Edmond Builds Smarter Underground Facilities

Jun 1, 2007 12:00 PM
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Edmond Electric gained valuable insight into reliability after converting nearly 700 residents to underground facilities. For the past five years, the municipal utility located in Edmond, Oklahoma, has been implementing several new equipment and system requirements.

Loops for Redundancy

Foundational to the revised construction design is installing loop feeds. When Edmond began the underground conversion of some of its older, high-maintenance neighborhoods in 2002, some of its underground was still a dual-radial system. A loop-feed system insures that, should equipment malfunction or an excavation cut occur, customers will quickly receive power from another feeder.

Almost 100% of the new underground infrastructure and loops installed has been done by directional drilling. This more expensive trenchless method is justified when compared to the significant costs of restoration and street cuts associated with open-cut and trenching. Some of the equipment in these neighborhoods was outdated; poles needed replacing and some of the areas were not on a loop-feed system.

Underground Construction

Edmond's alliance contractor Doyle Webb Inc. has been responsible for boring and installing the conduit and pulling the cable. A high-density polyethylene (HDPE) schedule-40 conduit system was chosen over direct-bury as the preferred method for installing the underground residential distribution (URD), to give maintenance and repairs crews easy access to the cable. Webb's crews install the additional backfeeds where necessary. Normally loops are split in half, with half the customers being fed from one feed and half from another. In some subdivisions three feeds are installed to serve an area, depending on the load and number of residents. For example, additional feeders were added in Clegern Place and Henderson Hills as they were converted.

Once the conduit is in place and the cable is pulled by the subcontractor, an electrician changes out the meter bases and makes the house connections where applicable. Edmond's underground crew assigned to the area then returns to make the cutovers, terminating the wire at the pole or pedestal, hooking up the transformer and energizing the service.

Edmond line crews vary according to their purpose and specialty. A typical underground crew

includes three crew members, a small bucket truck and a 1-ton service truck. Edmond combination overhead and underground crews, called “preventive maintenance teams” consist of three crew members and appropriate vehicles.

Reducing Vulnerability

High-voltage surges from lighting and equipment malfunctions are a major cause for URD outages. The loop-feed system creates redundancy, but it doesn't protect the system against these damaging and costly occurrences. In the URD environment, a high-voltage spike that exceeds the basic impulse level can quickly do thousands of dollars of damage to unprotected cable, transformers, switches and other equipment components. A lightning strike can blow all the way to the last transformer on that circuit, which is expensive both in equipment replacement and emergency repairs, and labor costs. Customer satisfaction is also affected.

To protect against voltage surges, Edmond has been installing elbow and parking stand surge arrestors. Surge arrestors are like an insurance policy that helps protect the transformers during adverse weather conditions and when equipment malfunctions. Should a spike or surge occur, the arrestors divert the overvoltage protecting the circuit from major damages.

Edmond's URD crews follow the alliance contractor installing the surge arrestors at strategic locations, such as ends of a radial section of line, switch points, transformers and in junction cans — anywhere there is a split point and where the loop feed/load feed ends.

Isolating a Fault

Loop configurations and surge arrestors insure a more reliable system, but unfortunately, outages are still a fact of life. Underground faults notoriously occur without warning, and there is seldom a visible indicator of the location, such as a tree limb or a downed powerline which is often the case in overhead failures. It is every Edmond lineman's job to isolate these underground failures as quickly as possible and restore services to the customer. Edmond linemen are assigned in pairs to standby crews, which rotate every seven days, providing 24/7 outage responses.

To address the underground challenges and help reduce outage durations, Edmond is installing fault indicators at strategic points throughout its URD system. A visual indicator light, that begins flashing when a fault occurs, is an important feature of these fault detectors. The light, mounted on the equipment lid in most cases, provides the trouble crew looking for the outage, a clear and visible means for isolating the faulty cable or equipment.

Edmond's underground crews typically install the fault indicator device inside the transformer cabinet, clamping it onto the cable. A ⅜-inch hole is drilled through the enclosure for the light-emitting-diode (LED) indicator and an optical line run from the fault-indicator device to the surface-mounted light.

All URD equipment is clearly labeled to enhance underground facility safety, and to further assist trouble and maintenance crews long after the equipment is installed. Tags and arrows on transformer connections, elbows and termination points tell line workers what they are working with, the direction of flow, and the voltage or capacity on that cable or device.

Results are Evidence

As Edmond Electric approaches its 100_{th} anniversary, the utility's goal for building underground residential systems is to redouble its already outstanding record of system reliability. The URD equipment and conductor Edmond installs should be more easily accessible for maintenance and outage calls. Edmond's investment in loop redundancy, voltage-surge arrestors and fault indicators demonstrates its commitment to these goals.

There is not enough information available yet to gauge the success of building smarter URD, but Edmond is confident they are headed in the right direction. For starters the average duration of outages has been cut in half.

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