Research Report
UKTRP-87-9

EVALUATION OF DRAINAGE ON NICHOLASVILLE BYPASS

by

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May 1987

EVALUATION OF DRAINAGE ON
NICHOLASVILLE BYPASS (US 27)

KENTUCKY HIGHWAY INVESTIGATIVE TASK NO. 5

INTRODUCTION

Construction of the Nicholasville Bypass (US 27) was completed in 1986. At the north end of the bypass is a raised, paved traffic median (Figures 1 and 2). The median was constructed wit a lip curb and gutter. The roadway at that location is in a superelevated section. A raised, paved traffic median also is located at the southern end of the bypass. Figures 3 through 5 are photographs of that median. The median is located on a tangent section therefore, the roadway has a normal crown. Tha section of roadway at the southern end is located on a sligh grade. The south median also is constructed with a lip and curb gutter.

Soon after construction, water began to emerge from near the gutter line of both medians. The Kentucky Transportation Research Program was requested to investigate the cause of the water problem and make recommendations for remedial solutions.

SITE CONDITIONS

A the north-end median, water was emerging at the interface between the concrete gutter and the asphalt pavement (see Figures through 8) on the west side of the median (lower side of the superelevation). Also, water was emerging through the pavement surface as shown in Figure 9.

The median was cored in November 1986 in a pattern similar to that shown in Figure 10. From information gained from drilling, it appeared that water was moving from the high side of the median to the lower side. The dashed line in Figure 11 indicates what appeared to be the general configuration of the phreatic surface in the median. The concrete lip and gutter section appeared to be damming the water. Consequently, water was flowing under the concrete gutter and was being forced upward at the joint between the pavement and the gutter, as indicated in Figure 11. In addition, some of the water was bypassing the joint and was being forced up through the pavement surface.

It is difficult to determine the exact source of the water. Because of the geometrics of this site, it does not appear that groundwater is a source. The northbound lanes on the high side of the superelevation are on a fairly high fill and there are no hills in the immediate area that could provide sufficient head to force the water up into the embankment. Therefore, it appears the source is surface water that has fallen on the shoulder and driving surface of the northbound lanes. Subsequently, this water has penetrated part or all of the asphalt bound layers of the northbound lanes and is moving laterally toward the low side of the superelevation. The construction joint between the asphalt pavement and the concrete gutter on the high side of the median appears to be well sealed and is probably not a source of water.

Most of the water at the southern median was emerging at the construction joint between the concrete gutter and the asphalt pavement. The only location where this was occurring was at the southern nose of the median (Figures 12 and 13). There appeared to be a considerable head, since water was flowing freely across the pavement. Additionally, a small amount of water appeared to be emerging from the pavement surface approximately 20 feet upgrade from the end of the median. That water may be seen in Figures 3 and 4.

Cores were obtained from each median on the same date. Figure 14 shows the general pattern of coring. A high phreatic surface under the median appears to be the cause of the drainage problem. From the elevations of the water in the core holes, a generalized phreatic surface has been sketched in Figure 15.

I appears there are two sources of water at the south end. Some surface water is almost certain to be penetrating the asphalt layers of the pavement and median. However, the rate of flow and the extent of time of flow after rain indicate ground water is probably an additional source of water. The geometrics are also ideal at this site to suspect ground water. The long grade would certainly provide sufficient hydraulic head to force water out through the pavement and construction joints.

It should be noted that, on the date the coring was done, the contractor was installing remedial drainage. At the north-end median, a 4-inch perforated pipe was installed on the lower side of the median for a distance of approximately 400 feet (Figure 16). The pipe was placed approximately 2 inches below the top of the subgrade and the trench was backfilled with sand. The drain was connected to a median drain already located at the site (Figure 17). Perforated pipe drains were placed on both sides of the southern median. On the side of the median next to the southbound lane, the drain was approximately 20 feet in length, ending at the nose of the median. The drain next to the northbound lane began at about 20 feet north of the end of the median and was connected to the drain on the southbound side of the median about 10 feet from the nose of the median. The configuration of the drain is shown in Figure 18. A pipe was run from the nose of the median to the southbound shoulder to handle the discharge from the drain (Figure 19).

CONCLUSIONS AND RECOMMENDATIONS

At present, the drains appear to be working well.

On future projects, consideration should be given to installing similar drains on paved medians on superelevated sections.

Also, on long grades that have similar paved medians, ground water may often be a problem. Therefore, it is recommended that drains be installed the full length of the median to permit discharge of the water.

List of Figures

Figure 1. Median, Northern End, US 27.

Figure 2. Overall View of Northern End of Project.

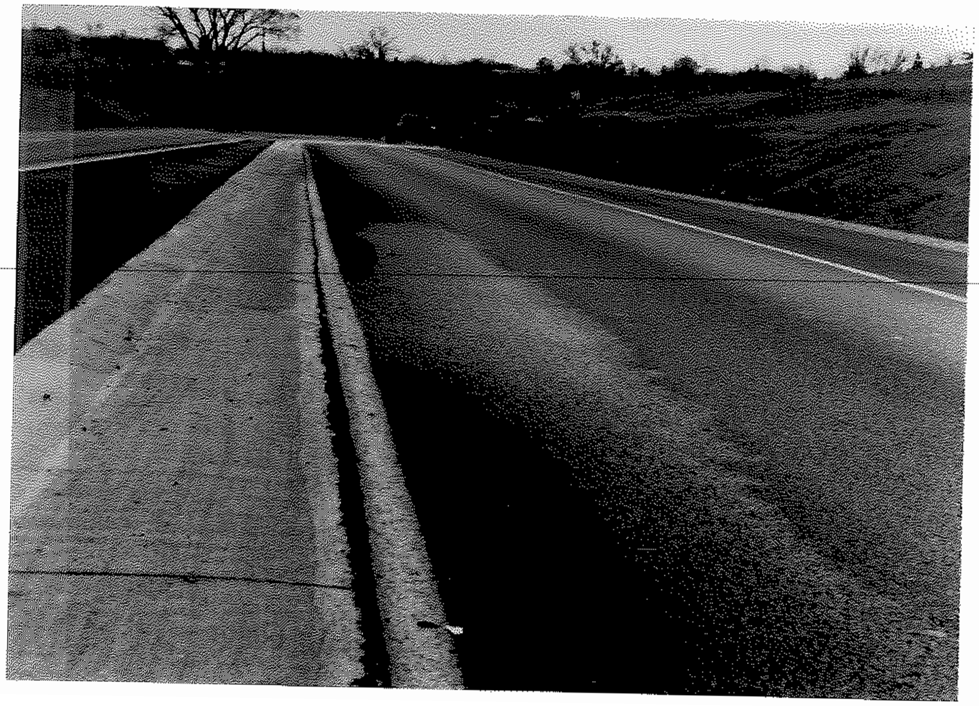

Figure 3. Raised Median, Southern End.

Figure 4. Overall View of Raised Median, Southern End.

Figure 5. View Showing Superelevation, Southern End.

Figure 6. Close-up of Water Emerging, Northern End.

Figure 7. Water Emerging from Gutter Flows onto Pavement.

Figure 8. Pavement is Wet due to Water from Gutter.

Figure 9. Water Emerged through Pavement Surface.

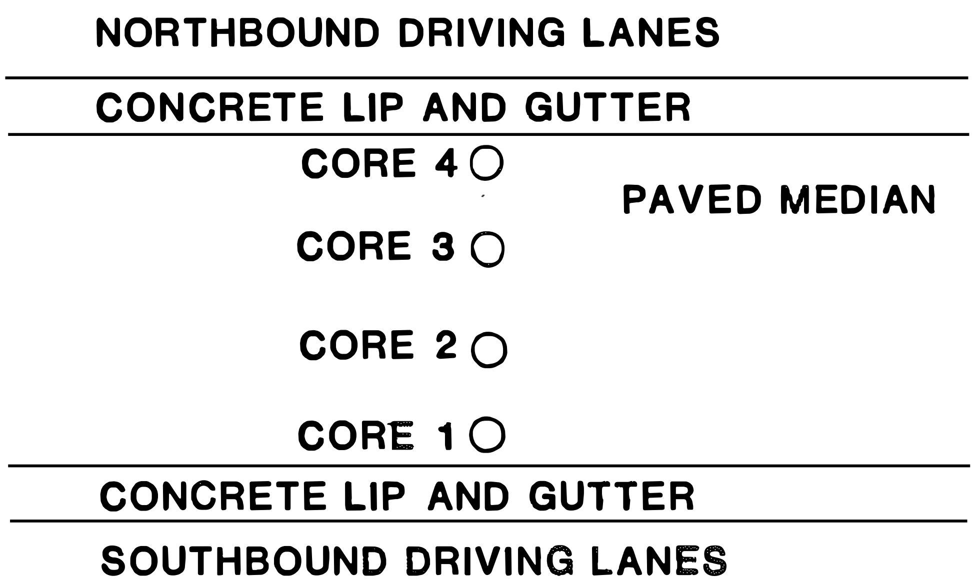

Figure 10. Coring Pattern, Northern End.

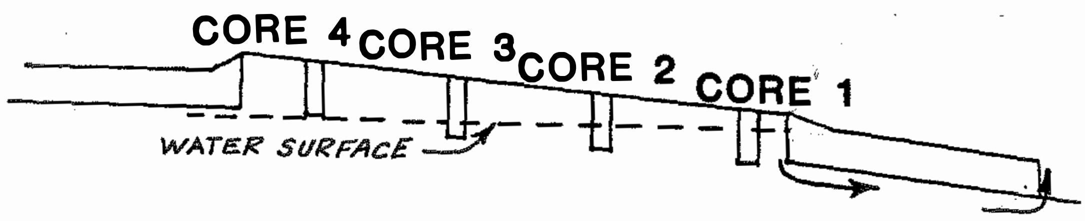

Figure 11. Phreatic Surface in Median, Northern End.

Figure 12. Water Emerging at Joint between Pavement and Gutter.

Figure 13. Water from Joint between Pavement and Gutter Wets Pavement.

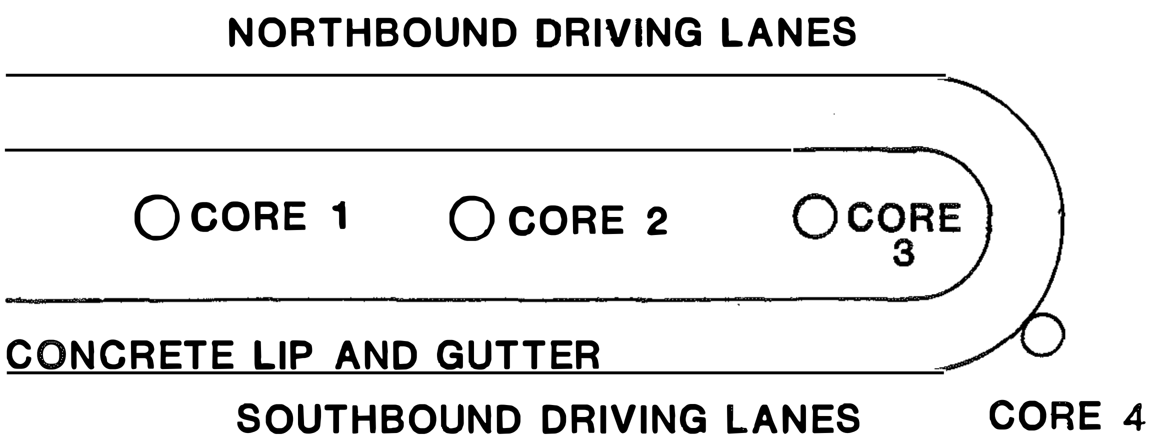

Figure 14. Coring Pattern, Southern End.

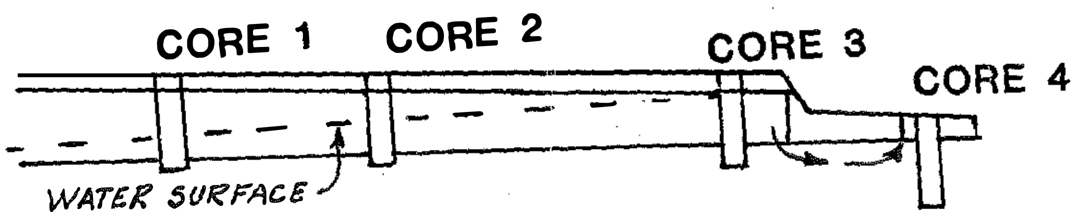

Figure 15. Phreatic Surface, Median, Southern End.

Figure 16. Perforated Pipe Installation.

Figure 17. Median Drain Connected.

Figure 18. Drain Connection.

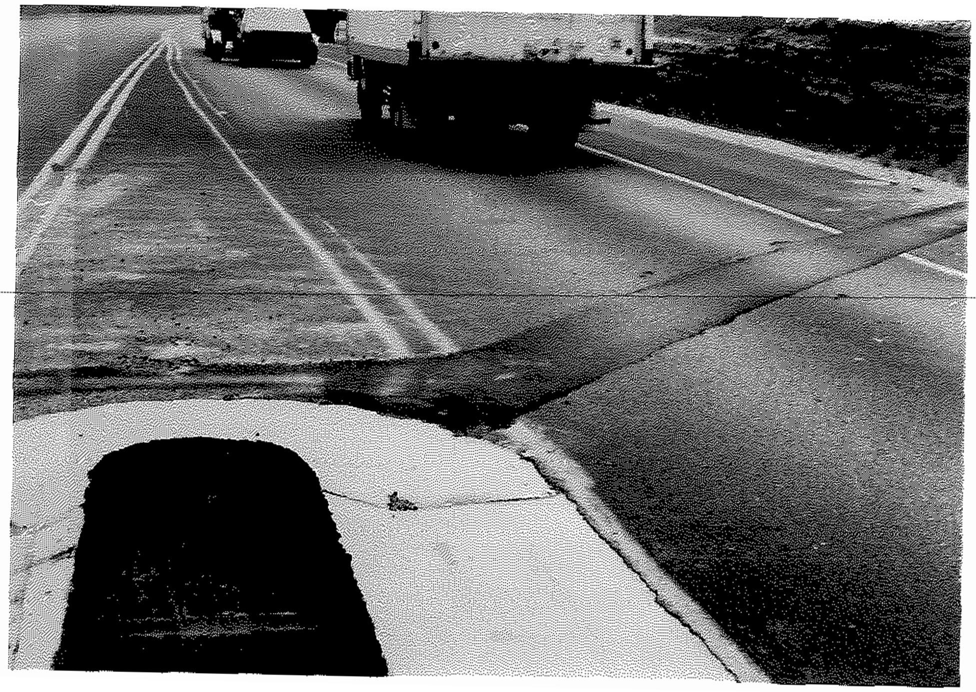

Figure 19. Pipe from Median Nose through Shoulder.