

SUMMARY REPORT 280-2F(S)

**SAFETY TREATMENT OF ROADSIDE
PARALLEL-DRAINAGE STRUCTURES**

**SUMMARY REPORT
of
Research Report of Number 280-2F
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Safety Treatment of Roadside Parallel-Drainage Structures

by

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Research was conducted to develop traffic-safe end treatments for parallel-drainage structures that would not appreciably restrict water flow. Guidelines or warrants for use of the end treatments were also developed. Parallel-drainage culverts are used to convey water under driveways, side roads, or median crossovers.

Preliminary designs were first evaluated using a computer simulation program and a full-scale test program. From these studies, tentative design parameters were selected, including the ditch and driveway slopes and the grate spacing.

The end treatment developed in the preliminary studies was then subjected to full-scale prototype testing. These tests involved evaluation of the end treatment on a 6.7 to 1 driveway slope with a subcompact automobile. The end treatment was subjected to tests at 40 mph (64.4 km/h) and 50 mph (80.5 km/h). A benefit/cost analysis was conducted to determine warrants for the use of the treatments.

To achieve a traffic-safe driveway/culvert design, the following conditions should be met:

1. The roadway sideslope (or ditch slope) should be 6 to 1 or flatter.
2. The driveway slope should be 6 to 1 or flatter.
3. The transition area between the roadway sideslope and the driveway slope should be rounded or smoothed as opposed to an abrupt transition.
4. Safety treatment of the culvert opening should include an end section cut to match the driveway slope with cross members (grates) spaced approximately every 2 ft (0.61 m) perpendicular to the direction of water flow. The cross members should be designed to support a concentrated wheel load of approximately 10,000 lb (44,480 N) applied at midspan.

Guidelines for use of safety treatments were developed through a benefit/cost analysis. Assumptions made in the analysis were: (1) the roadway side slope was 6 to 1, (2) the roadway

had a 12 ft (3.66 m) shoulder, and (3) the centerline of the driveway culvert was 25 ft (7.62 m) from the edge of the travelway.

Three driveway/culvert options were evaluated

- I. Untreated condition (1-½ to 1 driveway slope and no culvert end treatment).
- II. Driveway slope of 6 to 1 with culvert end out to match slope with no safety grates.
- III. Same as II but with safety grates on culvert

Based on the benefit/cost analysis, guidelines were developed that identify conditions (traffic volume and culvert size) that warrant safety treatment of parallel drainage culverts on rural high-speed highways.

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