ID number: 14398
Subject: Pavement Material Engineering
Instructor: Engr. Shabir Ahmad
Semester: M.S (Civil Engineering)

QUESTION 1

1. Given Figure. 1 refers to which phenomena of the pavement conditions?

Figure 1 refers to the Stress-Strain phenomenon of the pavement condition. Vertical stress is acting whose intensity on the top layer is maximum and reduces with depth and this value of stress comes to lower value when it comes to subgrade. E1>>E2 means top layer must be of higher quality material.

QUESTION 2

Being a material design expert, if client department award you the consultancy for preparation of the geotechnical report for the upcoming road project.

1. Which steps (General Procedure) you would consider while soil investigation and preparation of Geotechnical Report?

The steps considered for soil investigation and preparation of Geotechnical report are

i. Desk study
ii. Site Reconnaissance
iii. Preliminary Investigation
iv. Main investigation
v. Geotechnical report

2. Elaborate the steps briefly in your own words.

i. Study Desk

- General Geology of the Site

- History of the Site (Existing Reports…)
- Pavement Details

ii. Site Reconnaissance
- Site Visit
- General Topography
- General Ground Slope
- Plain, Rolling, Hilly…….
- Property in Proposed ROW
- Presence of Water Courses
- Soil Stratification from Deep Cuts
- Prospect Material Sources
- Any Local Problems (Floods, Cracks, Subsidence…..

iii. Preliminary Investigation
It includes preliminary BHs and preliminary tests.

iv. Main Investigation
Detailed investigation is carried out.
SITE TESTS
- Test Pits
- Boring/Drilling
- Sampling
- In-situ Density/Moisture
- Testing (SPT, CPT,....)

LABORATORY TESTS
- Classification Tests (Sieve Analysis, Atterberg Limits)
- Strength
- Consolidation/Settlement/Expansion
- Resilient Modulus
- Permeability
- Chemical Testing

QUESTION 3

The below **Figure. 2-1.7** refers to the CBR results showing penetration of the piston in X-axis and bearing value on Y-axis. At y-axis right side of the graph, it shows ranges in percentage from 5% to 100% referring to different degrees of the subgrade (any material) quality in reference to CBR test.

1. Please elaborate the Figure in your own words in detail.

The figure shows the relationship between bearing values and penetration values with respect to CBR values for quality of soil in percentage from 5% to 100%. The dotted lines shows the standard values of CBR for different soils.
Starting from Adobe soils, it gives a maximum penetration of 0.5inch very quickly without any resistance and it is considered very poor subgrade.
Clay Loam load penetration curve, it also show little resistance and penetrates quickly to a value of 0.5inch. it is considered poor subgrade.
Sandy loam soils are considered good subgrade and it gives resistance to penetration and gives 0.5 inch penetration at 800 lb per sq in.
Disintegrated Granite curve comes between 30% and 50% CBR Value, considered fair quality subbase.

Gravel base curve indicates that gravel base shows resistance to penetration and at bearing value of 1050 lb per sq inch it gives penetration of 0.5inch. it is considered poor quality base course.

Crushed rock base shows maximum resistance and at maximum bearing value of 2500 lb per sq inch it gives penetration of 0.45 inch and is considered very good quality material.

QUESTION 4

1. In the Figure given below what is Dry of optimum and Wet of optimum? Explain?

DRY OF OPTIMUM

As the water content increases, the particles develop larger and larger water films around them and dry density increases with moisture content.

. Samples compacted dry of optimum have higher strengths than those compacted wet of optimum.

WET OF OPTIMUM

. The amount of water added is more than OMC then it is called as wet of optimum. After addition of more water dry density decrease

2. What are effects of compaction on Engineering properties of soil? Details.

EFFECT OF COMPACTION ON PROPERTIES OF SOIL

1. PERMEABILITY

The effect of compaction is to decrease the permeability. In the case of fine grained soils it has been found that for the same dry density soil compacted wet of optimum will be less permeable than that of compacted dry of optimum.

2. COMPRESSIBILITY

In case of soil samples initially saturated and having same void ratio, it has been found that in low pressure range a wet side compacted soil is more compressible than a dry side compacted soil, and vice versa in high pressure range.

3. PORE PRESSURE

In undrained shear test conducted on saturated samples of clay it has been found that lower pore pressures develop at low strains when the sample is compacted dry of optimum, compared to the case when the sample is compacted wet of optimum. But at high strains in both types of samples the development of pore pressure is same for same density and water content.

4. STRESS-STRAIN RELATION

Samples compacted dry of optimum produce much steeper stress-starin curves with peaks at low strains, whereas samples compacted wet of optimum, having the same density, produce much flatter stress-strain curves with increase in stress even at high strains.

5. SHRINKAGE AND SWELLING

At same density a soil compacted dry of optimum shrinks appreciably less than that of compacted wet of optimum. Also the sol compacted dry of optimum exhibits greater swelling characteristics than samples o f the same density compacted wet of optimum.