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Research Report  
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EVALUATION OF HYDRAWAY AND  
ADVANEDGE PAVEMENT EDGE DRAINS  
ON THE MOUNTAIN PARKWAY

by

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## **INTRODUCTION**

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Since 1985, Kentucky has used prefabricated edge drains on many of its major highways. Three brands have been installed to date (Hydraway, Advanedge, Akwadrain). By far, the largest quantity of material used has been Hydraway. In the past year, considerable effort has been expended in observing these materials and their behavior in the field. Problems have developed with the Hydraway material, some of which were documented in Research Report No. UKTRP-88-15 (Evaluation of Hydraway Edge Drain on Pennyriple Parkway). This brief report documents the history of edge drain installations, recent observations made on the Mountain Parkway in Powell County, and makes some recommendations based upon experience gained to date.

## **BRIEF HISTORY**

In 1985 Transportation Research Center investigators began studying the performance of the Hydraway edge drain and the four-inch perforated pipe drain on I-64 in Franklin County. The Hydraway drain was installed in a four-inch trench which was backfilled with a coarse, clean sand, and the four-inch pipe was placed in a one foot trench and also backfilled with sand.

To evaluate the effectiveness of both the Hydraway drain and the conventional pavement edge drain (four-inch pipe), outflow water volumes were measured with calibrated tipping buckets. A tipping bucket was placed at a discharge pipe on both systems which were located in similar hydrologic locations. After evaluating the discharge data, it was apparent that the Hydraway drain responded more quickly to precipitation and discharges a greater volume of water. Although there are no data to confirm this, it appears the conventional perforated pipe edge drain backfill medium may have to be saturated before it discharges.

During March 1987, a section of the Hydraway drain was excavated and inspected. The Hydraway drain showed no signs of wear or clogging after two years of service.

On September 22, 1987, four tipping buckets were installed at headwalls of the Hydraway drain and Akwadrain systems along I-64 in Fayette County. The discharge data indicate that the Hydraway drain discharges a greater volume of water, over a given period. The response time of the two drainage systems to rainfall appears to be about the same.

In April 1988, a request was made by the Kentucky Department of Highways to investigate a premature pavement failure on the Pennyriple Parkway in Webster County. The section was composed of a rigid pavement that had been broken and seated, and overlaid with four inches of asphaltic concrete. Hydraway had been installed at the time the pavement was rehabilitated. In the eight-mile length of the project, there were approximately forty areas that had been patched or required patching. What appeared to be fine material from the

broken concrete pavement or the dense graded aggregate was pumping through the asphaltic surface in various places. Water was also pumping up between the shoulder and the outside driving lane at the old construction joint.

On April 19 and 20, 1988, the pavement was opened for observation in two locations. Water was standing in the rubble of the broken concrete. The Hydraway drain was then excavated and water was observed ponding between the edge drain and the adjacent road structure. Several of the outlet pipes were excavated and it was apparent that several of the pipes were partially crushed and were not placed to the proper grade.

During May 1988, Transportation Research Center personnel inspected numerous areas throughout the eight-mile study area with a borescope. The borescope was used on three dates to "look" inside the edge drains to determine if damage and/or silt were present. In several areas, the support columns were bent (tilted), some rows of columns were completely crushed, the rigid to semi-rigid plastic backing had been bent, and the inner core had large amounts of silt.

Findings from the Pennyriple Parkway failure indicated that too much compactive effort was damaging the Hydraway drain during installation. It was apparent that the damaged Hydraway core was decreasing the velocity of the water in the drain, allowing silt to settle. It was also apparent that the improper gradient and crushed outlets were allowing silt to be deposited in the outlet pipe and the drain itself. The metal screens over the mouth of the outlet pipes in the headwalls also appeared to cause silt to be deposited behind them. Later projects have screens having wider mesh.

From the findings on the Pennyriple Parkway investigation, it was apparent that the Hydraway panel may have an inherent weakness in the vertical plane. This weakness permits the panel to bend or crush during backfill compaction. This was further confirmed by borescope inspections performed on several other Hydraway installations throughout the state. Included in the inspection were Western KY Parkway, Ohio County; Interstate 65, approximate milepost 56; and Interstate 64 in Franklin County and Fayette County.

## **MOUNTAIN PARKWAY**

### **INITIAL BORESCOPE INSPECTION (JUNE 1988)**

Both edge drain systems were visually inspected in June 1988 after installation and prior to the break and seat. Deflections were observed in cores of both the Hydraway and the Advanedge edge drains. The ADS was inspected at milepost 22.45 on the east approach ramp at Stanton and the Hydraway was inspected at milepost 22.65. Photographs were taken during the initial inspection and after breaking and seating.

In comparing the photographs before and after the breaking and seating operation, it was apparent that most of the deflections in the core of the edge drains were occurring during the installation and backfilling of the drains and

not during breaking and seating. It is difficult to determine from the photographs how much deflection was occurring during breaking and seating operation.

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In 1988, visual inspections were limited to a borescope with a still camera mounted on top. Since that time, a camcorder has been attached to the borescope making inspection much clearer.

## **SECOND BORESCOPE INSPECTION (JULY 1988)**

### **Advanedge**

Two permanent inspection ports were installed in a section of ADS after the asphalt overlay at milepost 22.45 in July 1988. The inner core at the top half of the ADS drain appeared to be free of silt and open to flow with slight horizontal deflections in the core walls. The bottom half of the core showed considerable horizontal compression between the horizontal support columns and was free of silt. Some of the emulsified tack coat was present in the invert to a height of approximately one-inch. Emulsified tack coat was observed flowing from several head walls of the edge drains shortly after the overlay had been completed.

### **Hydraway**

Two permanent inspection ports were installed July 1988 at milepost 22.65 in a section of the Hydraway drain. These ports were installed after placing the asphalt overlay. The inspection ports were approximately four-feet apart. The inner core of the first Hydraway port was damaged and could not be borescoped. The second port was heavily damaged at the top. The 1st, 2nd, and 3rd rows of support columns were moderately bent. The 4th, 5th, and 6th rows were compressed on top of each other. The water contained a considerable amount of silt below the 6th row.

## **THIRD BORESCOPE INSPECTION (MARCH 1989)**

On March 30, 1989, the edge drains were inspected for a third time, approximately eight months after installation. The ADS drains were inspected at mileposts 22.45 and 25.13. The Hydraway drains were inspected at mileposts 22.65, 24.71, and several other locations throughout the job site in unbroken sections.

### **Advanedge**

The drains appeared to show the same signs of horizontal compression that was noticed July 1988. Thin crystalline deposits appeared to be forming on the water surface above the invert and a 1/4-inch of silt was building up between the corrugations. The bottom inch of the ADS drain above the invert does not have any perforations allowing water to escape or enter. On relative shallow grades,

water tends to stand in these area's. This permits formation of thin crystals on top of the water surface.

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## **Hydraway**

The Hydraway drain was inspected for a third time at milepost 22.65. Structurally the drain appeared the same as noted during the second inspection, but an increase of silt was noticeable on the horizontal support columns. The water contained a large amount of silt below the sixth row of support columns.

An additional Hydraway inspection port was installed March 1989 at milepost 24.71, in a rehabilitated section. The port was visually inspected on April 7, 1989. The rows of support columns appeared to be tilted (angled) up on the fabric faced side. The drain was 3/4 full of water and a flocculated material was being deposited in the lower half of the drain.

Approximately eight additional Hydraway inspection ports were installed April 1989 in unbroken sections of the rigid pavement. In the majority of the Hydraway sections, there are areas in which the support columns are tilted, or pushed together. The semi-rigid backing is folded 90 degrees or folded between the support columns, and the top or bottom of the inner core is J-shaped.

## **EXCAVATION (APRIL 1989)**

On April 13 and 17, 1989, sections of the edge drains were removed. A six-inch section of the ADS panel was removed at milepost 22.45, and sections of the Hydraway panel were removed at mileposts 22.65 and 24.71.

## **Advanedge**

The ADS panel showed signs of horizontal compression as viewed earlier with the borescope. A build up of material between the corrugations was apparent, and crystalline deposits were noticeable throughout the bottom of the drain. The fabric was then removed and a silty material had been deposited between the fabric and the rigid plastic core mostly between the corrugations. The build up of silt between the fabric and the rigid core was partially blocking the bottom perforations approximately inch up on the rigid core.

## **Hydraway**

The Hydraway panel removed at milepost 22.65 showed signs of compression in both the vertical and horizontal planes. The panel had been compressed in its vertical plane by approximately three-inches and the horizontal plane had been compressed to approximately half of its original thickness. It appeared that during the backfill operation the stiff Hydraway backing had been forced down relative to the open front side causing the support columns in the inner core to fold up.

The top of the Hydraway core was "rolled over" (J-shaped). The Hydraway product is designed to conform to irregular trench walls; which was noted at

milepost 22.65. It appears the compaction of the backfill causes the "role over" and the columns to stack on top of each other (Photo 1).

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**Photo 1.** The top of the fabric "rolled over" and the support columns compressed on top of each other.

The filter fabric appears to be fairly clean and permeable. The inner core of the Hydraway drain was partially filled with silty water. The DGA adjacent to the panel was saturated.

The Hydraway panel removed at milepost 24.71 had been compressed in its vertical plane by 1.75 inches. The support columns were angled up as at milepost 22.65, and the bottom two inches of the inner core was J-shaped (Photo 2).

During the excavation at milepost 24.71, the backfill on the shoulder side was saturated adjacent to the Hydraway panel. The panel was half full of silty water. There was water ponding between the edge drain and the road.



**Photo 2.** The bottom of the Hydraway drain J-shaped, and the trench filled with water.

### **HEADWALL OBSERVATIONS**

The headwalls in the unbroken sections are relatively free of silt. The headwalls in the broken sections have large amounts of silty water still flowing from them to date. Some siltation is occurring at the headwalls.

### **BROWN STAINING**

In several areas throughout the rehabilitated section, brown stains have appeared on the surface. From experience on the Pennyrite Parkway (Report No. UKTRP-88-15), it appears water may be standing at the interface between the broken concrete and the asphalt overlay (Photo 3). Laboratory tests performed on this material indicate it is calcium being pumped to the surface.



**Photo 3.** Calcium being pumped to the surface.

### **EDGE DRAIN INSTALLATION INSPECTION, SOUTH CAROLINA.**

On April 17, 1989, Spartan Construction requested the use of Transportation Center's personnel and equipment, at their expense, for an edge drain inspection in South Carolina.

The ADS edge drain was installed in a two-inch and four-inch trench and backfilled with a pea size crushed granite. The backfill was vibrated in place instead of compacted. These sections of ADS, that have been in place since December 1988, showed no signs of horizontal or vertical deflections or siltation. The concrete pavement, to date, has not been broken or been overlaid. (The ADS panel installed on the Mountain Parkway was modified prior to the South Carolina installation.)

### **RECOMMENDATIONS**

In view of the observations made to date, and based upon experience from other edge drain sites, the following recommendations are made.

1. It is recommended that Hydraway edge drain material (as presently designed) not be permitted on future projects.



2. It is recommended that only Advanedge (manufactured by Advanced Drainage Systems) be permitted as an alternate to round pipe on a routine basis, until other products can be tested and approved.

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3. It is understood that a redesigned Hydraway panel is now available. It is recommended that it be permitted as an experimental product, and that it be evaluated in the field for a period of several months. In addition, one other available product should also be permitted as experimental item, for the purpose of observing its performance in the field. This product is Contech.
4. The maximum permitted trench width should be approximately 2.5 inches. In this narrow trench, only clean natural sand should be permitted as a backfill material.
5. It is also recommended that an experimental construction technique be evaluated on some future project where the edge drain panel is placed next to the shoulder side of the trench, and a clean natural sand backfill is placed between the panel and the pavement. This procedure would permit the sand backfill to act as a graded filter, and this might help to prevent the fabric on the drain from clogging.
6. On breaking and seating projects, installation of an 18-inch panel should be considered. It appears the 12-inch panel may not have sufficient height to properly drain the interface between the broken concrete surface and the bottom of the asphalt overlay.
7. The use of rigid outlet pipe would probably increase flow and decrease silt buildup. In addition, this would decrease the problems associated with improper flowlines associated with the flexible pipe.