Introduction

The Cedar Rapids metropolitan area has been identified as a geographic area that could benefit from the deployment of intelligent transportation systems (ITS) technology and implementation of enhanced traffic incident management procedures. To begin the process of determining what is appropriate for the metropolitan area, a Concept of Operations is being developed. The initial step in the process of developing the Concept of Operations is an assessment of the needs in the area. The needs are assessed through operational studies that have been completed for the I-380 corridor as well as a discussion with stakeholders that maintain and operate the freeway network within the Cedar Rapids area. Based on the needs assessment, goals and objectives for the metropolitan area were developed and documented.

Stakeholder Input

A stakeholder workshop was held in Cedar Rapids on March 3, 2011. The workshop was intended to solicit input from local stakeholders for incorporation into the Needs Assessment and Concept of Operations for this project as well as for a separate Iowa DOT study, by HNTB Corporation, analyzing the ITS needs for a short stretch of I-380 near the Cedar River crossing. The workshop was attended by 23 stakeholders including representatives from local public works departments, law enforcement, fire and rescue, the Iowa DOT, Federal Highway Administration, and the towing and recovery industry. See Appendix A for list of attendees at the workshop. The four hour workshop included the following:

- Introductions of each stakeholder, their agency and how they are involved in traffic incident management;
- A video presentation on typical conflicts in traffic incident management and the need for coordination, cooperation and communications in traffic incident management;
- Discussion of safety and operational problems in the Cedar Rapids region that impact the safety and efficiency of vehicular movement;
- Review and discussion of the recommendations from an earlier safety audit;
- Discussion of existing or planned ITS technologies that impact safety and mobility;
- Discussion of existing or planned traffic incident management processes/programs;
- Discussion of goals and objectives for ITS deployment in the Cedar Rapids metropolitan area.

During the workshop, the stakeholders were asked to identify problems related to mobility, safety and traffic incident management in the Cedar Rapids region. A complete list of input provided by the stakeholders is provided in Appendix B. The input was then screened by categorizing the input as identifying a problem, an opportunity or an existing situation. The resulting problems were then grouped together when they were similar enough to be summarized with an overarching problem statement. The following overarching problem...
statements were developed and are presented with the associated problems expressed by a stakeholder(s):

- The quality and quantity of information provided to the travelling public on traffic incidents or roadway conditions is insufficient.
  - Getting messages on DMS’s far enough from incident to get drivers to good alternate routes
  - Better messages on DMS’s that better inform drivers
  - Getting drivers to “believe” the message on the signs
  - Do not put too much reliance on drivers heeding messages on DMS
  - Minimizing secondary incidents by better diversion of traffic – better use of diversion tools – DMS, arrow boards, etc.
  - Use of ITS on arterial streets to provide direction to drivers to use alternate interchanges to avoid congestion

- Notification of incidents to those responsible for traffic operations and/or public safety is not timely or does not provide adequate information to quickly and appropriately respond.
  - A lack of situational awareness results in delayed and inefficient response to traffic incidents.
  - Hazmat response issues in the 5-in-1 area – getting proper equipment to deal with spills – dispatching from various areas of the town to quickly respond – cameras would be very beneficial to get a more accurate description of the location of an incident
  - Police not familiar with use of mile-marker- more intuitive to use street names
  - Need to get local 911 centers involved in incident management efforts and planning- not present at this meeting
  - How do we share camera views/resources between agencies – who has control of the camera view? How do agencies coordinate this?
  - Might be limitations with communications infrastructure to operate available technologies
  - City just put up PTZ cameras- needs coordination with Iowa DOT ITS as well as local police, EMS, others

- Barriers to clearing incidents quickly exist.
  - Improving communication with other agencies involved in an incident – “Many Hats”
o Even small incidents require a lot of resources to handle traffic control in 5-in-1 area – only use cones during major incidents
o Police light “flooding” makes directional signs hard to distinguish, especially at night
o “rubbernecking” causes bottlenecks
o Are currently not tracking overall response times for past incidents
o Lack of consistent training requirements for tow services

- Alternative routes for detouring traffic are not efficiently being utilized.
  o Development of diversion plans during incidents
  o Diversion routes are currently developed for each closure on an ad hoc basis.
  o Closing of ramps during incidents on I-380 – how do you coordinate this?
  o A lot of enforcement officers to implement a diversion route – deciding what routes, setting access points, etc.
  o North part of I-380 does not have a good diversion route
  o Shift changing of agency staff during major incidents
  o North part of I-380 does not have a good diversion route – County Home Rd not adequate to handle good diversion (unlike south parts with Hwy 13/151) – lack of a good bypass route
  o NB I-380 and Hwy 30- weaving traffic creates lane usage issues- becomes a safety and bottleneck area- merging traffic slows overall traffic flow
  o SB I-380 and Hwy 30- challenging geometry at ramp split- signing is not adequate- creates a safety issue- lane usage is not intuitive for the driver
  o More development along Hwy 30- creates safety issues with more at-grade intersections
  o Traffic lights (lack of) at Hwy 13/Hwy 151 and Mt. Vernon Rd.- creates bottlenecks- existing all way stop

**Metro Area Needs**

Three recent study efforts assessed the need for improvements along I-380 in the Cedar River area. The first study was the *Road Safety Audit for I-380 through the Cities of Cedar Rapids and Hiawatha in Linn County, Iowa*\(^1\). The second study effort was the *I-380 Corridor Feasibility Study Phase 1 - Needs Assessment*\(^2\). The *I-380 River Crossing Concept of Operations*\(^2\) was the most recent

\(^1\) McDonald, Thomas J. Road Safety Audit for I-380 through the Cities of Cedar Rapids and Hiawatha in Linn County, Iowa. Center for Transportation Research and Education Iowa State University. March 2009.
effort. Results from these studies are used to establish the need for improvements Cedar Rapids. Key results from these studies are summarized below.

**Road Safety Audit**

A road safety audit for I-380 through the cities of Cedar Rapids and Hiawatha was completed in 2009. The road safety audit was requested by the City of Cedar Rapids and the Iowa Department of Transportation based on concerns about the number of crashes and the number of serious crashes given the increasing volume of traffic in the corridor. The section of I-380 crossing the Cedar River and the horizontal curves either side of the river were of particular concern. The following issues and observations were presented in the audit:

- It was suggested that the increased traffic volume on I-380 resulted from its designation as part of the “Avenue of the Saints” and many of the new drivers are unfamiliar with the roadway.
- Law enforcement officers on the audit team noted that traffic surveillance and apprehension of violators was difficult through the S-curves.
- The horizontal curves north and south of the Cedar River are designed for 60 mph and I-380 has a posted speed limit of 55 mph.
- Safety concerns through the 5-in-1 Bridge area, notably between the 1st Avenue interchange and the 1st Street NE interchange were identified. Through this section, 139 crashes were reported from 2001 through most of 2008, including one fatal crash and four major injury crashes. The audit also reported that 21 of these crashes involved a truck and almost all of these truck-related crashes occurred on wet surface conditions, resulting in one fatality, eight injuries, and approximately $862,000 in property damages.

The audit provided the following recommendations related to traffic incident management and ITS:

- Establish an active multi-disciplinary safety team for the Cedar Rapids area.
- Add 1/10-mile markers to help with locating traffic incidents.
- The Cedar Rapids Police Department and Iowa DOT maintenance personnel should work together to develop acceptable messaging and operation of advisory notices for drivers using the existing DMS devices.
- Consider installing additional sensors in the S-curve area to monitor traffic volume and speed.
- Consider installation of an ice detection system on the 5-in-1 Bridge, with appropriate warning provided to approaching drivers using the existing dynamic message signs. The warning messaging could be automated.

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- Consider installation of additional dynamic message signs on each side of the S-curve to advise drivers of pavement surface conditions, crashes and delays.

- Study the implementation of automated enforcement in this corridor, both traffic signal and speed enforcement.

- Install surveillance cameras along the corridor.

At the joint stakeholder meeting for the I-380 River Crossing Concept of Operations and Cedar Rapids ITS Project Concept of Operations, the recommendations from the Road Safety Audit were reviewed with participants. The general consensus was that the recommendations were still valid. It was noted that an automated speed enforcement system has been implemented on I-380. Stakeholders felt that coordination between the Cedar Rapids Police Department and Iowa DOT on the use of the existing DMS’s was working well. Some concern was expressed about the added maintenance requirements that would result from the installation of 1/10-mile markers. Use of 2/10-mile markers were proposed to reduce the number of new signs that must be maintain, while still providing location information that drivers can relay to 911 dispatchers. The need for training of the 911 dispatchers to facilitate the use of the markers was also discussed.

**Feasibility Study**

As part of the feasibility study for the I-380 corridor, a needs assessment was completed. The needs assessment covered the I-380 corridor from the Johnson/Linn county line to the I-380 interchange at County Home Road. The needs assessment and recommendations were made for four sections of the corridor. One of the sections was the downtown and s-curve area. Based on stakeholder engagement, conducted as part of the feasibility study, the following three priority concerns were identified in the vicinity of the s-curve area:

- Accidents and incident management on the S-curve through downtown
- Traffic congestion along A Avenue and 8th Street during the P.M. peak
- Confusing truck access at the 7th and 8th Street ramp system

The feasibility study also identified perceived problems along the corridor, particularly the I-380/US 30 interchange as an area of concern due to confusing geometry of ramps, short weave area(s), and driver expectations.

The northern portion of the I-380 corridor was identified as an area of concern due to the heavy volume of traffic from the 42nd Street interchange north to Boyson Road. Roadway geometry issues at the Highway 100/Collins Road interchange contributed to decreased level of service.

The feasibility study needs assessment found that the City of Cedar Rapids, Iowa State Patrol and Cedar Rapids Police, have installed automated speed enforcement in this area.
Observations by stakeholders at the stakeholder workshop suggest that the automated speed enforcement has reduced speeds of locals through the S-curves.

I-380 River Crossing Concept of Operations

A Concept of Operations document for a deployment of ITS devices along the I-380 corridor along and immediately adjacent to the I-380 5-in-1 Cedar River crossing structure was completed in mid-2011. Completed by HNTB Corporation, the effort included the development of a Needs Assessment document as well as the Concept of Operations. This effort included meetings with local stakeholders to develop the Needs Assessment for the river crossing area as well as gathering information about the needs of the metropolitan area as a whole. HNTB developed recommendations for improvements to the area immediately adjacent to the 5-in-1 structure as well as suggestions for longer term implementation.

The document made specific recommendations for ITS devices in the area immediately surrounding the 5-in-1 structure. The document also developed a list of potential ITS solutions to be considered as part of the larger Cedar Rapids ITS project.

Existing Technology

Dynamic Message Signs (DMS)

Dynamic message signs have been installed along northbound I-380 at two locations, south of the U.S. 30 interchange and just North of 15th Avenue SW. Southbound on I-380 there are also two dynamic message signs. One is located at the Boyson Road interchange and the second is located at 29th Street NE. The Cedar Rapids Police Department works with the Iowa DOT to post messages. In the Road Safety Audit it was noted that the Cedar Rapids Police Department and Iowa DOT have a good working relationship that allows for the dynamic message signs to be used when needed. At the stakeholder meeting this was reaffirmed. The Cedar Rapids Police Department can post messages on the signs following a usage policy agreed to by both agencies. It was suggested that the two agencies should work together to assess whether or not the messages and usage policy for the signs could be enhanced to provide more descriptive messages and allow the signs to be used more frequently.

Pan-Tilt-Zoom (PTZ) Cameras

The Iowa DOT has installed three (3) PTZ cameras within the Cedar Rapids area as part of an earlier ITS deployment in the Iowa City area. The cameras are located at I-380 interchange with Wright Brothers Blvd., I-380 at 6th Street SW, and I-380 interchange with US 30. The Iowa DOT Statewide Operations Support Center (SOSC) and local DOT maintenance staff can view and control these cameras with software provided by the DOT. Other local stakeholders will be provided access by the Iowa DOT upon request and execution of a formal agreement.

Road Weather Information System (RWIS)
The RWIS network of sensors is designed to provide Iowa DOT Maintenance employees the specific weather information they need about the roadway. The RWIS sites collect data on air temperature, dew point, relative humidity, precipitation type, precipitation intensity, wind speed, wind direction and four surface sensors. The sensors report pavement temperature, surface condition, salinity and winter chemical information. There are currently three RWIS installations in the Cedar Rapids area; one on US 30 west of the I-380/US 30 interchange, one on US 30 over the Cedar River, and one just off the west end of the I-380 Cedar River bridge.

Automated Speed Enforcement

In 2010 the City of Cedar Rapids implemented automated speed enforcement on I-380 in the vicinity of the s-curve area. The automated speed enforcement sites are located on northbound I-380 at Diagonal Drive SW and H Avenue NE. On southbound I-380 the sites are at J Avenue NE and 1st Avenue SW.

Other ITS Technologies

At the stakeholder workshop attendees were asked what other technologies, systems or practices were currently used or planned. The following enhancements were mentioned as being underway or planned:

- The City of Cedar Rapids is upgrading their signal system fiber optic network. They are extending the fiber optic system to additional signals.
- Within 3 years all the Public Safety Answering Points (PSAPs) will have 10MB network connections.
- The City of Cedar Rapids is using more in-pavement wireless detection. They are considering using it to provided travel time information for an ATIS.

Goals and Objectives

The goal of the Iowa DOT’s ITS Program is to provide systems that improve safety and mitigate traffic impacts resulting from daily traffic congestion and current and future construction projects in various locations throughout the state.

In an effort to meet this goal there are two primary objectives. They are:

Objective No.1:

Communicate accurate and timely traffic information to the public.

It is planned that information will be communicated to the traveling public via the following methods:
• Through the Internet using the Iowa DOT’s 511 Travel Information Service web site (www.511ia.org)
• By landline and cellular telephone by dialing 511;
• By use of overhead and side-mounted DMS signs to deploy specific information related to traffic incidents and situations;
• Through the automated broadcast of selected messages by Highway Advisory Radio (HAR); and
• From traffic information broadcast by local media outlets having access to camera video and the public web site.

Objective No. 2:
Provide traffic and incident management tools to authorized users.

The traffic and incident management needs shall be addressed by:

• Use of dynamic, color-coded traffic flow maps (from traffic sensor information) to monitor traffic flow in a graphical representation;
• Using traffic sensor data algorithms to program “alarms” for traffic situations (e.g., accidents, congestion) for authorized personnel;
• Providing authorized personnel the capabilities to view and control PTZ camera video to monitor traffic flow, confirm traffic incidents, and to assess needs and determine appropriate response plans;
• Semi-automatically deploying specific message sets to overhead and side-mount DMS signs, simultaneously, based on traffic needs and predetermined response plans;
• Messages broadcast on AM HAR transmitters;
• Providing communications capabilities (e.g., instant messaging) between authorized traffic management and emergency response personnel located at various sites in the metro area; and
• Automated transfer of major traffic incident data from local law enforcement CAD systems to disseminate incident information to the public and others in a timely manner.

These goals and objectives provide a general vision for what a proposed system must achieve. Since these goals and objectives were developed based on input from multiple stakeholders, they are comprehensive and take into consideration many viewpoints.
# Appendix A - Stakeholder Workshop Attendee List

<table>
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Appendix B - Stakeholder Workshop Comments

Stakeholders were asked to identify issues that they see related to safety, traffic operations and traffic incident management along I-380 in the vicinity of the Cedar River crossing and regionally. The following issues were mentioned:

- Risk County for Radiological – Traffic control, access during major evacuation events – Manual being developed – County will be doing “time studies”
- Traffic “blending” for entering and exiting vehicles at interchange ramps – difficult weaving due to slower traffic speeds – outside lane is a “comfort” lane for many drivers
- Traffic lights (lack of) at Hwy 13/Hwy 151 and Mt. Vernon Rd. – creates bottlenecks – existing all-way stop
- Look at why yield signs are/are not installed at ramp merge points
- 5 in 1 interchanges – NASCAR like driving conditions
- Operation of DMS signs – effective?? – during construction and other incident events
- Development of diversion plans during incidents
- Closing of ramps during incidents on I-380 – how do you coordinate this?
- Getting messages on DMS’s far enough from incident to get drivers to good alternate routes
- Improving communication with other agencies involved in an incident – “Many hats”
- Minimizing secondary incidents by better diversion of traffic – better use of diversion tools – DMS, arrow boards, etc.
- Maintaining good access to/from I-380 with addition of new developments in downtown
- Use of ITS on arterial streets to provide direction to drivers to use alternate interchanges to avoid congestion
- City just put up PTZ cameras – needs coordination with Iowa DOT ITS as well as local police, EMS, others
- Related to Speed Cameras – variable speeds of traffic (local drivers slow down, but other “out of area” drivers go faster and creates more weaving of traffic)
- Speed cameras are still needed - many local drivers speeding through I-380 corridor (and specifically 5 in 1)
- Need to get local 911 centers involved in incident management efforts and planning – not present at this meeting
- Funding!!!!
• North part of I-380 does not have a good diversion route – County Home Rd not adequate to handle good diversion (unlike south parts with Hwy 13/151) – lack of a good bypass route
• New Tower Terrace interchange would aid in the evacuation plans – additional access
• NB I-380 and Hwy 30 – weaving traffic creates lane usage issues – becomes a safety and bottleneck area – merging traffic slows overall traffic flow
• SB I-380 and Hwy 30 – challenging geometry at ramp split – signing is not adequate – creates a safety issue – lane usage is not intuitive for the driver
• Aging driver population – challenge to adequately sign routes
• Hazmat response issues in 5 in 1 area – getting proper equipment to deal with spills – dispatching from various areas of the town to quickly respond – cameras would be very beneficial to get a better/more accurate description of location of incident
• Police not familiar with use of mile-marker – more intuitive to use street names
• City building new fire station near 6th/7th/8th interchange – looking at use of more advanced traffic signal preemption system
• Cedar Rapids has a consolidated dispatching system
• Working on joint communication system with law enforcement agencies
• Do not have signal pre-emption for emergency/fire
• Even small incidents require a lot of resources to handle traffic control in 5 in 1 area – only use cones during major incidents
• Do not put too much reliance on drivers heeding messages on DMS
• Better messages on DMS’s that better inform drivers
• Getting drivers to “believe” the message on the signs
• Median-side incidents are hard to work on – especially from a towing perspective – use “truck stacking” to create a safe work area
• Tow bans put in place for safety issues – how can we work around this or alter to allow tow trucks to work in the area and get the incident cleared safely
• Police light “flooding” impact both directions of travel, especially at night
• Lack of adequate training requirements for tow services
• A lot of enforcement officers to implement a diversion route – deciding what routes, setting access points, etc.
• DOT has developed a draft set of diversion route plans – working to distribute for review and comment
• Shift changing of agency staff during major incidents
- Currently using total stations to investigate fatality related crashes more efficiently
- Are currently not tracking overall response times for past incidents
- Weather conditions create problems in 5 in 1 – fog is an infrequent issue
- Most of the time have good warning of need for ice treatment on 5 in 1
- S-Curves to be friction treated in 2011
- More development along Hwy 30 – creates safety issues with more at-grade intersections
- Towing during rush hour – not a good idea – regardless of weather
- “rubbernecking” causes bottlenecks
- Abandoned trucks are left at the incident location until a time it can be done safely with the right resources
- How do we share camera views/resources between agencies – who has control of the camera view? How do agencies coordinate this?
- Might be limitations with communications infrastructure to operate available technologies