

ENGINEERING SHOPPING MALLS IV 2019

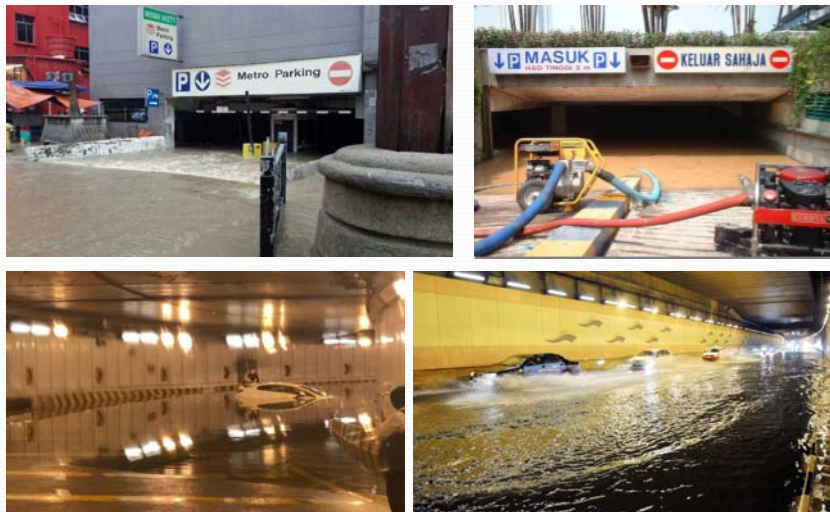
Flood Abatement for Buildings

Ir. Loo Chee Kin
27 November 2019



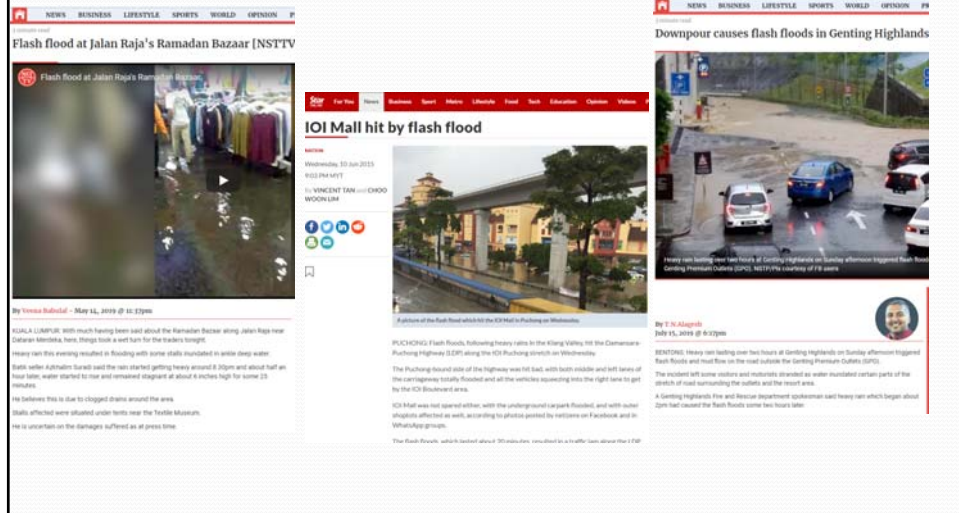
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Building Flooding



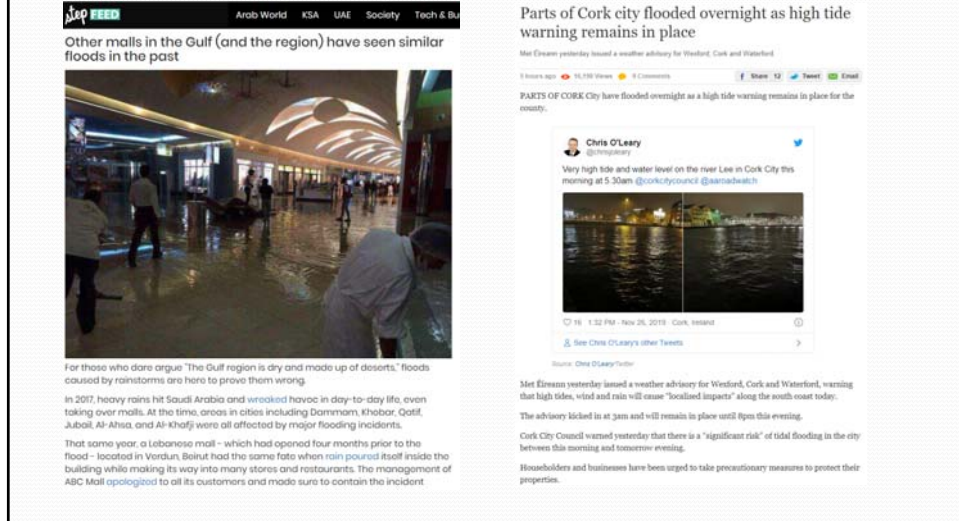
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Building Flooding

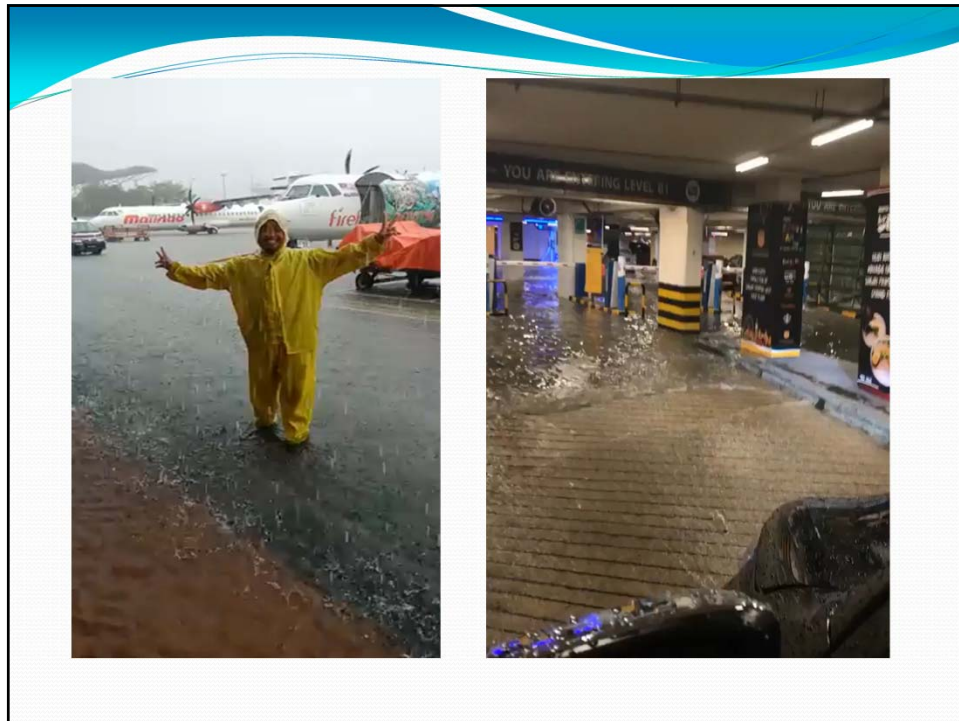


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Building Flooding



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Flood

Definition of Flood	What is Flood
<ul style="list-style-type: none"> A rising and overflowing of a body of water especially onto normally dry land (Merriam-Webster) The inundation of land that is normally dry through the overflowing of a body of water, especially a river (Geography) As any accumulation of surface or subsurface water from any source (Insurance) Water where it is not wanted (Property owner) 	<ul style="list-style-type: none"> Bodies of water (rivers, streams, oceans, bays, lakes, canals, etc.) overflowing their normal boundaries, Heavy rainfall, too much water till it overtops the banks or breaks levees. When the flow rate exceeds the capacity of the river channel, particularly at bends or zigzags in the waterway. Rain or storm water runoff accumulating in normally dry areas.

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What is Flood

In a
simple
idea

- Flood is where water is not supposed to be
- Too much water at the wrong place and/or the wrong time

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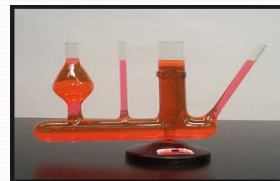
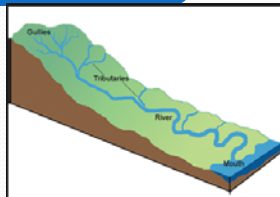
Basics of Water

Water flow

- Downhill, due to gravity.
- In the path of least resistance.

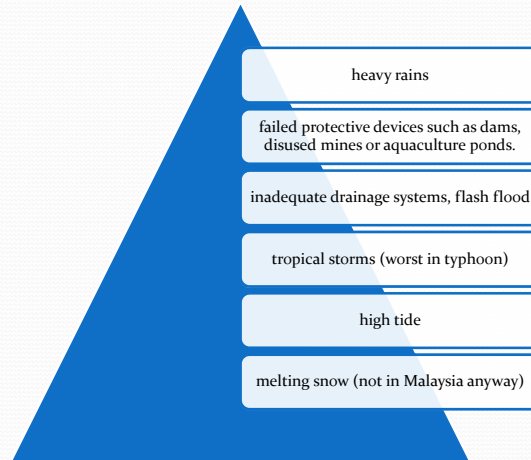
Fluid
mechanics

- Water move relative to each other, but the volume remains relatively constant because of the strong cohesive forces between the molecules.
- As a result, a liquid takes the shape of the container it is in, and it forms a free surface in a larger container in a gravitational field.



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Type of Flood



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Flash Flood

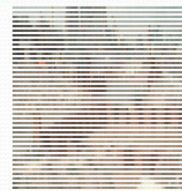


Operation & Maintenance

- Blocked drains
- Improper inlets
- Damaged drains lines
- Unmaintained drains
- Blocked channel
- Channel diversion
- Damaged channel
- Rubbish in system

Inadequate design;

- Insufficient slope
- Narrow drain
- Insufficient freeboard
- New area connected to system
- Inadequate assumptions, rainfall intensity, duration or period.



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Flash Flood

- Rubbish in system

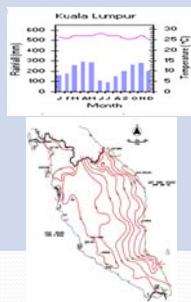


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Rainfall

Chart

- Monthly rainfall charts are monthly average of average year.
- Usually does not say how much rain in a day or in an hour.



Rainfall intensity

- The rate of precipitation in a time period.
- Like in 5-min, 10-min, 30-min, 60-min, 12-hours, 1-day, 72-hours, etc.
- There is difference in annual average rainfall and highest intensity in any period of time.

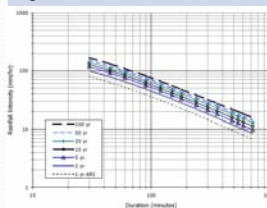


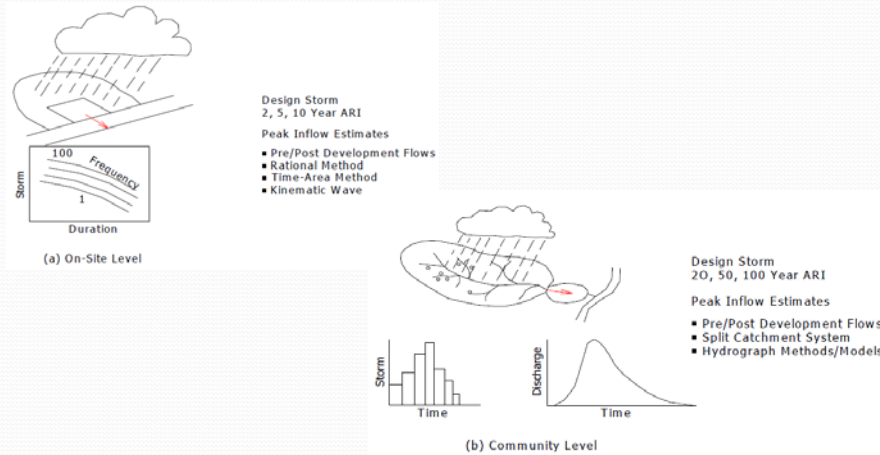
Figure 13.2 IDF Curves for Kuala Lumpur

Return period or frequency.

- Likelihood or probability of an event with a specified intensity and duration.
- The term 1 in 10 year rain intensity
- Describes a rainfall event likely to occur once every 10 years, so it has a 10 percent likelihood any given year.
- It is probability events (though improbable) to have multiple "1 in 10 year rain intensity" in a single year.

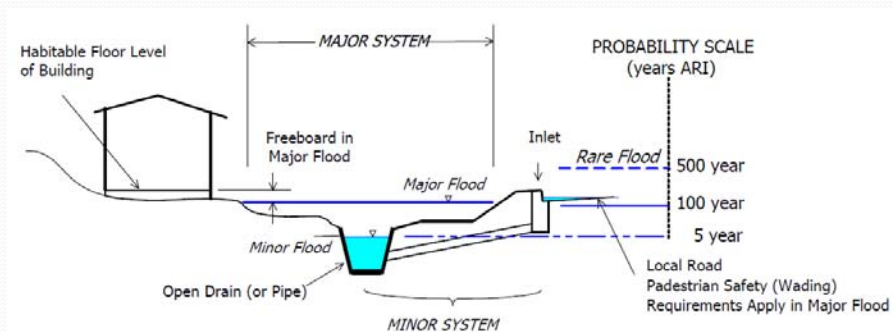
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Water flow design concept



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Flood return period or frequency



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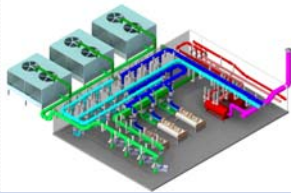
Flood abatement needed

- Building would have openings for people, vehicles and utilities.
- These could lead into below ground levels, such as basement, tunnels or underpasses, where the water could flow into and then pool.
- The water pool could get deep if the water flowing in is not stopped.
- The pooled water will damage the mechanical and electrical utilities, parked cars or cut-off connections within the building.
- This will shut down the building operations, devalue the property, cause property damage, economic loss, injury and loss of life. .

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Basement & Below Grade

Floor of this building is clearly below ground level on all sides.



Space for carpark, utilities, storage, etc.



Below grade basement is the portion of the basement that is below the ground or grade level.



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Flood Mitigation Strategies

Permanent

- Raise building, yard equipment & stock above 500 yr. flood level
- Build flood barrier or walls for the 500 yr. flood event
- Provide pumped systems to handle 100 yr. rainfall event



Temporary

- Provide gates, barriers, shields at grade entrances
- Drain plugs or valves
- Sandbags



Emergency Response

- Supplement the permanent and most temporary protection
- Understand the flood exposure and available warning time



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Flood Mitigation Strategies

Area Wide



Local



Specific



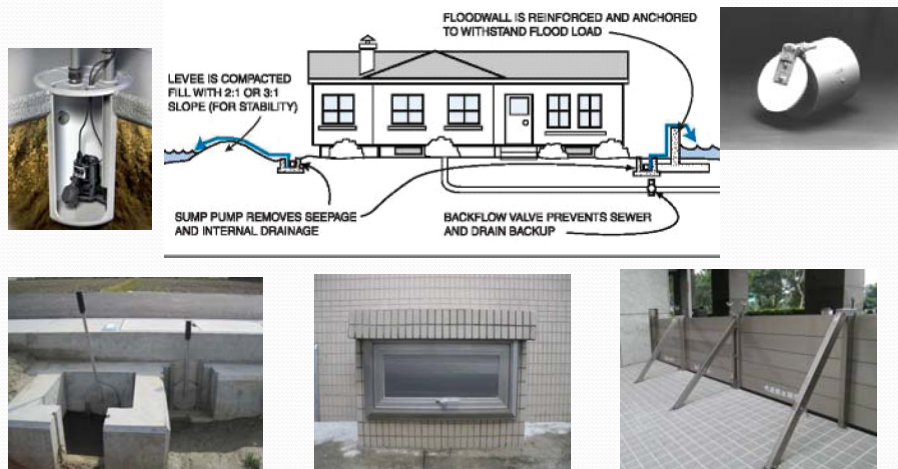
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Flood Mitigation Strategies



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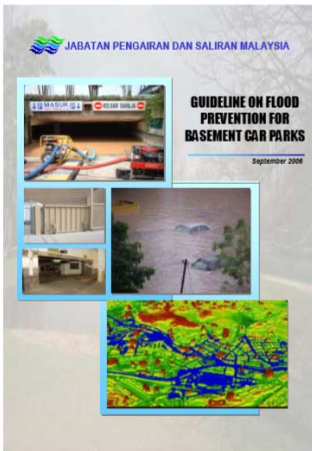
Basement & Below Grade



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Requirements

- The Department of Irrigation and Drainage (DID)
- 'Guideline on Flood Prevention for Basement Carpark'
- September 2006,
- Required flood risk assessment and hydraulic computations are stipulated.



Requirements

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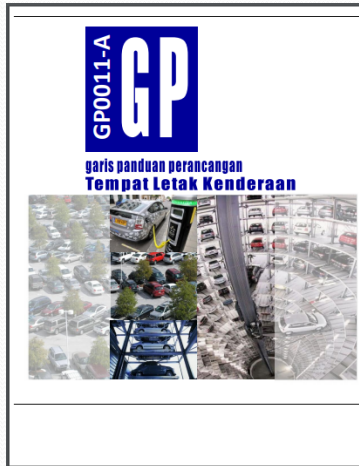
GARIS PANDUAN PERANCANGAN Tempat Letak Kenderaan

JABATAN PERANCANGAN BANDAR DAN DESA
SEMANJANG MALAYSIA
(KEMENTERIAN PERUMAHAN DAN KERAJAAN TEMPATAN)

Susunan Atar dan Reka Bentuk	Ciri-ciri	Landskap
	 <ul style="list-style-type: none"> • Sistem keselamatan yang baik hendaklah disediakan di setiap lorong masuk dan keluar dan di lokasi lain yang sesuai, contohnya pemasangan CCTV dan penempatan pengawal keselamatan. 	
	 <ul style="list-style-type: none"> • Sistem kawalan banjir yang eluahkan air ke phos, bersepadu, hendaklah disediakan, contohnya <i>floor gate</i>. • Kapasiti untuk reka bentuk dan perincian ini <i>Building or Floor Area Requirements Manual For Residential Car Parks</i> terbitan Jabatan Perancangan dan Kerajaan Tempatan bertarikh September 2006 hendaklah dipatuhi. 	 <ul style="list-style-type: none"> • <i>Speed breaker</i> hendaklah dipasang untuk mengawal kanta dipandu lalu. • Senarai petak parkir dipasang penghalang konkrit (barier check) untuk menghalang kanta berpada lalu ke hadapan. • Papan arahan maklumat, papan tanda petunjuk arah aliran kenderaan dan sistem pemantauan yang jelas, mudah dilihat dan memandu pengguna hendaklah disediakan.

*Rujukan: Manual Arahan Merit pada 11 September 2005.

Requirements



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ELEMEN	(2A) TLK BERTINGKAT ARAS PERMUKAAN DAN BAWAH TANAH
	<p>Foto 38 : Contoh sistem pencarayaan yang baik</p>  <p>Contoh sistem TLK yang luas, terbuka, terang, dan mempunyai sistem pencarayaan yang baik.</p> <p>ix. Sistem kawalan banjir yang diluluskan oleh pihak berkuasa seperti Jabatan Saliran dan Pengiran (JPS) hendaklah disediakan; contohnya 'flood gate'.</p> <p>x. Keperluan umum reka bentuk dan penentuan lain seperti Guideline on Flood Loss Prevention Measures For Basement Car Parks terbitan Jabatan Pengiran dan Saliran Malaysia bertarikh September 2006 hendaklah dipatuhi.</p> <p>Rajah 39 : Reka bentuk Fasad Bangunan TLK Area Permukaan dan Bawah Tanah</p> 
(b) Ciri-ciri	<p>i. Sistem pencarayaan dan pengudaraan yang baik hendaklah disediakan bagi tujuan keselamatan dan keselesaan pengguna.</p> <p>ii. Tahap pencerahan cahaya yang dicadangkan ialah minimum 100 LUX dan perlu konsisten bagi keseluruhan ruang TLK.</p>

*Rujukan Majalah Amali (Majalah) 10 September 2005.

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Flood abatement performance

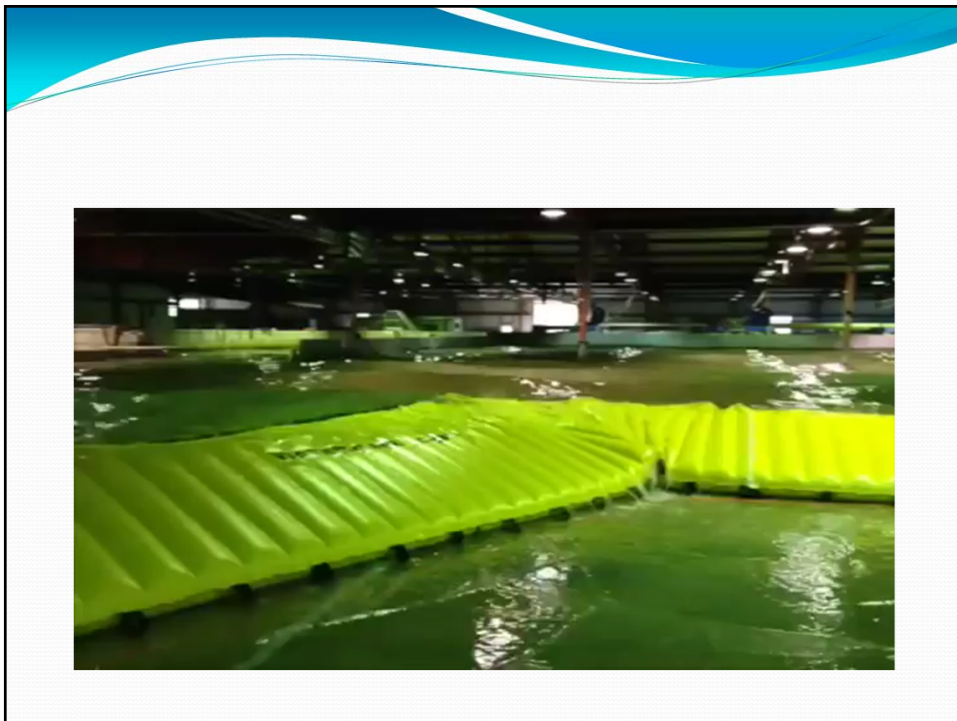
- In keeping water out in a flood situation, the barrier is only as strong at its weakest link.
- Therefore, the flood barrier components and material have to meet the hydraulic performance likely to be encountered in a flood situation.



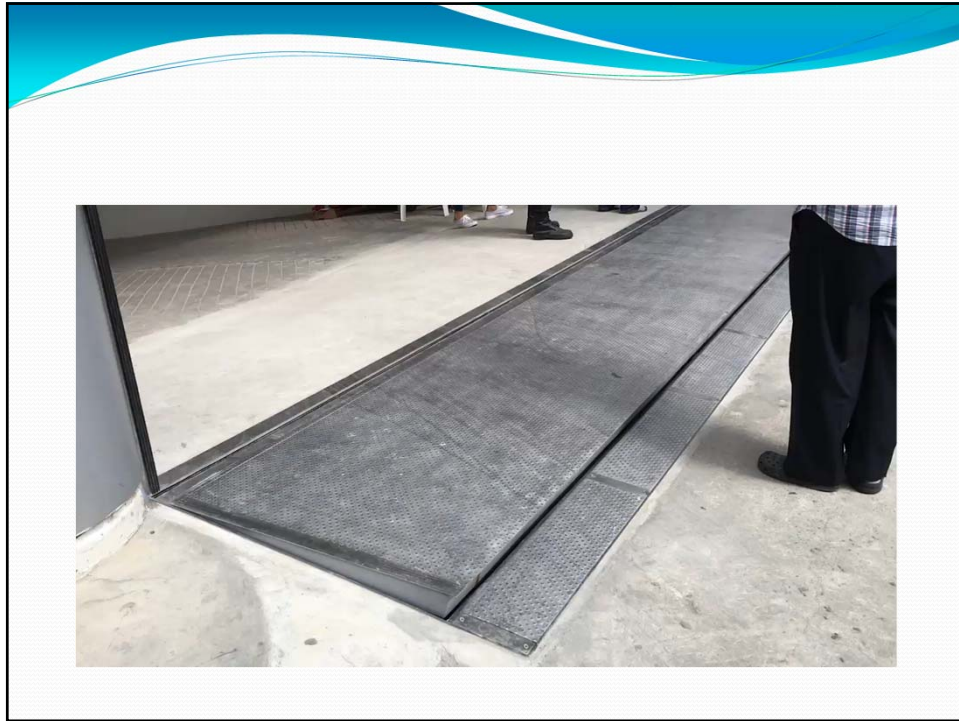
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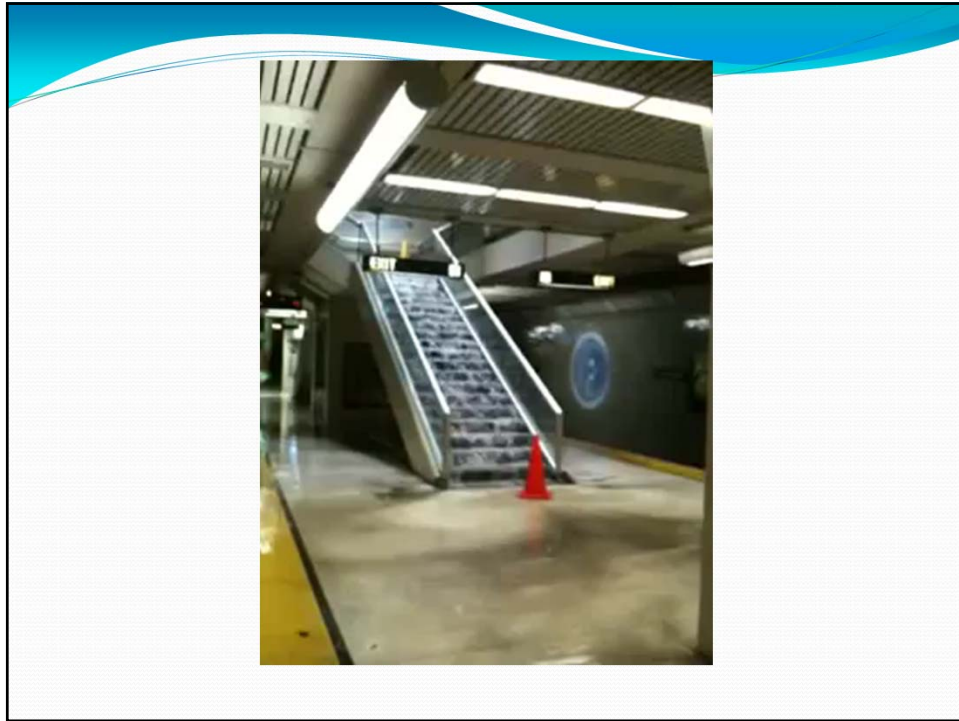
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Requirements



IEM Guideline 01
Revision 0 - April 2018

**IEM Guideline on
Flood Abatement Equipment –
Engineering Guide of Designation,
Testing and Documentation**

The Institution of Engineers, Malaysia
Bangunan Insanior, Lot 80162,
Jalan S24, PPR Surut 223 (Larkin Subst),
46720 Petaling Jaya,
Selangor Darul Ehsan, Malaysia
General Line: (603) 7968 4001/4002
Fax: (603) 7967 7076
http://www.iem.org.my/
iem@iem.org.my

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Benefit of tested flood abatement equipment

Engineers

- Knowing the equipment has met a standardised performance specification and has been certified by test.
- Potential to selected optional testing when situation warrants

End users

- There is known performance of the equipment and rigorously testing in the equipment certification.
- Comfort the equipment had been designed and installed to a specific standard.
- The equipment comes with complete manual and instructions. There will be established deployment time and prescribe maintenance.
- The needed resources for deployment are known and can be written into the flood emergency response plan.

Contractor

- There is established and uniform performance criteria for the equipment.
- Potentially eliminate the need for individual design review or making factory acceptance test.
- Manufacturer would provide the needed documentations for site preparation and installation.

Manufacturer

- The manufacturer's designer can engineer the equipment to the requirements in this Guideline and select materials to meet the stipulated performance.
- There are uniform testing perimeters and it could lead to a certification program.

Authority and Insurance

- The equipment has met a set of specific performance and certified criteria.

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Test

Required mandatory test

- Hydrostatic leakage test
- Wave leakage test
- Current leakage test

Component required

- Hydrostatic test strength for pressure operating components
- Cycling durability test
- Salt spray test
- Tensile strength and accelerated aging test
- Compression set test

Optional test

- Overtopping
- Debris impact
- Outside load condition
- Power supply and control for automatic equipment

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Equipment documentation

- Certification of equipment
- Deployment time
- Document manual
- Equipment marking
- Installation information
- Tools



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Annex

- | | |
|---------|--|
| Annex A | NAHRIM Hydraulics and Instrumentation Laboratory Test Facility Description |
| Annex B | Guideline on Flood Prevention for Basement Carpark |
| Annex C | Climate Change Factor |
| Annex D | Flood Return Period |
| Annex E | Flood Protection Strategy |
| Annex F | Flood Insurance |

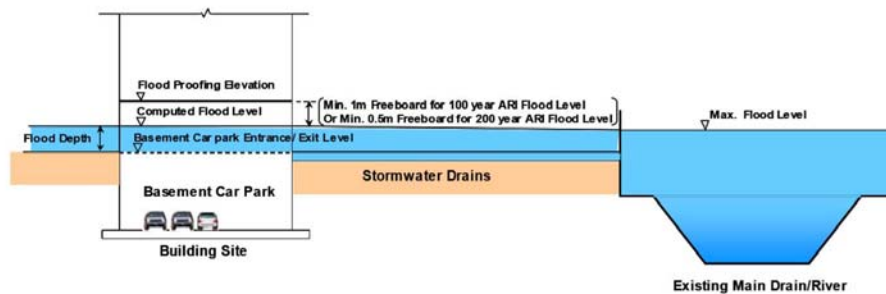
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Annex A - NAHRIM



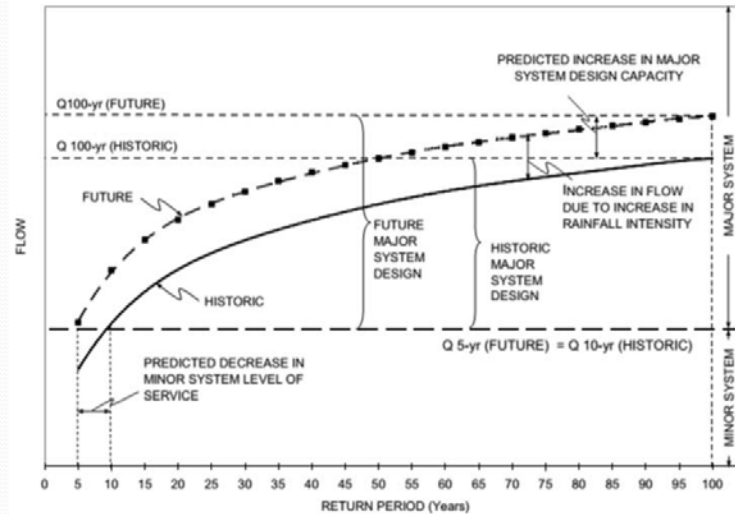
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Annex B - Flood Prevention



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Annex C - Climate Change Factor



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Annex D - Flood return period

- In hydrology, flood severity is normally designated by a recurrence interval of the flood (i.e. 25-year, 100-year, 500-year). The recurrence interval of an event gives the average length of time between occurrences.

Flood recurrence interval	Time period being considered				
	1	2	5	10	50
10	9.52%	18.13%	39.35%	63.21%	99.33%
25	3.92%	7.69%	18.13%	32.97%	86.47%
50	1.98%	3.92%	9.52%	18.13%	63.21%
100	1.00%	1.98%	4.88%	9.52%	39.35%
250	0.40%	0.80%	1.98%	3.92%	18.13%
500	0.20%	0.40%	1.00%	1.98%	9.52%

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Annex D - Flood return period

- If a location is built on a 25-year recurrence interval flood level, should the plant be around for five years, the chance of flooding is 18.13% and if it was occupied for 50 years, the chance increases to 86.47%.

Flood recurrence interval	Time period being considered				
	1	2	5	10	50
10	9.52%	18.13%	39.35%	63.21%	99.33%
25	3.92%	7.69%	18.13%	32.97%	86.47%
50	1.98%	3.92%	9.52%	18.13%	63.21%
100	1.00%	1.98%	4.88%	9.52%	39.35%
250	0.40%	0.80%	1.98%	3.92%	18.13%
500	0.20%	0.40%	1.00%	1.98%	9.52%

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Annex F - Flood Insurance



- Flood insurance is not a standard or automatic cover under a typical property fire insurance in Malaysia.
- The building owner will have to add flood as a special or extended peril in the basic insurance. Additional premium is payable.
- The type of property fire insurance is dependent on the sum insured, and the typical structure is below:
 - Fire Tariff - sum insured below RM 10 million.
 - Self-Rating - RM 10 to 50 million.
 - Special Rating - above RM 50 million.
 - Large and Specialise Risks - above RM 300 million

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Annex F - Flood Insurance



Fire Tariff	<ul style="list-style-type: none"> The rate is 0.086%. The excess is 1% of the total sums insured against such peril or the first RM2,500 of the loss
Self-Rating,	<ul style="list-style-type: none"> The tariff rate is applied. There is peril rate available discount, which is 50% to 82%, depending on sum insured.
Special Rating,	<ul style="list-style-type: none"> There is peril rating formula in Discount of 50% to 90%, depending on sum insured. Have to be agreed and approved by the Rating Committee, which is a committee appointed by PIAM.
Large & Specialised Risks (SILSR)	<ul style="list-style-type: none"> Locations when qualified by the Scheme Manager. Favourable cover at internationally competitive terms for Malaysian risk owners. Terms and coverage could be specific to the insurance company. The pricing and coverage under this scheme would be subject to global insurance conditions. Examples of events which had affected the global appetite for flood risk would be the 2012 flooding in Thailand and hurricanes in the US.
No cover/limit	<ul style="list-style-type: none"> The insurance company could elect to not provide flood coverage if the location is a flood prone or have a history of flooding. When coverage is provided, additional terms could be imposed. Flood coverage could be provided if the location has flood mitigation steps.

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Summary

- Flood can be predicted and mitigated.
- Various engineering measures had been made to mitigate flood.
- When a building is located in a flood prone area, additional measures have to be taken to keep the water out.
- In any building, the engineered flood solutions could have limitation and other challenges.
- Product conformity certification scheme, provide assurance to potential users or specifiers of flood protection products that these have been tested and verified by a third party.

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