Applying Green Infrastructure Solutions to Road Projects, New Road Construction, and Roadway Redevelopment in Summit County

Presented By:

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GPD Group
Projects

• SUM-Frank Blvd (Akron, Ohio)
• SUM-31st Street (Barberton, Ohio)
• Lakeside Drive (Barberton, Ohio)
SUM – Frank Blvd.
PID#86385
Roadway & Drainage Improvements

A Case Study on Permeable Concrete Pavement Applied in Roadway Redevelopment Applications
what’s he talking about?
Overview
Project Components:
1. 2,210 LF roadway Reconstruction
   a. Subgrade Stabilization w/ aggregate refill and geogrid
   b. Correct deficient sight distance issues at W&LE at grade rail crossing
   c. No Right-of-Way Impact Tolerated
2. Stormwater Collection System
   a. Two bored & jacked culvert replacement s under W&LE railroad
3. Watermain Replacement
4. Traffic Signalization & Control
5. Pedestrian & residential access management
6. LED Street Lighting (NEW FOR CITY OF AKRON),
7. Streetscaping, and
8. On-street parking utilizing PERMEABLE CONCRETE PAVEMENT
2009 American Recovery & Reinvestment Act Funding

$2,156,644 should cover it...

3.81 Jobs Created or $537,500/Job
37.14 AC,
$Q_{25} = 22.8$ cfs (Post)
$Q_{25} = 35.4$ cfs (Future)
21” dia. RCP

58.52 AC,
$Q_{25} = 22.9$ cfs (Post)
$Q_{25} = 47.2$ cfs (Future)
36” dia. RCP
**Watershed (cont.)**

Boring B-2 contained soils identified as coarse sand (A-3a), extending to a depth of approximately 10 feet below the existing pavement surface. The soil consists of coarse sand with varying amounts of gravel and silt. Possible fill encountered beneath the pavement surface. Below the natural soil, the ground is very stiff to very-stiff brown silty clay, some fine to coarse sand, trace gravel, slightly organic, with 3.64% organic content.

Natural inorganic soils were encountered in Borings B-1 and B-3 through B-6 beyond the pavement surface. Below the natural soils encountered were predominate coarse sand with varying amounts of gravel and silt. Possible fill encountered below the pavement surface in order to determine the organic content which, per Explorations (ODOT SGE), designated.

Seepage was encountered in Borings B-2 at a depth of about 14.5 feet below the existing ground surface. Boring B-2 at a depth of about 13.5 feet below the existing ground surface. Seepage and upon completion. It should be noted that the groundwater table may cause the groundwater table to rise, as observed at the time of drilling.

**What does this mean?!!!!**
... What is It?

1. Special high porosity concrete that has little or no fine aggregate
2. Commonly referred to as:
   a. “Porous Concrete”
   b. “No-fines Concrete”
   c. “Gap-Graded Concrete” or
   d. “Enhanced-Porosity Concrete”
3. Mainly comprised of normal portland cement, coarse aggregate, carefully controlled amounts of water, and chemical admixtures
4. Has low workability, hence the need for admixtures such as retarding, viscosity modifying or enhancing, and hydration stabilizing chemicals.
5. Lack of fine aggregate allows for a porosity range between 15 to 35%; typically falls around 20%. Allows for the passage of water and air.
6. Single-sized coarse aggregate or graded between 3/4” and 3/8”.
   a. Frank Blvd. project utilized uniform No. 9
7. Infiltration rates range b/w 2 to 18 gallons per minute per square foot or 0.04 to 0.4 cfs
Permeable Concrete Specs

. . . What the contractor needs to know . . .

1. **Quality Assurance:**
   a. Does the contractor have a working history with this material?
   b. Is at least one member certified by the ORMCA Pervious Concrete Contractor Certification
   c. Are 30% of his/her crew certified by the ACI Certified Concrete Flatwork Finisher program
   d. Qualified Testing Laboratories

2. **Special Equipment:**
   a. Requires specific equipment for compaction and jointing
   b. Steel pipe roller or hydraulically actuated rotating tube screed capable of spanning entire width of section placed and exerting vertical pressure b/w 10 to 30 psi
   c. ¼” thick minimum “Pizza cutter roller” w/ beveled fin for creating rolled contraction joints

3. **Project Conditions:**
   a. Weather limitation when ambient temperatures are between 40 and 90 F
. . . What the contractor needs to know . . .

4. **Products:**
   a. Course Aggregate Base - No. 1 & No. 2 Stone per ODOT Table 703.01-1 (AASHTO M43)
   b. Leveling Course Aggregate - No 57 Uniformly Graded Limestone per ODOT Table 703.01-1 (AASHTO M43)
   c. Geogrid (Alt. Bid for Contech Tensar BX 1100 & BX 1200)
   d. Isolation (Expansion) Joint Material (1/4” to 1/2” Proflex Vinyl ASTM D 1751 or 1752)
   e. Curing Material – 6 mil thick min. Polyethylene waterproof sheeting
   f. Pervious Concrete Pavement

5. **Test Panel & Execution:**
   a. Minimum of 2 panels each 100 SF and at required project thickness, consolidated, jointed and cured using specified products and equipment
   b. Performance:
      a. Compacted thickness no less than 1/4” less than specified thickness
      b. Void Structure b/w 15 – 25%
      c. Unit Weight within 5lbs +/- of design weight
6. **Mix Design:**
   a. Aggregate/cementitious ratio: range of 4:1 to 5:1
   b. Concrete mixture unit weight: range of 105 lb/ft$^3$ to 130 lb/ft$^3$ per ASTM C 29, paragraph 11, jigging procedure.
   c. Concrete mixture void content: range of 15% to 25%, per ASTM C 138, Gravimetric Air Determination.
   d. Cementitious content: 600 lb/yd$^3$ total cementitious content.
   e. Supplementary cementitious content: Fly ash: 25% maximum; slag: 25% maximum, or combined supplementary cementitious content: 35% maximum.
   f. Water – cementitious ratio: range from 0.27 to 0.35
   g. Aggregate content: The bulk weight of aggregate per cubic yard (cubic meter) shall be between 2,650 and 2,800 lbs.
   h. Admixtures: Admixtures shall be used in accordance with the manufacturer’s instructions and recommendations.
   i. Mix Water: The quantity of mixing water shall be established to produce a pervious concrete mixture of the desirable workability to facilitate placing, compaction and finishing to the desired surface characteristics. Mix water shall be such that the cement paste displays a wet metallic sheen without causing the paste to flow from the aggregate.
. . . What the contractor needs to know . . .

7. Placing, Jointing & Finishing:
   a. Soak the subbase; failure results in a reduction in strength of the pavement
   b. Deposit concrete continuously by mixer truck chute, conveyor or buggy
   c. Strike off concrete using mechanical vibratory screed or hydraulically actuated pipe roller screed
   d. No other internal vibration is permitted after strike-off
   e. Do not disturb concrete while in the plastic state
   f. Overfill low spots for surface repair using hand tampers
   g. Joint at regular intervals not exceeding 15’ (Maybe performed during the concrete’s plastic state w/ small roller)
   h. Use edging tools and hand tampers along form lines, isolation joints, and construction joints.

8. Curing:
   a. Begin immediately after concrete is discharged from truck, no later than 20 mins.
   b. Cover pavement surface with 6 mil thick polyethylene sheet
   c. Cover shall remain in place for 7 days
What the contractor needs to know . . .

9. Quality Control:
   a. Employ a testing laboratory
   b. Traditional testing for strength and slump control are not necessary
   c. One test performed per every 150 ft\(^3\) placed or each day’s placement
   d. Test for:
      a. Unit Weight (Density) – ASTM C 29
      b. Void Content – ASTM C 138
      c. Thickness
      d. Core Unit Weight – ASTM 642

10. Method of Measurement / Basis of Payment:

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<th>Item</th>
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<th>Description</th>
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. . . . Or $9.15 / SF Installed
it works!  .  .  .  Check it out.

**Maintenance:**
1. Will last for decades if maintained properly with common sense procedures
2. Starts with proper installation of base
3. Oil and debris (grass cuttings & leaves) can clog porous pavement
4. Use blowers and vacuum sweeps
5. Cover snow plow blades w/ rubber stripping
Barberton-31st Improvements

PROPOSED EXTENDED DETENTION AND WATER QUALITY POND

PROPOSED STORM AND MANHOLE

(6.37 acres)
Innovation Business Park (Roadway)

31st Street Resurfacing

Bio-Swale

Lakeside Drive Full Depth Section