



U.S. Department
of Transportation
**Federal Highway
Administration**

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Maintenance of Pavement Underdrain System

Office of Engineering
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MAINTENANCE OF PAVEMENT UNDERDRAIN SYSTEM

Purpose:

This review of underdrain outlets was initiated due to the observation of stripping of asphalt from pavement surface on the ___ Parkway at several locations, believed to be caused by blocked underdrains. The review was to determine the extent of possible problems and to gauge the maintenance efforts for assuring underdrains being kept functioning properly.

Scope:

This inspection consisted of a spot check of headwall outlets for approximately 100 lane miles of one outside lane of Interstate and Parkway Route. Two days were spent reviewing the headwall outlets. Portions of four State Highway Districts were traveled for the review.

Objective:

The review was to assure that appropriate corrective steps are taken to assure pavements are not stripping due to water caused by blocked underdrains.

Findings:

This report documents several examples of ways that underdrain outlets may become blocked, causing excess water to concentrate in the pavement. The locations of the blocked headwall outlets are not provided, since the incidence of blocked outlets appear to be widespread, and statewide efforts are needed rather than concentrating on the identified ones. The locations can be made available upon request. Cleaning of headwall troughs was found to be practically non-existent, except for one area where approximately 15 outlets had been cleaned.

It is estimated that underdrain outlets were inspected intermittently for approximately 100 lane miles for the outside lane. Due to it being extremely dry at the time of the review, blocked or clogged underdrain pipes would not have been evident from the pavement surface. Therefore, this correspondence does not address concern for clogged pipe back of outlet due to siltation or construction related problems. Because of the long spacing for underdrain outlets on earlier projects, the clogging from siltation has to be kept in mind as a possibility. This, along with construction related problems, may warrant as great a concern as for the blocked headwall outlets.

Photographs:

Photographs are provided to illustrate the type of blockage found and kind of action that may be needed to correct and prevent the blockage. The photographs are not intended to illustrate the number of the blocked outlets. The blocked outlets are prevalent for certain conditions. The trend would be rather consistent for an area. A grouping of how the outlets may have become blocked is provided in the photographs and is as follows:

- **Rock Blocking Outlet, Attachment A**
Crushed stone from the shoulders was found to be the most consistent and probable cause of the blockage. Occasional maintenance checks should have greatly eliminated this problem.
- **Silted Headwall Troughs, Attachment B**
Partially blocked headwall troughs allowed silt to build-up in the troughs preventing silt from being washed through the trough. Some large cut sections have ditches filled with material possibly completely covering the headwalls.
- **Vegetation Blocking Outlet, Attachment C**
Vegetation retains the silt causing gradual build-up to where many outlets were largely blocked. Trimmings from mowing operations were found to be the cause of some blockages.
- **Ditch Higher Than Outlet, Attachment D**
Headwalls were found to be constructed such that frequent maintenance would be required to keep the outlets clear. Water in the ditches would block many of the outlets.
- **Clogged Outlet Pipe, Attachment E**
Clogged outlet pipes were found at many locations. Some were recent installations. Some had the old heavy type screens. Some pipes were clogged even though the troughs were clear, perhaps cleared after the blockage.

The last page of photographs is of typical pavement damage that results from water in the pavement. (Attachment F)

Observation, Recommendation and Concerns:

The following observations, recommendations, and concerns are offered for your consideration.

- There was a recently completed resurfacing project, with small cut slopes, that had numerous headwall outlets located about ditch level. There were a couple of old projects that the outlets could not be found in long cut sections for which the ditches were filled with material. It is believed that some outlets were completely covered with this material.

It is recommended that a minimum height be established for the outlets above the ditch flowline, that would reasonably assure that water would not back up into the pavement.

- There were numerous headwall troughs completely full and many more partially filled from sediment.

It is recommended that the design for underdrain pipe headwalls be revised to have the pipe outlet above the headwall apron to allow for some sediment, if routine maintenance is expected to be haphazard and infrequent.

- There were several old-heavy type screens that may have caused the pipes to become silted back of the screens.

It is recommended that consideration be given to removing these screens in areas that silt has built up.

- Dense graded aggregate and/or chip seal aggregate from the shoulder had filled numerous troughs resulting in the pipes becoming totally clogged.

It is recommended that a list of locations of headwall troughs prone to blockage be kept so frequent checks are assured.

- The State needs to inspect underdrain pipes to assure pipes are not blocked or becoming clogged, particularly the older installations with long outlet spacing, as well as before acceptance of construction projects.

It is recommended that equipment is acquired (borescope) and a program established for inspecting and maintaining underdrain pipes.

- The delineator posts were missing at many locations sometimes for great lengths eliminating easy determination of outlet location. There was some question if the underdrains might be outleted into existing boxes, existing culvert headwalls or completely covered by silt in ditches.

An alternative method for locating the outlets should be considered. It is recommended that as a minimum the stationing (Mileposts) be maintained as a readily available permanent record.

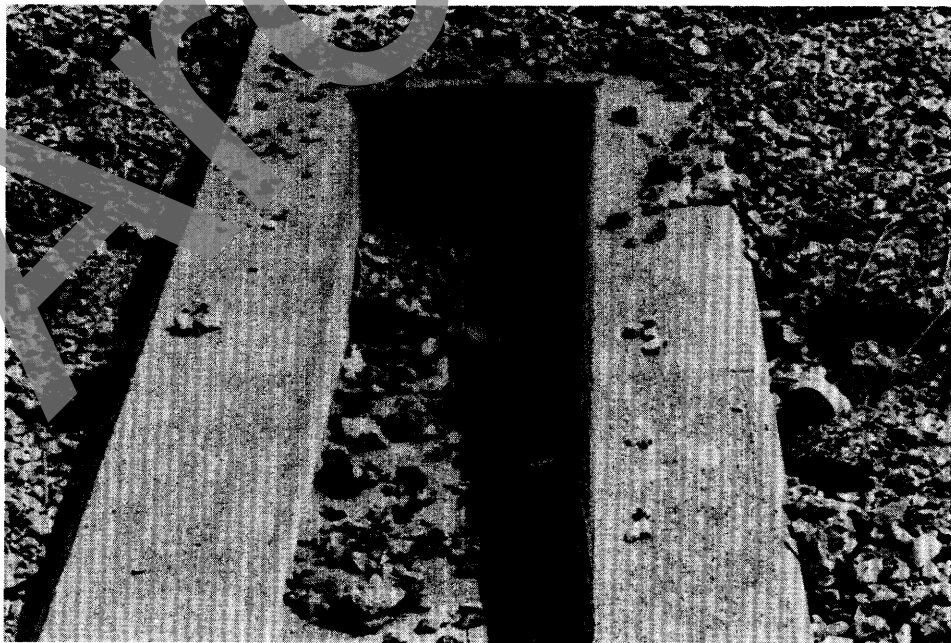
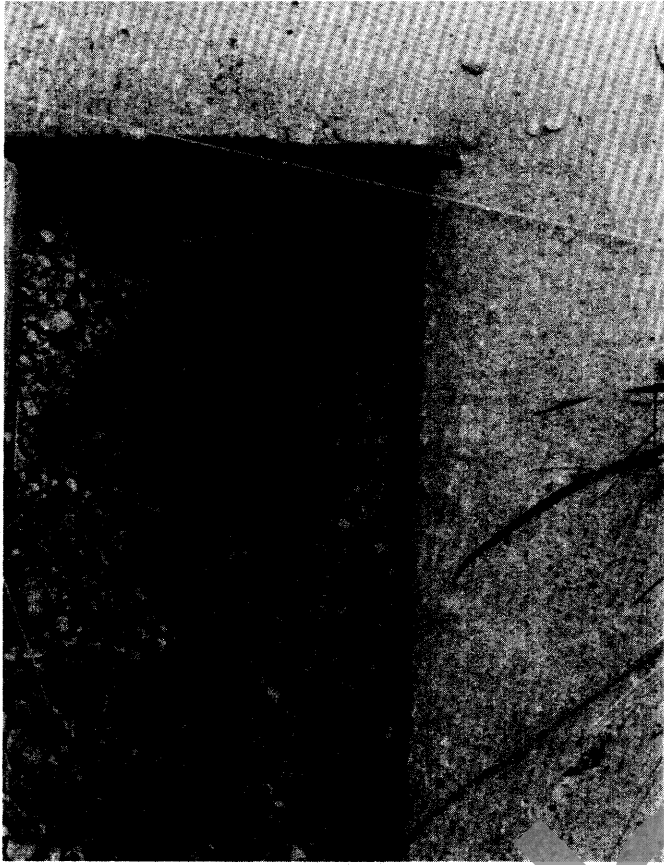
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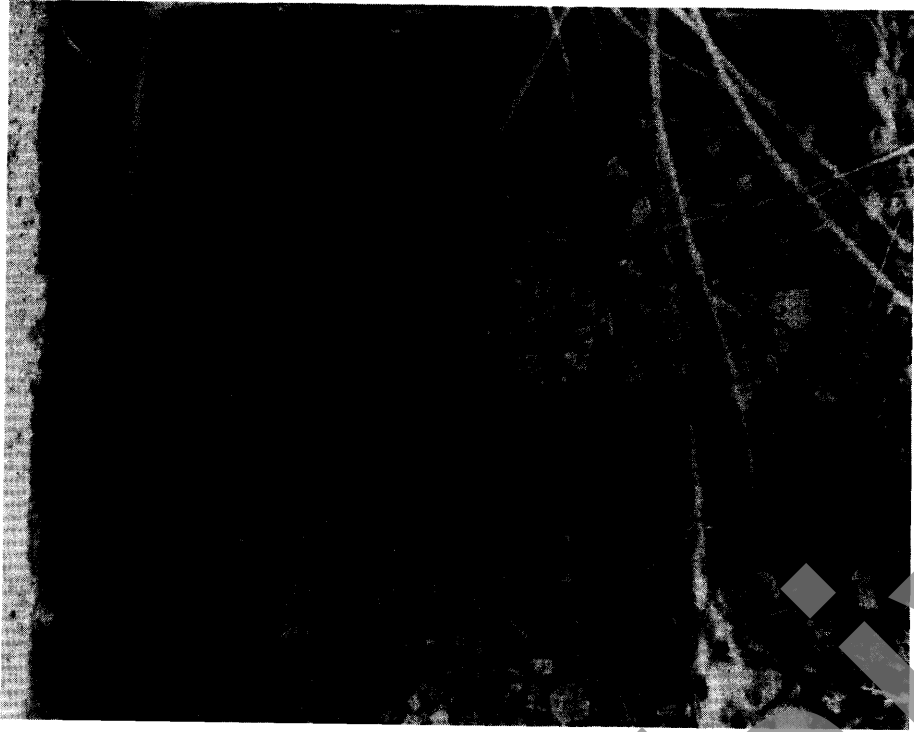
It is readily apparent that greater effort and emphasis is needed to be placed on the underdrain systems. It appears that major decisions and understandings need to be reached on the continued use and maintenance of underdrains. Construction and/or design related problems often make the proper maintenance of underdrains very difficult. Upon completion of our review, we learned that _____ has done extensive investigation of a recent completed project and found numerous construction problems related to pavement drainage. Their findings should be evaluated. It is requested that the Department evaluate needed changes, needed resources, maintenance capabilities, and maintenance priority for underdrain related problems to assure that pavements are not damaged by blocked underdrains.

ROCK BLOCKING OUTLET

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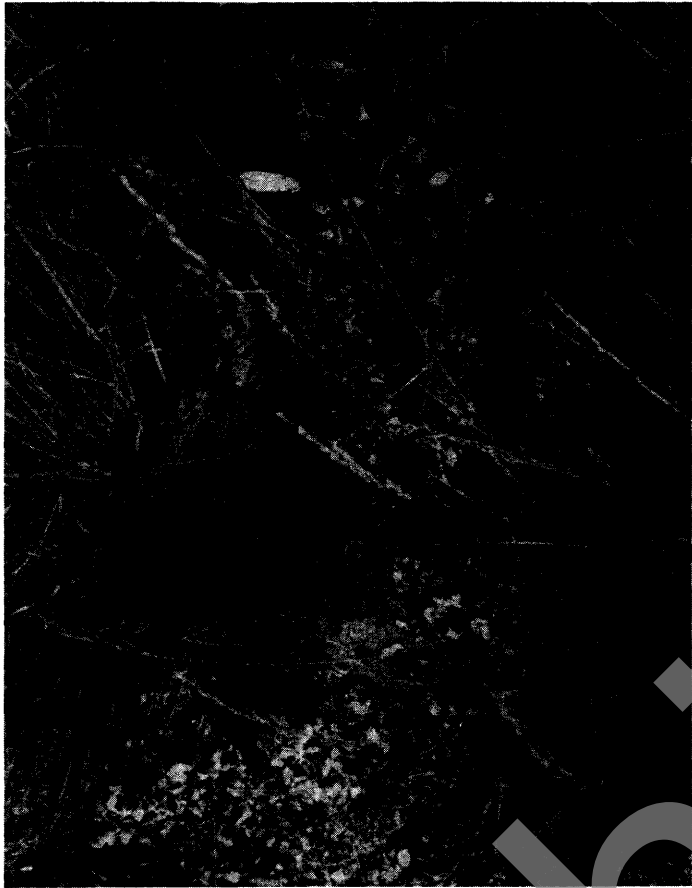


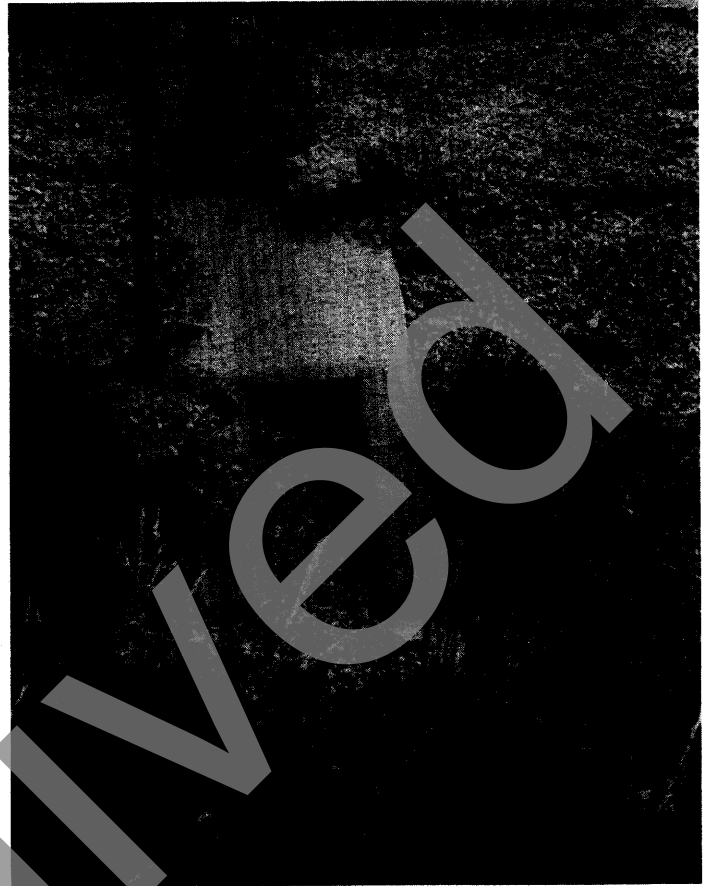


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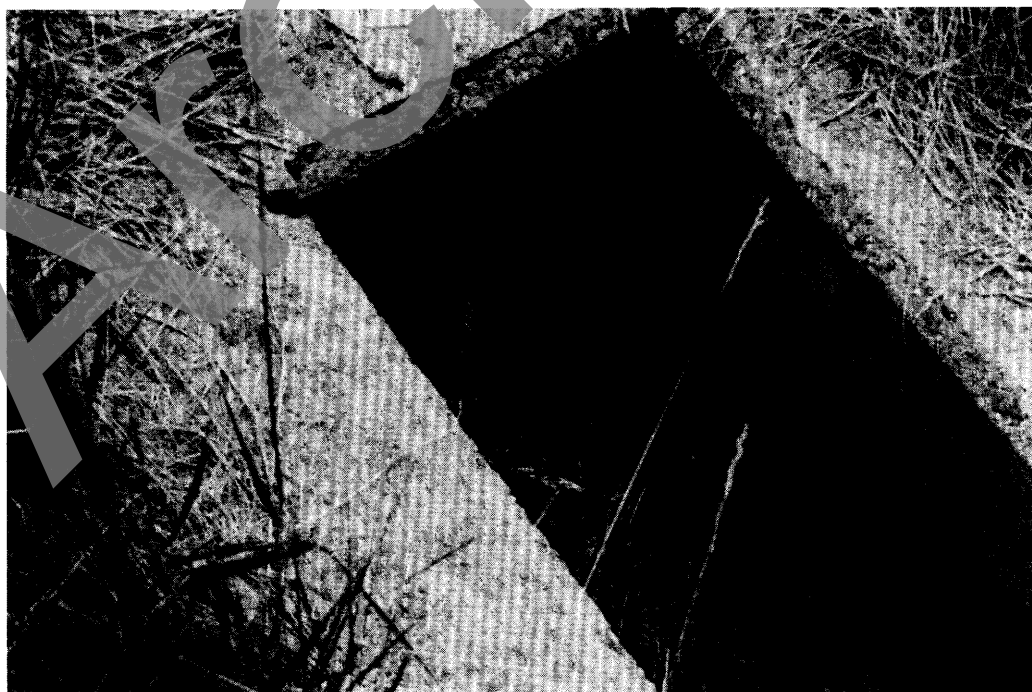
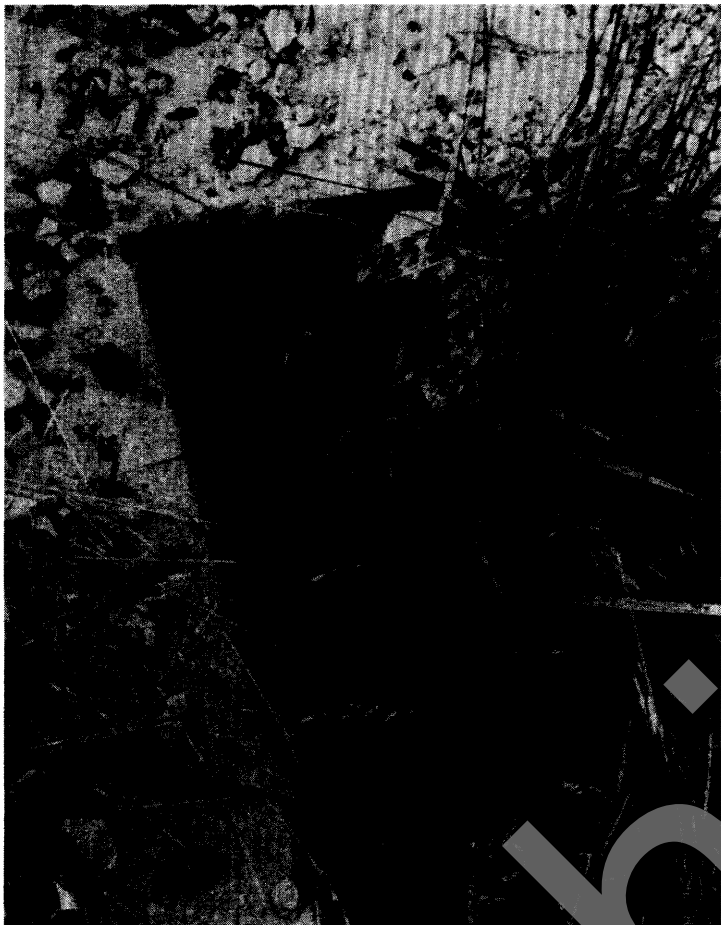
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SILTED HEADWALL TROUGHS

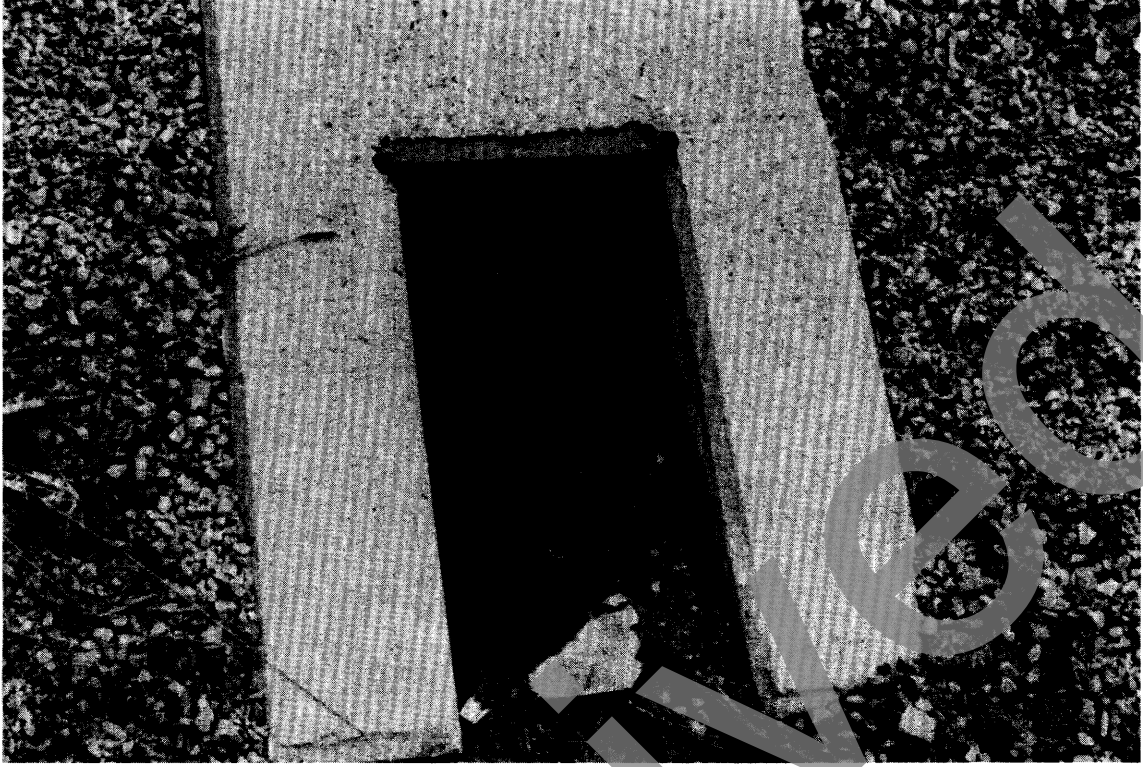
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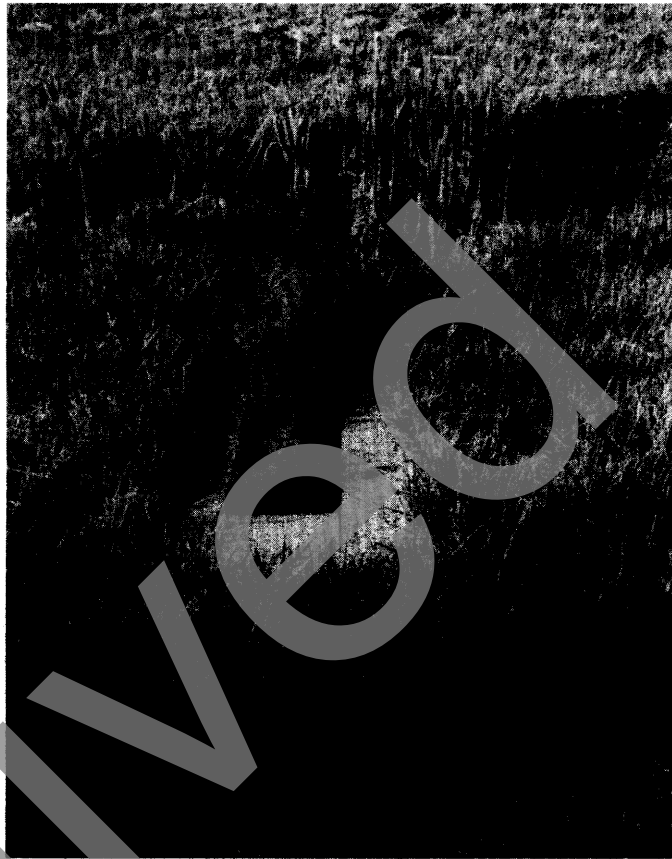
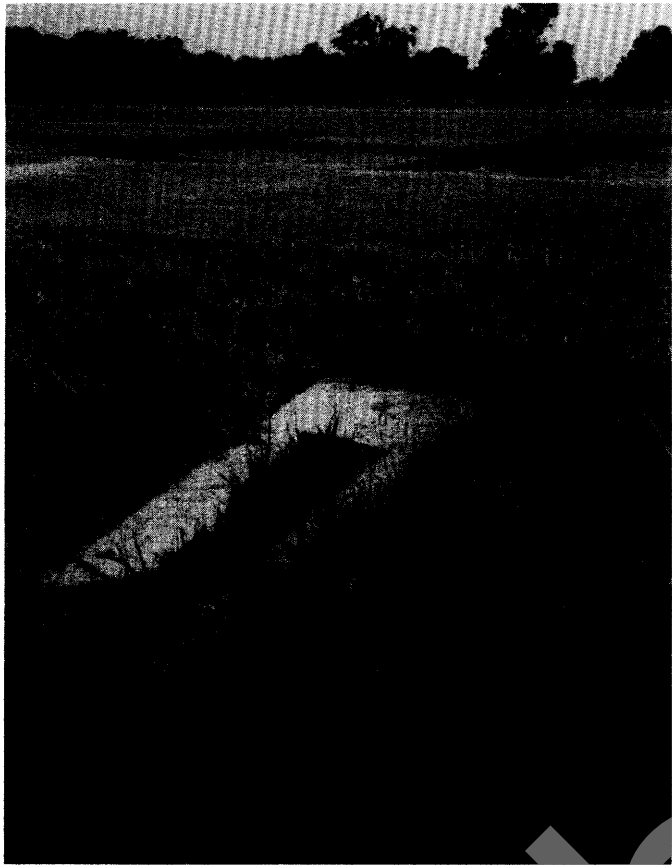


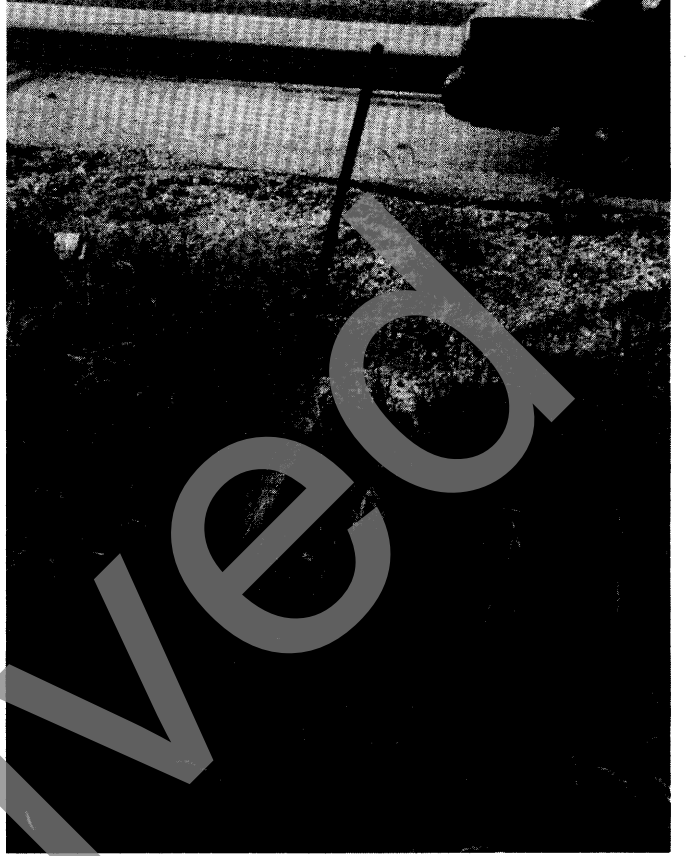
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VEGETATION BLOCKING OUTLET

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DITCH HIGHER THAN OUTLET

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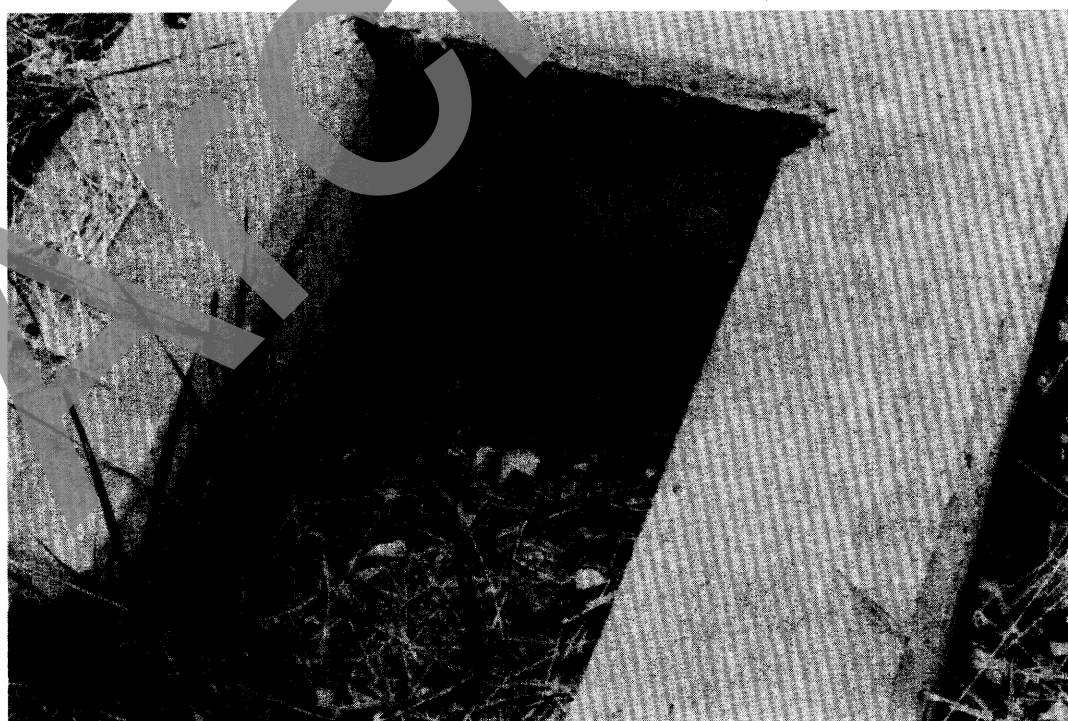
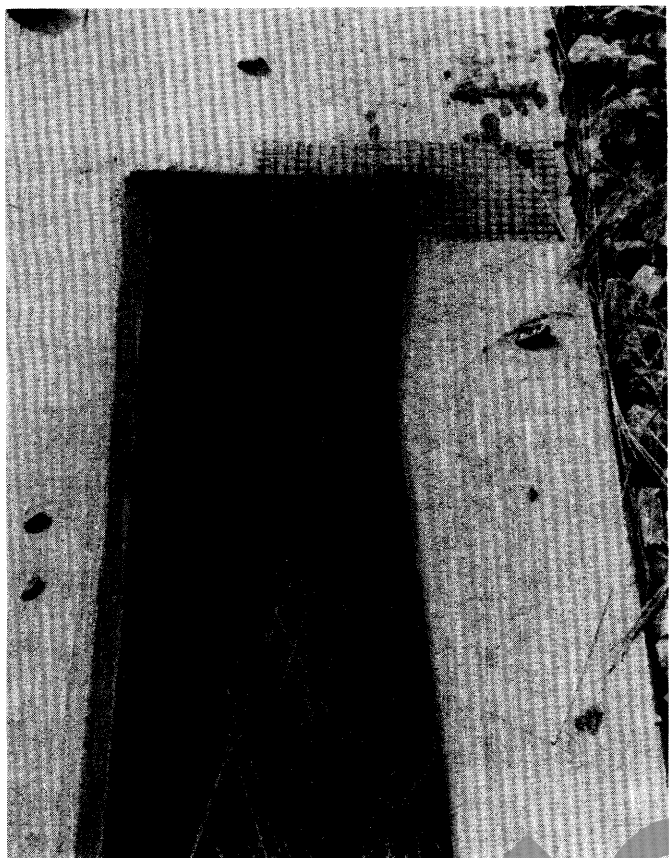
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CLOGGED OUTLET PIPE

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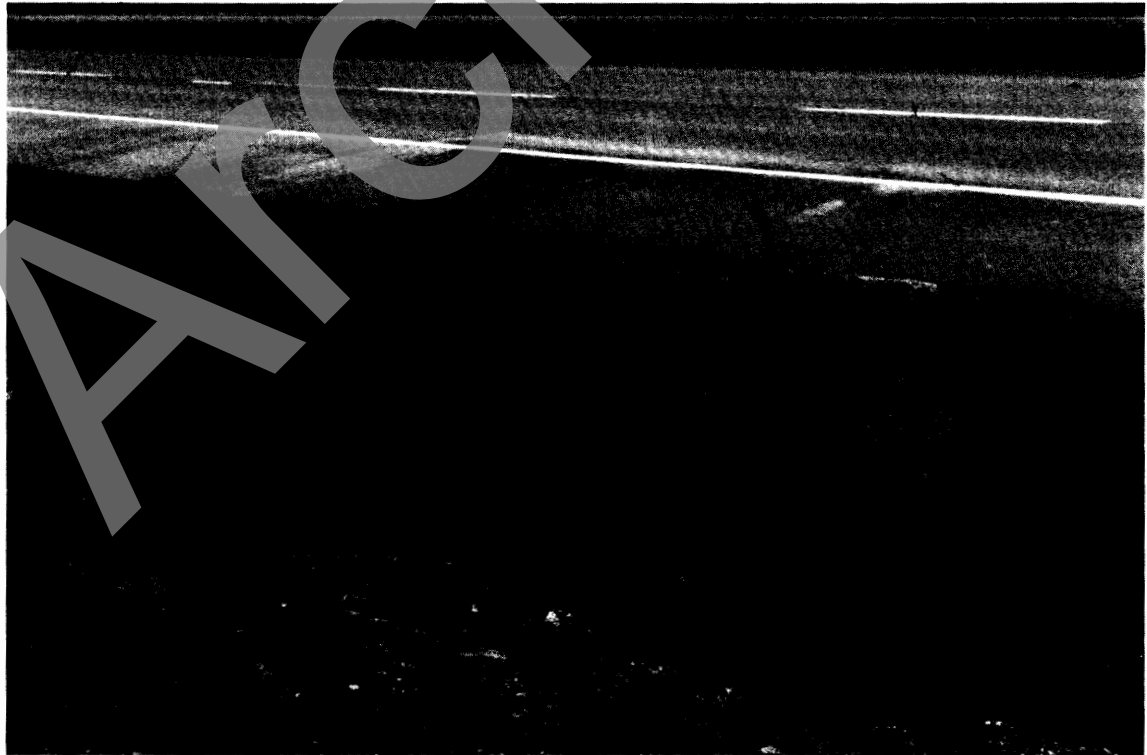


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WATER PAVEMENT DAMAGE

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