SUMMARY OF KEY FINDINGS WITH RECOMMENDATIONS .....</b>	<b>18</b>
<b>CONCLUSION.....</b>	<b>24</b>

## LIST OF APPENDICES

- APPENDIX A: GLOSSARY OF ACRONYMS
- APPENDIX B: PUBLIC WORKS' TRANSPORTATION GROUP ORGANIZATIONAL CHART
- APPENDIX C: CITY OF SAN ANTONIO'S TRANSPORTATION GROUP STAFFING  
ASSIGNED TO TRAFFIC SIGNAL WARRANT STUDIES
- APPENDIX D: CITY OF SAN ANTONIO'S TRAFFIC SIGNAL WARRANT STUDY  
BUSINESS PROCESS DIAGRAM
- APPENDIX E: CURRENT TSPW WORK ORDER PRINT-OUT AND PREFERRED VERSION
- APPENDIX F: CITY OF SAN ANTONIO'S TRAFFIC SIGNAL INSTALLATION RANKING  
CRITERIA
- APPENDIX G: DETAILED SURVEY RESULTS
- APPENDIX H: CITY OF SAN DIEGO'S 15-MINUTE TRAFFIC VOLUME COUNT SHEET
- APPENDIX I: CENTER FOR TRANSPORTATION RESEARCH REPORT *PROCEDURES  
FOR APPLYING MUTCD WARRANTS AND INSTALLING SPEED ZONES*
- APPENDIX J: OTHER CITIES' TRAFFIC SIGNAL BROCHURES

## INTRODUCTION

During the Spring of 2007, the City of San Antonio's (COSA) Human Resources Innovation Group (Innovation Group) was tasked by the City Manager's Office to study COSA's Traffic Signal Warrant Study (Warrant Studies) policies and processes. This report reflects the findings and recommendations from the study.

### Project Objective, Scope and Research Methods

The objective of this study is to identify policy and process efficiencies to include those that might be gained by implementing industry identified best practices and/or by reducing the number of Warrant Studies performed annually.

This scope of this study covers Warrant Study policies and processes generally, and COSA's Warrant Study policies and processes, specifically.<sup>1</sup>

To achieve the objective, various research methods were utilized including the following:

- Reviewing literature, local and state government web sites, and authorizing legislation regarding Warrant Studies;
- Discussing policy and process issues with staff;
- Mapping the business processes for COSA Warrant Studies
- Analyzing work load data; and
- Surveying other cities across Texas and the United States.

Due to the use of multiple acronyms, a Glossary of Acronyms has been included as Appendix A.

## Background

On January 1, 2007, District 9 Councilmember Kevin Wolff circulated a Council Consideration Request (CCR) Memo requesting that the Governance Committee consider the issue of unfunded, recommended traffic signals. The concern is that when no funding is available there can be lengthy delays of the installation of traffic signals that would otherwise help to ensure the safety and security of residents. On March 7, 2007, the City Council Governance Committee met to discuss the funding of recommended traffic signals. Consequently, the Office of Management and Budget (OMB) was directed to bring to the full City Council an item establishing a budget policy to address the funding of recommended traffic signals. City staff also informed the Governance Committee that the City's Innovation Group was in the process of reviewing current practices of conducting Warrant Studies to determine potential efficiencies.

**Authorizing Legislation for New Traffic Signal Installations** The installation of new traffic signals is governed by Federal Law, State Statute and City Code. Federal law requires that states either adopt the National Manual on Uniform Traffic Control Devices (MUTCD) or establish their own manual that is "in substantial conformance with the national MUTCD", and,

---

<sup>1</sup> The policies and processes for reviewing and analyzing the need for other traffic control devices, such as left turn signals, pedestrian signals, stop signs, etc., are not a component of this study.

should states adopt their own manual, “[c]hanges to the national MUTCD issued by the FHWA [Federal Highway Administration] shall be adopted by the States...within 2 years of issuance.”<sup>2</sup> Texas Law, through Section 544.001 of the Texas Transportation Code, requires the Texas Transportation Commission to “adopt a manual and specifications for a uniform system of traffic-control devices.” This Manual is the 2006 Texas MUTCD, as adopted by the Texas Transportation Commission on February 23, 2006.<sup>3</sup> Furthermore, Section 544.002(b) allows localities to “place and maintain a traffic-control device on a highway under [its] jurisdiction” as long as the device “conform[s] to the manual and specifications adopted under Section 544.001.”

The City of San Antonio’s Code of Ordinances confirms Texas Law, as stated below:

All traffic-control signs, signals and devices installed or erected in the city shall conform to the manual and specifications approved by the state highways and public transportation commission. All signs and signals required under this chapter shall so far as practicable be uniform as to type and location throughout the city. All traffic-control devices so erected and not inconsistent with the provisions of state law or this chapter shall be official traffic-control devices.<sup>4</sup>

**Texas Manual on Uniform Traffic Control Devices** The Texas Manual on Uniform Traffic Control Devices (Texas MUTCD) sets forth the state standards used to govern all traffic signal devices including their installation.<sup>5</sup> These standards have been developed by practicing engineers and through research and experimentation since the early 1930s and are updated frequently. Chapter 4C, Traffic Control Signal Needs Studies, outlines the factors that must be considered when determining the need to signalize an intersection. Generally speaking, a Warrant Study should include consideration of eight different traffic signal warrants:

1. Eight Hour Vehicular Volume
2. Four Hour Vehicular Volume
3. Peak Hour
4. Pedestrian Volume
5. School Crossing
6. Coordinated Signal System
7. Crash Experience
8. Roadway Network

If one or more of the warrants is met, the Texas MUTCD clearly indicates that consideration must be given to the need of a traffic signal; however, it also states that “[t]he satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.”<sup>6</sup> In addition to these specific warrants, a Warrant Study should also include other factors requiring engineering judgment such as how to discount the number of vehicles turning right from minor street approaches. In other words, MUTCD warrants are guidelines to be used by engineers in their overall analysis and recommendation.

---

<sup>2</sup> Code of Federal Regulations, Part 655.603.

<sup>3</sup> Texas Administrative Code, Title 43, Part 1, Chapter 25, Subchapter A Rule § 25.1.

<sup>4</sup> Code of Ordinances, City of San Antonio, Texas. Article III. Traffic Control Devices, Sec. 19-66. Conformity with state manual. See also Sec. 19-69, Traffic and Engineering Survey.

<sup>5</sup> Texas MUTCD. Texas Department of Transportation. (2006)

<sup>6</sup> Texas MUTCD (2006) page 4C-1.

**City of San Antonio Funding for New Traffic Signal Installations** The City of San Antonio's FY 2007 annual budget for new traffic signal installations is \$1,010,000. This amount funds roughly eight new signal installations per year (at an average City-force cost of \$126,250). The current annual budget amount reflects an increase of \$500,000 from an original FY 2006 budget amount of \$510,000.

In February 2007, the City Council approved a Rolling 5-Year Infrastructure Improvement Plan (IMP). The IMP is intended to establish a more technical process for development and recommendation of infrastructure improvement priorities for City Council's consideration and approval. The scope of the IMP covers street maintenance, drainage maintenance, sidewalks, and traffic signals. The traffic signal component includes the installation of new traffic signals and the conversion of existing wood pole signals to mast arm assembly (a metal vertical pole and horizontal arm used to position traffic signal heads for optimum visibility). The Traffic Signal Program component is funded utilizing the annual base budget for new traffic signal installations. Based on the IMP as approved in February 2007, over the five year period 13 new traffic signals will be installed: eight in FY 2007 and five in FY 2008. Consequently, as indicated in Table 1 below, no base budget funding is currently earmarked in the IMP for the installation of new traffic signals beyond FY 2008.

<b>TABLE 1</b>						
<b>Rolling 5-Year Infrastructure Management Plan Funding for Traffic Signal Component</b>						
<b>Traffic Signals</b>		<b>FY 2007</b>	<b>FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>
New Signals	Quantity	8	5	0	0	0
	Amount	\$1,010,000	\$631,250	\$0	\$0	\$0
Signal Conversions	Quantity	0	3	8	8	8
	Amount	\$0	\$378,750	\$1,010,000	\$1,010,000	\$1,010,000
<b>Total Amount</b>		<b>\$1,010,000</b>	<b>\$1,010,000</b>	<b>\$1,010,000</b>	<b>\$1,010,000</b>	<b>\$1,010,000</b>

On May 3, 2007, the City Council approved a new funding policy for warranted traffic signals.<sup>7</sup> The policy requires that, upon an intersection being warranted (and recommended by an engineer) for a traffic signal, City staff should include funding within two budget cycles subsequent to the completion of the Warrant Study (if base budget funding is not available). The policy also states that if a City Council District has available, unprogrammed Neighborhood Accessibility & Mobility Program (NAMP) resources, then these resources should be considered to fund newly warranted traffic signals in that District. Furthermore, the policy also recommends that should City Council not favor an annual proposed Budget's reallocation of resources from certain program(s) and/or City service(s) to fund a "mandated" inventory of new traffic signals, then City Council could amend that Budget to address such a funding decision. Finally, because the traffic signal budget policy does not provide for the reallocation of IMP-earmarked conversion funds to cover the cost of the installation of new traffic signals, no base budget funding for new traffic signals is available through FY 2011.

<sup>7</sup> City of San Antonio Ordinance 2007-05-03-0506.

**City of San Antonio Public Works Department Transportation Group Staffing** The Public Works (PW) Department's Transportation Group consists of four operational divisions: Traffic Operations (TO), Traffic Management (TM), Traffic Engineering (TE), and Neighborhood Traffic Engineering (NTE). (See Appendix B for a copy of the Transportation Group organizational chart.)

The TM division is responsible for coordinating and performing most of the data collection and all of the analysis for Warrant Studies; staff from the NTE division assist with the collection of 24-hour traffic volume counts. The TO division assists by assigning Service Requests to various Transportation Group divisions. In total, eight Public Works Department staff are directly involved with the Warrant Study process (see Appendix C). However, Warrant Studies are not their primary responsibility. Traffic Management division staff are also responsible for reviewing requests and issues related to left turn signals, pedestrian signals, and signal timings, as well as the design of new signal installations and the continued maintenance of existing signal operations. Neighborhood Traffic Engineering staff are also responsible for collecting 24-hour traffic volume counts for all other internal traffic studies: there is only one count crew for the entire City.

During the review and assessment period, the TM division had two vacant positions, a Sr. Engineering Tech and an Engineering Tech, both of which have been very recently filled.

## CITY OF SAN ANTONIO TRAFFIC SIGNAL WARRANT STUDIES

This section covers Warrant Study business processes, work load inputs and outputs, and identified key issues.

### Business Processes

The TM division receives numerous requests to install traffic signal installations at various intersections across the City. These requests come from residents, councilmembers (usually at the request of citizens) and staff.<sup>8</sup> Requests are logged into the Tracking System Public Works, or TSPW system, by the Customer Service/311 Department, by City Council offices (they have limited capabilities to enter requests into the TSPW system utilizing an interface system), and Public Works staff. The TSPW is a legacy mainframe system developed by the City's Information Technology Services Department (ITSD) to track and to report on the status of the Public Works Department's (as well as other departments') various Service Requests.<sup>9</sup> While requests are received year round, the collection of data occurs (in nearly all cases) during the months when school is in session, or roughly from September through May.

**Traffic Signal Warrant Studies** Warrant Studies involve the collection and analysis of traffic and vehicle crash data in conformance with the Texas MUTCD, to aid engineers in their decision on whether or not to recommend a new traffic signal installation. Below are the detailed business processes for the TM division's Warrant Studies (see subsequent discussion

---

<sup>8</sup> In addition, the TM division is responsible for reviewing developer Warrant Studies as a part of the City's development process.

<sup>9</sup> A recent audit by the City Auditor's Office (AU07-003) found that there are data inconsistencies between the TSPW system and the City Service Report Card. The Report Card is a web-based reporting system that tracks service requests and staffs' performance responding to those requests within an agreed upon timeframe or Service Level Agreement (SLA), which currently stands at 120 days for new traffic signals.

on the variations in Warrant Studies and Appendix D for a diagram of these various business processes):

Phase 1: Assignment and Communication of TSPW Service Requests

1. A New Traffic Signal Service Request is entered into the TSPW system. (Customer Service/311, City Council Offices, PW Department)
  - a. Status is Open.
2. New Traffic Signal Service Request is printed out at the TO division's office.<sup>10</sup> (Automatic Process)
3. Electronic Technician and/or Sr. Administrative Assistant retrieves print-out. (TO)
4. Electronic Technician and/or Sr. Administrative Assistant "pulls-up" individual Service Request in TSPW system. (TO)
  - a. Status is changed from Open to Pending.
  - b. Service Request is assigned to TM division.
5. Electronic Technician and/or Sr. Administrative Assistant manually inputs Service Request information into MS Access database.<sup>11</sup> (TO)
6. Electronic Technician and/or Sr. Administrative Assistant scans print-outs and sends them via electronic mail (e-mail) to the TM division; hard copies are also sent via bin-mail (these are delivered to Municipal Plaza, 9<sup>th</sup> Floor). (TO)

Phase 2: Initial Review

7. Secretary II checks MS Access database to make sure TSPW Service Request has been logged. (TM)
8. Secretary II gathers any prior Warrant Study data on the intersection in question. (TM)
9. Secretary II submits data to Engineering Associate for review. (TM)
10. Engineering Associate decides if a Warrant Study is required. (TM)
  - a. A Warrant Study is not required if one was previously completed within the last 12 to 24 months and new traffic volume counts are not required. In these cases a Supplemental Study may be conducted (see discussion of Supplemental Studies beginning on page nine).
  - b. A Warrant Study is also not required if one is currently planned or underway. In these cases the request will be closed out upon completion of the original study (see discussion of Supplemental Reviews beginning on page nine).

Phase 3: Warrant Study

11. Sr. Engineering Tech conducts a site visit to gather geometric data in order to prepare an intersection drawing. (TM)

---

<sup>10</sup> Based on input from the TM division, the current print-out is not detailed enough for their needs. Consequently, additional time is spent "pulling up" and printing out more detailed TSPW screen data. See Appendix E for a copy of the current "work order" print-out and the preferred, more detailed TSPW screen data print-out. The Environmental Services Department (ESD) utilizes this same print-out.

<sup>11</sup> The TM and NTE divisions utilize a MS Access database to manage their work related to signal and other requests (traffic, left turn, pedestrian, timings, all-way stops, speed humps, etc.), because the TSPW system does not currently allow them to sufficiently track and query data based on various request characteristics (e.g., type of study and actions taken) or more detailed request statuses (e.g., tasks assigned and study in progress). The MS Access database is manually updated and maintained by the TO, TM and NTE divisions. In addition to this database, work load and effort related to 24-hour road tube counts are being tracked in an MS Excel spreadsheet.

12. Sr. Engineering Tech requests 24-hour traffic volume counts from the NTE division. (TM)
  - a. Engineering Techs collect 24-hour traffic volume data using road tubes. (NTE)
  - b. Engineering Tech downloads data into VIAS (Vehicle Identification and Analysis System) and analyzes it. (NTE)
  - c. Engineering Tech sends TM division staff 24-hour traffic volume data in raw form via e-mail. The average turnaround time based on calendar year 2006 and 2007 data (through March) is roughly six weeks. (NTE)
13. Sr. Engineering Tech utilizes the CTAS (San Antonio Traffic Analysis System) mainframe system to identify traffic accident cases that occurred at the intersection (or block) in question.<sup>12</sup> (TM)
14. Sr. Engineering Tech requests via facsimile crash data from the San Antonio Police Department's (SAPD) Records Unit. (TM)
  - a. Records Unit staff gathers and photocopies all traffic accident reports. Currently, the average turnaround time to complete the photocopying is roughly two to four days depending on overall workload. (SAPD)
  - b. Police reports are picked up by TM division staff. (TM)
  - c. Sr. Engineering Tech creates collision diagram using crash data. (TM)
15. Sr. Engineering Tech completes initial warrant analysis based on the traffic volume and crash data. (TM)
16. Sr. Engineering Tech submits initial warrant analysis to Engineering Associate. (TM)
17. Engineering Associate reviews and discusses warrant analysis with Sr. Engineering Tech. (TM)
  - a. If warrants 1 (eight hour vehicular volume) and 2 (four hour vehicular volume) are met, the Sr. Engineering Tech is tasked with gathering Turning Movement Counts (TMCs).
  - b. If warrants 1 and 2 are not met but other warrants are, the Sr. Engineering Tech may be tasked with gathering TMCs. If TMCs are not required, the Engineering Associate will make a recommendation to signalize or not signalize the intersection based on the warrant analysis and engineering judgment and submit the analysis to the Sr. Engineer and/or Traffic Engineer for review. If a traffic signal is not recommended, exploration of an alternative traffic control device may be recommended.<sup>13</sup>
  - c. If no warrants are met, the Engineering Associate submits the analysis to the Sr. Engineer and/or Traffic Engineer with a recommendation not to install the traffic signal.
18. As required, the Sr. Engineering Tech conducts TMCs at the intersection during peak period hours usually between 7:00am–9:00am and 4:00pm–6:00pm. When the intersection is in the vicinity of an elementary or middle school, the afternoon peak period is studied between 2:30pm-6:00pm. (TM)

---

<sup>12</sup> Often times, the CTAS system does not provide sufficient data for TM division staff to determine if a particular case actually involved a crash. The result is that TM division staff may unknowingly request case information that is not required, adding marginally to SAPD Records Unit staff time required to process the request.

<sup>13</sup> Recommendations to explore alternative traffic control devices are forwarded to the NTE division for consideration. In some of these cases, TM division staff may also perform the warrant analysis for an all-way stop since they have already collected the necessary data.

19. Sr. Engineering Tech compares TMCs to peak period volume counts to verify validity of traffic volume counts<sup>14</sup> and to determine how much traffic volume might be discounted based on right-hand turns. (TM)
20. Sr. Engineering Tech completes final warrant analysis based on initial warrant analysis and TMCs. (TM)
21. Sr. Engineering Tech submits final warrant analysis to Engineering Associate for review. (TM)
22. Engineering Associate reviews and discusses the warrant analysis with the Sr. Engineering Tech and then submits it to the Sr. Engineer and/or Traffic Engineer with a recommendation to signalize or not signalize the intersection. If signalization is not recommended, exploration of an alternative traffic control device may be recommended. (TM)
23. Sr. Engineer and/or Traffic Engineer reviews warrant analysis and discusses recommendation with other engineers and then, with Traffic Engineer's final approval, a decision is made to recommend or not recommend signalization of the intersection, the latter of which may include a recommendation to explore an alternative traffic control device. (TM)
  - a. Generally speaking, engineering judgment includes consideration of the following when reviewing a Warrant Study:
    - i. Will the signal improve traffic operations without being detrimental to traffic safety?
    - ii. Will the signal improve safety performance without being detrimental to traffic operations?

#### Phase 4: Close Out and Prioritization of Recommended Signals

24. If signalization is not recommended, then:
  - a. Citizen is informed, if follow-up was requested, and, if a councilmember has inquired, he/she is also informed.
  - b. Request is closed out in TSPW system.
25. If signalization is recommended, then:
  - a. Citizen is informed, if follow-up was requested, and, if a councilmember has inquired, he/she is also informed.
  - b. Request is closed out in TSPW system.
  - c. Signal is prioritized for funding and installation utilizing prioritization criteria and scoring methodology (see Appendix F).
  - d. Funding is identified based on the Traffic Signal Budget Policy.

***Variations in Traffic Signal Warrant Studies*** These detailed business processes are reflective of a full-blown Warrant Study; however, the TM division also conducts two scaled-down variations referred to herein as Supplemental Studies and Supplemental Reviews. These terms were coined for this report to describe those unique business processes that occur based on specific circumstances as described below.<sup>15</sup>

Warrant Studies, discussed in detail above, are usually performed under one of the conditions listed on the following page:

---

<sup>14</sup> When TMCs are significantly different from the 24 hour traffic volume counts, TM division staff will request the NTE division staff to redo the count.

<sup>15</sup> Supplemental Studies and Supplemental Reviews are not tracked within the TSPW system or the MS Access database.

- No prior studies have been completed on the intersection in question; or
- The most recent study was completed more than 24 months prior and signalization was *not* recommended.

Supplemental Studies, on the other hand, are usually performed when:

- The most recent study was completed not less than 12 and not more than 24 months prior and signalization was *not* recommended; or
- A study was completed not more than 12 months prior and additional data is required based on an engineer's judgment and/or an "anticipated requirement" to gather new data. The "anticipated requirement" to gather new data arises when TM division staff anticipate a need within the organization to provide the details associated with the analysis.<sup>16</sup>

The difference in process (and thus work load) between Warrant Studies and Supplemental Studies is in the amount of data collected. Supplemental Studies only involve updating crash data and TMCs.

Supplemental Reviews usually occur with duplicate requests under any of the conditions listed below:

- Signalization was recommended; or
- A study is planned or already underway; or
- Signalization was *not* recommended, there is no engineering determination or "anticipated requirement" to gather additional data, and the most recent prior study occurred within the past 12 months.

In these cases, requests are closed out and, if a call back is requested, the individual is informed of the findings from the most recent prior study.

The differences in work load and time requirements between Warrant Studies, Supplemental Studies and Supplemental Reviews, are substantial. Supplemental Studies do not require additional 24-hour traffic volume counts, which take up to an average of six weeks to obtain. This allows for more time to conduct the initial warrant analysis. Supplemental Reviews take much less time as no new data collection is required.

## **Work Load Inputs and Outputs**

Based on detailed Warrant Study data provided by the TM division, Table 2 on the following page illustrates, the number of requests for new traffic signals received in FY 2006 and FY 2007 (through March); the number of those requests that are duplicate in nature; the total number of Warrant Studies and Supplemental Studies completed; and the resulting number of signals recommended for installation as a result of the studies.<sup>17</sup> This information is valuable in that it illustrates the volume and characteristics of the demand for new signals, the TM division's work

---

<sup>16</sup> Based on anecdotal evidence from TM division staff, a councilmember or his/her staff's involvement is the determining factor for anticipating a need to provide the details related to the review of duplicate requests. Typically, they inquire about how close the numbers came to meeting any of the various warrants and often request that new data be gathered, despite an engineer's professional judgment that new data may not be required.

<sup>17</sup> The information received is un-audited. Due to the need for detailed work load information, the TM division had to compile this information from its Microsoft (MS) Access database and original hard copy files.

load (Warrant Studies), and the resulting ratio of work load to service delivery requirements (recommended signals).

Because Warrant Studies span fiscal years, 24 of the 84 completed studies in FY 2006 are related to requests received prior to that fiscal year. Similarly, 27 of the studies completed in FY 2007 were from requests submitted in FY 2006. Over the 18-month period reviewed, a total of 299 requests have been received at an average of 16.6 per month.

In FY 2006, 41 requests, or 21.2 percent of all requests, were duplicates. Through March of FY 2007, 25 requests, or 23.6 percent, were duplicates; however, when looked at over an 18-month period, a total of 95 requests, or 31.8 percent, were duplicates.

TABLE 2							
Traffic Signal Warrant Study Work Load Inputs and Outputs							
Fiscal Year	No. of Requests	Avg. Monthly Requests	No. of Duplicate Requests	Total Studies Completed	Warrant Studies	Supplemental Studies	Recommended Signals
2006	193	16.1	41	84	57	27*	14
2007 (through March)	106	17.7	25	45	23	22*	3
*No signals were recommended as a result of these studies.							

In FY 2006 14 intersections were recommended for signalization, which reflects a factor of six studies per recommended traffic signal. Through March of FY 2007, three studies resulted in recommendations to signalize an intersection (15 studies per recommended traffic signal). Over the 18-month period, the TM division has performed on average roughly eight Warrant Studies for every intersection recommended for signalization.

### Identified Issues

During the review of Warrant Study business processes and related work load/effort, several issues were identified, including the following:

- Use of Engineering Judgment* The use of professional engineering judgment may not be sufficiently utilized with certain duplicate requests received within 12 months of the most recent prior study, when signalization was not recommended, and for which engineering judgment deems it appropriate to “reiterate” those findings. In other words, a Supplemental Study is performed in lieu of a Supplemental Review, when the latter may be justifiable. This results in a requirement to perform additional data collection and analysis.
- Reactive Assessment of Traffic Signal Needs* The current program to assess the need for new traffic signals is primarily reactive in nature. While the Traffic Management division does review developer-related Warrant Studies, there is no proactive work plan to assess traffic signal needs prior to receiving a request from a citizen, councilmember or staff person.

- *Antiquated Process to Identify and Gather Crash Data* The current method for identifying and gathering crash data utilizes a mainframe system (CTAS) that is functionally outdated. Because crash data is not provided electronically, Traffic Management staff must spend time querying crash-related police report/case numbers, requesting copies of the reports, and picking them up. However, most of the work load is born by SAPD Records Unit staff that must spend time locating and photocopying the reports. In addition, the CTAS system is not always up-to-date, resulting in additional marginal work load. Currently, each request for crash data takes between two and four days.
- *Extended Turnaround Time for Traffic Volume Counts* Currently, the NTE division has only one traffic count crew, which is responsible for gathering all traffic volume counts for the entire City. Each request for a 24-hour traffic volume count takes on average six weeks, which is inclusive of other tasks performed by NTE division staff.
- *Insufficient Systems and Processes to Manage New Traffic Signal Service Requests and Related Work Load and Efforts* The current process to assign Transportation Group-related Service Requests is managed centrally by the TO division. The process involves the manual transfer of data from one system to another—from the TSPW system to the MS Access database—based on the automatic printing of a Service Request form from the TSPW system. Due to the current design of the MS Access database, this process is subject to unnecessary human oversight, e.g., street naming conventions are not standardized and no system checks or error messages are built into the database. In addition, the existing TSPW Service Request form is not as detailed as the TM division staff would prefer it be, requiring them to devote time gathering additional TSPW data to process each request in the MS Access database. Finally, because the TSPW system does not currently allow staff to sufficiently track and query data on various Service Request characteristics (e.g., type of study and actions taken) or more detailed statuses (e.g., tasks assigned and study in progress), staff must utilize two discrete systems to manage and to report on work load and effort.
- *Installation of Unwarranted/Not Recommended Traffic Signals* Based on discussion with staff, as well as the recent audit by the City Auditor's Office, the installation of unwarranted traffic signals has resulted in a combination of additional Warrant Study work load requirements, design and installation costs, and, as identified and recommended by the City Auditor's Office, a need to study the impact from the installation of unwarranted/not recommended traffic signals. In addition, there may be unknown liability issues related to such installations.
- *No Identifiable "Go-Away" Costs or Necessary Additional Staffing Requirements* Based on the current Warrant Study work load demand and resulting efforts, there are no identifiable savings to be redirected toward the installation cost for new traffic signals nor identifiable requirements for needed additional staffing.

Most of these issues can be addressed to reduce work load and/or the time required to conduct Warrant Studies, as well as to increase staff's ability to manage and to report on such studies.

## SURVEY OF OTHER CITIES

To help identify policy and process best practices, a survey of other cities across the United States was conducted via telephone and e-mail. Through discussion with PW staff, a total of eight cities were included in the survey based on the criteria as summarized in Table 3 below.

TABLE 3		
Population of Surveyed Cities		
City	Identified as "Best-in-Class"	Peer Cities and/or Previously Surveyed
Atlanta, GA		
Austin, TX		
Dallas, TX		
Houston, TX		
Phoenix, AZ		
San Diego, CA		
St. Louis, MO		
Round Rock, TX		

The intent of the survey was to capture data on key city demographics; technical and operational environments; traffic signal installation budgets and costs; work load inputs, outputs and staffing; key decision points throughout the Warrant Study process; as well as general Warrant Study business processes. Below is an overview of the survey results.

### Overview of Survey Results

Five of the eight cities were fully responsive within the given timeframe, including Atlanta, Austin, Dallas, San Diego and St. Louis; however, data was gathered (and therefore included) on Phoenix’s Warrant Study process. See Appendix G for a detailed listing of survey results.

**Key City Demographics** The responsive cities range in population size from a low of 344,362 in St. Louis to a high of 1,255,540 in San Diego. Geographically, COSA is the largest city at 504 square miles with Dallas the next largest at 385 square miles; St. Louis is the smallest city at 61 square miles. The number of centerline miles varies from a low of 1,100 in St. Louis to a high of 3,980 in COSA; Dallas is the next largest with 3,525 centerline miles. Three of the cities have a mayoral form of government: San Diego and Atlanta have moderate terms limits and St. Louis has no term limits. Unlike COSA, no city has a lifetime ban on the number of terms an elected official is allowed to serve.

**Technical and Operational Environments** The technical and operational comparisons included data on controller environments, predominant communication networks, methods utilized for signal construction (outsourcing versus in-house), number of existing signals, the location of Traffic Management and Traffic Operations functions, and the city department within

which Warrant Studies are conducted. Controller environments and signal construction methods are relatively evenly distributed across the cities, and, except for St. Louis, each of the cities' Traffic Management and Traffic Operations functions are geographically separated. The predominant communication network is copper cable with a trend of moving to fiber optic. The number of existing signals ranges from a low of 650 in St. Louis to a high of 1,475 in San Diego. Finally, the traffic engineering functions are housed in Public Works, Streets and Transportation Departments.

**Traffic Signal Installation Budgets and Costs** San Diego is the only city with an annual operating line-item budget for new traffic signal installations. Currently, it is at \$340,000; however, at its high point in FY 1998 it was at \$1.2 million. In addition to this annual funding source, San Diego has a \$50,000 annual line item budget to outsource traffic volume counts (for all types of studies). Dallas and Austin are currently utilizing long-term debt while Atlanta and St. Louis have an informal policy that requires their councilmembers and aldermen, respectively, to identify funding for warranted and recommended new traffic signals. Finally, signal installation costs range from a low of \$70,000 in St. Louis to a high of \$170,000 in San Diego. No city has a formal budget policy addressing the funding mechanisms for new traffic signal installations.

**Work Load and Staffing** Table 4 below contains a snapshot of FY 2006 workload and staffing data for the surveyed cities and COSA. It is important to note here that the figures identified by each city for the number of Full Time Equivalent (FTE) dedicated to Warrant Studies is an approximation.

TABLE 4							
FY 2006 Work Load and Estimated FTE Staffing Levels							
City	Total Requests	Warrant Studies	Recommended Signals	Warrant Studies per Recommended Signal	Warrant Study FTEs	Requests per FTE	Warrant Studies per FTE
COSA	193	84	14	6.00	1.07	180.37	78.50
San Diego, CA	92	30	6	5.00	1.18	77.97	25.42
Dallas, TX	88	17	5	3.40	0.66	133.33	25.76
Austin, TX	15	15	10	1.50	0.60	25.00	25.00
Atlanta, GA	20	20	5	4.00	0.72	27.78	27.78
St. Louis, MO	3	3	3	1.00	0.50	6.00	6.00

As indicated in the table, COSA's demand for new traffic signals is significantly greater than all other cities. In comparison, COSA received more requests and completed more Warrant studies both in absolute terms and per FTE. While the ratio of requests to FTEs for the other cities varies quite significantly, studies per FTE are quite similar. The only outlier is St. Louis, which has an altogether different request process compared to the other cities (see discussion below). Excluding COSA, in FY 2006 the average number of Warrant Studies per FTE was 22. If St. Louis, which is an outlier, is excluded from this calculation, the average number of Warrant Studies per FTE was 26: COSA's is more than three times this amount. In terms of Warrant

Studies per recommended signal, excluding COSA, in FY 2006 the average number of Warrant Studies per recommended signal was three, while COSA conducted six Warrant Studies for every recommended signal installation.

**Key Traffic Signal Warrant Study Decision Points** Information was requested about key decision points for each city's Warrant Studies. Each city, with the exception of St. Louis, receives requests directly from citizens, councilmembers and staff. St. Louis requires that all requests be submitted through the appropriate alderman in written form.<sup>18</sup> No city requires a critical mass of requests per intersection: only one request is required. However, built into each city's Warrant Study processes are informal practices to not revisit relatively recent studies that were "not recommended" for signalization (up to one year on average). When duplicate requests are received for which the last study was more than one year prior, the other cities typically perform a site visit to determine if anything has substantially changed traffic volume or other conditions, to include reviewing crash data. Generally, the scope of new data collection and analysis efforts is based on this review process. Finally, while most cities typically study all warrants for new requests, Phoenix tends to focus on Warrants 1 (8-hour Vehicular Volume), 4 (Pedestrian Volume) and 7 (Crash Experience).

With regard to new intersection requests (intersections not previously requested for study), the cities of Atlanta, Austin, Dallas and St. Louis will perform a site visit to gauge, using their professional engineering judgment, the likelihood that warrants will be met, and, as a result, may forward the request for consideration of an alternative traffic control device or simply not recommend the intersection for signalization. Incorporating a more quantitative method into their process, the City of San Diego will conduct a 15-minute volume count prior to the peak period. These figures will be projected to calculate a one-hour volume count, and, if the threshold is not met, no formal Warrant Study will be completed (see Appendix H for a copy of the chart utilized in this process).

The Center for Transportation Research at the University of Texas at Austin recently drafted a report entitled *Procedures for Applying MUTCD Warrants and Installing Speed Zones*, in which they discuss their findings from a survey of eight cities across the US (see Appendix I for a copy of the report). Two of the eight cities – San Antonio and San Jose – always check warrants before approving or denying requests for new traffic signals. However, the other surveyed cities – including Austin; Dallas; Houston; Cambridge, MA; Portland, OR; and Denver – perform pre-Warrant Study site visits, and, using their professional engineering judgment may decide to not recommend a new traffic signal.<sup>19</sup>

**Traffic Signal Communication and Outreach Efforts** Due to the complex nature and often misunderstood process of Warrant Studies (there is often confusion between the terms "warranted" and "recommended"), a review of traffic signal communication and outreach efforts was conducted to identify potential enhancements to the TM division's current efforts. The premise being that effective communication of the Warrant Study process will result in a less cumbersome process for all parties. The review involved surveying local and state transportation departments' web sites for information on traffic signals generally and Warrant Studies specifically. In addition, as a part of the phone survey, each city was asked to identify other communication and outreach efforts.

---

<sup>18</sup> In discussion with St. Louis staff, this is in part due to the fact that aldermen are required to identify the funding for new traffic signals recommended for installation within their districts.

<sup>19</sup> The report also identified San Antonio as the most likely city to install traffic signals that are unwarranted-not recommended.

The survey of web sites found that many cities provide a wide range of detail, including contact information, frequently asked questions (FAQs), discussion of traffic signal benefits and limitations, details on how to request new signals or other traffic control devices, as well as the factors considered when reviewing such requests. Some cities provide an on-line option to request a new traffic signal or file a complaint about an existing signal (e.g., timing or maintenance issues). Also noticeable, many cities provide links to other transportation related web sites such as state departments of transportation, their respective state's MUTCD or the National MUTCD, and regional transportation authorities. Each of these other sites tends to include similar supporting information regarding traffic signals in general and warrant studies in particular.

From a layperson's perspective, probably the most important web site factor, besides the availability of detailed information, is the ability to find it. To this end, a minimalist approach to web page design and the use of easily identifiable links significantly enhances navigation. Moreover, the use of succinct language and bulleted formatting is also very helpful. Finally, links to information topics within a web page is also extremely helpful: the less "scrolling" required the better.

The use of graphics was found to be limited and basic in nature. Most sites include static graphics; less frequently used are topic-related graphical links (e.g., a traffic signal as the link to information on traffic signals), which can aid in the navigation process. Dynamic graphics such as interactive maps were not found; however, many city and state web sites have links to static traffic count/volume maps.

Many cities also have links to signal-related brochures in PDF (Portable Document Format) format. The content of these brochures is relatively similar and tends to reflect the information provided on-line. As is the case with web site design, a minimalist approach and the use of succinct language and bulleted formatting results in a more user-friendly brochure (color helps, too) (see Appendix J for a sample of these brochures).

Finally, based on the discussion with the surveyed cities, formal outreach efforts above and beyond information provided on-line tend to be limited to communications via telephone, e-mail and at community meetings. Because these cities do not experience issues related to the installation of unwarranted/not recommended traffic signals, and they tend to receive less requests for Warrant Studies, they have not experienced a need to intensify proactive education efforts beyond those currently in place.

### **Summary of Other Cities' Traffic Signal Warrant Study Business Processes**

This section summarizes the various business processes undertaken by the survey cities, including Phoenix. The cities of [Atlanta](#), [Austin](#) and [St. Louis](#) all follow similar business processes when conducting Warrant Studies, as summarized below (differences are noted):

1. Requests received from citizens, councilmembers and staff.
  - a. St. Louis requires all requests to be submitted through the appropriate Alderman.
2. Prior Warrant Study data compiled, if applicable.
3. If studied within the last 12 months (on average) no new study will be performed, unless engineering judgment deems it appropriate.

4. If the request is new or was studied more than 12 months prior, a site visit will be conducted to gauge the need to study based on engineering judgment.
5. If Warrant Study is deemed necessary, traffic counts and crash data are compiled and warrants are analyzed.
  - a. St. Louis collects all crash data from their Police Department on a monthly basis, whether needed or not.
6. Engineer utilizes Warrant Study and professional judgment to determine if signal should be recommended or not.
  - a. St. Louis' Deputy Commissioner of Traffic reviews engineer's decision and makes final determination.

The City of Dallas' Warrant Study business processes are as follows:

1. Requests received from citizens, councilmembers and staff.
2. Prior Warrant Study data compiled, if applicable.
3. If studied within the last 12 months no new study will be performed, unless engineering judgment deems it appropriate.
4. If the request is new or was studied more than 12 months prior, a site visit will be conducted to gauge need to study.
  - a. If Warrant Study is not deemed necessary, the request is forwarded to the Sign Group for consideration of an alternative traffic control device.
5. If Warrant Study is deemed necessary, traffic counts and crash data are compiled and warrants are analyzed.
6. Engineer utilizes Warrant Study and professional judgment to determine if signal should be recommended or not.
7. Engineer's recommendation reviewed by Sign Group.
8. Sign Group's recommendations sent to Assistant Director for review.
9. Assistant Director makes final recommendation.

The City of San Diego's Warrant Study business processes are as follows:

1. Requests received from citizens, councilmembers and staff.
2. Prior Warrant Study data compiled, if applicable.
3. If studied within last 12 months no new study will be performed, unless engineering judgment deems it appropriate.
4. If the request is new or was studied more than 12 months prior, a site visit will be conducted to gauge the need to study based on engineering judgment and 15-minute traffic volume counts. Counts are projected to calculate one-hour traffic volume counts prior to the peak period and if certain thresholds are not met, a Warrant Study may not be conducted.
5. If Warrant Study is deemed necessary, traffic counts (through private contractor) and crash data are compiled and warrants analyzed.
6. Engineer utilizes Warrant Study and professional judgment to determine if signal should be recommended or not.
7. Engineer's recommendation reviewed by panel of engineers, which makes final recommendation.

The City of Phoenix's Warrant Study business process is as follows:

1. New requests received from citizens, councilmembers and staff.
2. Requests are placed on a master list of intersections to potentially study.

3. Engineer prioritizes top 200 intersections for study in any given year.
  - a. Top 100 from prior year are automatically included.
  - b. New requests are added to the top 100.
  - c. Requests that have not been studied in at least three years are also included.
4. Prioritized list reviewed by engineering committee and finalized.
5. Data gathering and analysis for 200 intersections completed November through February.
6. Group of three engineers utilize Warrant Study and professional judgment to determine final recommendation.

Except for the City of Phoenix, each of the city's Warrant Study business processes follows a similar pattern; however, there are noticeable practices that fall outside the pattern including the following:

- The City of St. Louis only processes written requests that are generated from an alderman's office.
- The City of St. Louis collects on a monthly basis all traffic-related police accident reports, regardless of immediate need.
- There are varying levels and degree of review, ranging from internal division review up through the Department director, to review across divisions and among groups.
- The City of San Diego utilizes a quantitative method to help gauge the need to conduct a new Warrant Study or revisit one previously studied more than 12 months prior.

Finally, in contrast to the City of San Antonio's Warrant Study process, and in addition to Warrant Study policy/process differences noted above, the surveyed cities all incorporate some form of engineering judgment prior to an actual Warrant Study to gauge the appropriateness of a traffic signal in general and in comparison to other traffic control devices or geometric changes to an intersection.

## **SUMMARY OF KEY FINDINGS WITH RECOMMENDATIONS**

The following is a summary of key findings with recommendations to address or resolve various policy and process efficiency issues. While there is no one simple solution, it is believed that implementation of these recommendations will result in an improved and more efficient Warrant Study process.

1. **Finding – City of San Antonio Traffic Signal Warrant Studies Incorporate Limited Use of Professional Engineering Judgment when Compared with Other Cities and Work Load is Greater than All Surveyed Cities**

The current process to review certain duplicate requests limits the use of professional engineering judgment, resulting in additional work load and time requirements for TM division staff. Furthermore, the process does not allow engineering staff to exercise their judgment prior to the study of new requests to expeditiously identify more appropriate alternative traffic control devices, geometric improvements to the intersection, or gauge the likelihood that signalization would be

recommended. These practices are found to be uniform across the population of surveyed cities and others.

A. Short-Term Recommendation – Standardize the Practice for Processing Certain Duplicate Requests Falling within 12 Months of the Most Recent Prior Study

Standardize the practice to not re-study an intersection within 12 months of the most recent prior study, unless engineering judgment deems it appropriate to gather additional data.

B. Pilot Recommendation – Implement a Pilot Practice for Processing Intersections Never Before Studied and Certain Duplicate Requests and Assess the Program after 12 Months of Implementation

Implement a pilot program to gauge the need to perform a Warrant Study or Supplemental Study utilizing the City of San Diego's 15-minute count method, or some internally designed alternative criteria. This would apply to new requests (intersections never before studied), as well as duplicate requests for intersections previously studied more than 12 months prior to the request.

If this pilot program is implemented, it should remain in operation for 18 months in order to gather sufficient operational data. At the end of 12 months, a follow-up review should be completed to assess the impact of this practice on work load and SLAs, as well as recommendation for permanent implementation beyond the 18 months.

Implementation of these recommendations is anticipated to reduce overall Warrant Study work load and related work efforts.

2. Finding – City of San Antonio Traffic Signal Warrant Study Work Load is Greater than All Surveyed Cities

Utilizing FY 2006 data as a comparison, COSA received more requests and conducted more Warrant Studies than all other surveyed cities. In addition, COSA staff had significantly more work load in terms of studies per recommended signal (6.0) and studies per FTE (78.5). It is unclear, however, what type of staffing adjustments may be justified, if any, given the very recent hiring actions to fill the vacant Sr. Engineering Tech and Engineering Tech positions, as well as the unknown impacts from the efficiency and programmatic recommendations included herein.

A. Mid-Term Recommendation – Limit the Number of Warrant Studies Performed Annually to 30 and Establish an Even Distribution of Requests Studied (10 each) for Citizens, Councilmembers and Staff

Implement a pilot program to limit the number of studies completed annually based on the average number of studies per FTE from the survey cities (26) (excluding St. Louis). This would limit the number of studies to 28 per fiscal year, or 30 if rounded to tens. To effectively limit the number of studies, Recommendations 1-A and 1-B should be implemented in conjunction with this recommendation.

If this pilot program is implemented, it should remain in operation for 18 months in order to gather sufficient operational data. At the end of 12

months, a follow-up review should be completed to assess the impact of this practice on work load, SLAs, as well as recommendation for permanent implementation beyond the 18 months.

Implementation of this recommendation would reduce overall Warrant Study work load and related work efforts.

3. **Finding – Current System to Identify and Gather Intersection-related Crash Data is Antiquated, Requiring Unnecessary Staff Time**

The PW Department TM division staff is required to use a functionally outdated mainframe application (CTAS) to identify potential crash-related police reports. Crash data, such as type of crash, direction, etc., is not available in electronic format. This requires TM division staff to request hard copies of police reports from SAPD Records Unit staff. In addition, because the CTAS system is not always up-to-date some cases are unknowingly requested, adding marginal work load for SAPD Records Unit staff.

Currently, SAPD and ITSD staff have formed a working group to explore a CAD (Computer Aided Design) alternative to the previously planned Field Entry Reporting System (FERS). Based on initial inquiries, the new system will include an electronic link to crash data.

A. **Short-Term Recommendation – Upgrade the Existing CTAS System**

In the short-term, it is recommended that PW TM division and Information Systems staff work with SAPD Information Systems staff and ITSD staff to facilitate a work order to upgrade the current CTAS system to provide for more accurate querying of police reports.

B. **Mid to Long-Term Recommendation – Ensure the Planned New Direct Entry Reporting System Allows for Sufficient On-line Access to Crash Data**

In the long-term, it is recommended that the PW TM division and Information Systems staff work with SAPD and ITSD staff to ensure that the new CAD-based system will completely eliminate the need to request hardcopies of police reports and that the appropriate PW Department staff are allowed necessary and sufficient access to the system.

Implementation of these recommendations is anticipated to reduce overall work efforts related to Warrant Studies.

4. **Finding – Current Capacity to Provide Needed 24-Hour Traffic Volume Count Data is Limited**

The City of San Antonio has only one traffic count crew to gather data for all traffic-related studies. As a result, the current turnaround time to gather 24-hour traffic volume counts for Warrant Studies is the single longest task of all the business processes, averaging roughly six weeks. Based on this and anecdotal evidence, it appears that there is a need for additional count crews. However, because the scope of this project did not include a comprehensive evaluation of NTE division count crew work load and business processes, only those business processes related to Warrant Studies, it is indeterminable as to what the appropriate additional staffing requirements are. Nonetheless, adding one additional count crew would, theoretically, reduce the average turnaround time by half, from six weeks to three

weeks. According to Public Works fiscal staff, one new count crew, including all necessary capital expenditures is estimated to cost roughly \$124 thousand in year one, with an additional incremental increase of over \$11 thousand in year two, for a total second year cost of just over \$135 thousand. However, a brief survey of two private firms within the San Antonio-Austin area indicates that the cost to outsource 24-hour traffic volume counts at one, four-leg intersection would be roughly \$650 with an estimated turnaround time of two weeks.

A. Short-Term Recommendation – Request through the Annual Budget Development Process One-time Funding to Outsource the Collection of Traffic Volume Counts

To reduce the turnaround time for 24-hour traffic volume counts it is recommended that the TM division considers requesting funding to outsource this service for Warrant Studies only. The impact of this recommendation should reduce overall turnaround times for 24-hour traffic volume counts performed by existing City forces, but should not result in the reduction of these resources, as these counts only represent a portion of their total work load.

Implementation of this recommendation is anticipated to reduce the turnaround time for 24-hour traffic volume counts by four weeks or 66 percent.

5. **Finding – Existing Systems and Processes to Manage New Traffic Signal Service Requests and Related Work Load and Effort are Insufficient**

The TSPW system as currently designed is not sufficiently dynamic to manage traffic signal requests (or other signal requests and related work efforts such as the 24-hour traffic volume counts). Consequently, the TM and NTE divisions have been utilizing an external system (MS Access) to manage and to report on work load and effort; however, even this system is not comprehensive and requires additional staff time to maintain. Moreover, the requirement to manually transfer data from one system to another is susceptible to unnecessary risk. Finally, the process of assigning Service Requests could be improved through technical upgrades and task reassignments.

A. Long-Term Recommendation – Identify and Implement Technology and Process Solutions to Better Manage Traffic Signal Warrant Studies and Other TSPW-related Service Requests

Begin exploratory meetings with ITSD, the Office of Customer Service/311 and the Environmental Services Department (ESD) to identify either 1) potential modification to the TSPW system or 2) potential software applications to replace the TSPW system. The impact from Recommendation 7-A must be considered when developing the final technology solution.

If it is decided that modification of the TSPW system is the best course of action, it is further recommended that the TM division work with the NTE division and PW Department Information Systems staff to modify the existing MS Access database to eliminate risk factors (lack of standard street naming conventions and system checks or error messages); to begin tracking Supplemental Studies and Reviews, as well as 24-hour road tube counts associated with each Service Request; and, to determine if there is a mechanism to link the TSPW system to the MS Access database such as

through a SQL Server back-end, which could negate the need to print out Service Request forms. If the latter recommendation is not feasible, it is also recommended that the process of assigning TM division Service Requests be transferred from the TO division to the TM division, and that the current Service Request forms be augmented to provide more detailed and necessary information. These changes would require that the TM division work with ITSD and ESD staff to establish the requirements for the new Service Request forms. These include 206-Traffic Signal New Request; 208-Left Turn Signal New Request; 209-Traffic Signal Timing Modification; 211-Traffic Signal Removal; and 212-Pedestrian Signal New Request.

Implementation of this recommendation is anticipated to reduce overall work efforts related to the collecting, tracking, querying and reporting of Warrant Study data, and to enhance management of these requests for service.

6. **Finding – Current Traffic Signal Related Communication Efforts Should be Updated and Augmented**

The TM division web pages could be substantially enhanced. The primary web page is limited in terms of links to other important web sites; there is one link to the Transguide site and one link to information on traffic signals. The web page on traffic signals is text heavy and suffers from various grammar, spelling, and punctuation errors, and is also missing illustrations referenced in the text. In addition, no topic-related links are provided within the web page to help with navigation. Similarly, the current traffic signal brochure is also very text heavy (the web site was designed based on the brochure) and in need of graphical enhancements: it has not been updated in years.

Due to the aforementioned complexity and often misunderstood nature of Warrant Studies, as well as the use of engineering judgment, coupled with the fact that there have been recent installations of unwarranted/not recommended traffic signals, communication and outreach efforts could stand to be augmented.

A. **Short-Term Recommendation – Upgrade Traffic Management Division Web Site**

It is recommended that the TM division work with PW Department Information Systems and Graphic Design staff to update the web page to include adding additional links to other important web sites such as the Texas MUTCD, the Institute of Transportation Engineers, and other Texas cities' transportation web pages. Similarly, navigational links are needed within the web page on traffic signal information to provide for easier access to the important information already included. Furthermore, the various grammatical, spelling and reference issues need to be fixed, and the web page could be visually enhanced by adding additional graphics. Including information on other signal issues, such as left turn and pedestrian signals, would augment the site's overall content. Finally, to enhance the ability to navigate, improved integration (i.e., hyper links) with the other Transportation Group web pages is recommended. These enhancements should be coordinated with the ITSD and Communications and Public Affairs (CPA) departments when appropriate.

B. Short-Term Recommendation – Create a New More Dynamic Signal Brochure

It is recommended that the TM division work with PW Graphic Design staff to update the existing Traffic Signal brochure to include information on timings, left turn signals, pedestrian signals, etc. It is also recommended that the overall design is modernized to incorporate color and additional graphics.

Implementation of these recommendations will provide citizens, councilmembers and staff with improved access to comprehensive traffic signal information.

7. Finding – Current Program to Assess Traffic Signal Needs is Reactive in Nature

The current program to assess the need for new traffic signals is primarily reactive in nature. While the Traffic Management division does review developer-related Warrant Studies, there is no proactive work plan to assess traffic signal needs prior to receiving a request from a citizen, councilmember or staff person. Although none of the surveyed cities' processes were proactive in this sense, they do not experience the same volume of requests nor do they conduct as many studies as does COSA.

A. Long-Term Recommendation – Consider the Design and Implementation of a Proactive Program to Assess New Traffic Signal Needs throughout the City

During implementation of the efficiency recommendations included herein, develop a proactive approach to studying the need for traffic signals, to include the following:

- Establishing and outsourcing a systematic traffic volume count program to cover the entire City by quadrant (or some other geographic unit) over a period of years.
- Studying internally the need for traffic signals (or other traffic control devices) based on the outsourced traffic volume count program.
- Developing and outsourcing a program to handle requests, above and beyond the annual work plan, from citizens, councilmembers and staff.

It is strongly suggested that Recommendations 1-A, 1-B and 2-A be implemented in conjunction with this recommendation. Furthermore, implementation of this recommendation would necessitate increasing or eliminating the current SLAs for traffic signals and other traffic control devices (e.g., stop signs). In addition, it will be important to consider the business process requirements of a pro-active Warrant Study approach when evaluating potential technology changes to the TSPW and MS Access database systems as identified in Recommendation 5-A.

Implementation of this recommendation is anticipated to provide staff with the ability to better manage and balance Warrant Study work load and effort and to proactively and systematically identify new traffic signal needs, while continuing to maintain a process that allows citizens and councilmembers the ability to request Warrant Studies.

## **CONCLUSION**

The objective of this study was to identify policy and process efficiencies related to the TM division's Traffic Signal Warrant Studies to include those that might be gained by implementing industry identified best practices and/or by reducing the number of studies performed annually. To achieve the objective, various research methods were utilized including, among others, mapping COSA business processes and surveying other cities. As a result of these efforts, the list of recommendations included herein attempt to address both how and why Warrant Studies are performed. While none of the recommendations is a panacea, and no immediate remedy exists to bridge the funding gap, it is believed that implementation of these recommendations will result in a more efficient and pro-active Warrant Study process that will provide staff with mechanisms to better balance and manage work load and related efforts.