
NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL
CASE STUDY REPORT

NTCIP 9003-Amendment 1 v04

Washington State DOT NTCIP VMS Software Upgrade

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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. CASE STUDY UPDATE

The initial deployment of NTCIP-conformant equipment by the Washington State Department of Transportation (WSDOT) was documented in a case study of their Variable Message Sign (VMS) implementation in NTCIP 9003 Version 01.04, dated September 29, 1999. Now that some time has elapsed since that initial effort, AASHTO, FHWA, ITE, and NEMA are sponsoring this case study update. This effort, presented as a case study amendment, focuses on insights gained over the three years of deployment since the initial case study was performed. Specifically, this Amendment will address Agency issues concerning current implementation efforts and needs based upon experience gained through NTCIP deployment experience.

2. RECENT NTCIP IMPLEMENTATION EFFORTS

The original WSDOT NTCIP VMS Software Upgrade Project incorporated three variable message signs into the Seattle Freeway Management System (FMS). These signs were deployed using a multi-drop communications infrastructure (Null/PMPP, also known as Class B); a separate contract was let to develop an NTCIP-conformant device driver for their central system.

The Agency has since procured an additional 16 NTCIP-conformant signs under eight separate contracts. All 16 of the new signs use multi-drop communications (Null/PMPP). The signs were acquired from four separate manufacturers and then integrated into the FMS.

2-1 CURRENT PROCUREMENT PRACTICES

Signs are typically procured as a part of a larger construction project, of which the procurement of a sign is only a small part. In order to ensure that the signs meet agency requirements, the Agency requires the prime contractor to select products from a "Qualified Products List."

The Agency has significantly enhanced its testing process. It now performs pre-qualification testing using the NTCIP Exerciser and a customized version of the ENTERPRISE Test Procedures, using its in-house NTCIP experts. The customization to the Test Procedures was designed to focus the testing on only those features that are used by the Agency; the Agency recognizes that most vendors claim support to many other features, but these are not tested as a part of the pre-qualification process. The Agency has pre-qualified four manufacturers and has had a fifth express interest in being pre-qualified.

2-2 CURRENT SPECIFICATION CHANGES

In the original project, the deployment was largely experimental and there were no formal NTCIP specifications prior to the initiation of the project. The Agency has since developed a set of NTCIP specifications as shown in Annex A. Individual projects may modify these base specifications in order to reflect project-specific requirements (e.g., sign size, etc.), but most deployments now use these specifications as a starting point.

3. FUTURE NEEDS

Based upon their experience to-date, the Agency believes that NTCIP provides both interoperability and interchangeability for message signs. Previously, they required conformance to the one proprietary protocol supported by their central system, which effectively resulted in a single manufacturer providing signs. By implementing the NTCIP within their system, they have developed a competitive market for their signs and realized a cost savings in sign procurement.

Several users have requested improved functionality and feature sets in the NTCIP standards. However, WSDOT is satisfied with the current feature set offered by the standard. Their central system uses only a subset of what the standard defines and what most vendors have implemented.

Overall, the agency has a favorable opinion of the state of the NTCIP standards related to message signs. While there were some growing pains in the initial project, the standards are now more mature and agencies and vendors are now more experienced with these standards. As a result, they experience fewer headaches when trying to deploy new equipment within their system.

The Agency is also beginning to use the NTCIP for environmental sensor stations (ESS). These systems, however, are being deployed by other divisions of the Agency and those interviewed as a part of this case study were not aware of any details of these deployments.

ANNEX A: WSDOT VMS SPECIFICATIONS

The following contains complete versions of the generic WSDOT procurement specifications for Dynamic Message Signs. Parties interested in additional information should contact Mr. Mark Morse with WSDOT at (206) 440-4479.

ITSVMSQUAL.DT1

(NWR May 6, 2002)

VMS Manufacturer Eligibility Process

The Manufacturer Eligibility requirements herein are to ensure manufacturers have adequate experience and have been keeping up-to-date on the latest communication technology for VMS. Any manufacturer successfully qualifying under this contract will be required to conform to all specification requirements and pass all acceptance tests as listed in these Special Provisions. The Contractor-provided VMS Manufacturer must complete this Eligibility Process prior to submittal of materials or shop drawings.

Qualification Information

Prior to or at the pre-construction conference, the applicant shall submit qualification information to the Project Engineer to show conformance to the following requirements:

1. Applicant shall have at least five (5) years of experience in the manufacture of LED technology VMS used as permanent traffic control signs on highways. The applicant may use the experience of a subsidiary company in meeting this requirement provided the applicant is a participant in the manufacturing process.
2. Applicant shall provide all past customer references for the years 1996 through 2001 where they have provided LED technology VMS used as permanent traffic control signs on highways. These references shall be from the owning agency of the signs and shall include the owning agency's name, contact person's name, contact person's title, address and phone number along with details on the VMS that were provided to each jurisdiction. These references will be contacted by the Contracting Agency to determine, but may not be limited to, the performance and quality of the variable message signs provided from the manufacturer as determined by the owner. The Contracting Agency will determine successful qualification by using predetermined selection criteria.
3. Applicant shall provide a sign simulator test package. The test package shall contain an executable computer program that operates on the Microsoft Windows (95,98,NT,2000) computer platform. The software shall simulate the operation and communications between the new sign(s) and the Contracting Agency's central VAX computer. The connection between the simulator and the VAX computer will be EIA-232 at 1200 bits per second and conform to the NTCIP standards as specified in this contract. The software shall be provided on CD-ROM or 3.5 inch diskettes. Operating instructions shall be included and contain the contact information for the manufacturer's support engineer.

The qualification information shall be submitted in a sealed envelope, which shall be prominently identified as VMS MANUFACTURER ELIGIBILITY. On the letter transmitting the submittal shall be the submitted date, the name and address of the submitting company and the specific individual [with mailing address, if different than above, telephone number and email address (if available)] to be contacted relative to matters in the submittal.

Annex A – Project-Specific NTCIP Items

The acceptance of the Manufacturer Eligibility Application does not in any way constitute that the applicant has met the requirements of the eligibility and may be rejected based on the review of the information submitted.

The Contracting Agency may, at its sole discretion, contact any of the applicants during the evaluation process for clarification of any entries in the application and/or request additional information supporting any clarification offered. Such clarification and additional information shall be submitted along with the completed Affidavit of Accuracy form to the Engineer in writing no later than five (5) business days after the Contracting Agency's request. Contacts made by the Engineer to the applicants will be made between the hours of 8:00 AM and 5:00 PM PST.

The Contracting Agency may deny the manufacturer if any of the following conditions apply:

1. The manufacturer does not indicate the appropriate experience as stated in this solicitation.
2. The references provide information that causes the applicant to not successfully qualify under the established criteria.
3. The applicant fails to provide the Engineer within the required time frame any additional information requested as stated previously.
4. The Engineer determines that the manufacturer fails to provide a complete list of their past customer references for the years 1996 through 2001.
5. The Engineer determines that the provided software sign simulator is incompatible with the Contracting Agency's VAX computer.

The application submittal shall include clear and concise documentation to demonstrate the applicant is qualified, however the submittal shall be limited to ten (10) pages exclusive of the customer reference list. Qualification information shall only include that information needed to show conformance to the requirements herein. No additional explanation or information shall be submitted.

ITSVMS1.DT1

(NWR February 11, 2002)**Description**

Section 8-20.1 is supplemented with the following:

This work shall consist of furnishing, installing and testing all materials and equipment necessary to complete in place the variable message sign system, and when specified, the modification of such an existing system.

ITSVMS2.DT1

(NWR February 11, 2002)**Materials**

Section 9-29 is supplemented with the following:

Sign Display

The sign display shall be a continuous matrix of pixels, 27 pixels high and 105 pixels wide. Each pixel shall be made from a grouping of amber light emitting diodes and contain no moving parts. The matrix of pixels shall be capable of displaying a message of 3 lines of text, 18 characters long. The sign display and other associated

VMS components shall permit a test message using all 2,835 pixels, running at the maximum brightness and 100 percent duty.

VMS Sign Beacon

Three flashing beacons shall be installed on top of the sign housing. The beacons shall be as specified in Section 9-29.21. The 12 inch lamps shall be LED type, amber in color and meet the applicable portions of Section 9-29.16(2)A.

The beacons shall be aluminum and consist of single section, 12 inch traffic signal heads with cadet visor, square doors, and amber display. The center beacon shall flash alternatively to the two outside beacons.

Controllers for flashing beacons shall be as specified in Section 9-29.15, with aluminum sheet metal cabinets. The sign controller shall operate the beacons as commanded by the NTCIP communications protocol.

Sign Housing

The VMS housing shall provide walk-in service access for all LED display modules, electronics, power supplies, environmental control equipment, air filters, wiring, and other internal VMS components. The internal size of the housing shall be a minimum of 6 feet high. The access doors shall be a minimum of 2 feet wide by 6.5 feet high.

The nominal external dimensions of the sign shall not exceed 25 feet in width, 8 feet in height, and 4.25 feet in depth. The VMS back and side housing walls shall be vertical. The front VMS wall shall be built at an angle of 3 degrees toward the viewing motorists. Display modules shall be parallel to the front VMS wall, so that use of the LED viewing cone is optimized. The dead load of the housing and contents shall not exceed 3750 lbs.

VMS housing exterior sheet material shall be aluminum alloy number 5052-H34, and shall have a minimum thickness of 0.125 inches. Exterior sheet seams shall be continuously welded and waterproof. VMS housing structural frame members (I-beams, C-channels, Zee-extrusions, and bar stock) shall be aluminum alloy number 6061-T6.

The minimum distance from the interior rear wall of the VMS housing to the closest display components shall be 36 inches. This free space shall be maintained across the entire interior of the sign housing, with the exception of structural members. Structural members shall be designed and positioned so as to not be an obstruction to free movement of maintenance technicians throughout the interior of the housing. Circuit boards/display components shall be protected from accidental contact by maintenance personnel.

VMS housings shall be constructed to present a clean, neat appearance, and the equipment located within shall be protected from rain, snow, dirt, and corrosion. Sign housing floors shall contain small weep holes for draining water that accumulates due to condensation. Weep holes shall be fabricated in a manner which prevents the entrance of insects.

The front of the LED display matrix shall be completely covered with polycarbonate sheeting that is weather tight, ultraviolet (UV) light protected, non-glare, and which has a minimum thickness of 0.17 inches. To achieve maximum display contrast and legibility, the outside of the polycarbonate sign face shall be fully covered with a mask, which is formed from aluminum sheeting. The mask shall have a minimum thickness of 0.09 inches and shall contain a circular opening for each pixel. The openings shall not hinder the 15° LED viewing angle. All exposed metal on the VMS front face, which is visible to viewing motorists, shall be coated with black Kynar 500 resin or an equivalent oven-fired fluoropolymer-based coating having a minimum outdoor service