

# SMAHiTRA (Smart application highway and traffic)

## SPECIAL PROJECT BY Muhammad Muzani Muhd Kelana Nurul Ain Nabilah Mohd Zakri Ainul Haezah Noruzman

# SMAHiTRA (Smart application highway and traffic)

### ALL RIGHTS RESERVED

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, photocopying, recording, etc. without the prior written permission of Polteknik Sultan Salahuddin Abdul Aziz Shah.

Special project by : Muhammad Muzani Muhd Kelana Nurul Ain Nabilah Mohd Zakri Ainul Haezah Noruzman No eISBN: 978-967-0032-00-9

First issue 2022



Published by: UNIT PENERBITAN Politeknik Sultan Salahuddin Abdul Aziz Shah Persiaran Usahawan, Seksyen U1, 40150 Shah Alam Selangor No.Telefon: +603 5163 4000 No.Fax: +603 5569 1903

## DISCLAIMER

The information provided in this book is designed to provide helpful information on the subject discussed. The contents including examples, images, and references are provided for informational purpose only. Any opinions expressed in this presentation constitute our judgement at the time of issue and are subject to change. We believe that the information contained in this presentation is correct and that any estimates, relying on anything contained in or opinions, conclusions or recommendations are omited reasonably held or made as at the time of compilation. However, no warranty is made as to their accuracy or reliability (which may change without notice) or other information contained in this presentation. To the maximum extent permitted by law, we disclaim all liability and responsibility for any direct or indirect loss or damage which may be suffered by any recipient through relying on anything contained in or omitted from this presentation

# 

## Assalamualikum w.b.t and greeting to all

It gives us a great pleasure to release the first edition of this book as a main reference for student who are enroll in Diploma of Civil Engineering program especially in subject of highway and traffic DCC30103.

The book is compulsory to use when using the SMHiTRA application especially for third semester students. The books contains method to install software that will be used to develop SMAHiTRA applications and how to use the SMAHiTRA application

Happy learning and good luck !





### **Muhammad Muzani Muhd Kelana** Nurul Ain Nabilah Mohd Zakri **Ainul Haezah Noruzman**

Department of Civil Engineering Polytechnic of Sultan Salahuddin Abdul Aziz Shah

# TABLE OF CONTENT

TITLE	PAGE
Course outline	1-2
Chapter 1 Introduction of ATJ form 2013	3-4
Chapter 2 Introduction to junction design	5-6
Chapter 3 3.1 Introduction of SMAHiTRA 3.2 Method to install software that will be used to develop SMAHiTRA application 3. 3 How to use the SMAHiTRA application 3.4 Exercise	7-8 9-15 16-23 24-31
Appendix	32-36
Acknowledgement	37
Reference	38

# COURSE OUTLINE

00000	DALAT		DIAN	A 141 OF	11	SINIFER-					
RUG	RAMME	D	PLOM	A IN CIV	AL EN	JINEERI	NG				
PAL		CI	ICHWA	VAND	TDAFF	IC ENC	NEEDING				
OUR	SE CODE	H	CC2CT	AND 02	TRAFF	IC ENG	NEEKING				
	OPEDIT	D	0000	03							
	CREDIT	14	20 & 3								
'RE-R	EQUISITE	N	UNE			SVM	OBSIS				
HIGHV nvolve nvolve nateri urnitu	WAY AND T ed in Malays ed in traffic ials, constru ure, flexible p	RAFFIC E ia. This c : enginee ction of f avement	ENIGIN ourse a ring. lexible design	EERING also pro This co pavem , junctic	is a vides t urse e ent, co on desi	study o he stud mphasi nstruct gn, traff	n history ents with zes on i on of rigi ic manag	of highv the know ntroducti d pavem ement an	vay constr /ledge rega on to hig ent, traffic d highway	ruction and the o arding the method hway and traffic, control equipmen maintenance.	rganizati and desi paveme nt and ro
CLO	PLO	DT	-	COL	JRSEL	EARONII	CLI	DESCR	IPTION		
1	PLO 1	01	Anni	Long	opriote	mode	Lto oplus	problem	n in highu	ou and traffia an	ainearin
2	PLO 3	C5	Asse appr	esses c opriate	lesign spec	perfori ificatio	mance for with co	r highwa nsiderat	ay and tra ion of put	ffic engineering blic safety, socie	based or ty and
3	PI 0 10	64	Expl	ronmer ain the	nt findin	ns of a	case sti	idv in a f	ormal pre	sentation	
J	FLO IU	A	LAPI	ani uic	TIC	DICSRA	SSESSME	NTS	onnai pre	sentation	
					ONLI	NE TriL	A DECEMBER OF	NTINUAL	C ACCECCH	ENT (100%)	5025
NO.	т	OPICS		CLO	MET	HOD(S)	TEST (Online)	ASSIGN MENT	CASE STUDY	PRESENTATION (Online)	FINAL EXAM (F2F)
					SYN	ASYN	20%	(Online) 10% (1)	(Online) 15% (1)	5%	50%
1	INTRODU HIGHWAY TRAFFIC	CTION T ( AND	0	1	v	V	√				v
2	PAVEMENT			13	~	7	~				v
10125				.,.							5 <b>*</b> 50
3	CONSTRU FLEXIBLE	JCTION (	DF ENT		v	V	√				V
4	CONSTRU RIGID PAY	JCTION ( VEMENT	DF	t	V	V	v				v
5	FLEXIBLE DESIGN	PAVEM	ENT	1,2	V	V	v				v
6	TRAFFIC CONTROL EQUIPMENT ,ROAD FURNITURE AND ROAD MARKING		)L D	ţ	V	V	v				v
7	JUNCTIO	N DESIG	N	1,2,3	√	V	√	~			√
8	TRAFFIC MANAGE	MENT		1,2,3	v	~	v	v	v		v
9	HIGHWAY	( IANCE		1,2,3	V	V	V		V		V

	REFERENCES
1	Arahan Teknik Jalan (Jalan) 8/86.(Pindaan 2015). A <i>Guide On Geometric Design Of Roads</i> .Cawangan Ibu Pejabat JKR.
2	Arahan Teknik Jalan (Jalan) 5/85. (Pindaan 2013). Manual For The structural Design of Flexible Pavement Design.
3	Arahan Teknik Jalan (Jalan) 11/87. <i>A Guide To The Design Of At Grade Intersection</i> Cawangan Jalan Ibu Pejabat JKR Kuala Lumpur
4	Martin,R (2009). Highway Engineering. 111 River Street Hoboken, NJ: Wiley, John & Sons, Incorporated
5	Atkins,H.N.(2003) Highway Materials,Soils and Concrete. Saddle River, New Jersey Prentice Hall
6	Banks, J.H. (2002). Introduction to Transportation Engineering (2nd ed.). New York: McGraw Hill.
7	Bent,T.(2005). Highway and Traffic Engineering in Developing Countries. UK: Spon Press
8	O'flaherty. (2008). Transport Planning and Traffic Engineering :U.S.A Butterworth-Heinemann

Note:

DT – DOMAIN TAXONOMY (AS STATED IN SYLLABUS) SYN – SYNCHRONOUS (LIVE TEACHING: MS TEAMS) ASYN – ASYNCHRONOUS (DIGITAL INSTRUCTIONAL MATERIAL: LMS CIDOS)



# INTRODUCTION OF ATJ FORM-2013

This manual on the design of flexible pavement structures aims to provide JKR and consultants engaged in pavement engineering projects in Malaysia with a uniform process of designing pavement for all classes of traffic. This manual is based on proven validated design pavement technologies; it builds on past JKR practice and experience and on design methodologies that have been successfully used in other countries over the last twenty years. The design approach recommended in this manual combines improved design development data and mechanistic method of analysis into a single tool that is presented in the form of a catalog of pre-designed pavement structures.



# CHAPTER 2 :



# INTRODUCTION OF JUNCTION DESIGN

A road junction is a location where vehicular traffic going in different directions can proceed in a controlled manner designed to minimize accidents. In some cases, vehicles can change between different routes or directions of travel. An intersection is a road junction where two or more roads either meet or cross at grade (they are at the same level). Such a road junction may also be called a crossroads. At grade intersections present a driver with several points of conflict with other vehicles. The aims of intersection design are to improve traffic flow and reduce the number of accidents.







# **3.1 INTRODUCTION OF** SMAHITRA

**SMAHiTRA** application is an application used in highway and traffic subjects registered under DCC 30103. This subject is registered in semester 3 as a civil engineering major subject. This app is a device that helps students perform the calculations found in this subject. The calculation topics involved are topic 5 and topic 7, namely the 2013 ATJ form and Junction Design.

The function of SMAHiTRA was created to help students make calculations more quickly and accurately. Therefore students can save time and make it easier for students to understand the sub-topics taught. In addition, these apps also display notes that will help students in the calculations to be done. Accordingly, students do not need to open books or notes to make references

**Title :**Smart application highway and traffic (SMAHiTRA) **Aim :** The goal of creating this SMAHiTRA application is to help student learn more effectively.

### **Objective of smahitra apps:**

1) To produce smart application (SMAHiTRA) for students effective learning

- 2) To evaluate student performance using smart application (SMAHiTRA)
- 3) To determine the statisfaction among student using smart application (SMAHiTRA)

### **Advantages of smahitra:**

1) Helping students can easily understand how the calculation are done

- 2) Helping students to speed up the calculation process
- 3) The application is simple to use and quick to load.



## 3.2 METHOD TO INSTALL SOFTWARE TO DEVELOP SMAHITRA APPLICATION







🖬 YouTube 💡 Maps	Free Grammar Chec Se BKM: Pe	mohonan 🧟 www.triplet-lab.co	
	🖉 Java	Search (4) Download Help Developers	
	Help Resources  What is Java?  Remove Older Versions  Disable Java	Download Java for Windows Recommended Version 8 Update 321 (filesize: 2.15 MB) Release date: January 18, 2022	
	Eroscherbladet     Eroscherbladet     Eroscherbladet     Eroscherbladet     Other Hels     Windows 64-bit Users     Do you use both 32-bit and     64-bit Universit     EsQ about 64-bit Avia for     Windows     Other Installation     Trouble downloading*	Important Oracle Java License Update     The Oracle Java License has changed for releases starting April 16, 2019.     The energinatic Technology, Methods, Leante Aptement for Oracle Java SE is substantially     different from prior Oracle Java Licenses. The new Lonese permits certain use, such as personal     use and development rus, at no orall – but other uses atmortced under prof Oracle Java     Kennese may no longe the available. Passar review the terms carefully before downloading and     using this product. An FAO is available <u>Passar</u> review the terms carefully before downloading and     using this product. An FAO is available <u>than</u> .     Commercial license and support is available with a low cost <u>Java SE Subscrutono</u> .     Oracle Java complet the litense to the TM energy and the page atmore diff. License and	
	ny na <u>veda 1940a</u>	Agree and Start Free Download	



4. Java that has been downloaded will be stored in the file section





5. Then, we need to click on the downloaded file to download the file in the java







6. When finished downloading go to the next step which is to download Java se



			_							
× B https://www.	oracle.com/java/techno	ologies/downl	oads/							
YouTube V Map	s 🔌 Free Grammar Che	nc 👥 BKM	Permohonan	- 🦀 www.trig	plet-lab.co					
RACLE	Products Inc	dustries R	esources	Customers	Partners	Developers	Events	۹	② View Accounts	Contact Sales
a 🔰 Technical Details										
ava Downl	oads									6
										Ê
100000Aurole										lava
a downloads Tools a	and resources Java	a archive								
a downloads Tools a	and resources Java	a archive								
a downloads Tools i	and resources Java	a archive	Looking	for other	Java do	wnloads?	Open JDK Earl	v Access Builds	30E for Consumers	1
a downloads Tools a	and resources Java	a archive	Looking	; for other	r Java dor	wnloads?	OpenJDK Earl	y Access Builds	JRE for Consumers	]
a downloads Tools a	and resources Java	a archive	Looking	; for other	r Java dov	wnloads?	OpenJDK Earl	y Access Builds	JRE for Consumers	]
a downloads Tools a	and resources Java	a archive	Looking	; for other	r Java dov	wnloads?	OpenJDK Earl	y Access Builds	J&E for Consumers	]
a downloads Tools a va 18 and Java a 17 LTS is the latest lon reduction and free to re	and resources Java 17 available r .g-term support releas edistribute, at no cost,	a archive	Looking SE platform acle No-Fee	t for other	JDK 17 bina onditions.	wnloads? ries are free to	OpenJDK Earl	y Access Builds ern about Java S	JRE for Consumers	]
a downloads Tools a va 18 and Java a 17 LTS is the latest lon roduction and free to ri c 18 will receive updates	and resources Jave <b>17 available r</b> g-term support release distribute, at no cost, under these terms, ur	a archive	Looking SE platform acle No-Fee r 2022 when	r, JDK 18 and Terms and C nit will be sup	JDK 17 bina onditions. perseded by	wnloads? ries are free to JDK 19	OpenJDK Earl	y Access Builds ern about Java S	JRE for Consumers	]
a downloads Tools a va 18 and Java a 17 LTS is the latest lon roduction and free to re c 18 will receive updates score.	and resources Java <b>17 available r</b> ig-term support release distribute, at no cost, under these terms, ur under these terms, ur	a archive	Looking SE platform acle No-Fee r 2022 when otember 202	t for other n. JDK 18 and Terms and C n it will be sup 24.	JDK 17 bina orditions. perseded by	wnloads? ries are free to JDK 19	OpenJDK Earl	y Access Builds	JRE for Consumers	]









9. Then, we need to upload android studio

10. Click the download button to download android studio into the device

lopers 📥	Platform	Android Studio	Google Play	Jetpack	More 👻	Q, Search	🕀 English 🕶	<u>ک</u> (
_								
			an	droi	d 🍊			
			~	L		1		
			S	cuai	0			
	An	droid Studio pro	vides the fast	test tools fo	r building apps	on every type of Android	d	
				devid	ю.			
			•	ownload And	roid Studio			
		,	Android Studio Bumbl	ebee   2021.1.1 Pa	tch 2 for Windows 64-b	it (872 MiB)		
		ownload options	$\supset$		(	Release notes		
		ownload options	$\square$		(	Release notes		



11. After finishing downloading android studio will be saved in a file

12. Click on the android studio file for running and download the file on the inside







13. Click next button to continue downloading android studio



14. When finished downloading it will continue to bring to the front page of android studio





15. After that, download the flutter framework to complete the coding work





Dadali - Disaat Aku 🔹 🛪 📋	👔 Download Java for Windows 🗙 🛛 😋 Java Downloads   Oracle 👘 🗙 📄 — Download Android Studio a: 🗙 🧹 Windows install   Futter 👘 🗙	+		-				
C A https://docs.flut	ter.dev/get-started/install/windows		2	2 A S				
🖬 YouTube 💡 Maps	📎 Free Grammar Chec 🧱 BOAt Permohonan 🚕 www.briglet-lab.co							
lutter	Multi-Platform • Development • Ecosystem • Showcase Docs • Q	У	0	Get sta				
ted A	Tools: Flutter depends on threes tools being available in your environment.     Windows PowerShell 5:0 or newer (this is pre-installed with Windows 10)     Git for Windows 2.x, with the Use Git from the Windows Command Prompt option.		Conte	nts				
up an editor	If Git for Windows is already installed, make sure you can run git commands from the command prompt or PowerShell.							
e your first app m more	Get the Flutter SDK		Updat Run fl Android s	e your path utter doctor etup				
another platform? ter for Android	1. Download the following installation bundle to get the latest stable release of the Flutter SDK:		Instal Set up device	Android Sti your Andro				
s ter for IOS devs	flutter_windows_2.10.3-stable.zip		Set up emula	the Androic for				
ter for React ive devs	For other release channels, and older builds, see the SDK releases page.		Licen	to Android Jes				
ter for web devs ter for narin.Forms devs	<ol> <li>Extract the zip file and place the contained r1utter in the desired installation location for the Flutter SDK (for example, C:\Users\-your-user-name&gt;Documents).</li> </ol>		Windows Addt requir	setup onal Windov ements				
oduction to larative UI	A Warning: Do not install Flutter in a directory like C:\Program Files\ that requires elevated privileges.		Web setu Next step	P				
nguage overview								
Type here to search	😆 🗰 🥵 💽 🦸 🚳 🖪 🖷 🔕	~	10 /6 08	ENG 924				



17. After entering the website, click on the blue button to download the flutter framework

18. When finished downloading it will be saved in the file section on the dekstop

Copy Parts D Ports Inc	en hortest	e New folder	Down	Select all Select none Invert selection Soluct	
- + SSC > SSC	50 (C) > 94C >				
PEL A News Dive - Personal A Dive - Personal A atop cuments consoft Banes On Ket Lens haves consoft Banes On Ket Lens haves consoft Banes On Ket Lens haves consoft Banes On Ket Diports antick haves antick haves banes	ne <sup>A</sup> Anter Rater, window, 2313-stable	Due multined 17/3/2021 10:15 PM 6/3/2022 2:09 PA	Yoya Siza Filo falder Windda (29 mehine 91)		

Copy	ut opy puth inte shortcut tar tar	e New Tolder	Properties	Select all Select none Nevert selection	
Coperand	Organize				
• 🕈 📑 > This PC	> SSD (C) > src > flutter				
sa. ^		Date modified	Type		
New - Personal	<b>.</b>	21/3/2022 9:39 PM	File folder		
	athab	7/3/2022 9:59 PM	Filefolder		
Nive - Politeknik	. idea	7/3/2022 9:59 PM	Filefolder		
ktop	-pub-cache	7/3/2022 10:09 PM	File folder		
uments		7/3/2022 10:11 PM	Filefolder	_	
rosoft Teams Ch_	dev	7/3/2022 10:14 PM	File folder		
ketens	examples		Filefolder		
lens .	packages		Filefolder		
retires.	ciyaml	3/3/2022 10:40 AM	VAML File		
	ximusprd	3/3/2022 10:40 AM	YML File		
eknik Sultan Salal	-gitattributes	3/3/2022 10:40 AM	GITATTRIBUTES File		
M I	- gitignore	3/3/2022 10:40 AM	GITIGNORE File		
(hint)	analysis_options.yaml	3/3/2022 10:40 AM	VAMI, File	12 108	
	AUTHORS	1/1/2022 10:40 AM		40	
	CODE_OF_CONDUCT.md	1/1/2022 10:40 AM	MD File	10	
uments	CODEOWNERS	\$/1/2022 10:40 AM	Pile .	1 48	
entoads	Contracting and	1/2/2022 10:40 AM	VILLE FOR	100	
*	Batter concels	harden sowe and	Windows Ratch Edg	100	
tures	Butter and ind	1/1/2022 10:40 404	IN CA	149	
601	LICENSE	1/1/2022 10-40 AM	Ele.	210	
1(0)	PATINT GRANT	1/1/2022 10:40 AM	File	210	
54 (D.)	REACHE-md	1/1/2022 10:40 AM	MD File	643	
	- WYPNAM PAR	10.000 10.00 10.0			
Titlem selected					
Tree here to ce	arch 📫	- A A	- o o	- 0	A 10 d di Dis <sup>9327</sup>



19. Open the file and click on the happy bin to see the data in the file







21. Then go to the search section and type env and click on edit environment variables for your account

22. Next, Click on the edit button



	Environment Vanabréi				^	
	User variables for ACER					
Four Fauder Wood (provincente	Variable	Value			^ (i)	
Country	MOZ_PLUGIN_PATH	C//Program Files (x86)	Foxit Software/Foxit Rea	deralugins'.		
	OneDrive	C//Users/ACER/OneDr	ive - Politeknik Sultan Sal	shuddin Abdul Aziz		
	OneDiveConversa	Chibert/ACER/OneDr	ve - Politeknik pultan pa	invoon koovi koo		
	Path	C/Usen/ACER.AppDr	talLocal Microsoft Wind	lowsAppsClarchut		
Chrome Branc Mathem	10.40	Childrent & CER Loofty	tail and Tama			
and the second se	Edit Üser Variable				×	
	Variable value:	m Files (o 160 d'ente Softmane) rowse Fée	<u>Fenil Render(glug)er(</u>	OK Ca	ncel	
Clasic Picka 2 Picka 2 Pick	Variable value Browse Directory Br TMMP TAP USENIAME winde	Invest File		ОК Са	sed	
Case Case Frazz S Frazz S Codeck S Codeck S Codeck S Case S Codeck S Case S Codeck S Case S Codeck S Case S Codeck S Case S Case S Case S Codeck S Case S	Variable value Drowse Directory Be TRAP Data USEPstant winde	In the Lot of the Construction rouse File Crivinioousy TEMP Crivinioousy TEMP System Crivinioows	Next Control (Control)	OK Ca	v	
Cuor Person	Variable value:	ID Long Labor Laboration Rouse File	Nes	OK Car IL. Delete K Cancel		
Cluck Person Context and the formation Person Context and the formation	Variable value Charges	In the control of the function reverse File Crivinikoows TEMP Crivinikoows TEMP SYSTEM Crivinikoows	Nex. 6	OK Car Charles Cancel	v	
Cuord Porter 3 Acress Porter 4 Acress Porter 4 Porter 4 Porte	Variable value Charges	en loca dalla dalla Cellanov reveste File	Nes 6	OK Ca Charles Control	kal	



23. Then paste the address that was copied earlier

24. Then go to the search section again and type cmd and click on the command prompt









25. Type flutter to test whether flutter has been installed in the device or not

26. If the word flutter 'run' is written then flutter is fully downloaded





lib ) DesignTraffic ) 🖺 Phase1Diagram.dart			🚦 <no device="" selected=""> 💌 🛛 🍕 main.datt 💌 🖓 4 WVC</no>	A (Nexus S) API 30 👻	► 0	G A + Q	6 =	0	a, (
- \$ ÷ I © - + ba	Dagram.dat		🐔 TimePhase.dat 🗵 🐔 Phase1Diagram.dat 🗵 🚜 LoginPage.dat 🗵 🗸	Device Manager					
🖉 launcherigeeg	33		TextEditingController _email = M 0 0 A 10 A 2 2 3 A -	Virtual Physical					
🖾 logo,jpeg	34		TextEditingController _password = new TextEditingCont						
🖬 pldt.png	35			Create device	7				
E post-prog	36			Device ~	API	Size on Disk	Actions		
E tenan.gog	37			C. 4 WVGA (Ne	24	0.000			1
a stand on	38		Future <null> _loginApps(BuildContext context) async</null>	Android 11.0 G		9.0.08		-	~
in int	39			C. Burd M. AN M.					
III Putter	40		var url = Uri.porse("https://www.triplet-lab.com/st	Android 11.0 G.	30	8.9 GB		54	1
IIII Runner	41			-					
III Runner.xcodeproj	42		try(						
III Runnerscovorkspace	43			1					
15. gitignore	44		final response = amait http.post(url,body:{	-					
- <u>Sh</u>	45		'Token':"Wht@11650",						
<ul> <li>Di Designifraffic</li> </ul>	46		'EMAIL':_email.text,						
🛃 Phase1Diagram.dart	47		'PASSBORD': password.text,						
Phase2Diagram.dart	48		));						
in ImePhase.dat	49								
Compression and Compression	50			1					
C TimePhaseDiasem.dat	51		if(response.statusCode == 200){						
DI Singletons	52								
DI SubGrade									
K Home.dart	54		<pre>var data = json.decode(response.body);</pre>	-					
🕰 LoginPage.datt	55								
🕰 main.dat	55		print(response.body);						
🖡 SplashScreen.dart	57			-	O Andre	id Studio and plu	pin updates	availa	ble
e test	58		setState(() {	1 1	Comp	onent: Android SD	K Platform	Teels	
5-gitignore E-metadata	59				Update	-			
0 🛛 Problems 🛛 Terminal 🍙 Dart Analysi	IE Logat	n	Profiler 🔮 App Inspection			0.	lvent Log	2,6	yout in
Studio and plugin updates available: Component: A	ndroid SDK Plath	jem-	Tools // Update (27 minutes ago)			22:32	UF UTF-	8 2 10	aces 1
	•		= 4 0 5 0 0 =			~ 10	46.46	ING .	942 48
	-								N 2 00



27. Finally, when complete downloading to the three devices we can start the coding work

## 3.3 How to use SMAHiTRA applications







• After completing the registration you can log in by entering the email and password that has been registered





### account is valid

• There are 2 types of calculations that can be used, namely subgrade category calculations and traffic design





• After completing the registration you can log in by entering the email and password that has been registered







### account is valid

• There are 2 types of calculations that can be used, namely subgrade category calculations and traffic design



 For sub-grade strength calculation you need to enter the value of average daily traffic (ADT), percentage of cv (Pcv), load equivalance factors of applicable vehicle class (LEF), lane distribution factors (L), and terrain factor (T)







• Get the value of ESALy1 and need to enter the design period and annual growth rate to get the value of TGF



• Then, get the type of traffic category and the value of design traffic over 20 years (ESALdes) multiplied by ESALy1 x TGF





 CBR mean value, CBR standard deviation and probability 85%
 (normal deviate) must be stated to obtain the characteristic CBR value used for design



















For phase 1 - Enter the optimum ycle time (CO), actual green time phase 1 (G1 = H) and amber time **(K)** 









• Then, press the home button and press on the time phase diagram (phase 2)



NEXT



• Then enter the intergreen value 2 (12) and amber time (K)

TIME PHASE DIAGRAM

TIME PHASE DIAGRAM (PHAS

TIME PHASE DIAGRAM (PHASE 1)







• Finally the time for each traffic light color will be shown in phase 2 diagram

U

S













A road with asphalt concrete base has a surface width of 7.0 and road shoulder of 1.25m is to be built as the main road in a residential area of flat terrain. Design a road pavement for Three or more lane highway with an average daily traffic 7000 veh/day. The rate of traffic growth is 6%. The percentage of commercial vehicles is 20 %. Design a flexible pavement by employing the JKR Malaysia Design Method for the road. The road design life is 25 years. FIND THE Esaly1 IN DETERMINE DESIGN TRAFFIC.

## QUESTION 2

A road granular base has a surface width of 7.0 and road shoulder of 1.25m is to be built as a main road in a rolling terrain. Design a road pavement for Three or more lane highway with an average daily traffic 5000 veh/day. The rate of traffic growth is 8%. Percentage of commercial vehicle is 15 %. Design a flexible pavement by employing the JKR Malaysia Design Method for the road. The road design life is 15 years. Find the sub grade category.





A road with stabilised base has a surfacewidth of 7.0 and road shoulder of 1.25m is to be built as a main road in a rolling terrain. Design a road pavement for two lane highway with an average daily trafficof 6000 veh/day. The rate of traffic growth is 7%. Percentage of commercial vehicle is 13 %. Design a flexible pavement by employing the JKR Malaysia Design Method for the road. The road design life is 10 years. Find the pavement structures



Design a road pavement for a TWO(2) lane highway with an average daily traffic of 5000 ,17% of commercial vehicle with un-laden weight > 1.5 tons. The following . additional project related information is available:

25

PCV = 17%Lane Distributor Factor ,L = 1.0 (one lane in one direction)Terrain factor, T = 1.0 (Flat)Design life = 20 yearsAnnual Traffic Growth = 4.0%Pavement Type = Granular baseFIND THE TRAFFIC CATEGORY



Design a road pavement for a ONE(1) lane highway with an average daily traffic of 450 ,17% of commercial vehicle with un-laden weight > 1.5 tons. The following . additional project related information is available:

PCV = 17%

Lane Distributor Factor , L = 1.0 (one lane in one direction)

Terrain factor, T = 1.1 (rolling)

Design life = 30 years

Annual Traffic Growth = 7.0%

Pavement Type = Asphalt concrete base Find the total growth factor (tgf)



# EXERCISE

(JUCTION DESIGN)

### EXERCISE 1

Lane Group		North	South	East	West
Veh/hr	Motor cycle	300	670	550	220
(Kend/j)	Car	60	100	70	60
	Lorry	50	40	40	50
	Bus	45	35	45	40
Lane width (m)		4	4	3.5	3.5

Assume: Amber time, k = 3s Intregreen Time, I = 5s Lost time, I = 2s Given PCU conversion: Motorcycle = 0.33 Car = 1.00 Lorry = 1.75 Bus = 2.25

Design a two phase traffic signal to accommodate the flow of traffic in that junction.

# EXERCISE

The North – South movement, the intergreen period and lost time for starting and ending movement is 10s and 3s. For East-West, intergreen period and lost time is 9s and 2s. Assume amber period for both phases is 3s. Based on Table 1, determine: i) Total time loss ii) Optimum time cycle iii) Effective green time for each phase iv) Actual green time for each phase Yellow time = 3s

PHASE	NORTH	SOUTH	EAST	WEST

ACTUAL FLOW, Q (Pcu)	550	500	800	850
SATURATED	<b>2400</b>	2000	2500	3000





•Traffic flow direction (pcu/hr) and entry space lane width W (m) for a signalized junction given in the figure below. Design the traffic signal system for this at grade junction.Assume:-

Integreen period for N-S = 4 sec and E-W = 8 sec Amber period for both phases is 3 sec Lost time per phase is 2 sec



# EXERCISE 4

The North – South movement, the intergreen period and lost time for starting and ending movement is 10s and 3s. For East-West, intergreen period and lost time is 5s and 2s. Assume amber period for both phases is 2s. Based on Table

- 1, determine:
- i) Total time loss
- ii) Optimum time cycle
- iii) Effective green time for each phase
- iv) Actual green time for each phase
- Yellow time = 3s

PHASE	NORTH	SOUTH	EAST	WEST

ACTUAL FLOW, Q (Pcu)	550	500	800	950
SATURATED	3000	2050	2000	3000



# EXERCISE 5

The peak hour volumes was observed for the unsignalized 4 legs junction on Jalan Sultan Idris Shah, Ipoh and tabulated in the Table below. Design a two phase traffic signal to accommodate the flow of traffic in that junction

LANE GROUP		NORTH	SOUTH	EAST	WEST
Veh/hr	motorcycle	300	670	550	220
Veh/hr	passenger car	60	100	70	60
Veh/hr	lorry	50	40	40	50
Veh/hr	bus	45	35	45	40
Lane width (m)		4	4	3.5	3.5

Given PCU conversion: Motorcycle = 0.33 pcu Passenger car = 1.00 pcu Lorry = 1.75 pcu Bus = 2.25pcu

Assume: Amber Time, a:b3 sec Intergreen Time, I: 5 sec Lost Time, l: 2 sec



PAVEMENT TYPE	SUB-GRADE CATEGORY			
	SG <u>1 :</u> CBR 5 TO	SG 2: CBR 12.1 TO	SG <u>3 :</u> CBR 20.1	SG <u>4 :</u> CBR > 30
	12	20	TO 30	
CONVENTIONAL	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50
FLEXIBLE:	<u>CAB :</u> 250	<u>CAB :</u> 200	<u>CAB :</u> 200	CAB: 100
GRANULAR	<u>GSB :</u> 150	<u>GSB</u> : 150	<u>GSB :</u> 100	<u>GSB</u> : 100
BASE				
DEEP	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50
STRENGTH:	STB 2: 100	STB 2: 100	STB 2: 100	STB 2: 100
STABILISED	<u>GSB :</u> 200	<u>GSB :</u> 150	<u>GSB :</u> 100	<u>GSB :</u> 100
BASE				
STABILISED	GSB: 300	GSB: 300	GSB: 250	GSB: 250
BASE WITH	OR	OR	OR	OR
SURFACE	STB 2: 250	STB 2: 250	STB 2: 200	STB 2: 200
TREATMENT				

TRAFFIC CATEGORY T 1: < 1.0 MILLION ESALs (80 Kn)

SUB-GRADE CATEGORY

TYPE				
	SG <u>1 :</u> CBR 5 TO	SG 2: CBR 12.1 TO	SG <u>3 :</u> CBR 20.1	SG <u>4 :</u> CBR > 30
	12	20	TO 30	
CONVENTIONAL	<u>BSC :</u> 140	<u>BSC :</u> 140	<u>BSC :</u> 120	<u>BSC :</u> 100
FLEXIBLE:	CAB · 200	CAB · 200	CAB · 200	CAB · 200
GRANULAR	<u>CAD.</u> 200	<u>CAD.</u> 200	<u>CAD.</u> 200	<u>CAD.</u> 200
BASE	GSB : 150	GSB : 150	GSB : 100	GSB : 100
DEEP	<u>BSC :</u> 120	<u>BSC :</u> 120	<u>BSC :</u> 100	BSC : 100
STRENGTH:	CTD 2, 150	CTD 2, 150	CTD 2, 120	CTD 2, 120
STABILISED	STB 2: 150	STB 2: 150	STB 2: 120	STB 2: 120
BASE	GSB : 200	GSB : 150	GSB : 150	GSB : 150
FULL DEPTH:	BSC : 50	BSC : 50	BSC : 50	BSC : 50
ASPHALT	<b>DD</b> 400		<b>BB</b> 400	
CONCRETE	<u>BB</u> : 100	<u>BB</u> : 100	<u>BB</u> : 100	<u>BR :</u> 80
BASE	GSB : 250	GSB : 200	GSB : 150	GSB : 150

TRAFFIC CATEGORY T 2: 1.0 to 2.0 MILLION ESALs (80 Kn)

Segres

гагадгартт

PAVEMENT	SUB-GRADE CATEGORY			
ITPE	SG <u>1 :</u> CBR 5 TO	SG 2: CBR 12.1 TO	SG <u>3 :</u> CBR 20.1	SG <u>4</u> : CBR > 30
	12	20	TO 30	
CONVENTIONAL	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50
FLEXIBLE: GRANULAR	<u>CAB :</u> 200	<u>CAB :</u> 200	<u>CAB :</u> 200	<u>CAB :</u> 200
BASE	<u>GSB :</u> 200	<u>GSB :</u> 200	<u>GSB :</u> 150	<u>GSB :</u> 100
	<u>BC :</u> 130	<u>BC :</u> 130	<u>BC :</u> 130	<u>BC :</u> 130
DEEP	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50
STRENGTH: STABILISED	STB 1: 150	STB 1: 150	STB 1: 100	STB 1: 100
BASE	<u>GSB :</u> 200	<u>GSB :</u> 150	<u>GSB :</u> 150	<u>GSB :</u> 100
	<u>BC :</u> 100	<u>BC :</u> 100	<u>BC :</u> 100	<u>BC :</u> 100
FULL DEPTH:	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50
ASPHALT CONCRETE	BC/ <u>BB :</u> 160	BC/ <u>BB :</u> 150	BC/ <u>BB :</u> 130	BC/ <u>BB :</u> 130
BASE	<u>GSB :</u> 200	<u>GSB :</u> 150	<u>GSB :</u> 150	<u>GSB :</u> 100

TRAFFIC CATEGORY T 3: 1.0 to 2.0 MILLION ESALs (80 Kn)

PAVEMENT TYPE SUB-GRADE CATEGORY

	SG <u>1 :</u> CBR 5 TO	SG 2: CBR 12.1 TO	SG <u>3 :</u> CBR 20.1	SG <u>4 :</u> CBR > 30
	12	20	TO 30	
CONVENTIONAL	SUB-GRADE	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50
FLEXIBLE: GRANULAR	IMPROVEMENT IS RECOMMENDED	<u>CAB :</u> 200	<u>CAB :</u> 200	<u>CAB :</u> 200
BASE		<u>GSB :</u> 200	<u>GSB :</u> 150	<u>GSB :</u> 100
		BC/ <u>BB :</u> 150	BC/ <u>BB</u> : 160	BC/ <u>BB :</u> 150
DEEP	SUB-GRADE	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50
STRENGTH: STABILISED	IMPROVEMENT IS RECOMMENDED	STB 1: 120	STB 1: 100	STB 1: 100
BASE		<u>GSB :</u> 200	<u>GSB :</u> 150	<u>GSB :</u> 100
		BC/ <u>BB :</u> 150	BC/ <u>BB</u> : 140	BC/ <u>BB</u> : 130
FULL DEPTH:	SUB-GRADE	<u>BSC :</u> 50	<u>BSC :</u> 50	<u>BSC :</u> 50
ASPHALT CONCRETE	IMPROVEMENT IS RECOMMENDED	BC/ <u>BB</u> : 200	BC/ <u>BB :</u> 180	BC/ <u>BB :</u> 150
BASE		<u>GSB :</u> 200	<u>GSB :</u> 150	<u>GSB :</u> 100

TRAFFIC CATEGORY T 4: 10.0 to 30.0 MILLION ESALs (80 Kn)

PAVEMENT	SUB-GRADE CATEGORY			
TYPE	SG 1 CBR 5 TO	5 1 - CBR 5 TO 5G 2: CBR 12.1 TO 5G 3 - CBR 20.1		
	12	20	TO 30	
CONVENTIONAL	SUB-GRADE	<u>BSC -</u> 50	<u>RSC -</u> 50	<u>BSC -</u> 50
FLEXIBLE:	IMPROVEMENT IS	CA8 : 200	CA8 : 200	CAB : 200
GRANULAR	RECOMMENDED			
BASE		<u>658 -</u> 200	G58 - 150	<u>GSB -</u> 100
		BC/ <u>BB -</u> 190	BC/ <u>BB -</u> 190	BC/ <u>BB -</u> 190
DEEP	SUB-GRADE	<u>850 -</u> 50	<u>RSC -</u> 50	<u>850 -</u> 50
STRENGTH:	IMPROVEMENT IS	STR 1: 150	STR 1: 150	STR 1: 150
STABILISED	RECOMMENDED	5151.155	5151.155	5151.155
BASE		<u>G58 -</u> 200	<u>658 -</u> 150	<u>G58 -</u> 100
		BC/ <u>BB</u> 160	BC/ <u>BB -</u> 140	BC/ <u>BB -</u> 140
FULL DEPTH:	SUB-GRADE	<u>RSC -</u> 50	<u>RSC -</u> 50	<u>RSC -</u> 50
ASPHALT	IMPROVEMENT IS	pr/pp - 710	pr/pp - 200	pr/00 - 190
CONCRETE	RECOMMENDED	00,000 210	bej <u>un</u> zoo	DC/
BASE		<u>G58 -</u> 200	<u>GSB -</u> 150	<u>GSR -</u> 100
SPECIAL	SUB-GRADE	SMA, PA, FC OR	SMA, PA, FC OR	SMA, PA, FC OR
PURPOSE	IMPROVEMENT IS	PMA: 50	PMA: 50	PMA: 50
SURFACE	RECOMMENDED	nr (nn - 1 m	nn (nn - 1 cn	nr (nn - 1 nn
COURSE		BC/ <u>BB 1</u> 70	BC/ <u>BB</u> 160	BC/ <u>BB 150</u>
		OR PMA - 140	OR PMA : 130	OR PMA - 120
		CAR 200	CAR 150	CAR 100
		<u>G58 -</u> 200	GSB : 150	<u>GSB -</u> 100
DEEP	SUB-GRADE	<u>850 -</u> 50	<u>RSC -</u> 50	<u>RSC -</u> 50
STRENGTH	IMPROVEMENT IS			
HIGH-	RECOMMENDED	PMA BASE: 250	PMA BASE: 220	PMA BASE: 200
BASE COLIRSE		G58 - 200	G58 - 150	G58 - 100

TRAFFIC CATEGORY T 5: > 30.0 MILLION ESALs (80 50)

### LANE DISTRIBUTION FACTORS

Number of Lanes (In ONE direction)	Lane Distribution Factor, L
One	1.0
Two	0.9
Three or more	0.7

#### **Terrain Factors**

Type of terrain	Terrain Factor, T	
Flat	1.0	
Rolling	1.1	

#### Total Growth Factors (TGF)

Design Period	Annual Growth Rate (%)					
(Years)	2	3	4	5	6	7
10 15	10.95 17.29	11.46 18.60	12.01 20.02	12.58 21.58	13.18 23.28	13.82 25.13
20	24.30	26.87	29.78	33.06	36.79	41.00
25	32.03	36.46	41.65	47.73	54.86	63.25
30	40.57	47.58	56.08	66.44	79.06	94.46



Traffic Categories used in this manual (ESAL = 80 KN)

Traffic Category	Design Traffic (ESAL X 10^6)	Probability (Percentile) Applied to Properties of Sub-Grade Materials
• T1	≤ 1.0	≥ 60%
• T 2	1.1 to 2.0	≥ 70%
• T3	2.1 to 10.0	≥ 85%
• T 4	10.1 to 30.0	≥ 85%
• T 5	> 30.0	≥ 85%

Classes of Sub-Grade Strength (based on CBR) used as input in the Pavement Catalogue of This Manual

Sub-Grade	CBR (%)	Elastic Modulus (Mpa)		
Category		Range	Design Input Value	
• SG 1	5 to 12	50 to 120	60	
• SG 2	12.1 to 20	80 to 140	120	
• SG 3	20.1 to 30.0	100 to 160	140	
• SG 4	>30.0	120 to 180	180	

# ANSMER

## **EXERCISE ATJ FORM 2013**

## **QUESTION 1** ANSWER = 1.32349 MILLION

**QUESTION 2** ANSWER = SUB GRADE CATEGORY 2

QUESTION 3 Answer = BSC : 50 STB 1 : 120



GSB:200 BC/BB:150

## **QUESTION 4** ANSWER= TRAFFIC CATEGORY 5

## **QUESTION 5**

Answer = 94.56



# ANSWER

## JUNCTION DESIGN

## **Exercise 1**

## **Exercise 2**

## **Exercise 3**

Time phase 1 -Green time = 10 s amber time = 3 s Red time = 18 s Phase 2 -Red time 1 = 15 s Amber time = 3 s Green time = 11 s Red time 2 = 2s

Time phase 1 Green time = 25 s Amber time = 3 s Red time = 47 s

Time phase 2 Red time 1 = 41 s Amber time = 3 s Green time = 31 s Time phase 1 Green time = 34 s Amber time = 3 s Red time = 50 s

Time phase 2 Red time 1 = 43 s Amber time = 3 s Green time = 41 s

## **Exercise 4 Exercise 5**

Time phase 1 Green time = 32 s Amber time = 2 s Red time = 48 s Time phase 1 Green time = 10.24 s Amber time = 3 s Red time = 17.76 s

Time phase 2 Red time 1 = 41 s Amber time = 2 s Green time = 39 s Time phase 2 Red time 1 = 17.24 s Amber time = 3 s Green time = 10.76 s



# ACKNOWLEDGEMENT

We express our deep gratitude and appreciation to unit penerbitan Politeknik Sultan Salahuddin Abdul Aziz Shah for having assisted and approved SMAHiTRA related manuals for publication. It is to them that we are most indebted, and we can only hope that the application we developed can benefit students and lecturers, especially in the field of Civil Engineering.

We had been immeasurably enriched by working under the supervision of Dr. Ainul Haezah Binti Noruzman, the subject teacher, who has a great level of knowledge and who has an art of encouraging, correcting, and directing in every situation possible, which has enabled us to complete the project. Special thanks to Ts. Ainie Hayati Binti Noruzman for guidance and mentoring in developing SMAHiTRA

applications.

We thank our family and our fellow students for their best understanding and support. And also dedicated to lecturers who teach the subject of highway and traffic, especially Puan Arduniwati bt Ahmad who give a lot of guidance related to this subject.

We also acknowledge to all the people who have involved and supported us in making this project.



# THANK YOU

# VERY MUCH



## Published by: UNIT PENERBITAN Politeknik Sultan Salahuddin Abdul Aziz Shah Persiaran Usahawan,

- Seksyen U1, 40150 Shah Alam
- Selangor
- No. Telefon: +603 5163 4000 No. Fax: +603 5569 1903

