DID Malaysia




Innovative Solutions on Stormwater Detention Systems

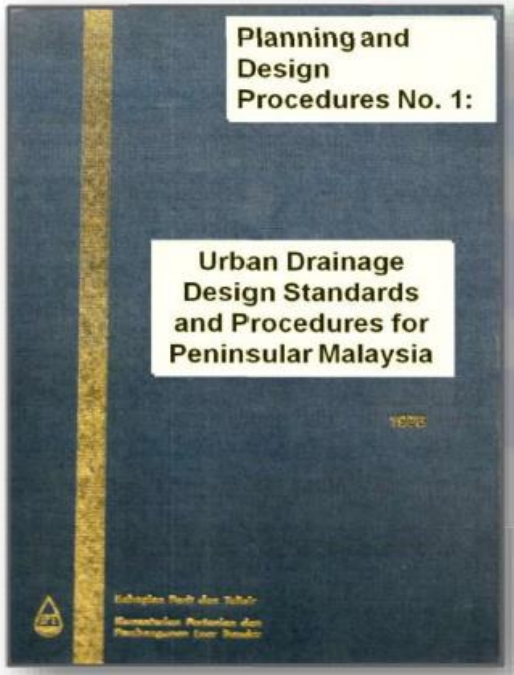
Ir. Dr. Teo Fang Yenn

Department of Drainage and Irrigation Malaysia
Ministry of Natural Resources and Environment

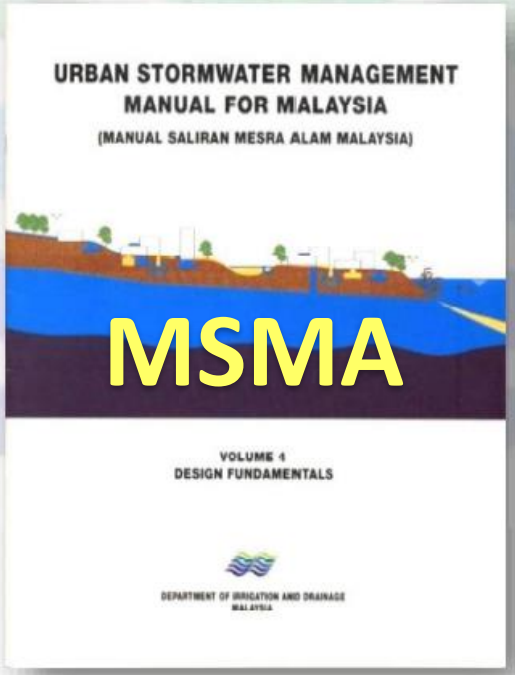
Stormwater Management in Malaysia

Urban Stormwater Design References for Malaysia :

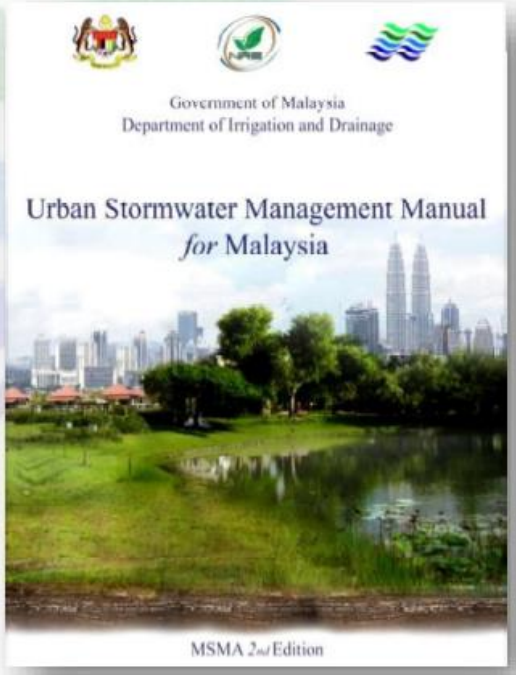
1975



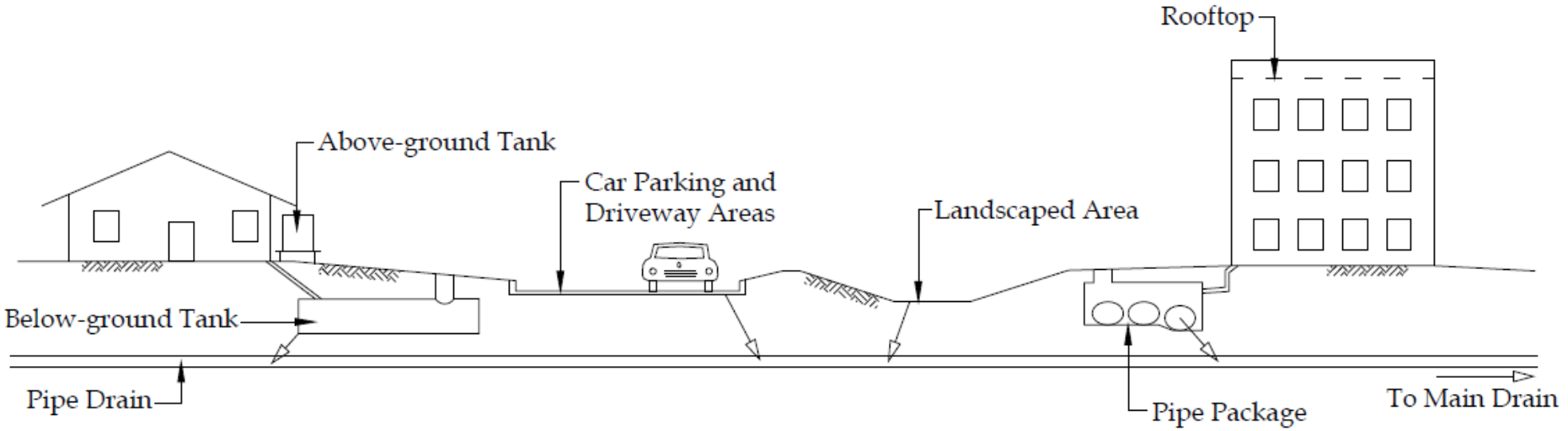
2000



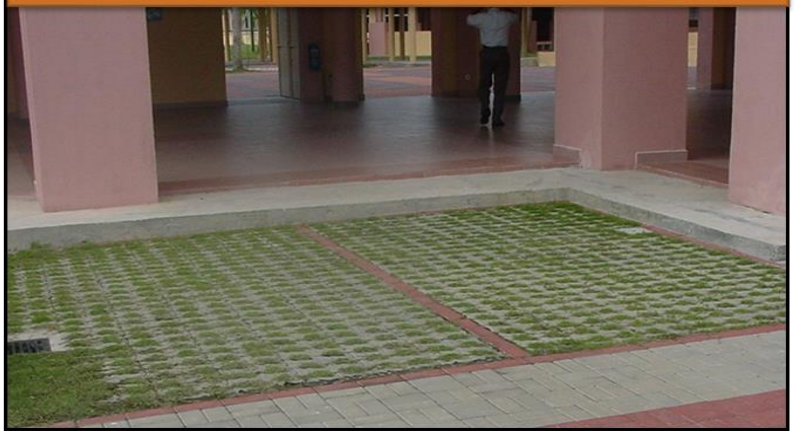
2011



Stormwater Detention Systems



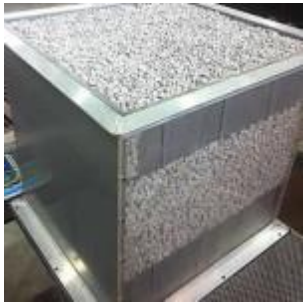
Infiltration Car Park



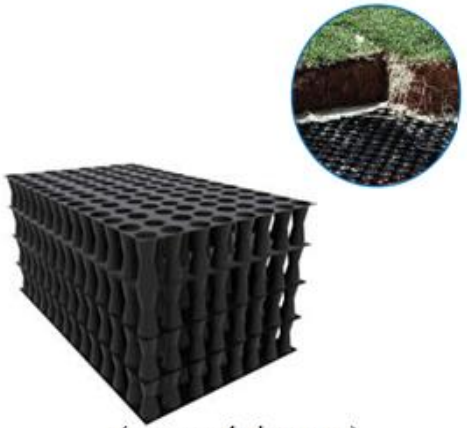
Swale

Research & Development
- Past Innovations

- Paver with aggregate
- Underdrain

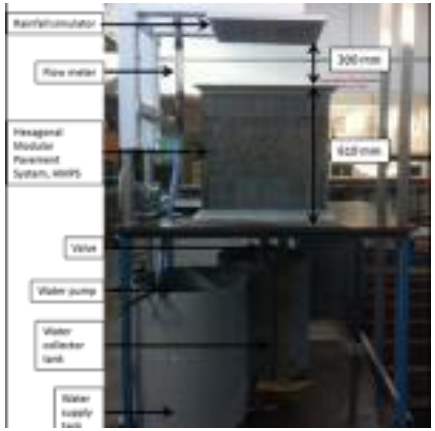


(www.invisblestructures.com)



(www.usdrainage.co)

- REDAC, USM
- Bio-Ecological Drainage System



- Pre-cast Concrete Unit
- Industrialized Building System

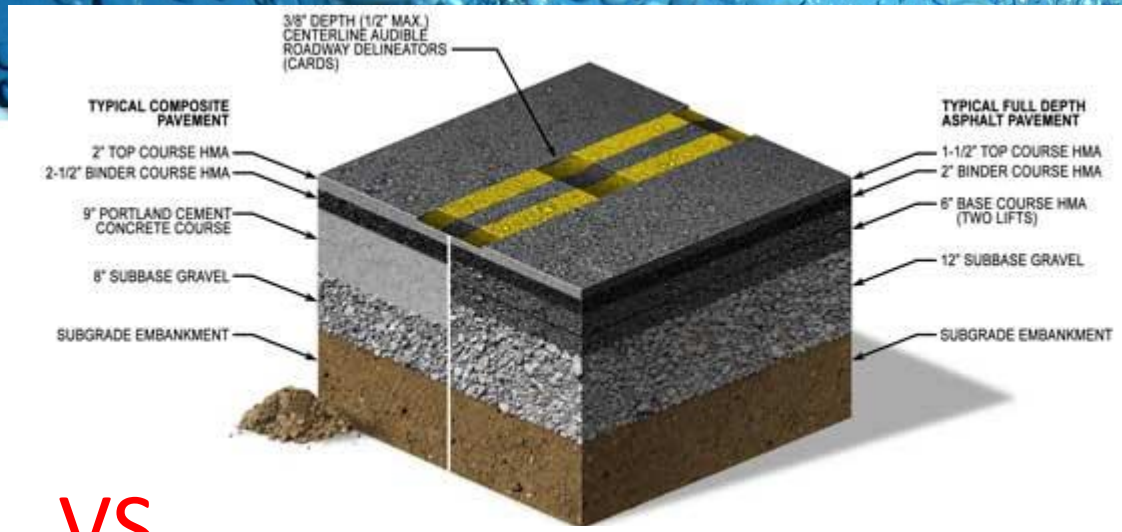
(www.precast.org)

(www.ih.constantcontact.com)

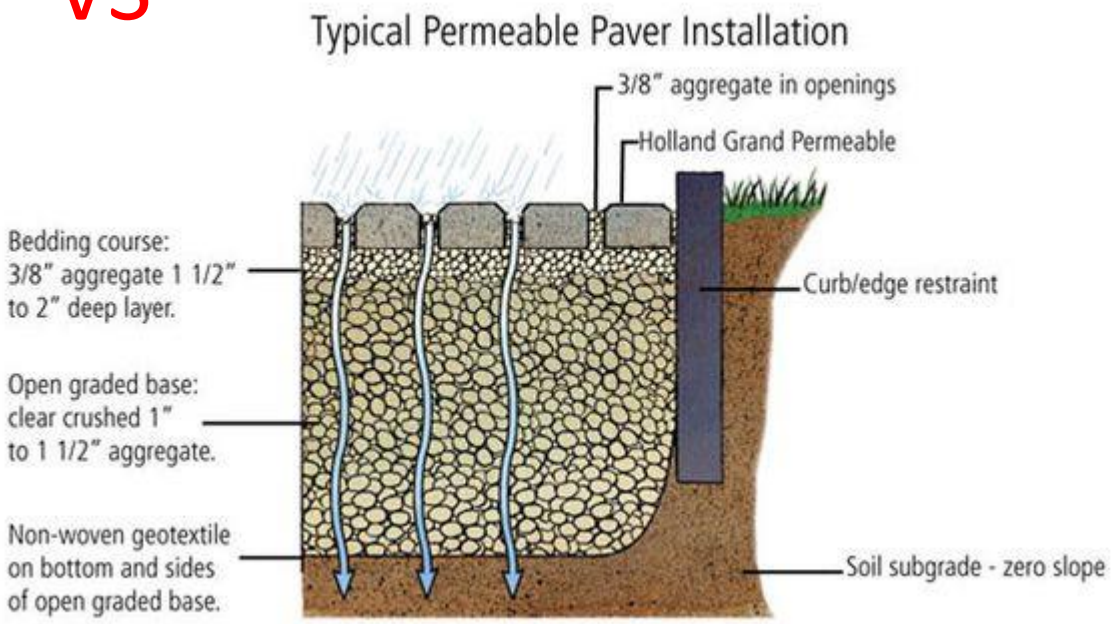
(www.terrestorm.com)

(www.construction.com)

Storage Facilities Under the Road



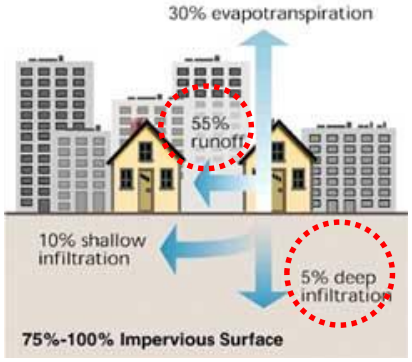
VS

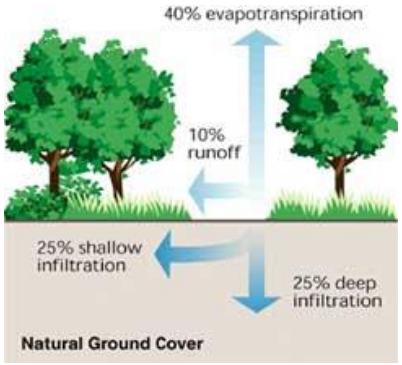


Malaysian roads not 'flood-friendly'

"Clouds come floating into my life, no longer to carry rain or usher storm, but to add colour to my sunset sky."

NST.COM.MY

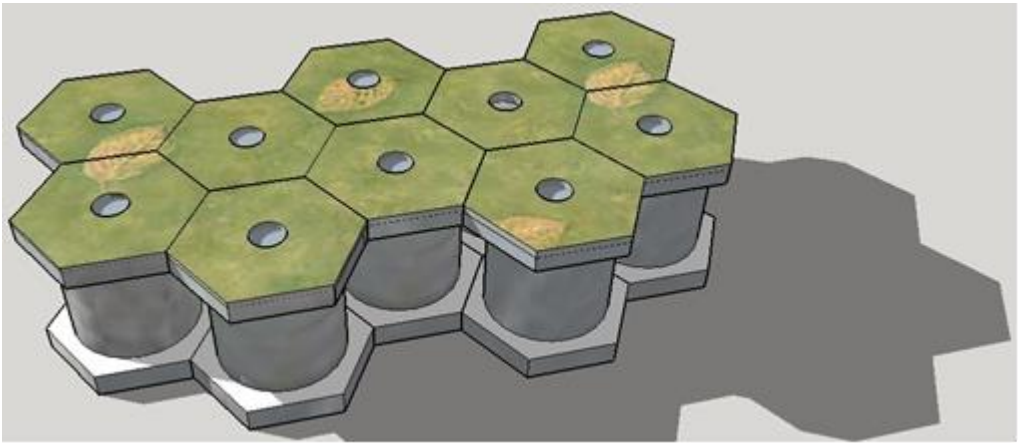




The Innovative Solutions

Dr. Darrien Mah Yau Seng

UNIMAS
UNIVERSITI MALAYSIA SARAWAK



Differences with Past Studies :

1. StormPav is more mobilized / less dependent on heavy machineries
2. StormPav is of high strength concrete meant for heavy loading up to 100 kN/unit due to its small & compact size
3. Low risk compared to Past Studies

- StormPav

System and Method of Green Pavement

+ Concrete Technology

+ Stormwater Detention

+ Soil Stabilization

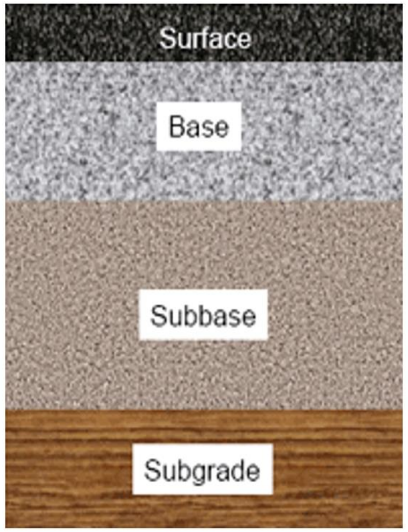
Single Unit:

Top Cover

Hollow Cylinder

Bottom Cover

Conventional Paving	StormPav

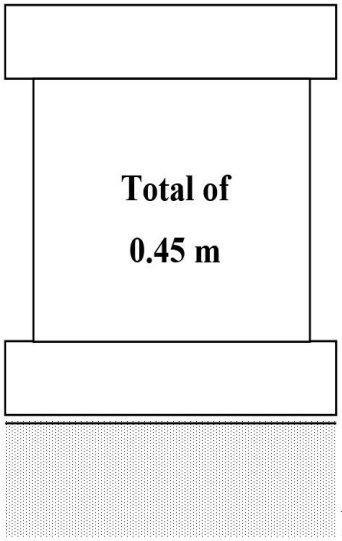


0.04 m

0.06 m

0.30 m

Total of 0.40 m



Top Cover 0.075 m

Total of 0.45 m

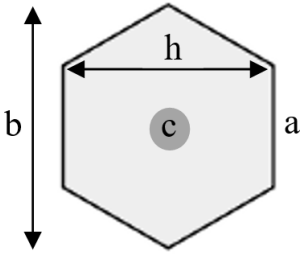
Hollow Cylinder 0.30 m

Bottom Plate 0.075 m

Geotextile

Native Subgrade

Dimension of Hexagon



a = 0.25 m

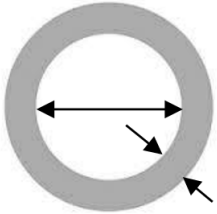
b = 0.5 m

c = 0.04 m

h = 0.433 m

Area = 0.1624 m^2

Dimension of Hollow Circle

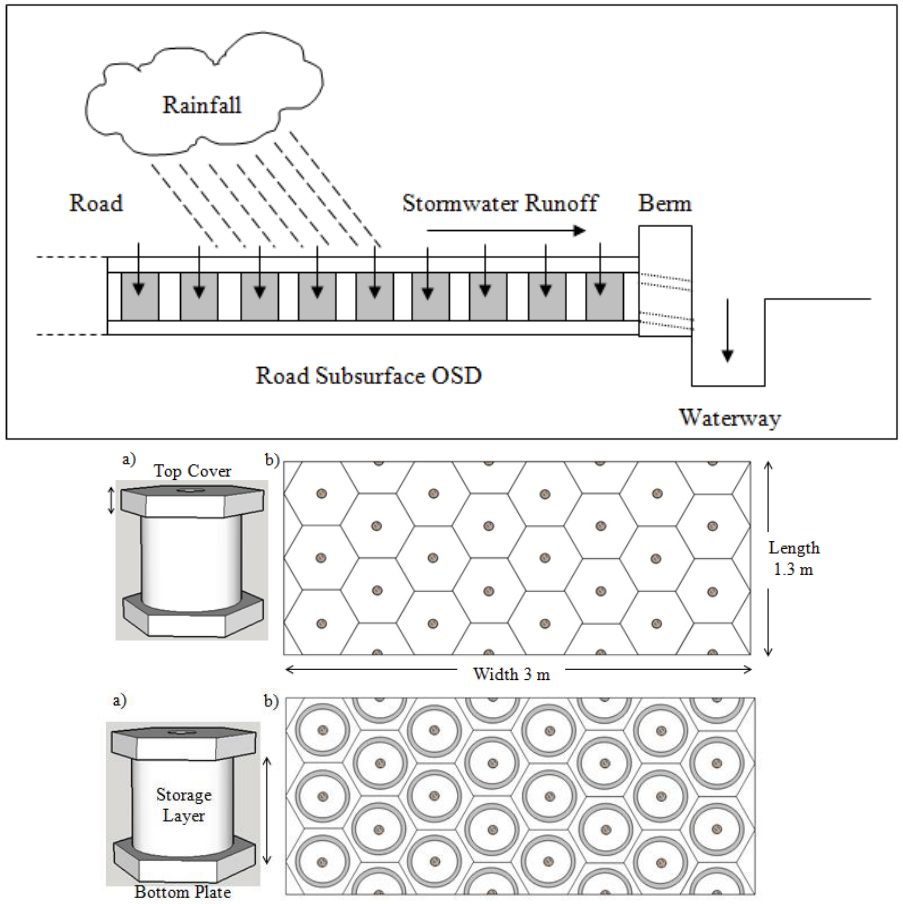


Inner Diameter = 0.28 m

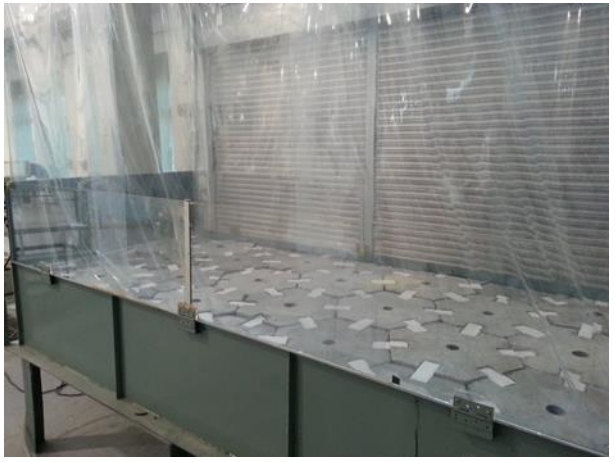
Thickness of Wall = 0.06 m

Investigation

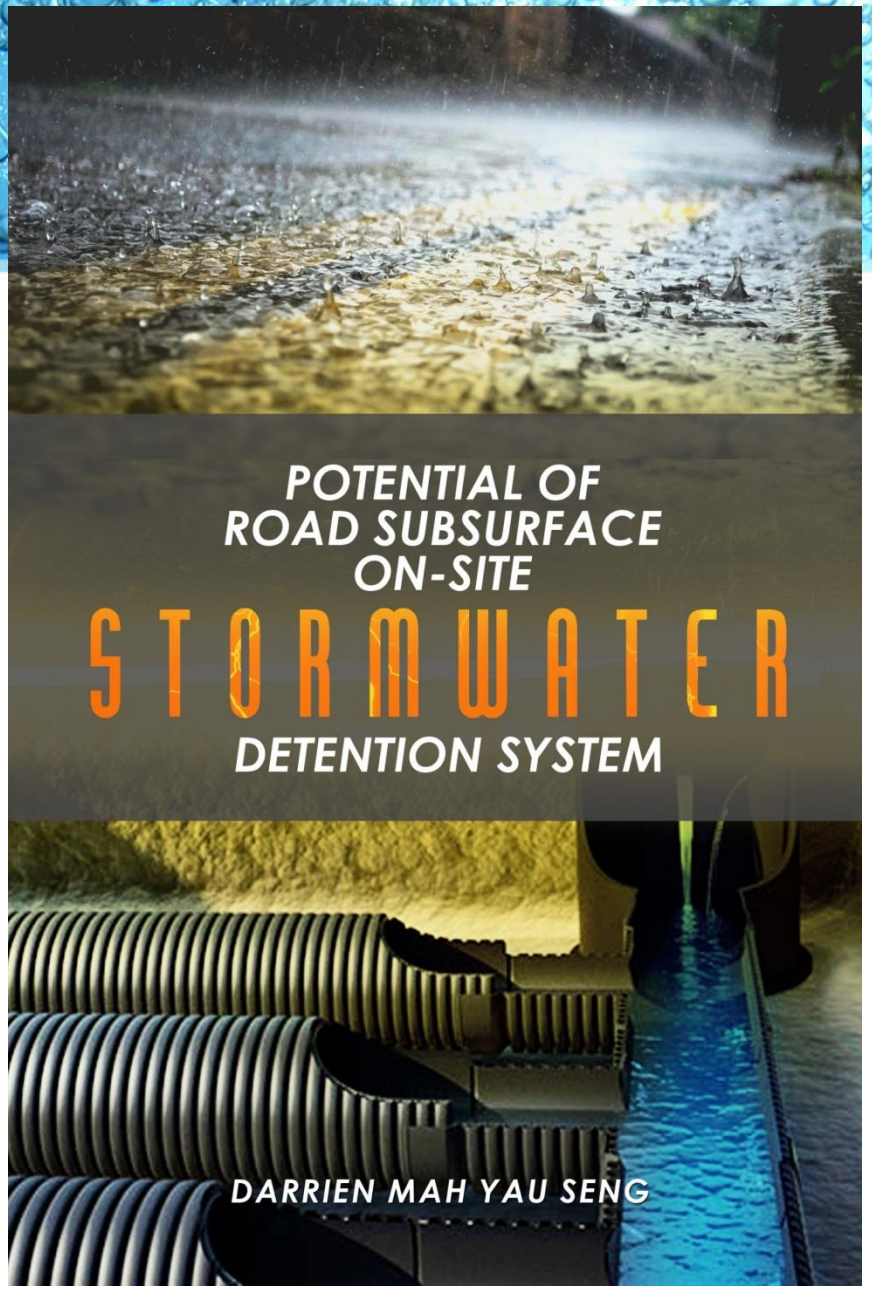
- SWMM Modelling



- Physical Modelling



- Research Monograph by UNIMAS Publisher (Kota Samarahan)
- Published in November 2016
- ISBN 978-969-2008-05-7



Salient Features

- Hollow cylinder acts as water storage to hold water at capacity of 0.19 m^3/m^2 pavement area
- Service hole in hexagonal block acts as orifice for draining surface water downward at about 10,000 mm/hour
- Hollow cylinder acts to trap pollutant and low risk of subsoil pollutant thus it provides potential water cycle benefit through infiltration
- Hollow cylinder having empty space of 0.19 m^3/m^2 pavement area acts to lower heat island effect
- Hollow cylinder acts to accelerate melting of snow due to internal air circulation space of 0.19 m^3/m^2 pavement area

Green Technology

- StormPav has the potential to earn the credit points in **U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED)** on Green Building Rating System (Sustainable Sites Credit 6.1), IBS concrete products for other environmental benefits, such as reducing heat island effects (Sustainable Site Credit 7.1) and regional materials (Materials and Resources Credit 5).

- StormPav has also the potential to earn credit points in **Malaysian Green Building Index, GBI, for Township** on (i) Heat Island design principles (CEW1, 4), (ii) Flood management and avoidance (EEC4, 1), (iii) Sustainable stormwater design and management (EEC8, 2) (iv) Health design (CPD6, 2) (v) Low impact material (BDR1, 1), (vi) Regional material (BDR3, 1), (vii) Quality in construction (BDR4, 2), (viii) Site sedimentation and pollution control (BDR6, 1), (ix) Sustainable construction practice (BDR7, 2), and (x) Innovation (BSI2, 6).

Prototypes

Idea first surfaced in 2012

Until end of 2014 to have enough moulds

First mass casting in February 2015

Until September 2016 to have enough units for pilot project

- Pilot Study – a collaboration with JKR Sarawak Research Centre

1 Preparation of site

3 Laying of cylinders

2 Laying of bottom hexagonal plates

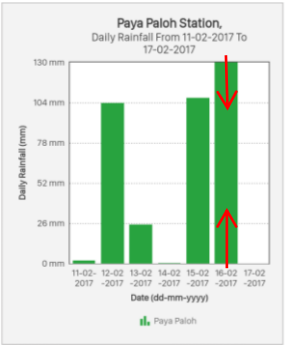
4 Laying of surface hexagonal plates

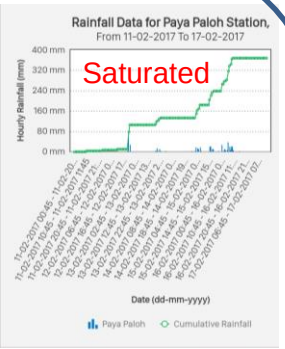
10mm peat

15mm clay

Decayed peat

28 min (23 km)

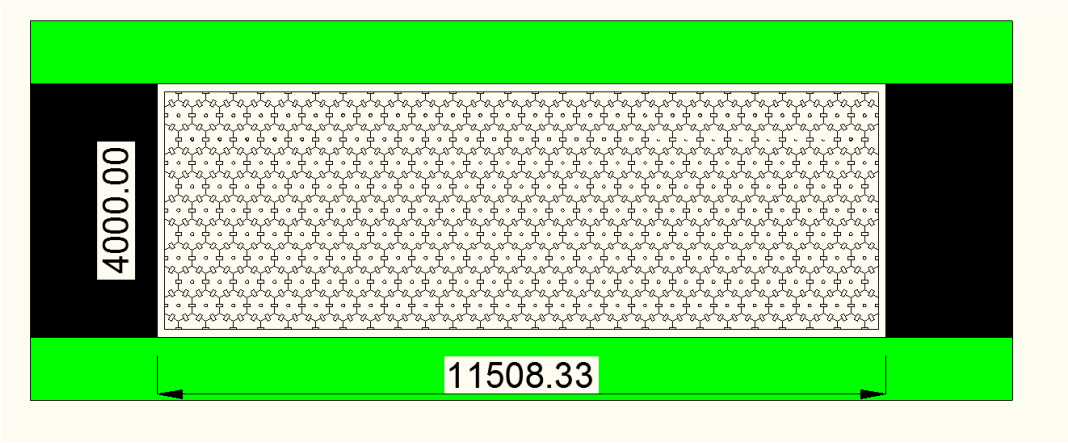


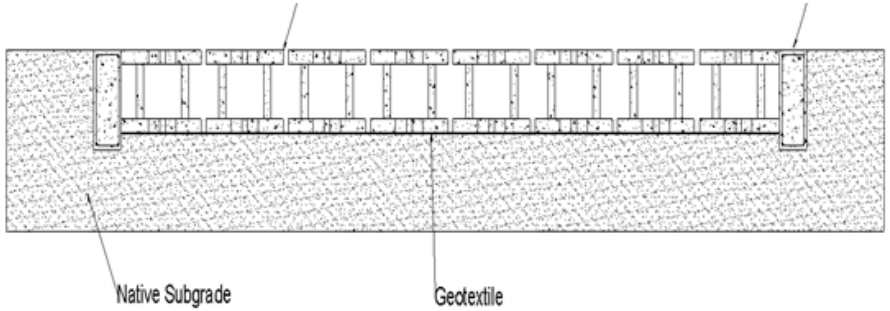


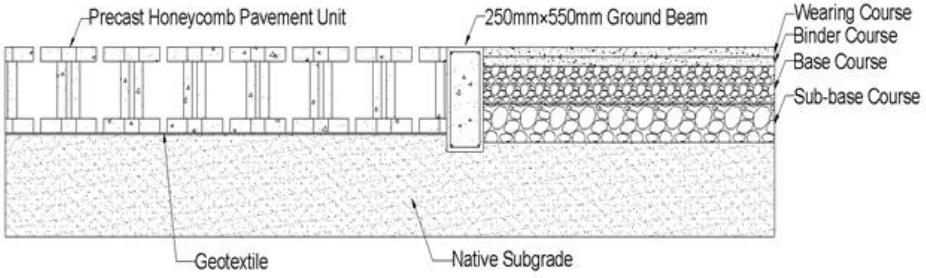
Infiltration about 10mm/hr to underlying peat

NO overflow NO stagnant water inside

- Layout of Pilot Study







Pilot project completed in mid February 2017

- Appointment as Research Fellow
- 3rd MoU with JKR Sarawak

(2015-2019)

Telefon : 082-203100
Kawat : "WORKS KUCHING"
Teleks : JKR KG MA70112
Telefeks : 082-429679
: 082-429789

JABATAN KERJA RAYA
IBU PEJABAT
WISMA SABERKAS
JALAN TUN HAJI OPENG
93582 KUCHING
SARAWAK
MALAYSIA

Ruj. Tuan :

Ruj. Kami : PWD/CML/151 (180)

14th January, 2016

Dr. Mah Yau Seng
Department of Civil Engineering
Faculty of Engineering
Universiti Malaysia Sarawak
94300 Kota Samarahan

Re: Appointment Letter of Fellow Researcher for JKR Research Centre

With the signing of the extension of Memorandum of Understanding (MoU) between JKR Sarawak and UNIMAS on 6th November 2015, we are very pleased to appoint your good self as a Fellow Researcher for our JKR Sarawak Research Centre. The appointment is effective from **6th November 2015** for **two (2) years.**

Your contribution in research collaboration between JKR Sarawak and UNIMAS is very much appreciated. We hope that our research initiatives will bring much benefit to the *'rakyat'*, state and country.

Thank you.

"BERSATU, BERUSAHA, BERBAKTI"
"AN HONOR TO SERVE"

(Ir. Haji Zuraimi bin Haji Sabki)
Pengarah Kerja Raya,
Sarawak.

- Presentation to Director of JKR Sarawak on 6 July 2017

Telefon : 082-203100
Kawat : "WORKS KUCHING"
Teleks : JKR KG MA70112
Telefaks : 082-429679
: 082-429780

JABATAN KERJA RAYA
IBU PEJABAT
WISMA SABERKAS
JALAN TUN HAJI OPENG
93582 KUCHING
SARAWAK
MALAYSIA

Ruj. Tuan:

Ruj. Kami. PWD CML 151 Pt.2(110)

0 3 JUL 2017
Pejabat Dekan, F.K

19 June 2017

Dean
Faculty of Engineering
University Malaysia Sarawak (UNIMAS)
94300 Kota Samarahan

Associate Professor Dr. Al-Khalid Haji Othman,

Presentation on StormPav to JKR Sarawak

Reference is made to the above subject matter.

2. This office would like to invite your team of esteemed researchers to present the findings and recent achievements of StormPav to our upcoming Research Board to be chaired by our Director.

Date: 6th July 2017 (Thu)
Time: 0900
Venue: Bilik Muhibbah, 18th Floor, Wisma Saberkas

3. We look forward to welcoming your team.

Thank you.

"Cepat, Ekonomi dan Betul"
"BERSATU, BERUSAHA, BERBAKTI"
"AN HONOR TO SERVE"

Fax Sent on: 20/6/2017

(Ir. Chin Hon Sin)
b.p. Pengarah Kerja Raya,
Sarawak.

Assoc Prof Ir Dr Al-Khalid Hj Othman
Dean
Faculty of Engineering
UNIVERSITI MALAYSIA SARAWAK

Community

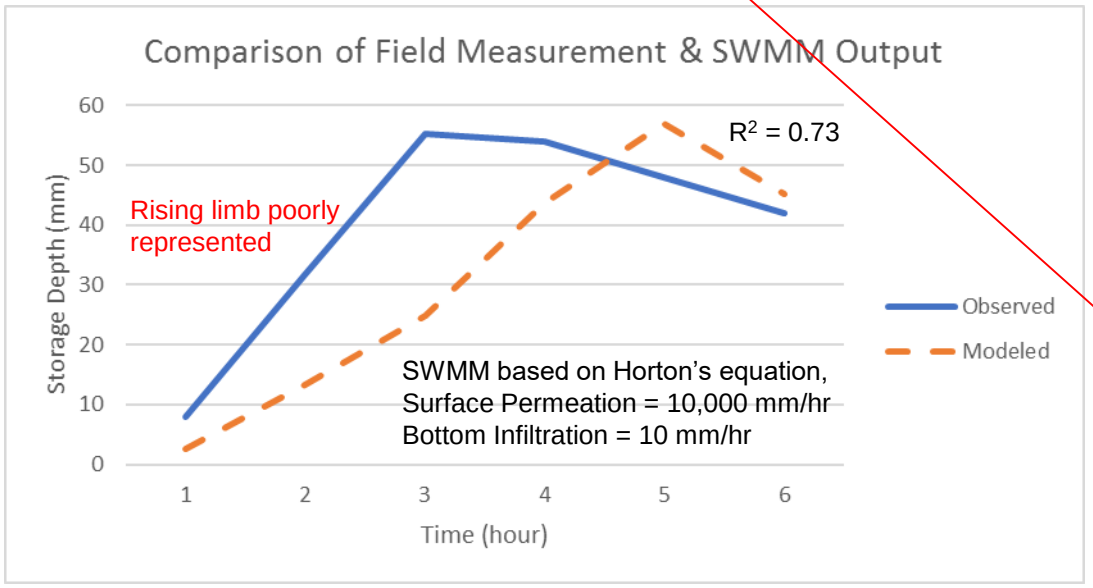
- Kpg Mang pilot project is on shallow peat
- Courtesy visit to JKKK (Community Leaders) Kpg Mang on 8 April 2017

Hydrological Monitoring

Wireless Rain Gauge

Receiver: use power bank as power source & wi fi from handphone

Wireless Water Level Indicator



UNIMAS Innovation Technology Exposition InTEX 2016 – May 2016

SIIF 2016 Seoul International Invention Fair 2016

1 – 4 December 2016

Unimas excels in research, product devt

KUCHING: Universiti Malaysia Sarawak (Unimas) continued its strong presence in research exposition by winning four Gold medals, three Silver and one Bronze at the Seoul International Invention Fair…

THEBORNEOPOST.COM

UNIMAS Innovation Technology Exposition InTEX 2017 – May 2017

Patent Filing Number

Fw: RE: PROPOSED PATE

https://dominomail.unimas.my/mail/feng/adm/ysmah.nsf?OpenDatabase

IBM iNotes — Mah Yau Seng

Mail

Mail-Inbox | Fw: RE: PRO...

Mah Yau Seng
DominoMail/UNIMAS

- Inbox
- Drafts
- Sent
- Follow Up
- All Documents
- Junk (2)
- Trash
- Views
- Folders
- Tools
- Other Mail

Reply | Reply To All | Forward | More | New | Show

Fw: RE: PROPOSED PATENT APPLICATION [OUR REF: U015-1608-05597-CASE/IRF/HKM ; YOUR REF: UNIMAS/RIMC2014/IPMCU/1-1]

MD Abdul Mannan
To: Mah Yau Seng

Tuesday, November 29, 2016 03:44PM
Show Details

-----Forwarded by MD Abdul Mannan/ADM/FENG/UNIMAS on 11/29/2016 03:43PM -----

To: "'MD Abdul Mannan'" <mannan@unimas.my>
From: "Muhammed Abdul Hakim Azman" <hakim@pro-ip.com.my>
Date: 11/29/2016 03:37PM
Cc: "'Siti Emalia Merzuki'" <msemalia@unimas.my>, "'Siti Emalia Merzuki'" <msemalia@rimc.unimas.my>, <msemalia@cttc.unimas.my>, "'Roziah Bt Bojey'" <broziah@unimas.my>, "'Lo May Chiun'" <mclo@unimas.my>, "'Irfan Mustaqim'" <irfan@pro-ip.com.my>, <mannan@feng.unimas.my>, <yuszaini@pro-ip.com.my>
Subject: RE: PROPOSED PATENT APPLICATION [OUR REF: U015-1608-05597-CASE/IRF/HKM ; YOUR REF: UNIMAS/RIMC2014/IPMCU/1-1]

Assalamualaikum dear Dr. Mannan,

We wish to inform that we have filed the patent application for your invention. Your patent application has been assigned with an application no. **PI 2016704420.**

Our formal report will follow soon.

Best regards,

Hakim Azman
Patent Engineer

PRO IP SDN BHD (Member of APAA, INTA, AIPPI, FICPI, MIPA, ITMA)
Lot C9-3, Jalan Selaman 1, Dataran Palma, 68000 Ampang, Selangor, Malaysia
Tel:+603-42701819 Fax:+603-42701821 www.pro-ip.com.my

(Our brand new website is now live!)

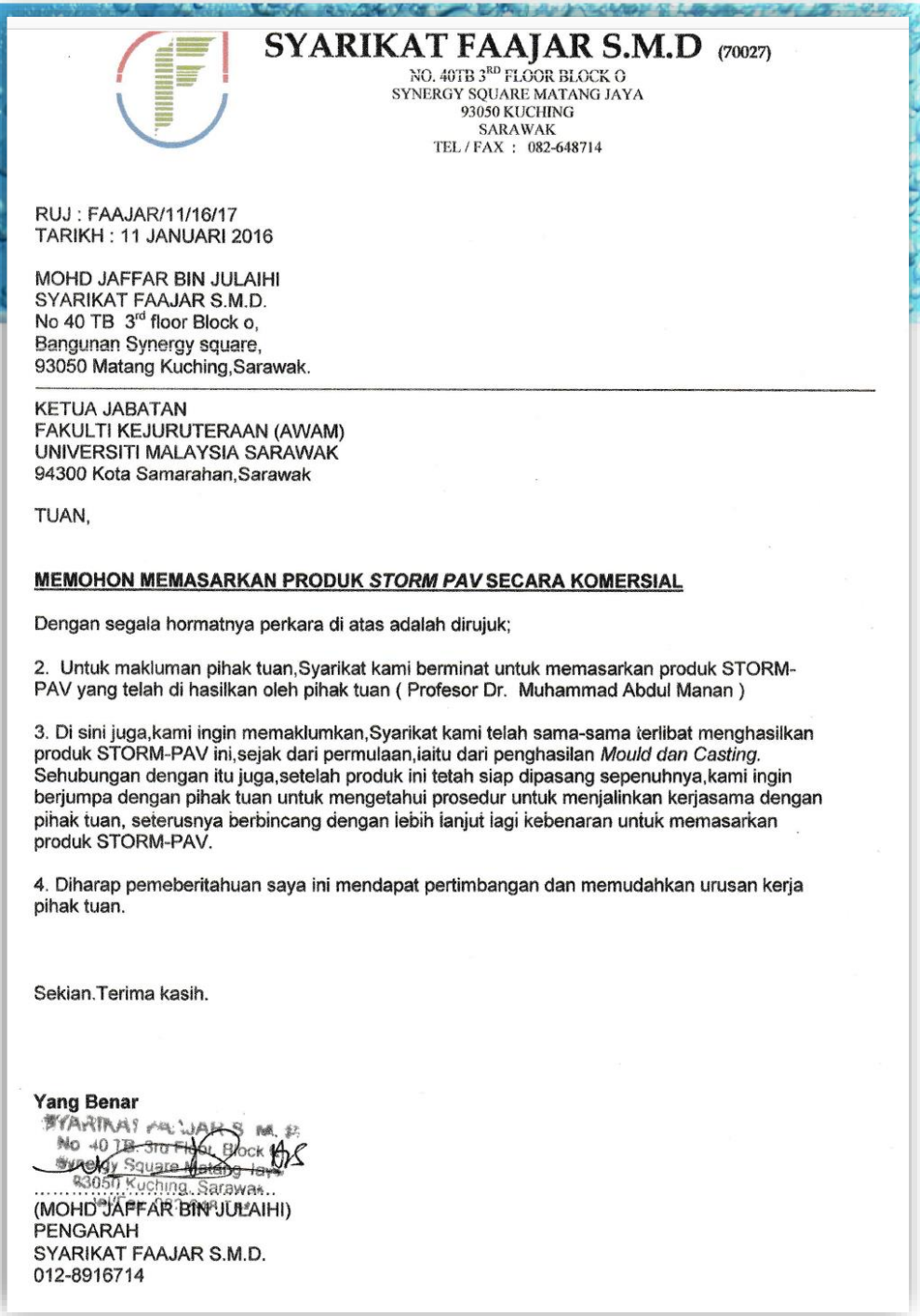
Your Trusted IP Experts. 20 Years of Excellence — PROIP managing intellectual assets

ENG US 5:46 PM 29/11/2016

Commercialization

- StormPav

Licencing with Syarikat Faajar (local company)



SYARIKAT FAAJAR S.M.D (70027)
NO. 40TB 3RD FLOOR BLOCK G
SYNERGY SQUARE MATANG JAYA
93050 KUCHING
SARAWAK
TEL / FAX : 082-648714

RUJ : FAAJAR/11/16/17
TARIKH : 11 JANUARI 2016

MOHD JAFFAR BIN JULAIHI
SYARIKAT FAAJAR S.M.D.
No 40 TB 3rd floor Block o,
Bangunan Synergy square,
93050 Matang Kuching,Sarawak.

KETUA JABATAN
FAKULTI KEJURUTERAAN (AWAM)
UNIVERSITI MALAYSIA SARAWAK
94300 Kota Samarahan,Sarawak

TUAN,

MEMOHON MEMASARKAN PRODUK *STORM PAV* SECARA KOMERSIAL

Dengan segala hormatnya perkara di atas adalah dirujuk;

2. Untuk makluman pihak tuan,Syarikat kami berminat untuk memasarkan produk STORM-PAV yang telah di hasilkan oleh pihak tuan (Profesor Dr. Muhammad Abdul Manan)

3. Di sini juga,kami ingin memaklumkan,Syarikat kami telah sama-sama terlibat menghasilkan produk STORM-PAV ini,sejak dari permulaan,iaitu dari penghasilan *Mould dan Casting.* Sehubungan dengan itu juga,setelah produk ini tetah siap dipasang sepenuhnya,kami ingin berjumpa dengan pihak tuan untuk mengetahui prosedur untuk menjalinkan kerjasama dengan pihak tuan, seterusnya berbincang dengan lebih lanjut lagi kebenaran untuk memasarkan produk STORM-PAV.

4. Diharap pemeberitahuan saya ini mendapat pertimbangan dan memudahkan urusan kerja pihak tuan.

Sekian.Terima kasih.

Yang Benar

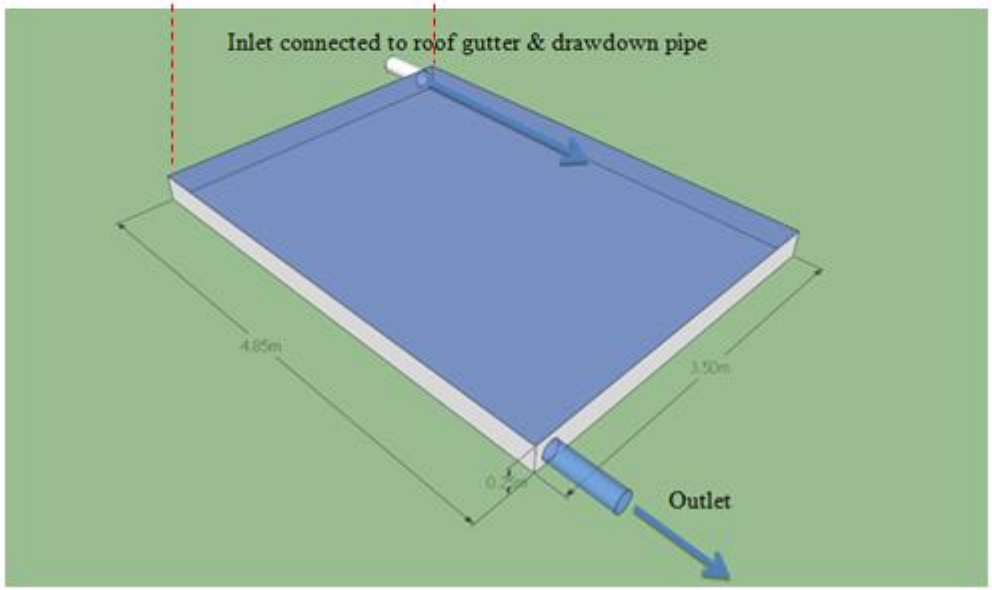
SYARIKAT FAAJAR S.M.D
No 40 TB 3rd Floor, Block G
Synergy Square Matang Jaya
93050 Kuching, Sarawak

(MOHD JAFFAR BIN JULAIHI)
PENGARAH
SYARIKAT FAAJAR S.M.D.
012-8916714

Costing

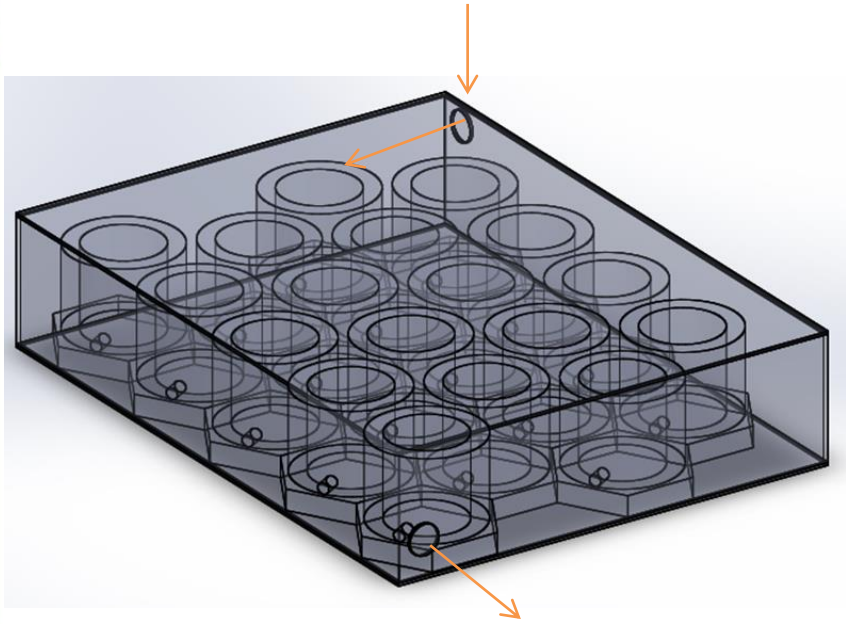
	StormPav RM120/m^2	Conventional RM240/m^2
- Labour	~ Simple ~ Modular IBS	~ Layer by layer ~ Aggregates
- Time	~ Rapid ~ Distance of site	~ Weather

Other Application (1)



Research Acculturation Grant Scheme (RAGS) :

Individual Lot Stormwater Detention Underneath Residential Car Porch

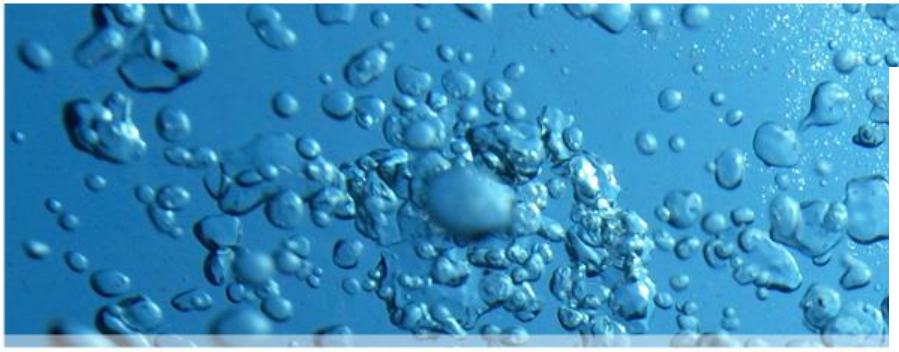


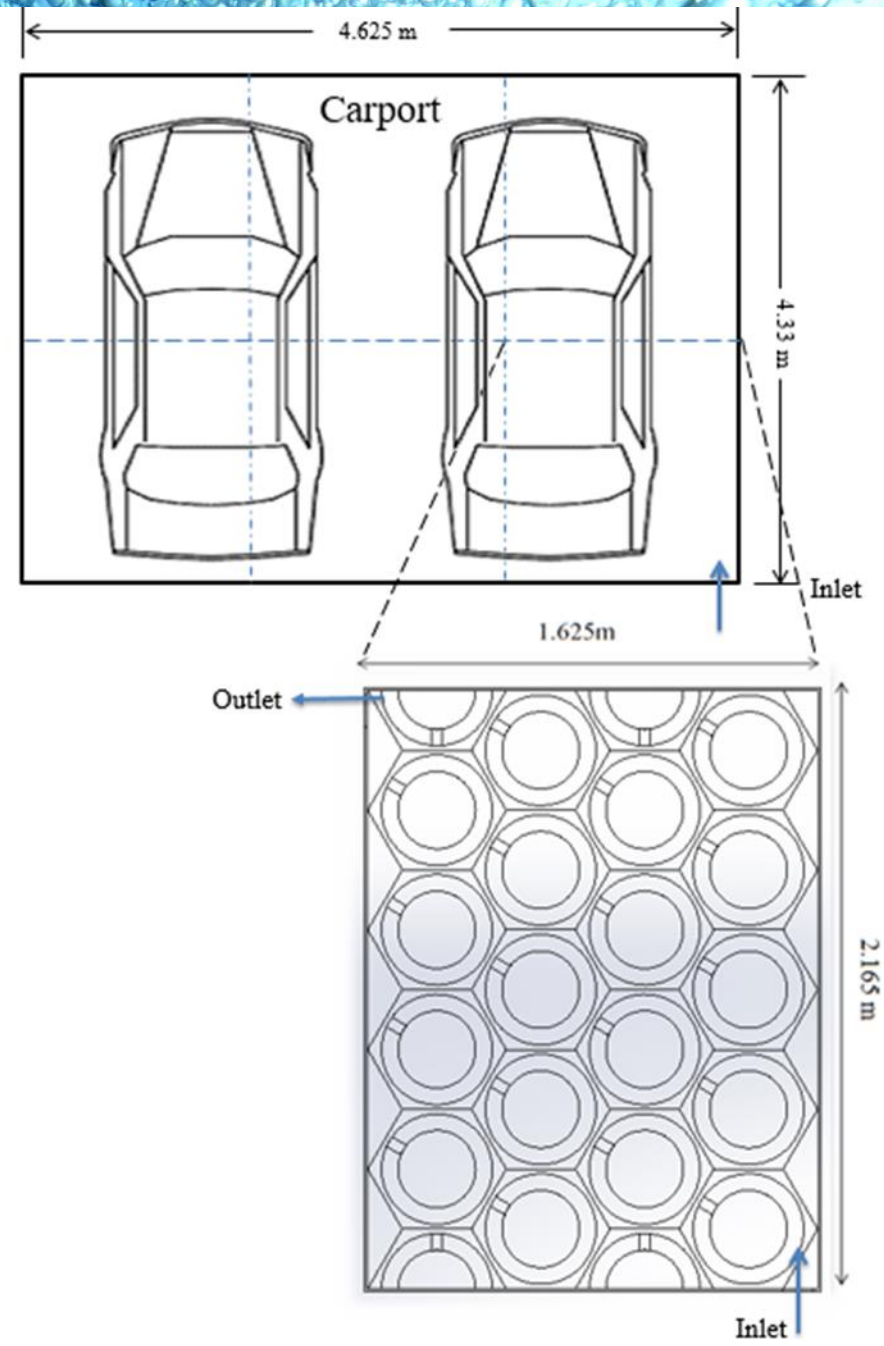
Flow characteristics of individual lot stormwater detention

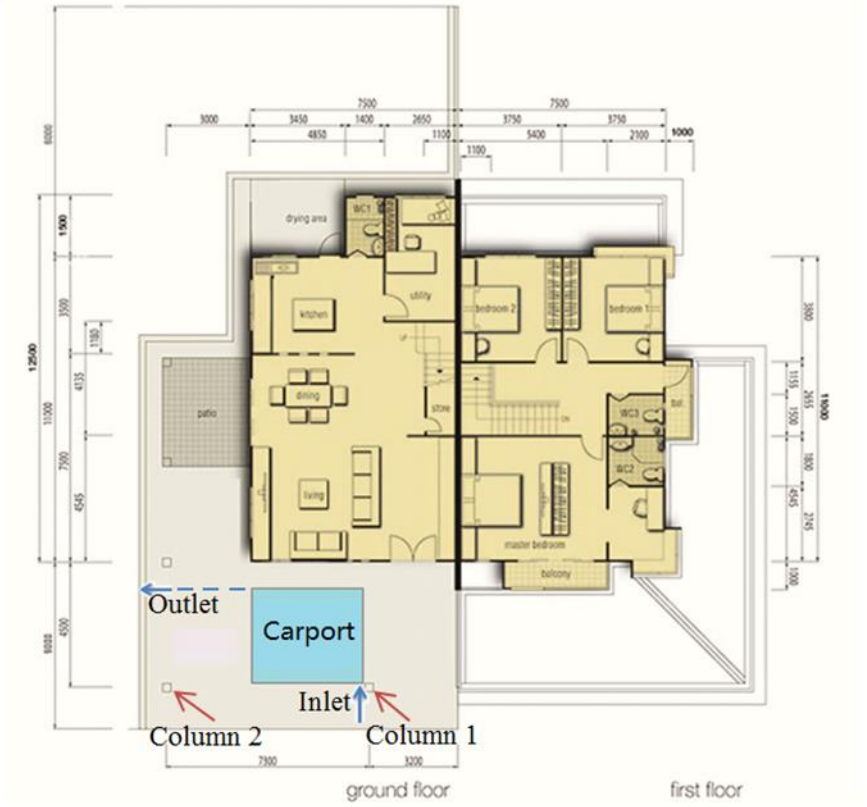
Johnny Ong King Ngu, *Darrien Yau Seng Mah*, *Charles Hin Joo Bong*
Published December 2016, 11 (4) 721-727; **DOI: 10.2166/wpt.2016.079**

Abstract

In this paper the flow characteristics of stormwater are analyzed as it travels from a roof gutter down-pipe and the turbulent flow generated on entering an individual lot on-site stormwater detention (OSD) unit beneath a residential carport. Comparison was made between a full-scale model and computational fluid dynamic (CFD) simulations to determine the flow characteristics. These modular tanks with multi-unit chambers can capture the roof run-off from a 15-minute, 10-year return period storm. The results from the physical and CFD models matched well, suggesting that turbulent flow occurs when stormwater is directed to an individual lot stormwater detention tank. However, turbulence in the OSD was concentrated around the inlet, after which the pattern changed from turbulent to laminar flow. This work implies that the use of modular underground storage tanks is practical for managing stormwater from a roof.

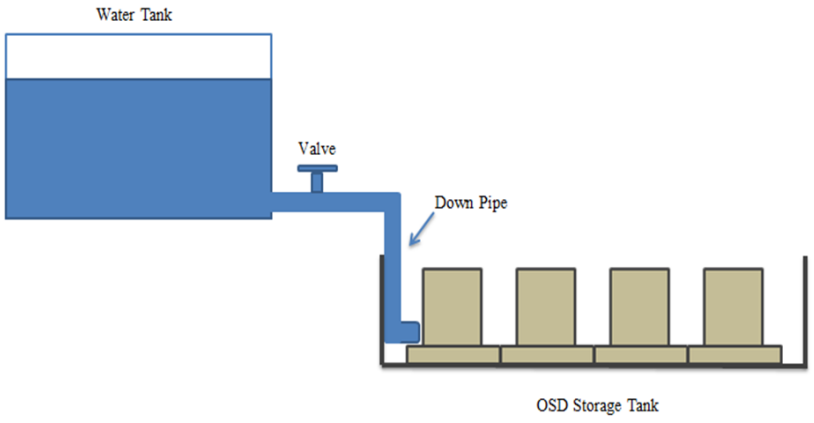


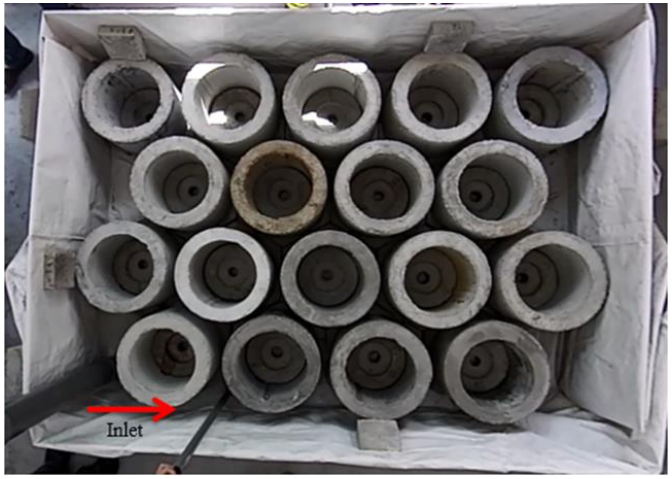

4.625 m
Carport
4.33 m
Inlet
1.625m
Outlet
2.165 m
Inlet


Outlet
Carport
Inlet
Column 2
Column 1
ground floor
first floor

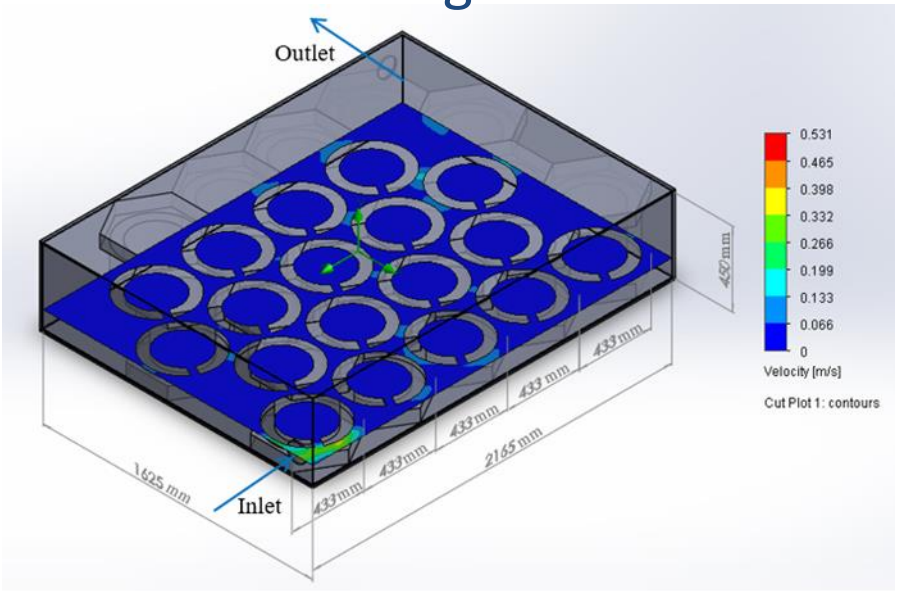
Investigation

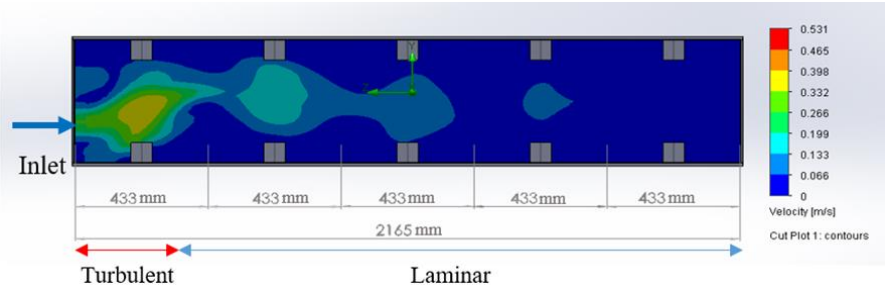
- Physical Modelling





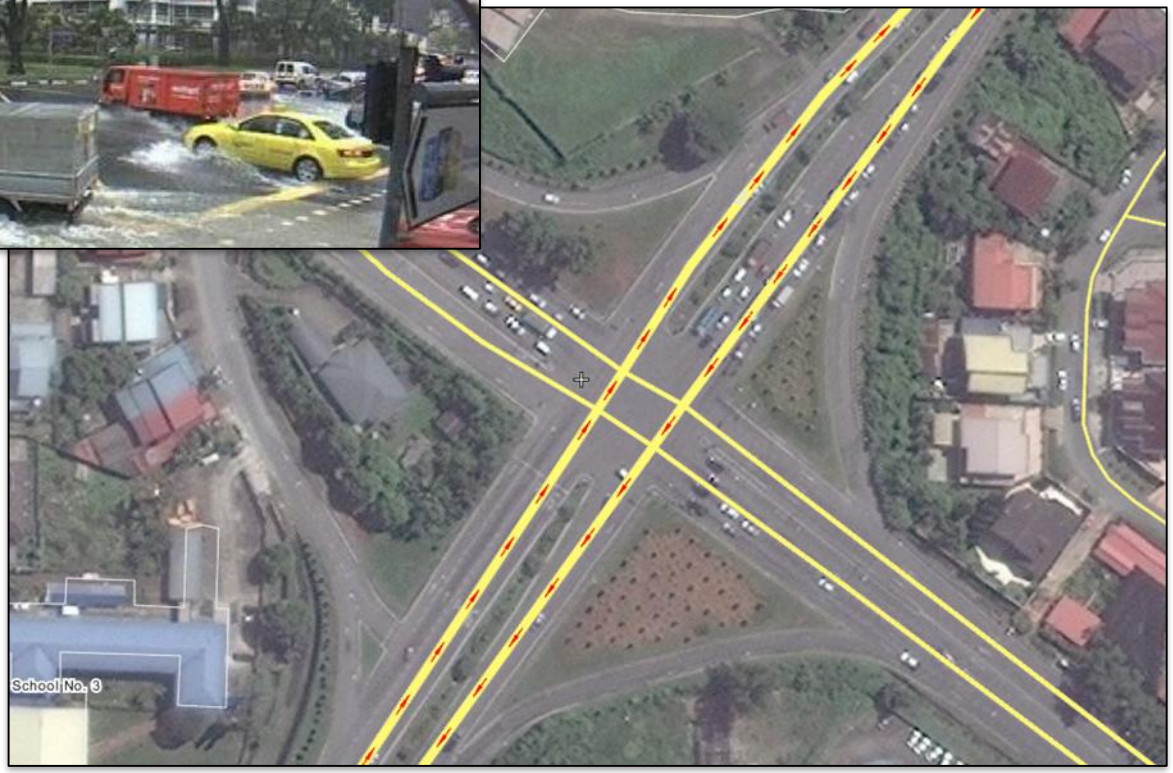
- CFD Modelling





Other Application (2)

Road Intersection as Stormwater Detention Basin



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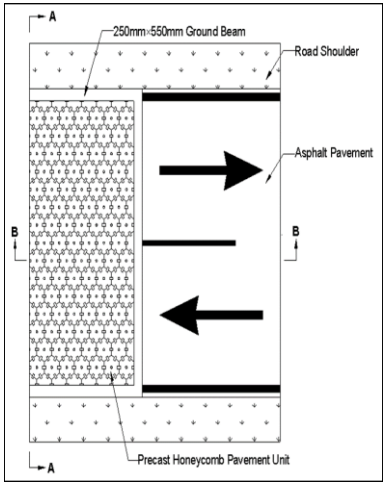

ROAD INTERSECTION AS STORMWATER DETENTION BASIN

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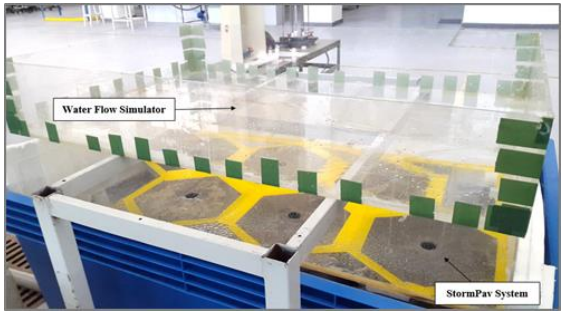
ABSTRACT

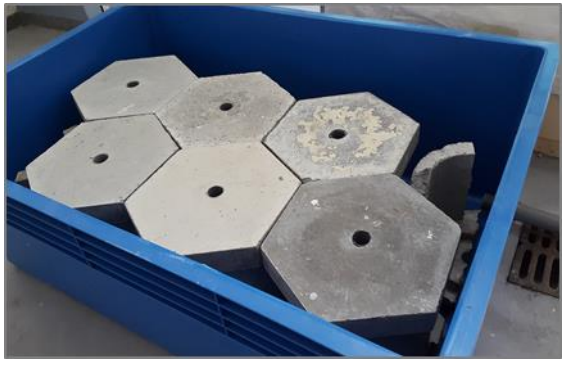
This study is exploring the potential of transforming road junction with dual functions in supporting traffic flow and accommodating stormwater detention. High loading capacity in specialist concrete could be used to construct precast concrete modular units, as it could be strong enough to allow passing of vehicles. It could also be molded to form hallow chambers that function as temporary stormwater storage. A modelling case study is presented to showcase the application of such stormwater on-site detention system. Initial modelling has indicated that the design could reduce the flow of urban runoff by 40-50% on road surface; and the running water could be fully captured within a height 0.4 m of underground storage.

Keywords: flash flood, junction, road drainage, subsurface, pavement, urban runoff

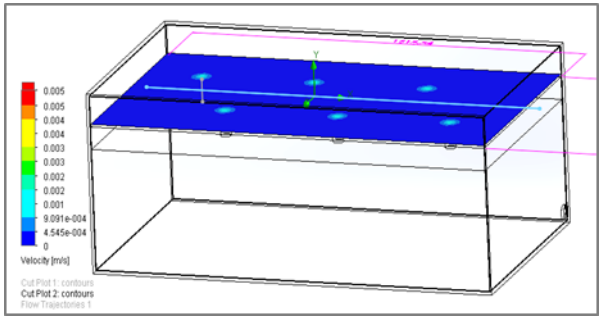
Investigation

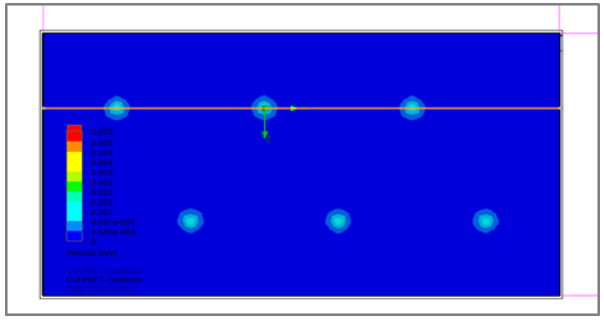
- Physical Modelling

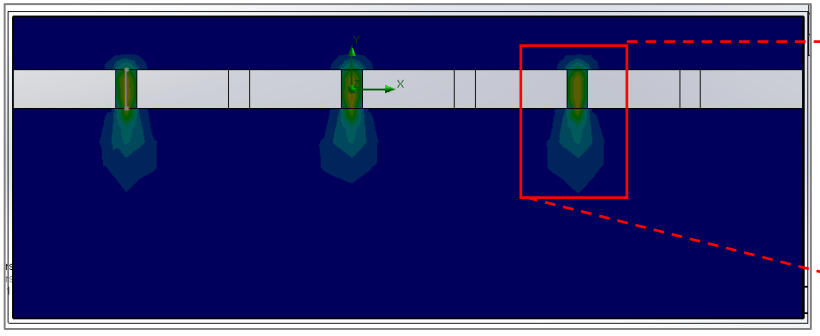


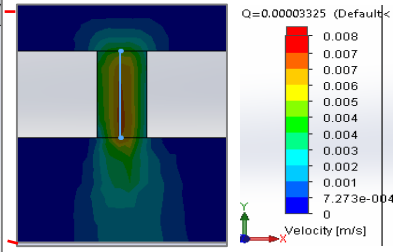


- CFD Modelling









Rainfall 90mm/hr (Red Alert) **Permeability** 0.0067m/s or 24,120mm/hr

55mm/hr (Heavy) 0.0036m/s or 12,960mm/hr

30mm/hr (Light) 0.0025m/s or 9,000mm/hr

Acknowledgements

Concrete Team

Prof Dr Md Abdul Mannan

Prof Dr Ng Chee Khoon

Dr Delsye Teo Ching Lee

Dr Chen Mien Sin (JKR Sarawak)

Mr Lim Hung Ling

Mr Constantine Lee Lim Fah

Water Team

Dr Darrien Mah Yau Seng

Ir Dr Teo Fang Yenn (DID M'sia)

Mdm Norazlina Bateni

Mdm Rosmina Ahmad Bustami

Prof Dr FJ Putuhena

Highway Team

Prof Dr Wan Hashim Wan Ibrahim

Geotechnical Team

Associate Prof Ir Dr Siti Noor Linda Taib

Thank You!