

# Sidewalk Inventory and Analysis Executive Summary Texarkana MPO



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## Introduction

The Texarkana Metropolitan Planning Organization (MPO) contracted with Data Transfer Solutions, LLC (DTS) to perform a Sidewalk Inventory and Analysis Project for all roads located within the MPO's jurisdictional boundaries. The main objective of this project was to provide the MPO with detailed inspection and condition information on the current state of the sidewalk network.

In order to achieve this objective, mobile data collection and sidewalk analysis was performed for approximately **1,036.45** centerline miles of roadway in the MPO network. This amount represents the segments that were to be evaluated during the sidewalk collection process.

This sidewalk condition survey and the resulting values can become the basis for management, maintenance, project, and budget decisions for the MPO and their member cities.

## Purpose

The primary purpose of this document is to describe the tools, processes, and procedures used to collect and analyze the sidewalk data; as well as provide a summary of the results obtained from this effort.

# 1 Project Scope

The overall project scope of work contains 3 main tasks outlined below:

- Verify MPO Street Network
- Mobile Image Data Collection
- Sidewalk Condition Index

This report will cover aspects related to the collection, analysis and reporting of sidewalk data within the MPO's network.

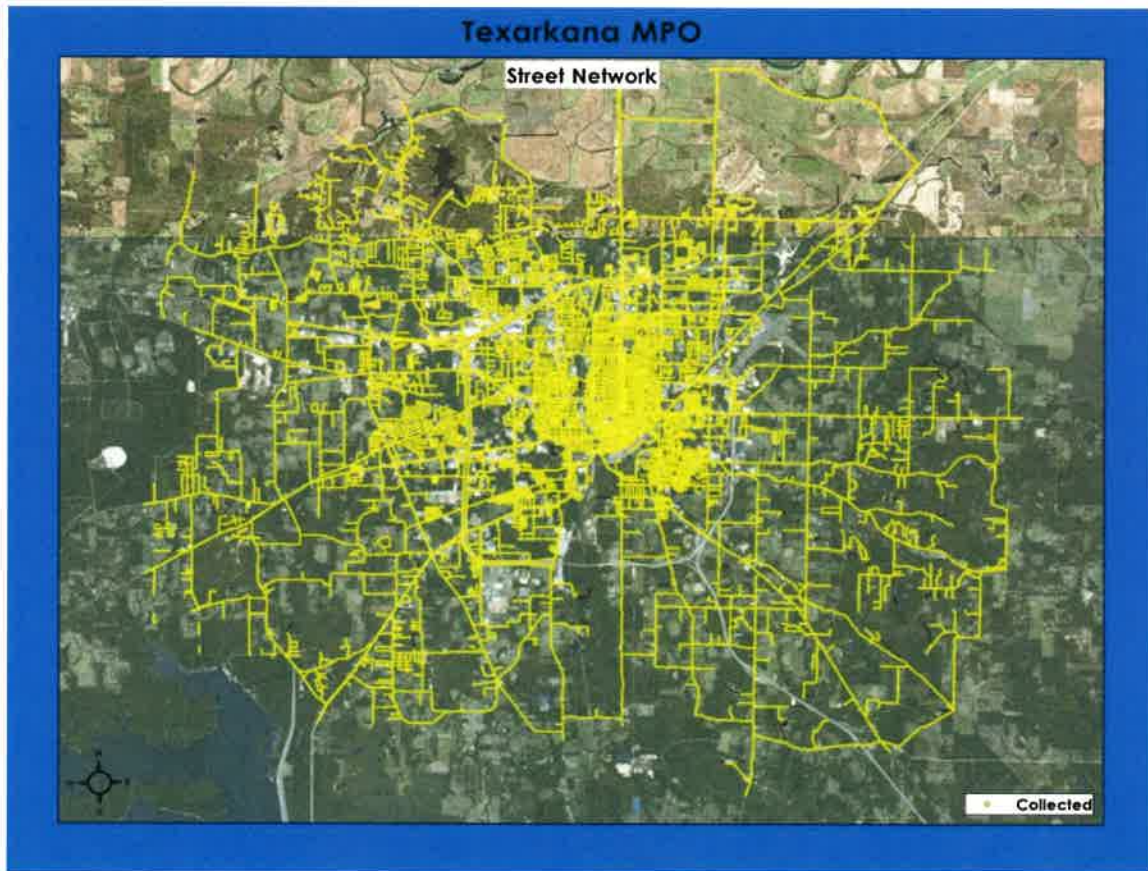


Figure 1 – Texarkana MPO Road Network

## 2 Mobile Image Data Collection

### 2.1 Automated Data Collection and Equipment

In order to determine the general characteristics of each sidewalk segment, DTS utilized our Mobile Asset Collection (MAC) vehicles to collect street-level, right-of-way imagery. DTS MAC vehicles combine multiple engineered technologies to collect real-time right-of-way data and images at posted speed limits. This effectively eliminates the need to place inspection technicians in the field in close proximity to vehicle traffic. DTS MAC vehicle components include:

#### Navigation System

- **Inertial Measurement Unit (IMU):** generates a true representation of vehicle motion in all three axes; producing continuous, accurate position and orientation information
- **POS Computer System (PCS):** enables raw GPS data from as few as one satellite to be processed directly into the system, to compute accurate positional information in areas of intermittent, or no GPS reception
- **GPS Receivers:** Embedded GPS receivers provide heading aiding to supplement the inertial data
- **GPS Antennas:** Two GPS antennas generate raw observables data
- **Sub-meter accuracy:** The system is rated to get 0.3 m accuracy in the X,Y position and 0.5 m in the Z position

#### Distance Measuring Indicator (DMI)

- Allows for collection of high resolution imagery at posted speeds. Distance Measurement Indicator computes wheel rotation information to aid vehicle positioning.

#### Cameras

- High-definition cameras with precision lenses allow for accurate asset extraction and videolog recording
- Frame rate: 15 images per second, with 1936x1456 color resolution

#### Pavement Imaging System

- Two line-scan cameras and lasers configured to image 4m transverse road sections with 1 mm resolution (4000 pixel) at speeds that can reach 100 km/h
- Allows fully illuminated pavement image collection even in heavy shadow/canopy areas



**Figure 2 – DTS MAC Vehicle**

For this project, the MAC vehicle was configured with a four-camera setup: three forward-facing cameras and one rear-facing camera. The images were captured at roughly 15-foot intervals and were post-processed using collected inertial and GPS data. This allowed for more accurate asset extraction to be completed during the asset extraction portion of this contract.



**Figure 3 – Right-of-Way Image Example**

The automated data collection efforts for the Texarkana MPO Road Network began in September of 2016 and were completed in December of 2016.

## 3 Sidewalk Condition Assessment

### 3.1 Sidewalk Inventory

DTS utilized one of its Mobile Asset Collection (MAC) vehicles to collect right-of-way imagery. The vehicles captured images at an interval of approximately 15 feet for both forward and oblique-facing directions and geo-referenced them to each road segment.



**Figure 4 – Right-of-Way Image Example**





**Figure 5 – Right-of-Way Image Example**

DTS worked with the MPO to determine the exact attributes for the sidewalk inventory and included the following attributes for sidewalks as a linear feature delivered in an ArcGIS file geodatabase:

- AssetID
- Location (Line representing sidewalk location)
- Location (Street Name asset located on)
- Photo Image Link
- Physical Condition Rating
  - Good = sidewalk is level with no uprooting or cracking
  - Fair = sidewalk has minimal uprooting or cracking
  - Poor = sidewalk has major uprooting or cracking and poses a hazard to pedestrians
- Comments
- Length
- Width
- Buffer
- Material Type



Figure 6 – Right-of-Way Image Example

### 3.2. Sidewalk Inspection Methodology

DTS' extraction team imported the digital images into the extraction and attribution software (EarthShaper™) and proceeded through each photo to identify the required assets on the photos. DTS staff used the image that offered the geographic location of the sidewalk by evaluating multiple images and selecting the camera image that offered the closest capture point. This method increases the visibility of any sidewalk feature (asset) identified for extraction, and allows for a more accurate visual assessment. This also produces the best positional (coordinate) accuracy for each sidewalk segment. DTS inventoried each sidewalk with a unique ID number, the starting and ending point, and any required intermediate points to create the linear shape of each sidewalk.

DTS utilizes its own EarthShaper software to perform feature extraction and attribution of asset data. **Since EarthShaper incorporates the use of modern GIS and database technologies, assets can be identified and mapped spatially as points, lines, or polygons. The attributes are entered at the same time. The EarthShaper software is capable of accommodating ANY asset/attribute combination through a configurable data model.** This model was set up specifically for the MPO's data models and is 100% Esri-integrated to streamline the data capture process into a GIS. The software also enables a high

level of “workflow process continuity” by “fusing” the capabilities of the external sensors and GIS and database technologies in a singular system. This allows the DTS team to fully leverage the capabilities of each component in the most efficient manner possible, and results in a high level of data quality, integrity, and consistency.

DTS has designed the EarthShaper asset data extraction software by optimizing the performance of visualization/QC of the roadway condition and inventory data. Moreover, the EarthShaper application allows for efficient data creation through the use of simple point, line, and polygon vector tools. Users can also assign condition inventory ratings to data inside of EarthShaper.

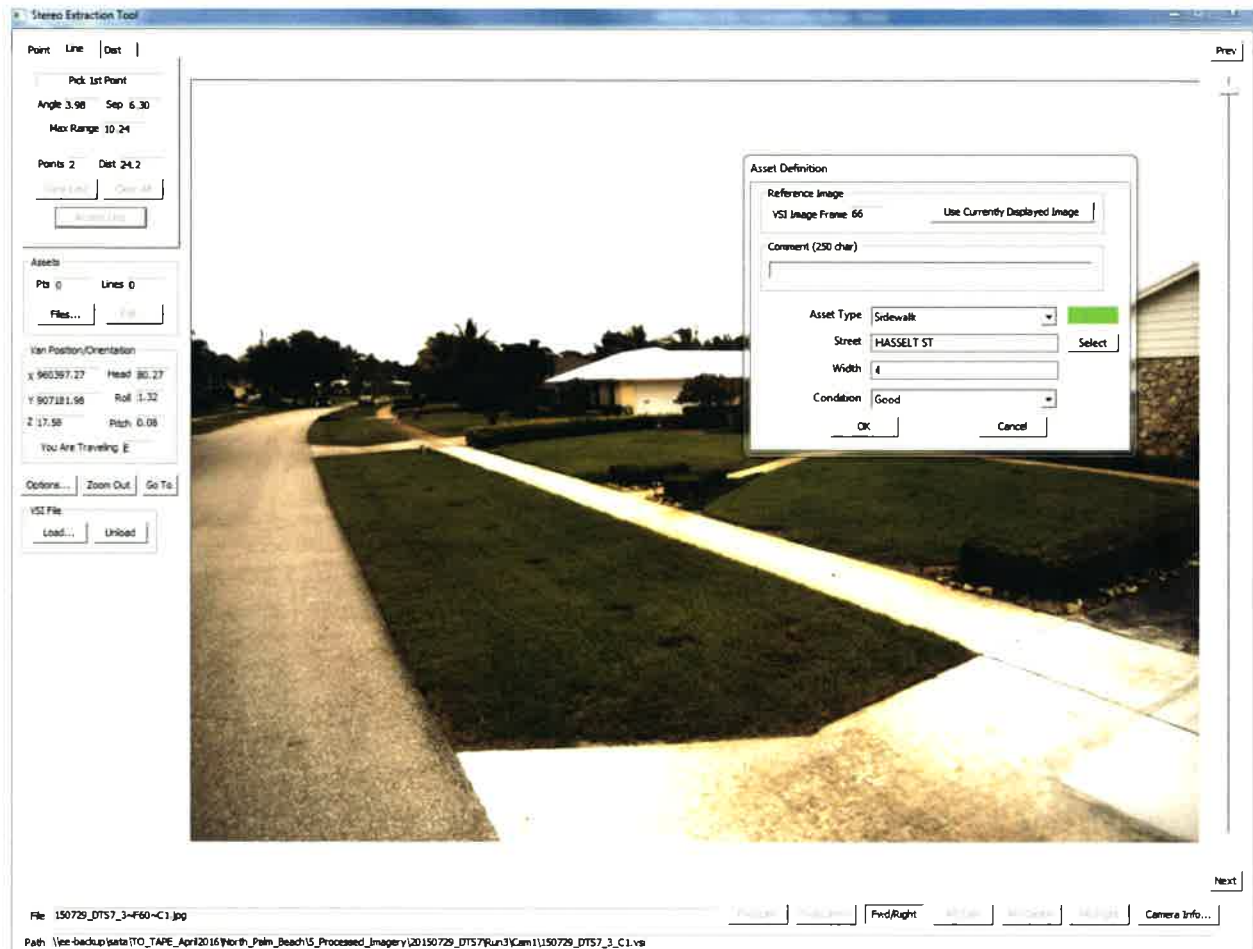
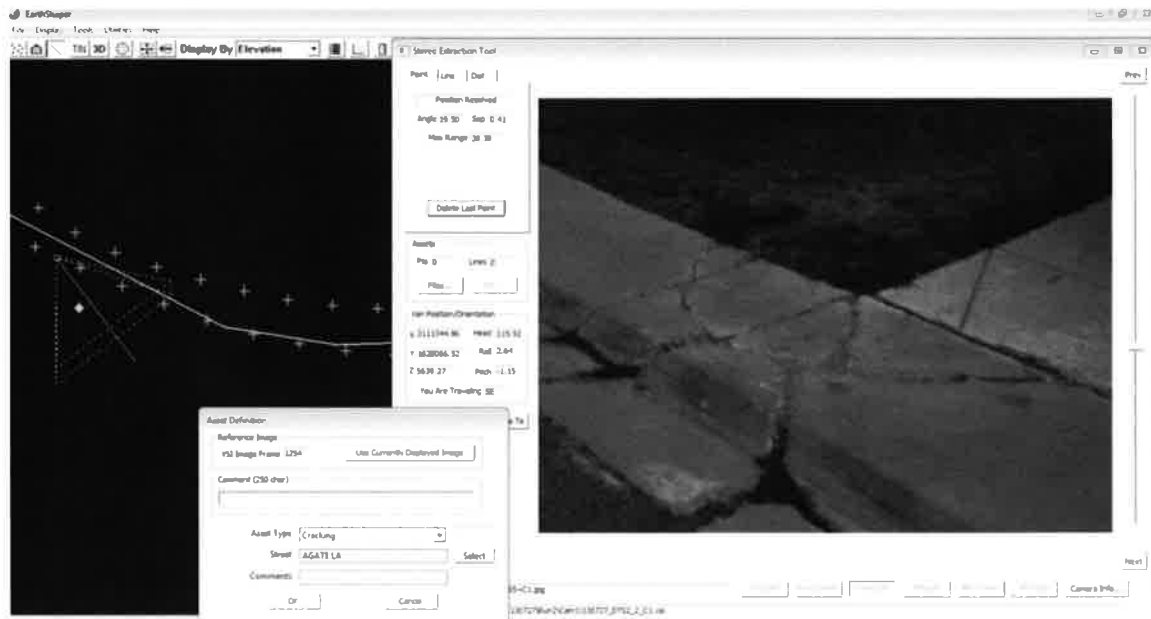


Figure 7 – Asset Extraction from ROW Imagery Utilizing EarthShaper™



**Figure 8 – Sidewalk Cracking Verified in EarthShaper™**

## 4 Indexed Sidewalk Asset Database

The attributes for all extracted sidewalk assets can be observed from the Attributes Table within the Geodatabase. A detailed breakdown for each sidewalk asset is provided below.

Number of Sidewalk Segments	2,645
Total Length of Sidewalks	121.00 mi.
Average Segment Length	241.55 ft.
Average Segment Width	4.20 ft.
Average Sidewalk Buffer	4.90 ft.

Figure 8 – Texarkana MPO Sidewalk Assets Breakdown

Condition	Count	Miles
Good	1,784	86.96
Fair	664	27.52
Poor	197	6.52

Figure 9 – Texarkana MPO Sidewalk Assets Breakdown by Condition



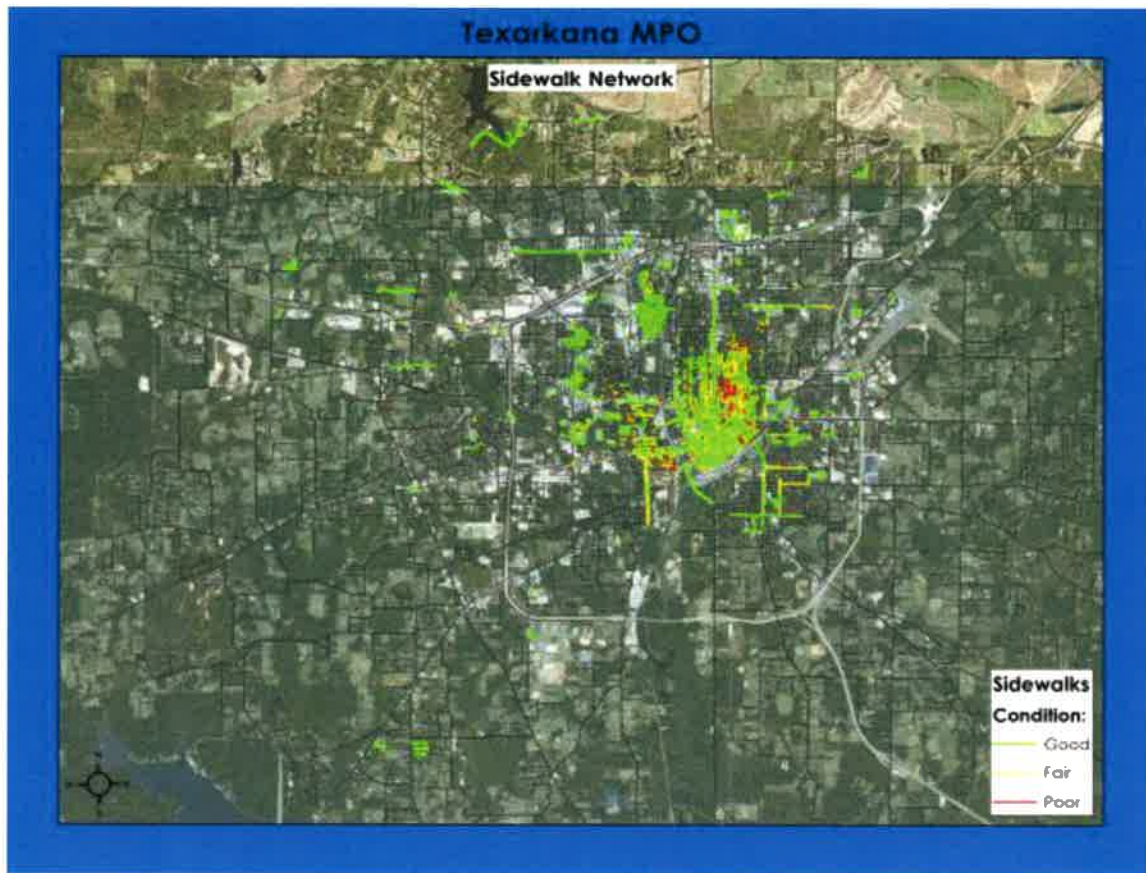


Figure 10 – Texarkana MPO Overall Sidewalk Network

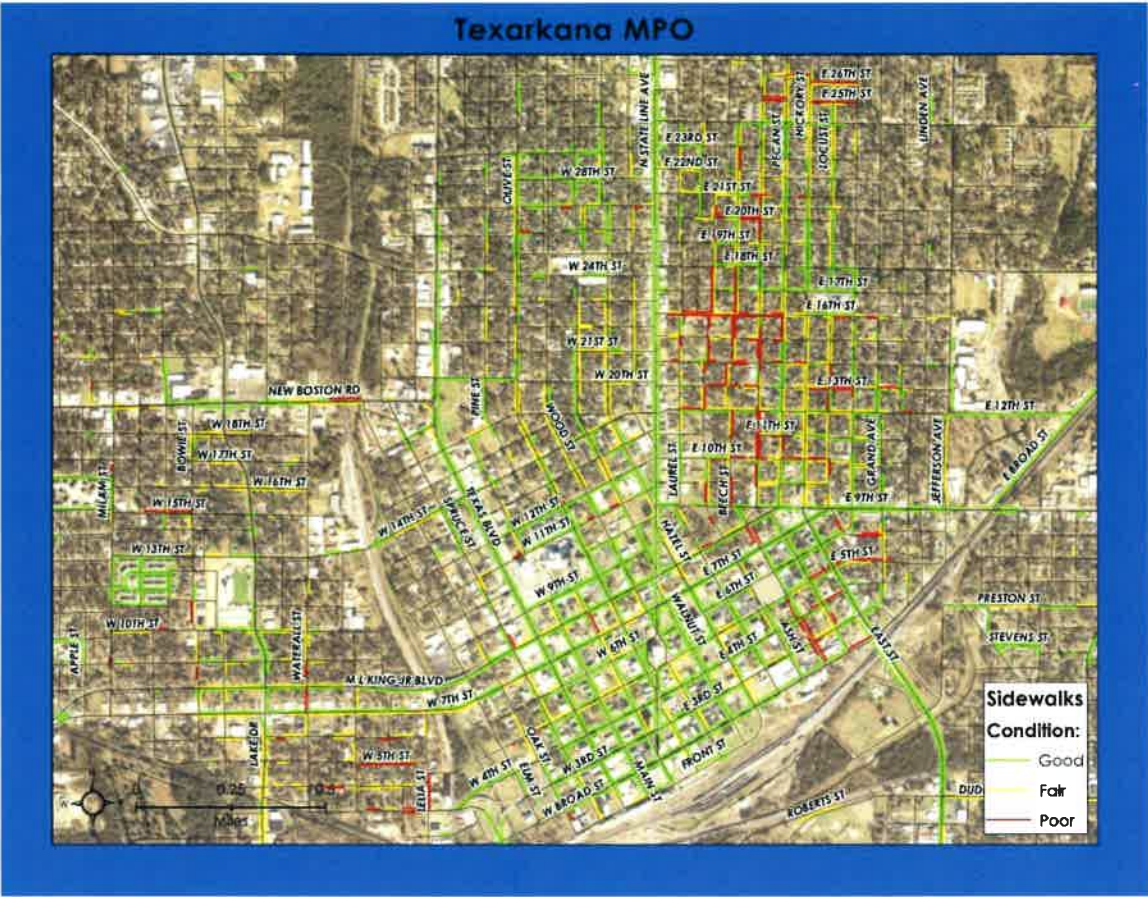


Figure 11 - Texarkana MPO Downtown Sidewalk Network



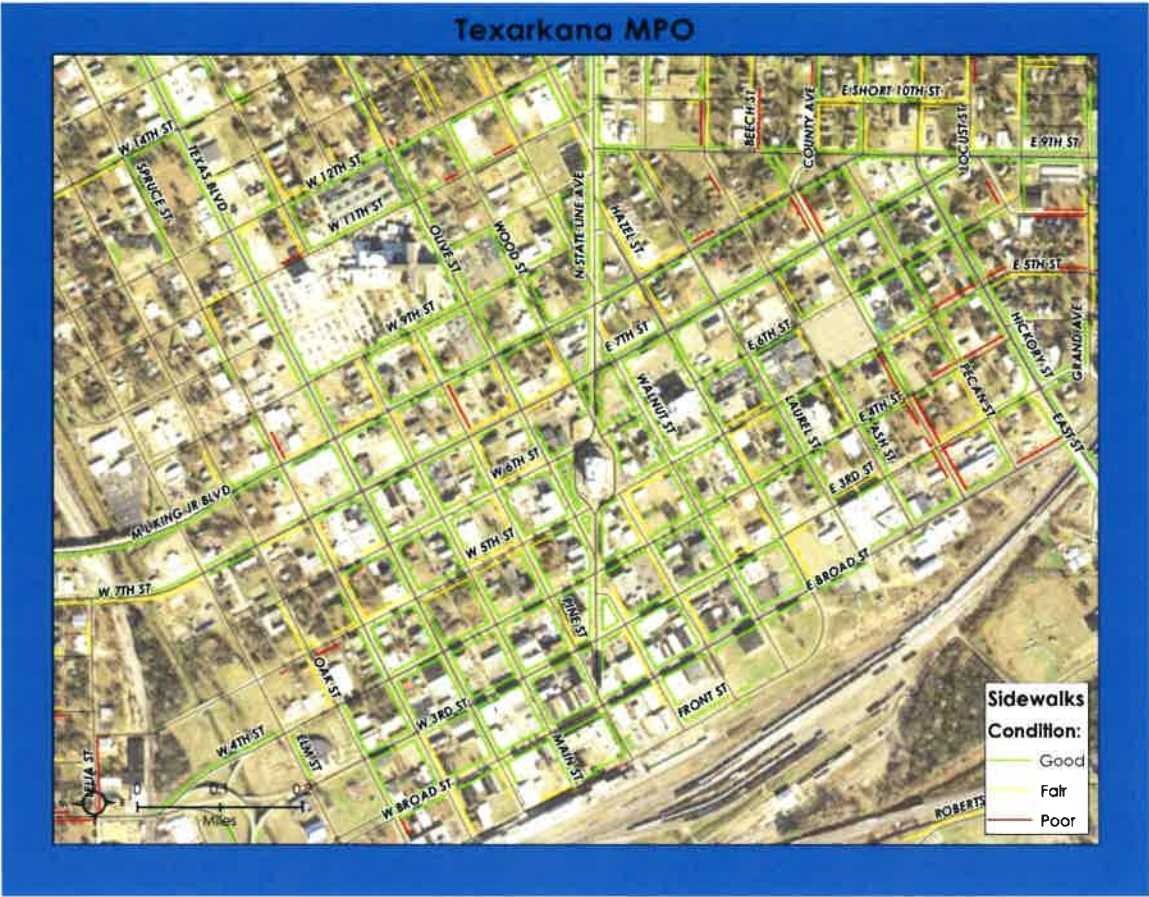


Figure 12 – Texarkana MPO South Downtown Sidewalk Network





Figure 13 – Texarkana MPO North Sidewalk Network



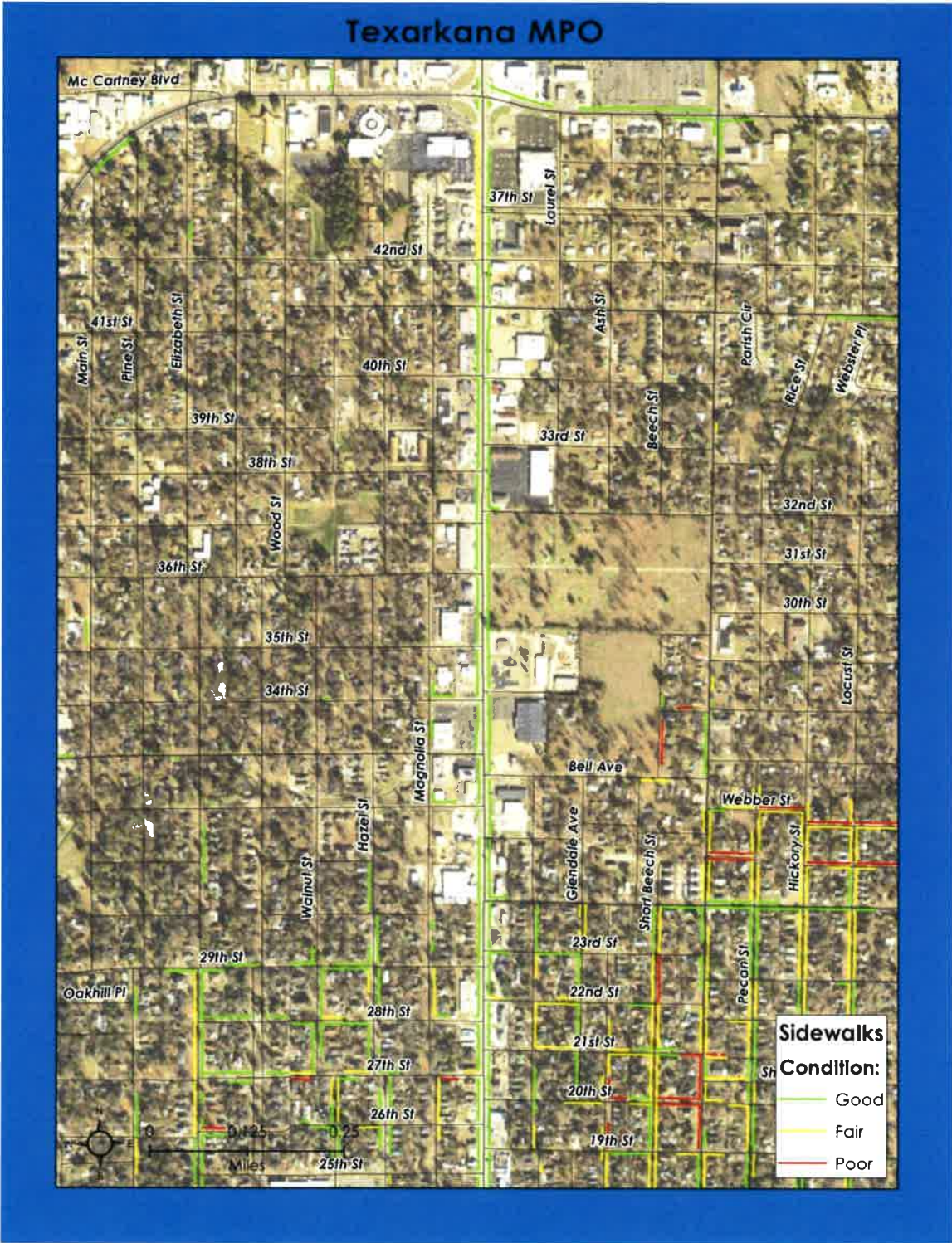


Figure 14 – Texarkana MPO North Central Sidewalk Network



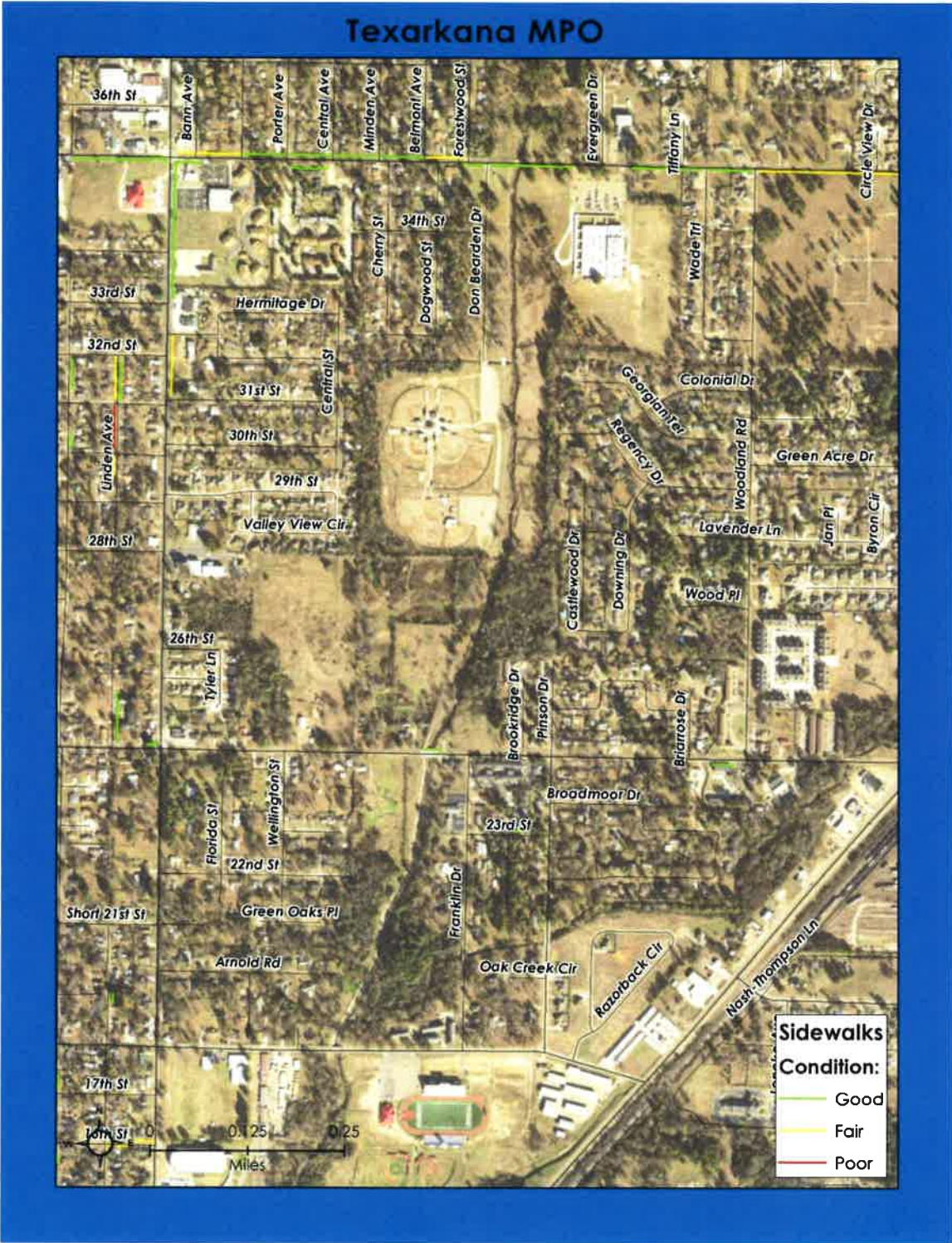


Figure 15 – Texarkana MPO Northeast Sidewalk Network





**Figure 16 – Texarkana MPO Northwest Sidewalk Network**



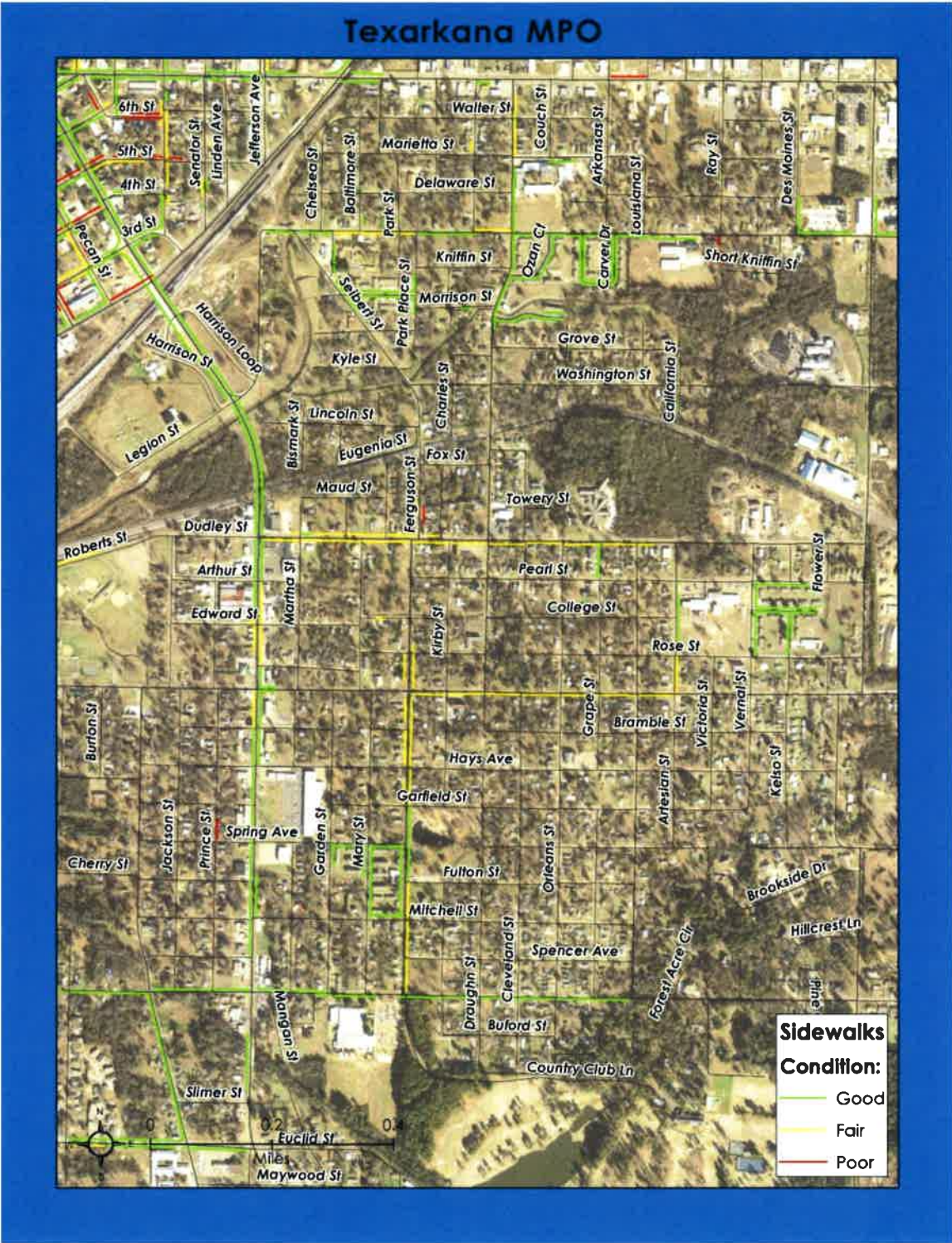


Figure 17 – Texarkana MPO Southeast Sidewalk Network





Figure 18 – Texarkana MPO Southwest Sidewalk Network



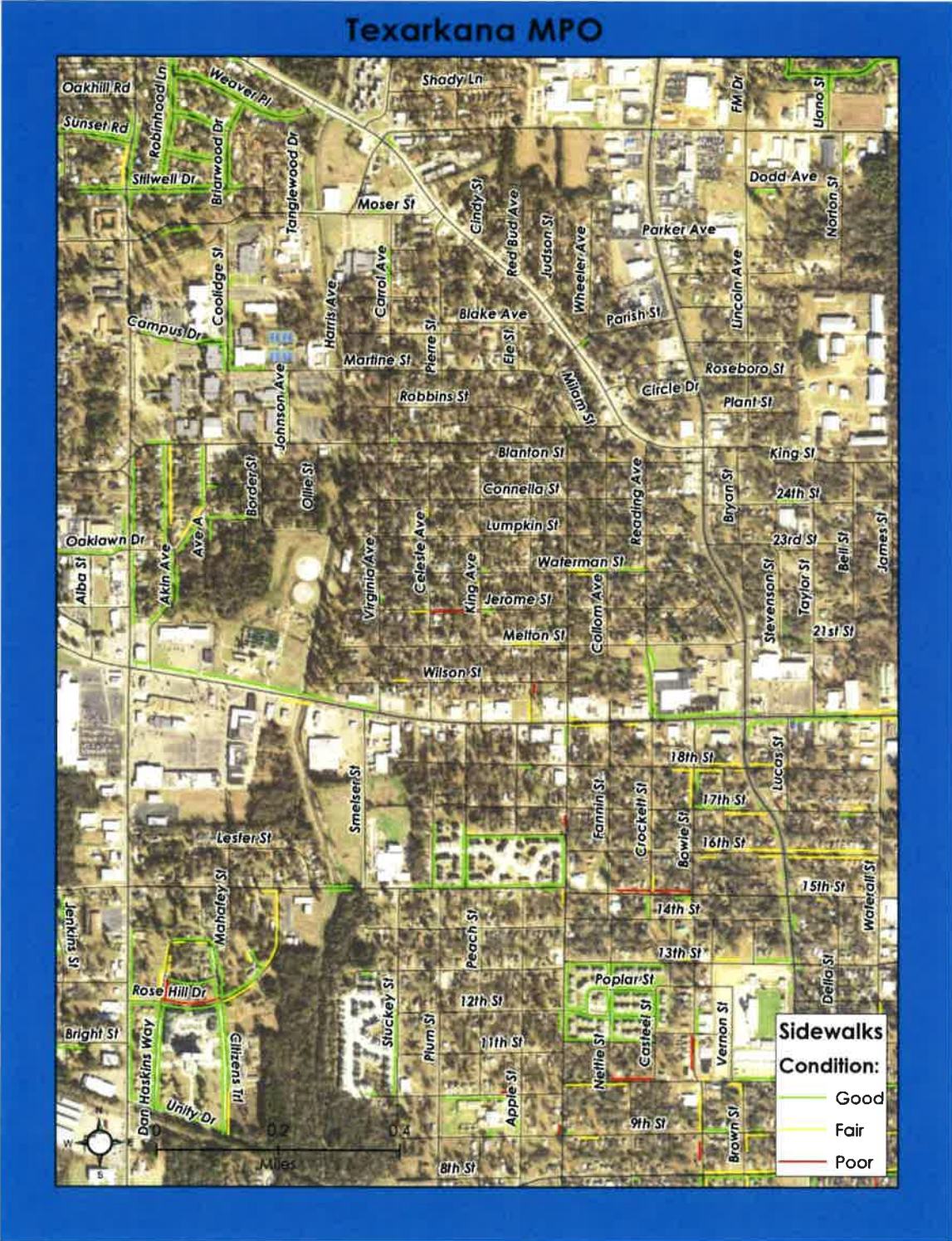


Figure 19 – Texarkana MPO West Sidewalk Network

Example imagery used during DTS' visual assessment of the various sidewalk segments' condition can be observed below:



**Figure 20 – Example Imagery of Sidewalk Condition (Good)**

The sidewalk observed in the image above is level, contains minimal to no joint seal damage, and no dividing cracks in the individual concrete slabs. Assessment places this sidewalk segment firmly within the 'GOOD' condition rating



**Figure 21 – Example Imagery of Sidewalk Condition (Fair)**

The sidewalk observed in the image above is mostly level, but contains moderate joint seal damage in the form of invasive grass growth. The individual slabs also display low severity weathering and sporadic chipping. Assessment places this sidewalk segment within the 'FAIR' condition rating.





**Figure 22 – Example Imagery of Sidewalk Condition (Poor)**

The sidewalk observed in the image above is not level, and a portion of the segment has been destroyed by extremely invasive grass growth. Individual sidewalk slabs also display severe weathering and moderate chipping. Assessment places this sidewalk segment firmly within the 'POOR' condition rating.