EVALUATION OF THE BREAK-OUT SQUARE POST BREAKAWAY SYSTEM

Location: Montana & Central Ave Jct. – Billings: Yellowstone County

Project Name: Break-Out Square Post

Project Number: N/A

Exp. Project Number: MT-12-08

Project Type: Sign Post Breakaway Trial

Principal Investigator: Craig Abernathy, Experimental Project Manager (ExPM)

Installation Date: August 28, 2012

Evaluation Date: April 2013 & May 2014

Objective

Determine the effectiveness of the Break-Out Square Post coupler as a possible alternative to other breakaway devices. This product is designed to (upon impact) break flush with grade with no damage apparent to base or anchor and offer a quick turnaround to get the sign back in service.

Evaluation Procedures

When the break-away device has been involved in an active traffic event (sheared off by a vehicle impact), Research will document the condition of the unit and all steps involved to put it back in service. Cost of repair and time required will be included.

Construction Documentation: Will include information specific to the installation procedures of the break-out device.

Annual Evaluation: Document condition of the break-out unit.
**Initial Remarks and Issues - 08/28/2012**

The installation of the Break-Out device took about forty (40) minutes. It was found when the drilling of the three (3) inch hole for the anchor adapter that the thickness of the concrete foundation was less than 2.5".

Normally in circumstances where the foundation has less than four (4) inches an extension would be attached to the adapter for more support. Since no extension was available without delay in the installation it was decided to install the adapter with the expectation it will not affect performance of the breakaway unit.

Pages three (3) to eleven (11) details the installation.

**April 2013 Site Inspection**

During this inspection it was found that the sign was leaning northwards about five degrees (5°) and leaning forward (easterly) about ten to fifteen degrees (10-15°).

Several of the top coupler attachments (lower socket cap nut and corner hex screw) were loose. The anchor adaptor has depressed into the 3" drilled hole about ¼".

As stated above in the initial remarks, the concrete base thickness was less than 2.5" which to date, appears proven inadequate to support the anchor with sign; however the installation went ahead. In retrospect with the thickness of the base as it was, an anchor extension (which attaches to the anchor adaptor) may have kept the anchor to base a stable installation. These extensions range from twelve inches (12") to twenty-six inches (26"). Another option with the thinness of the base would have been to pack that hole with fresh concrete to make a solid connection.

A current assumption is that wind-generated vibration has caused the above conditions but that is only speculation.

Pages twelve (12) to fourteen (14) details the site inspection.

**April 2014 Site Inspection and Subsequent Sign Hit in Early May**

The sign unit was still in the same condition as reported in 2013 except the lean northward was more pronounced.

The District notified Research in early May that the sign unit had taken a vehicle hit and was down. Upon a site visit it was found the breakaway unit had performed exactly as designed snapping flush with the median surface with all components intact. See page sixteen (16) for more details.
Condition of the lane divider after two sign impacts. Location of the first sign placement (yellow arrow). Yellow circle will approximate location of new sign base.
Main components of the Break-out. The top coupler (red arrow) is set above grade and the receptacle for the sign post base.

Although difficult to see with the black washer in place (yellow arrow), this is the 360 degree breakaway point that breaks flush with grade.

The wedge-lock (white arrow), when fully tightened firmly secures the coupler into the anchor adapter.

Close-up of the anchor adapter which will be inserted into the drilled hole flush to the surface of the median.
Using a rock drill with a 3" bit the workman begins to bore into the median surface with an emphasis to keep the drill as vertically plumb as possible.

Continuing to bore with a good vertical drilling.

Boring completed. It was found the depth of the concrete was approximately 2.5" (6.4 cm).

Normally for slabs less than 4" thick an extension is added to the anchor adapter for added base support.

Since an extension was not supplied it was decided to use only the adaptor with this installation.
A drive cap designed to fit and place the anchor adaptor for insertion into the bore hole is attached to the jackhammer.

A conventional post leveler is attached to the anchor adapter to act as a visual guide in assuring a good vertical seat.

The anchor is basically a wedge and almost impossible to remove if not placed correctly without damaging the surrounding foundation.

The adapter is hammered flush and in correct alignment (as indicated by the diagram) for the sign to face towards oncoming traffic.
The coupler base is placed in the anchor adapter first, and then followed by the top coupler wedge.

The Break-Out in place ready for the tension bolt.

The fastener is the type that relies on tension rather than friction in keeping the wedge lock secure in anchor adapter.

Tension bolts (Inclined cams on the inside and radial teeth/ridges on the opposite sides) are less susceptible to vibration caused by wind-generated post movement.
The tension bolt is first hand tightened into the coupler wedge lock.

The tightening is finished off using a conventional socket wrench and cheater bar.

The vendor stated no torque requirement is specified, only to tighten the bolt until it no longer moves.

The Break-Out Square Post Breakaway is ready to receive the sign base.
The sign is inserted into the Break-Out receiver.

Corner hex screws are tightened first.

Round head socket cap screws are set through the sign base and Break-Out and tightened firmly.
↑ Note that the round cap screws are compressed against the sign pole base and not the coupler.

↓ Completed sign base to coupler attachment.
Completed installation of the Break-Out Square Post coupler (view west).
April 2013 Site Inspection

Upon inspection it was noticed that the sign post had a northern tilt as seen from the rear (view east).

From a side view (looking north) the sign post had a substantial forward lean.
The top coupler and wedge-lock unit appeared to be tight in the anchor base; however the anchor base was moveable in the drilled concrete.

The rear lower base nut to socket cap attachment was loose. It could not be determined if the other socket cap nut attachment was tight or not.
In comparing the lower image taken in 2012 of the completed placement and the upper image taken during the April 2013 inspection, shows that the anchor (wedge) adaptor has recessed almost a half inch (½") into the concrete base.

Also note the corner hex screws (yellow arrows) appear to have reversed out of the top coupler hex attachment.
April 2014 Site Inspection

As compared to the image taken in April 2014 the sign incline has increased. Even at this severe angle and in shallow placement the anchor adapter has held.

Close-up of top coupler and anchor base.
May 2014 Site Inspection: Sign Impact by Vehicle

The District notified Research that the Montana and Central Ave. Jct. sign unit had taken a vehicle hit in early May.

As these images show (even at the severe tilt of the base) the top coupler (red arrow) sheared cleanly from the 360° wedge-lock base insert (yellow arrow). Note the round black deformed object is the seal washer.

The impact did not affect the placement of the anchor base.

Conventionally, this design allows the wedge-lock to be removed from the anchor base by releasing and removing the tension bolt (in which sanding debris has covered – white arrow) to allow a new break-out unit to be reinserted into the anchor (refer to pages 7 & 8).

Since the current median will be replaced and upgraded the existing anchor will be removed and may be used again.
Map View of Sign location