Montana Department of Transportation
Research Programs
June 2016

**EXPERIMENTAL PROJECTS FINAL REPORT**

# EVALUATION OF THE METADOME TRUNCATED DOME USED IN EXISTING AND NEW ASPHALT APPLICATIONS

| | |
|---|---|
| **Location:** | **Missoula:** Clements Rd. to Spurgin Ave.<br>**Three Forks:** Bike Path – Kansas St. to First Ave. West |
| **Project Name:** | ADA Asphalt DWD |
| **Project Number:** | STPP-STPE 13-5(8)96 |
| **Exp. Project Number:** | MT-12-06 |
| **Project Type**: | Truncated Domes (Detectable Warning Devices-DWD) |
| **Principal Investigator:** | Craig Abernathy, Experimental Project Manager (ExPM) |
| **Installation Date:** | July (Missoula)\October (Three Forks), 2012 |
| **Evaluation Dates:** | April 2013, February 2014**,** April 2015, March/April 2016 |

## Objective

Determine the effectiveness of the MetaDome DWD in existing and new asphalt installations.

MetaDome stainless steel units are installed at the Missoula location. MetaDome cast iron units are installed at the Three Forks locations.

## Evaluation Procedures

**Construction Documentation:** will include information specific to the installation procedures of the MetaDome product at both project locations.

**Semi-annual Inspections and Annual Report**: Research staff will visit the sites semi-annually (late fall/early spring) to document performance for inclusion into the annual report. All project information can be located at: http://www.mdt.mt.gov/research/projects/dwd.shtml.

The purpose of an experimental features report is to document the phases and events of any given project to gain the reader an understanding of the general activities required to install or incorporate the research element into an active construction or maintenance project. This report also establishes a baseline for defining performance for any given feature under actual service conditions to determine its relative merits.

## Missoula Stainless-steel Panel Installation: Existing Asphalt

▪ **2012 Installation:** Pages three (3) –eleven (11); represent the activities regarding the installation of the MetaDome stainless steel units.

▪ **April 2013 Site Inspection:** Pages twelve (12) – eighteen (18).

▪ **February 2014 Site Inspection:** Pages nineteen (19) – twenty-one (21).

▪ **April 2015 site Inspection:** Pages twenty-two (22) – twenty-three (23).

**-April 2016 final site inspection:** Page twenty-four (24).

## Three Forks Cast Iron Panel Installation: New Asphalt

▪ **2012 Installation:** Pages twenty-five (25) – thirty-one (31); represent the activities regarding the installation of the MetaDome cast iron units.

▪ **April 2013 Site Inspection:** Pages thirty-two (32) – thirty-four (34).

▪ **February 2014 Site Inspection:** Pages thirty-five (35) – thirty-six (36)

▪ **April 2015 Site Inspection:** Pages thirty-seven (37) - thirty-eight (38)

▪ **May 2016 Site Inspections:** Page (39)

## Analysis to Date

The stainless steel DWD units installed on the Missoula walking path are continued to be replaced with cast-iron units as they become damaged by apparent snow plow activities. Although stainless steel DWD's are durable products they will not perform well if snow removal practices involve fixed blade plow equipment.

The cast iron DWD's installed in Three Forks are performing well with no appreciable performance issues to report. These units are maintained in the winter with trucks using mounted plow blades.

**Missoula MT – Clements Rd. & North Ave: Existing Asphalt Installation - 2012**

🡸🡻 Sample images of the DWD panels used on the installation.

Panels were brick red powder coated stainless steel. Sizes used on the project range from 2'x5' and 2'x4' with a two (2") flange.

Sixteen (16) DWD's sites were installed on this project.

🡅 Side view of panels showing 2" and 1¼" flanges.

🡇 The contractor begins by using the panel as a template and a hand-held power cutter scores the perimeter of the panel.

½" in depth.

debris.

🡅 Construction adhesive (Loctite Pro-Line 3X) is applied liberally in the joints.

🡇 Close-up of the level of adhesive applied to the sawed groove. Also note how the cut goes beyond corners of the panel groove (red arrow).

🡅 Adhesive is applied to the interior of the panel placement, not for additional adhesive support but to eliminate the air pocket inherent with this type of DWD installation

🡇 The panel is placed within the grooves.

🡅 The contractor sets the panel by walking on it.

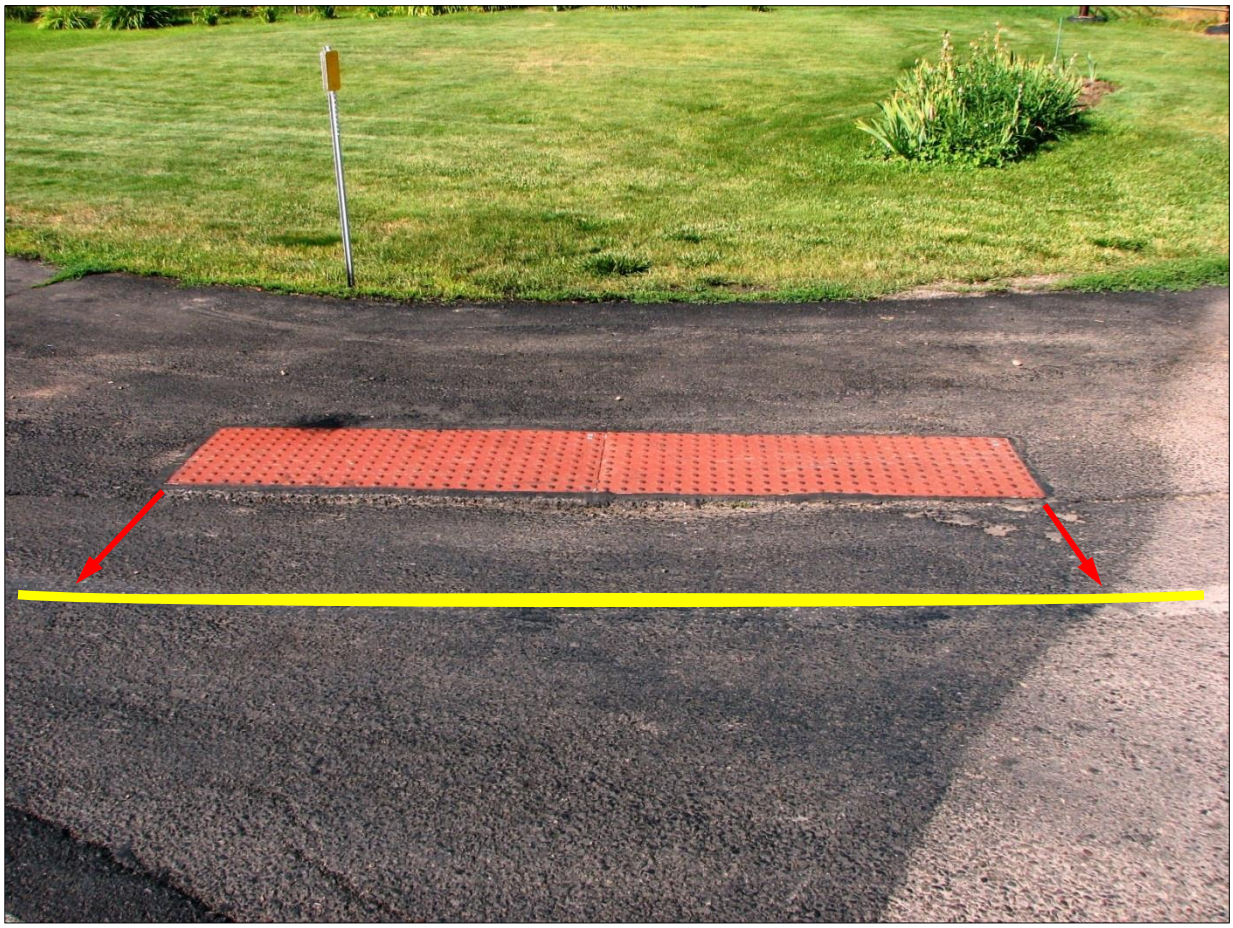
🡇 A mallet may be used to further seat the panel to be flush as possible to the pavement.

🡅 Conventional driveway patch is used to feather out the edge of the panel and the surrounding pavement surface.

🡇 Completed truncated dome installation. Since the bike path will be sealed the paper covering will be left on and removed after the sealing.

Sample images of MetaDome DWD with paper removed after asphalt sealing.

**Supplemental**

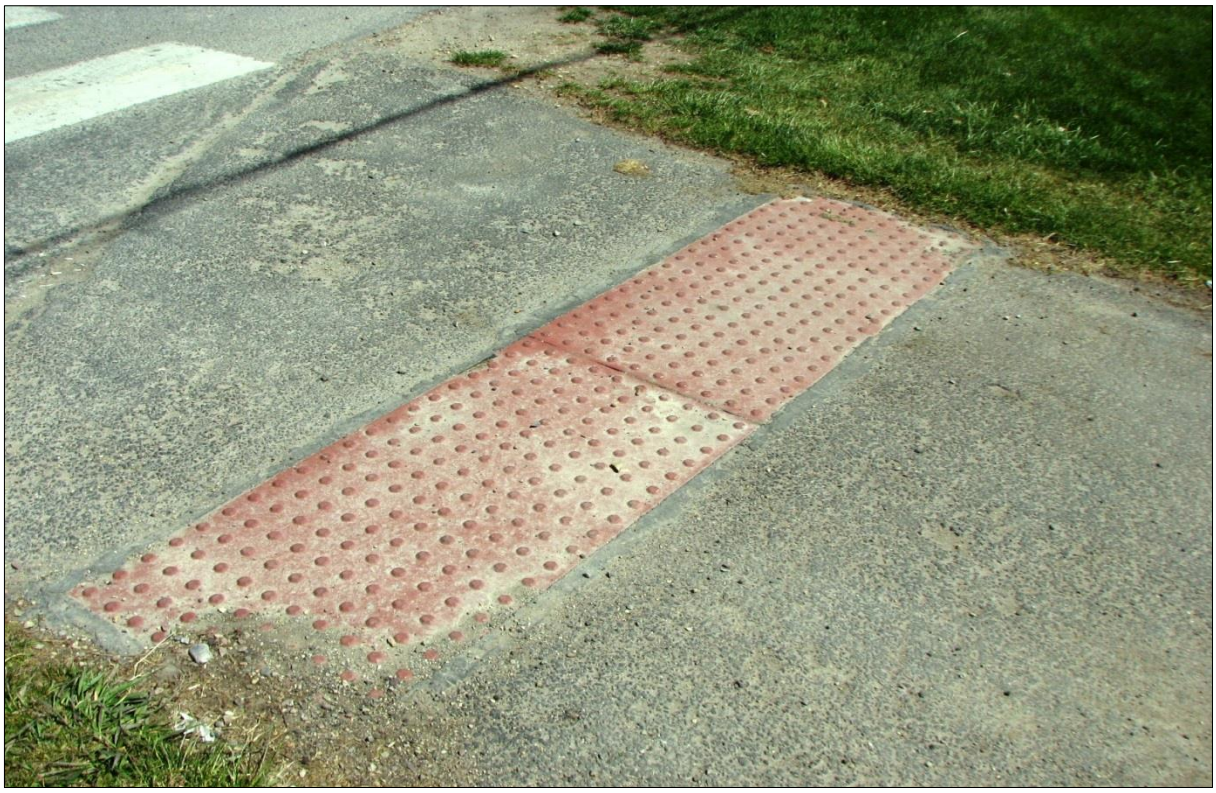


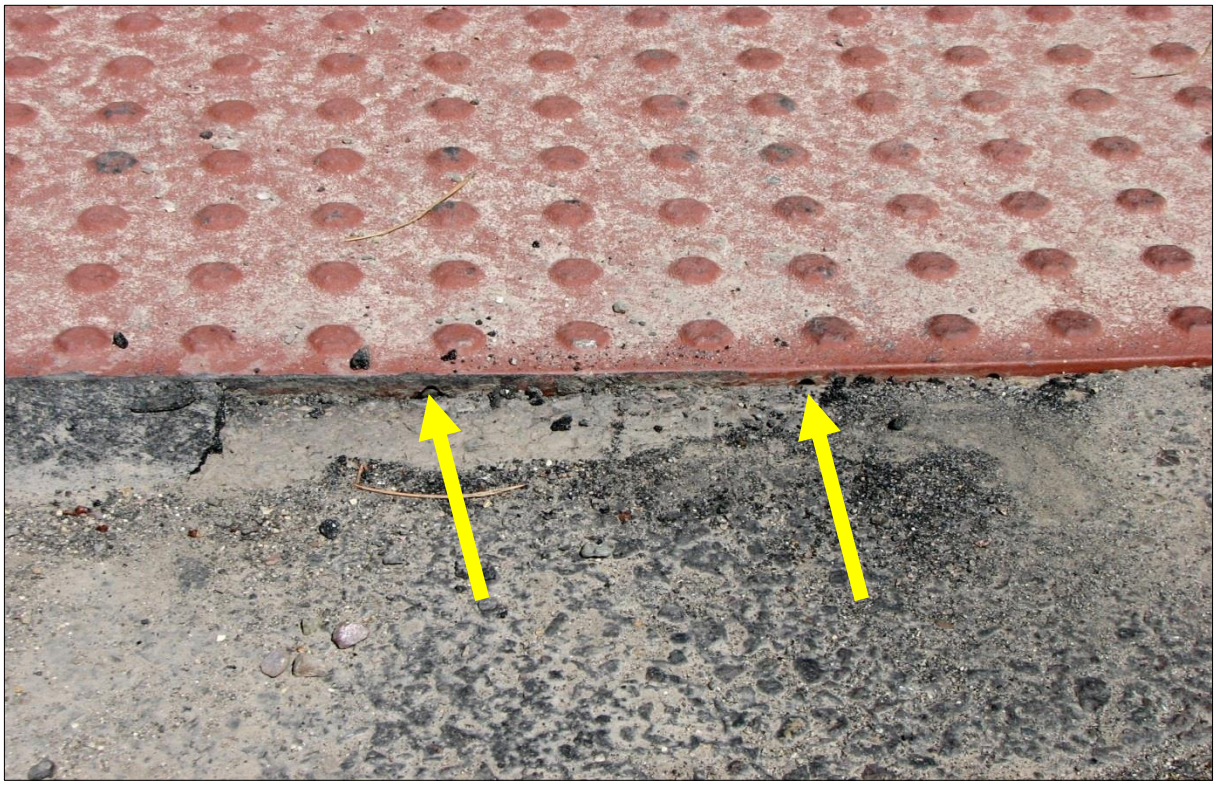
🡅 The manufacturer's representative had a concern over the placement of the DWD located on the southwest corner at the intersection of North Ave. and Clements Rd.

As seen in the image above the panel is set on a radius within several feet of the white line (or fog line), The yellow line in the image is superimposed since sealing the bike path no longer made the stripe visible. The issue is the location of the panel may be prone to be plowed. Although the height of the panel lip to pavement is within ADA tolerance (<¼"), a plow blade hitting the panel at the right angle could damage the unit.

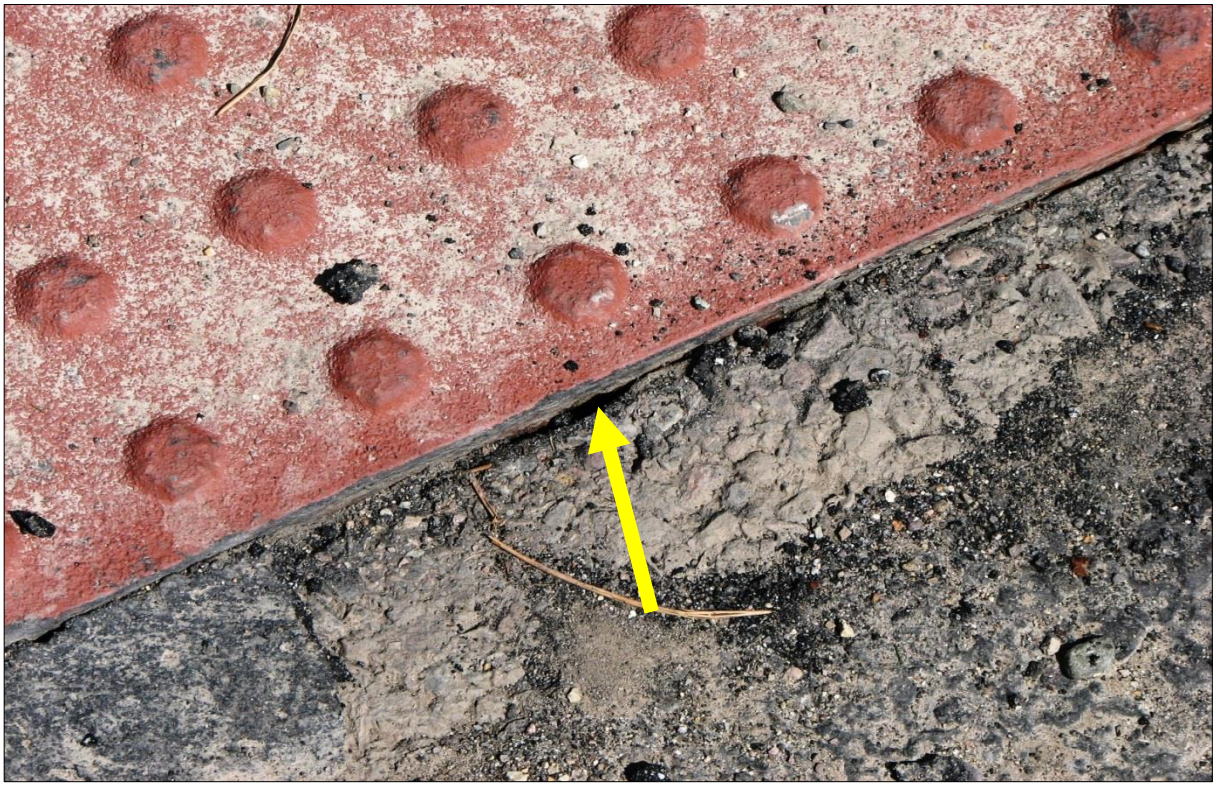
**April 2013 Site Inspection: Missoula**

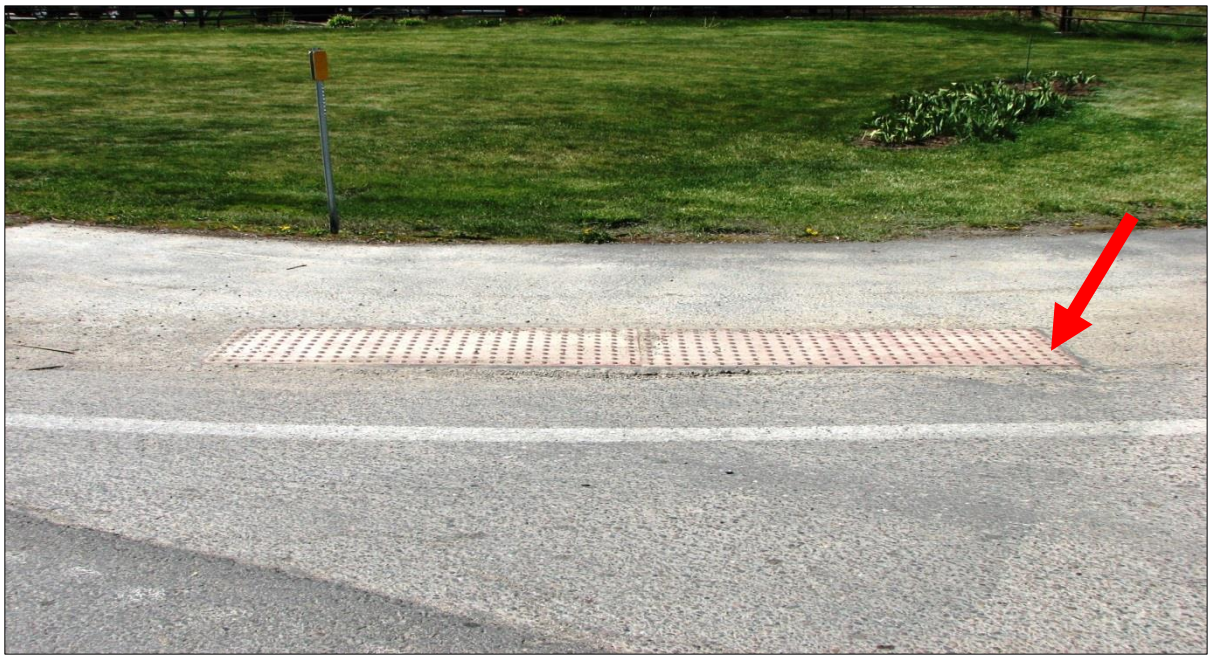
🡅 🡇 Intersection of Mount Ave. and Clements Rd; east side of installation. The DWD's at this location were visually in good shape.





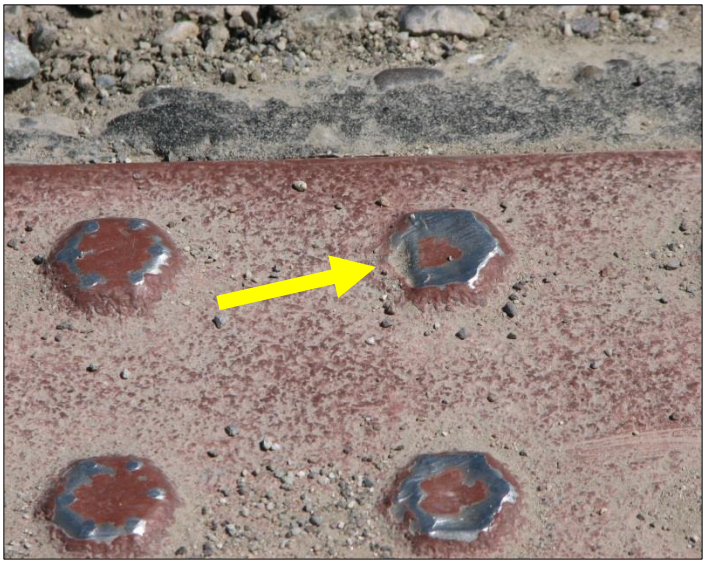
🡅🡇 The driveway patch used in the installation is beginning to crack and delaminate as seen in the above and below images. This is exposing the flange openings (yellow Arrow) to potential entry of moisture which may promote freeze/thaw activity.





🡅 **Intersection of North Ave. and Clements Rd**. View of DWD on west side of intersection.

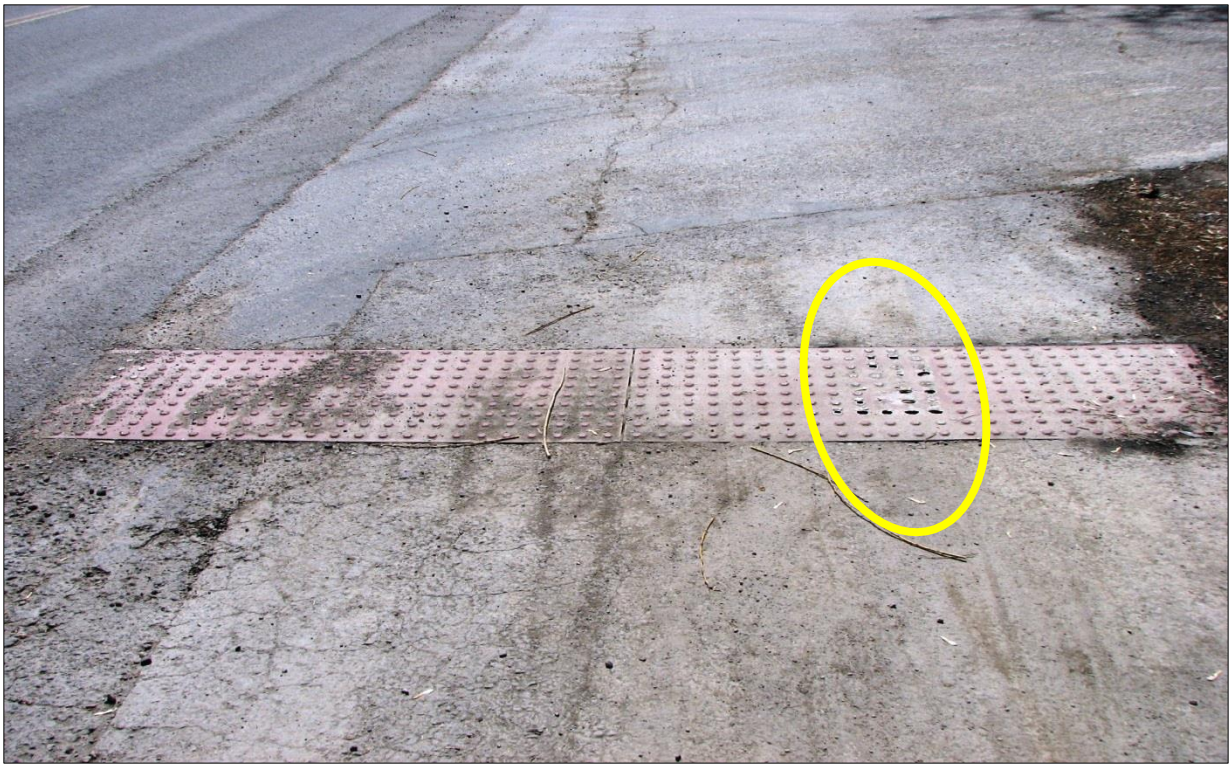
🡄 It was observed on the leading edge of the northeast corner (red arrow) of the DVD had visual plow damage of either the scraping off of the powder coating or actual depression of the domes.

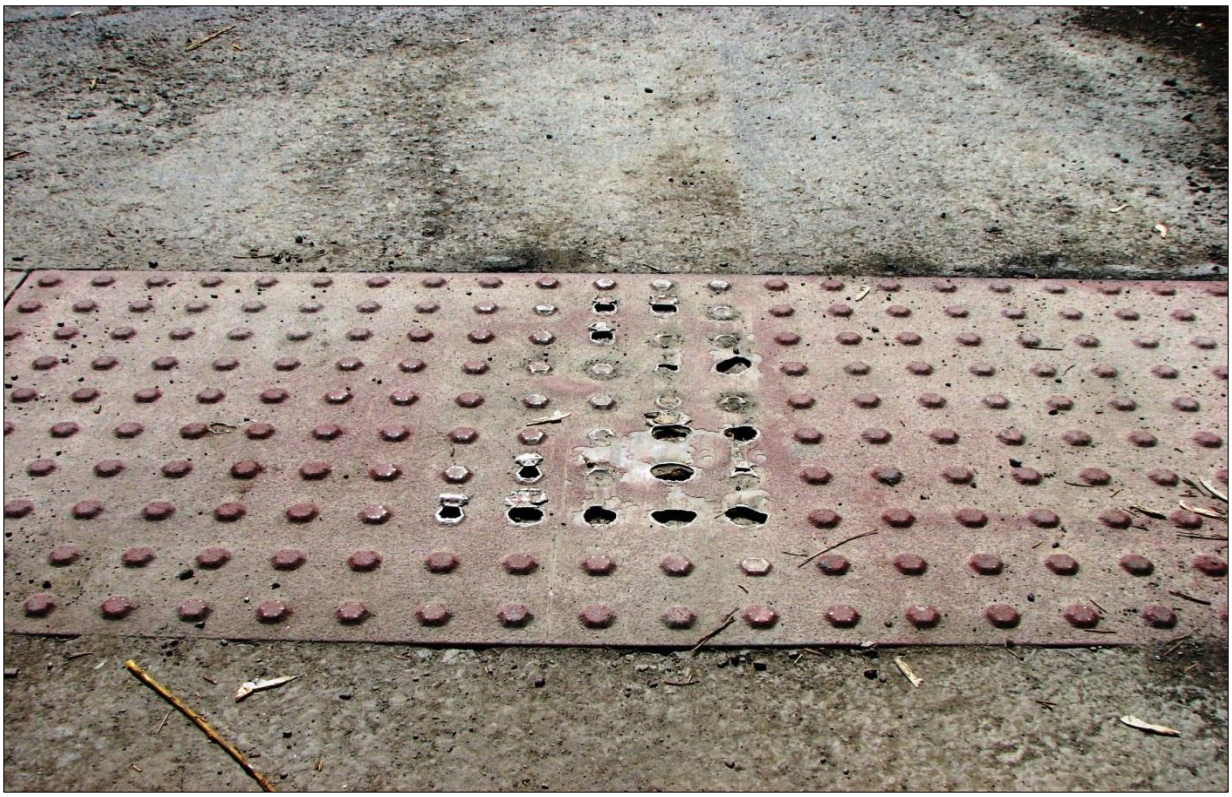


🡄 A close-up of the damage done to the panel domes. The yellow arrow shows the direction of the hit.

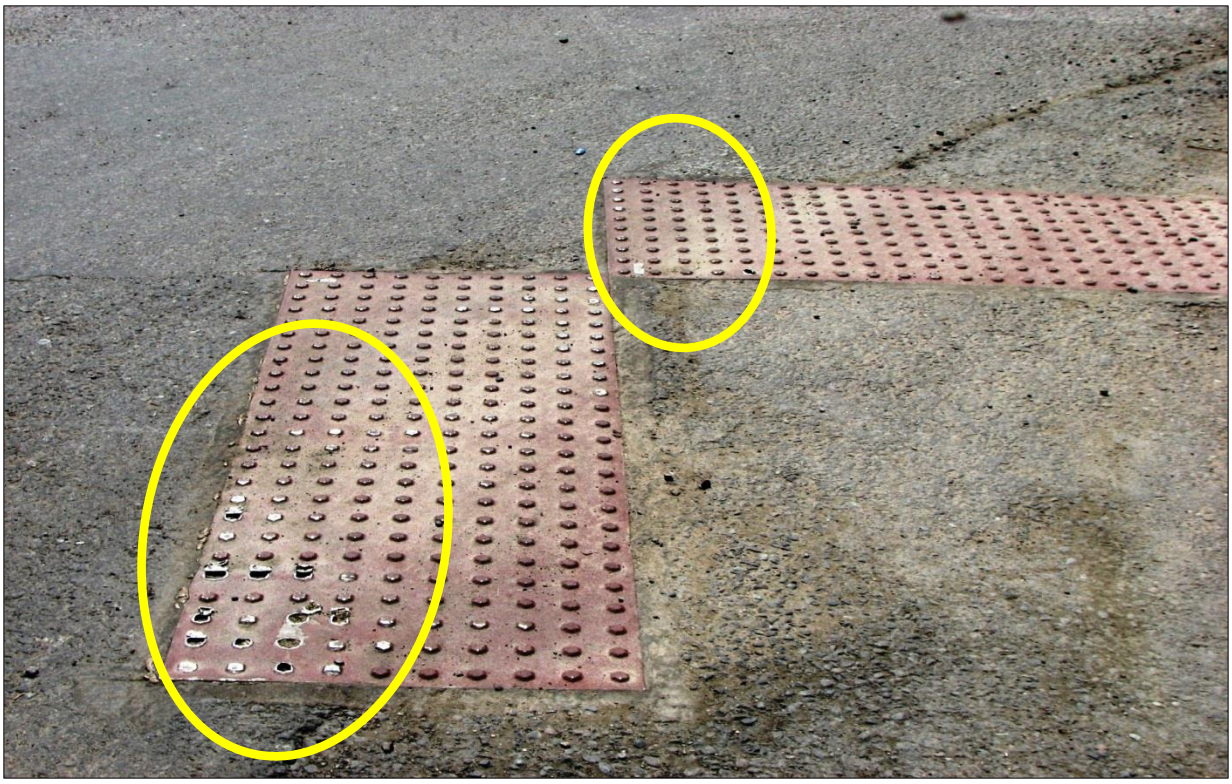
🡅 Southeast DWD placement at intersection of North Ave. and Clements Rd. Panels are in good condition.

🡇 **Intersection of Colonial Ave. and Clements Rd.** West panel placement has severe plow damage of sheared or flattened domes as defined in the area of the yellow circle.





🡅🡇 Several close-ups of the damaged domes. Some domes were flattened; others completely removed or peeled back as seen in lower image. The peeled back domes may be a safety hazard since they are razor sharp to the touch.



🡅🡇 **Intersection of South Ave. and Clements Rd – West placement**: Additional damaged panels by plow as defined in the area of the yellow circles. Lower image is a close-up of the damaged domes.

🡅🡇 All panels which exhibited damage from plowing activities were located on the west side of the project with the pedestrian/bike path essentially an extension of the roadbed as seen from these images. This allowed the plow truck to treat the path as an extended lane. The east side DWD installations is a basic widened sidewalk which to date has no visual damage since it can be assumed it was not cleared by fixed-blade.

## February 2014 Site Inspection: Missoula

**Intersection of South Ave. and Clements Rd – West placement**: Due to the damage to the DWD's as documented on the April 2013 inspection; it was elected to remove the stainless-steel panel and replace them with cast iron units embedded in portland cement concrete (PCC).

🡅 **Intersection of North Ave. and Clements Rd – Southwest placement**: This unit was also replaced with cast-iron DWD's.

🡇 **Intersection of North Ave. and Clements Rd – Southeast placement**: Original stainless steel DWD exhibiting heavy plow damage at the corner (yellow circle).

🡸 Close-up of the Metadome cast-iron MetaPanel DWD's replacing the damaged stainless-steel units.

These are the same panels being used on the Three Forks project which were placed in new asphalt on October 2012.

🡸 Another example of a replaced DWD at the intersection of Spurgin and Clements Rd. (southwest corner).

As the stainless-steel panels begin to exhibit distress or are actually damaged, they are replaced with cast iron units in a perimeter of portland cement concrete (PCC).

🡸 This stainless steel DWD at the intersection of Spurgin and Clement has signs of slight plow damage and the asphaltic patch used to seal the perimeter has mostly deteriorated exposing the DWD lip.

**April 2015 Site Inspection: Missoula**

🡸🡻 General representation of condition of DWD's along Clements Rd.

This unit located at Spurgin Rd. road is in good shape but does have minimum plow damage indicated by the yellow arrow.

🡸 Another unit at the Spurgin Rd. intersection that has been replaced by cast-iron DWD's.

🡸 DWD's at the Mound Ave. intersection.

🡐 Another unit replaced with cast-iron at the Mount Rd. intersection.

As stated in earlier site inspections the District is replacing the damaged stainless steel DWD's with cast iron units.

🡐🡻 Intersection of Clements Rd. & North St.

Condition of plow damaged DWD as documented in February 2014.

The below image of the same DWD taken in April 2015.

**March 2016 Site Inspection: Missoula**

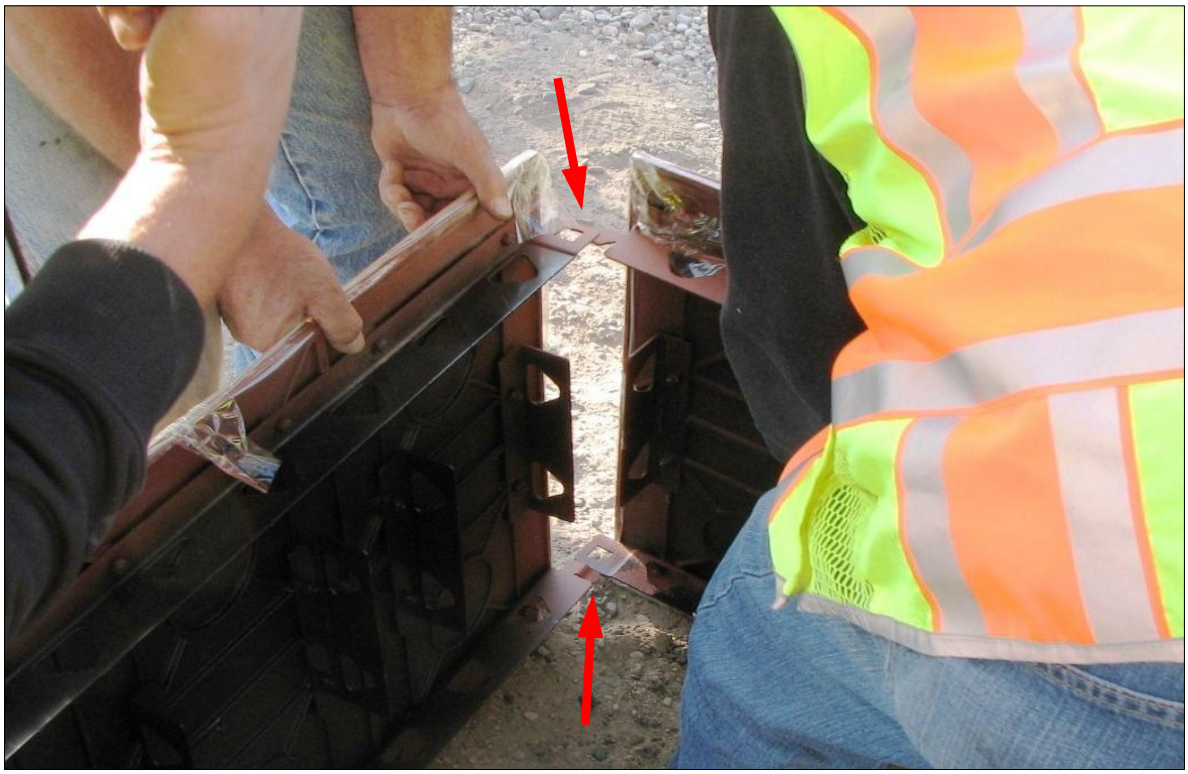
🡸 Example of cast-iron DWD's replacing the damaged stainless-steel units.

🡸 General example of stainless steel DWD still in service.

🡸 Example of the type of distress seen on this project with stainless steel DWD apparently caused by snow plow maintenance.

**Three Forks: New Asphalt Installation – October 2012**

🡅🡇 Sample images of the MetaDome Cast-DWD 2'x3' cast iron panels. The panel relies on perimeter and interior embedment flanges to secure the plate's in-place once the pavement material has cured or set.



- ↑ Panels are connected by male and female tabs (red arrows) that when inserted into each other creates a hinge.
- ↓ Once the tabs are properly in place the panels fold back to keep the units in place as they are carried to the installation site.

🡅 The asphalt is trenched out to an approximate depth of one inch (1"). Trench width was expanded 5-6 inches from the foot print of the panel.

🡇 Using a hand operated asphalt vibroplate (plate compactor), the contractor compacted the interior of the trench (sub-base) prior to placement of the panel.

🡅 The panel is centered and positioned within the prepared trench.

🡇 The contractor initially sets the panel by walking on it.

🡐 The trenched asphalt is then spread back evenly around the panels.

The vibroplate compacts over the panels first, and then edges out beyond the panel perimeter.

🡐 Here compaction is extended several feet beyond the panel edge.

🡐 Completed plate compaction.

Note: In using the vibroplate for compaction of the sub-base and the surface areas on both sides of the plates before the final compaction phase, allows the asphalt to be rigid enough to support the weight of the larger dual-roller as it approaches the edges of the plates.

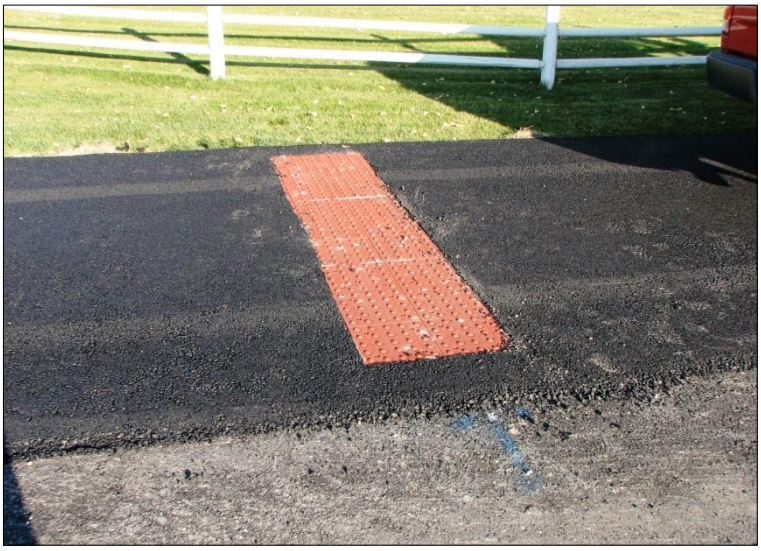
The operator of the roller compacter is directed to approach the warning fields for the first two passes at an angle to the plates for final compaction. This enables the edge of the roller to easily get on top on the plates and hold them in place as it continues to cross over them.

As stated earlier the initial compaction by the vibroplate of the panel sub-base and surrounding surface areas, allows the DWD to be locked firmly in the asphalt to prevent movement or displacement of the panel by the roller as it crosses over.

**Completed Installation**

🡐 Close-up of completed ADAsphalt DWD cast iron panels.

All panels installed on the project inspected were visually placed well in the pavement with plate edges either flush to the asphalt surface of several millimeters below. All plates appeared securely anchored.



🡐 Overview of whole panel installation.

🡐 View of completed bike path and panel installation at the intersection of South Illinois St. and the I-90 frontage Rd. looking south towards the fairgrounds.

Eleven (11) DWD's sites were installed on this project.

## Supplemental

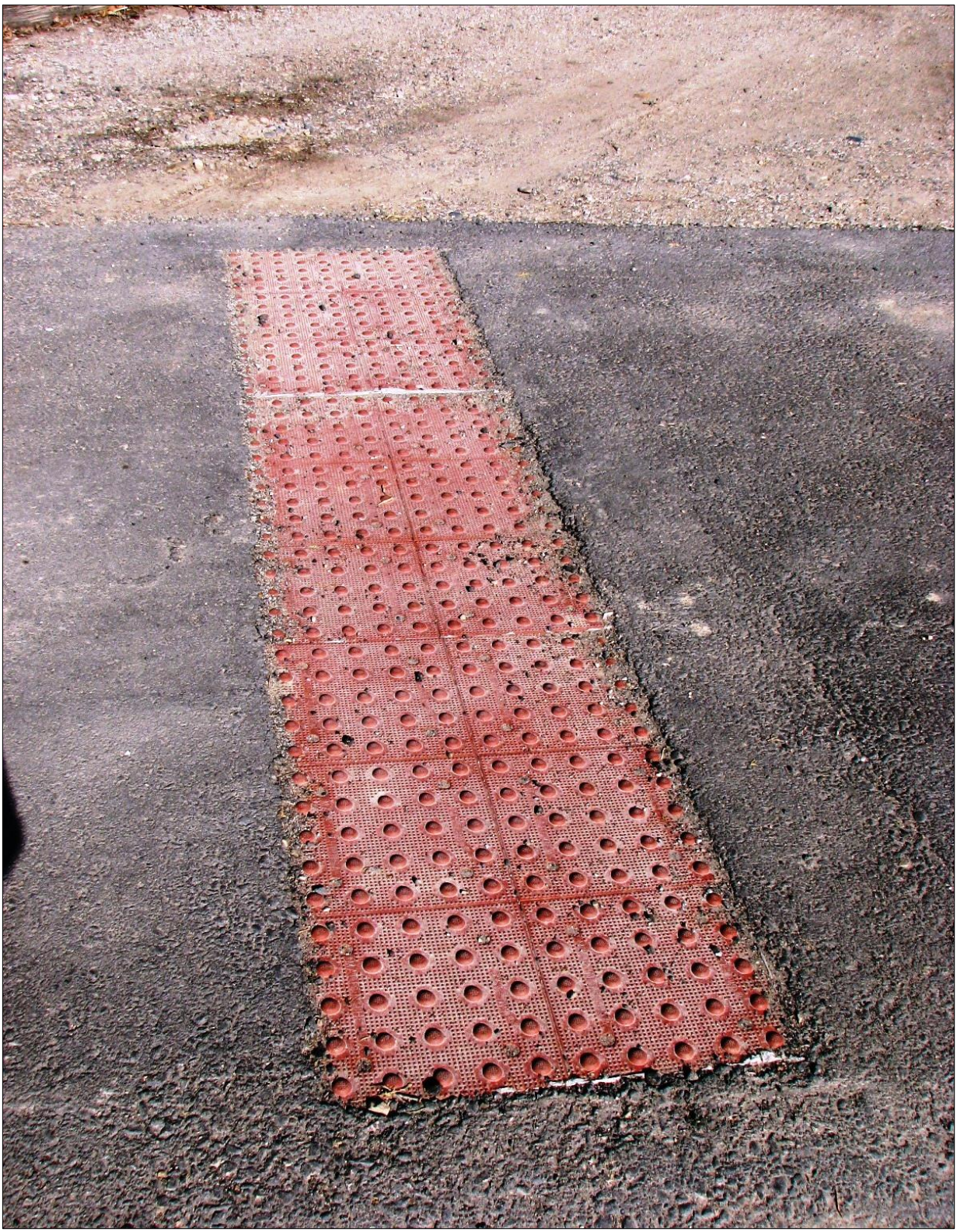
The information contained within this report on the installation at the Three Forks project reflects the best practice used to install this type of DWD in newly placed asphalt.

The installation of the bike path and detectable warning devices started late in the day (around 5:30 PM.) It was obvious the contractor was in a hurry to get started and once the paving of the asphalt began, they instigated the placement of the DWD's at several locations. Initially the manufacturer's representative (MR) had a difficult time in conveying to the contractor the correct method of installing the MetaDome units. Eventually, after several haphazard attempts to set the devices, the contractor was adequately placing the DWD's per the MR's direction.

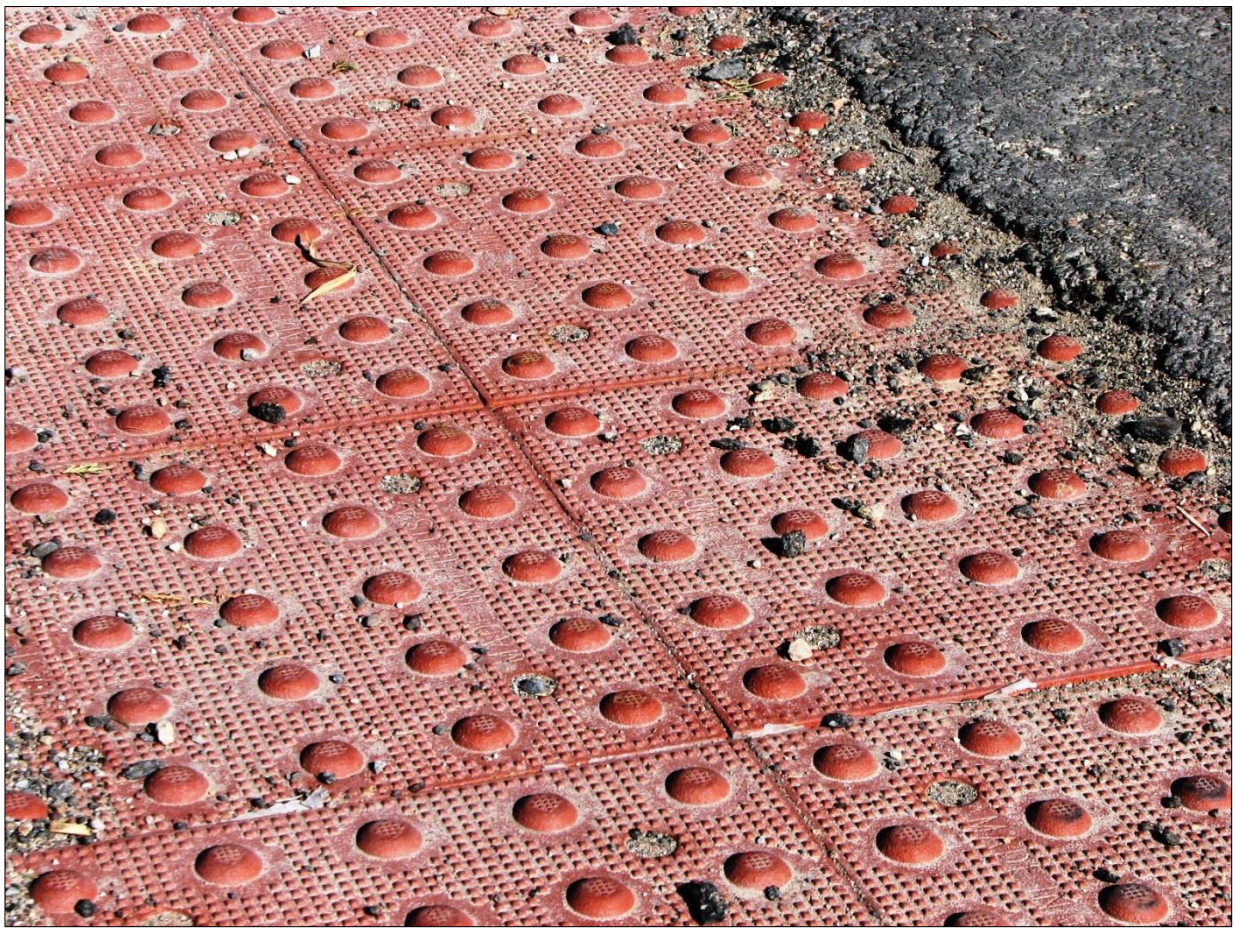
Another issue which modified the way these devices were installed was the gradation of the asphalt mix. Other states where these units have been installed may use gradations of aggregate smaller on bike or pedestrian paths than would be required for mainline applications. The asphalt mix used on this project was the same as being used on the roadways. This larger aggregate did modify the way these units were installed as described in the report.

Regardless of the initial confusion of how to correctly install the DWD, all site installations appear to be sound. Upon a visual inspection the following day, the DWD plates are firmly anchored to the pavement. As evidence this was witnessed by observing the contractor' truck drive over the DWD's as they were removing the paper covering from the cast iron plates.

**April 2013 Three Forks Site Inspection**



🡅 Representative image of the cast-iron DWD placement. All sites exhibited no visual distress. All eleven (11) panels were in tight with no evidence of debonding or faulting with the asphalt cement (AC) base.



🡅 Close-up of panel domes. It is unclear on how the Three Forks installation was maintained if not at all. The powder coating on all sites were undisturbed, if a fixed-blade had been used you may see some abrasion on the exposed domes.

**February 2014 Three Forks Site Inspection**

🡸🡻 The images on this page represent the average condition of the cast-iron DWD's.

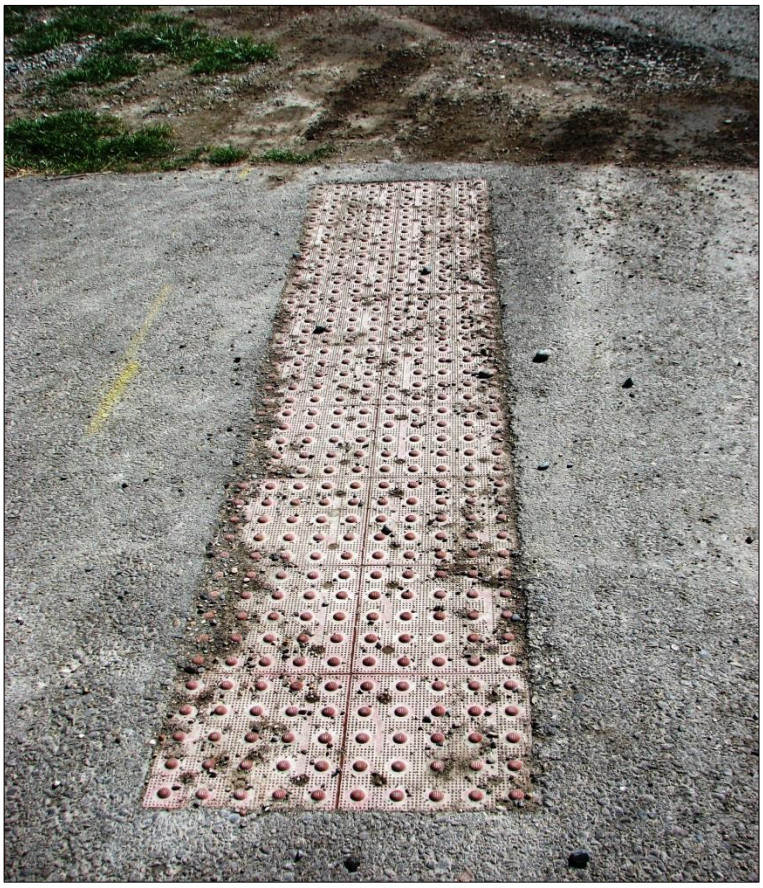
All units on the project exhibited no distress, movement or debonding from the asphalt cement (AC) base.

🡸 This is the DWD unit at the northwest corner of the entrance of the Three Forks Market on Jefferson River Rd.

As you can see this unit is actively being driven by vehicles entering the store's parking lot.

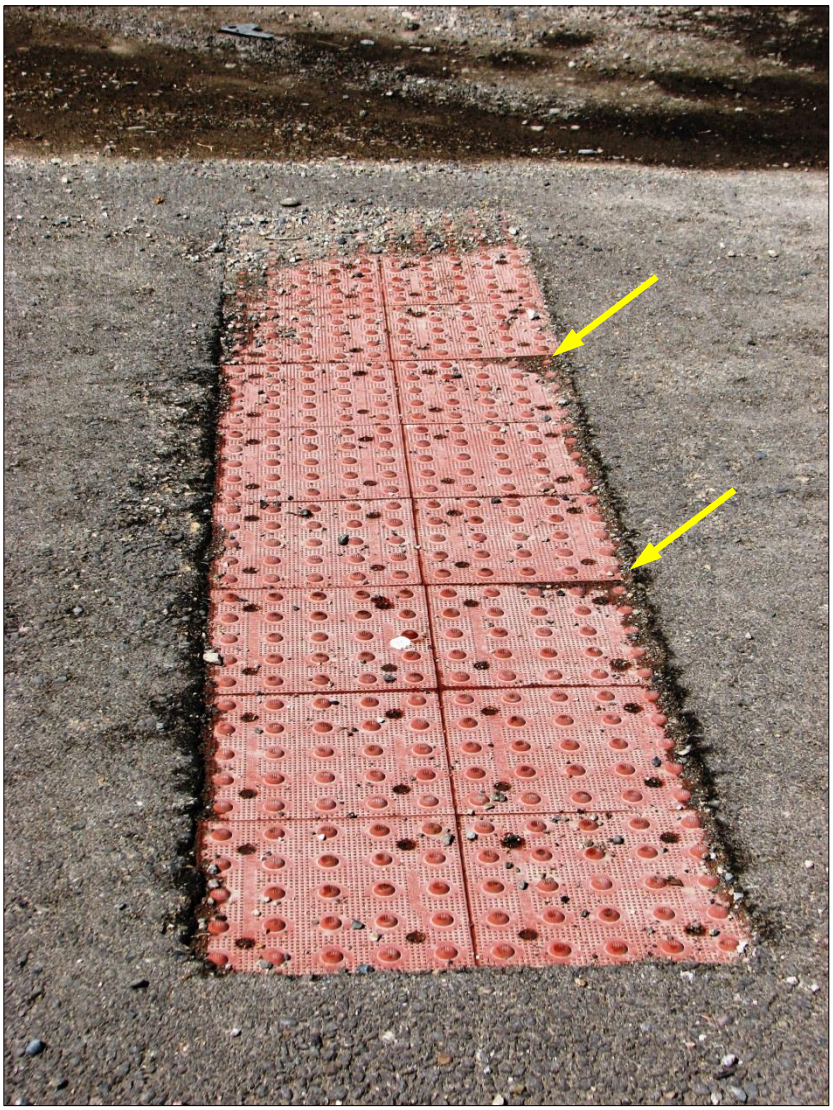
🡅 Per information received from the Three Forks Road Superintendent, the bike/walk pathway snow removal is maintained by truck-mounted snow plow. They report no issues with plow blade moving over the DWD's

**April 2015 Three Forks Site Inspection**



🡅🡄 Representative images of the general condition of the project DWD's.

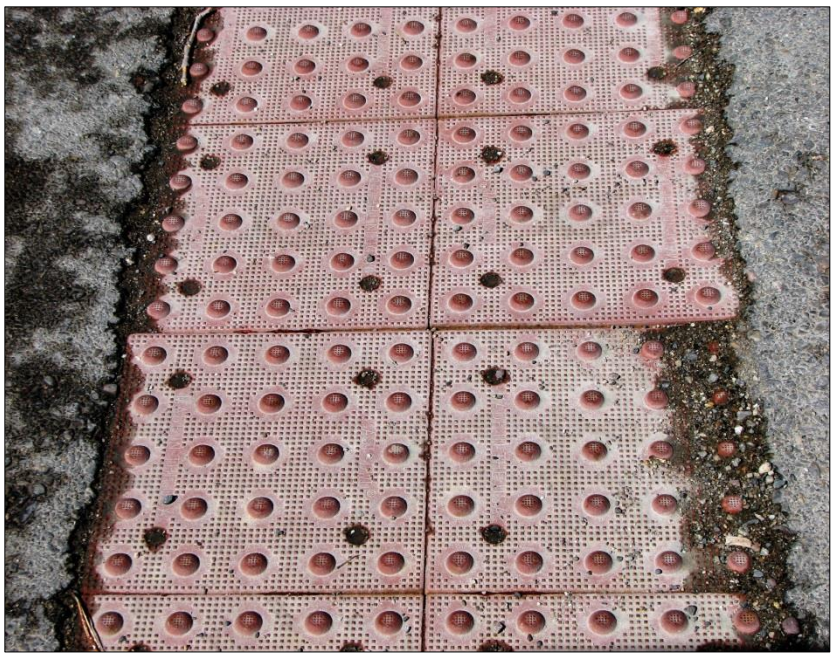
All units are intact with no appreciable performance issues to date.



🡐 One DWD unit had a noticeable depression (yellow arrows) at the edge of the connection plates.

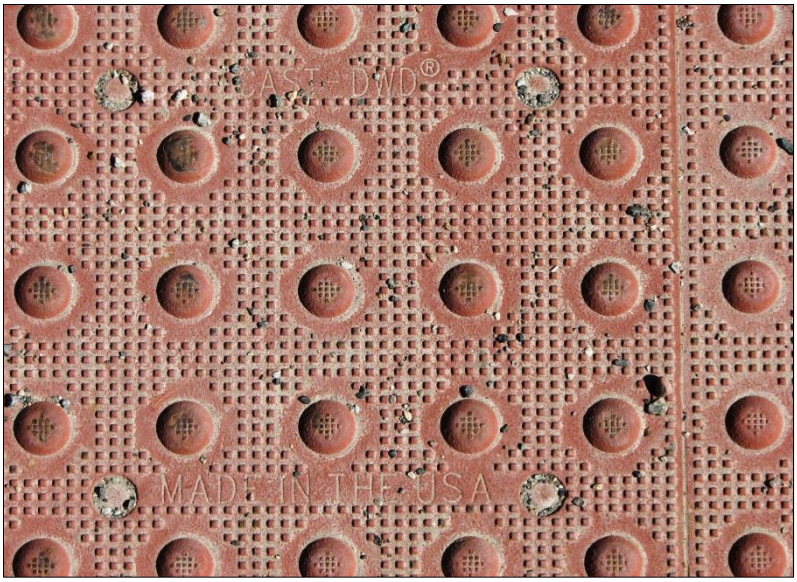
Since snow removal is done by truck-mounted plow this apparent faulting may be the cause of the vehicle weight pushing the edge of the DWD down.

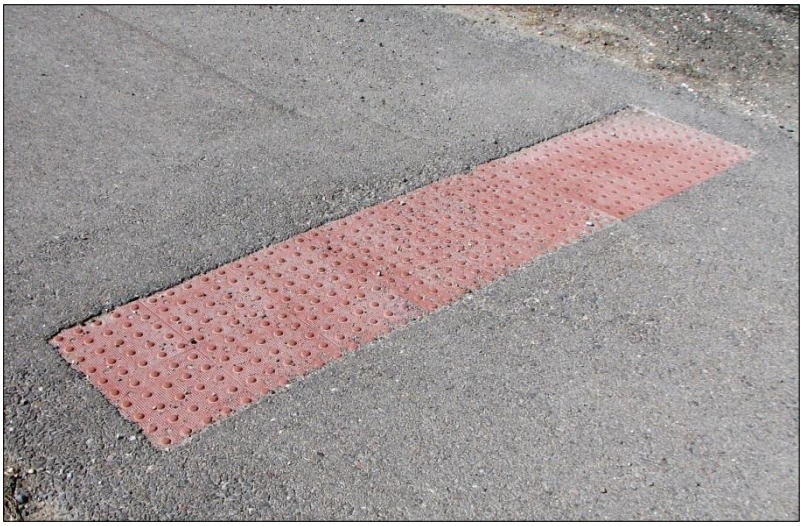
The unit plates are connected by male/female tabs (see page 25), which may limit the indent to the extent as seen in this image.



🡐 Close-up in the shift of the cast-iron plates.

**May 2016: Three Forks Site Inspection**



🡸🡻 Images represent general condition of cast iron units.

No distress to report to date.

**Disclaimer**

The use of a product and/or procedure in the course of an evaluation does not constitute an endorsement by the Department nor does it imply a commitment to purchase, recommend, or specify the product in the future.

Data resulting from an assessment of a submitted experimental feature is public information and will not be considered privileged. The MDT may, at its discretion, release all information developed during the in-service performance evaluation.