

# SEV414 Transportation Infrastructure

## Assessment item 1— Pavement Design Project

**Due date:** Week 8 (Monday @9am)

**ASSESSMENT**

**Weighting:** 50%

**Length:** As required (but not exceeding 40 pages excluding appendices)

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### Submission Requirements

- **All students:** prepare (sequentially organise, properly format and scan if necessary) and upload a single PDF file (only one file per assignment item with your Student ID as file name, for example, 211111111.pdf) on CloudDeakin Dropbox. **Note:** Softcopy docs (Excel, Word, AutoCAD etc) and multiple files for one assessment item will not be assessed or referenced!
- **Extension Requests:** (i) if you require an extension of maximum of *one working day*, you write the reason/s with supporting documents and *submit together with your assignment* and, (ii) if you require extension of *more than one working day*, you must *complete the extension request form and submit*. **Note:** please do not send emails requesting extensions.

### Objectives

This assessment item relates to the course learning outcomes 1, 2, 3 and 4. It develops students' ability to design alternative pavement configurations (both flexible and rigid pavements), to compare them and to recommend the best alternative using current Australian Guidelines and Design Practices. Use of CIRCLY software (pavement design software) is highly recommended when required.

### Details/Questions

Geometric design and construction of a new two-lane two-way road has been recently completed and now it is time for design pavement near Ballarat, Victoria. The design should cover all commonly used pavement configurations of both flexible and rigid pavements. The following are the project specific information supplied by the client (VicRoads):

- Average annual daily traffic (AADT) is given by  $\frac{1}{4} \times \sqrt{\text{full student ID}}$ , rounded to nearest whole number (two-way total).
- Pavement design period 30 years.
- Project reliability 95%.
- Lane width= 3.5m.
- Directional distribution 55/45
- Percentage of heavy vehicles is given by:  $\frac{1}{2} \times (\text{full student ID})^{0.15}$ , rounded to nearest two decimal places.
- Subgrade CBR value is given by:  $\frac{1}{4} \times (\text{full student ID})^{0.15}$ , rounded to nearest whole number.
- Annual heavy vehicle growth rate is expected to be 1.02% throughout the design period.
- The traffic load distribution for the project is given in Table 1 (there is no anticipation of increase in load magnitudes).
- Other required information can be assumed within Australian Standard (Austroads Guides)

## Submission Guidelines

- Suggested contents of the report chapters (can be modified as required) are:
  - Title pages (title, acknowledgement, executive summary or abstract, table of contents, list of figures and tables, abbreviations) (**2 marks**)
  - **Chapter 1 Project Introduction** (client, location, objectives, issues, scopes, summary of the information supplied by the client, methodology adopted, report organisation etc.) (**3 marks**)
  - **Chapter 2 Pavement Design Input Parameters** (some of these can be just the list of known information; others may be required to calculate, e.g. subgrade evaluations, pavement materials, traffic loading etc.) (**6 marks**)
  - **Chapter 3 Flexible Pavement Alternatives** (can be sub-sectioned based on the type--- detailed stepwise calculations must be provided with proper referencing either inside the report texts or in the appendices) (**15 marks**)
    - ✓ Unbound granular pavement with thin bituminous surfacing
    - ✓ Full depth asphalt ( $E=2500\text{MPa}$ )
    - ✓ Asphalt ( $E=3000\text{MPa}$ ) with granular base ( $E=550\text{MPa}$ )
    - ✓ Asphalt (150mm thick,  $E=5000\text{MPa}$ ) with cemented material ( $E=5000\text{MPa}$ ) base
    - ✓ Asphalt (175mm thick,  $E=2000\text{MPa}$ ), cemented material ( $E=2000\text{MPa}$ ) and unbound granular material ( $500\text{MPa}$ )
  - **Chapter 4 Rigid Pavement Alternatives** (can be sub-sectioned based on the type--- detailed stepwise calculations must be provided with proper referencing either inside the report texts or in the appendices) (**12 marks**)
    - ✓ PCP pavement with concrete shoulder
    - ✓ PCP pavement without concrete shoulder
    - ✓ CRCP pavement with concrete shoulder
    - ✓ CRCP pavement without concrete shoulder
  - **Chapter 5 Comparison of the designs and recommendations** (compare all alternative designs in a tabular form and propose the best alternative in terms of cost criteria ONLY... unit costs of different pavement materials are to be collected from current Australian references... students are to search and locate these unit costs) (**5 marks**)
  - **References** (**2 marks**)
- Follow the report structure as given above (**5 marks** is reserved for overall presentation quality).
- Start new chapter from a new page.
- Do not copy and paste any tables, figures from lecture notes and design guides, except you created by yourself, just provide a proper reference to them.
- Number each table and figure you created sequentially and refer them inside the text.
- The submission should be easily understandable for general audience, who may or may not have technical knowledge on pavement design.
- Write proper unit of measurements.

## Assessment criteria

(100%) Content, presentation and layout include:

- the accuracy and relevance of information
- application of knowledge
- language and grammar used in writing reports
- proper referencing of sources of information (when referencing, Harvard style should be used.)
- equations, images, data and tables, and the quality of presentation and layout.

Table 1 Project Specific WIM (Traffic Load Distribution) Data

Axle load group	SAST (53kN)	SADT (80kN)	TAST (90kN)	TADT (135kN)	TRDT (181kN)
10	0.2569	2.1791	0.1033	0.0971	0.0043
20	13.5274	10.2319	0.9558	0.6798	0.1057
30	18.0167	20.6747	1.2562	1.4088	0.2529
40	19.9923	17.9923	1.3315	3.7622	1.0424
50	25.7379	13.4201	4.5162	7.7252	4.9203
60	17.1140	8.2995	13.6576	10.3152	9.4372
70	4.3708	6.2664	17.9501	10.2244	9.7940
80	0.7690	7.6773	17.3598	8.5571	8.6152
90	0.1182	6.3741	13.2328	6.7596	6.5257
100	0.0573	3.5792	9.9221	5.3419	4.3467
110	0.0128	1.6833	9.7695	4.3809	3.1213
120	0.0128	0.9164	4.6565	4.1481	2.7006
130	0.0086	0.4354	2.3255	4.2917	2.4734
140	0.0053	0.1888	1.1946	4.7138	2.6452
150	0.0000	0.0486	0.8719	6.1501	3.0875
160	0.0000	0.0250	0.3289	5.7139	3.4186
170	0.0000	0.0000	0.3108	4.9741	3.8058
180	0.0000	0.0079	0.1268	3.3997	4.9435
190	0.0000	0.0000	0.1025	2.6397	6.2365
200	0.0000	0.0000	0.0278	1.7043	7.2185
210	0.0000	0.0000	0.0000	1.1941	5.2375
220	0.0000	0.0000	0.0000	0.8293	3.7047
230	0.0000	0.0000	0.0000	0.4222	2.0195
240	0.0000	0.0000	0.0000	0.2111	1.4500
250	0.0000	0.0000	0.0000	0.1620	0.8953
260	0.0000	0.0000	0.0000	0.0753	0.6025
270	0.0000	0.0000	0.0000	0.0752	0.6229
280	0.0000	0.0000	0.0000	0.0137	0.3055
290	0.0000	0.0000	0.0000	0.0094	0.1953
300	0.0000	0.0000	0.0000	0.0000	0.1616
310	0.0000	0.0000	0.0000	0.0110	0.0409
320	0.0000	0.0000	0.0000	0.0045	0.0257
330	0.0000	0.0000	0.0000	0.0000	0.0254
340	0.0000	0.0000	0.0000	0.0000	0.0181
350	0.0000	0.0000	0.0000	0.0000	0.0000
360	0.0000	0.0000	0.0000	0.0000	0.0000
370	0.0000	0.0000	0.0000	0.0000	0.0000
380	0.0000	0.0000	0.0000	0.0000	0.0000
390	0.0000	0.0000	0.0000	0.0000	0.0000
400	0.0000	0.0000	0.0000	0.0000	0.0000
Total	100	100	100	100	100
Proportion of each axle group	$2f \times$ Full student ID divided by $10^9$	$f \times$ Full student ID divided by $10^9$	$0.25f \times$ Full student ID divided by $10^9$	$1.25f \times$ Full student ID divided by $10^9$	remaining proportion

Student ID	value of factor ( $f$ )
8 digits Student ID starting with 9	2.000
9 digits Student ID starting with 2	1.000
9 digits Student ID starting with 4	0.500
9 digits Student ID starting with 7	0.275
9 digits Student ID starting with 8	0.250
9 digits Student ID starting with 9	0.225

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