
NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL
CASE STUDY REPORT

NTCIP 9008 v01.06

Minnesota DOT Statewide R/WIS Project

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PREFACE

When early adopters began using the NTCIP in their deployment activities, there was limited guidance available. Since then, *The NTCIP Guide* (NTCIP 9001) has been developed to help users understand, specify, and deploy the family of standards. NTCIP 9001 version 03 was completed in 2002 and is available.

Early NTCIP deployments and the initial NTCIP case studies identified issues due to content ambiguities and shortfalls in the first version of several standards. Subsequent amendments addressed many of these issues.

Case study reports revealed that functional requirements within user specifications could be improved. As a result, a systems engineering approach to standards development has been adopted to help users better specify NTCIP-based systems. New versions of ITS standards will add sections on concepts of operation, functional requirements, traceability to the data dictionary, and dialogs and sequences.

Early adopters also revealed that testing was an issue in many of their deployments. An NTCIP working group on testing and conformity assessment was created in 2002 to further assess and define testing issues.

The case studies also revealed a general need for continued outreach, education, and training. These needs are being addressed through a variety of ongoing Standards Development Organization activities.

These NTCIP case studies have proved valuable to the ITS community and have facilitated the continued improvement of the standards. As a result of lessons learned from the case studies and improvements in the standards development process, future deployments are expected to face fewer challenges.

1. PURPOSE OF THE CASE STUDY

1-1 INTRODUCTION

Field deployment of NTCIP-conforming equipment has begun. State and local Departments of Transportation and their consultants are aware of the interoperability and interchangeability features promised by the NTCIP, and are including references to the NTCIP in their procurement documents. For all but a few, this is their first experience with the NTCIP.

The purpose of this project, sponsored by AASHTO, FHWA, ITE, and NEMA, is to:

- a. Prepare a second series of case studies that describe the lessons-learned by vendors, agencies, and consultants during another five of the early projects that required NTCIP compliance, and
- b. Update the existing three Case Study projects.

The objective is to compile an unbiased investigation that incorporates the perspectives from different implementation positions.

Two Environmental Sensor Systems (ESS)¹ projects, one Center-to-Center Project using NTCIP 2304 (DATEX-ASN), and two traffic signal control projects were selected for Phase 2 of the study. The two Variable Message Sign (VMS) projects and the one signal control project investigated during Phase 1 are to be revisited to update the status of these projects. Additional projects may be investigated in FY 2003.

The material for these eight case studies (5 new ones and 3 updates) were drawn from interviews with individuals who were directly involved in the NTCIP implementation and from project-related documents such as specifications, test plans, and procurement documents. An attempt was made to interview at least three individuals that performed different roles in each project, such as agency champion, procurement specification writer, agency field technician, and vendor representative. The interviews, conducted by individuals familiar with the NTCIP, were structured around an updated survey prepared for these case study investigations. Whenever possible, relevant project documents for each project are included in that case study report.

This document focuses on one of the ESS implementations using the NTCIP, but it does not attempt to explain the details of the NTCIP. Additional information on the NTCIP, including specific NTCIP standards, is available on the NTCIP Website (www.ntcip.org)².

2. THE CASE STUDY

This report presents a case study of an Environmental Sensor System (ESS) implementation by the Minnesota Department of Transportation (MnDOT). Other project participants include: Surface Sensor Inc. (SSI), the Vendor.

Seventy-six (76) ESS using the NTCIP standards were to be installed and placed into operation. The ESS were spaced on an approximate 60-kilometer grid throughout the State of Minnesota. Additionally, the following work items and services were to be provided:

¹ Environmental Sensor Stations are considered a device subgroup addressed within the NTCIP Standard NTCIP 1204. The term ESS is used to address road weather information systems. ESS were previously termed RWIS.

² The 'NTCIP Guide' and the White Paper "Understanding the NTCIP Class Profiles from an End User's Perspective" are excellent sources of information.

- Incorporate the existing 17 road/weather ESS into the new RWIS network;
- Incorporate the existing 50 Automated Weather Observation Systems (AWOS) stations operated by the State Office of Aeronautics into the new RWIS network;
- Incorporate the existing Automated Surface Observing System (ASOS) systems operated by the Federal Aviation Administration into the new RWIS network;
- Incorporate the existing 10 agricultural weather system (CR 10) stations into the new RWIS network;
- Provide roadside equipment, communications systems, an RWIS database integration center, information delivery systems, and other elements that are required for the successful use, operation, and maintenance of the state of Minnesota's RWIS project;
- Incorporate road condition and weather information from all appropriate sources including other states and Canadian provinces, and share it with identified users, and interface with other related programs and systems;
- Provide real-time road and weather data to State Maintenance Area Supervisors; and
- Develop and conduct a successful training program for State staff, and other selected persons, in the operation, support, and maintenance of the integrated system.

The communication with several existing devices was accommodated by connecting the ESS Central System to the central system server of these existing systems. Those connections were dial-up, direct Ethernet, and/or Internet connections. The data from those systems was transmitted using proprietary formats within File Transfer Protocol (FTP) files for which the Vendor wrote 'data translators.' Since these connections and data transmissions were not NTCIP, we have not considered these links further within this report. However, two system diagrams of the overall system are provided in Figure 1 (highlighting the NTCIP links that are the subject of this report) and Figure 2.

Figure 1: MnDOT Statewide R/WIS Project – System Diagram

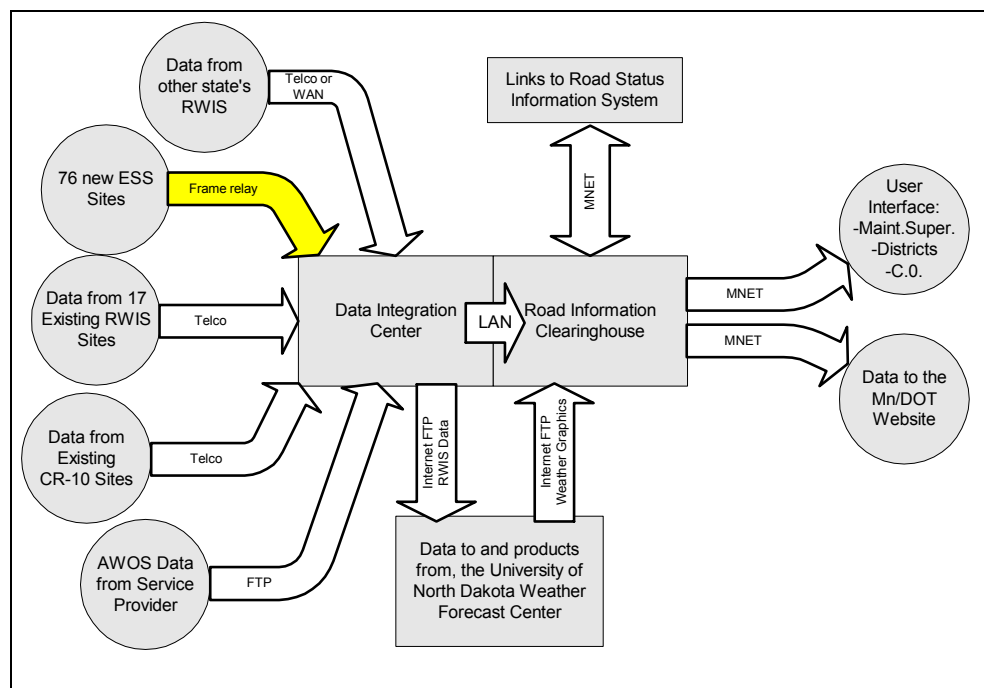
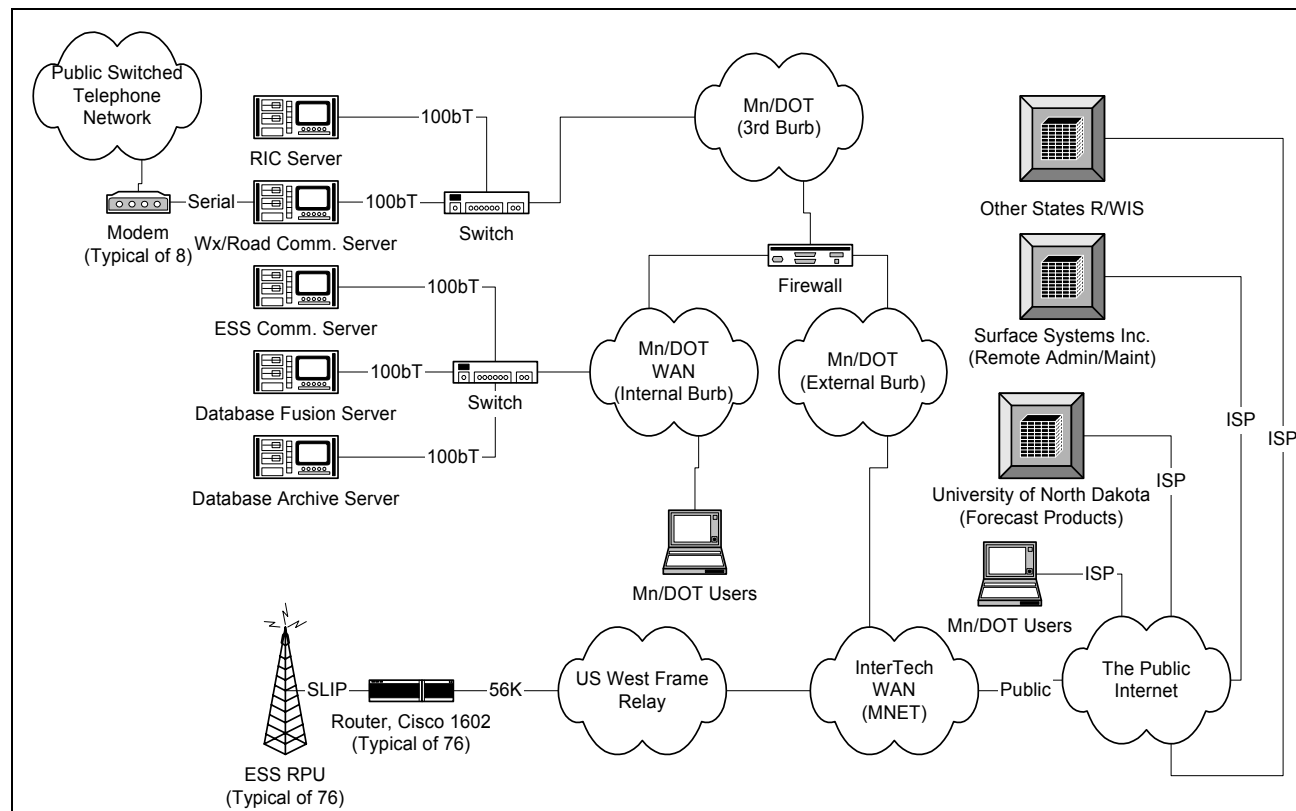


Figure 2: Physical Representation of the Statewide R/WIS system



Important milestones and dates for this project and the applicable NTCIP standards are shown in Table 1.

Table 1: Project Milestones & Dates

AGENCY	VENDOR	NTCIP Standards Status	Date
Report on Road Information Systems Fact Finding Study, by Dean Larson and Edward Fleege. This report was the report of a fact finding tour of Sweden, Finland, and England in February of 1989.	Not applicable	Not applicable	3/89
RWIS Task Force Report to New Technology Research Committee	Not applicable	Not applicable	3/93
Evaluation of Road Weather Information Systems in Minnesota by Braun Intertec Corporation.	Not applicable	Not applicable	9/94
ENTERPRISE Group host a national RWIS workshop for public and private sector entities. This information was used by Mn/DOT in preparing its Request for Private	Not applicable	Not applicable	12/95

AGENCY	VENDOR	NTCIP Standards Status	Date
Partnership.			
MnDOT let a Request for Private Partnership for a statewide RIW project. Two proposals were received. Negotiations were not successful with either group.	Not applicable	Not applicable	7/96
Not applicable	Not applicable	User Comment Draft of TS 3.7 (NTCIP 1204) was approved and distributed.	8/96
MnDOT working through AURORA ³ joined the NTCIP Working Group in developing the NTCIP ESS standard.	Not applicable	Not applicable	11/96
Not applicable	Not applicable	Modifications to TS 3.2 and TS 3.3 first published as Technical Revision (SNMP now mandatory and STMP optional)	5/97
Not applicable	Not applicable	Recommended Standard for TS 3.7 (ESS)	8/97
		Approved Standard for TS 3.7	11/97
The Regional Weather Information Center (RWIC) evaluated 79 potential Environmental Sensor Stations sites throughout the state in Minnesota.	Not applicable	Not applicable	11-12/97
Publication date of RFP for a statewide RWIS project.	Not applicable	Not applicable	4/98
Opening date of the RFP. Four (4) proposals were received.	Not applicable	Not applicable	5/98
Interviews were held with three (3) of the companies that had submitted proposals. July 14, 1998: Surface Systems, Inc. (SSI) was selected as the successful proposer. Negotiations began with writing an Agreement with SSI.	Not applicable	Not applicable	7/98
Not applicable	Not applicable	Additional amendments for OER, time differential, and dynObj Table recommended and incorporated with previous Technical Revisions	8/98
Not applicable	Not applicable	Recommended Amendment to TS 3.7 was approved	9/98
Not applicable	Not applicable	Amendments formally Approved by SDOs through balloting process	10-11/99
An Agreement was signed with SSI.	Not applicable	Not applicable	12/98
Not applicable	Began software development	Not applicable	02/99
Not applicable	First ESS Commissioned (SNMP/UDP/IP/[PPP/Ethernet])	Not applicable	08/99
March 31, 2000: Original work completion date of the agreement.	Not applicable	Not applicable	3/00
The work completion date was	Not applicable	Not applicable	7/01

³ AURORA = Consortium of Agencies and Countries to promote RWIS equipment.

AGENCY	VENDOR	NTCIP Standards Status	Date
extended to this date.			
Not applicable	Server optional ClassB (SNMP/NULL/PMPP/RS232) stack delivered	Not applicable	08/01
The last deliverable was received and contract is completed.	Not applicable	Not applicable	10/01

The advertisement of the project was published about eight months after the ESS-standard (NTCIP 1204, formerly TS 3.7) reached Recommended⁴ status.

3. PROJECT PROCUREMENT

In order to understand the procurement process chosen for this project, the activities leading up to the issuance of the Request for Proposals (RFP) need to be presented. As outlined in the table, the Agency had already conducted a fact-finding tour to other agencies and countries to determine their experiences with RWIS/ESS equipment. Additionally, the Agency went through an unsuccessful attempt to implement a public-private partnership to provide ESS data.

Since the Agency was participating in the NTCIP ESS standards development from an early point in the process, it had confidence and in-house experience to prepare an RFP that required NTCIP as the communications suite of protocols of choice. The agency also had support from a consultant who was also an active member of the NTCIP ESS WG.

The process used to procure the ESS is described below, while the process used to develop the specifications is described in Section 4.

3-1 ADVERTISEMENT / REQUEST FOR PROPOSAL

The decision to require the NTCIP as the primary communications protocol was made, because the AGENCY was looking for an open standards approach that could be easily added onto in the future. Due to their active participation in the other standards development efforts and their Fact Finding Study, the AGENCY had a very good understanding of the potential benefits of open standards. The AGENCY started to participate in the NTCIP ESS effort to ensure that an open standard was developed that addressed its needs.

NTCIP was selected for the project for the following reasons:

- The fact-finding tour of other agencies and countries revealed that one of the major problems was the inability to exchange data among agencies and states.
- The Agency wanted to purchase and install a 'state-of-the-art' RWIS system.
- Interoperability among new and existing system was difficult to achieve. The AGENCY understood that it had to develop 'protocol translators' to its legacy RWIS systems (AWOS, ASOS, CR 10, and other existing non-NTCIP RWIS systems from a variety of vendors), but the use of NTCIP now and in the future is believed to ensure that further 'protocol translator' developments to integrate RWIS products from companies other than the Vendor will not be necessary.

⁴ See Annex C for explanations of the standards development process and the various status states.