



Infrastructure

Managing and Maintaining Your Community's Most Valuable Assets

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Plymouth Country Club

By

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Principal



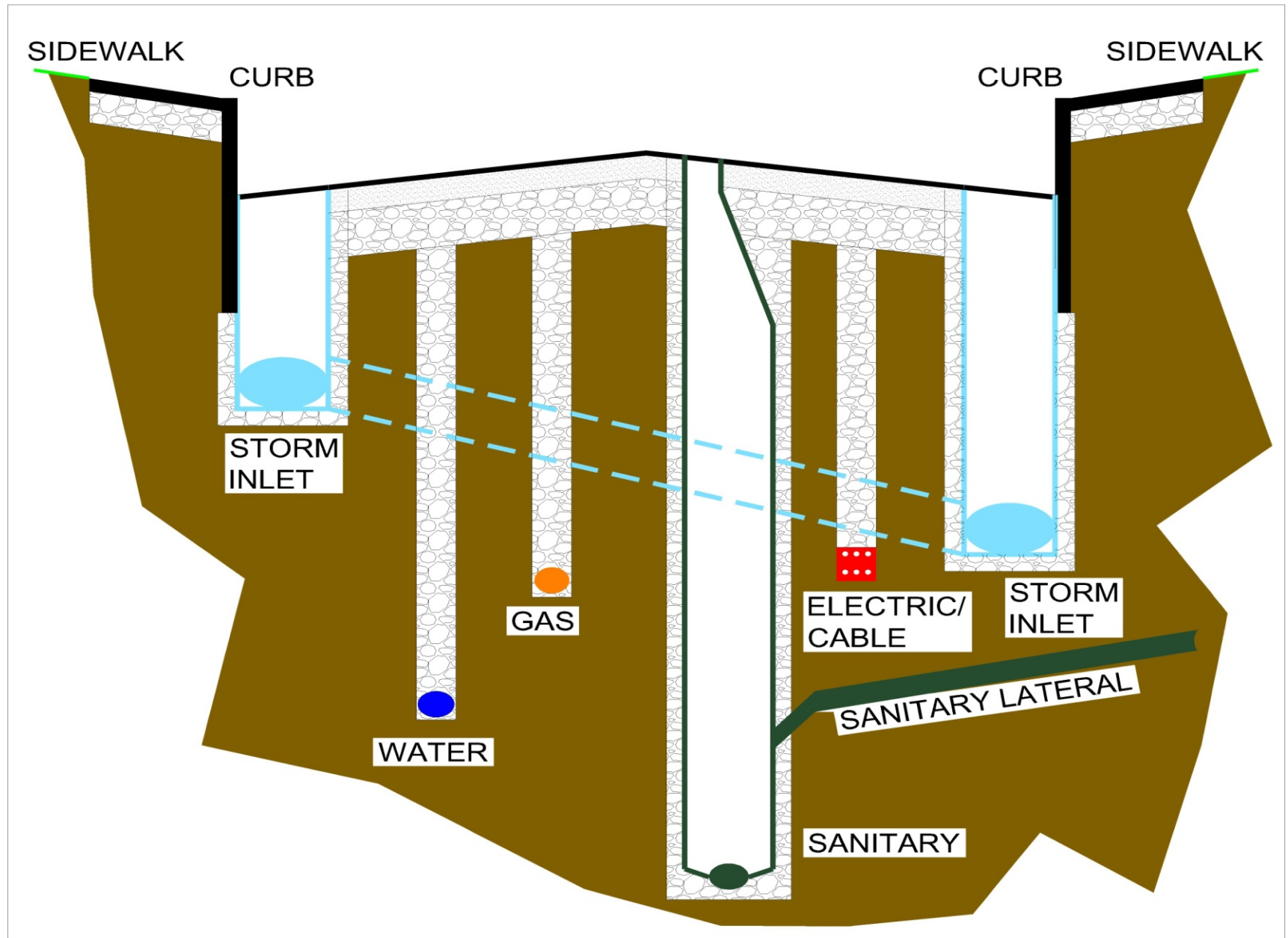


Jeffrey A. Wert, P.E., P.L.S.

**30+ YEARS OF MUNICIPAL ENGINEERING -
ROAD CONSTRUCTION, RECONSTRUCTION,
DRAINAGE, CONCRETE, CONSTRUCTION
ADMINISTRATION AND INSPECTIONS**

**50+ YEARS EXPERIENCE OF BUILDING
DEVELOPMENT STREETS, SEWERS, CURB AND
SIDEWALK**

How Roads Are Built




Roads, Driveways & Parking Areas

Managing

- Ownership
- Obtain Design Plans – (what was supposed to be built)
- Perform Assessment
- Core Test
- Measure to Determine Quantities – SY (Square Yard)
- Determine Areas of Extreme Use - Trash Areas, Delivery Areas, Poor Drainage Areas
- When was it Built?
- Where was Construction Entrance?
- Catalog Failures (Surface & Base)

ENEMIES OF YOUR ROADS

- Water
- Age
- Oxidation
- Shrinkage/cracking
- Frost heave
- Trucks – 80 times the impact of cars
- Settlement due to poor compaction
- Lack of regular maintenance
- Poor initial installation
- Lack of drainage
- Lack of proper crown
- Inadequate design elements



HOW IMPORTANT IS SURFACE DRAINAGE AND UNDERDRAIN?



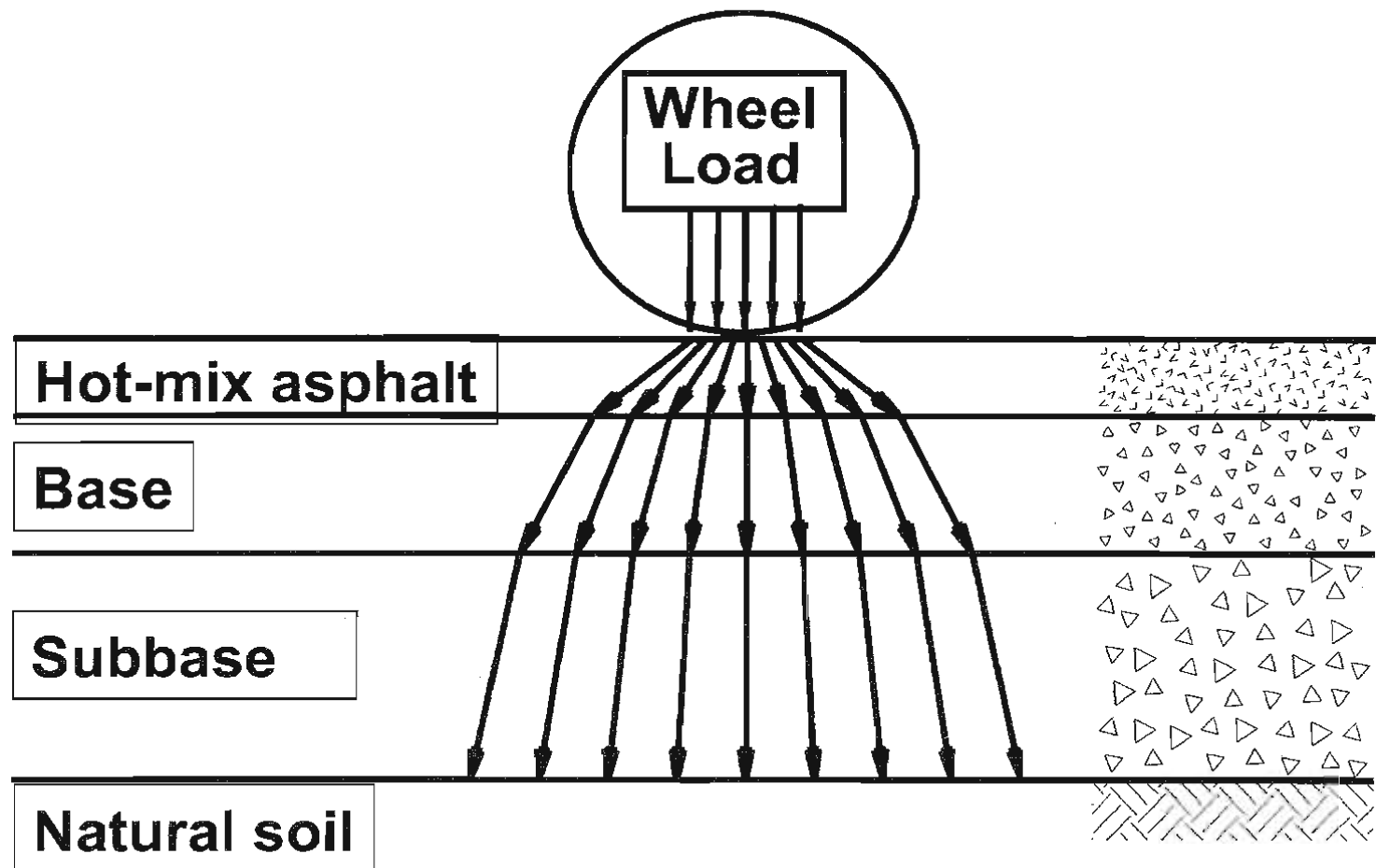
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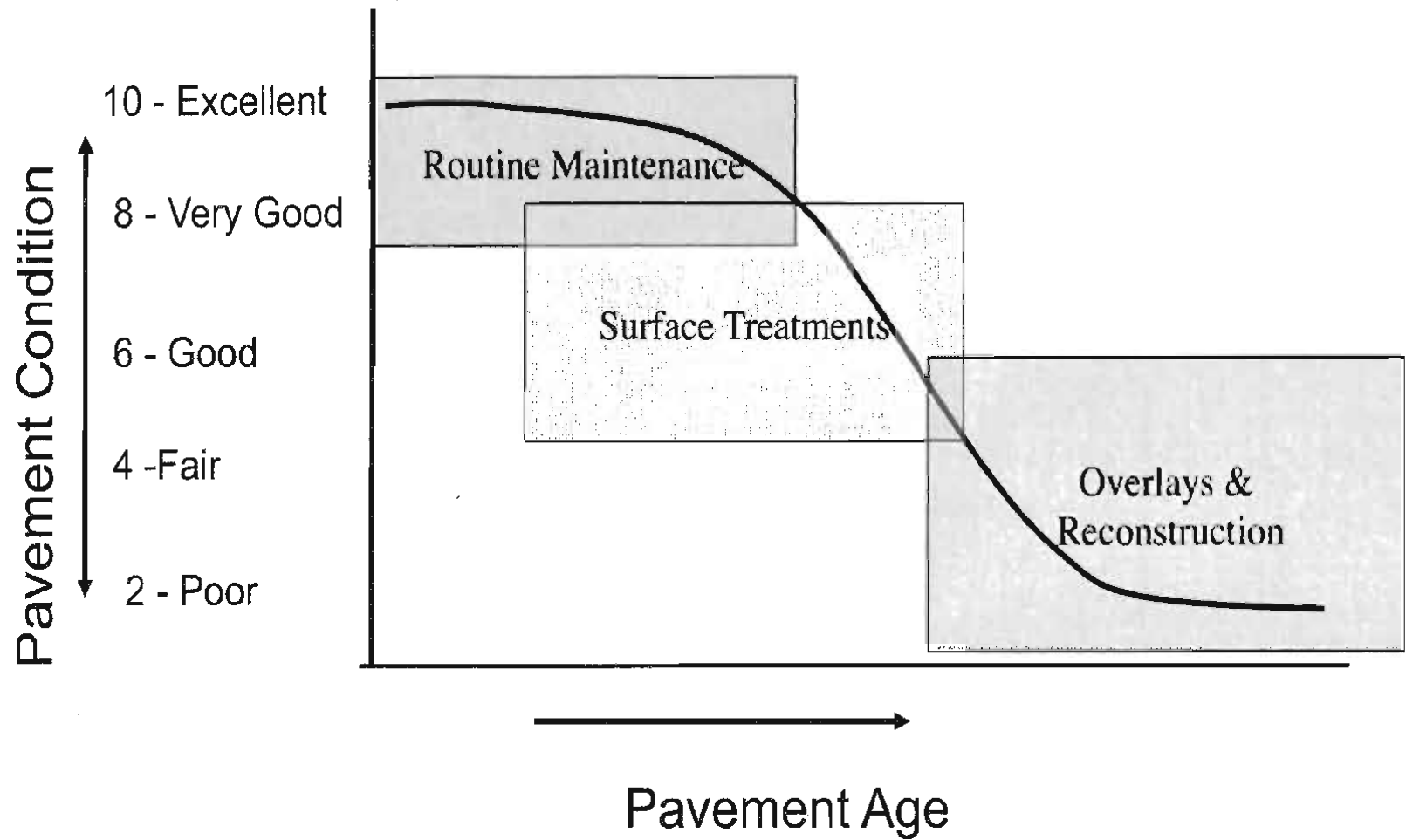


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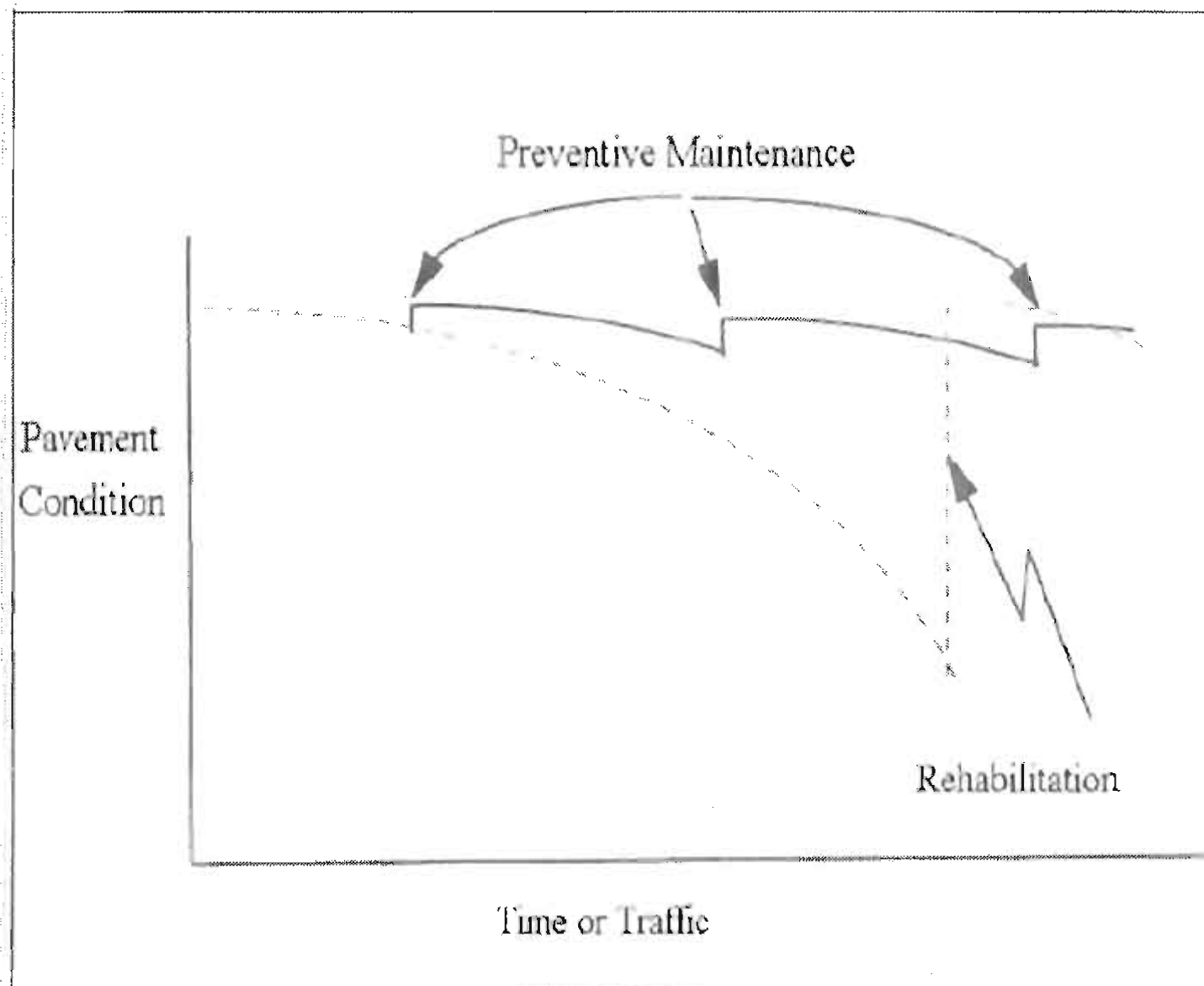
Distribution of Wheel Load



Pavement Rating Related to Maintenance or Repair Strategy



Preventive Maintenance extends useful life





Roads, Driveways & Parking Areas

Maintaining

- How Roads Age
- Crown, Slope
- Crack Sealing
- Patch Repairs
- Seal Coating
- Ultra Thin Overlays
- Structural Overlays
- Full Depth Reconstruction
- Cold Mill Recycling & Paving



11.10.2009





03/02/2010



12.16.2008



03/02/2010



03/02/2010



03/02/2010



Curb, Sidewalk & Patios

Managing

- Ownership
- Obtain Design Plans
- Perform Assessment
- Measure to Determine Quantities – (LF, SF, SY)
- When was it Built?
- Design Strength of Concrete
- ADA Compliance?



ENEMIES OF YOUR CONCRETE

- Weather (temperature, hot/cold, wind, precipitation)
- Finishing (over-worked surface, water added)
- Curing (temperature, blankets, water spray)
- Low strength concrete
- Time on truck
- Lack of correct sealer
- De-icing chemicals



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Curb, Sidewalk & Patios

Maintaining

- Salts, Deicing Materials, Fertilizers
- Environmental Factors
- Settlements, Trips, Spalling, Cracks
- Joints
- Repairs
- Coatings
- Grinding
- ADA Compliance?



Storm Sewer Collection System

Managing

- Ownership
- Obtain Design Plans
- Perform Assessment
- Televisе Pipes
- Assessment of Structures





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Storm Sewer Collection System

Maintaining

- Cleaning
- Repairs
- Inlet & Manhole Frames
- Bicycle Safe Grates
- Torrent Grates

Sanitary Sewer

Managing

- Ownership - Association, Authority, Municipality
- Obtain Design Plans
- Perform Assessment
- Televisе Pipes
- Assessment of Structures
- Pump Stations
- Grinder Pumps
- Force Mains



Sanitary Sewer

Maintaining

- Age?
- Cleaning
- Repair
- Infiltration
- Grouting
- Slip Lining
- Vents

Trails and Walkways

- Ownership
- Paving, Concrete, Stone, Mulch, Pavers
- Safety, Clear Zones, Handicap Access
- Drainage
- Maintenance

Retaining Walls

- Type - Modular, Redi-Rock, Gabion, Concrete, Vegetated
- Structural Assessment
- Drainage
- Batter or Slope of Face of Wall
- Foundation
- Height and Fences



Lighting

- High Pressure Sodium
- Metal Halide
- LED
- Fluorescent / CFL
- Mercury Vapor
- Induction
- Cutoff
- Full Cutoff
- Shields
- IESNA



Creeks

- Ownership
- Permitting
- Floodplain (Zoning issue)
- Condition
- Grants
- Maintenance

Bridges & Culverts

- Ownership
- Type of Material – Concrete, Steel
- Structural Inspection
- Condition of Deck, Sub-structure and Foundations
- Dead Load
- Drainage, Erosion
- Signage
- Salt



Dams

- Ownership
- Structural Inspection
- Permitted versus Non-Permitted
- Height, Impoundment
- Drainage Area
- Permanent Water Surface, Aeration
- Leakage
- Erosion
- Breach Analysis

Water Systems

- Ownership
- Lines, Valves, Hydrants
- Meter Pits
- Backflow Prevention!
- Wells
- Tanks
- Services
- Usage / Conservation

Regulatory Environment

- Municipal Codes & Standards
- County Conservation District (Erosion & Sediment Controls)
- PADEP (State)
- NPDES (Federal)
- PA One Call
- Municipalities Planning Code
- ACOE
- PennDOT

Current Stormwater Regulations

- Clean Water Act (Federal)
- Act 167 (1978 – Pennsylvania initiated Rate of Runoff)
- Phase I (1990 - Federal)
- Phase II (1999 - Federal)
- MS4 –Municipal Separate Storm Sewer Systems
- BMP - Best Management Practices
- Annual Reporting
- PCM Plans, Schedule of Maintenance & Reporting (2003)



Current Stormwater Practices

Non-Structural BMPs

- Protect Sensitive/Special Value Features
- Protect Riparian Areas along Streams
- Re-Vegetate & Re-Forest Disturbed Areas
- Reduce Impervious Cover (Street/Parking)
- Disconnect Roof Drains
- Disconnect from Storm Sewers
- Streetsweeping



Current Stormwater Practices

Structural BMPs

- Permeable Paving
- Pervious Concrete
- Vegetated Swale/Filter Strips
- Naturalization of Detention/Retention Facilities
- Rain Gardens / Bioretention Areas
- Infiltration Trenches/Beds/Basins
- Vegetated Roofs
- Runoff Recapture & Reuse (rain barrels)
- Snouts



Current Stormwater Practices

Structural BMPs Continued

- Sand Filters
- Wet Ponds
- Wetlands
- Riparian Buffers
- Dry Extended Detention Basin
- Landscape Restoration
- Floodplain Restoration
- Level Spreaders

Future Stormwater Regulations?

- TMDL – Total Maximum Daily Load? (Volume, Sediment, Nutrients, Temperature)
- Discharge Monitoring? (Water Quality)
- Reporting?
- Retrofitting?
- Stormwater Authority? (Fees)
- Association Responsibilities?

Resources

- PennDOT
- LTAP
- Asphalt Institute
- University of Wisconsin
- American Concrete Institute
- ADA
- IESNA
- PennBOC