MnROAD Site Infrastrcture

Site Description

MnROAD consists of two road segments that are divided into more than 50 test cells. The Mainline Segment is a 3.5-miles long freeway segment paralleling west bound I-94. The freeway segment consists of 23 original test cells many of which have been sub-divided and renamed. The Low Volume Road (LVR) is a 2.5-mile, closed loop roadway adjacent to the mainline segment. The LVR had 17 original test cells, many of which have been broken into sub-cells. Every roadway cell represents a unique variation in materials, design, or construction practices.

Infrastructure Description

MnROAD's instrument infrastructure consists of data acquisition nodes, an electrical grid, and a communications network. The data acquisition nodes are principally traffic control cabinets housing sensor terminations, data loggers, and communications end equipment but may be as simple as a BD closure with cable terminations ready to hook up to portable data acquisition equipment. The electrical grid consists of several transformers providing power to the data acquisition nodes. The communications network is both fiber-optic and copper for transferring data between data acquisition nodes and the MnROAD main building.

Environmental data (Temperature, Water Content, Static Strain, etc.) is collected at short time intervals and downloaded daily. Dynamic data (Stress, Strain, Displacement, etc.) is collected on both the ML and LVR on a quarterly time basis.

Data Acquisition Nodes

Data acquisition nodes are principally made up of a series of interconnected traffic-control-type cabinets that allow the sensors, data collection equipment, AC power and communications elements to come together. Sensor leads are brought from the pavement structure through conduit, hand holes and vaults and terminated in the cabinets. Cabinets are interconnected with communications and power cables through a vault and conduit system.

Most of these cabinets are insulated and heated during the winter months and fan cooled in the summer. The original cabinets and anything added prior to 2007 is a four door cabinet measuring 30" X 54" X 54". In the later years a smaller, two-door, cabinet has been used measuring approximately 24" X 30" X 54". Each cabinet has been placed to accommodate a particular cell or a group of cells.

The cabinets provide an environmental closure for data acquisition and communications end equipment and power distribution. Depending upon the number of cells served or the intensity of sensor arrays, cabinets may house one to four, or more, data loggers for environmental sensing and termination panels for dynamic sensing.

Most of the cabinets are supplied with 220 volts of AC power.

AC Power

AC power for the site is distributed via 8 transformers located at various points to allow for shorter runs to the cabinets, buildings and remote locations. All of the power cabling is run underground. Power pedestals exist at most data acquisition nodes.

Communications

Communication between cabinets and between the cabinets and the Research Operations Center is done basically as a Local Area Network using fiber optic cables. The fiber is run underground to the cabinets and other locations. A number of locations are used as network hub points. There are two main hub locations, one at cabinet 4 for the north side of the Low Volume Road and another at cabinet 17 to serve the rest of the site. Cabinet 17 is then connected to cabinets 12, 15, 20 and 23. Each of those cabinets then serves as a hub location for other cabinets. In addition the road side fiber, there is a connection from the Operations Center to the Weigh-In-Motion building which is east of the main site. This location serves as our connection to the rest of MnDOT and the world. In addition to the fiber-optic cables there are also some copper communications cable buried at MnROAD. The system is used for the alarm system and transmitting a timing signal.

Underground Utilities

All of the cabling, be it sensor leads, communications cables or AC power is buried underground. Most of the AC power and the copper cabling is a direct buried installation. However, the fiber and sensor cables run through a series of buried conduit and access points. The access points are of two main types. One is the original splice vaults measuring either 3’ x 5’ or 4’ x 6’ with a depth of either 36 or 42 inches. In recent years, two-foot diameter hand holes are used. We use two different types of hand holes. The first is made of Polyvinyl Chloride (PVC) with a cement cover. The second ones are made of Polyethylene (PE) with a cover of the same material. They also vary in depth from 36 to 42 inches. The original construction used primarily steel conduit when the conduit needed to run under the roadway or the ditch and used PVC pipe to go from the splice vault to the sensors. We have gone to using all PVC pipe in recent construction cycles.

For more information

For more information about MnROAD and the Road Research program at MnDOT:

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