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Fargo-Moorhead Traffic Operations Center: Operational Concept

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Prepared for:
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(Metro COG)

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INTRODUCTION

This document provides an updated concept of operations for the Fargo-Moorhead Traffic Operations Center (TOC) efforts, which was originally developed by the Advanced Traffic Analysis Center (ATAC) on April 19, 2007. The information contained in this document is intended to facilitate and document discussions among TOC stakeholders to move towards the goal of establishing a F-M metropolitan TOC.

A TOC may be defined as a center for coordinating and supporting transportation system operations by bringing together various jurisdictions to focus on a common goal of optimizing the performance of the system and maximizing its safety and service to the traveling public. The TOC acts as a hub for sharing and directing information on traffic control, travel management, traveler information, and traffic incident/emergency management.

BACKGROUND

Geographically, the F-M metropolitan area consists of several jurisdictions between two states, therefore, transportation system operations involve several transportation, planning, and law enforcement agencies. Most major and minor arterials cross at least two transportation agency and jurisdictional boundaries and at least one corridor (Main Ave.) involves five transportation agencies.

The growth experienced in the F-M area has resulted in additional burdens on its transportation system. Although the system functions satisfactorily for the most part, the high demand levels during peak periods, traffic incidents, special events, and inclement weather can result in significant traffic congestion. Limitations of the current transportation system in terms of traffic operations include the following:

- Lack of coordination on inter-jurisdictional corridors
- Agencies have varying levels of resources in terms of training and number of staff dedicated to traffic operations
- Agencies have different software and hardware (field devices) that might hinder integration and information sharing (traffic data and traffic images).
- No established regional practices for traffic control and dealing with large-scale special events, incidents, or emergencies (e.g., flooding)

Although traffic operation efforts have been improving in the F-M area over the past several years, several activities over the past year have reenergized the importance of this topic. In 2007, the F-M Metro ITS Plan and F-M Regional ITS Architecture were updated, which identified several TOC components as being desired by numerous transportation agencies [*1,2*]. The traffic signal operation assessment conducted in November of 2008 by the Federal Highway Administration (FHWA) reinforced the importance of performing effective traffic operations rather than focusing on maintenance activities [*3*]. Shortly after the FHWA assessment, Metro COG formed a traffic operations working group to develop a F-M Traffic Operations Action Plan, which focuses on signal operations, system performance, incident management, and creating a traffic operations center [*4*]. A significant portion of the tasks/projects identified in the plan relate to TOC functions.

TOC FUNCTIONS

The primary goals of a TOC are related to enhancing transportation agency coordination and improving transportation system operations and safety. To accomplish these goals, several functions/activities will be performed at the F-M TOC, which will serve as the focal point for collecting, processing, and sharing operational information in the metropolitan area, including

coordination among the various jurisdictions and agencies. The following is an initial list of functions envisioned for the TOC:

1. Collect and share information among agencies about:
    a. Traffic signal data
    b. Traffic congestion (recurring and special events)
    c. Incidents (short term and long term)
    d. Road construction
    e. Real-time video monitoring
2. Implement inter-jurisdictional traffic control plans
    a. Coordinate traffic signal timing on major corridors
    b. Coordinate traffic signal timing at freeway interchanges
3. Implement traffic management strategies in response to traffic incidents
    a. Modify traffic signal timing
    b. Coordinate incident response
4. Provide information to travelers using some of these options:
    a. DMS
    b. Internet
    c. Media

STAKEHOLDER JURISDICTIONS

Although most local agencies have some level of intelligent transportation system (ITS) deployment, the North Dakota Department of Transportation (NDDOT) and the City of Fargo have deployed significant ITS devices over the past several years. Therefore, these two agencies have the greatest potential to integrate several TOC functions. However, it is important to identify all potential stakeholders when creating a TOC and include them in the early phases of the project. Initial objectives and funding may limit the level of coordination among various agencies; however, it is important to plan for future agency integration/interaction. The following jurisdictions have been initially identified for possible roles in the TOC:

1. Transportation agencies with operating and control responsibilities:
    a. NDDOT
    b. Mn/DOT
    c. City of Fargo
    d. City of Moorhead
    e. City of West Fargo
    f. Cass County Highway Department
    g. Clay County Highway Department
    h. Metro Area Transit
2. Law enforcement agencies responsible for enforcement functions:
    a. Fargo Police
    b. Moorhead Police
    c. West Fargo Police
    d. Cass County Sheriff
    e. Clay County Sheriff
    f. North Dakota Highway Patrol
    g. Minnesota State Patrol
3. Emergency management agencies for responding to incident/special events:
    a. Fargo Fire
    b. Moorhead Fire
    c. West Fargo Fire
    d. F-M Ambulance

e. Cass County Emergency Management
f. Clay County Emergency Management
g. Red River Regional Dispatch Center

4. Supporting agencies/organizations:
   a. Metro COG
   b. NDSU-UGPTI
   c. FHWA

INFRASTRUCTURE/NETWORK

Traffic operations functions/tasks are performed by using various traffic and ITS devices, such as traffic signals, vehicle detection systems, video surveillance systems, communication infrastructure, and various management software systems. Several transportation agencies in the F-M area have traffic signal systems, as well as vehicle detection and video surveillance systems (Figure 1). It should be noted that the traffic signal systems of each jurisdiction are primarily independent from neighboring jurisdictions.

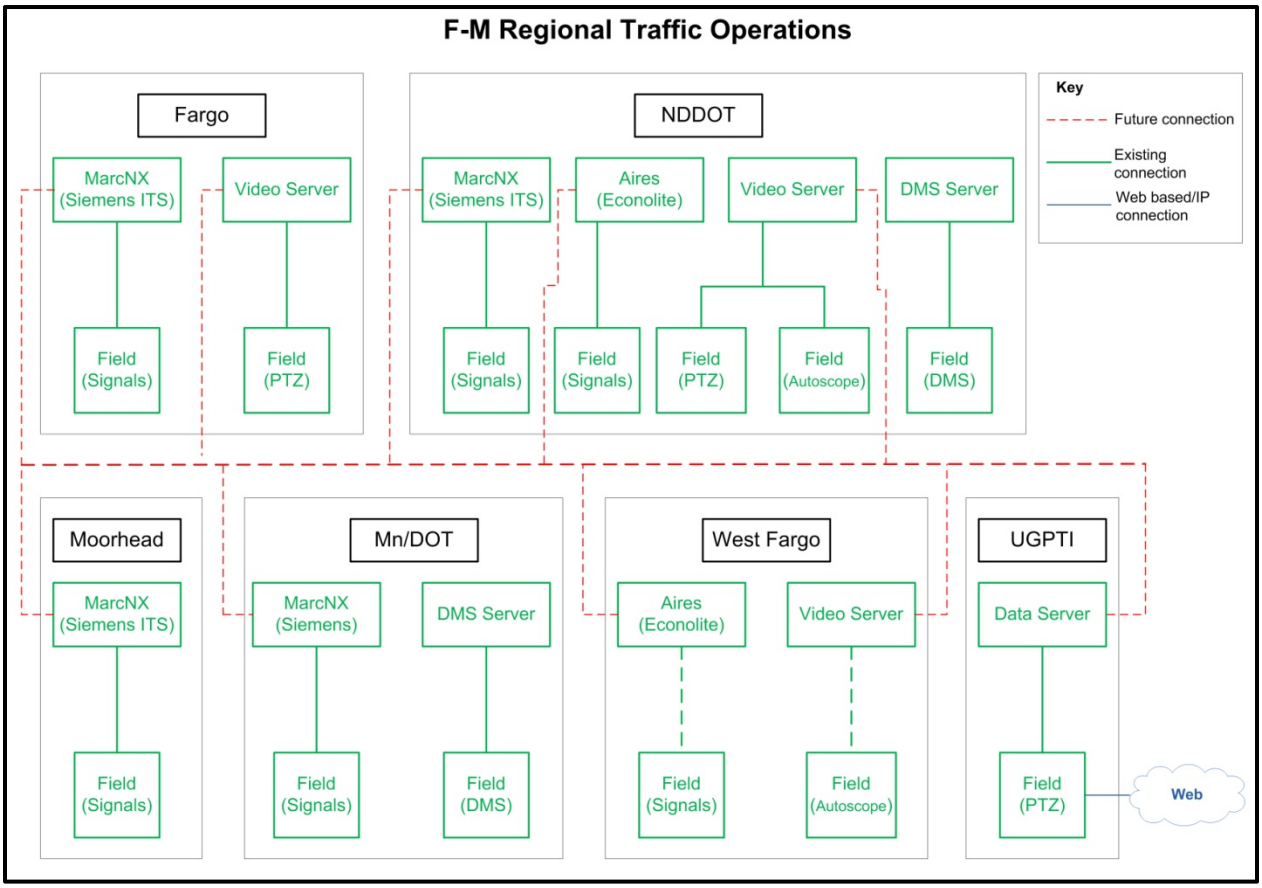

Figure 1. F-M traffic operations devices

Traffic signals comprise a majority of the traffic devices and have the largest impact in effective traffic operations. The F-M area will have approximately 233 signalized intersections by the end of the 2009 construction season (Table 1). The city of Fargo has the most traffic signals with 154 or 66% of the metro total.

Table 1. F-M Signalized Intersections

F-M Jurisdiction	Number of Traffic Signals*	Percent of F-M Metro	Traffic Signal Controller Brand
Fargo	154	66%	154 - Eagle
Mn/DOT	24	10%	9 - Eagle, 15 - Traconex
NDDOT	23	10%	19 - Eagle, 4 - Econolite
Moorhead	17	7%	16 - Eagle, 1 LMD
West Fargo	15	6%	15- Econolite
F-M Metro	233	100%	198 - Eagle, 15 - Econolite, 15 - Traconex, 1 - LMD

* Maintained by jurisdiction

Issues with system compatibility may arise with existing hardware and software. Equipment compatibility is required to interconnect the various traffic signals. Of the five jurisdictions that operate/maintain traffic signals, four traffic signal controller brands are used. However, most of the F-M arterials, which are the primary focus of signal interconnects, are equipped with Eagle traffic controllers which are managed by the MarcNX closed-loop traffic management software (Table 2). In addition, the signalized intersections along arterial roadways that use a different vendor's traffic controller could be changed to Eagle controllers ($3,000 to $5,000 each).

Table 2. F-M Traffic Signal Controllers

Traffic Controller Brand	Percent of F-M Metro
Eagle (Siemens ITS)	85%
Econolite	8%
Traconex and LMD (PEEK)	7%

To obtain an integrated transportation system, communication infrastructure and supporting devices must be installed. Communication to local and master traffic signal controllers in the field allows technicians and engineers to effectively operate, maintain, and monitor the traffic signal system. Signal coordination can be achieved since system-wide controller clock uniformity becomes possible, which currently occurs on a limited basis.

Connecting existing transportation communication systems and extending/installing new systems are critical for effective traffic operation and management. These connections allow various types of data to be shared between various field devices and agencies. The City of Fargo and NDDOT have extensive fiber-optic systems for communicating to their transportation field devices (Figure 2). At several locations, fiber-optic conduits of these two agencies cross each other. Therefore, connecting the City of Fargo and NDDOT fiber optics would allow for 177 traffic signals (76%) of the F-M signals to be interconnected. Additional connections among the remaining agencies would provide additional traffic signal integration. In addition, establishing network connections would allow almost all of the F-M traffic monitoring camera data (using pan/tilt/zoom – PTZ cameras) to be shared.

Although creating the network connections will allow traffic signal data and video monitoring data to be shared, additional management software will be required for other agencies to access the data. For example, the City of Fargo has a Pelco system (27 PTZ cameras by 2010), while the NDDOT uses a Cameleon traffic management system for accessing their devices (6 PTZ cameras by 2009).

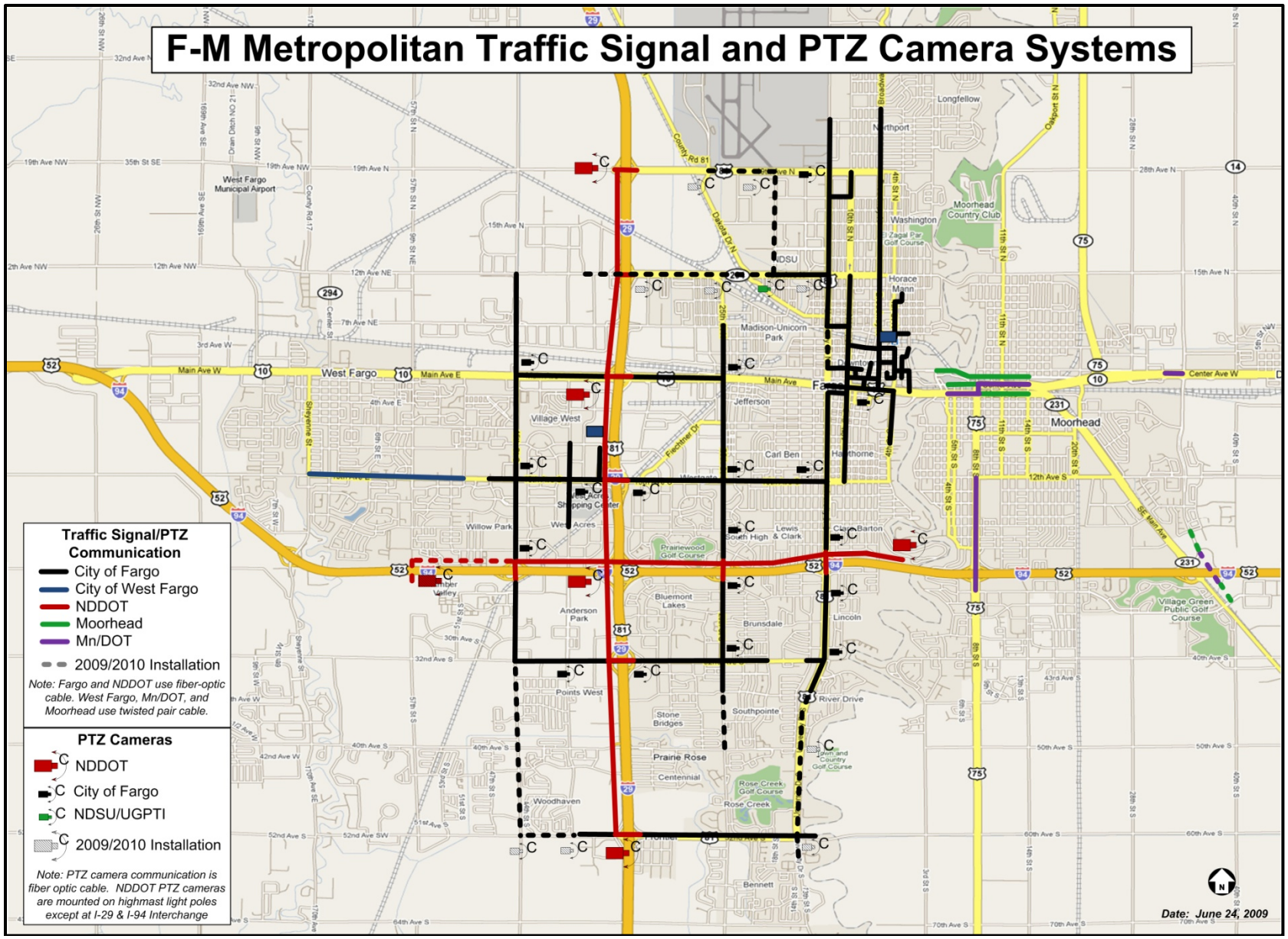

Figure 2. F-M traffic signal interconnects and PTZ camera systems

SYSTEM DESCRIPTION

Several types of TOC models are available for implementation, which are based on the regional needs and potential funding sources. A staged development approach is common and ranges from a virtual TOC, which consists of software and communication networks, to a centralized TOC, which includes a specific location for performing all transportation operations and management activities. Since the City of Fargo and NDDOT already have agency specific TOCs, a short-term TOC would consist of a hybrid TOC that would connect the existing centers together along with other agencies and devices as they became available. The hybrid TOC would not require significant resources (depending on functional requirements) and would serve the F-M area until funding for a long-term center is identified.

The long-term TOC would be classified as a centralized TOC that includes dedicated physical space for performing all transportation operations and management activities. The centralized TOC could be a portion of an existing transportation agency/entity or a standalone facility. Options discussed and documented in the F-M Metro ITS Plan included the Red River Regional Dispatch Center (RRRDC), the Metro Area Transit expansion (future), and the proposed Center of Transportation Studies Building at NDSU [*4*].

NEXT STEPS

As previously discussed, several efforts have occurred and continue to take place related to improving regional traffic operations and management. The following is a preliminary list of steps necessary to proceed with the development of the TOC:

1. Form TOC committee and identify needs and requirements for the project
2. Review existing TOCs in other states as well as best practices
3. Perform TOC ITS architecture for both hybrid and centralized TOCs
    a. Functional requirements
    b. Roles and responsibilities
    c. Agreements (MOUs, Joint powers agreements, etc.)
4. Perform TOC Concept of Operations
    a. In additional to the TOC architecture, it will include
        i. Infrastructure and support needs
        ii. Funding arrangements
5. Identify system requirements
6. Develop RFP for TOC(s)

REFERENCES

1. Fargo-Moorhead Metro ITS Plan (2008)
2. Fargo-Moorhead Regional ITS Architecture (2008)
3. Assessment of Fargo-Moorhead Traffic Signal Operations Program, FHWA-HOP-09-013, January 2009
4. Metro Traffic Operations Action Plan - Draft (2009)