Effect of Changing ACW on Accident Trend

Ir. Abdul Rahman Baharuddin, Ir. Eliyani Yazreen A. Rani, Hidra Hasbee Jamil

CIVIL CORE 2020
CONFERENCE ON RESEARCH IN ENGINEERING
JKR CREaTE
15 Sept 2020

INTRODUCTION

- With the growing populations and increasing number of vehicles on the roads, the road traffic accidents and related deaths have been ever-increasing worldwide.
- Road accident statistics showed that Malaysia has the Third highest road fatality risk among all the ASEAN countries.
- Data from Polis DiRaja Malaysia (PDRM) also indicated that the Federal roads had the highest number of road accident fatalities from 2000 to 2018 followed by State roads, Municipal and Expressway.

CIVILCORE 2020

Year | 2019 | News | Local News | May

WHO: Malaysia is Third in Road Deaths in ASEAN and Asia

By **Wahid Ooi Abdullah** - 14/05/2019

Courtesy of freemalaysiatoday.com

- According to the WHO, Malaysia has the third highest rate of ASEAN and Asia.

Bike Accessories for Sale

GET GENUINE BMW MOTORRAD PARTS ON OUR ONLINE STORE!

Sep Irran - 12/06/2020

ACCIDENT CASES IN SOCIAL MEDIA

Tiga maut kema

KUALA KRAI: Tiga maut
awal pagi tadi

Komander Operasi Pega
pihaknya menerima pan

Katanya, kemalangan itu
Triton, lori dan kereta Pr

CIVI

MIRI - Beberapa buah

Dalam kejadian pagi
berpunca dari keadaan jalan raya ya

Home
Explore
Notifications
Messages
Bookmarks
Lists
Profile
More
Tweet

hidra
@HasbeeHidra

kemalangan jalan licin

Top Latest People Photos Videos

Nordin @burungman · Jun 21
Aku tau tgh discuss psl putrajaya. Saja guna kes tmpt lain sbb nak tunjuk di tahun 2020 ni masih ada kes buang paku dan minyak di **jalan** raya. Dan kemungkinan benda tu berlaku di putrajaya juga ada memandangkan kes2 **kemalangan** akibat **jalan licin** terlalu byk. Benda tak jd tanpa sbb

2

twt_borneomy @twt_borneomy · Jun 5
Tak Sampai Sehari, 12 **Kemalangan** Dilaporkan Di Kuching Akibat **Jalan Licin**

Tak Sampai Sehari, 12 Kemalangan Dilaporkan Di Kuching Akibat Jalan ...
Tak Sampai Sehari, 12 Kemalangan Dilaporkan Di Kuching Akibat Jalan Licin. Kepada pemandu di luar sana, hati-hati di jalan raya.

ROAD ACCIDENT BY CATEGORY

TABLE B2
Road Accident By Category

JENIS JALAN *Road Category*	JENIS KEMALANGAN *Type of Road Accident* MAUT *Fatal*	PARAH *Serious*	JUMLAH *Total*
JALAN EKSPRES *Expressway*	408	276	684
PERSEKUTUAN *Federal*	2,089	3,129	5,218
NEGERI *States*	1,365	2,334	3,699
BANDARAN *Municipal*	918	1,307	2,225
LAIN-LAIN *Others*	452	807	1,259
JUMLAH *Total*	5,232	7,853	13,085

2000

Jadual B2 - KEMALANGAN MENGIKUT JENIS JALAN

Table B2 - Road Accident by Road Category

KEMALANGAN MENGIKUT JENIS JALAN
Road Accident by Road Category

JENIS JALAN *Road Category*	MAUT *Fatal*	PARAH *Serious*	RINGAN *Minor*	JUMLAH *Total*
JALAN EKSPRES *Expressway*	715	197	261	1,173
PERSEKUTUAN *Federal*	1,809	774	1,421	4,004
NEGERI *States*	1,671	706	1,351	3,728
BANDARAN *Municipal*	1,047	377	722	2,146
LAIN-LAIN *Others*	628	188	481	1,297
JUMLAH *Total*	**5,870**	**2,242**	**4,236**	**12,348**

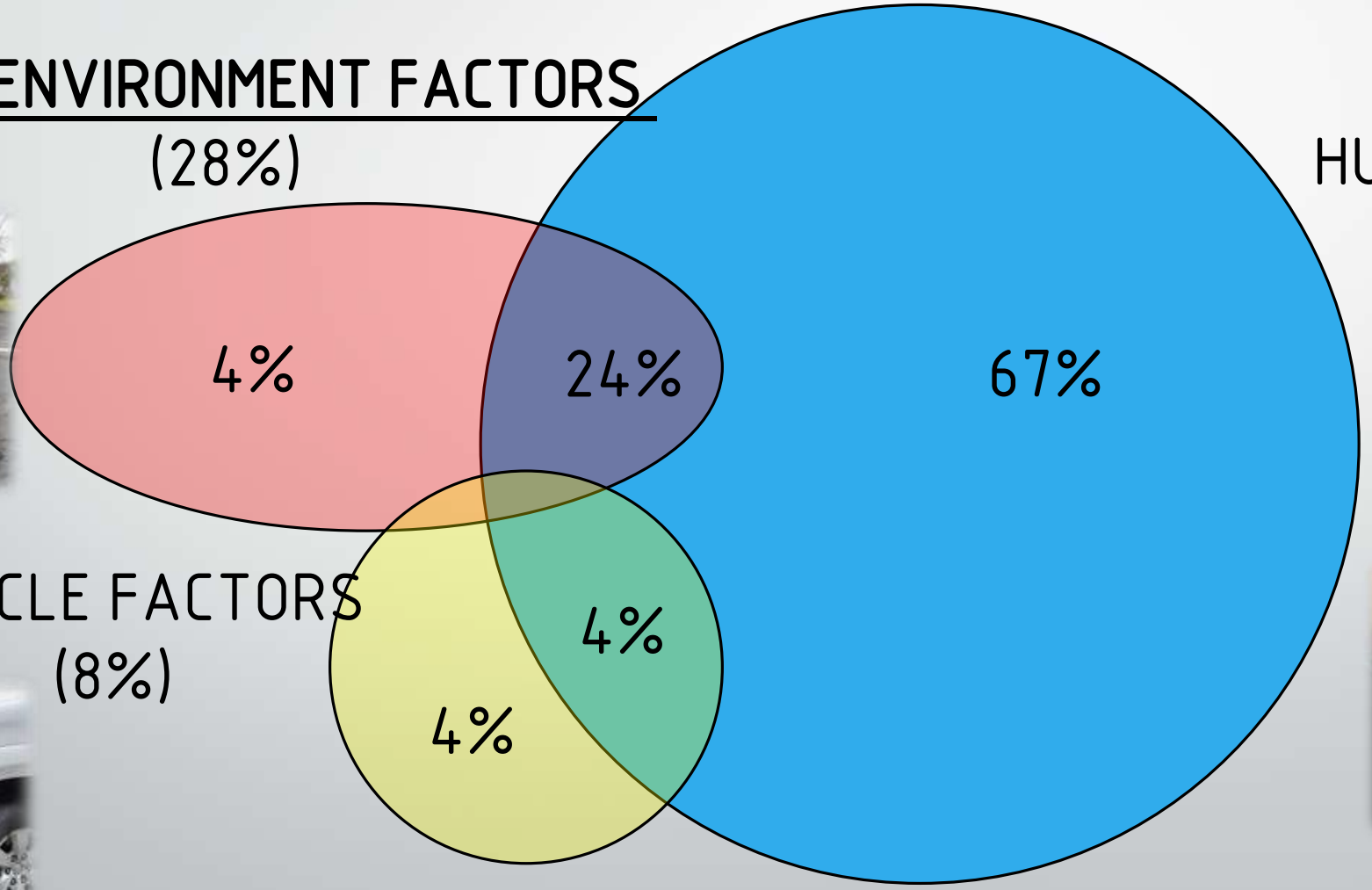
2018

FEDERAL ROADS IN MALAYSIA HAD THE HIGHEST NUMBER OF ROAD ACCIDENTS COMPARED TO OTHER ROAD CATEGORIES

CIVILCORE 2020

CAUSES of ROAD ACCIDENTS

ROAD ENVIRONMENT FACTORS
(28%)



HUMAN FACTORS
(95%)

VEHICLE FACTORS
(8%)

ROAD AND ENVIRONMENTAL FACTORS

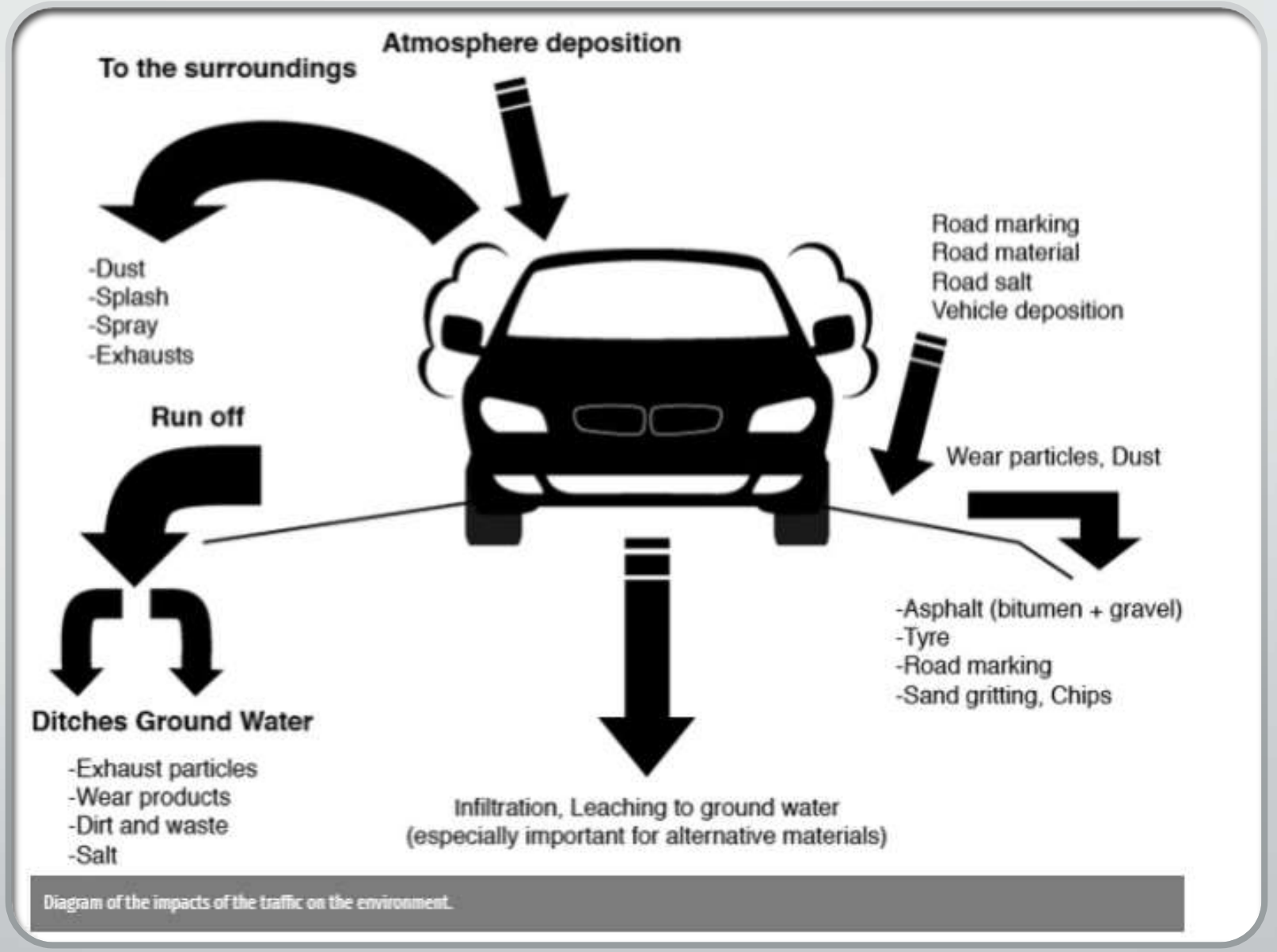
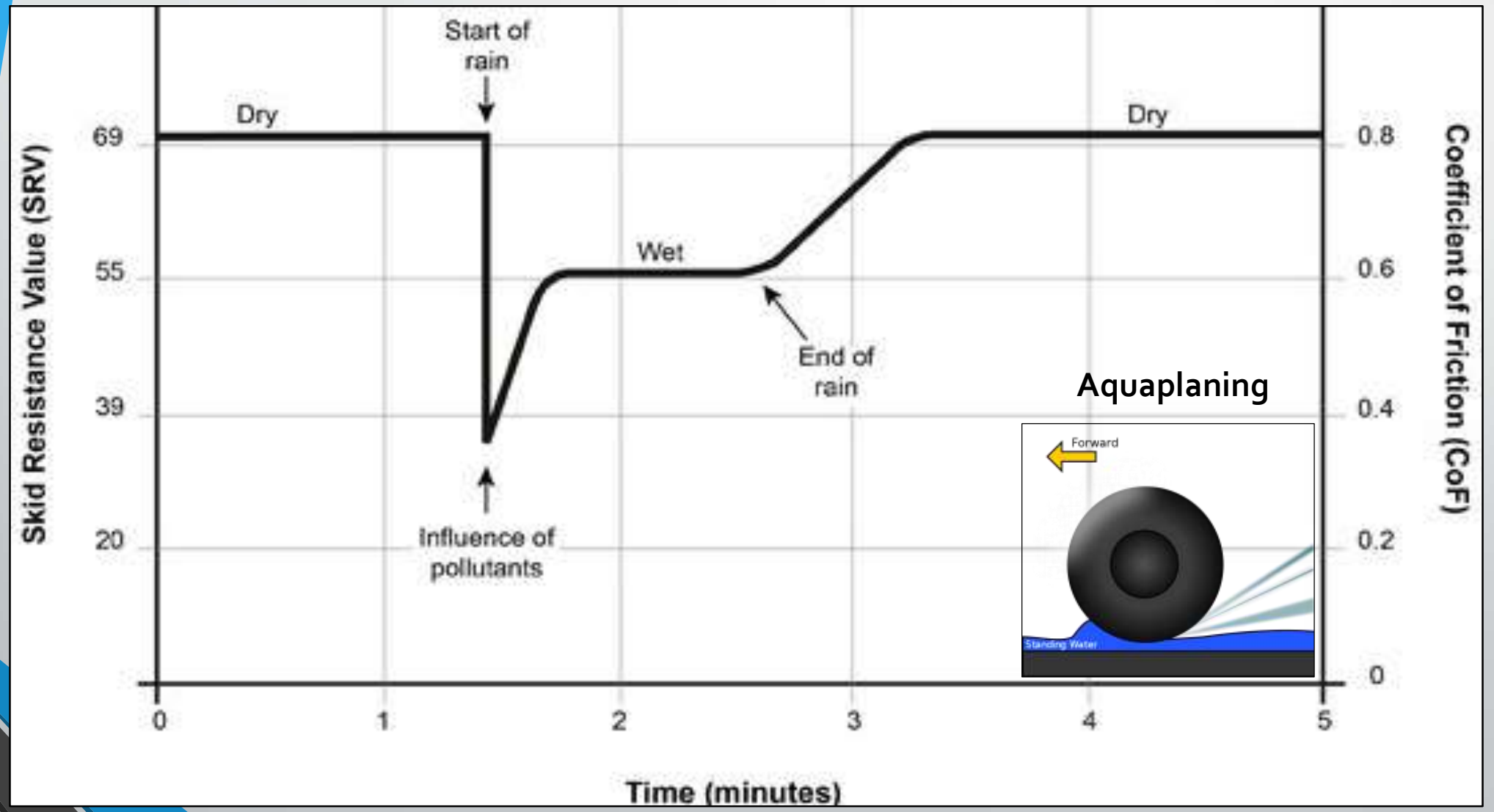


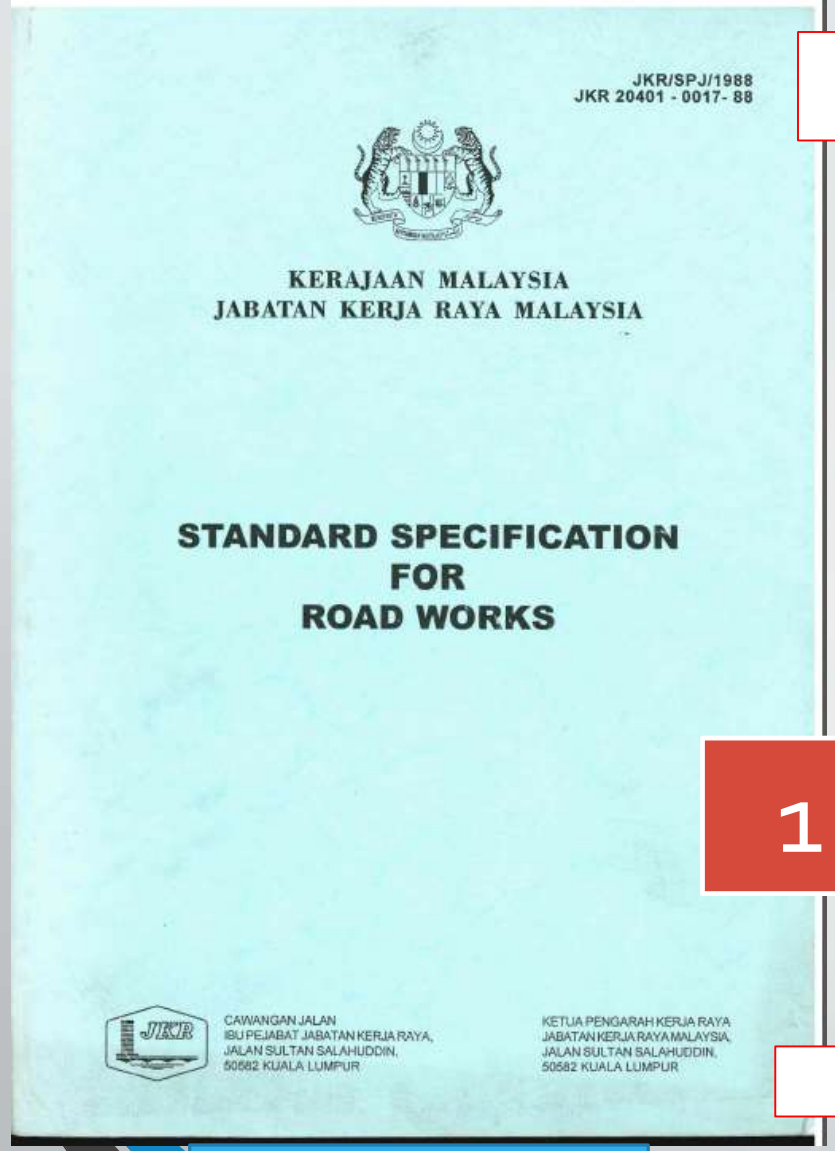
Diagram of the impacts of the traffic on the environment.

VARIATION IN COEFFICIENT OF FRICTION (CoF) DURING A RAIN EVENT

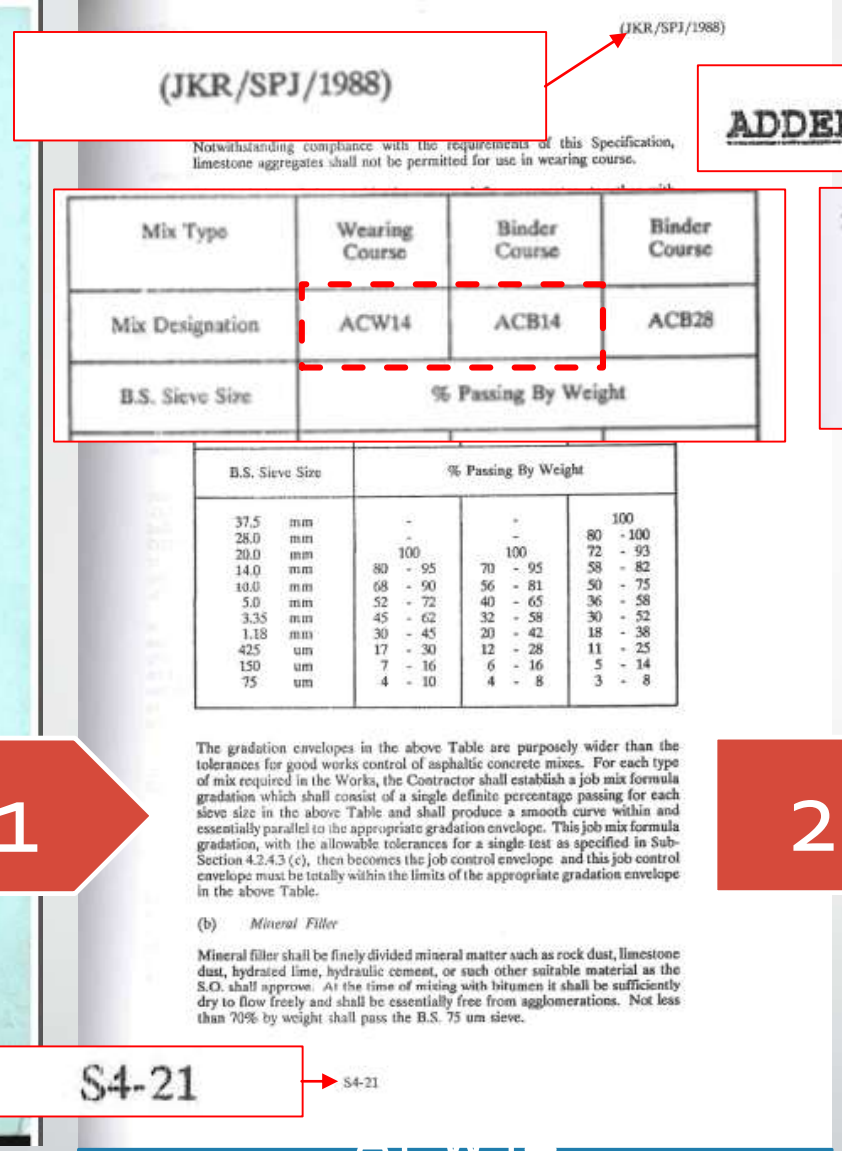


CHRONOLOGY STANDARD SPECIFICATION FOR ROAD WORKS

CIVILCORE 2020

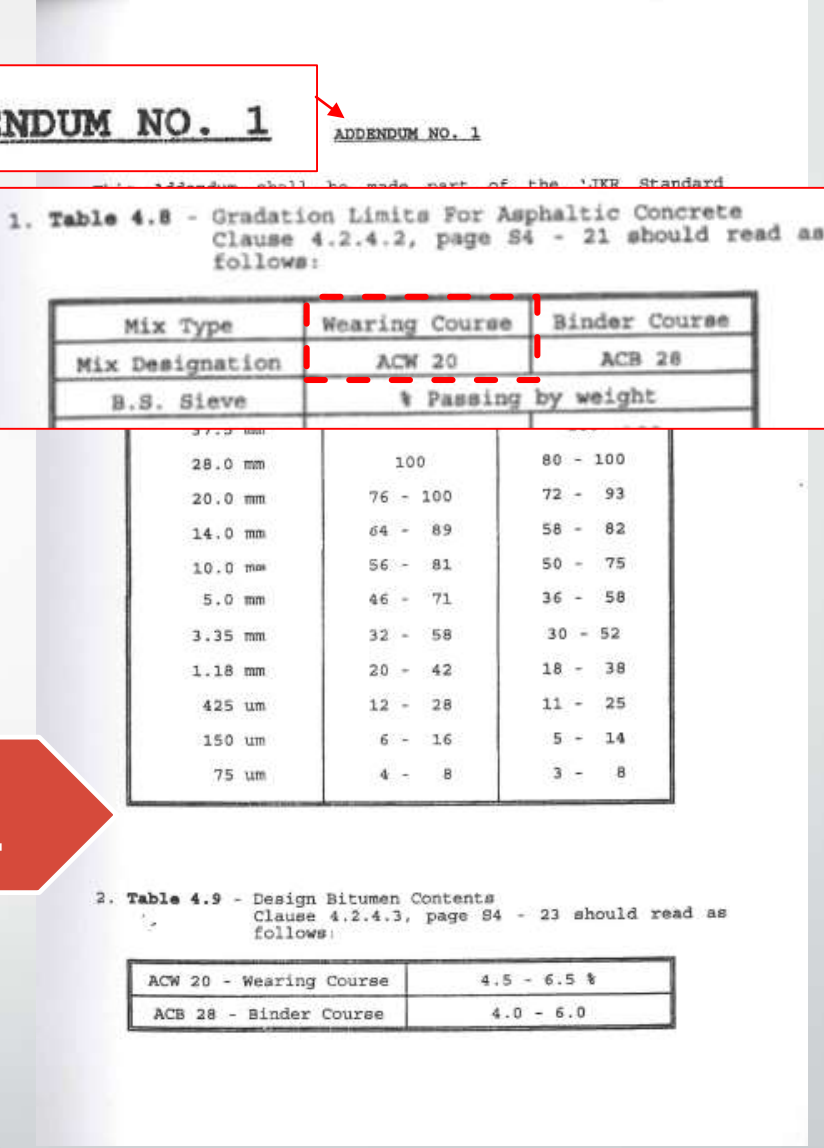


JKR/SPJ/1988



(JKR/SPJ/1988)
S4-21

1



2

(JKR/SPJ/1988)
S4-21

ACW14 ADDENDUM NO.1

CIVILCORE 2020

Satu spesifikasi baru bagi kerja-kerja jalan untuk *Section 4: Flexible Pavement JKR/SPJ/2008-S4* telah disiapkan pada Februari 2008 bagi menggantikan spesifikasi lama JKR/SPJ/1988-S4. Spesifikasi baru ini telah diedarkan melalui surat dari Pengarah Cawangan Jalan rujukan (23) JKR.PCJ/UKJ/STD/SPJ/Sec 4 bertarikh 19 Februari 2008.

3

JABATAN KERJA RAYA MALAYSIA
PEJABAT KETUA PENGARAH KERJA RAYA
IBU PEJABAT JKR MALAYSIA,
JALAN SULTAN SALAHUDDIN,
50582 KUALA LUMPUR.
Telefon : (03) 26919011
Telefax : KRT MA 30415
Kawat : MINWORK, KUALA LUMPUR
Fax : (03) 2694 8477 (Tkt. 2)
: (03) 2692 1202 (Tkt. 4)
Laman Web : http://www.jkr.gov.my

Rujukan : JKR.KPKR:113.020.050/03 Jld. 2 (3)
Tarikh : 21 November 2011

Semua Pengarah Kanan / Pengarah Cawangan Ibu Pejabat JKR
Semua Pengarah Kerja Raya Negeri
Pengarah Bekalan Air Negeri Pahang
Semua Pengarah / Pengurus Pembinaan
Pengarah JKR Unit,Khas KESEDAR
Semua Jurutera Daerah

SURAT ARAHAN KPKR BIL. 14/2011

ARAHAN PENGGUNAAN *STANDARD SPECIFICATION FOR ROAD WORKS JKR/SPJ/2008-S4: FLEXIBLE PAVEMENT*

1.0 LATAR BELAKANG

1.1 Satu spesifikasi baru bagi kerja-kerja jalan untuk *Section 4: Flexible Pavement JKR/SPJ/2008-S4* telah disiapkan pada Februari 2008 bagi menggantikan spesifikasi lama JKR/SPJ/1988-S4. Spesifikasi baru ini telah diedarkan melalui surat dari Pengarah Cawangan Jalan rujukan (23) JKR.PCJ/UKJ/STD/SPJ/Sec 4 bertarikh 19 Februari 2008.

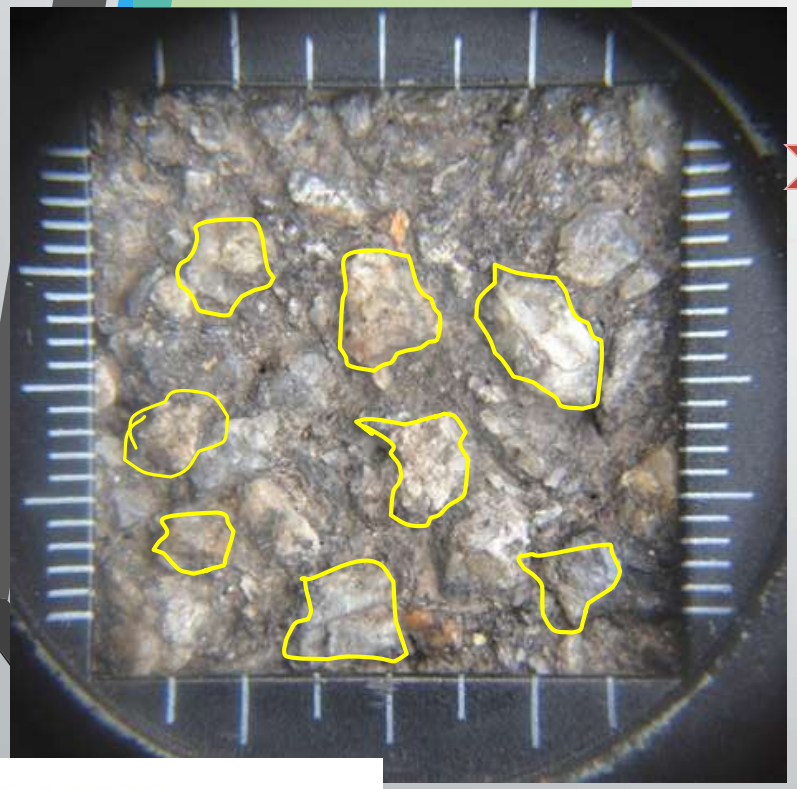
2.0 ARAHAN PENGGUNAAN

2.1 Dengan Surat Arahan ini, semua projek jalan yang dikendalikan oleh JKR adalah dikehendaki menggunakan spesifikasi baru ini untuk memastikan kualiti kerja pembinaan jalan memenuhi spesifikasi yang ditetapkan.

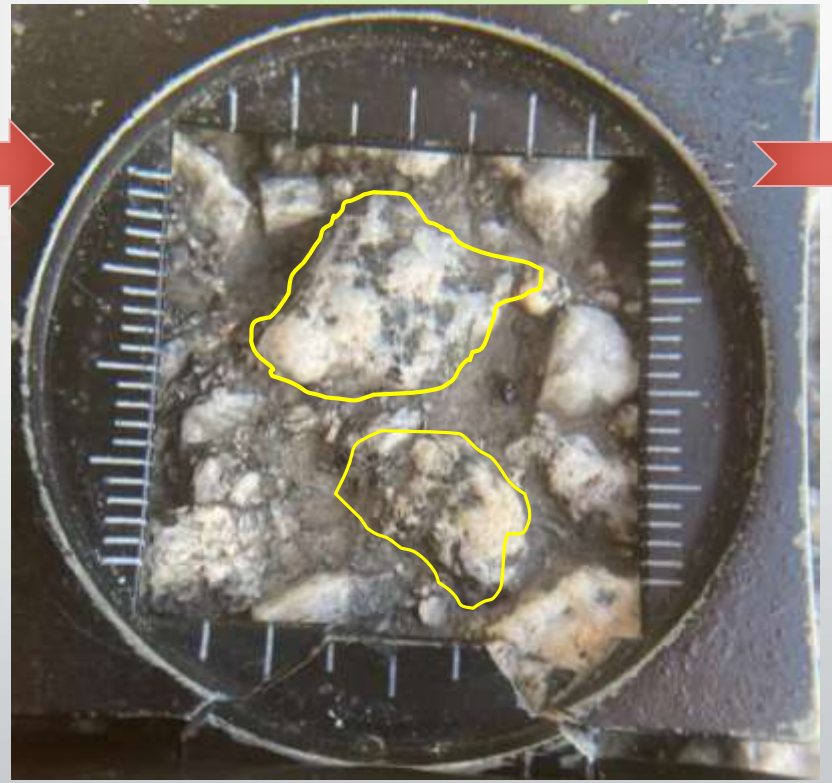
2.2 Spesifikasi baru ini boleh dimuat turun di Laman Web Rasmi Cawangan Kejuruteraan Jalan dan Geoteknik (http://rakan1.jkr.gov.my/ckjg/) atau memohon kepada Unit Standard dan Spesifikasi, Cawangan Kejuruteraan Jalan dan Geoteknik, Tingkat 26, Menara PJD, No. 50, Jalan Tun Razak, 50400 Kuala Lumpur.

ASPHALTIC CONCRETE WEARING COURSE

ACW 10



AC 14

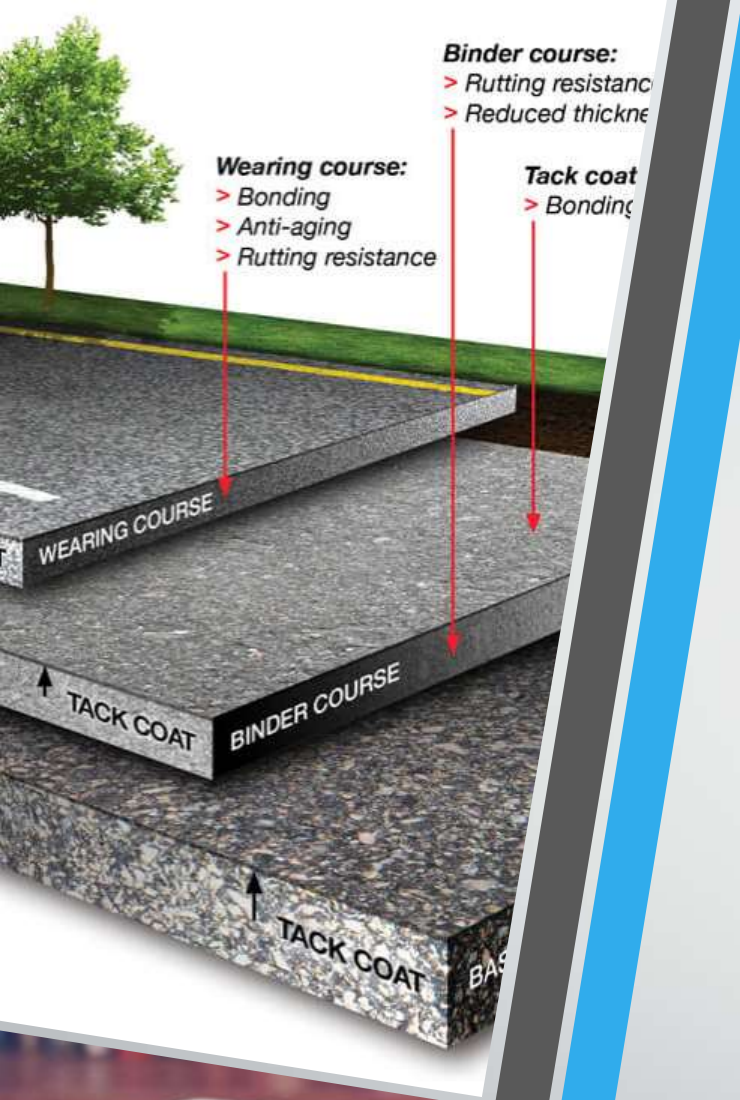


ACW 20

WHO USE THIS SPEC FOR SECTION 4: FLEXIBLE PAVEMENT JKR/SPJ/2008-S4??

- JABATAN KERJA RAYA MALAYSIA (JKR)
- LEMBAGA LEBUHRAYA MALAYSIA (LLM)
- DEWAN BANDARAYA KUALA LUMPUR (DBKL)
- MAJLIS BANDARAYA SHAH ALAM (MBSA)

CIVILCORE 2020



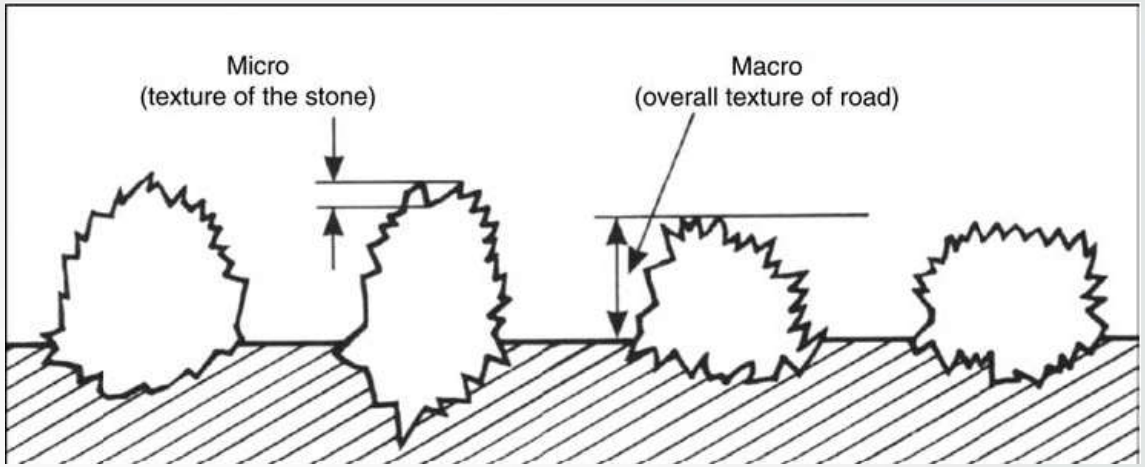
LITERATURE REVIEW

CIVILCORE 2020

SKID RESISTANCE

- Skid resistance depends on a pavement surface's microtexture and macrotexture
- **Microtexture** refers to the small-scale texture of the pavement aggregate component (which controls contact between the tire rubber and the pavement surface)
- **Macrotexture** refers to the large-scale texture of the pavement as a whole due to the aggregate particle arrangement (which controls the escape of water from under the tire)

Types of Surface Irregularity		
No.	Surface Irregularity	Range
1	Microtexture	TD < 0.5 mm
2	Macrotexture	0.5 mm < TD < 5 cm
3	Megatexture	5 cm < TD < 0.5 m
4	Roughness	0.5 m < TD < 50 m



- Microtexture and adhesion are the prevailing factors influencing skid resistance at speeds less than 50 kmph (AASHTO Guide 2008). Irregularities that are larger than 0.5 m are considered as roughness and have minimum bearing in pavement skid resistance (Henry, 2000).

- A study by Pulugurtha using data from four (4) highway pavements at North Carolina indicated that macrotexture of the pavement greater than 1.524mm able to reduce accidents and improve highway safety.

EARLY STUDY ON THE EFFECT OF USING AC14 by BAHAGIAN KEJURUTERAAN FORENSIK JALAN


CJ Technical Updates

Cawangan Jalan

Bulletin on lessons learnt in
- Road Safety
- Road Engineering

Theme of the month:

AC14: HOW IT AFFECTS SKID RESISTANCE

Issue No. 4 4/2017

JKR 21300-0060-14

Website: http://www.jkr.gov.my

ISSN 2231-7988


Issue No.

4

4/2017

ISSN 2231-7988

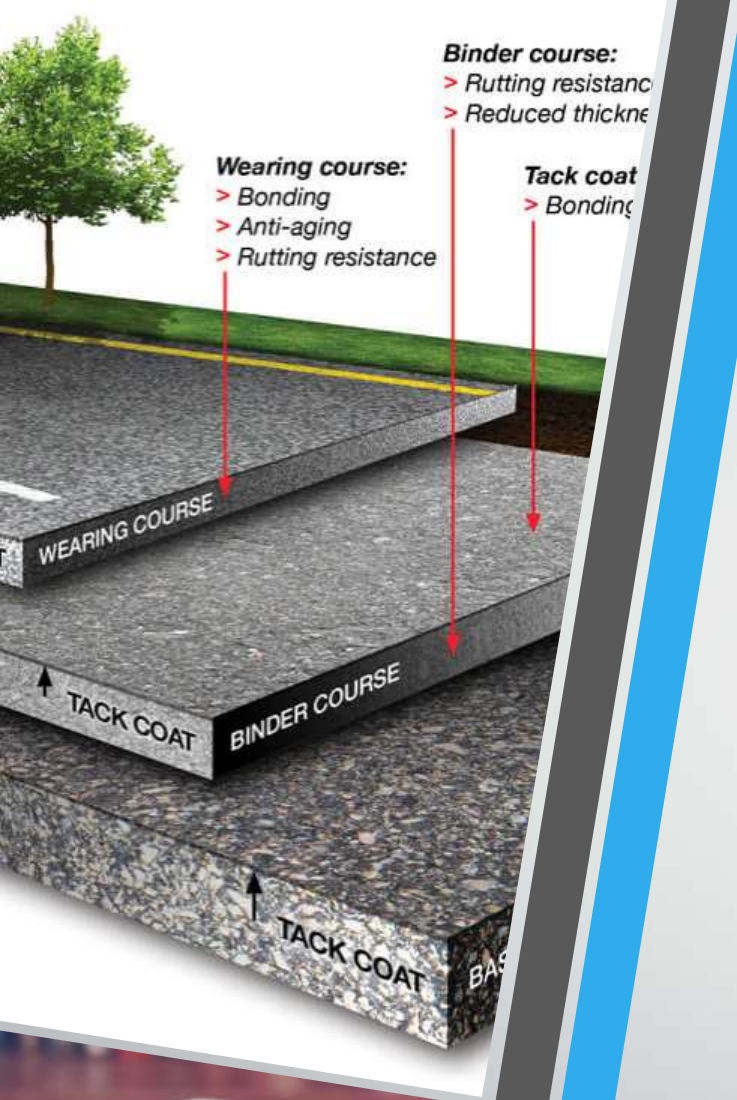
a) British Pendulum Tester (BPT) was conducted based on ASTM E303-87 to measures friction by Skid Resistance Value (SRV) from micro-texture.

b) Sand Patch Test (Volumetric spot test) was conducted based on BS 598 Part 105 (1990) to provides Mean Texture Depth (MTD) of pavement surface macro-texture.

FINDINGS

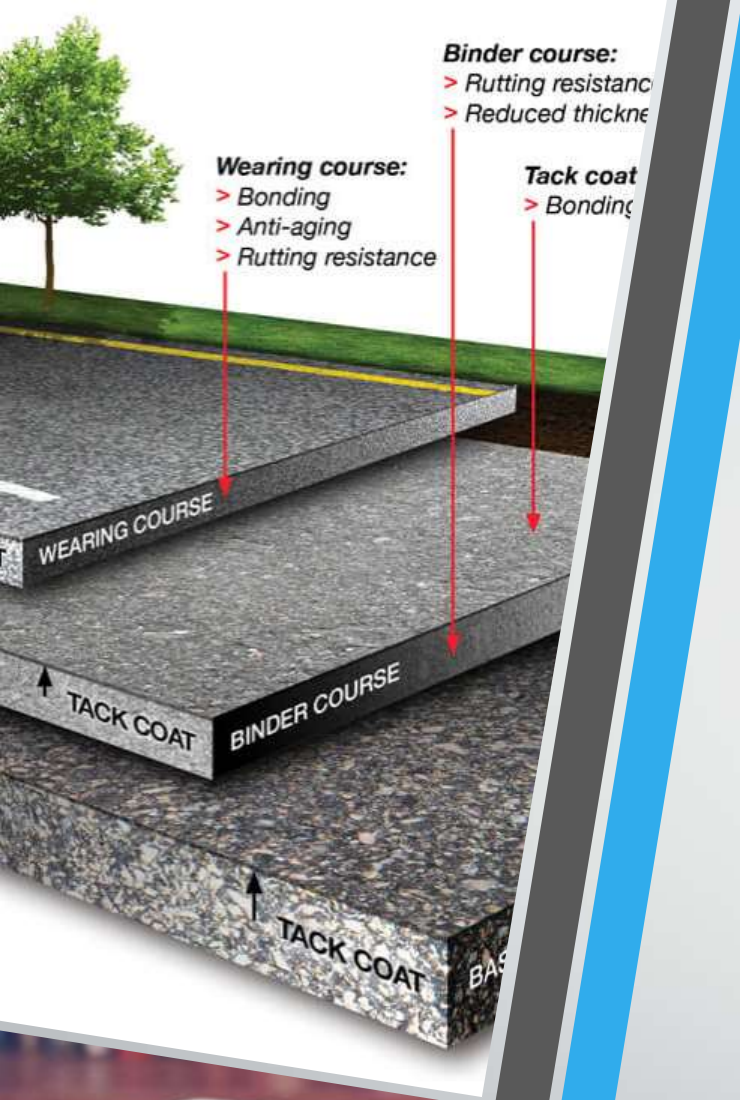
- Average SRV values for **ACW20 is higher than AC14**, averaging 57.4 against 56.6. But the difference is not too much.
- For MTD, **ACW20 act better as compared AC14** during wet-weather conditions to flow out water run-off.
- Analysis of data indicates there are **no clear evidence** that AC14 has lower skid resistance properties compared to ACW20 under normal dry condition. Further study is needed on this subject.

* SRV = SKID RESISTANCE VALUE, MTD = MEAN TEXTURE DEPT



METHODOLOGY

CIVILCORE 2020



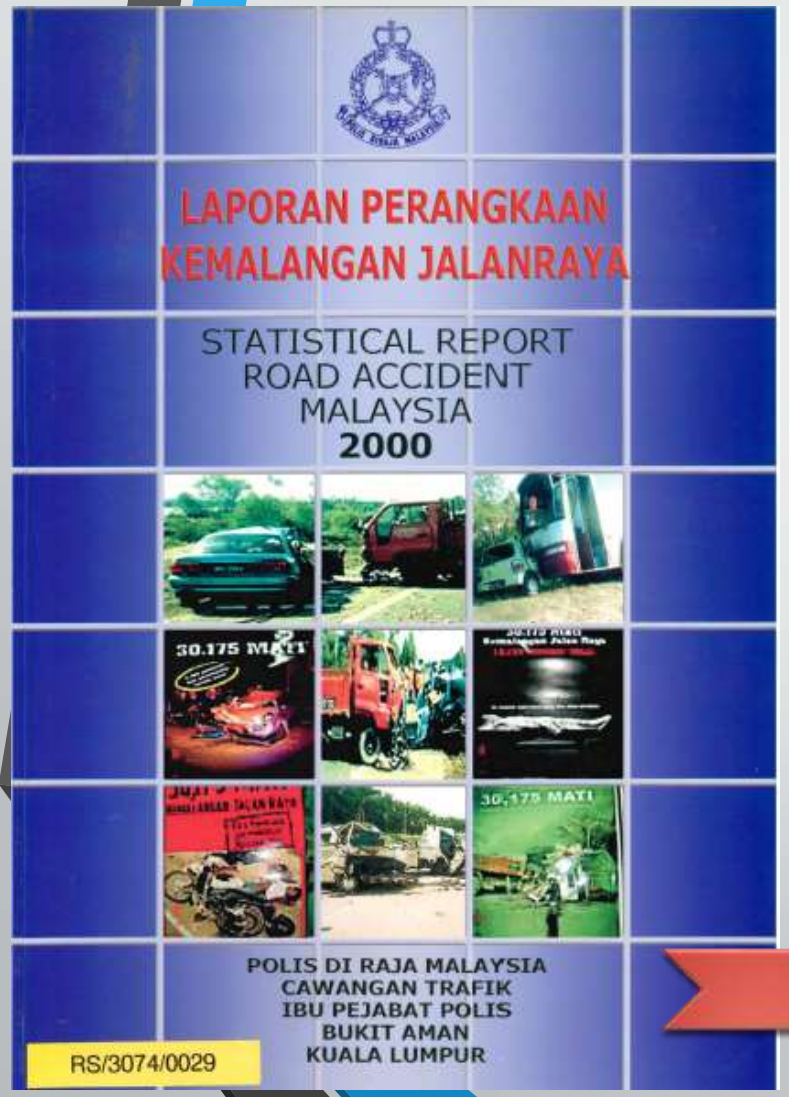
METHODOLOGY

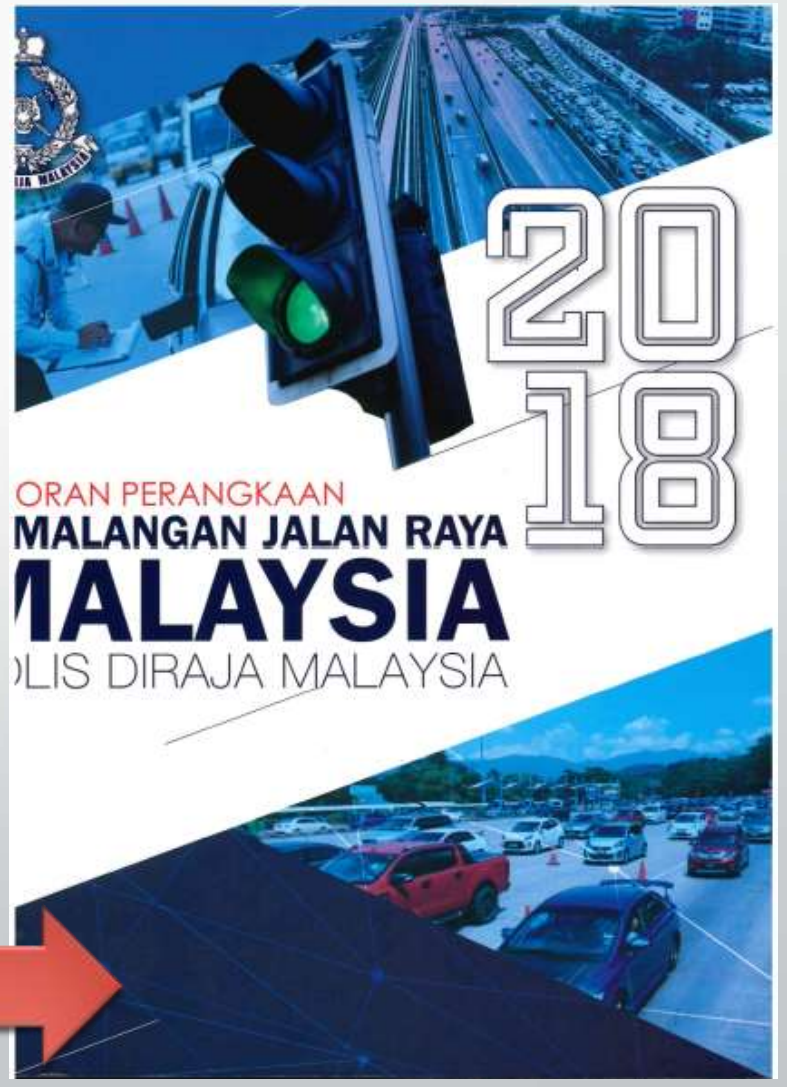
- Malaysian Road Accident Statistics Report (Laporan Perangkaan Kemalangan Jalan Raya Malaysia)

- T test & Chi Square Test

$$t = \frac{(x_1 - x_2)}{\sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}}}$$

(Laporan Perangkaan Kemalangan Jalan Raya Malaysia)





ROAD ACCIDENT DUE TO ROAD DEFECTS

JADUAL B10
KEMALANGAN MENGIKUT KEADAAN KECACATAN JALAN

TABLE B10
Road Accident Due To Road Defects

KECACATAN JALAN *Road Defect*	JENIS KEMALANGAN *Type of Road Accident* MAUT *Fatal*	PARAH *Serious*	JUMLAH *Total*
BAHU JALAN RENDAH/TINGGI *Road Shoulders Low/High*	94	160	254
MANHOLE RENDAH/TINGGI *Manhole Low/High*	18	16	34
BATU LONGGAR *Loose Gravel*	17	17	34
JALAN BERDEBU *Dusty Roads*	14	27	41
JALAN BERLUBANG *Pot Holes*	49	76	125
JALAN LICIN *Slippery Roads*	50	53	103
KEROSAKAN LAMPU ISYARAT *Defective Traffic Lights*	6	5	11
LINTASAN KERETAPI SEMPIT *Narrow Railway Crossings*	—	2	2
JAMBATAN SEMPIT *Narrow Bridges*	16	11	27
TIADA GUARD RAIL *No Guard Rails*	6	10	16
TIADA/KURANG LAMPU JALAN *No/Insufficient Street Lights*	120	78	198
JUMLAH *Total*	5,412	8,024	13,439

Jadual B10 - KEMALANGAN MENGIKUT KEADAAN KECACATAN JALAN

Table B10 - Road Accident Due to Type of Road Defects

KEMALANGAN MENGIKUT KEADAAN KECACATAN JALAN
Road Accident Due to Type of Road Defects

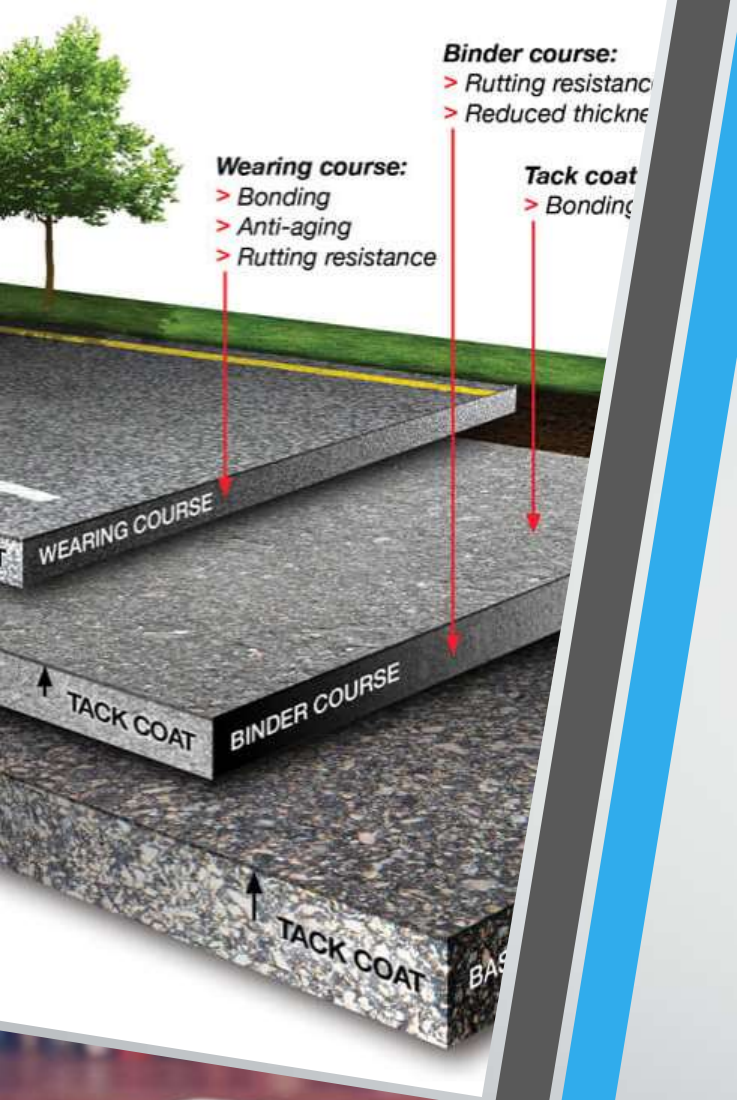
KECACATAN JALAN *Road Defect*	MAUT *Fatal*	PARAH *Serious*	RINGAN *Minor*	JUMLAH *Total*
BAHU JALAN RENDAH / TINGGI *Road Shoulder Low / High*	73	35	57	165
MANHOLE RENDAH / TINGGI *Manhole Low / High*	7	3	3	13
BATU LONGGAR *Loose Gravel*	16	8	3	27
JALAN BERDEBU *Dusty Road*	28	5	10	43
JALAN BERLUBANG *Pot Holes*	55	16	40	111
JALAN LICIN *Slippery Roads*	121	43	84	248
KEROSAKAN LAMPU ISYARAT *Defective Traffic Light*	2	4	4	10
LINTASAN KERETAPI SEMPIT *Narrow Railway Crossings*	0	0	0	0
JAMBATAN SEMPIT *Narrow Bridges*	14	3	6	23
TIADA GUARD RAIL *No Guard Rails*	36	8	28	72
TIADA / KURANG LAMPU JALAN *No / Insufficient Street Lights*	314	65	114	493
JUMLAH *Total*	5,870	2,242	4,236	12,348

JALAN LICIN *Slippery Roads* 50 53 103

JALAN LICIN *Slippery Roads* 121 43 84 248

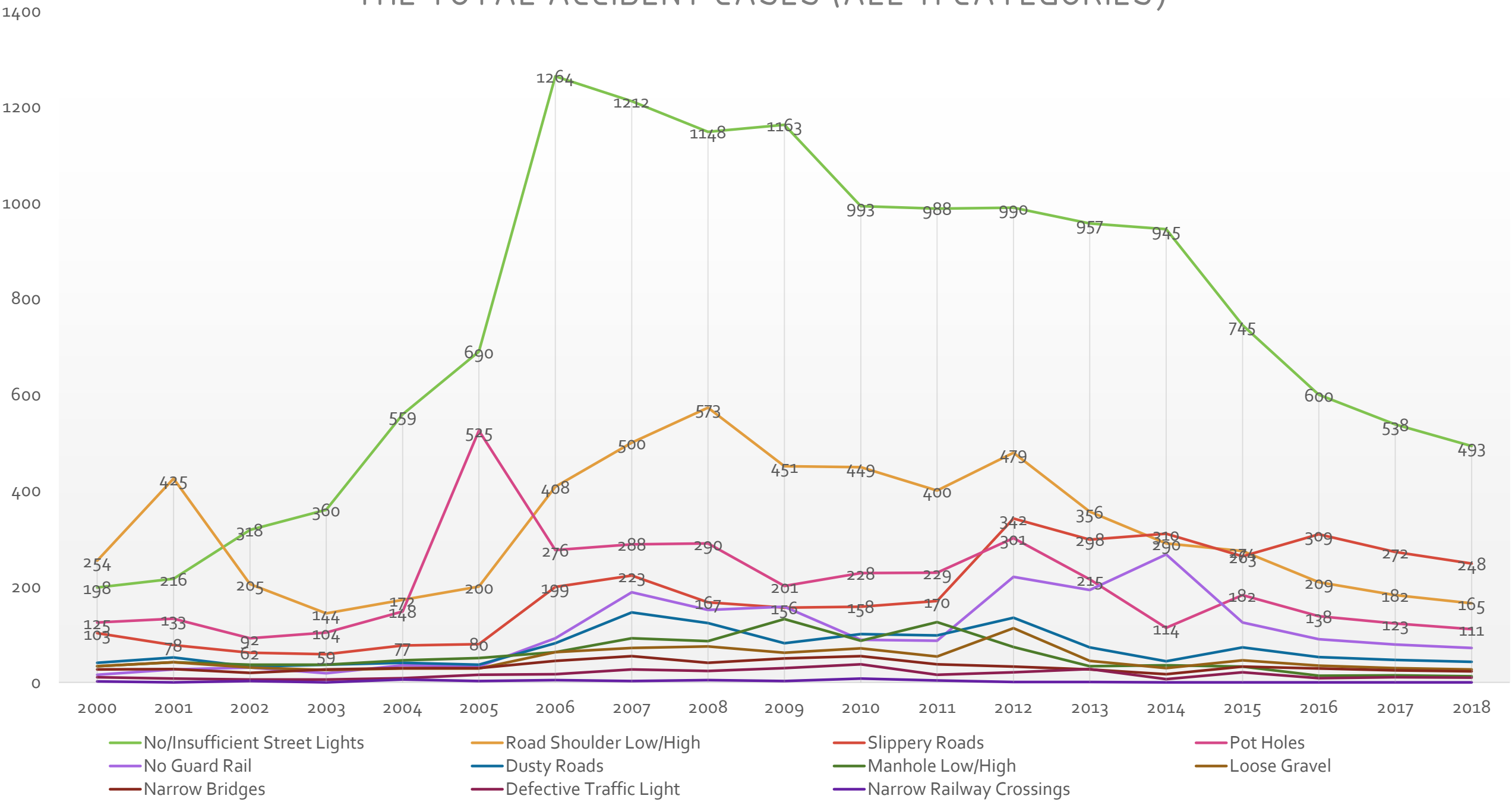
A total of eleven (11) types of road defect have been recorded and they are as follows:

1. No or insufficient street lighting
2. Road shoulder low/high
3. Potholes
4. Slippery road
5. Dusty road
6. No guardrail
7. Manhole low/high
8. Loose gravel
9. Defective traffic light
10. Narrow bridges
11. Narrow railway crossings

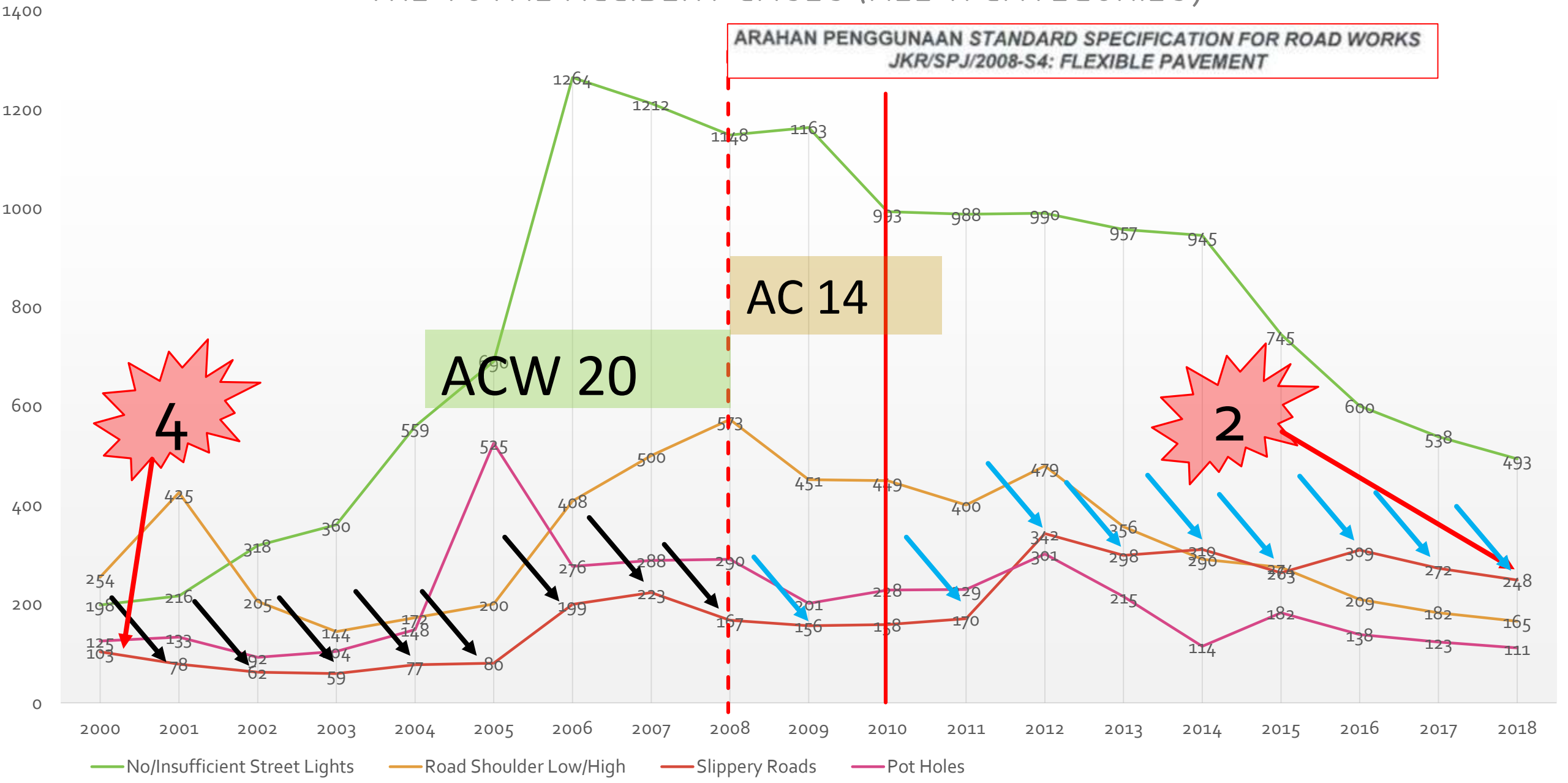


RESULTS AND FINDINGS

THE TOTAL ACCIDENT CASES (ALL 11 CATEGORIES)



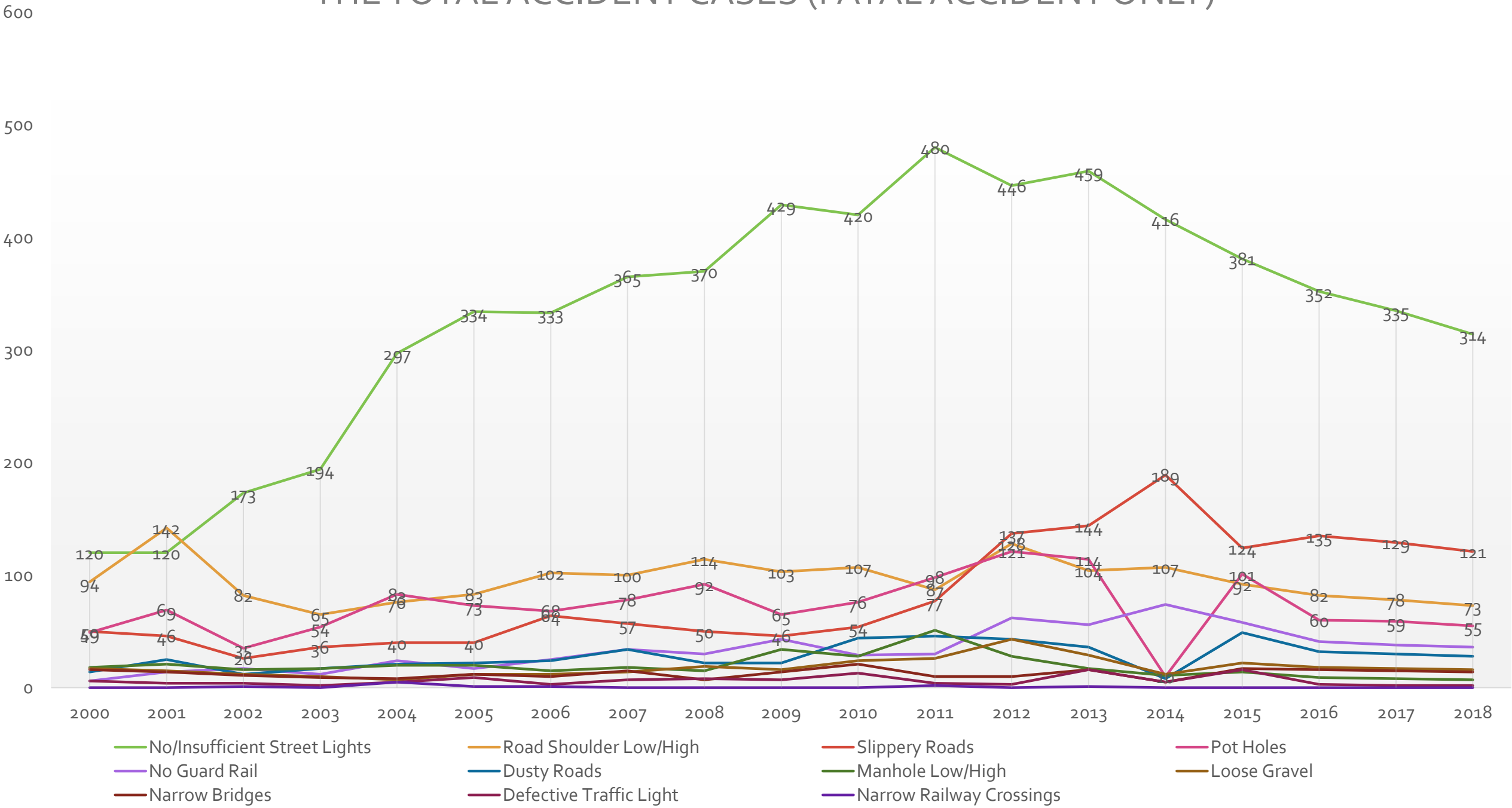
THE TOTAL ACCIDENT CASES (ALL 11 CATEGORIES)



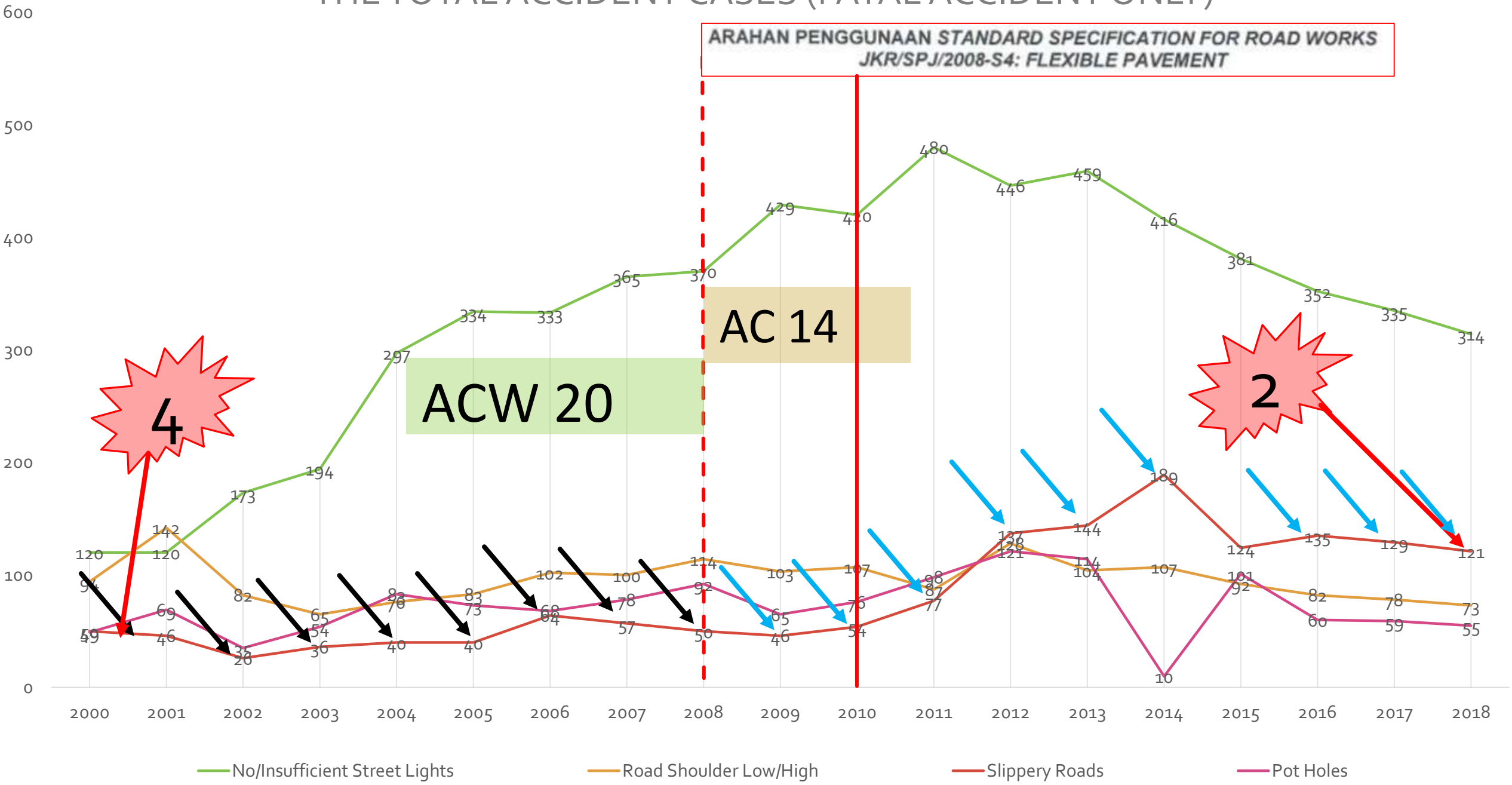
The ranking of 'Slippery roads' accident cases during pre and post AC 14

Ranking	Pre-AC14 (ACW20) 2000-2009	Proportion	Post-AC14 (AC14) 2010-2018	Proportion
1	No/insufficient street lights	(42.2%)	No/insufficient street lights	**(41.92%)**
2	Road shoulder low/high	(19.73%)	Road shoulder low/high	**(16.22%)**
3	Potholes	(12.92%)	**Slippery roads**	**(13.7%)**
4	**Slippery roads**	**(7.13%)**	**Potholes**	**(9.49%)**

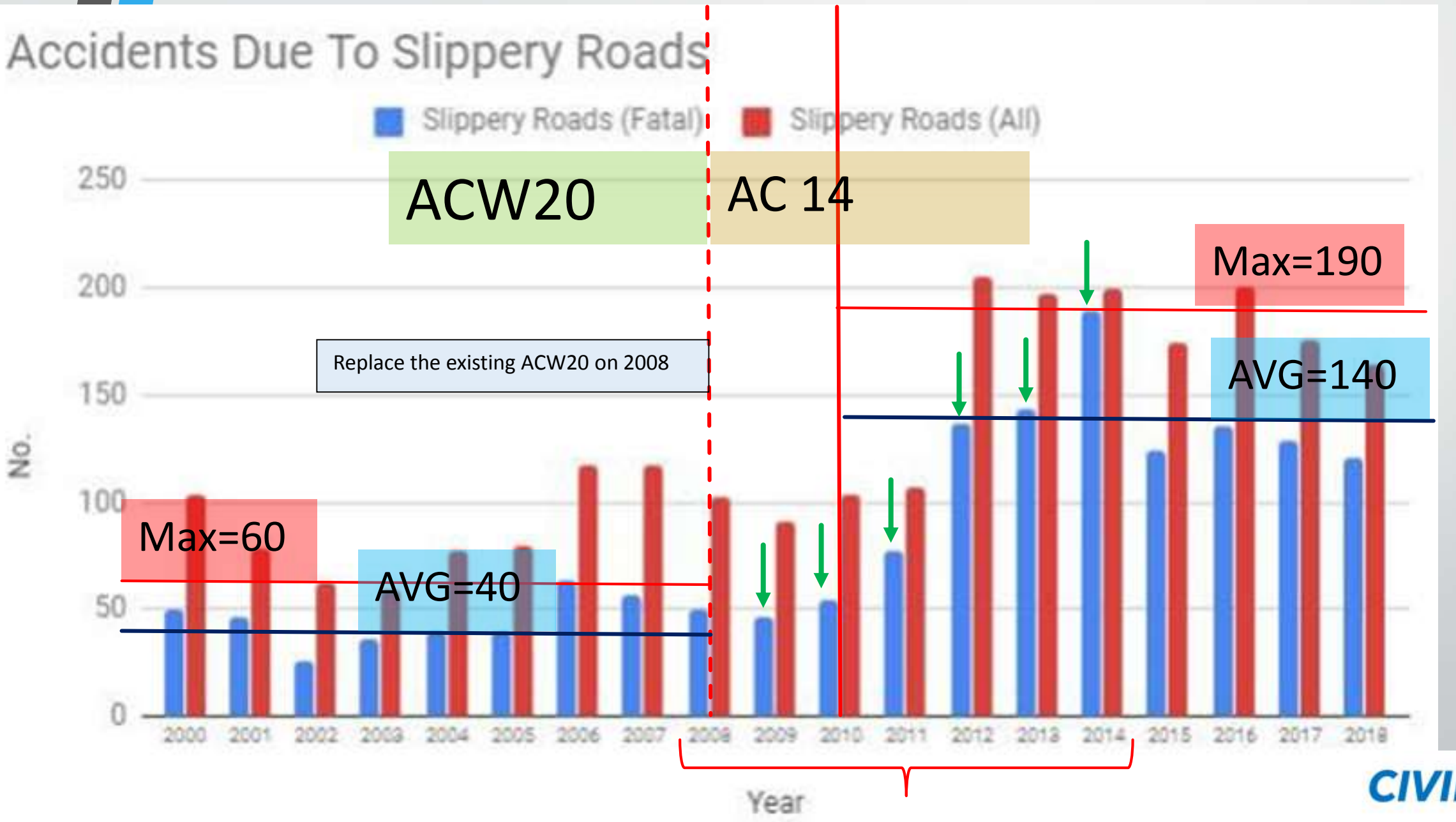
THE TOTAL ACCIDENT CASES (FATAL ACCIDENT ONLY)



THE TOTAL ACCIDENT CASES (FATAL ACCIDENT ONLY)



THE TOTAL ACCIDENT CASES (FATAL ACCIDENT ONLY)



THE TOTAL ACCIDENT CASES (FATAL ACCIDENT ONLY)

The ranking of 'Slippery roads' for fatal cases during pre 14 and post AC 14				
Ranking	Pre-AC14 **(ACW20)**	Proportion	Post-AC14 **(AC14)**	**Proportion**
1	No/insufficient street lights	(47.49%)	No/insufficient street lights	**(47.60%)**
2	Road shoulder low/high	(16.69%)	**Slippery roads**	**(14.31%)**
3	Potholes	(11.56%)	Road shoulder low/high	**(11.36%)**
4	**Slippery roads**	**(7.90%)**	**Potholes**	**(9.25%)**

T-TEST ANALYSIS METHOD

Mean and Standard Deviation during Two Observation Periods

	2000 - 2009	**2010 - 2018**
Mean (Fatal cases)	45.50	**123.33**
Mean (All cases)	88.60	**169.67**
Std Dev (Fatal cases)	10.23	**36.60**
Std Dev (All cases)	**19.77**	**37.06**

- The computation showed that the difference in the fatal accidents between years **2000 - 2009 (Mean = 45.50; SD = 10.23)** and the year 2010 - 2018 (Mean = 123.33; SD = 36.60) was statistically significant at 5% level ($p < 0.05$) with **$p = 0.000242$.**

Therefore, we can conclude that there is a significant difference between the two sets data.

CHI-SQUARE TEST

No.	Road Defect	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	No/Insufficient Street Lights	185.44	223.48	184.97	197.80	278.64	296.23	312.40	343.30	345.68	370.41	388.00	433.17	485.48	471.69	397.99	415.58	355.67	338.07
2	Road Shoulder Low/High	53.75	64.77	53.61	57.33	80.76	85.86	90.55	99.50	100.19	107.36	112.46	125.55	140.71	136.71	115.35	120.45	103.09	97.99
3	Pot Holes	44.45	53.57	44.34	47.42	66.79	71.01	74.88	82.29	82.86	88.79	93.01	103.83	116.37	113.07	95.40	99.62	85.26	81.04
4	Slippery Roads	40.17	48.41	40.07	42.85	60.36	64.17	67.68	74.37	74.89	80.24	84.05	93.84	105.17	102.18	86.22	90.03	77.05	73.24
5	Dusty Roads	18.78	22.63	18.73	20.03	28.22	30.00	31.63	34.76	35.00	37.51	39.29	43.86	49.16	47.76	40.30	42.08	36.02	34.23
6	No Guard Rail	15.42	18.59	15.38	16.45	23.17	24.64	25.98	28.55	28.75	30.81	32.27	36.03	40.38	39.23	33.10	34.56	29.58	28.12
7	Manhole Low/High	11.08	13.36	11.05	11.82	16.65	17.70	18.67	20.52	20.66	22.14	23.19	25.89	29.01	28.19	23.78	24.84	21.26	20.20
8	Loose Gravel	10.00	12.06	9.98	10.67	15.03	15.98	16.85	18.52	18.65	19.98	20.93	23.37	26.19	25.45	21.47	22.42	19.19	18.24
9	Narrow Bridges	6.96	8.38	6.94	7.42	10.45	11.11	11.72	12.88	12.97	13.90	14.56	16.25	18.21	17.70	14.93	15.59	13.34	12.68
10	Defective Traffic Light	3.60	4.34	3.59	3.84	5.41	5.75	6.07	6.67	6.71	7.19	7.54	8.41	9.43	9.16	7.73	8.07	6.91	6.57
11	Narrow Railway Crossings	0.34	0.41	0.34	0.36	0.51	0.54	0.57	0.63	0.63	0.68	0.71	0.79	0.89	0.86	0.73	0.76	0.65	0.62

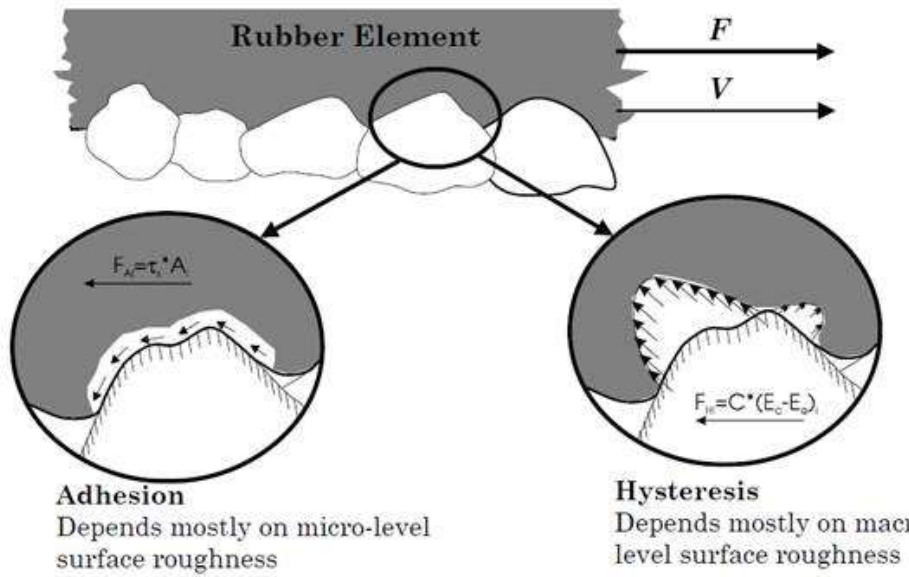
X^2=1016 and $X^2_{170,0.05}$=190.516

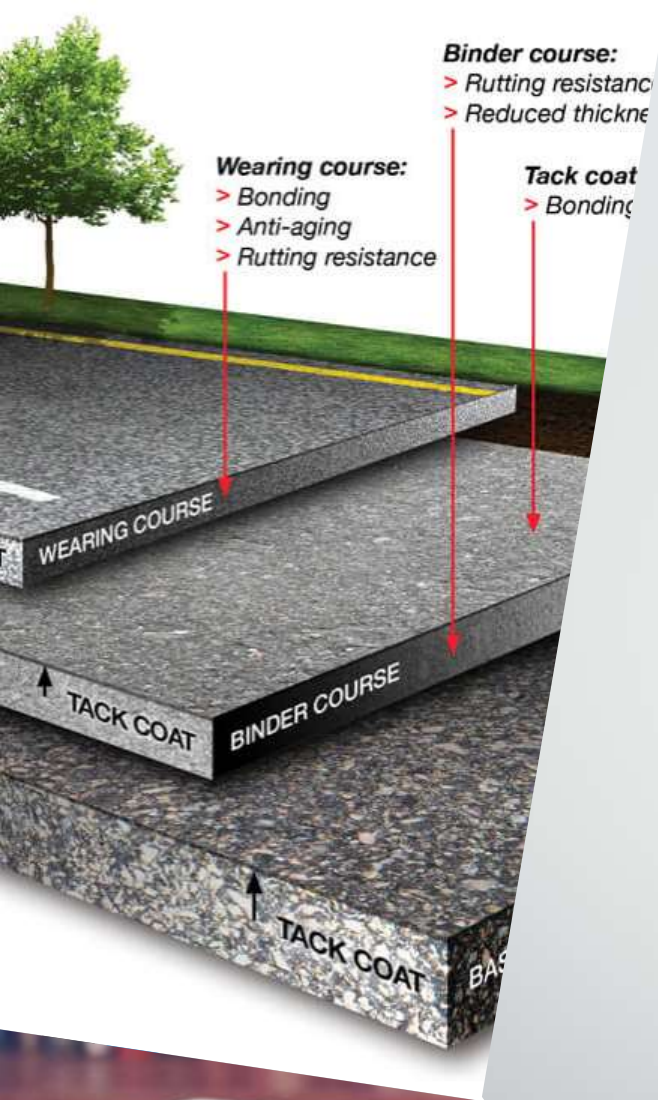
X^2 calulated > X^2 tabular/critical = We reject null hypothesis, and accept alternate hypothesis

Alternate hypothesis: There is significant relation between number of death based on road defect and it is **not merely** due to chance.

POSSIBLE CAUSES OF SLIPPERINESS

- NUMBER OF CONTACT POINTS OF TYRES WITH AGGREGATES
- TEXTURE DEPTH
- WATER FLOW
- AGGREGATE POLISHED STONE VALUE





CONCLUSION

- Analysis of accident data on road defects indicated that there is significant evidence to show that the use of AC14 may have contributed to the increase in the number of accident cases involving slippery roads.
- The T-test analysis & Chi Square Test showed that there is a significant difference in the number of road traffic death between slippery road. In other words, there is statistically significant difference in the number of road traffic deaths before and after 2010.

CIVILCORE 2020

THANK YOU

Q&A

Special Appreciation to:
Ir. Abdul Rahman Bin Baharuddin
Ir. Eliyani Yazreen Binti A. Rani
Bahagian Kejuruteraan Forensik Jalan, Cawangan Jalan