Montana Department of Transportation
Research Programs
November 2013

EXPERIMENTAL PROJECTS INSTALLATION REPORT

TAPCO (BLINKERBEAM/BLINKSYNC) BLINKERCHEVRON TRAFFIC CONTROL SIGNAGE

Location:	MT Highway 41 (P-49) Reference Point 14.3; Madison County: Butte District
Project Name:	Curve Near Beaverhead Rock
Project Number:	HSIP 49-2(10)14
FHWA Project Number:	MT-12-09
Project Type:	Sequential Dynamic Curve Warning System
Principal Investigator:	Craig Abernathy, Experimental Project Manager (ExPM)
Contractor:	Stillwater Electric, Kalispell MT
Date of Installation:	July/August 2013

Objective

Implementation of the TAPCO BlinkerBeam & BlinkSync dynamic LED curve warning system is to provide additional signage and delineation to better depict the curve to area motorists. The TAPCO product is solar-charged, nickel-metal hydride (NiMH) battery powered triggered wireless device; which is actuated by doppler radar when a vehicle approaches to warn and provide visual orientation through the curve.

The selected curve crash analysis reports on seventeen (17) crashes during the time frame of January 2001 through June 2012, four of those events involving fatalities. A realignment project is scheduled for (estimated) 2018 which will correct the roadway geometrics attributing to the safety issue. In the interim this automated chevron sign system will attempt to alleviate the current hazard and be in service for a sufficient duration to establish a trend and determine overall performance.

Current layout of the chevrons was placed on the northbound lane (eastside shoulder) encompassing eleven (11) bi-directional sign panels. Every odd number sign (1, 3, 5, 7, 9, and 11) has the TAPCO devices (see page 10 for a schematic diagram). Each

odd sign post has two (2) solar-charged battery powered blinker chevrons angled to capture both southbound and northbound traffic.

Chevrons are activated by approaching vehicles using radar which will signal the master transmitter to initiate the chevron slave receivers to flash sequentially to navigate the driver through the curve.

The even numbered signs (2, 4, 6, 8, and 10) have conventional type 11 highly retro-reflective dual panels per post angled as the blinker chevrons to capture both lanes of travel. Additional warning signage and delineation enhancements were installed on both north and south lanes approaching the chevron system to caution and prepare drivers of the approaching curves.

Evaluation Procedures

Installation Documentation: Will include information specific to the installation procedures of the curve warning system as documented in this report.

Post Documentation: Will entail semi-annual (late fall/early spring) inspections of the TAPCO unit's condition and operations; and supplemental information supplied by District maintenance personnel on repairs and adjustments if applicable. Safety related information will be added as it becomes available.

All project information may be found at:
http://www.mdt.mt.gov/research/projects/tapco.shtml

Initial Remarks and Project Status

There were no issues reported during installation by the electrical contractor and from District personnel which may affect the performance of the TAPCO system. Product components were delivered to the Department factory preassembled.

Post-installation: In early October, maintenance staff have reported several times the dual-light flashing approach warning signs were not working and one of the southbound LED chevrons were not activating.

The issue with the LED chevron appears to have been a defective battery which had to be replaced twice within a period of 1 month. The solar panel used in the approach warning signs were low-wattage models and were not adequately charging the batteries which supply power to the dual LED units. Subsequently larger solar capacity panels were installed and (to date) have corrected the problem.

November 8, 2013: A northbound chevron unit was reported not operating.

November 22: The entire northbound chevron system was not in service. Apparently

the battery failed on the northbound master control and the chevron slave unit.

December 3: With new batteries installed, both southbound and northbound chevrons systems and approach warning signs are working normally.

December 30: District personnel reported that two more chevron slave units (one northbound and one southbound) were inoperable due to insufficiently charged batteries.

January 3, 2014: The batteries have been recharged and the units are back in operation but TAPCO has stated the charge may only last for 1-2 weeks.

January 7, 2014: District personnel have reported another northbound slave unit has quit operating.

The current issue being questioned by the MDT to TAPCO service representatives is there a problem with the wiring from the solar panel to the rechargeable batteries in not maintaining a sufficient charge for activation.

District personnel have reported spending substantial time on site since installation of the TAPCO system in dealing with issues stated above. With the problems experienced to date there is some concern about the efficacy of the product and future performance. District personnel will continue to contact Research directly on all matters concerning operations of the units during this evaluation.

In a minor issue the dual chevron slave units (per post) are presently using one solar panel per individual chevron (refer to page 9); manufacturer specifications were to only have one (larger-wattage panel) to provide battery charge and power to both chevron units. Per consultation with District personnel and the vendor it was determined the currently installed panels will be adequate to supply sufficient charge to maintain functioning NiHM battery power.

Technical notes: The units are activated at a vehicle speed range of 1-100mph (per information supplied by manufacturer), at about (estimated) 600 ft. from the chevron system. Once initiated by the master control cabinet, the chevron slave units (all 6) will cycle 12 times with an estimated duration of sequence time of one second.

The TAPCO system is a 24/7operation and will actuate at any time a vehicle approaches. The doppler style radar had the sensitivity to detect a vehicle the size of motorcycles as well.

The solar panel control circuitry is designed to automatically adjust the brightness of the high–intensity LEDs by measuring the available light and adjusts the LED flash accordingly.

Specifically; during full sunlight the LEDs brightness will be at its maximum and conversely the LEDs during nighttime will be at the minimum brightness setting. There

are six levels of preprogrammed illumination available for varying conditions such as fog, rain, and snow.

Research would like to thank Dean Harris (Butte District Construction) and his team for the coordination between Research and the project events which made this report possible. In addition to the Stillwater Electric crew for a good job of installation. A special thanks to Tom ‘Tater’ Broksle, MDT Butte Maintenance field personnel in dealing with the technical problems on site.

Video Links

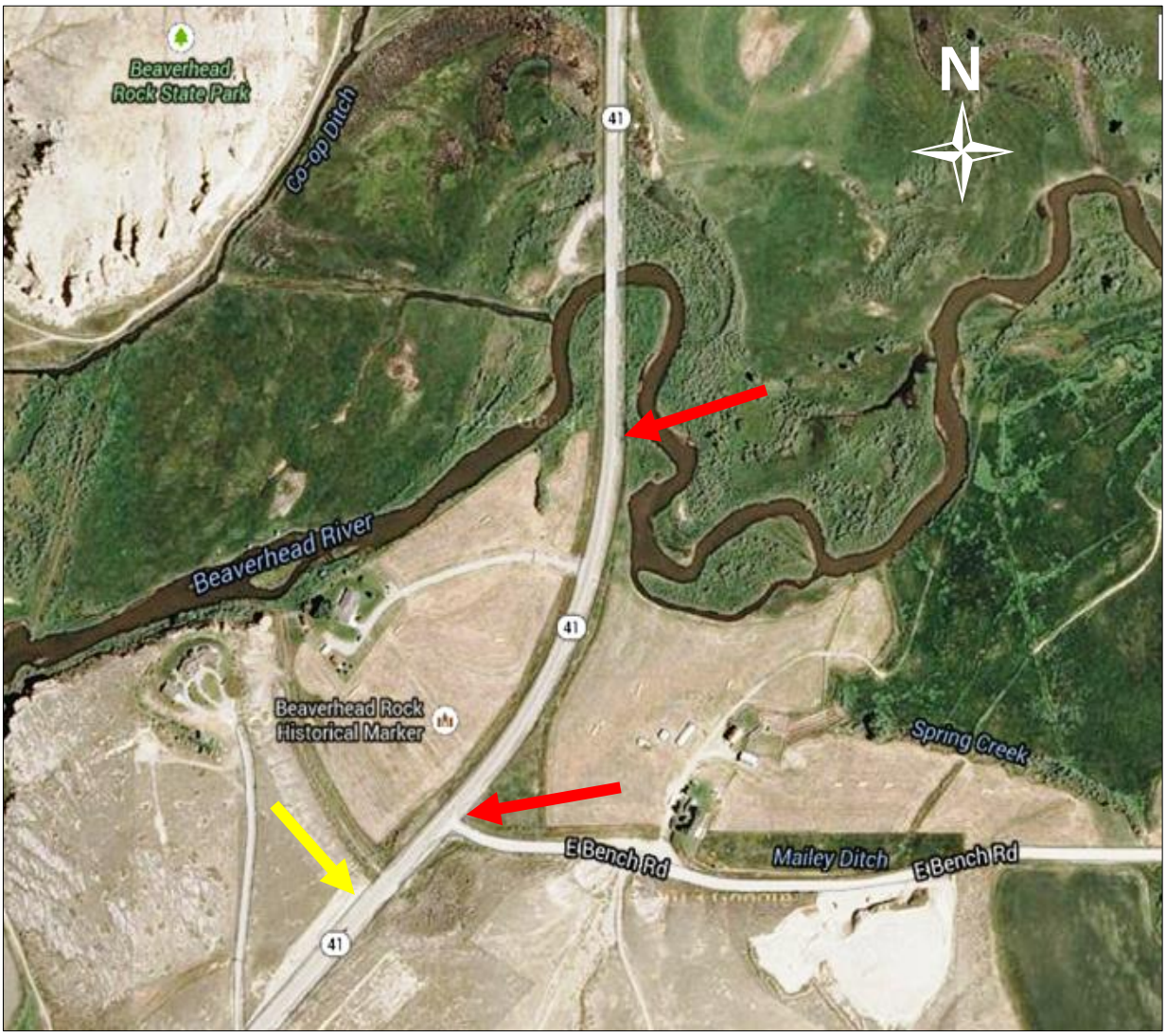
TAPCO-Daytime Activation Northbound

TAPCO-Daytime Activation Southbound

TAPCO-Nighttime Activation Southbound

March 2013

Project site pre-installation images of the curve at Beaverhead Rock: 🡅 Upper image is the northbound view; 🡇 lower image is southbound.



Arial view of the TAPCO installation project location. Red arrows show the approximate placement of the chevron system.

The yellow arrow denotes the approximate point of the crest of the vertical curve in relationship to the northbound traffic. From this point the road slopes downward with minimum sight distance and reaction time to drivers approaching the curve.

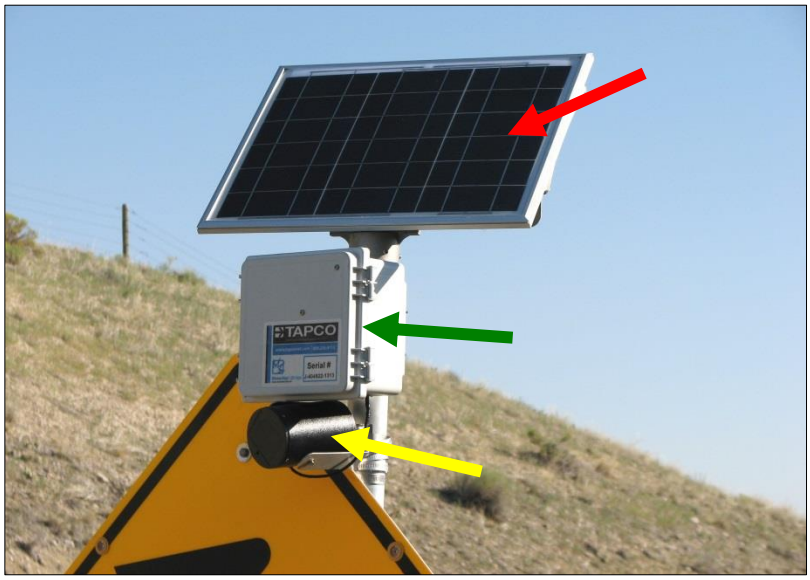
July 2013

⬆ Erection of the solar dual flasher warning approach sign assembly.

⬇ Northbound (identical to the southbound approach) completed dual flasher warning sign with the larger wattage solar panel replaced in October.

⬅ This is the northbound advance-signal, wireless sequence master unit.

A similar unit is in place on the southbound approach to the curve.



⬅ Close-up of the 13 watt solar panel (red arrow), the radio sequence control master cabinet (green arrow); and the doppler radar unit (yellow arrow).

Although difficult to see in this image the sign boundary edge have eight (8) high-intensity LEDs which will activate upon approach of an oncoming vehicle.

⬅ Rear view of the northbound full system, radio sequence control unit.

The tube bracket (red arrow) which supports the solar panel and master control cabinet contains the unit's nickel-metal hydride (NiMH) battery.

Prior to installation the battery must be charge a minimum of 8 hours to function properly.

⬆ One of the six dual BlinkerChevron's installed on site. The chevron components are fixed on a four (4) inch post with added reflector panels. Each individual LED chevron has its own solar panel and slave radio control unit (yellow arrow). As in the advance signal master control, the NiMH battery is located in the tube bracket (red arrow).

⬅ Side view of the BlinkerChevron unit under activation. There are ten (10) high-intensity LED's per each panel.

The LED panels (upon inspection during activation) required to be angled correctly for maximum visual illumination to oncoming traffic.

⬅ Five (5) conventional chevron signage alternating with each of the six (6) radar-activated units.

Project Schematic