Evaluation of Hydraway Edge Drain on Pennyrile Parkway

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Kentucky Transportation Research Program
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in cooperation with
Transportation Cabinet
Commonwealth of Kentucky

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July 1988
INTRODUCTION

In April 1988, a request was made by the Kentucky Department of Highways to investigate a premature pavement failure on the Pennyrile Parkway in Webster County. The section was comprised of a rigid pavement that had been broken and seated, and overlayed with 4 inches of asphaltic concrete. Geocomposite edge drains (Hydroway) had been installed at the time the pavement was rehabilitated (Fall of 1987).

In the 8-mile length of the project, there were approximately 40 areas that had been patched or required patching. What appeared to be fine material from the broken concrete pavement or the dense-graded aggregate base was pumping through the asphalt surface in various places (Photo 1). Water was also pumping up between the shoulder and the outside driving lane at the old construction joint (Photo 2).

Photo 1. Fines pumping through the pavement.
PAVEMENT EXCAVATION

On April 19 and 20, 1988, the pavement was opened for observation in two locations. The following photos and accompanying descriptions illustrate the conditions present at Milepost 58.2.

Photo 2. Water pumping through the pavement.
Photo 3. The 4-inch asphaltic overlay has been removed exposing the old broken concrete pavement. Note water standing in the excavation.

Photo 4. The exposed broken concrete surface showing water standing in the debris.
Photo 5. Excavation of the Hydroway edge drain.

Photo 6. The excavated edge drain with water standing behind it, and additional water in the trench.
Photo 7. Excavated outlet pipe showing partial crushing and a small "hump" in the pipe.

BORESCOPE PHOTOGRAPHS

The borescope was used on three dates to "look" inside the edge drains to determine if damage and/or silt were present. It should be noted that it is difficult to take photographs with the borescope, therefore, details in some of the photographs may be difficult to see. Also, brief field notes on the edge drains at various locations and dates are included in the attached appendix.

Photos Taken on May 11, 1988

Photo 8. This photo shows how the material should appear. Note the two rows of columns are parallel, and very little silt is present.
Photo 9. This shows the material to be fairly clean, but the back wall (left side of photo and the part of the drain farthest from the pavement edge) is partially crimped, and the rows of columns are not parallel.

Photo 10. This shows the drain badly silted.
Photo 11. This shows the drain almost blocked with silt.

Photos Taken on May 11, 1988

Photo 12. This shows the back wall crimped and the rows of columns are not parallel.
Photo 13. Two rows of columns are completely crushed together.
Photos Taken on May 26, 1988
(Approximately one week after flushing)

Photo 14. This shows damaged drain with considerable silt remaining after flushing.
Photo 15. Illustration of silt remaining after flushing.
Photo 16. Damaged drain relatively free of silt.

Photo 17. Badly damaged drain. Two rows of columns are completely crushed together.
DISCUSSION AND CONCLUSIONS

It appears too much compactive effort is damaging the Hydraway drain. It is understood that the drain is designed to flush out all of the silt material that washes through the fabric. However, it appears this could not be done effectively if obstructions caused by crimping and crushing of the material cause the velocity of water in the drain to decrease, allowing the silt to settle. Also, if the outlet pipes to the headwalls have an improper gradient or are partially obstructed by crushing, silt will be deposited in the outlet pipe and in the drain panel itself. The metal screens over the mouth of the outlet pipe in the headwall also appeared to cause silt to be deposited behind it (Photo 18). A screen with a more open mesh would help prevent silting. Future projects have used screens having wider mesh.

Photo 18. Silt deposits behind outlet screen.

A chemical analysis was performed on the silt that had collected in the drain. Only two samples were tested. One sample was obtained from the silt collected in the top portion of the drain and the second sample was obtained from the bottom of the drain. The specimen from the top portion of the panel contained a large proportion of silica. This indicates debris from the broken concrete. The bottom specimen contained mostly calcium carbonate indicating fines washing from the dense-graded aggregate.

It appears the Hydraway panel may have an inherent weakness in the vertical plane. This weakness permits the panel to bend or crush under heavy compaction. This is further confirmed by photographs taken from other projects in the state where Hydraway was used. The following photographs are from the Western Kentucky Parkway, Ohio County (Photo 19) and Interstate 65, approximate Milepost 56 (Photo 20).
It should be noted that there was little of no silt build-up at both sites.

It is recommended that less compaction be used on future projects that use the Hydraway drain panel.

There is concern about the ability of the Hydraway drain panel on the Pennyrile Parkway to perform satisfactorily in the future. Although the panels have been flushed, it appears all silt may not have been removed. Furthermore, with the panels partially blocked from crushing and crimping, it appears there is a very real possibility the drain may clog again. It is recommended the drains on the Pennyrile Parkway be replaced with new material. Hopefully, this would insure better performance of the drain in the future.
APPENDIX A
Milepoint 57.15  A 3/4 - inch hole was opened near the headwall using a masons drill. The edge drain was clear of silt.

Milepoint 57.19  The edge drain was clear of silt, but partially collapsed.

Milepoint 57.2  The edge drain was completely open from top to bottom.

Milepoint 53.6  The first 9 rows were clear. We were unable to view the bottom 5 rows of the edge drain with the borescope.

Milepoint 53.61  The top portion of the edge drain was partially collapsed. The bottom 6 or 7 rows were entirely collapsed.

Milepoint 53.56  The bottom 5 rows were collapsed due to crushing.
Inspection after flooding/washing of Hydraway

Milepoint 58.18 Material was clean and drain was open for the first 6 rows from the top. Below the sixth row, the material was compressed into a J-type pattern, and completely silted. Only half of the edge drain was open to flow.

Milepoint 58.28 After coring the pavement, silty water from the edge drain filled the hole before the borescope could be used. An attempt to borescope the drain was not successful, but later in the day we were able to borescope the drain because the silt had settled. The drain was slightly compressed but open. Water was flowing up through a patch in the asphaltic concrete approximately 30 feet south.

Milepoint 58.32 Water was observed coming up at the shoulder and pavement interface.

Milepoint 58.35 Material was open all the way to the bottom approximately 30 minutes before flushing. Once the water reached the inspection point, small particles could be seen washing away.

Milepoint 58.4 Water was being injected into the drainage system.
* Approximately a week after flushing.

Milepoint 54.7  Some silt was present but no blockage occurred. Thin layers of silt particles were observed on the plastic edge drain material. The top 8 rows were functional, but the bottom 6 rows were crushed. The material should carry 57% of its total volume. The hole was drilled in a good section of the pavement.

Milepoint 54.8  The pavement was in good condition. The first 8 rows of the edge drain were clear of silt. The bottom 6 rows could not be viewed due to a crimp in the material. In an attempt to get a better view we flushed the edge drain with water. Between rows 8 and 9 the fabric was buckled.

Milepoint 55.1  The inspection port was installed in a swag between failures. The top of the edge drain was rolled over as a result of breaking and seating. The bottom 1/3 of edge drain was collapsed. Between the seventh and eighth rows, the plastic backing had been completely folded into a V shape. The displacement of columns could be seen some distance along the drain.