



Pervious Pavement

Design and Implementation Lessons Learned

June 4, 2014

ECT Environmental
Consulting &
Technology, Inc.



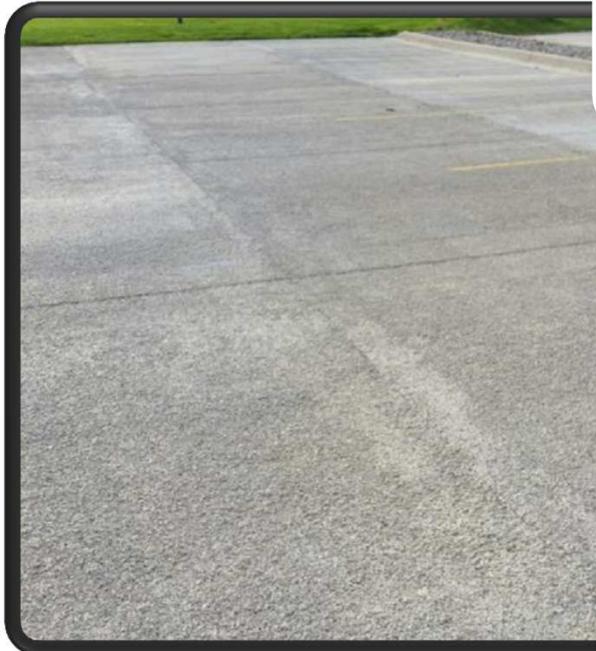
Pervious Pavement

What

Why

Where and
When

How

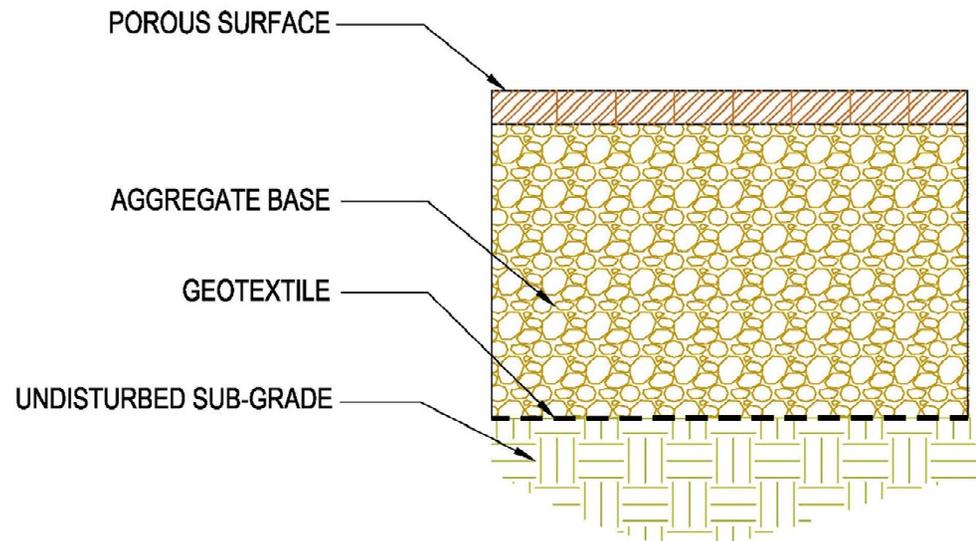


Pervious Pavement (What)

Porous Surface- pervious concrete, porous asphalt, permeable pavers, reinforced turf/gravel...

Aggregate Base- open graded, clean, and washed coarse aggregate for storage and support

Sub-grade- minimally compacted to promote infiltration



Benefits (Why)



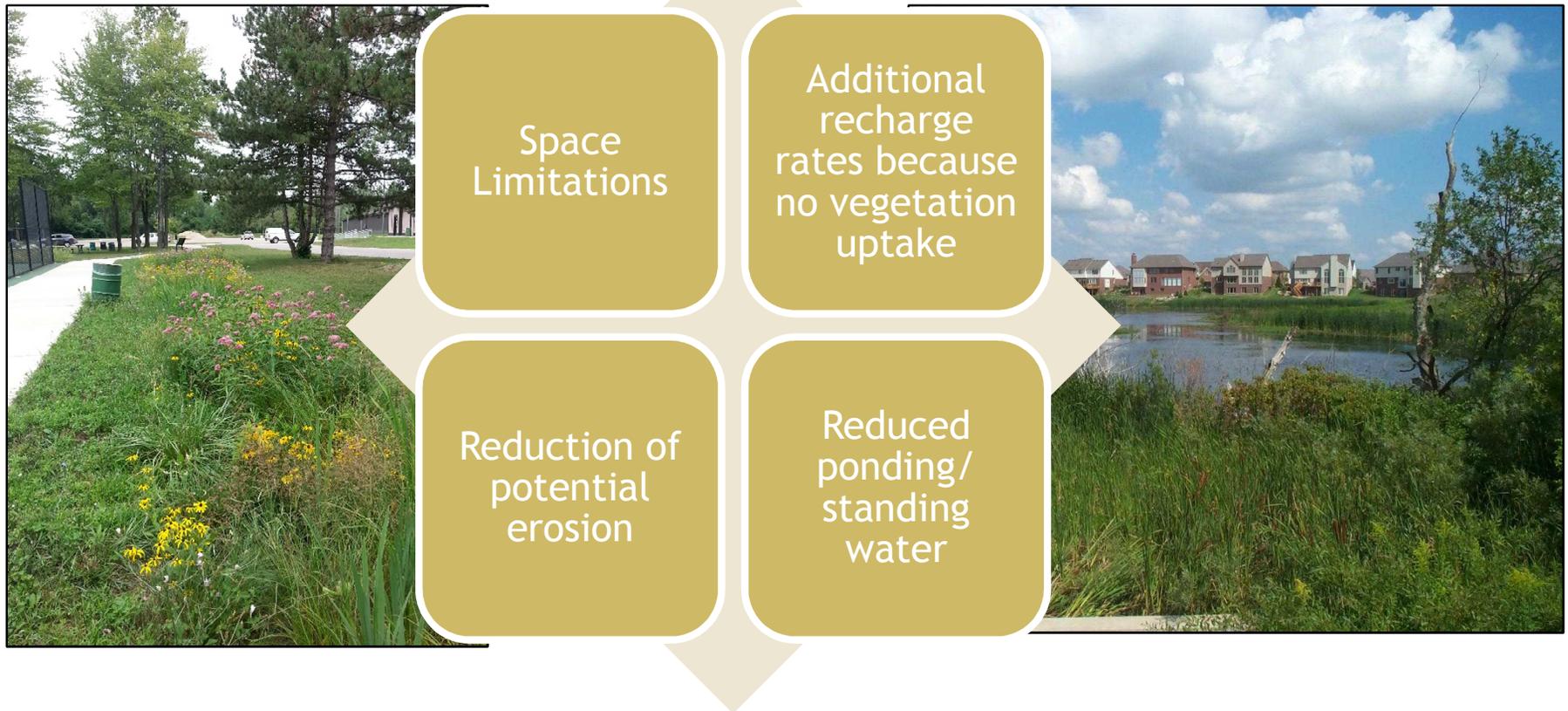
Effectiveness

Pervious
Pavement
Pollutant
Removal, % by
mass*

- Total Suspended Solids 82-95%
- Total Phosphorus ~65%
- Total Nitrogen 80-85%

*Schueler, 1987, as quoted in EPA, 2004.

Benefits over other GI



Planning (Where and When)

Considerations

- Proposed Use
- Soil Conditions
- Water Table
- Topography
- Space
- Cost
- Other Site Considerations

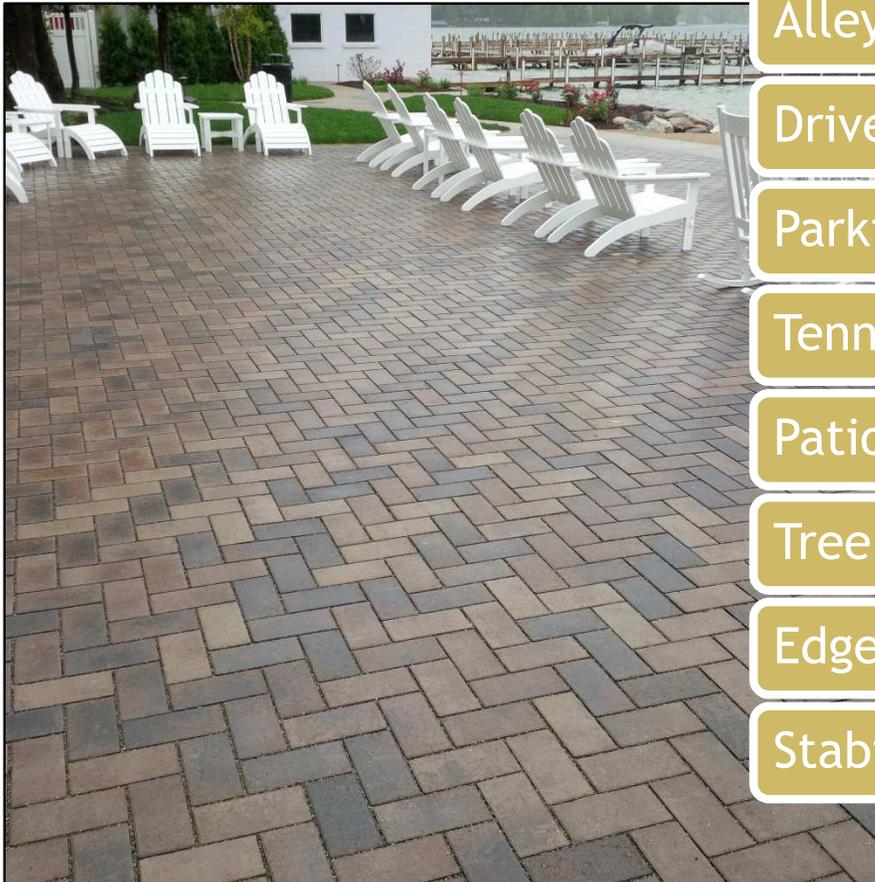
Planning (Where and When)

Why we chose not to:

- Known Site Contamination
- Adjacent to Retaining Structures
- Cost



Applications



Sidewalks

Alleys

Driveways

Parking Lots

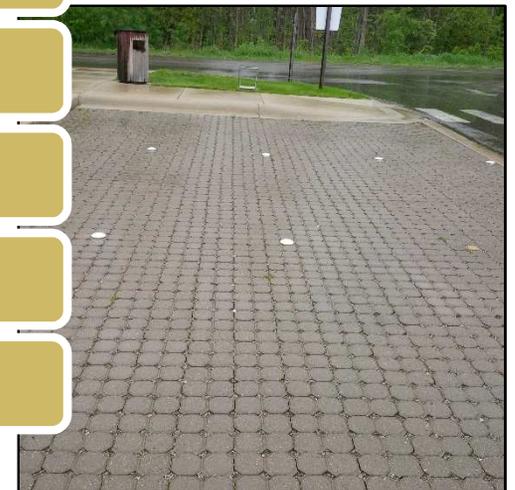
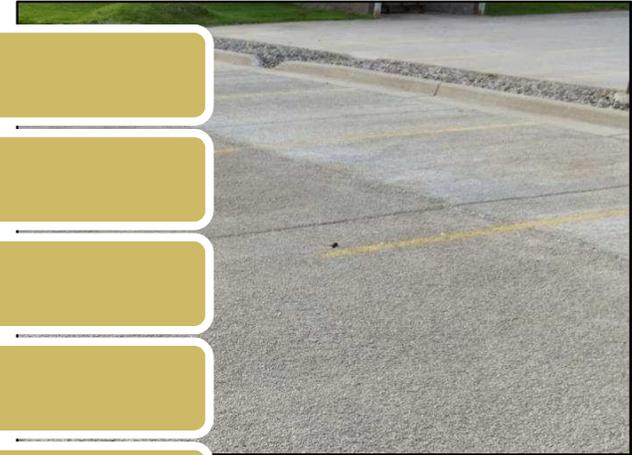
Tennis Courts

Patios

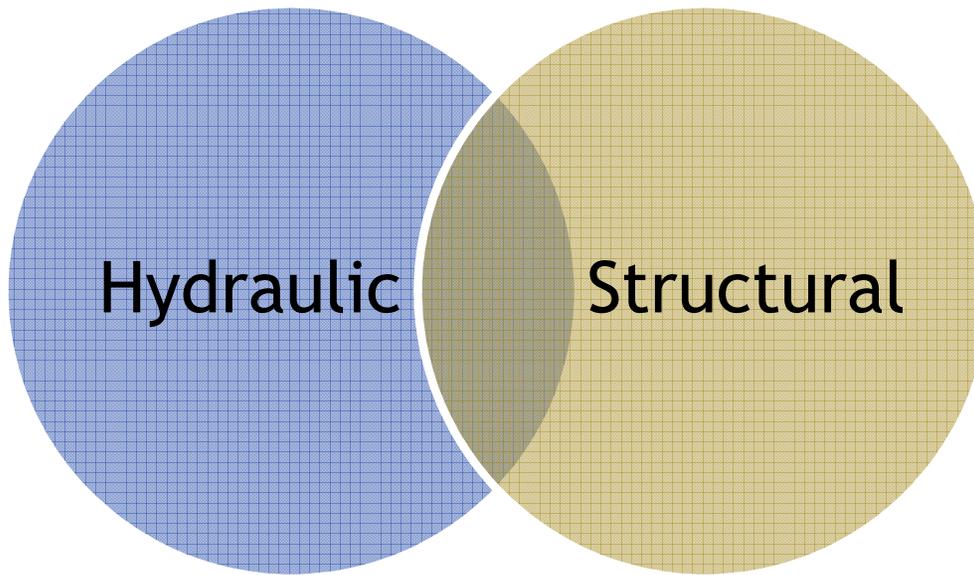
Tree Grates

Edge Drains

Stabilization



Designing



Variables

- Soil Conditions
- Water Table Location
- Hydrology
- Topography
- Intended Use
- Budget
- Client Expectations

Designing- Soil Conditions and Hydrology

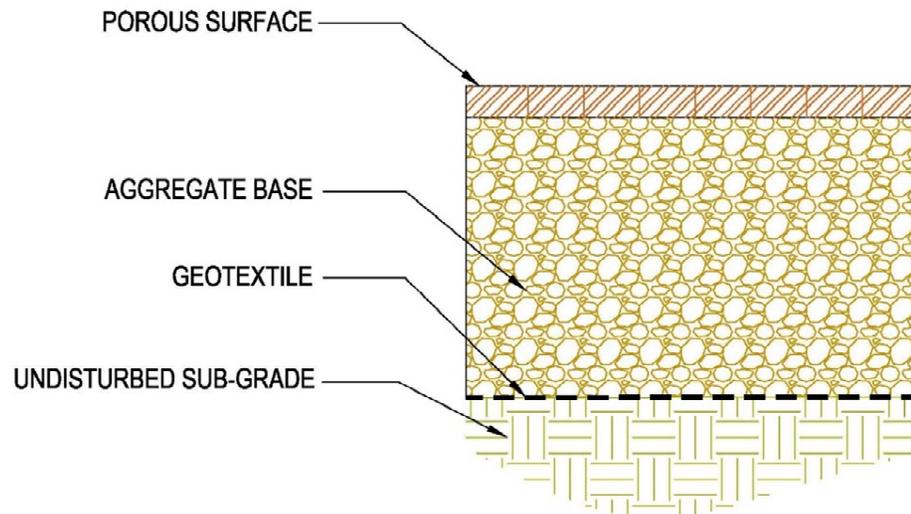
How much water will you have and how much will infiltrate?

Infiltration

- ½ in/hour- ideal
- Drawdown time < 5 days

Hydrology

- Drainage Area
- Volume of Water



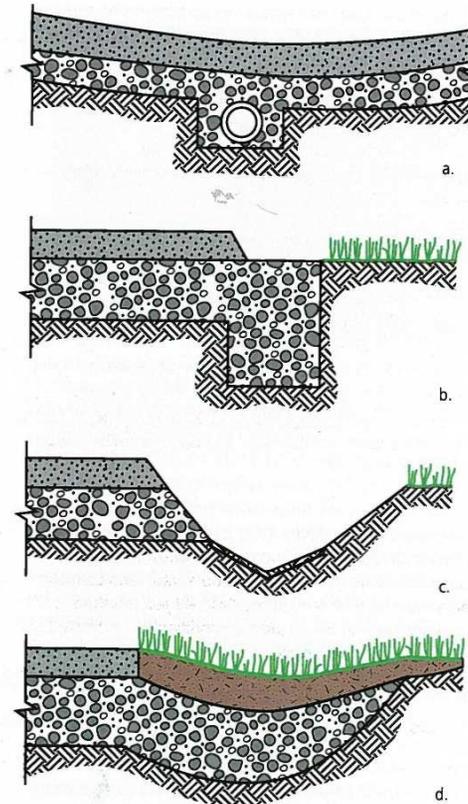
Designing



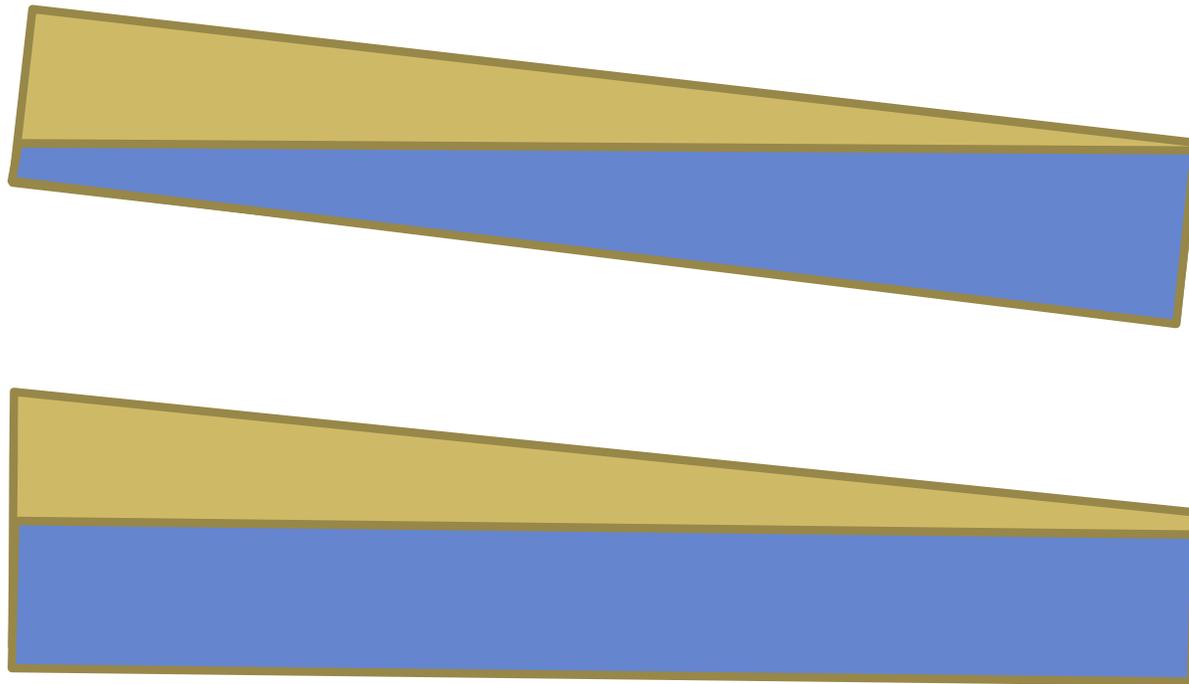
Amount of
Stone



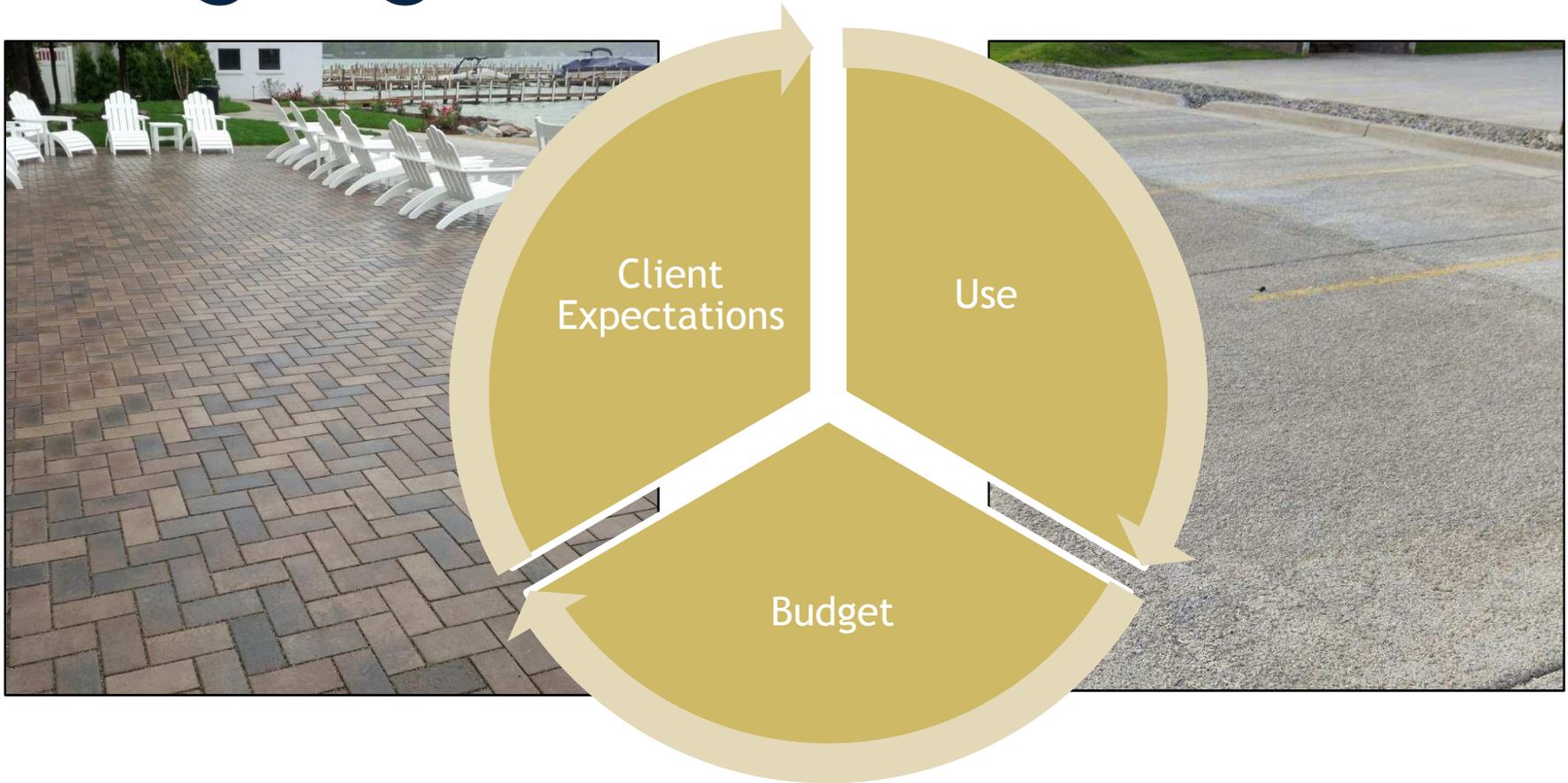
Underdrain/
Overflow
Options



Designing- Topography



Designing



Beech Woods Park

Southfield, MI

Part of an overall
greening project

Parking lot in
need of repair

Geotechnical-
Silty Sand

Topography- 3'
drop

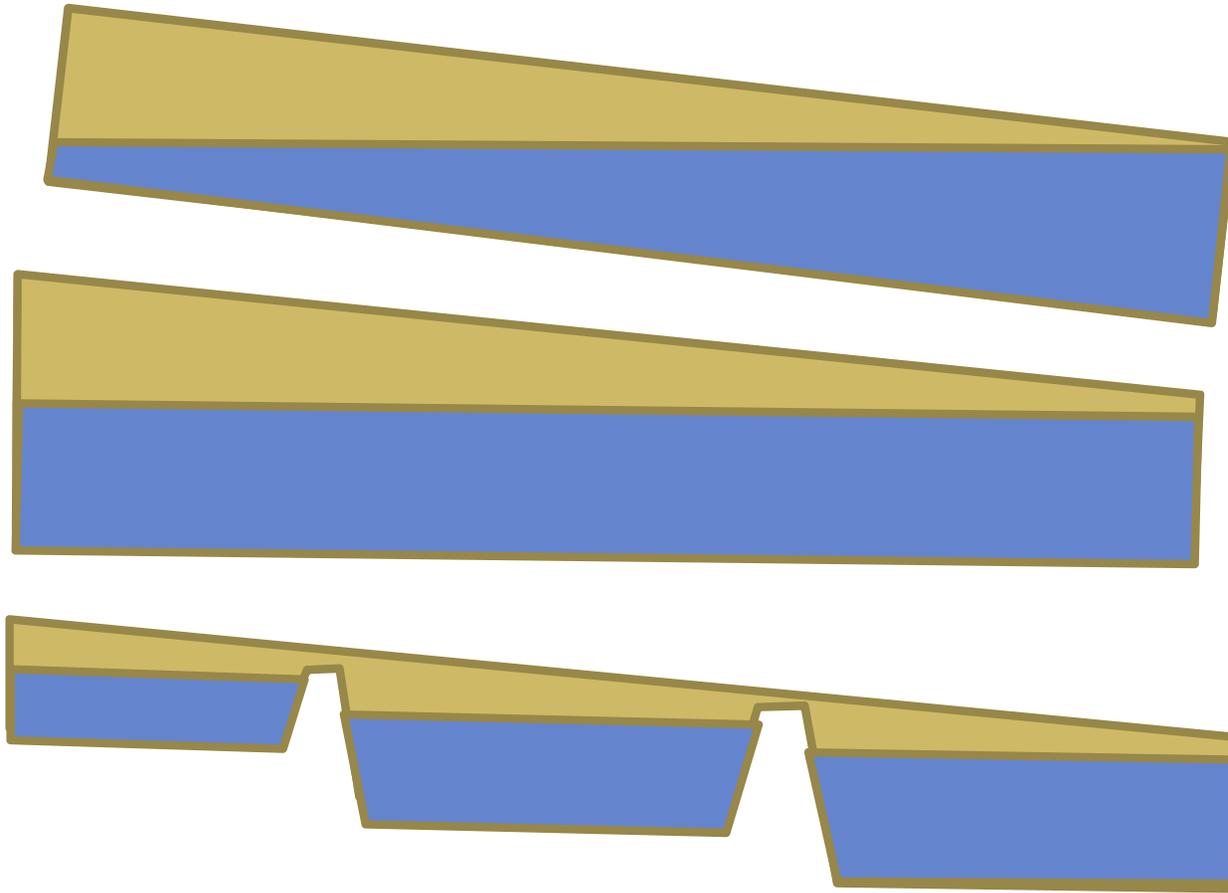


Beech Woods Golf Course

Southfield, MI



Designing- Topography



Beech Woods Park

Southfield, MI



Beech Woods Golf Course

Southfield, MI



Beech Woods Golf Course

Southfield, MI



Beech Woods Golf Course

Southfield, MI



Beech Woods- Lessons Learned

Southfield, MI

Geotechnical

Topography

Aesthetics

Rain Garden/
Bioswale



Inglennook Park

Southfield, MI

Need for additional parking

Site Drainage Issues

Need Asphalt Repairs

Aesthetics



Inglennook Park

Southfield, MI



Inglennook Park

Southfield, MI



Inglennook Park

Southfield, MI



Inglennook Park

Southfield, MI



Inglennook Park

Southfield, MI



Inglennook- Lessons Learned

Southfield, MI

Geotechnical

Hydrology

Transition from Asphalt to Pavers

Aesthetics

Rain Garden/ Bioswale



Inglenook Park

Southfield, MI



Pervious Concrete

Concrete solutions for a sustainable tomorrow.

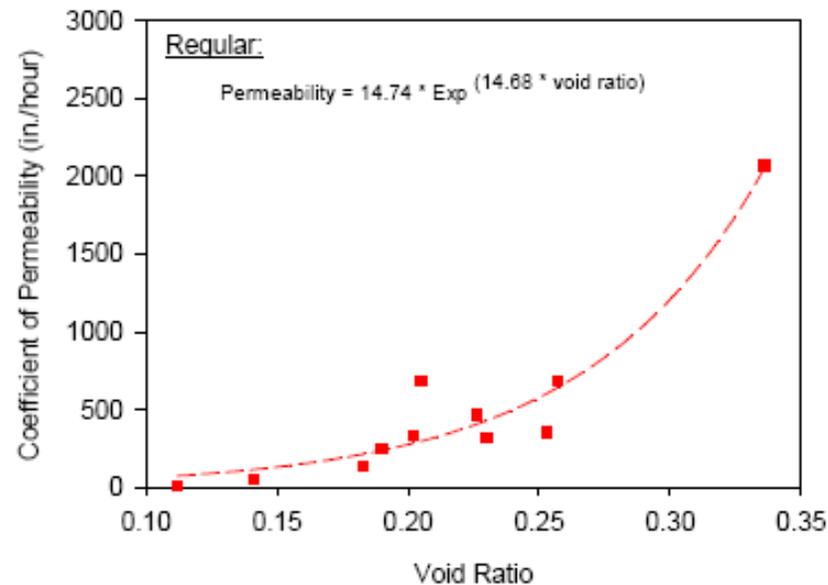


Texture and Material



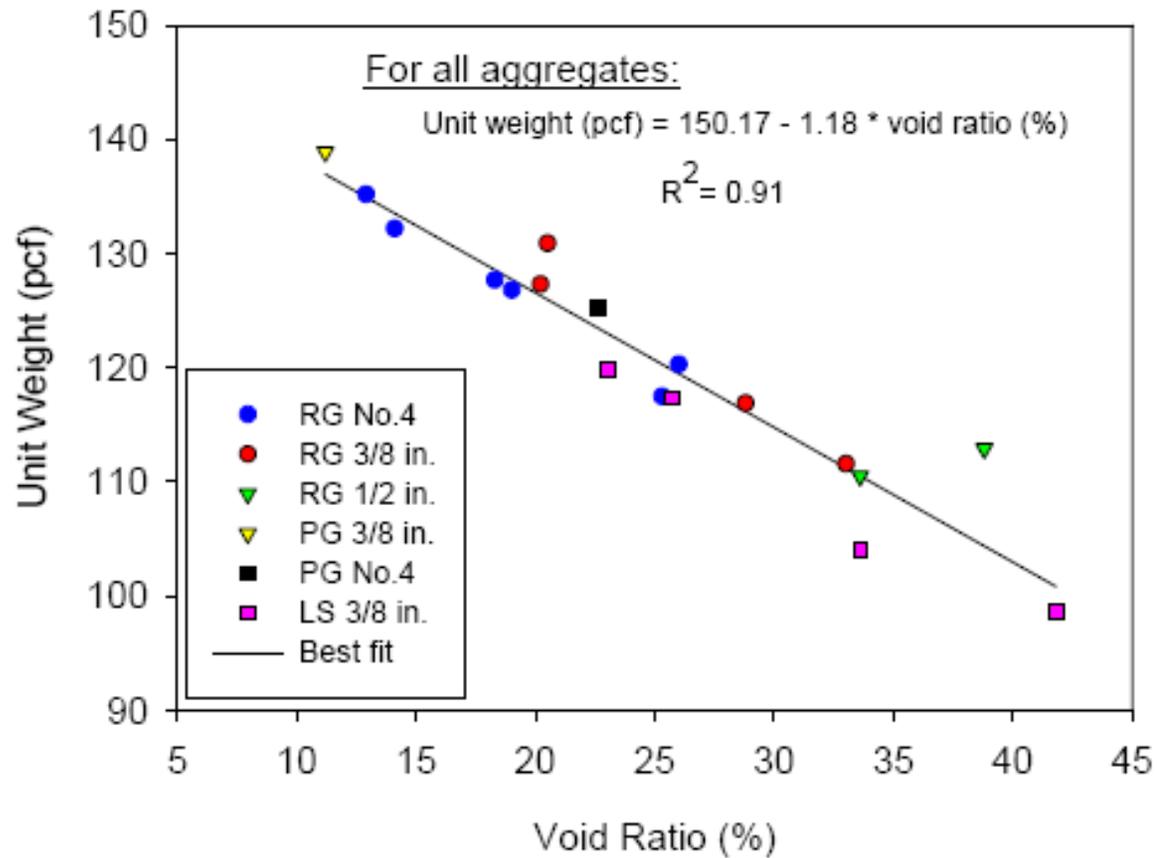
Permeability

- ▣ Permeability increases expediently with void ratio



- ▣ 15-19% void ratio equates to 135-240 in/hr

Unit Weight vs. Void Ratio



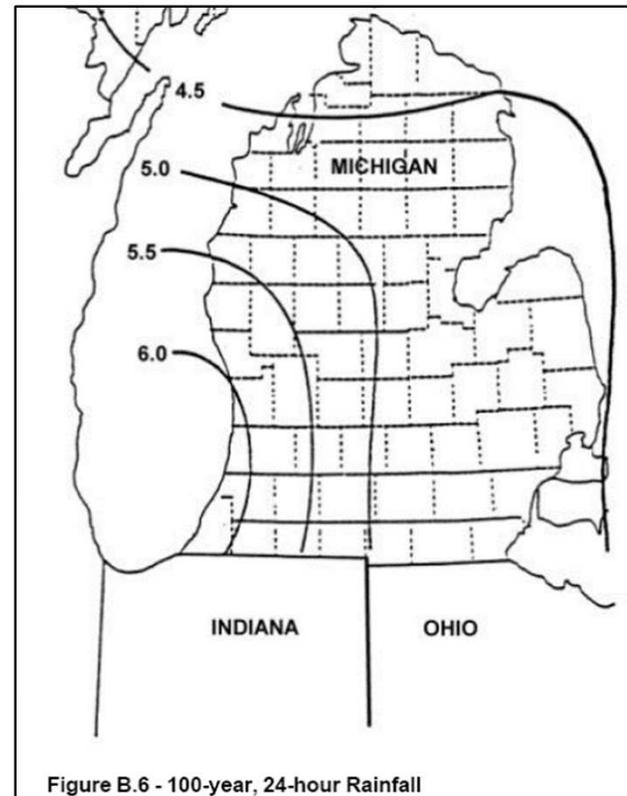
100 Year Storm 24 Hour Rainfall

Average Michigan Yearly Rainfall

Grand Rapids 36.04 inches
Monthly 3.00 inches

Detroit 32.62 inches
Monthly 2.72 inches

Lansing 30.63 inches
Monthly 2.55 inches



To handle a month worth of rain with no percolation through sub-grade

- ▣ 6 inches of pervious concrete with a 15% void structure will hold. ($6 \text{ in} * .15 = .9 \text{ in}$)
- ▣ 6 inches of stone with 40% porosity will hold ($6 \text{ in} * .4 = 2.4 \text{ in}$) ($.9 \text{ in} + 2.4 \text{ in} = 3.3 \text{ in}$) Capacity
- ▣ **But since we don't want water freezing in the pervious 8 inches of stone base with 40% porosity**
($8 \text{ in} * .4 = 3.2 \text{ in}$)

Low W/C Ratio?



Pavement Ravels

Dry Mix



High W/C Ratio?



Pavement Seals

W/C Just Right



Placement- should be sticky



Compaction and Jointing Tools



Curing



Salt - some pull moisture from air

- ⦿ Sodium Chloride - table salt - stays dry
 - Best Option - rock salt
- ⦿ Calcium chloride - pulls high moisture
 - Works great for road dust control
- ⦿ Magnesium Chloride - Problem

Jointing



MCA Lot - Placed 2006



Thank you!

Alice Bailey, P.E. -
Environmental Consulting &
Technology

Daniel DeGraaf- Michigan
Concrete Association