ACADEMIC SESSION SEM 1 2020/2021
EAL 337 PAVEMENT ENGINEERING
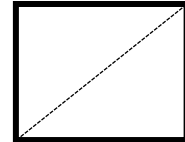
ASSIGNMENT 1

Name:

Matric No.:

Question 1
Quarry operations are multistage operations that cover extraction of raw materials (rocks) until the production of final products (including crushed aggregate) for construction industry.

[a]   There are a few common issues raised related to the quarry operations that affected local residence where the housing units are close to quarry operation area. Describe **TWO** critical issues pertaining to sustainability associated with quarry activities.

(4 Marks)

[b]   Aggregate segregation is unfavorable in stockpile management. With the aid of sketches, explains the segregation of the aggregate considering "single vertical cone stockpile built using a moveable conveyor belt" technique. Why segregated stockpiles are not desired in asphalt mix production? **(5 Marks)**

[c]   State **THREE** conditions when verification of aggregate gradation is required for an aggregate stockpile? **(3 Marks)**

[d]   A stockpile has 4,000 tons of course granite aggregates. Determine the minimum number of sampling required for aggregate gradation tests? **(3 Marks)**

Question 2
An assemblage of granite aggregate sample was subjected to a laboratory test procedure to determine whether the aggregate toughness pass the requirement by Malaysian Jabatan Kerja Raya (JKR) or not. Table 1 summarizes the information related to Aggregate Crushing Value (ACV) test conducted for a local road project.

Table 1: Aggregate Crushing Value Test Parameter

Mass of cylinder mold + base (W)	Mass of aggregate + cylinder mold + base (W₁)	Mass of aggregate passing 2.36 mm sieve (W₂)
500 gram	2500 gram	350 gram

[a]   Calculate the ACV based on the information provided in Table 1. Write down JKR specification for ACV test. Compare the value obtained with JKR specification and write down your comments.
(10 Marks)

[b]   The aggregates were blended with the following proportion (Table 2) to achieve a smooth gradation curve falling within the upper and lower limits. Since the specific gravity of the individual aggregate and its percentage used is known, the Specific Gravity of Mixed Aggregate (SGMA) can be calculated. Show the equation used to calculate SGMA and calculate the SGMA for the blended aggregates.   **(5 Marks)**

Table 2: Specific Gravity of Individual Aggregate and Percentage Used

Aggregate Type	Percentage Used (%)		Bulk Specific Gravity	
12.5 mm	P1	60	G1	2.619
Quarry Dust	P2	38	G2	2.611
Cement	P3	2	G3	3.10

Question 3

[a]   Pavement engineering is a branch of civil engineering that uses engineering techniques to design and maintain road pavements. It involves new construction as well as rehabilitation and maintenance of existing pavements. Based on your understanding, discuss **THREE (3)** potential actions that could be taken into consideration in pavement engineering to support sustainable development.   **(6 Marks)**

[b]   Prime coat and tack coat are applied for different pavement layers during road construction. As a pavement engineer, you should be able to differentiate between both materials, its preparation method, and the application protocols.   **(9 Marks)**

[c]   Polymer Modified Bitumen (PMB) is used to enhance the performance of binders on heavily trafficked or distressed pavement surfaces
   i.   Explain **TWO (2)** reasons why modified binders are developed and discuss **TWO (2)** modifier's roles to make modified bitumen as an ideal binder for all road applications.   **(8 Marks)**
   ii.   Based on the data presented in Table 3, determine the mixing and compaction temperatures for each asphalt binder. Discuss your findings.   **(7 Marks)**

Table 3: Rotational viscosity test results at four different temperatures

Sample Designation	Test Temperatures			
	135 °C	150°C	175°C	190°C
60/70 Control Binder	0.3208	0.1625	0.0696	0.0450
3% LLDPE - PMB	0.6354	0.3729	0.1517	0.1108
5% LLDPE - PMB	0.9749	0.5542	0.2958	0.1633
Note: The unit for viscosity is Pa.s				