Shoulder and Ditch Maintenance

- Berming
- Shoulder Maintenance
- Edge Drain Maintenance
- Ditch Maintenance

Where did Modern road design originate?

Remains of a Roman road in Britain


The Romans?

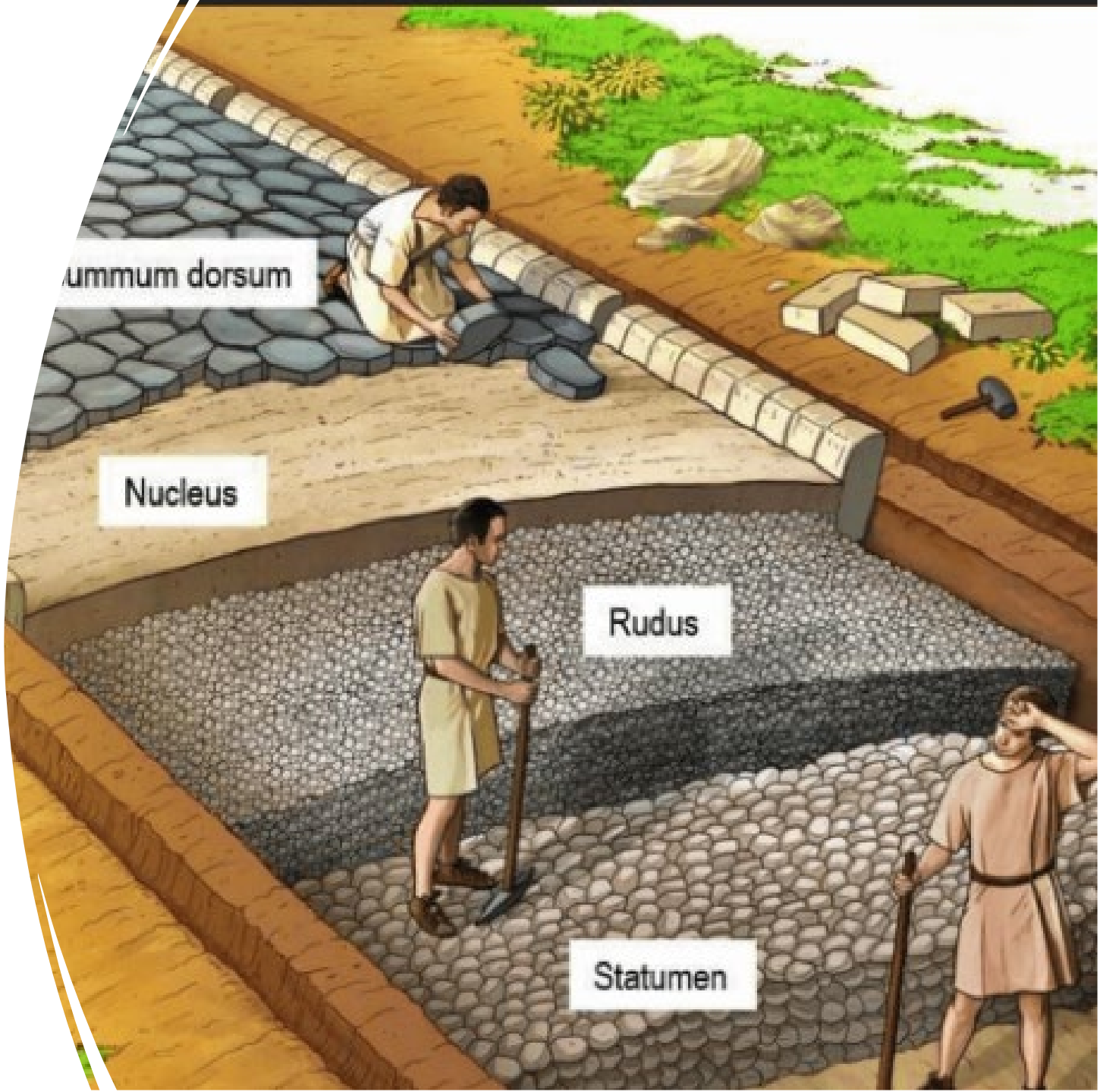
Romans did not invent roads, but for their time they perfected them.

- The Roman road network began around 509 BC went to 476 AD


50,000 miles of paved roads.
Equal to the U.S interstate system.
The total road network is estimated at
185,000 miles

Three Types of Roman Road

- Foot traffic
- Pack horse traffic
- Wheeled carts



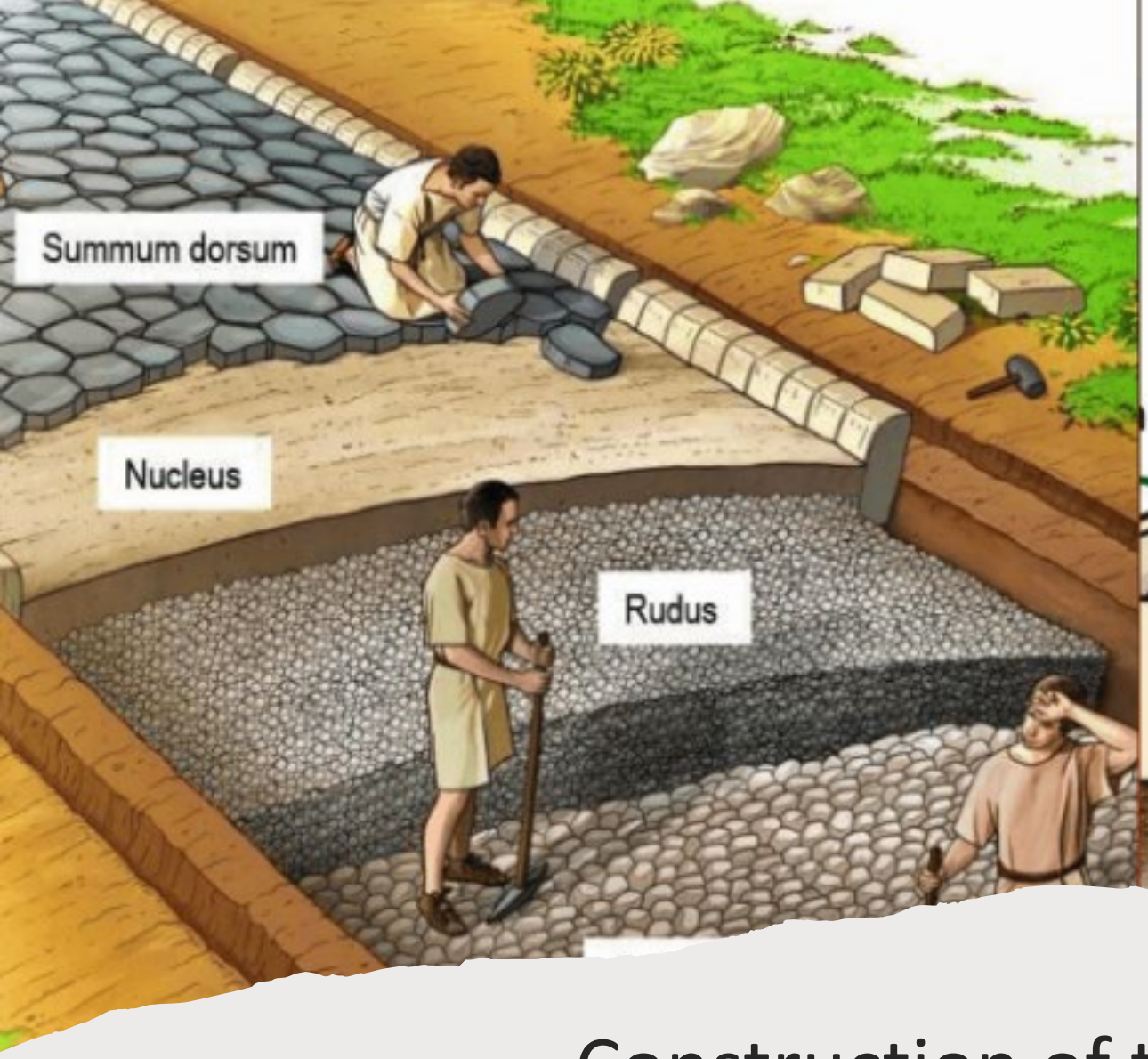
Road Surface and Size

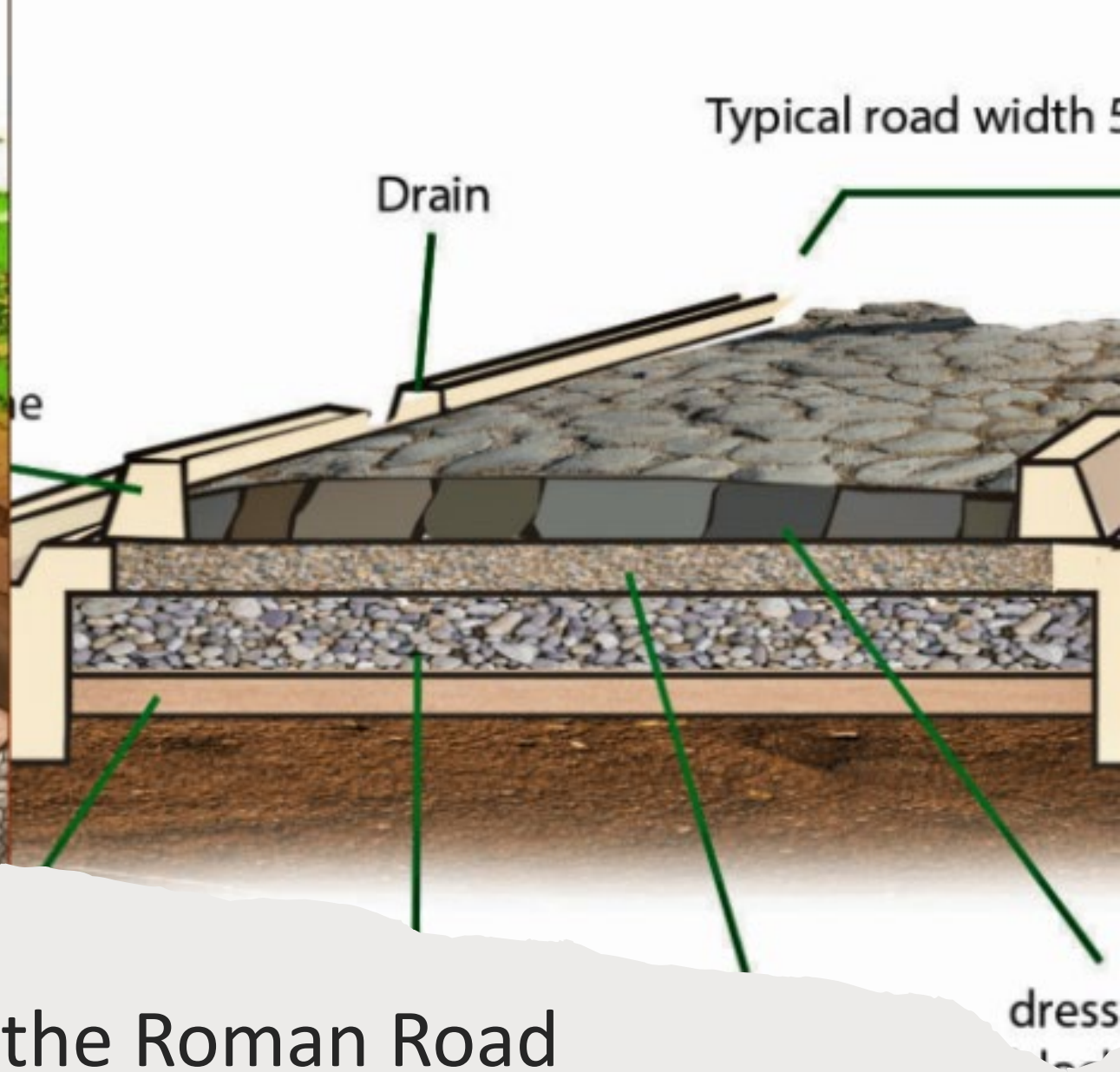
- Most Roads were finished with a gravel surface sometimes mixed with lime to make them smooth

- Major roads were around a standard 12-13 ft wide, which was enough space for two wheeled carts to pass each other.

- The most famous great Roman road is the Appian Way.

- Constructed from 312 BCE and it is about 121miles long

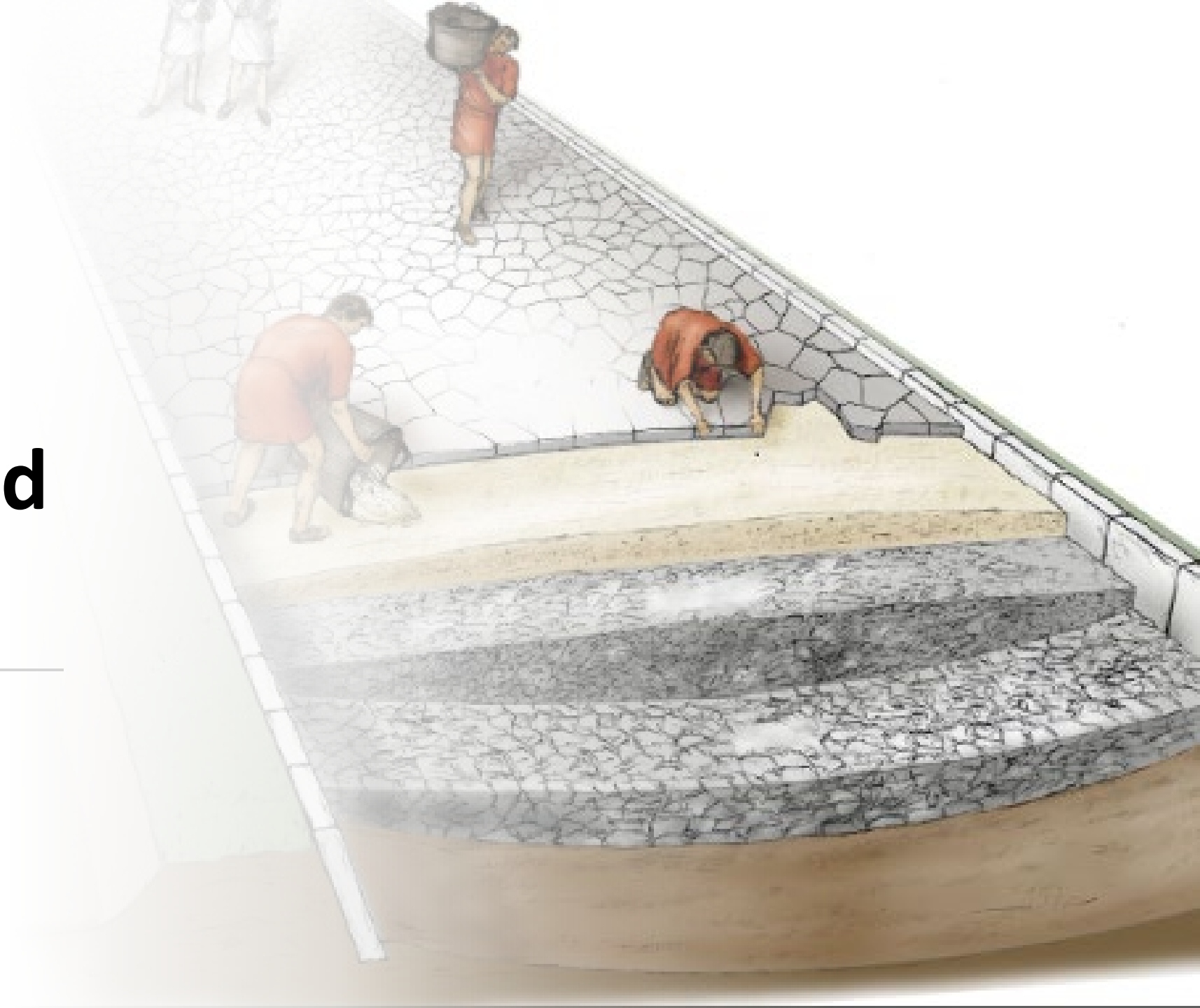




Construction of the Roman Road

Surveying and Planning:

Excavation and Foundation:



Layers

- Constructed in Three to Four layers.

The Materials

- The first layer was a base of large stones or rubble
- Next was a layer of smaller stones and mortar, which helped bind it together
- The Third layer of finer gravel or crushed stones, formed a solid yet smoother surface.
- Finally, cities and major roads add a layer of stone slabs, fitted closely together to form a durable surface.

Why am I talking about the construction of Roman Roads

Cambering and Drainage:

- The roads were all built with a Crown to direct rainwater to the sides of the road into the ditches.

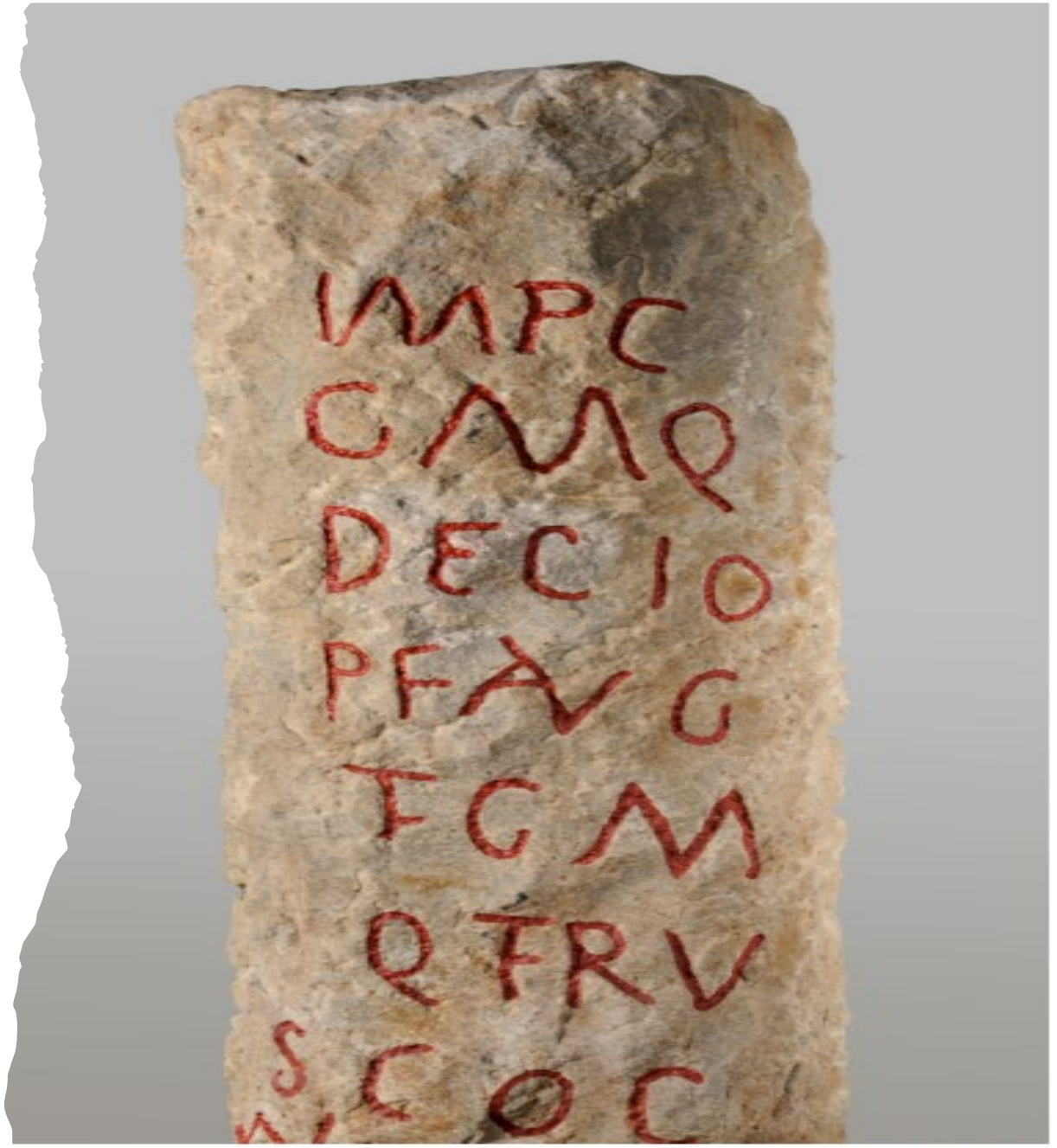
Durability and Maintenance

- Roman roads were built to last, with some still in use today.
- High-quality materials to minimized wear and tear.
- Additionally, Roman authorities regularly maintained roads,

Remains of a R

Mile Stones

- Distances
- Direction of travel
- Maintenance record



Roman Milestone

Modern Roads

- Remove unsuitable soils
- Still built using layers of aggregates
- Crown the surfaces
- Ditches on both sides
- We now use Asphalt or Concrete instead of stone slabs

Some Interesting Facts About Michigan Roads

Shortest State Trunkline road (M Route) in Michigan?

M-212 in Cheboygan County at 7/10ths of a mile long

Shortest Highway in Michigan?

I-375 in Detroit at 1.1 miles long.

Longe*st* Highway in Michigan?

I-75 Spanning from Ohio state line to the International Bridge in Sault Ste. Marie

Total Lane Miles of Roadside Ditches

County maintenance crews maintain approximately 179,000 lane miles

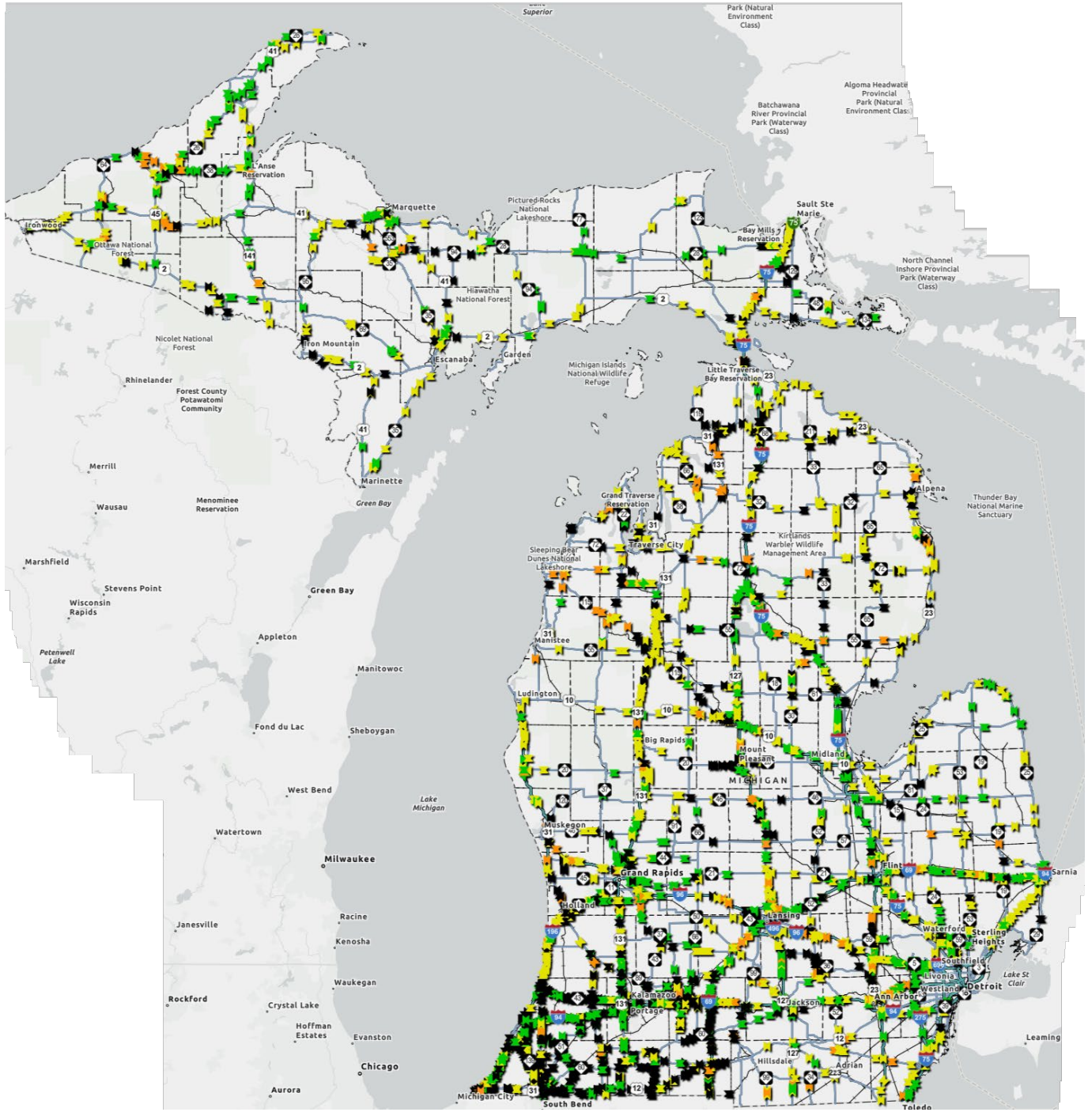
MDOT's maintenance crews and Contracting agencies maintain approximately 19,500 lane miles

Cities and Villages maintain approximately 42,500 lane Miles

Culverts

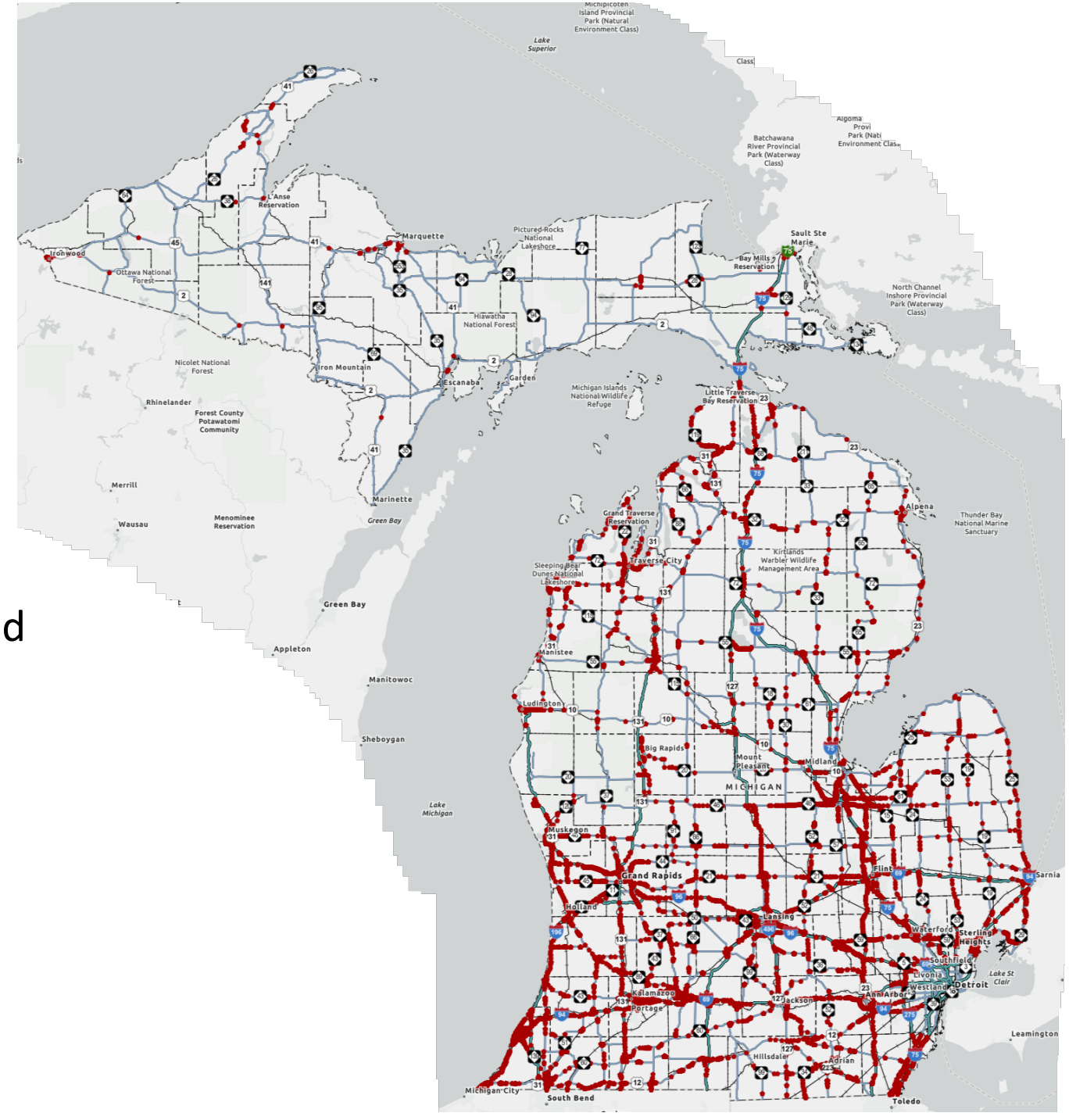
Ancillary Structures Less than 10 feet

- 49,928 Culvert located in GIS
- 2,585 Rated in Serious to Poor condition



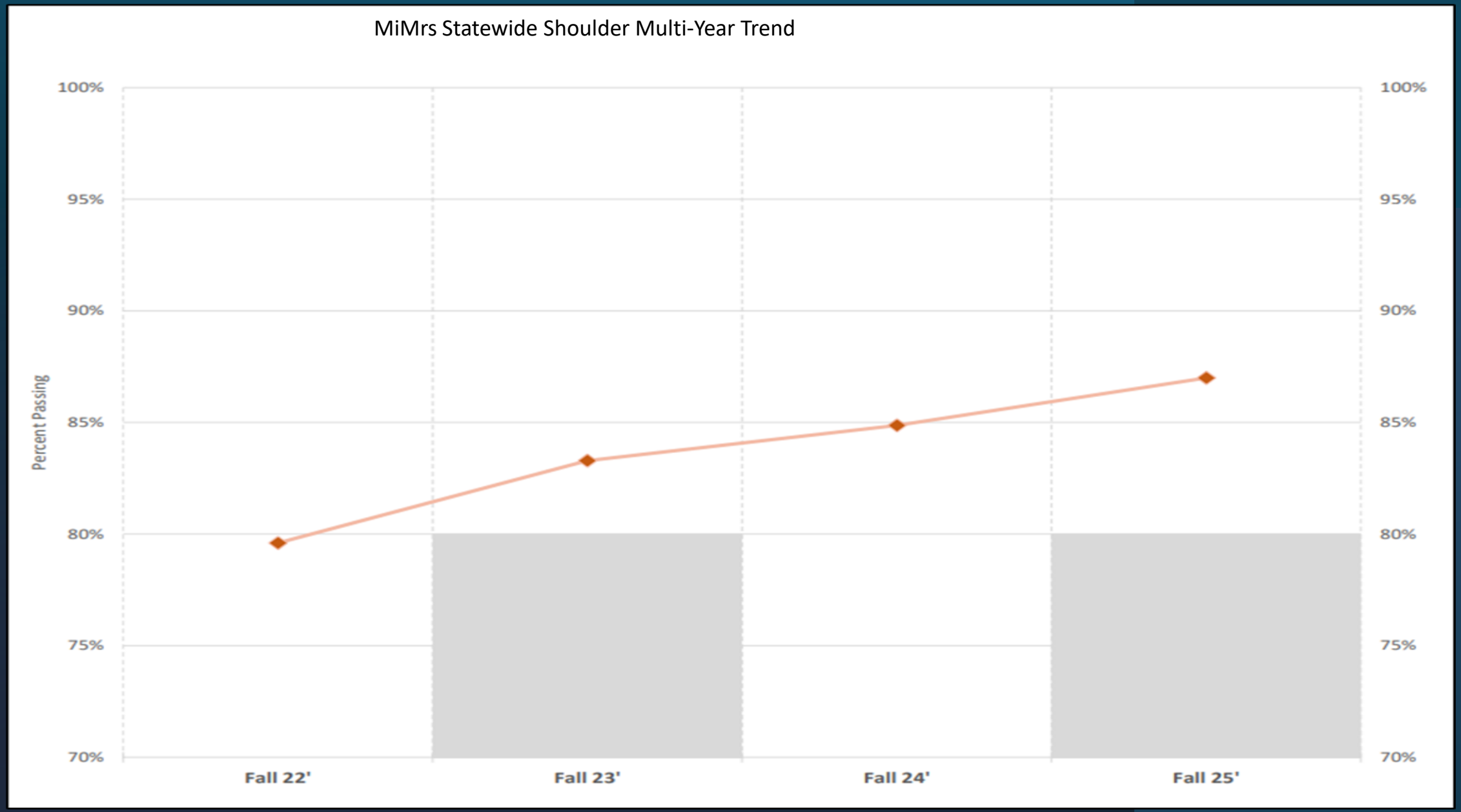
Catch Basins

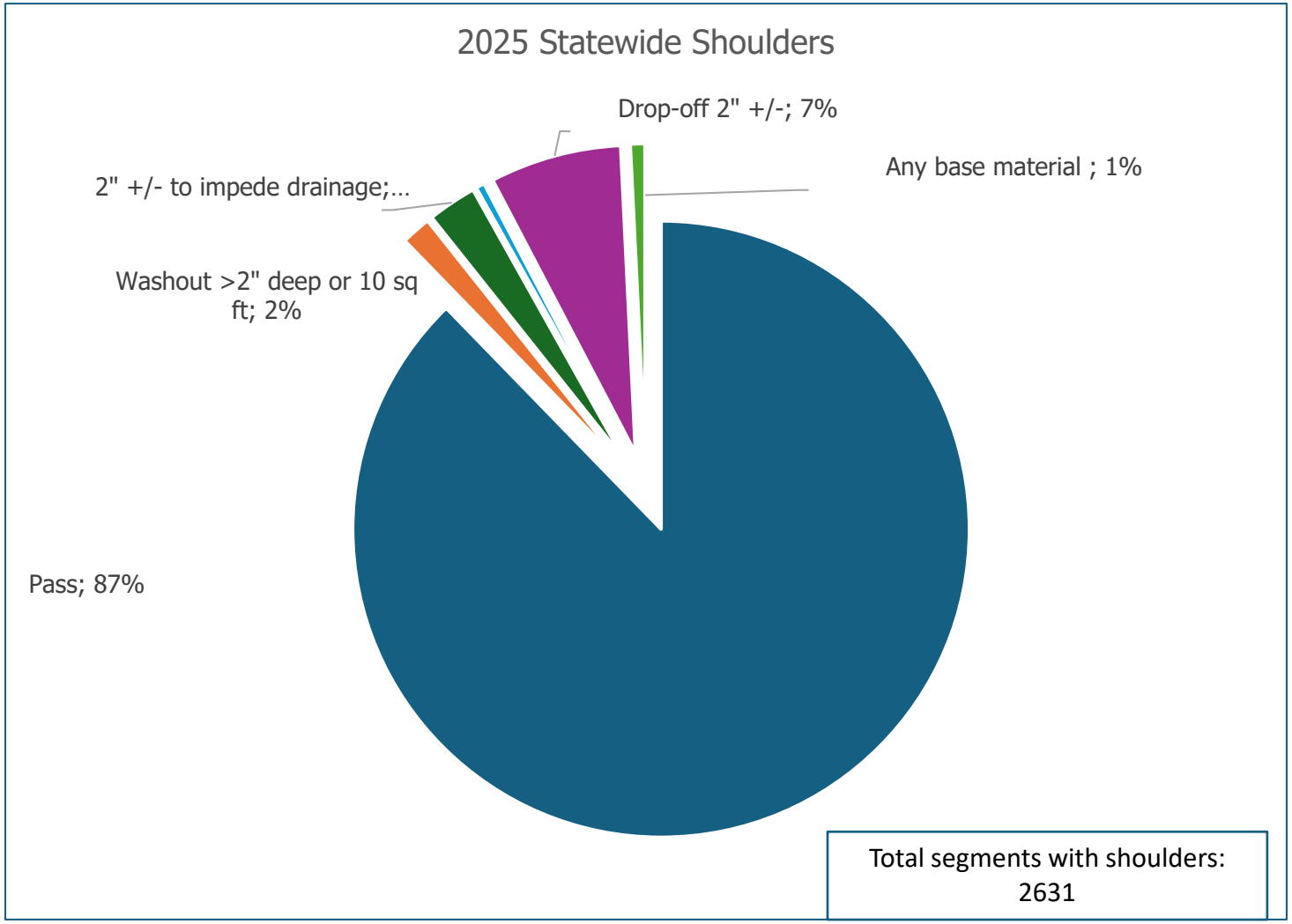
- 40,520 GIS located
- 31,795 Listed as Cleaned not inspected or Lid cannot be removed



This makes Drainage features a major asset.

MiMrs Statewide Shoulder Multi-Year Trend




2025 Statewide Shoulders
Drop-off 2" +/-; 7%
Any base material ; 1%
2" +/- to impede drainage;…
Washout >2" deep or 10 sq ft; 2%
Pass; 87%
Total segments with shoulders: 2631

The Break Down

Shoulders	Pass		2631		87%
	Washout >2" deep or 10 sq ft	2		41	2%
	2" +/- to impede drainage	3		67	3%
	Edge Loss (6" inward, 256' length)	4		12	0%
	Drop-off 2" +/-	5		180	7%
	Any base material	6		20	1%
	Buildup under guardrail	7		22	0%

Shoulders,
Ditch clean out,
Culvert and
underdrain
maintenance

- MDOT direct forces and Contract Agencies in FY 24 spent approximately $29,949,295.92 Drainage Maintenance on State Trunk Line

- This can create a significant constraint on budgets and labor.

What are the visible impacts of poor drainage maintenance?

- Washouts on hill sides
- Ponding,
  - Surface
  - Shoulder
  - Full ditches (Capillary Soft shoulder)
- Pot – Holes
  - Shoulder
  - Road

Signs of Drainage issues

Wash outs

- Water flowing on surface cause erosion down hills.

Wash outs

- Berm under Guardrail can channel water.

Ponding

- **Surface ponding:** Water that sits on the road surface seeps through cracks or joints, saturating the base layers.

Ponding cont.

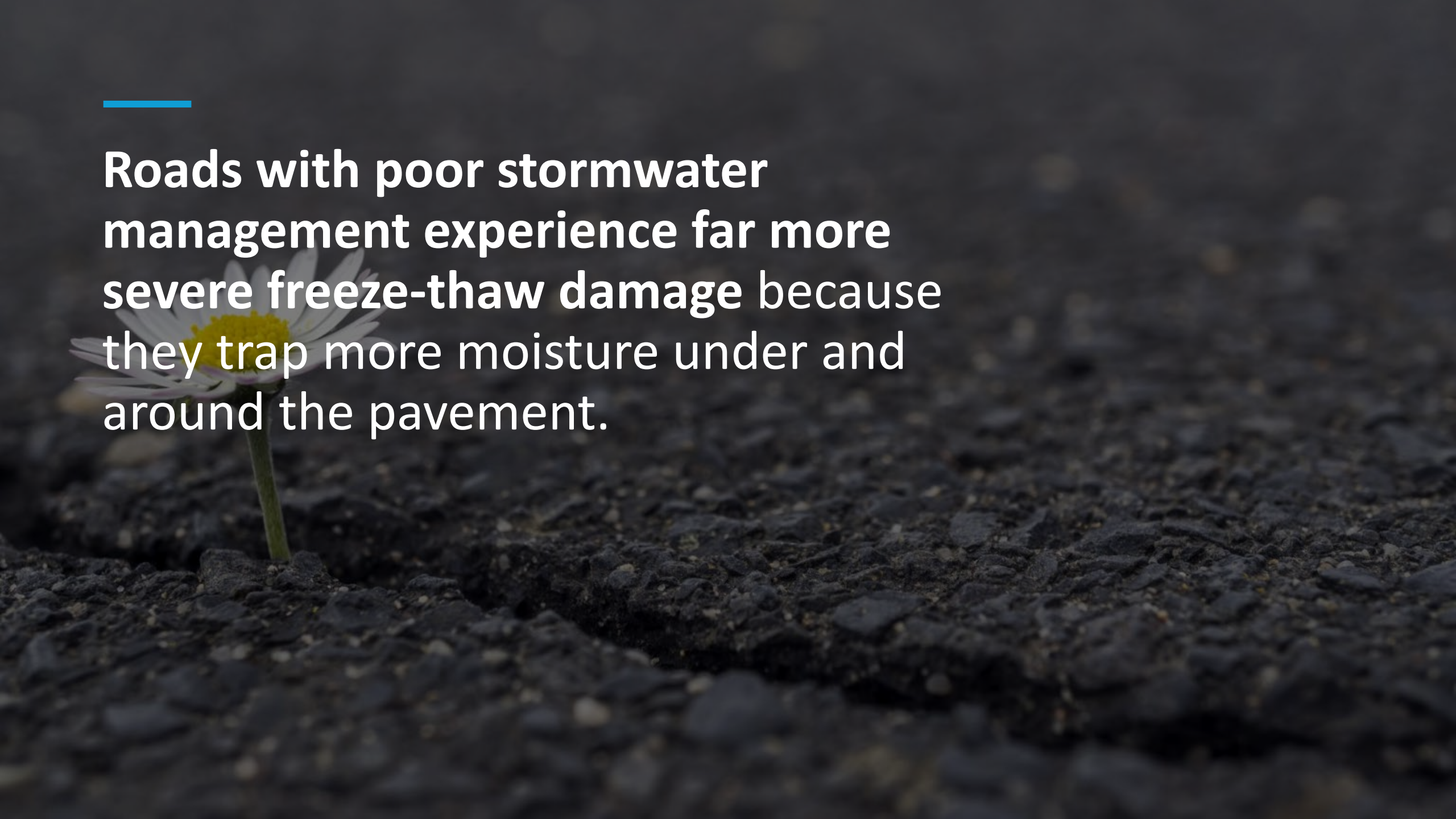
- **Shoulder Ponding:** Water along shoulders will saturate the ground and can migrate laterally into the subbase, softening support under the edge of the pavement.

. Full Ditches

- **Capillary rise:** Poorly drained soils can wick moisture upward into the pavement structure even without direct surface infiltration.

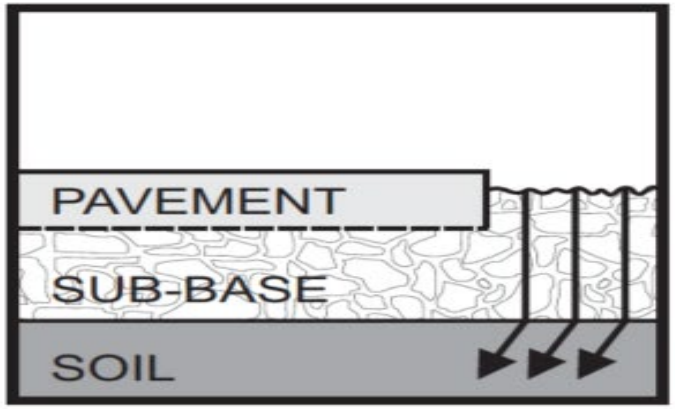
POT HOLES

- Unraveling
- Cracking

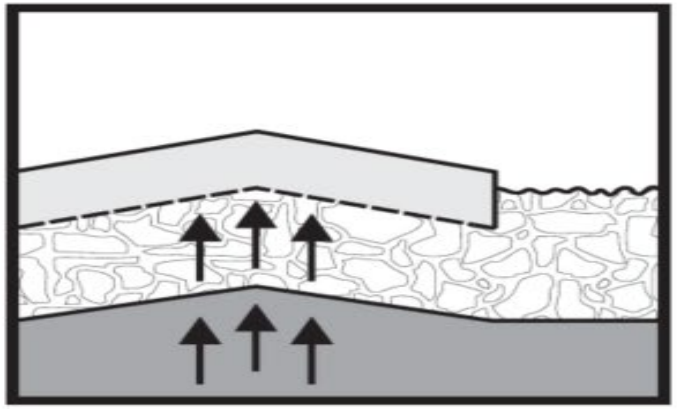


Roads with poor stormwater management experience far more severe freeze-thaw damage because they trap more moisture under and around the pavement.

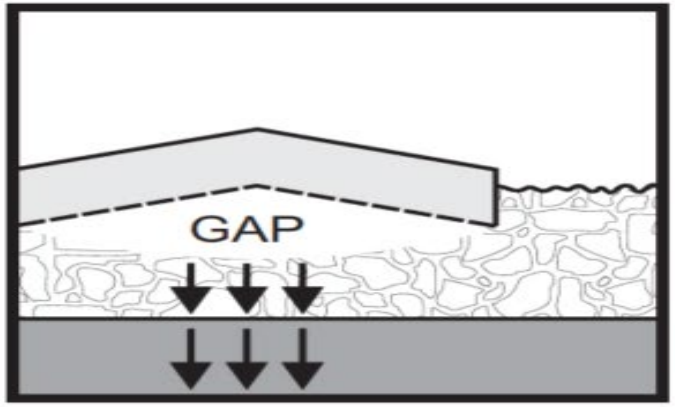
Birth of a Pothole



Potholes begin after snow or rain seeps into the soil below the road surface.



The moisture freezes when temperatures drop, causing the ground to expand and push the pavement up.



As temperatures rise, the ground returns to normal level but the pavement often remains raised. This creates a gap between the pavement and the ground below it.

When vehicles drive over this cavity, the pavement surface cracks and falls into the hollow space, leading to the birth of another pothole.

This information can be accessed on MDOT's Web site at www.michigan.gov/mdot

MDOT Graphics\Offices\Communications\Pothole files k/h Rev. 4/27/2004

Standing water undermines road base

- Poorly maintained shoulders and ditches can block stormwater from draining as designed
- Trapped water weakens the road base, reducing the pavements' ability to carry loads
- Leading to deformation, cracking, rutting, potholes, shoulder failures, and ultimately full pavement failure.

BENIFITS OF GOOD DRAINAGE

PREVENTS BASE WEAKENING

Keeps water away from the pavement.

Ditches, and culverts direct runoff away from the roadway and shoulders.

Edge drains and sub-surface systems remove infiltrated water before it can saturate the base.

PREVENTS SHOULDER DAMAGE

Keeps water away from the shoulders

Drop offs at edge of pavement

Secondary ditches

Potholes

REDUCES FREEZE-THAW DAMAGE

By minimizing trapped moisture, good drainage reduces the volume of water available to freeze and expand.

Roads with dry bases and shoulders are far more resilient to winter damage.

EXTENDS PAVEMENT LIFE

Roads with proper drainage require fewer repairs over time.

LOWERS MAINTENANCE COSTS

Keeping water away from roadways reduces the most common causes of potholes

Every dollar invested in drainage can save more money in future pavement repairs.

BENEFIT OF GOOD STORMWATER MANAGEMENT

- Money spent on Shoulder and Ditch maintenance directly affects the long-term cost of all roadway maintenance.
- Slows deterioration
- Reduces cost of future repairs
- Protects the investment made in roads against premature loss.

How do we find out about drainage issues?

- Citizen complaints
- Field reviews

How do we Maintain Shoulders and Ditches

- Breaming
- Shoulder Maintenance
- Edge Drain Maintenance
- Ditch Maintenance

Berming

- Ideal time to Berm is before grading shoulders
- Moisture of soil

How we remove Berm

- Grader
- Harley rake
- Off set disk
- Backhoe/excavator

What do we do with the Berm

- Pull berm to roadway and haul away
- If mostly gravel incorporate back into shoulder with Harley rake or offset disk
- If you are going to ditch the same area place berm in ditch

Methods for achieving good shoulder maintenance

Initial spring Maintenance

- Run Harley rake over shoulder/berm edge
- Grade all shoulders and add gravel as needed

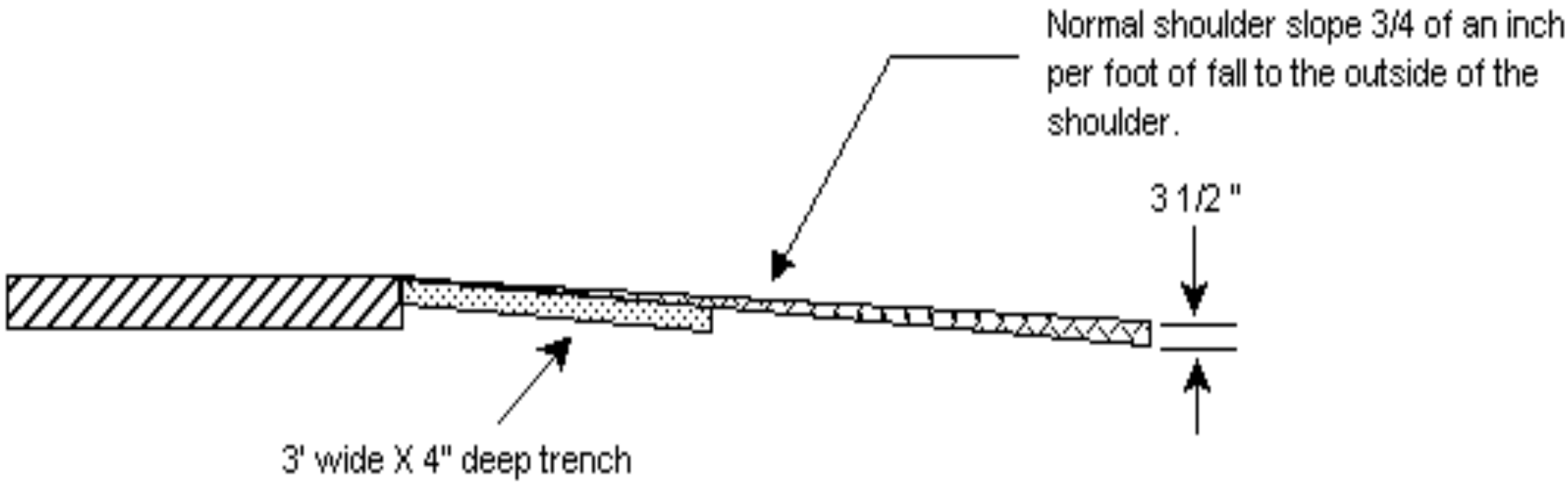
Rest of year Maintenance

- Grade shoulder minimum of 2 more times a year
  - Spot gravel patching
  - Spot Grading

- Fall repeat spring operation before winter

Gravel Shoulder Slope

1. Why we try to maintain a ¾ per foot of slope (6% slope grade)



What's Next?

- We have Bermed and graded the shoulder

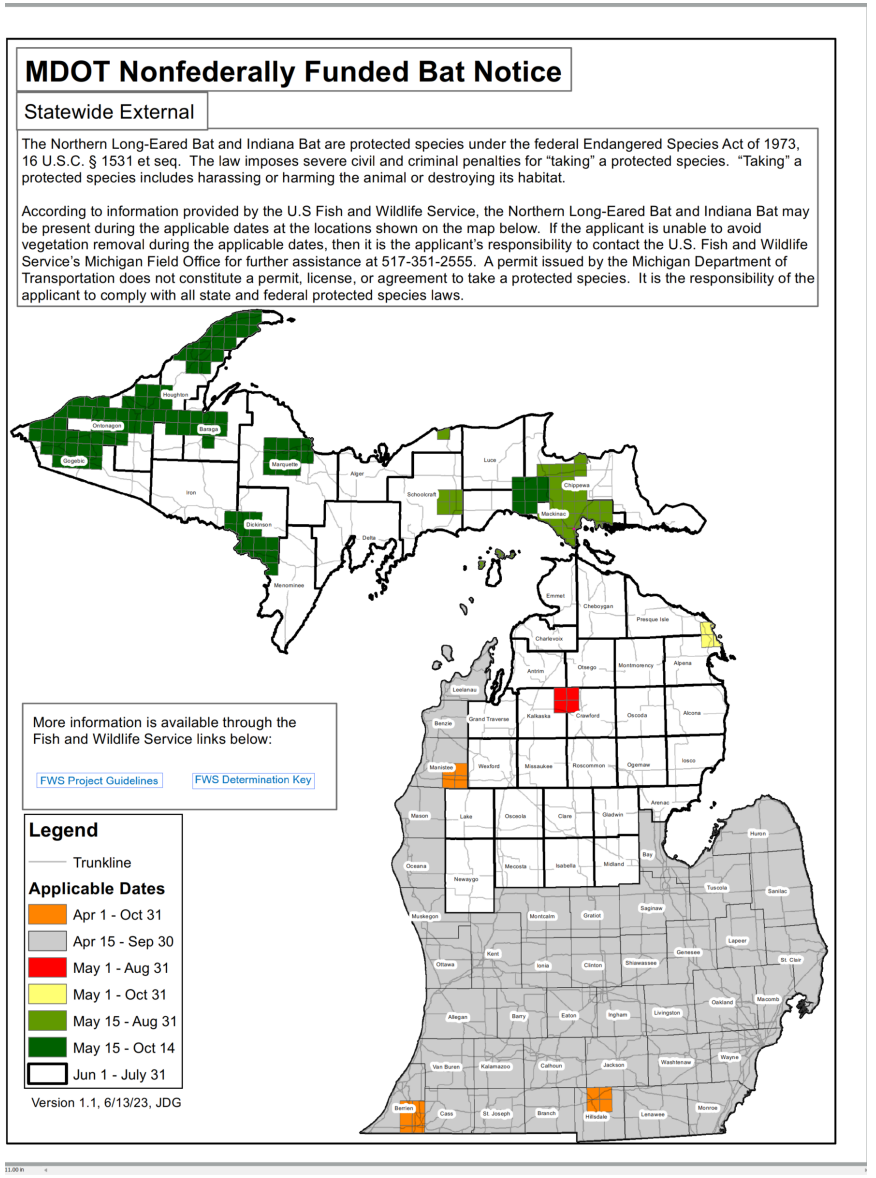
Preparing to Ditch

- **In winter look for ditch issues**
- **Clear trees and brush from ditches**
- **Spring - make rainy day inspections to look for protentional problems.**
- **Identify Edge drains, culverts and catch basins issues**
- **Come up plan to repair/ditch**

Tree Cutting Restrictions

- The Northern Long-Eared Bat and Indiana Bat are protected species under the Federal Endangered Species Act of 1973

- We are restricted to cutting trees down from September 30th to April 15th



Issues found

THE PLAN

- Identify problem Ditches culverts, and Catch basins
- Ownership
- Where does the water go next?
- Contact local agencies
- If on M route contact homeowners with flyer of coming project

THE PLAN Cont.

- If draining into stream or waterway of the State acquire appropriate permits from EGLE
- Purchase needed materials (Straw blankets, seed, Riprap, mulch , replacement culverts)
- Call MISS DIG

How we Ditch

Follow activity guide for Ditch Clean Out 1230

Activity Guide 1230

- Establish the ditch flow line (useing appropriate measuring device).
- Determine the location where the water will outlet.
- If spoils are left on site, remove all debris, grade properly, and prepare spoils for seeding.

- Avoid creating a "V" bottom ditch; a 2-foot round-bottom ditch is the minimum requirement. 3 feet or wider ditches are desirable for drainage and snow storage.

Activity Guide 1230

- Remove spoils and load into trucks with minimum interference with traffic.
- If spoils cannot be left at the ditching site, find an appropriate use on the right-of-way (i.e. slope flattening behind guardrail, washout repair, or filling ruts from runoffs).
- Refer to Maintenance Advisory 2018-03 “Environmental Requirements for the Disposal of Surplus and Unsuitable Soils”.

Maintenance Advisory

MA 2018-03
December 7, 2018

From Mark Geib, Engineer of Transportation Systems Management and Operations Division

MDOT
TSMO Division
6333 Lansing Road
Lansing, MI 48917

Questions regarding this Maintenance Advisory should be directed to:

Cameron Sherman,
Roadside Unit
Phone: 517-614-4068
ShermanC6@michigan.gov

Environmental Requirements for the Disposal of Surplus and Unsuitable Soils

Department maintenance personnel are prohibited from disposing of surplus and unsuitable soils from a maintenance activity into a floodplain or wetland within a Department-owned right-of-way or other public or private property. Any unauthorized material disposal in floodplains or wetlands is illegal and could result in the Regulatory Agencies (Michigan Department of Environmental Quality or United States Army Corps of Engineers) issuing a Notice of Violation with potential fines. In addition, they could require the material to be removed with the disturbed areas to be restored and stabilized. Following are the requirements for the proper disposal of surplus or unsuitable soils within a Department owned right-of-way:

Maintenance Activities:
Any disposal of surplus or unsuitable soil within a Department owned right-of-way, during maintenance activities, may require an environmental review to ensure that protected plants, wetlands, floodplains or other sensitive environmental resources are not impacted. Please coordinate with the Region Resource Specialist/Analyst and/or Permit Coordinator to determine if an additional environmental review is required.

The same requirements apply to any request from a contractor or private property owner to dispose of surplus or unsuitable material within a Department owned right-of-way.

Any request from private property owners to receive surplus or unsuitable soils from Department maintenance projects must follow subsection 205.03.P. of the Standard Specifications for Construction. T he disposal area must be inspected to ensure the area is not a w etland or floodplain, as well as determine if additional environmental revi ew is required prior to disposal. These requests will require an approved MDOT right-of-way permit prior to placing material in the MDOT right-of-way.

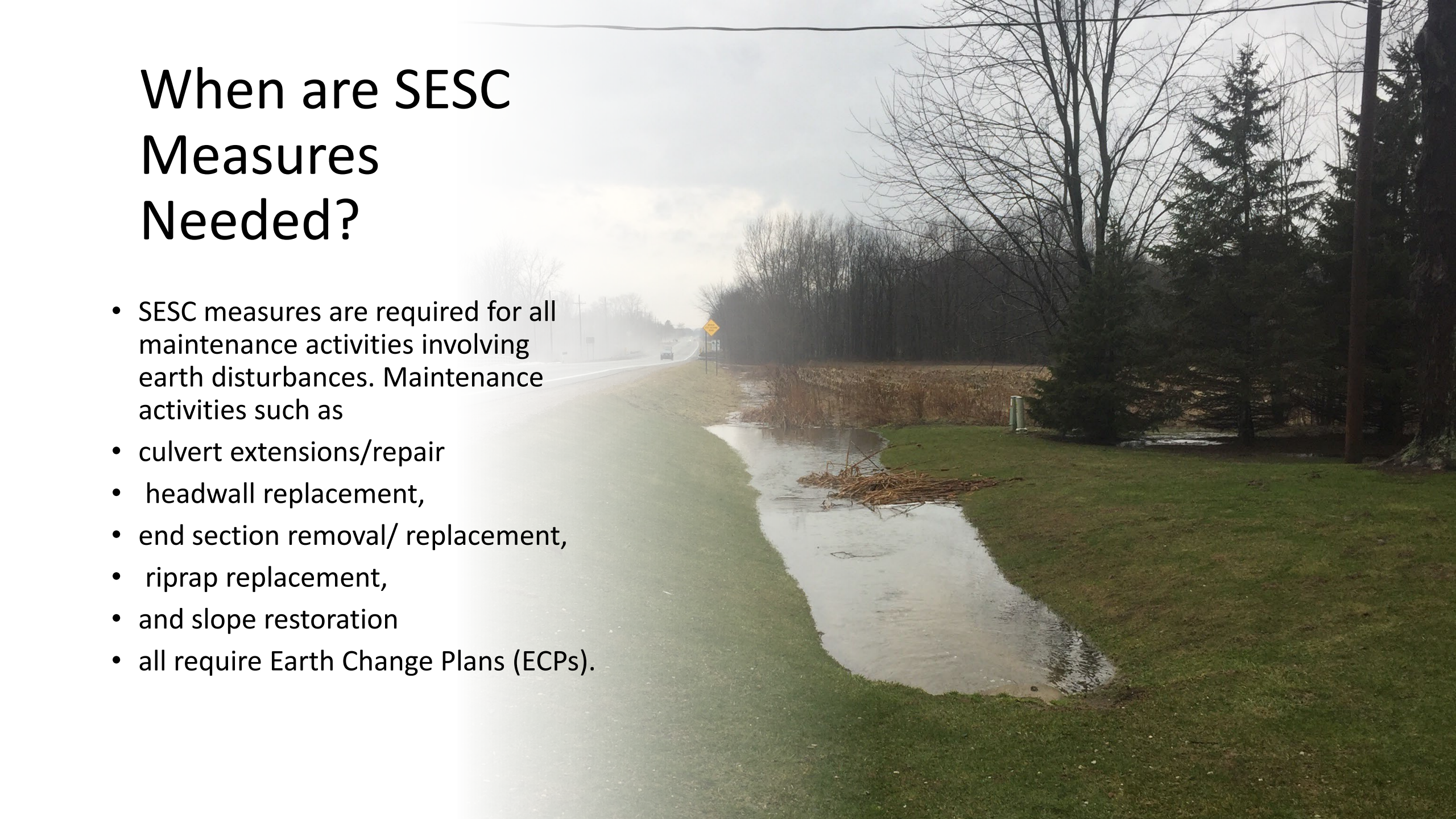
The above requirements apply regardless of funding source used for the work (federal or state).

- Department Maintenance personnel are prohibited from disposing of surplus and unsuitable soils from a Maintenance activity into a floodplain or wetland within a Department – owned ROW or other public or private property.

- Disposal area may require an environmental review to ensure protected plants, wetland, floodplains or other sensitive resources are not impacted

When are SESC Measures Needed?

- SESC measures are required for all maintenance activities involving earth disturbances. Maintenance activities such as
- culvert extensions/repair
- headwall replacement,
- end section removal/ replacement,
- riprap replacement,
- and slope restoration
- all require Earth Change Plans (ECPs).



SESC Measures

- **As required, dress, mulch and seed and/or sod slopes to prevent erosion. See sections 816 and 917 of the STANDARD AND SPECIFICATIONS.**

- **If the ditch slope is one percent or more, install sediment traps in the ditch bottom, spaced approximately 300 feet apart (± 50 feet).**

SESC Measures

- **Maintain a vegetative buffer between the lower limit of the ditch clean out operation and the outfall to the watercourse.**

- **If the vegetative buffer cannot be left in place while the disturbed area upstream stabilizes, place high velocity mulch blanket on the ditch bottom a minimum of 150 feet upstream from the lower limit of the ditch clean out operation.**

- **If the ditch carries water continuously, install a check dam and sediment trap at the downstream end of the ditch.**

SESC Measures

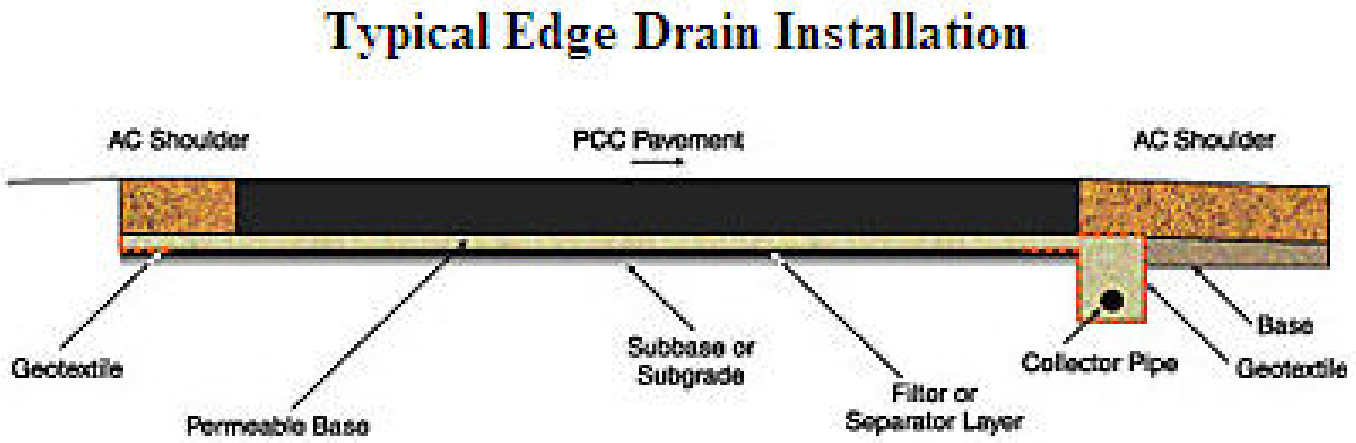
- **Remove the vegetative buffer only after the disturbed area upstream has been stabilized. After removing the vegetative buffer, stabilize that area with high velocity mulch blanket.**

- **Within five days of completing the work, seed and mulch all exposed areas resulting from the ditch cleanout activities.**

- **If the work is completed outside of the seasonal limitations for seeding, place high velocity mulch blanket over the entire disturbed area.**

- **Contact appropriate region resource staff for alternative restoration recommendations.**

Maintaining Edge Drains



What is an Edge Drain?

- Longitudinal drains under pavement
- Placed in permeable base layers
- Drain water out of subbase

Why Should They Be Maintained?

- Inadequate drainage may cause subgrade pumping leading to pavement distress
- To maintain the structural integrity of the roadway

Steps for Maintaining an Edge Drain

- Find the laterals (marked)
- Visually inspect the ending
- Remove vegetation from around the ending
- Clean laterals with jetter if plugged
- Inspect drainage system if there seems to be a problem.

Locating the Endings

- From 1998 on, the endings were marked on the shoulder and are 300’ apart
- Before 1998, the endings were marked with posts and are 500’ apart

Inspect the Ending

- Is water flowing
- Is vegetation restricting proper flow
- Check rodent screen
- Does the lateral appear to be plugged

Remove Vegetation

- Remove vegetation that is impeding flow of water
- Inspect and clean rodent screen if installed

Cleaning the Lateral

When using a jetter do not exceed 700 psi of water pressure


Traffic
10
KEEP LEFT
75
Post Event
Traffic
10
75

Culverts Maintenance

Before and After new tube


DOPIE'S


DOPIE'S

Before

- Added catch basin

- Shallow paned Ditch

THE END!