Session 7: Retrofitted Edge Drains
Learning Outcomes

1. List benefits of drainage
2. List components of edge drain systems
3. Describe recommended installation procedures
4. Identify typical construction problems and remedies
Effects of Water

- Excess water in a pavement can lead to:
  - Weakened pavement layers
  - Critical distresses
    - Pumping
    - Faulting
    - Corner breaks
Critical Distresses
Addressing Excess Moisture

• In **New** Pavements
  – Seal the pavement
  – Use nonerodible base materials
  – Incorporate combative design features (e.g., dowels)
  – Incorporate drainable base

• In **Existing** Pavements
  – Seal the pavement
  – Add retrofitted drainage
Purpose of Retrofitted Edge Drains

- Remove *surface infiltration* water from beneath pavement
  - Shortens drainage path
  - Gets water out more quickly
- Alleviate moisture problems on older pavements with inadequate drainage
- Delay or slow the development of moisture-related distresses
Drainage Paths

Pavement surface

Base daylighted (clogged)

Existing flow path

Granular base

Pavement surface

Granular base

New shortened Flow path

Outlet

Fig. 7.1 on p. 7.2
Project Selection Considerations

- Characteristics of “good” candidates
  - Early stages of moisture-related distress
  - Minimal cracking (<5% slabs cracked)
  - Young in age (< 10 years)
  - Acceptable geometrics
- Not recommended on pavements where base contains > 15 to 20% fines
- Recommended evaluation procedures:
  - Distress survey
  - Possibly subsurface borings
Limitations and Effectiveness

- Not intended to address subsurface drainage conditions (high water tables, lateral seepage)
- Mixed performance
  - Pavement too badly deteriorated
  - Difficulty in improving drainage characteristics
  - Poor installation
  - Inadequate maintenance
Types of Retrofitted Edge Drains

- Pipe edge drain
- Prefabricated geocomposite edge drain
Retrofitted Edge Drain Types
Typical Pipe Edge Drain

- PCC Pavement
- Nonerodible base
- Aggregate subbase
- Drainage pipe
- Shoulder
- Geotextile
- Backfill

200-250 mm (8-10 in)

Fig. 7.2 on p. 7.6
Retrofitted Edge Drain Types
Geocomposite Edge Drain (PGED)

Fig. 7.4 on p. 7.7
Cross-Section of a PGED
Comparison of Edge Drain Types

- Advantages of Pipe Edge Drains
  - Can be easily flushed/cleaned
  - Less potential of damage
  - Larger capacity
  - Can be inspected with video cameras
- Advantages of PGEDs
  - Less expensive
  - Easier to install
Design Considerations

• Inflow \( q_i \) (inflow)

• Outflow \( Q \) (outflow)

• Edge drain details
  – Trench
  – Filter
  – Outlets
  – Backfill

• Other repair considerations

- Drain Type
- Drain Sizing
Construction Procedure
Pipe Edge Drains

1. Trenching
2. Placement of geotextile
3. Placement of drainage pipes
4. Connection to outlets
5. Backfilling of trench (material compaction)
6. Headwalls and outlet pipes
Installing Pipe Edge Drains
Automated Equipment

- Corrugated plastic tubing
- Hopper
- Compactor
- Gate
- Digging chain
- Groover
- Boot
- Compactor

Fig. 7.8 on p. 7.14
Installing Pipe Edge Drains
Cutting The Trench
Installing Pipe Edge Drains
Placing the Geotextile and Drain
Installing Pipe Edge Drains
Trench Backfilled
Retrofitted Edge Drains
Construction Process – PGEDs

1. Trenching
2. Placement of PGED
3. Connection to outlets
4. Backfilling of trench (water puddling method of compaction)
5. Construction of headwalls
Installing PGEDs
Installing PGEDs
Outlets

Fig. 7.5 on p. 7.11

- Longitudinal edge drain
- 3% slope
- Rigid outlet pipe
- 150 mm (6 in)
- 10 year flow
- Ditch
Headwalls

Precast concrete headwall in slope

Top view

Front view

Side view

Rodent shield
1/4”-3/8” openings

Fig. 7.6 on p. 7.12
Key Factors For Success

- Selection of proper candidate projects
- Proper design of system
- Maintain correct line and grade of longitudinal drains
- Avoid damage to pipes during installation
- Proper compaction techniques
- Proper installation and marking of outlets
- Maintain the system!
Troubleshooting
Common Problems

- Crushed or punctured outlets
- Clogged outlet pipes or edge drains
- Missing rodent screens at outlets
- Missing outlet markers
- Erosion around outlet headwalls
- Shallow ditches clogged with vegetation
Typical Causes of Poor Performance

- Improper use or application
- Damage during installation (poor construction practices)
- Edge drain clogging (especially PGEDs)
- Lack of post-installation maintenance
- Inappropriate use of, or failure to provide, other needed pavement repairs
Importance of Maintaining Subdrainage Systems

Poorly maintained drains can be worse than having no drains at all!
Components of an Effective Drainage Maintenance Plan

• Placement of outlet markers
• Mowing around drainage outlets
• Conduct inspections at least twice a year
  – Inspection of outlets
  – Removal of vegetation/debris at outlets
  – Replacement of missing rodent screens, outlet markers, and eroded headwalls
  – Flushing/rodding of drains
  – Inspection of ditches
Video Inspection of Pipe Edge Drains
Video Inspection of PGEDs
Review: Learning Outcomes

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