# NORTH DAKOTA DOT LEADS THE WAY IN PORTABLE VARIABLE MESSAGE SIGN INTEGRATION

**Background**

The North Dakota Department of Transportation (NDDOT) operates a fleet of portable changeable message signs (PVMS) to keep motorists informed of traffic conditions in the state. During the summer months, these signs are primarily deployed along interstate construction projects in a work zone safety role, and during the winter months the signs are moved to semi-fixed locations to be used primarily to notify motorists of weather related road closures and diversions. The signs are regularly moved between districts so that they can be deployed where needed.

Each of the eight district offices control the signs deployed in their district via modem using dial-up cellular service.

This network of signs was complex to manage, as the fleet included four different manufacturer's signs, each of which could only be controlled by the manufacturer's central control software. This made it very difficult to achieve any kind of coordinated operation of the sign fleet, and made it very difficult to effectively deliver, for example, Amber Alert messaging.

**The Proposed Solution**

Ed Ryen and other NDDOT personnel came across the Intelligent Devices (IDI) booth at the ITS America show in Minneapolis, MN in May, 2003. Ed and the other NDDOT personnel realized that the Intelligent Devices product offerings would provide a solution to this problem.

These included a combination of expertise, software, test tools and hardware controllers.

IDI has expertise in the National Transportation Communication for ITS Protocol (NTCIP) standards. This communication protocol, which is the emerging national standard for Intelligent Transportation Systems (ITS) devices, would allow all the signs in North Dakota to be controlled and monitored using the same communication commands, irrespective of sign manufacturer.

IDI manufactures a series of NTCIP electronic translator cards, that can enable each of the non-NTCIP signs to convert their communication to NTCIP, and add any functionality that was missing from the older signs in the fleet. This would inexpensively bring the communication of the older signs up to standard, without the expense of replacing the signs.

IDI has expertise and experience in the practical testing of NTCIP communications and signs. The testing of the old and new signs ensures that all the signs (including the old signs converted with the translator cards) worked with the same NTCIP commands as the new signs, and that any difficulties in communication and sign functionality could be identified. Communication difficulties would be resolved by the original manufacturer via a software upgrade, or fitting translator cards, as required.

IDI provides an integrated NTCIP sign control software package. This software uses only standard NTCIP commands to control and monitor a fleet of signs (and other ITS devices), and would provide a uniform interface that all districts could use to control the signs in their jurisdiction. In addition, this software package could be used to control all the signs from a central location in a state wide incident, for example, an Amber Alert.

NDDOT thought that this combination of products and services would provide the integrated monitoring and control that they were looking for, and solve the problems that had been identified in the operation of their fleet of portable signs

*Fig 1.*
*An older NDDOT Portable Message Signs during its upgrade to NTCIP*

**Execution**

Intelligent Devices executed the solution in a number of steps.

A functional North Dakota DOT NTCIP Acceptance Test was developed, and this test was then scripted for the DeviceTester for NTCIP test software from IDI. This practical functional test tested ALL the functionality that was required of a portable sign when communicating using NTCIP commands. This included messages, configuration, scheduling, priority management, brightness control and all the other functions that are used by North Dakota DOT in the control and monitoring of signs.

On-site testing of one of the manufacturer's signs revealed some shortcomings that would prevent successful integration of these signs in the system. These shortcomings were communicated to the manufacturer, who then reproduced the testing results in the factory, using DeviceTester and the scripted test. A deficiency list was agreed with the manufacturer, and corrective action implemented. The software in the signs was revised to bring it in line with the requirements for integration using NTCIP.

Two of the brands of sign were of an older vintage, and did not support NTCIP communication at all. IDI installed translator/controller cards in these signs to enable them to respond to NTCIP commands. These translator cards also added functionality to support scheduling, priority management and several other functions that were required for the planned integration. Once complete, these signs were subjected to the same functional NTCIP Acceptance Test, which assured that they would correctly respond to all the NTCIP commands that were to be used in the completed system.

Prior to deployment, Intelligent Control (IDI's NTCIP based control and monitoring system) was configured for the North Dakota system. All the devices, device types, telephone numbers, icons and maps related to North Dakota were loaded and configured. This configuration was tested from IDI's offices in Atlanta for several weeks prior to deployment to ensure that communications were reliable. During this phase it was identified that one manufacturer's communications were consistently unreliable. This confirmed the experiences of NDDOT in operating this particular brand of signs, but it was now possible to reproduce the problem in a fixed environment, which was communicated to the manufacturer for corrective action.

Corrective action by the manufacturer resulted in the communication reliability being improved to match the other signs in the fleet, and allowed for successful integration.

The pre-configured and pre-tested Intelligent Control was then deployed in the field. Personnel from the eight district offices were trained on how to operate and monitor the signs using the control software. This included training on sign control, scenarios, Amber Alert and well as maintenance, security and configuration.

The experience during the execution of this contract was positive for all the parties involved. It showed that NTCIP is a practical way of achieving integrated systems that are straight forward to test, deploy and operate.

Deficiencies in manufacturers' equipment regarding NTCIP communication or reliability could be easily and repeatedly identified, and quantified to the manufacturer for resolution.

Different manufacturers' equipment is now clearly interoperable, and the basis has been established for effectively qualifying new procurements for adding to the system.

The system deployment was completed in December 2003, some 7½ months after the first contact between NDDOT and IDI at ITS America in May. This very short duration for scope definition, proposal, contract agreement and contract execution is testament to what can be achieved with the methodology used and the focus and commitment of everyone involved.

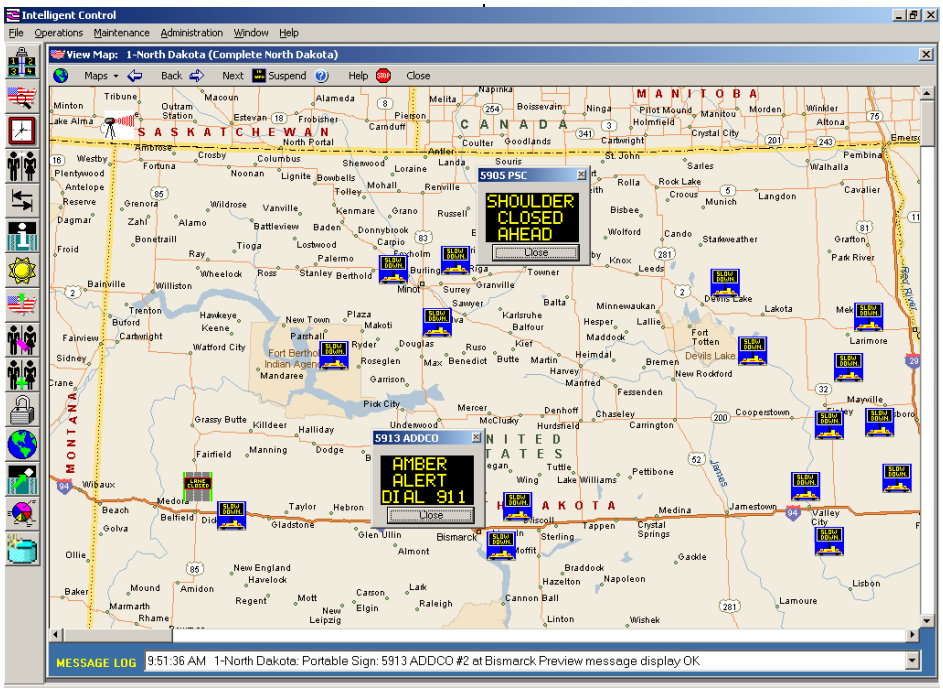


*Fig 2.*
*The new system showing the deployment of a mixed fleet of different manufacturer's signs*