**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**FACULTY OF INDUSTRIAL TECHNOLOGY**

**DEPARTMENT OF CIVIL AND WATER ENGINEERING**

**TRANSPORTATION ENGINEERING & PLANNING I**

**TCW 3105**

**Main Examination Paper**

**November 2016**

This examination consists of 4 pages

**Time Allowed: 3 Hours**

**Total Marks: 100**

**Examiner’s Name: T.C. Mdlongwa**

**INSTRUCTIONS**

1. Answer all Questions.
2. Use of calculators is permissible

**MARK ALLOCATION**

|  |  |
| --- | --- |
| **QUESTION** | **MARKS** |
| 1. | **19** |
| 2. | **25** |
| 3. | **31** |
| 4. | **25** |
| **TOTAL** | **100** |

**QUESTION 1**

1. Define the following terms in relation to transportation engineering:
2. Average daily traffic (ADT),
3. Annual average daily traffic (AADT),
4. Reaction Time,
5. Right of Way (ROW), provide neat sketch.

**[7marks]**

1. Equally important as the consideration of horizontal alignment is that of the facility’s vertical alignment. List at least five factors that influence the vertical alignment of highways.

**[5marks]**

1. Draw a simple horizontal curve and indicate all the fundamental elements.

**[7marks]**

**QUESTION 2**

1. A two-lane highway (3.6m lanes) has a posted speed limit of 80km/h, and on one section has both a horizontal (left turning) and a vertical curve. *(Sketch below is provided as aid only).*



|  |  |
| --- | --- |
| **Details for horizontal curve** | **Details for vertical curve** |
| PC: 4 + 160.000 | G1: -2% |
| PT: 4 + 600.000 | G2: +4% |
| ∆: 80º | PVC: 4 + 140.000 |
| There is an obstacle (site obstruction) located 6m from the inside edge of the inside lane. | PVT: 4 + 290.000 |
| e: 8% | PVI: 4 + 215.000 |

A recent daytime accident (driver travelling westbound and striking a stationary roadway object) resulted in a fatality and a lawsuit alleging that the 80km/h posted speed limit was an unsafe speed for the curves in question and a major cause of the accidents. Evaluate and comment on the roadway design.

Additional Information:

* Desirable SSD at 80km/h for the vertical curve is 139.4m and fmax=0.14 (AASHTO, 1994)
* Desirable ***K-value*** =32 minimum ***K-value* =25** (AASHTO, 1994)

**[21marks]**

1. Highways can be classified either functionally or administratively. Explain what is meant by each of the two classifications.

**[4 marks]**

**QUESTION 3**

1. List 8 factors that influence the geometric design of highways

**[8marks]**

1. In the design of vertical curves why is the design assumption of SSD<L preferred over the SSD>L assumption?

**[6marks]**

1. Provide a clearly labelled sketch of the cross section of a two-lane highway

**[4marks]**

1. What is Transportation Planning and why is it of importance?

**[6marks]**

1. With the aid of a well labelled diagram show the different stages of superelevation development in curves without Transitions

**[7marks]**

**QUESTION 4**

1. What are the functions of a pavement?

**[4marks]**

1. Draw a typical flexible pavement structure and identify each layer which plays a role in carrying the traffic loads.

**[5marks]**

1. For a rural road located in Matabeleland North Province the following information is available for the design of a flexible pavement:

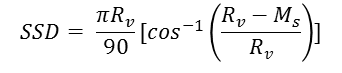
|  |  |
| --- | --- |
| AADT | 2400 |
| Directional split (2-way DF) | 50/50 |
| Traffic Growth Rate | 2% |
| Proportion of Heavy Vehicles | 15% |
| Average Weight of Heavy Vehicle | 1.5ESA’s |
| Design life | 15years |
| Subgrade Strength, CBR | 3.5% |
| Lane distribution factor | 1 |

For the given design parameters, determine the thickness of the granular layer to be provided above the subgrade [Assumption: A thin Hot Mix Asphalt surface course is to be provided and is assumed to be part of the granular layer].

**[16marks]**

**END**

**Equations**

** **

𝑵𝑫𝑻 = 𝟑𝟔𝟓 × 𝑨𝑨𝑫𝑻 × 𝑫𝑭 × %𝒂𝒈𝒆𝑯𝑽 × 𝑳𝑫𝑭 × 𝑪𝑮𝑭 × 𝑵𝑯𝑽𝑨𝑮