SUBGRADE
HOW TO DEAL WITH
SOFT SPOTS

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PAVEMENT SECTION

RECONDITIONED 8” TO 12” OF SUBGRADE
SUBBASES
BASES
SURFACE COURSES (CONCRETE OR ASPHALT)
SUBGRADE

ALL SOILS BELOW THE PAVEMENT SECTION

INCLUDES THE 8” TO 12” SUBGRADE RECONDITIONING
SUBGRADE SOIL TYPES

FINE GRAINED - PASSING #200 SIEVE
  – CLAYS
  – SILTS

SAND – GREATER THAN #200 SIEVE AND SMALLER THAN #4 SIEVE

GRAVEL – LARGER THAN #4 SIEVE

COMBINATION OF THE ABOVE
FIELD IDENTIFICATION

CLAYS – CANNOT SEE PARTICLES
  - SHEEN
  - ROLL
  - HOLD MOISTURE
  - MAINTAIN SHAPE WHEN DRY

SILTS – CANNOT SEE PARTICLES
  - WILL NOT ROLL OR SHEEN
  - WILL PASS WATER
  - WILL CRUMBLE WHEN DRY

SANDS – CAN SEE INDIVIDUAL PARTICLES

GRAVEL – LARGER THAN ¼ INCH
SOIL TYPE CHARACTERISTICS

CLAYS – SHRINK / SWELL POTENTIAL WITH CHANGES IN MOISTURE CONTENT

SILTS – LONG TERM CONSOLIDATION (SHRINAGE)

SANDS – OFTEN NOT STABLE

GRAVEL – MOST DESIRABLE FOR CONSTRUCTION
DETERMINING SUBGRADE STRENGTH

- ASTM D 1883-05 “STANDARD TEST METHOD FOR CBR (CALIFORNIA BEARING RATIO) OF LABORATORY-COMPACTED SOILS” (AASHTO T 193)
- ASTM D 4429-04 “STANDARD TEST METHOD FOR CBR (CALIFORNIA BEARING RATIO) OF SOILS IN PLACE”
- ASTM D 2844-01 “STANDARD TEST METHOD FOR RESISTANCE VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS” (R-VALUE), (AASHTO T 190), CP-L 3101
SOIL STRUCTURE

IN ENGINEERING, A SOILS STRUCTURE IS COMPOSED OF:

– GASES (AIR AND SOMETIMES METHANE)
– LIQUIDS (WATER)
– SOLIDS (SOIL PARTICLES AND DEPOSITED CRYSTALS)
SOIL PROFILES

1

GASES (AIR)

LIQUIDS (WATER)

SOLIDS (SOIL PARTICLES)

2

GASES (AIR)

LIQUIDS (WATER)

SOLIDS (SOIL PARTICLES)

3

GASES (AIR)

LIQUIDS (WATER)

SOLIDS (SOIL PARTICLES)

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TEST PROCEDURES TO MEASURE SUBGRADE STRENGTH

PRIOR TO SATURATION, LABORATORY TEST PROCEDURES ARE PERFORMED AT OR NEAR MAXIMUM DENSITY AND OPTIMUM MOISTURE CONTENT

CLAY SOILS HAVE LOW PERMEABILITY WHEN COMPACTED

SOAKING DOES NOT ALWAYS SIGNIFICANTLY CHANGE MOISTURE CONTENT OR DENSITY
DESIGN CHALLENGE

LABORATORY TEST RESULTS DON’T ALWAYS REPRESENT THE LONG TERM MOISTURE CONTENT OF THE SOILS BELOW THE PAVEMENT

IN THE FIELD, AS A SOIL GAINS MOISTURE ITS STRENGTH IS COMPROMISED

RESULTING PAVEMENT SECTION SUBGRADE MAY NOT BE STRONG ENOUGH TO SUPPORT TRAFFIC LOADS
IMPORTANCE OF DRAINAGE WITHIN AND BELOW THE PAVEMENT SECTION

- MAINTAIN UNIFORM MOISTURE CONTENT
- REDUCE POTENTIAL FOR SATURATION
- MAINTAIN STRENGTH OF SUBGRADE
- MAINTAIN STRENGTH OF PAVEMENT SECTION LAYERS
IDENTIFYING SOFT SUBGRADE

- VEGETATION CHANGES
- POOR DRAINAGE / RECENT IRRIGATION / PONDING WATER
- RIVER OR STREAM MEANDERS
- SHEENING SURFACES
- SATURATED AREAS
- SIGNS OF RUTTING/CRACKING
- PROOF ROLLING
- TESTING
MEDIATION OF SOFT SUBGRADE

REMOVAL & REPLACEMENT USING
- SIMILAR SOILS
- GRANULAR MATERIAL
- MILLED TAILINGS
- HMA MATERIAL
MEDIATION OF SOFT SUBGRADE

REINFORCEMENT
- GEOGRIDS
- WOVEN GEOTEXTILES
- NON-WOVEN GEOTEXTILES
MEDIATION OF SOFT SUBGRADE

SOIL MODIFICATION
- REMOVE AND REPLACE SAME SOIL
- COLLAPSE SOIL STRUCTURE WITH DYNAMIC FORCE
- PLACE SURCHARGE WEIGHT
- DE-WATER SOIL STRUCTURE
- SOIL CEMENT
- LIME STABILIZATION
- EMULSIONS
SPECIAL CONSIDERATIONS FOR POOR SUBGRADE CONDITIONS

- KEEP CONSTRUCTION WITHIN THE UPPER, DRIER SOIL HORIZON
- LIMIT CONSTRUCTION EQUIPMENT
- MAINTAIN POSITIVE DRAINAGE DURING CONSTRUCTION
- SUBGRADE SURFACE SHOULD HAVE MINIMUM 2% SLOPE
- POSITIVE SURFACE DRAINAGE AWAY FROM ROADWAY
- REQUIRE MOISTURE CONDITIONING AND COMPACTION OF UTILITY BACKFILL SOILS
SPECIAL CONSIDERATIONS

- DON’T PLACE GRANULAR BASES UNDER ADJACENT SIDEWALKS THAT BACK AGAINST IRRIGATED AREAS
- ISOLATE SIDEWALKS FROM ROADWAYS
- MAKE SURE CONCRETE GUTTERS & CROSS PANS ARE LARGE ENOUGH AND DRAIN CORRECTLY
- CRACK SEAL INTERFACES BETWEEN GUTTER & CROSS PANS AND PAVEMENT
- PREVENT OR REPLACE LEAKING UTILITIES & STORM DRAINS
- PREVENT INFILTRATION GALLERIES FOR COLLECTING WATER
QUESTIONS ?
THANK YOU