CITY OF OMAHA
TRAFFIC SIGNAL SYSTEM MASTER PLAN
Final Report with Executive Summary and Appendices

Adopted by City Council Resolution #1318
October 1, 2013
EXECUTIVE SUMMARY

Background

A safe, efficient, and reliable transportation system is a vital component of a healthy and successful community. In Omaha, like many other cities, the level of safety, efficiency, and reliability is closely related to the performance of its traffic signal system. Traffic signals affect the lives of most citizens on a daily basis. While the green-yellow-red operation of the signals seems simplistic, it is an output of a complex system of computers, sensors, and communications that works in harmony to:

- Allow conflicting traffic movements to alternately pass through an intersection safely
- Efficiently progress traffic through a series of traffic signals to minimize congestion
- Allow pedestrians to safely cross busy streets
- Give priority to emergency vehicles, such as police cruisers, fire engines, and ambulances

In the City of Omaha, the Traffic Engineering Division of the Public Works Department is responsible for the planning, design, operation, and maintenance of the City’s 1,000-plus traffic signal system. While the Traffic Engineering Division conducts many other important functions, the content of this master plan is solely focused on the traffic signal system, including its infrastructure, functionality, and staff.

The goal of the this project is to develop a clear and flexible traffic signal system master plan that results in the right-sized traffic signal system, providing value, improved safety, improved traffic operations, increased efficiency, and public support well into the future. This master plan can then be used to program projects, obtain funding, and upgrade the traffic signal system in a systematic and comprehensive manner over the next 10 years.

Need for Traffic Signal System Master Plan

The City of Omaha currently operates a traffic signal system that utilizes controllers and DOS-based management software that was largely developed in the 1970s and 1980s. The system communicates via dial-up modems to more than 60 closed-loop systems via on-street master controllers located throughout the City and an extensive twisted copper wire pair communications network. While functional, maintenance staff devotes an increasing amount of time to keep the communications system operational,
while parts for the system are becoming increasingly difficult to obtain. In addition, the communications system is limited in its ability to transmit the required amount of data in a timely manner, and operations staff is unable to implement new traffic signal features that could improve the safety and efficiency for motorists, bicyclists, and pedestrians. In short, the system is functionally obsolete for many of the traffic management needs of a large and growing metropolitan area.

The City of Omaha and key stakeholders including the Metropolitan Area Planning Agency (MAPA) and Nebraska Department of Roads (NDOR) have proactively been planning a major upgrade to the traffic signal system. Development of this master plan is essential in helping the City and associated stakeholders evaluate the existing traffic signal system, identify needs, analyze improvement alternatives, and develop a concept design, cost estimate, and deployment strategy in order to secure funding for full deployment of the system. The master plan addresses the following major system components:

- traffic signal system hardware and software
- communications infrastructure
- location and functionality of a traffic management center (TMC)
- field devices such as video cameras for detection and system monitoring
- traffic sensors and arterial dynamic message signs (DMS)
- data sharing among key stakeholders
- traveler information to the public
- operations and maintenance activities

In addition to the master plan document, systems engineering documentation is being developed in accordance with Federal Highway Administration (FHWA) and NDOR requirements in order to secure and utilize federal funding for deployment of the traffic signal system. A Strategic Communications Plan was also developed to assist City officials in educating and garnering support from the public and to facilitate the need for funding.

On a continuous, cyclical basis, certain physical and visible elements of the traffic signal system are being updated as parts of other projects and programs conducted by the Traffic Engineering Division. These include replacement of signal bulbs (from incandescent to more energy-efficient LED bulbs), replacement of poles and mast arms when they reach the end of their structural life, and installation of countdown pedestrian signal indications (as mandated by the federal government), to
name a few. While these visible elements of the system are important and necessary, much of what is addressed in the master plan deals with elements of the traffic signal system that are not visible to the public but are required to serve as a roadmap to the City’s next generation signal system.

**Key Recommendations**

The following list summarizes key recommendations identified in this master plan. Section 6.8 of the master plan lists all recommendations.

**Traffic Signal System Hardware and Software**

- Replace all existing controllers with Type 2070 ATC controllers.
- Convert all traffic signal cabinets to Type 332 cabinets, except where limited right-of-way exists.
- Procure advanced transportation management software (ATMS) to monitor, manage, and maintain traffic signals.
- Use the existing NDOR license for legacy ATMS software (Delcan NETworks), with the requirement that the ATMS the City procures for signal system management has the modules available in the future to also manage ITS devices. Ultimately migrate to a single ATMS software package in coordination with the selection of local controller software.

**Communications System**

- Construct a redundant, self-healing gigabit Ethernet backbone fiber optic network between eight hub locations located throughout the City.
- Deploy a high-speed, reliable, secure fiber optic cable network to most signals leveraging the existing agreement with Unite Private Networks (UPN) to minimize costs.
- Implement wireless communications to signals not located on arterial roadways.
- Establish internet protocol (IP) based communications on the new network.
Intelligent Transportation System (ITS) Devices

- Deploy approximately 200 closed-circuit television (CCTV) cameras with pan-tilt-zoom (PTZ) capabilities across the city at the intersections of arterial roadways, as well as other locations as needed.
- Consider deploying arterial DMS and trailblazer signs on certain routes for incident management, special events, congestion management, and travel time information.
- Coordinate with NDOR to integrate City cameras, DMS, and traffic data into the 511 system and other appropriate web sites for traveler information.
- Evaluate methods for disseminating traffic information to various media outlets.

- Install kiosks and other traffic-related information displays on the Farnam Street level of the Civic Center. Other locations could include high-activity areas such as public libraries, Eppley Airfield, CenturyLink Center, TD Ameritrade Park, the Old Market, and larger shopping centers.
- Continue deploying emergency vehicle preemption (EVP) systems per the procedures currently in place with various public safety agencies.
- Coordinate with Metro Transit to facilitate implementation of transit signal priority (TSP), bus rapid transit (BRT), or other transit projects.
- Explore software that integrates a future parking management system with the proposed central traffic signal management system software.

Traffic Operations and Management

- Establish traffic management capabilities at the following four facilities.

1. Traffic Engineering Offices, Civic Center 6th Floor, 1819 Farnam Street
2. Traffic Maintenance Facility, 50th and G Streets
3. NDOR District Operations Center (DOC), 108th and I Streets
4. Douglas County Emergency Operations Center (EOC), Civic Center lowest level

- Program additional staff to provide one TMC operator to monitor the traffic signal system and related devices from 6 am to 9 am and 3 pm to 6 pm, Monday through Friday, at a minimum.
- Program two to five additional traffic engineering staff and three to eight additional technicians to operate and maintain the existing and expanded traffic signal system.
• Continue to dedicate staff for evaluation of existing timing settings to ensure that they adhere to the latest Manual on Uniform Traffic Control Devices (MUTCD) guidelines, where available. Flashing schedules should also be periodically reviewed.
• Optimize traffic signal coordination plans, at a minimum, every 3 to 5 years based on traffic volume and pattern fluctuations.
• Determine the feasibility and/or benefits of installing an adaptive or responsive system on corridors with closely-spaced signals and fluctuating, unpredictable traffic volumes.
• Coordinate with NDOR to carry out the procedures identified in the traffic incident management (TIM) guidelines as well as this document during freeway incidents.
• Develop, implement, monitor, and revise timing plans as necessary to accommodate special event traffic around major traffic-generating facilities.

Maintenance

• Program additional staff positions to properly maintain the communications network and additional ITS devices deployed in the field.
• Continue to perform general traffic signal maintenance using internal maintenance staff, including fiber optic cable repairs.
• Continue to develop and implement a comprehensive and regular preventative maintenance program.
• Provide training for maintenance staff to adequately maintain the traffic signal system.

Estimated Cost

The total cost to upgrade the system, based on the recommendations outlined above, is $35 million not including design or system manager fees. This includes approximately $9.8 million for traffic signal hardware (controllers and cabinets) and software, $12.7 million for communications infrastructure, $6.5 million for ITS devices (cameras, signs, and sensors), and $0.5 million for traffic management center equipment. In addition, operations and maintenance costs are projected to increase from $1.8 million per year to $2.6 million per year at full system build out. This projection includes five additional staff positions, maintenance of new ITS devices (cameras, sensors, etc.), as well as server and other IT-related maintenance. Costs were kept to a minimum by incorporating these cost saving measures:

• Fiber optic cable agreement. A legal agreement between the City and Unite Private Networks (UPN) in 2011 will allow UPN to install fiber optic cable in City right-of-way in exchange for providing the City partial access to that fiber optic cable. UPN installations have already saved the City over $8 million. This savings will likely increase in the future as UPN installs additional fiber optic cable throughout the City.
• **Coordination with the Clean Solutions for Omaha (CSO) program.** The Traffic Engineering Division will coordinate with the CSO program to install fiber optic cable where necessary in conjunction with CSO projects. This will reduce costs associated with environmental reviews and installation of the conduit and cable itself. This process will also improve residents’ quality of life by consolidating these separate construction projects into a single project.

• **Coordination and cooperation with NDOR.** NDOR constructed the District 2 Operations Center (DOC) at 108th and I Streets in 2005. This facility is used by NDOR and Nebraska State Patrol staff to monitor and manage traffic on Omaha area freeways. The facility was constructed to accommodate a City of Omaha traffic management staff person. Access to this facility and related equipment has eliminated the need for the City to construct its own traffic management center, saving the City millions of dollars in building construction costs. The City also has access to ATMS software through NDOR at no cost, saving the City up to $1 million initially for this functionality.

• **Removal of unneeded traffic signals.** When used appropriately, traffic signals perform an important and often necessary role. Over time, however, traffic conditions change. In some cases, existing traffic signals may no longer be needed, or they can even become a safety hazard. Existing traffic signals that are no longer justified should be removed which eliminates the costs required to upgrade the signals as well as recurring costs to operate and maintain them.

**Deployment Strategy**
Recommended system upgrades are proposed to occur in 10 phases over a 10-year period. In general, the following table summarizes the geographic area and number of signals to be upgraded per phase. The figure at the end of this executive summary graphically illustrates the proposed deployment strategy.

<table>
<thead>
<tr>
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<th>No. of Signals</th>
<th>Geographic Area</th>
<th>Total Cost</th>
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<tr>
<td>1</td>
<td>121</td>
<td>Dodge, 72nd, and 84th Streets</td>
<td>$5,155,000</td>
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<tr>
<td>2</td>
<td>94</td>
<td>Southwest</td>
<td>$3,058,000</td>
</tr>
<tr>
<td>3</td>
<td>120</td>
<td>Northwest</td>
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</tr>
<tr>
<td>4</td>
<td>124</td>
<td>Southeast</td>
<td>$4,136,000</td>
</tr>
<tr>
<td>5</td>
<td>88</td>
<td>West Central</td>
<td>$2,272,000</td>
</tr>
<tr>
<td>6</td>
<td>120</td>
<td>Northeast</td>
<td>$2,923,000</td>
</tr>
<tr>
<td>7</td>
<td>149</td>
<td>Midtown</td>
<td>$4,046,000</td>
</tr>
<tr>
<td>8</td>
<td>114</td>
<td>Downtown</td>
<td>$3,247,000</td>
</tr>
<tr>
<td>9</td>
<td>89</td>
<td>Far West</td>
<td>$2,946,000</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>ITS Citywide</td>
<td>$3,954,000</td>
</tr>
<tr>
<td>Total</td>
<td>1,019</td>
<td>Citywide</td>
<td>$34,600,000</td>
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</table>
**Next Steps**

The City should move forward with deployment of the signal system which includes finalizing requirements for system software procurement and initiating design phases based on funding availability. Annual funding of $3.75 million was programmed by MAPA and City of Omaha over the next two years for the deployment of initial components of the traffic signal system; however, recent changes have modified the amount and timing of funding availability. The funding sources for both the master plan and the deployment projects are Surface Transportation Program (STP) federal funds (80%) and local funds (20%). Additional funding may be available through the Federal Highway Safety Improvement Program (HSIP), which has a match rate of 90% federal and 10% local. These funds are obtained through approval of the NDOR safety committees, and a safety evaluation of the project(s) is required. Additional funding beyond that described above will likely be required to fully implement all projects identified in the master plan.
## DOCUMENT VERSION CONTROL

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1.0 INTRODUCTION

A safe, efficient, and reliable transportation system is a vital component of a healthy and successful community. In Omaha, like many other cities, the level of safety, efficiency, and reliability is closely related to the performance of its traffic signal system. Traffic signals affect the lives of most citizens on a daily basis. While the green-yellow-red operation of the signals seems simplistic, it is an output of a complex system of computers, sensors, and communications that works in harmony to:

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- Efficiently progress traffic through a series of traffic signals to minimize congestion
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- Give priority to emergency vehicles, such as police cruisers, fire engines, and ambulances

In the City of Omaha, the Traffic Engineering Division of the Public Works Department is responsible for the planning, design, operation, and maintenance of the City’s 1,000-plus traffic signal system. While the Traffic Engineering Division conducts many other important functions, the content of this master plan is solely focused on the traffic signal system, including its infrastructure, functionality, and staff.

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The City of Omaha and key stakeholders, including the Metropolitan Area Planning Agency (MAPA) and Nebraska Department of Roads (NDOR), have proactively been planning a major upgrade to the traffic signal system. The master plan will address major system components including traffic signal system hardware and software, communications infrastructure, and location(s) and functionality of a traffic management center (TMC). It will also address intelligent transportation systems (ITS) field devices including cameras, traffic sensors, and arterial dynamic message signs (DMS), data sharing among key stakeholders, and providing key information to the traveling public. A system that is compatible with the needs of multiple jurisdictions that are responsible for traffic management in the greater Omaha area will be critical. The system will also need to be scalable and expandable to meet future system needs. **The goal of this project is to develop a clear and flexible traffic signal system master plan that results in the right-sized traffic signal system, providing value, improved safety, improved traffic operations, increased efficiency, and public support well into the future.**

Development of a successful master plan will be essential in helping the City and associated stakeholders in gaining public and political support and securing additional funding for full deployment of the traffic signal system. To that end, a Strategic Communications Plan was developed that will guide City staff in achieving this important goal. The Strategic Communications Plan is included in Appendix A to the master plan.

The remaining chapters in this master plan address the following topics:

- Systems Engineering
- Existing System Evaluation
- Needs Assessment
- Alternatives Analysis and Recommended Improvements Strategies
- Concept Design and Cost Estimate
- Deployment Strategy
2.0 SYSTEMS ENGINEERING

Systems Engineering (SE) documents were developed for four key deliverables. The Iteris team recently worked with the Federal Highway Administration (FHWA) and the Nebraska Department of Roads (NDOR) to develop template documents for the four SE documents that are intended to meet necessary documentation for projects in Nebraska. Deliverables include:

- **Project Plan** – This document provides a guide for all stakeholders that clearly define the Traffic Signal System Master Plan project scope, goals, schedule, and budget.
- **Systems Engineering Management Plan (SEMP)** – This document describes how the Systems Engineering Process will be integrated into the Traffic Signal System Master Plan and subsequent design and deployment phases.
- **Concept of Operations** - This document communicates overall qualitative system characteristics to the City and other involved stakeholders. This document will define the user needs that will drive requirements for the Traffic Signal System Master Plan.
- **High-Level Requirements and Verification Plan** – This document summarizes the system requirements and verification activities that are expected to be completed (as part of future projects). These will be used to demonstrate that the deployment meets the needs of the project stakeholders.

Supporting information for the above deliverables will include system diagrams, documentation of ITS project standards, and stakeholder assessments. The goal of the SE effort is twofold:

- Streamline necessary deliverables to meet State requirements and Federal Rule 940.11.
- Provide reference documents for planning, design, and integration of future phases.

The four systems engineering documents described above are provided as Appendices B, C, D, and E to the Traffic Signal System Master Plan.
3.0 EXISTING SYSTEM EVALUATION

One of the initial steps in developing a traffic signal system master plan for the City of Omaha was to conduct a thorough and accurate assessment of the existing system. This step is essential to:

- Understand existing operations,
- Leverage existing traffic signal, communications, and ITS systems to the extent possible,
- Identify existing system deficiencies,
- Establish a foundation for the recommendation of any potential future signal system improvements.

Signal system data was compiled from a variety of sources, including geographic information systems (GIS) databases, Traffic Maintenance Information System (TMIS) databases, and meetings and discussions with City engineering, operations, and maintenance staff. The following summarizes the various components of the existing traffic signal system.

3.1 TRAFFIC SIGNAL SYSTEM

The components that were evaluated as part of the traffic signal system include: traffic signals, controllers, cabinets, detection, closed loop systems and software, uninterruptible power supply (UPS) systems, and signal ownership and maintenance agreements.

3.1.1 TRAFFIC SIGNALS

The City of Omaha currently operates 1,019 traffic signals. The City of Omaha owns 986 of these signals, while NDOR owns 7, Douglas County owns 24, and Sarpy County agencies own 2. Table 1 summarizes the number of traffic signals by type, including full vehicle installations, pedestrian installations, flashing beacons, lane control signals, speed feedback signs, and fire station (emergency) signals.

<table>
<thead>
<tr>
<th>Type of Installation</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Signal</td>
<td>830</td>
</tr>
<tr>
<td>Pedestrian Signal</td>
<td>119</td>
</tr>
<tr>
<td>Flashing Beacon</td>
<td>40</td>
</tr>
<tr>
<td>Lane Control Signal</td>
<td>19</td>
</tr>
<tr>
<td>Speed Feedback Signs</td>
<td>7</td>
</tr>
<tr>
<td>Emergency Signal</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>1,019</td>
</tr>
</tbody>
</table>

In addition, eight signals are expected to be constructed and/or activated in the near future. Figure 1 illustrates the type and location of all traffic signals.
3.1.2 Controllers
All controllers in the field are Type 170E controllers operating on Wapiti Micro Systems local controller firmware, including W4IKS for actuated signals, W7OSM for on-street masters, and W9FT for fixed-time controllers. Ten intersections in the area around TD Ameritrade Park and the CenturyLink Center operate on 2070 controllers. The City of Omaha does own additional 2070 controllers. Figure 2 illustrates a cabinet with Type 170E local and master controllers.

![Figure 2 - Type 170E Local and Master Controllers](image)

3.1.3 Cabinets
The City of Omaha has a variety of traffic signal cabinets in the field. Table 2 summarizes the types of cabinets and the number of each used throughout the City.

<table>
<thead>
<tr>
<th>Cabinet Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 303</td>
<td>343</td>
</tr>
<tr>
<td>Type 330</td>
<td>6</td>
</tr>
<tr>
<td>Type 332</td>
<td>269</td>
</tr>
<tr>
<td>Type 336</td>
<td>273</td>
</tr>
<tr>
<td>Type 336S</td>
<td>70</td>
</tr>
<tr>
<td>NEMA</td>
<td>50</td>
</tr>
</tbody>
</table>

NEMA cabinets are only used for most, but not all, flashing beacons and lane control signals. Figure 3 illustrates typical pad-mounted and pole-mounted cabinets. As shown in the figure, existing equipment uses virtually all available space in the pole-mounted cabinets. Figure 4 on page 9 illustrates cabinet types for all traffic signals.
3.1.4 Detection
Five types of vehicle detection were identified and summarized as part of the system evaluation: 1) inductive loops, 2) optical cameras, 3) wireless magnetic, 4) microwave, and 5) thermal cameras. These types of detection generally apply to vehicle-actuated full intersection signals. Of the 830 full intersection signals in the City, 154 operate in fixed time and currently do not require any detection, but may in the future dependent upon timing needs. In addition, pedestrian crossing signals generally use pedestrian-activated push-button detection. The remaining signals may or may not have detection, depending on their specific function and actuation requirements. Some signals utilize a combination of detection types. Table 3 summarizes the number of signals (not the actual number of devices) that use the various types of detection.

<table>
<thead>
<tr>
<th>Detection Type</th>
<th>Number of Signals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inductive Loops</td>
<td>550</td>
</tr>
<tr>
<td>Optical Cameras</td>
<td>202</td>
</tr>
<tr>
<td>Wireless Magnetic</td>
<td>26</td>
</tr>
<tr>
<td>Microwave</td>
<td>2</td>
</tr>
<tr>
<td>Thermal Cameras</td>
<td>1</td>
</tr>
</tbody>
</table>
### 3.1.5 Closed-Loop Systems and Software

Currently, the City operates 72 closed loop systems, each with a master controller that communicates with the local controllers. Nine of these systems are stand-alone systems (only one signal in the system). Signals in stand-alone systems are generally located a significant distance from an adjacent closed-loop system. The remaining 63 systems have anywhere from 2 to 38 signals, with an average of 13 signals per system.

Of the 830 full intersection signals, 791 are part of a closed loop system. The remaining 40 are not part of a system and have no communications. Table 4 summarizes the number of signals in closed loop systems for each signal type. Figure 5 on page 11 illustrates the closed loop systems and master locations.

<table>
<thead>
<tr>
<th>Type of Signal</th>
<th>Number of Signals</th>
<th>Total</th>
<th>In Closed-Loop System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full</td>
<td></td>
<td>830</td>
<td>791</td>
</tr>
<tr>
<td>Pedestrian</td>
<td></td>
<td>119</td>
<td>32</td>
</tr>
<tr>
<td>Flashing Beacon</td>
<td></td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>Lane Control</td>
<td></td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Emergency</td>
<td></td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

City staff communicates and uploads/downloads data to these signals through the Wapiti Traffic View software. This software is a DOS-based application that sends and receives data via dial-up modems to the master controllers in the field. This software is used on a daily basis to set time clocks, generate communication reports (to determine if/which signals are off-line), and to download signal timing data to controllers. This software is generally used by staff in the Civic Center or at the Traffic Maintenance Facility at 50th & G Streets, but can also be accessed via a virtual private network (VPN) connection after hours.

### 3.1.6 Central Signal System Software

The City is managing 10 intersections in North Downtown with 2070 controllers with the Centracs Advanced Traffic Management System. Communications to these signals are provided wirelessly via Encom serial radios atop the Civic Center. Centracs provides significant functionality for traffic signal management and some functionality for ITS device management.

### 3.1.7 Uninterruptible Power Supply (UPS) Systems

UPS systems are deployed at 22 signals. All but one is located at intersections. The other UPS system is located at the high water flashing beacon on Saddle Creek Road at the Dodge Street underpass. In general, several of these UPS system locations have been difficult to maintain and update with continued preventative maintenance due to staff commitments, differing system requirements, and battery charging cycle schedules. Comments were noted by signal technician staff regarding some systems not being operational when needed, intermittent operations, and dead batteries at specific locations.
FIGURE 5
Existing Closed Loop Systems

Legend
- Master Controller*
- Local Controller*
  * Each color represents a unique closed-loop system.
- Standalone Master Controller
- Isolated Controller
3.1.8 **Signal Ownership and Maintenance Agreements with Other Agencies**

The City of Omaha owns, operates, and maintains all signals within the City limits. For signals located outside of the City limits but within Douglas County and a 3-mile planning jurisdiction, Douglas County owns the signal but pays the City of Omaha to operate and maintain the signals. Once any part of the land adjacent to the signal is annexed into the City, ownership of the signal transfers to the City of Omaha, and Douglas County ceases paying for maintenance. Douglas County signals are designed and constructed to the specifications of the City of Omaha, which facilitates this process. The City currently maintains 24 signals owned by Douglas County.

NDOR owns, operates, and maintains all signals located on state highways. In general, these functions transfer to the City once any part of the land adjacent to the signal is annexed by the City. Currently, there are eight signals on Highways 31, 36, and 133 that are located just outside of the existing City limits but within the 3-mile planning jurisdiction. NDOR also owns, operates, and maintains two signals on 84th Street (Highway 85) at Park Drive and Madison Street, which are located in Douglas County but on the borders of the Cities of Omaha and Ralston.

The City of Omaha also operates and maintains the signals on Harrison Street, which divide Douglas and Sarpy Counties. The City owns all of the signals, with the exception of those at 90th Street and 118th Street/Harry Andersen Avenue. The City has maintenance agreements with each respective jurisdiction in which the signal is located (Cities of Bellevue, La Vista, Ralston, Douglas and Sarpy Counties, and NDOR) to pay for maintenance costs and signal utility costs. Table 5 summarizes these agreements.

**Table 5 – Harrison Street Traffic Signal Maintenance Agreements**

<table>
<thead>
<tr>
<th>Traffic Signal</th>
<th>Maintenance</th>
<th>Utility Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>36th St</td>
<td>Bellevue and Omaha</td>
<td>Bellevue</td>
</tr>
<tr>
<td>48th St</td>
<td>Bellevue and Omaha</td>
<td>Bellevue</td>
</tr>
<tr>
<td>60th St</td>
<td>Douglas County and Omaha</td>
<td>Douglas County</td>
</tr>
<tr>
<td>66th St</td>
<td>Sarpy County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>72nd St</td>
<td>Omaha, La Vista and Ralston</td>
<td>Omaha</td>
</tr>
<tr>
<td>78th St</td>
<td>La Vista, Omaha and Ralston</td>
<td>Ralston/La Vista</td>
</tr>
<tr>
<td>83rd St</td>
<td>La Vista, Ralston and Omaha</td>
<td>Ralston/La Vista</td>
</tr>
<tr>
<td>84th St</td>
<td>La Vista, Ralston and Omaha</td>
<td>Ralston/La Vista</td>
</tr>
<tr>
<td>90th St</td>
<td>La Vista and Omaha</td>
<td>Ralston/La Vista</td>
</tr>
<tr>
<td>96th St</td>
<td>Omaha and La Vista</td>
<td>Omaha</td>
</tr>
<tr>
<td>102nd St</td>
<td>Sarpy County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>108th St</td>
<td>Sarpy County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>110th St</td>
<td>Sarpy County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>118th St</td>
<td>La Vista</td>
<td>La Vista</td>
</tr>
<tr>
<td>Giles Rd</td>
<td>Omaha and Sarpy County</td>
<td>Omaha</td>
</tr>
<tr>
<td>132nd St</td>
<td>Sarpy County and Omaha</td>
<td>Omaha</td>
</tr>
</tbody>
</table>
3.2 COMMUNICATIONS SYSTEMS

The following sections describe the existing communications infrastructure currently in use, its condition, and other communications in place that could be utilized for the traffic signal system.

3.2.1 EXISTING COMMUNICATIONS INFRASTRUCTURE

There are currently three primary types of communications media throughout the City: 1) twisted pair copper (overhead or in conduit), 2) wireless radio, and 3) fiber optic. Table 6 summarizes the total mileage for City-owned communications for each type based on inventory data provided by City staff.

<table>
<thead>
<tr>
<th>Traffic Signal</th>
<th>Maintenance</th>
<th>Utility Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>135th St</td>
<td>Sarpy County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>138th St</td>
<td>Sarpy County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>142nd St</td>
<td>Sarpy County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>144th St</td>
<td>NDOR and Omaha</td>
<td>NDOR</td>
</tr>
<tr>
<td>150th St</td>
<td>Sarpy County, Douglas County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>152nd St</td>
<td>Sarpy County, Douglas County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>156th St</td>
<td>Sarpy County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>161st St</td>
<td>Sarpy County, Douglas County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>168th St</td>
<td>Sarpy County, Douglas County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>177th St</td>
<td>Sarpy County, Douglas County and Omaha</td>
<td>Sarpy County</td>
</tr>
<tr>
<td>180th St</td>
<td>Sarpy County, Douglas County and Omaha</td>
<td>Douglas County</td>
</tr>
</tbody>
</table>

TABLE 6 – TYPES OF COMMUNICATIONS MEDIA AND AMOUNT IN USE

<table>
<thead>
<tr>
<th>Communications Media</th>
<th>Mileage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper (overhead)</td>
<td>14.4</td>
</tr>
<tr>
<td>Copper (conduit)</td>
<td>153.2</td>
</tr>
<tr>
<td>Wireless Radio</td>
<td>47.3</td>
</tr>
<tr>
<td>Fiber Optic</td>
<td>22.4</td>
</tr>
<tr>
<td>Total</td>
<td>237.3</td>
</tr>
</tbody>
</table>

In general, the twisted pair copper lines are older than the wireless or fiber installations. Furthermore, twisted pair in the eastern portions of the City is older than that in the western portions. Most of the overhead installations are found in the eastern section of the City. Almost all twisted pair copper is 6-pair, although some 12-pair does exist.

Fiber optic installations generally coincide with roadway reconstruction and/or traffic signal improvements over the last several years (e.g., North Downtown, Midtown Crossing, Aksarben Village, Harrison Street, West Center Road and Industrial Road area, 192nd Street and West Dodge Road area). The City has been installing fiber optic interconnect since 1995.

Wireless communications are utilized at several locations around the City, primarily to communicate with signals that are relatively isolated or where hardwire communications has
failed or not yet been installed. Currently, all radios are Encom brand. Figure 6 illustrates some of the existing communications pull box infrastructure.

![Figure 6 – Typical Varied Pull Boxes and Fiber Vaults](image)

### 3.2.2 Condition of Communications Infrastructure

As part of daily operations, the signal technicians at the Traffic Maintenance Facility at 50th and G Streets produce a daily communications report to determine which, if any, signals are not communicating. While all of the twisted pair copper is functional, technicians deal with recurring problems on a regular basis, primarily due to the fact that there are too many splices in the lines, or the conduit is in poor condition. Based on their qualitative knowledge of the system, the technicians developed a map that highlights sections of the communications network that is functionally obsolete. In total, technicians identified 22.2 miles of communications infrastructure (both overhead and in conduit) that is in poor condition.

Figure 7 illustrates the locations of all existing copper, wireless, and fiber installations throughout the City. Communications infrastructure identified as in poor conditions is also highlighted.