Penyenggaraan Jambatan di Bawah PBC

Dan

Isu-isu Senggara

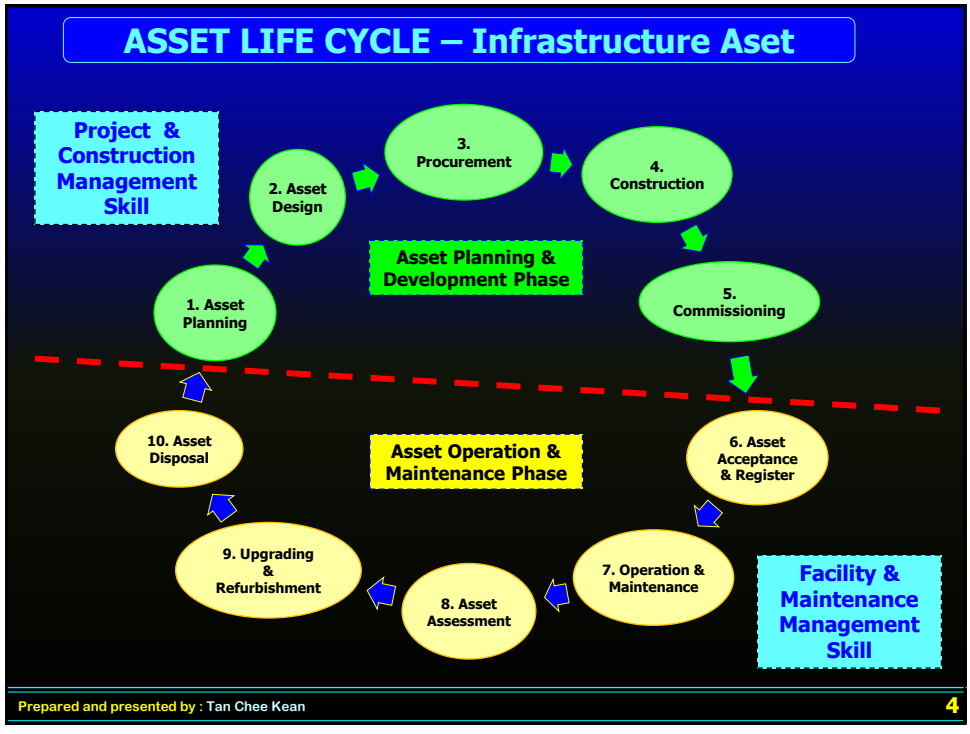
Culvert, Expansion Joint, Parapet Dan Steel Railing

Tan Chee Kean
Penolong Jurutera
Cawangan Senggara Fasiliti Jalan

Jenis-jenis Pemeriksaan Amalan JKR:

- INVENTORY
- ROUTINE CONDITION
- CONFIRMATORY
- DETAILED


Mengapa Perlu Ada Proses Penyenggaraan Jambatan?
Sebab ia merupakan sebahagian daripada
Asset Life Cycle.
Prepared and presented by : Tan Chee Kean
3


ASSET LIFE CYCLE – Infrastructure Aset
Project & Construction Management Skill
1. Asset Planning
2. Asset Design
3. Procurement
4. Construction
5. Commissioning
Asset Planning & Development Phase
6. Asset Acceptance & Register
7. Operation & Maintenance
8. Asset Assessment
9. Upgrading & Refurbishment
10. Asset Disposal
Asset Operation & Maintenance Phase
Facility & Maintenance Management Skill
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4

Dalam JKR apa jenis Penyenggaraan Jambatan biasa diamalkan?

- Rutin.
- Berkala.

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Amalan Penyenggaraan di JKR

- Penyenggaraan Rutin
  - Dikontrakkan kepada konsesi.
- Penyenggaraan Berkala.
  - Dirancang dan dilaksanakan tahunan bergantung pada peruntukan dengan merujukan kepada laporan Pemeriksaan Mandatori Tahunan Jambatan (PMTJ).

Prepared and presented by : Tan Chee Kean 6

Penyenggaraan Rutin Jambatan Dibawah Kontrak Konsesi.

Prepared and presented by : Tan Chee Kean 7

Routine Maintenance Work Berpandukan MANUAL For Federal Road Maintenance Contract Administration







Prepared and presented by : Tan Chee Kean 8

Breakdown Rates According to Activities
(Protocol / Primary / Secondary Roads)

ROUTINE MAINTENANCE WORKS

Breakdown Rates According to Activities
(Applicable for Protocol / Primary / Secondary Roads)

ITEM NO	ACTIVITY	COST/KM/MONTH (RM)
R01	Pavement	490.00
R02	Maintenance of Road Shoulder	140.00
R03	Grass Cutting	516.00
R04	Maintenance of Road Furniture	25.00
R05	Maintenance Bridges and Culvert	230.00
R07	Drainage	300.00
B	Routine Inspection	11.00
	TOTAL (RM)	**1,712.00**

Routine Maintenance Work Activities

- **RO1 – Pavement**
- **RO2 – Road Shoulder**
- **RO3 – Grass Cutting**
- **RO4 – Maintenance of Roads Furniture**
- **RO5 – Maintenance of Bridges and Culverts**
- **RO7 – Drainage (Cleaning & Desilting)**
- **B – Routine Inspection**

B – Routine Inspection

B	ROUTINE INSPECTION	
	Cycle: i) Protocol roads : 2 cycles / week ii) Primary roads : 2 cycles / week iii) Secondary roads : 2 cycles / week	1. Provide monthly report. 2. Removal of minor obstructions which affect the traffic upon detection by the inspector.

All asset data measured and captured to be submitted to JKR

Bridge & Culvert
- **Routine Condition Inspection Form**

Submit reports on work done as per work programes.

WORK PROCEDURES

i. The Company shall employ Inspectors to carry out daily routine inspection along all Federal Roads within the area concerned.

ii. The Inspectors shall be equipped with a motorcycle or other suitable vehicle, safety gears and communication equipment to perform his daily task/duty.

iii. The Inspectors shall also inspect and collect all road data such as width and type of roads, shoulders, drains, slopes, berms, structures and road furnitures.

iv. The Inspectors shall also inspect, identify and note down all defects and damages to road pavements, shoulders, drains, road furniture and structures.

v. in the case of major defects or damages that require urgent attention and/or which may affect the safety and the comfort of the road user, the Inspectors shall inform the Section Manager and JKR immediately via simple message services (SMS) or through the communication equipment provided for necessary action.

vi. The Company shall submit daily report in weekly basis in the form of soft copy (CD or E-mail) to JKR of all defects identified for his necessary action.

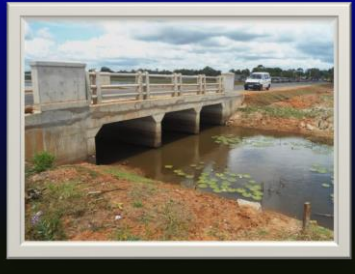
vii. Removal of minor obstruction which affect the traffic upon detection by the Inspectors.

viii. Submit monthly reports to the Government in soft copy form. The report shall include but not limited to the following:

(a) Summary of actions taken on defect detected in the reporting month.

(b) Summary according to mutually agreed format.

Pemeriksaan Rutin Oleh Konsesi

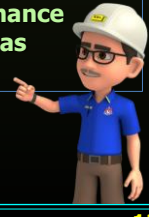


WORKING ROUNDS

Jalan Protokol	- 2 kali / seminggu
Jalan Primary	- 2 kali / seminggu
Jalan Secondary	- 2 kali / seminggu

SCOPE OF WORKS

The Company shall provide all necessary manpower, transport and equipment to carry out daily routine inspection along all Peninsular Federal Roads to identify defects that require work Routine Maintenance Works and to collect all road data as required in the contract.



Pemeriksaan Rutin Oleh Konsesi Penyenggaraan Jalan

Responsibility:

- Removal of minor obstruction which affect the traffic upon detected by the inspectors.
- The Company shall submit daily report in weekly basis in the form of soft copy (CD or E-mail) to JKR of all defects identified for his necessary action.

WORKS PROCEDURES

- The Company shall employ inspectors to carry out daily routine inspection along the Federal Roads within the area concerned.
- The inspectors shall be equipped with a motorcycle or other suitable vehicle, safety gears and communication equipment to perform his daily task/duty.
- The inspectors shall also inspect and collect all road data such as width and type of roads, shoulders, drains, slopes, berms, structures and road furnitures.
- The inspectors shall also inspect, identify and note down all defects and damages to road pevements, shoulders, drains, road furniture and structures.
- In the case of major defects or damages that require urgent attention and/or which may affect the safety and the comfort of the road user, the inspectors shall inform the Section Manager and JKR immediately via simple message services (SMS) or through the communication equipment provided for necessary action.

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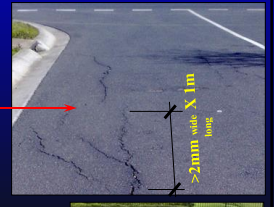
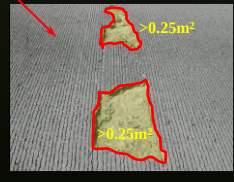
RO1 - Pavement

ITEM NO.	BRIEF DESCRIPTION OF CONDITION	AGREED PERFORMANCE STANDARDS
R 01	PAVEMENT	
1	Patching of potholes.	Repair when pothole exceeds 25 mm deep x 200 mm wide in any direction from edge of edge of pavement.
2	Surface cracking.	Line cracks more than 2 mm wide x 1 m long to be sealed or cracked material replaced. Crocodile cracks exceeding 5 sq.m in area to be repaired by other methods.
3	Edge deterioration of backfilled trenches.	Top-up or reinstate backfilled trench when trench develops potholes, crack or settle 25 mm below adjacent pavement level.
4	Deterioration of concrete pavement.	Treat affected area as necessary when area of deterioration is more than 0.25 sq.m and other specific treatment detailed above are not considered appropriate.
5	Deterioration of concrete pavements joints	Repair joints if more than 10% of every transverse joint has failed.
6	Repair to paving blocks and slabs	Repair blocks or slabs if failed area exceeds 0.25 sq.m

The defect shall be capped at a maximum of 1% paved area per year.





Prepared and presented by : Tan Chee Kean 14

RO2 – Road Shoulder

ITEM NO.	BRIEF DESCRIPTION OF CONDITION	AGREED PERFORMANCE STANDARDS
R 02	ROAD SHOULDER	
1	Irregularities in unsealed shoulders	Fill individual depression when more than 1 sq.m and more than 150 mm deep. Grade shoulders when more than 20 numbers depressions each 0.5 sq.m x 100 mm deep in any 100 m length.
2	Pavement / shoulder level difference.	Fill edge and grade when drop from traffic lane to shoulder exceeds 50mm over 20m length. Trim when step at edge of shoulder storm water run-off.

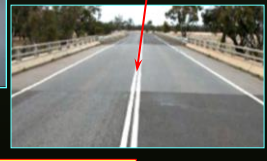
The Company shall provide all labour, tools, materials, equipment, transport and whatever necessary for the execution of the works below:

i. Re-grading and clearance of vegetation.
ii. Topping up of shoulders with suitable earth material.
iii. Filling irregularities in unsealed shoulders,
iv. Filling pavement/shoulder level differences

Prepared and presented by : Tan Chee Kean 15

RO5 – Maintenance of Bridges and Culverts

R 05	MAINTENANCE OF BRIDGES AND CULVERTS	
	a. Cleaning and Removal of Vegetation **Cycle:** i) Protocol roads : 6 cycles / year ii) Primary roads : 2 cycles / year iii) Secondary roads : 2 cycles / year	
1	Cleaning of weep holes.	Clean as per cycle.
2	Removal of vegetation.	Remove as per cycle.
3	Cleaning of waterway or culvert opening and bridge carriageway	Clean as per cycle.



Cleaning And Removal Of Debris

i. The waterway of bridges and culvert openings shall be kept clear from logs, stumps and others debris.

ii. The deck of bridges, culverts and the approaches shall be kept free of loose material. Scupper drain and water down pipes shall be cleared from any blockage and unwanted material to ensure smooth water flow.

iii. The weep holes in abutments shall be cleaned periodically to ensure that the hole through the wall is not blocked by foreign material which could prevent the free flow of seepage water.

Prepared and presented by : Tan C... 18

Penyenggaraan Berkala

Contoh Penyenggaraan Berkala Jambatan

Pembaikan beam jambatan dengan kaedah formwork repair.

Pembaikan pier jambatan dengan aplikasi CFRP.

Pembaikan pier column jambatan dengan kaedah jacketting.

Contoh Penyenggaraan Berkala Jambatan

Pembaikan pada epoxy nosing expansion joint.

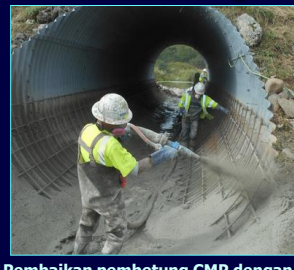
Pembaikan parapet konkrit dengan kaedah formwork repair.

Penggantian asphaltic plug expansion joint.

Aplikasi protective coating pada steel girder jambatan.

Contoh Penyenggaraan Berkala Pembetung

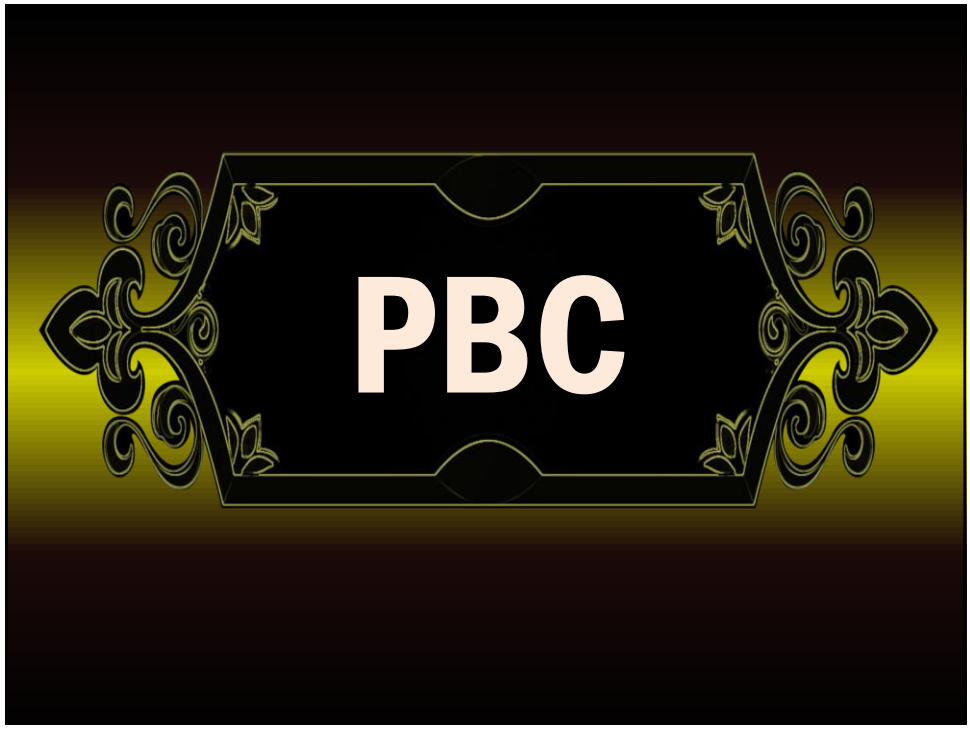
Pembaikan pada deck soffit pembetung konkrit dengan kaedah guniting.



Pembaikan pembetung CMP dengan kaedah shotcrete pada base.

Pembaikan pembetung kekotak konkrit dengan kaedah reline dengan CMP.

Pembaikan pembetung CMP dengan kaedah shotcrete pada base.



Apakah itu PBC?

Performance Based Contract

- Satu kontrak jangka panjang.
- Satu kontrak penyenggaraan yang mempunyai takrifan paras minima pencapaian (***Service Levels***) kualiti komponen aset jalan termasuk aset jambatan dan pembetung yang perlu dicapai oleh konsesi.
- Ia merangkumi khidmat untuk memeriksa, mengumpul data dan menyenggara aset tersebut termasuk juga kerja-kerja kecemasan yang terjadi, penyelesaian terhadap isu aduan dan segala maklumbalas status aset.
- Satu bentuk kontrak dimana pembayaran kontrak perlaksanaan kerja adalah berdasarkan kepada pencapaian kehidmat penyenggaraan mengikut kehendak kontrak.
- Pembayaran dibuat secara ***Lump Sum*** sekiranya mencapai standard prestasi yang dipersetujui.
- Penalti berbentuk denda akan dikenakan sekiranya tidak mencapai prestasi yang dipersetujui.

Prepared and presented by : Tan Chee Kean 25

Komponen Utama Dalam PBC:

OPM – Operational Performance Measure
RDPM – Road Durability Performance Measure
MPM – Management Performance Measure

Prepared and presented by : Tan Chee Kean 26

Jenis-Jenis Penyenggaraan PBC:

Routine Maintenance Works

Periodic Maintenance Works

Emergency Works

Additional Works

Prepared and presented by : Tan Chee Kean 27

Kandungan Kontrak PBC

Penyenggaraan Rutin Dibawah PBC

7. ROUTINE MAINTENANCE WORKS

7.1 Scope of Routine Maintenance Works

7.1.1 Performance of Routine Maintenance Works

Subject to the terms and conditions of this Agreement, the Company shall carry out the Routine Maintenance Works in accordance with the scope of works in **Appendix 3** and Specifications as set out in **Appendix 2** to achieve the Service Level as set out in **Appendix 11**.

7.1.2 Commencement of Routine Maintenance Works

Subject to the terms and conditions of this Agreement, the Company shall commence the Routine Maintenance Works or any part thereof on the Effective Date. .

7.1.3 Works Programme

The Company shall, if required, submit a Works Programme prior to the commencement of the repair and replacement works.

Penyenggaraan Berkala Dibawah PBC

8. PERIODIC MAINTENANCE WORKS

8.1 Scope of Periodic Maintenance Works

8.1.1 Performance of Periodic Maintenance Works

Subject to the terms and conditions of this Agreement, the Company shall carry out the Periodic Maintenance Works in accordance with the scope of works in **Appendix 4** and Specifications as set out in **Appendix 2**, Approved Conceptual Design, Approved Detailed Design and Accepted Works Programme to achieve the Service Level as set out in **Appendix 11**.

8.1.2 Commencement of Periodic Maintenance Works

Subject to the terms and conditions of this Agreement, the Company shall commence the Periodic Maintenance Works or each Separable Portion not later than the proposed dates for the commencement as set out in the Accepted Works Programme or, if later, within a period to be mutually agreed by the Parties. Subject as aforesaid, the Company shall diligently complete each of the Separable Portion within the relevant period set out in the Accepted Works Programme or within such longer periods as the Government may approve.

Skop Kerja Kecemasan Dibawah PBC

9. EMERGENCY WORKS

9.1 Scope of Emergency Works

9.1.1 Performance of Emergency Works

Subject to the terms and conditions of this Agreement, the Company shall carry out the Emergency Works in accordance with **Appendix 5**, the Specifications, requirements and standards as set out in the Works Order(s) as approved by the Government, if required.

Skop Kerja Kecemasan Dibawah PBC

9.1.2 Execution of Emergency Works

(a) Emergency Works, other than the minor works within the threshold values mentioned in **Table 2 of Appendix 5**, shall be executed by the Company on the basis of Works Order(s) issued by the Government. Subject always to **Clause 9.1.2(d)** below, the need for execution of the Emergency Works is jointly identified and determined by the Government and the Company.

(b) The Works Order shall be issued in writing and shall include the date on which the Works Order was issued and the signature of the Government's Representative. Two copies of the Works Order shall be transmitted by the Government's Representative to the Company, who shall immediately countersign one copy, including the date of acceptance, and return it to the Government's Representative.

(c) The execution of the Emergency Works shall be requested by the Company based on damages occurred as a result of Emergency Events under **Appendix 5**. In order to characterize the Emergency Works, the Company shall forward a technical report to the Government's Representative requesting the execution of Emergency Works and characterizing the situation. On the basis of the said report, the Government's Representative may issue a Works Order to the Company.

(d) The Government's Representative may issue a Works Order for the Emergency Works to the Company even without a request by the Company.

Skop Kerja Kecemasan Dibawah PBC

4.0 Scope of Emergency Works

4.1 Landslide

4.2 Embankment Failures and Road Subsidence

4.3 Failure/Collapse of Bridges and their Related Components

4.4 Collapse of Culverts and Drainages Structures

4.5 Flooding

4.6 Closure of Roads Due To Spillage of Chemical, Hazardous, Toxic or Inflammable Materials

4.7 Closure of Roads Due To Fallen Trees

4.8 Traffic Management Plan

Kerja Tambahan Dibawah PBC

10. ADDITIONAL WORKS

10.1 Scope of Additional Works

10.1.1 Performance of Additional Works

(a) Pavement-related Additional Works

Subject to the terms and conditions of this Agreement, the Company shall carry out the pavement-related Additional Works in accordance with **Appendix 4**, the Specifications in accordance with **Appendix 2**, Approved Conceptual Design, Approved Detailed Design and Accepted Works Programme to achieve the Service Level as set out in **Appendix 11**.

(b) Non-Pavement Works

Subject to the terms and conditions of this Agreement, the Company shall carry out the non-pavement-related Additional Works in accordance with the specifications set out in the Works Order(s) and, where applicable, in accordance with the Approved Conceptual Design, Approved Detailed Design and Accepted Works Programme.

Kerja Tambahan Dibawah PBC

10.1.2 Execution of Additional Works

(a) Additional Works shall be executed by the Company on the basis of Works Order(s) issued by the Government's Representative. The need for execution of the Additional Works is identified and determined by the Government.

(b) The Works Order shall be issued in writing and shall include the date on which the Works Order was issued and the signature of the Government's Representative Two copies of the Works Order shall be transmitted by the Government's Representative to the Company, who shall immediately countersign one copy, including the date of acceptance, and return it to the Government's Representative.

Kandungan CONCESSION AGREEMENT

(Performance Based Contract for the Maintenance of Federal Roads In the Southern Region of Peninsular Malaysia)

7. ROUTINE MAINTENANCE WORKS

7.1 Scope of Routine Maintenance Works

7.1.1 Performance of Routine Maintenance Works

Subject to the terms and conditions of this Agreement, the Company shall carry out the Routine Maintenance Works in accordance with the scope of works in **Appendix 3** and Specifications as set out in **Appendix 2** to achieve the Service Level as set out in **Appendix 11**.

7.1.2 Commencement of Routine Maintenance Works

Subject to the terms and conditions of this Agreement, the Company shall commence the Routine Maintenance Works or any part thereof on the Effective Date.

7.1.3 Works Programme

The Company shall, if required, submit a Works Programme prior to the commencement of the repair and replacement works.

- **Appendix 3 - Routine Maintenance Works (OPM)**
- **Appendix 2 - Specifications**
- **Appendix 11 - Performance Measures**

***OPM – Operational Performance Measures**

Kandungan CONCESSION AGREEMENT

(Performance Based Contract for the Maintenance of Federal Roads In the Southern Region of Peninsular Malaysia)

7. ROUTINE MAINTENANCE WORKS

7.1 Scope of Routine Maintenance Works

7.1.1 Performance of Routine Maintenance Works

Subject to the terms and conditions of this Agreement, the Company shall carry out the Routine Maintenance Works in accordance with the scope of works in **Appendix 3** and Specifications as set out in **Appendix 2** to achieve the Service Level as set out in **Appendix 11**.

7.1.2 Commencement of Routine Maintenance Works

Subject to the terms and conditions of this Agreement, the Company shall commence the Routine Maintenance Works or any part thereof on the Effective Date.

7.1.3 Works Programme

The Company shall, if required, submit a Works Programme prior to the commencement of the repair and replacement works.

Appendix 3 - Routine Maintenance Works (OPM)

- **Terkandung keperluan output dalam setiap skop OPM.**
- **Discripsi setiap kecacatan dengan berpandukan kepada keperluan output dalam setiap OPM.**
- **Spesifikasi bahan dan kerja serta tatacara perlaksanaan setiap OPM.**

Appendix 2 - Specifications

- **Merupakan spesifikasi tambahan yang menjuruskan kepada kehendak sifat dan keberkesanan bahan pembinaan.**
- **Rujukan kepada pemeriksaan, ujian dan penyediaan laporan untuk tujuan semakan kualiti.**
- **Rujukan Kod Amalan dalam isu penyiasatan, ujian dan penyedian laporan.**

Appendix 11 - Performance Measures

- ***Service Level* untuk setiap OPM.**
- **Tempoh maxima untuk melaksanakan kerja-kerja pembaikan terhadap setiap OPM.**
- **Konsesi perlu mengwujudkan *Conformance Management System*.**
- **Perincian Service Level untuk setiap kecacatan yang terkandung dalam OPM.**
- ***Management Performance Measures* untuk pengoperasian syarikat konsesi mengikut perjanjian kontrak.**

Kandungan CONCESSION AGREEMENT
(Performance Based Contract for the Maintenance of Federal Roads In the Southern Region of Peninsular Malaysia)

- **Appendix 13 - Inspections and Reporting**
- **Appendix 4 - Periodic Maintenance Works**
- **Appendix 11 - Performance Measures**

12.2 Quality of Maintenance Works

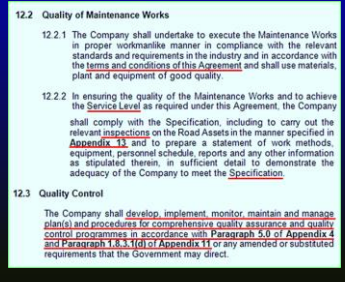
12.2.1 The Company shall undertake to execute the Maintenance Works in proper workmanlike manner in compliance with the relevant standards and requirements in the industry and in accordance with the terms and conditions of this Agreement and shall use materials, plant and equipment of good quality.

12.2.2 In ensuring the quality of the Maintenance Works and to achieve the Service Level as required under this Agreement, the Company shall comply with the Specification, including to carry out the relevant inspections on the Road Assets in the manner specified in **Appendix 13** and to prepare a statement of work methods, equipment, personnel schedule, reports and any other information as stipulated therein, in sufficient detail to demonstrate the adequacy of the Company to meet the Specification.

12.3 Quality Control

The Company shall develop, implement, monitor, maintain and manage plan(s) and procedures for comprehensive quality assurance and quality control programmes in accordance with **Paragraph 5.0 of Appendix 4** and **Paragraph 1.8.3.1(d) of Appendix 11** or any amended or substituted requirements that the Government may direct.

Kandungan CONCESSION AGREEMENT
(Performance Based Contract for the Maintenance of Federal Roads In the Southern Region of Peninsular Malaysia)



Appendix 13 - Inspections and Reporting

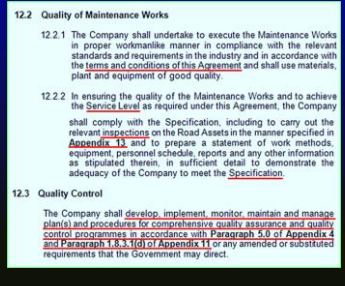
- **Perlu laksanakan pemeriksaan terhadap kesemua aset yang berkedudukan di dalam ROW. (all road surfaces, bridges, culverts, signs, vegetation, guardrails, barriers, marker pegs, pavement markings and footpaths)**
- **Jenis-jenis pemeriksaan adalah:-**
  - **Routine Patrols**
  - **Combined Day-time Inspections**
  - **Combined Night-time Inspections**
  - **Bridges and culverts – inspection**
  - **Emergency / Incident**
  - **Combined Inspection within Government's Representative and Compony's Representative**
- **Kesemua kecacatan yang ditemui harus dilaporkan dalam masa 24jam bermula dari titik penemuan.**
- **Segala kecurian dan tindakan vandalism perlu dilaporankan dalam masa 1 minggu bermula dari tarikh penemuan.**
- **Pemeriksaan terperinci bersertakan laporan perlu diserahkan kepada JKR dalam tempuh 1 minggu bermula dari tarikh perlaksanaan.**

Kandungan CONCESSION AGREEMENT
(Performance Based Contract for the Maintenance of Federal Roads In the Southern Region of Peninsular Malaysia)

Jenis Pemeriksaan dan Kekerapan Perlaksanaan

Inspection Type	Inspection Frequency
Routine Patrols	Protocol Roads and Primary Roads: Twice a week and during periods of heavy rainfall Secondary, Federal Institutional, Industrial, FELDA Access and Felda Internal Roads: Once a week and immediately after periods of heavy rainfall.
Combined Day-time Inspections	Protocol and Primary Roads: Every two (2) months Secondary, Federal Institutional, Industrial, Felda Access and Felda Internal Roads: Every six (6) months
Combined Night-time Inspections	Protocol and Primary Roads: Every six (6) months Secondary, Federal Institutional, Industrial, Felda Access and Felda Internal Roads: Every Twelve (12) Months
Bridges and culverts – inspection	(i) Every twelve (12) months (ii) Within two (2) days following the date of an agreed flood event
Emergency / Incident	Immediately following notification.
* Combined Inspection: Carried out with Government's Representative (refer Paragraph 1.5 of this Appendix) unless agreed otherwise.	

Kandungan CONCESSION AGREEMENT
(Performance Based Contract for the Maintenance of Federal Roads In the Southern Region of Peninsular Malaysia)



12.2 Quality of Maintenance Works

12.2.1 The Company shall undertake to execute the Maintenance Works in proper workmanlike manner in compliance with the relevant standards and requirements in the industry and in accordance with the terms and conditions of this Agreement and shall use materials, plant and equipment of good quality.

12.2.2 In ensuring the quality of the Maintenance Works and to achieve the Service Level as required under this Agreement, the Company shall comply with the Specification, including to carry out the relevant inspections on the Road Assets in the manner specified in Appendix 13 and to prepare a statement of work methods, equipment, personnel schedule, reports and any other information as stipulated therein, in sufficient detail to demonstrate the adequacy of the Company to meet the Specification.

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The Company shall develop, implement, monitor, maintain and manage plan(s) and procedures for comprehensive quality assurance and quality control programmes in accordance with Paragraph 5.0 of Appendix 4 and Paragraph 1.8.3.1(d) of Appendix 11 or any amended or substituted requirements that the Government may direct.

Appendix 4 - Periodic Maintenance Works

- Planned yearly program.
- Planned Periodic Maintenance Scopes to restore pavement strength and lifecycle :
  - Pavement overlay.
  - Pavement rehabilitation.
  - Pavement reconstruction works of the existing pavement.
- Road marking, reflective raised pavement markers on any newly rehabilitated pavement.
- Topping-up of unpaved road shoulders required for newly rehabilitated pavement.

Kandungan CONCESSION AGREEMENT
(Performance Based Contract for the Maintenance of Federal Roads In the Southern Region of Peninsular Malaysia)

14. SERVICE LEVEL

14.1 Routine Maintenance Works

The Company shall, throughout the Concession Period, carry out the Routine Maintenance Works according to the Operational Performance Measures to achieve and keep the Road Assets complying with the Service Level as specified in **Appendix 11**.

Kandungan CONCESSION AGREEMENT
(Performance Based Contract for the Maintenance of Federal Roads In the Southern Region of Peninsular Malaysia)

Service Level untuk setiap OPM.

14. SERVICE LEVEL

14.1 Routine Maintenance Works

The Company shall, throughout the Concession Period, carry out the Routine Maintenance Works according to the Operational Performance Measures to achieve and keep the Road Assets complying with the Service Level as specified in **Appendix 11**.

Scope Names	Operational Performance Measures (OPM)	Maximum Time for Defect Repair (During the Phase-in Period)	Maximum Time for Defect Repair (For the remainder of the Concession Period)
OPM-1	Pavement Maintenance excluding Potholes	3 Months	1 Month
OPM-1	Potholes	24 Hours	24 Hours
OPM-2	Unpaved Shoulder Maintenance	6 Months	3 Months
OPM-3	Drainage Maintenance	6 Months	3 Months
OPM-4	Routine Maintenance of Bridges and Other Structures	6 Months	3 Months
OPM-5	Obstructions on the Pavement Surface & Shoulders (non-hazardous)	24 Hours	24 Hours
OPM-6	Incident Response & Emergency Works Response	Not Applicable	Not Applicable
OPM-7	Vegetation Control	1 Month	1 Month
OPM-8	Road Signs Maintenance	3 Months	1 Month
OPM-9	Raised Pavement Markers	3 Months	1 Month
OPM-10	Pavement Markings	6 Months	2 Months
OPM-11	Kerbing for Traffic Island, Turning Bay, Footpath, Motorcycle Lane and Access	6 Months	2 Months
OPM-12	Longitudinal Barrier Maintenance (Guardrails)	3 Months	1 Week
OPM-12	Longitudinal Barrier Maintenance (Wire ropes)	3 Months	2 Weeks
OPM-12	Longitudinal Barrier Maintenance (Crash cushions)	3 Months	3 Weeks
OPM-13	Other Railing, Hand Rail, and Pedestrian Barrier Maintenance	3 Months	1 Month
OPM-14	Displacement Marker Post Maintenance	3 Months	1 Month
OPM-15	Footpath Maintenance	24 Hours	24 Hours

Kandungan CONCESSION AGREEMENT

(Performance Based Contract for the Maintenance of Federal Roads In the Southern Region of Peninsular Malaysia)

Appendix 18 - Form of Design Guarantee

- Form of Performance Bond
- Form of Design Guarantee
- Bidder's Declaration
- Successful Bidder's Declaration
- Forms & Templates.
  - Road Asset Damage Reporting Form
  - Bridge & Other Structure Inspection Form (JKR Routine Condition Inspection Form)
  - Routine Maintenance Works
  - Road Sign Reports
  - Emergency Works Or Additional Works Order
  - Accident Reporting Form

Operational Performance Measures (OPM)

Apakah itu Operational Performance Measures?

- Road user's expectation about day to day serviceability of the road under agreement.
- Service Level specified for each OPM must be comply by the company.
- The company must develop and implement monitoring system to ensure the Service Level are being achieved within the required timeframe.
- All OPM must be audited to check for compliance.
- All defects under the OPM must be rectified immediately or within the timeframe.
- All road asset shall be maintained with reference to Service Level specified for each OPM.

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 1 - SURFACED PAVEMENT MAINTENANCE On Bridge Deck
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
1	**Crack sealing.**
2	**Patching of potholes.**
3	**Repair heaves and shoves.**
4	**Repair asphalt surface with ravelling.**
5	**Repair block surfacing area.**
6	**Treatment for rutting.**
7	Repair concrete transverse joints.

OPM – Operational Performance Measures

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 1 - SURFACED PAVEMENT MAINTENANCE On Bridge Deck
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
8	Repair concrete pavement surface.
9	**Repair deficient asphalt surface.**
10	**Repair loss of asphalt surface.**
11	Reinstate pavement surface at utility covers.
12	**Apply temporary and permanent pavement marking .**
13	**Reinstate of reflective raised pavement markers.**

OPM – Operational Performance Measures

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 3 - DRAINAGE MAINTENANCE
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
1	Level, reinstate, improve sealed surface cross fall to avoid water ponding on sealed surface.
2	Cleaning and desilting works to clear ponding, blockage, debris and vegetation on the sumps, manholes and catch-pit.
3	**Cleaning and desilting works to clear ponding, blockage, debris and vegetation on inlet, outlet and inside culvert (barrel).**
4	**Cleaning and desilting works to clear ponding, blockage, debris and vegetation on kerb weep hole and side drain (covered and uncovered).**
5	Reseat mis-seated covers.
6	**Repainting all existing painted concrete or masonry structures on cross drainage facilities .**
7	**Provides monthly report on any defects of a structural nature along with photographs and supporting details.**

OPM – Operational Performance Measures

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 4 - ROUTINE MAINTENANCE OF BRIDGES AND OTHER STRUCTURES
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
1	Clean or remove of any unauthorized advertisements/stickers or graffiti.
2	Repaint of flaking, peeling of painted surfaces.
3	Report all damage to structure when discovered.
4	Clear of debris.
5	Clearing of drainage facilities.
6	Report and repair all damaged bridge joints.
7	Secure and repair damaged parapets and railings .

Harus ada rekod datas berikut:-
- No Struktur Jambatan.
- Jenis dan product property cat asal yang digunakan.
- Tarikh aplikasi cat.
- Warrenty.

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 5 - OBSTRUCTIONS ON THE PAVEMENT SURFACE AND SHOULDERS (On Bridge Deck)
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
1	Remove all litter and waste materials from pavement surface and shoulders and dispose from the ROW.
2	Removing all items on the sealed surface posing a safety or health hazard.

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 6 - INCIDENT RESPONSE AND EMERGENCY EVENTS (On Bridge Deck)
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
1	**Notify Government and relevant authorities on the incidents and emergency events.**
2	**Provide patrols in advance of and during any storm events or other weather related phenomena.**
3	**Remove fallen trees, branches and debris to free traffic flow.**
4	**Provide traffic management and install all temporary warning signage traffic control signage and barriers cones high visibility netting etc, to make the road passable to traffic.**

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 8 - ROAD SIGNS MAINTENANCE (at Bridge Approach)
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
1	**Cleaning, repair and replace damaged signs and supporting structures.**
2	**Notify and report unauthorised signs.**
3	**Inspect and submit yearly report on frangible post.**
4	**Repair damaged frangible posts.**
5	Inspect and submit yearly report on gantries.

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 9 - REFLECTIVE RAISED PAVEMENT MARKERS (RRPM) (On Bridge Deck)
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
1	**Replace dysfunctional and missing RRPM .**
2	**Realign the RRPM .**
3	**Replace the RRPM .**

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 10 - PAVEMENT MARKING (On Bridge Deck)
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
1	**Repaint non-compliant pavement markings .**
2	**Repaint all areas of wear or loss pavement markings.**

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 11 - KERBING FOR CARRIAGEWAY, TRAFFIC ISLAND, TURNING BAY, FOOTPATH, MOTORCYCLE LANE AND ACCESS (On Bridge Deck)
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
1	**Report all visible kerbs damage monthly.**
2	**Repair damaged kerbs.**
3	**Repaint all existing or new painted kerbing.**

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 12 - LONGITUDINAL BARRIER MAINTENANCE (On Bridge Deck)
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
1	**Secure damaged longitudinal barrier.**
2	**Clean or remove any grafiti, unauthorized markings, sign, posters, excessive build-up of dirt or soot.**
3	**Clean, repair or replace damaged longitudinal barrier and submit monthly report on confirmation of repairs.**

Appendix 3 - Routine Maintenance Works
(Related to Bridge works)

ITEM NO.	BRIEF DESCRIPTION OF WORKS
	OPM 13 - RAILING, HAND RAIL, AND PEDESTRIAN BARRIER MAINTENANCE (On Bridge Deck)
	The Company shall provide all labour, equipment, tools, materials, transport and whatever necessary for the execution of the works below:
1	**Secure damaged barriers.**
2	**Clean or remove any graffiti, unauthorized markings, sign, posters etc.**
3	**Clean, repair or replace damaged hand rail and pedestrian barrier and submit monthly report on confirmation of repairs.**

Penyenggaraan Pembentung




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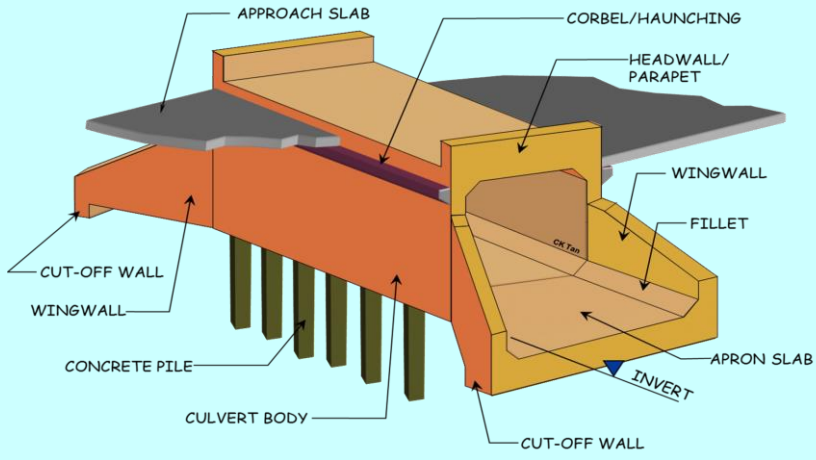
KOMPONEN PEMBENTUNG



TYPICAL 3D-VIEW OF CULVERT COMPONENTS

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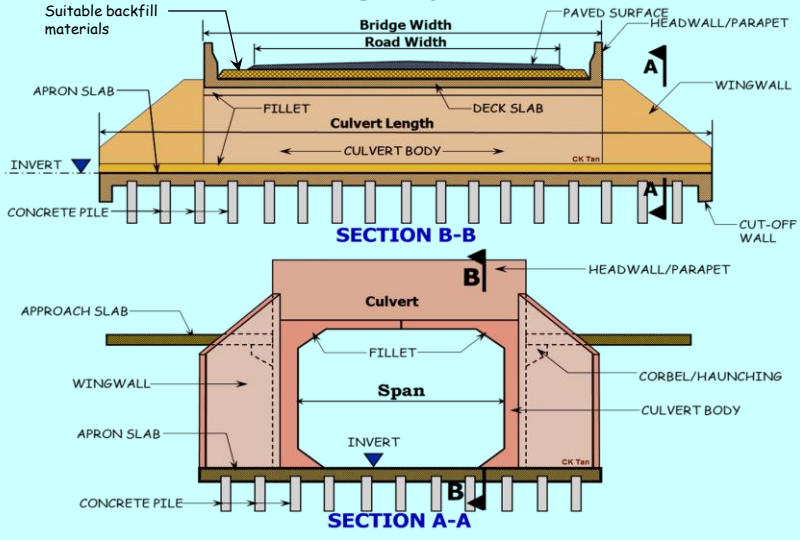


TYPICAL 3D-VIEW OF CULVERT COMPONENTS

Type of Culverts

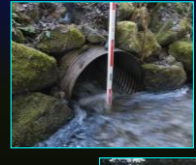
- Butt-ended Precast R.C. Pipe Culvert.
- Spigot And Socket Type Precast R.C. Pipe Culvert.
- Precast R.C. Box Culvert.
  Precast R.C. Bebo Arch Culvert
- Cast In Situ R.C. Box Culvert .
- Corrugated Metal Pipe Culvert.

Type of Culverts


Precast R.C. Box Culvert


Precast R.C. Box Culvert


Precast R.C. Box Culvert




CMP


Butt-ended Precast R.C. Pipe Culvert


Spigot & Socket Precast R.C. Pipe Culvert


Corrugated Metal Pipe (CMP) Culvert

Type of Culverts

Precast R.C. Bebo Arch Culvert

Cast In-situ R.C. Box Culvert

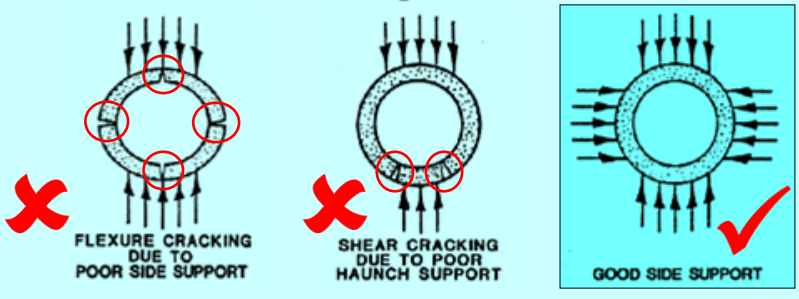
Culvert Installation Issue

- Constructed according to grade, size and type as per construction drawing.
- Alignment based on skew requirement at site.
- Gradient of flow according to design requirement (eg.1:200).
- Type of bedding and backfill materials.
- Road embankment profile. (eg. 1:1.5, 1:2)
- Precast culvert cell quality.
- Type of culvert joint.
- Butt joint width.
- Quality of sealing mortar, joint compound and rubber gasket.
- Inlet and outlet invert level.
- Inlet and outlet embankment quality including the protective system.

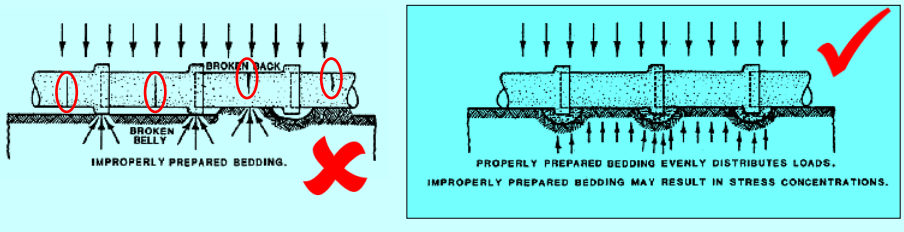
What to look for during inspection of Culvert?

- Look at the culvert invert for signs of abrasion/corrosion.
- Look for open or misaligned joints. Probe for voids behind open joints.
- Look for sign of settlement.
- Look for sedimentation.
- Look for blockage by debris, timber logs or vegetation.
- Look for cracking and spalling.
- Try to detect formation of voids in the embankment surrounding the pipe culvert with tapping of hammer.
- Look for evidence of fill materials inside the culvert that may have migrated through the open joints.
- Look for high water marks within the culvert.
- Look for sign of deformation.
- Look for sign of inadequate flow capacity.

Longitudinal Cracks at Pipe Culvert Caused by Wrong or Poor Compaction Process



Transverse Cracks at Pipe Culvert Caused by Wrong or Poor Compaction Process



Culvert Maintenance Strategies

Strategy	Objective	Work options
Routine maintenance	To keep a culvert in a uniform and safe condition by repairing specific defects as they occur.	• Debris and sediment removal. • Thaw frozen culverts.
Preventive maintenance	More extensive strategy than routine maintenance intended to arrest light deterioration and prevent progressive deterioration.	• Joint sealing. • Invert paving. • Concrete patching. • Scour prevention. • Ditch cleaning, repair. • Mortar repair.
Rehabilitation	Take maximum advantage of the remaining unusable structure in a culvert to build a reconditioned culvert.	• Repair of basically sound endwalls and wingwalls. • Repair of scour. • Invert paving. • Pave streambed. • Stabilize slope. • Install debris collector. • Add apron, cutoff wall. • Improve inlet configuration.
Upgrade to equal replacement	Upgrade to provide service that is equal to that provided by a new structure.	• Add, repair, or replace appurtenant structures. • Line the barrel. • Provide safety grates or safety barriers. • Lengthen the culvert.
Replacement	Provide a completely new culvert with a new service life.	Can be accompanied by: • Realignment. • Hydraulic structural and safety improvements. • Change in culvert shape or material.

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Contoh Pemasangan Debris Trap at Inlet

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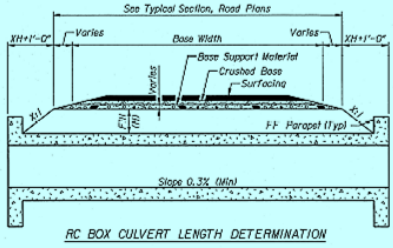
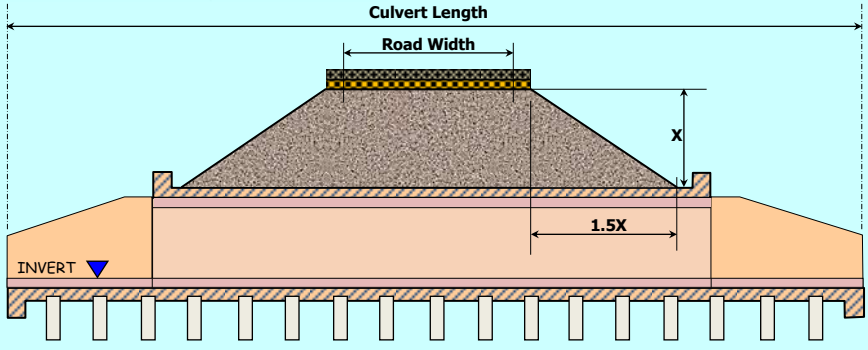
Cara Untuk Menentukan Panjang Pembentung



RC BOX CULVERT LENGTH DETERMINATION

Keberkesanan pembentung bergantungkan kepada:-

- Classification according to usage based on loading requirement.
- Type of bedding and backfill materials.
- Pipe diameter/Span as per discharge requirement of Q50.
- Effective length.



Typical Sectional View

Penyenggaraan Concrete Parapet dan Steel Railing

Penyenggaraan Concrete Parapet dan Steel Railing

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Type of Parapet

- Concrete new jersey parapet.
- Partial precast facial and partial cast in-situ concrete parapet.
- Masonry type parapet.
- Concrete base with steel railing.
- Aluminum steel railing.
- W-beam guard railing type.

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Type of Parapet




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Type of Parapet



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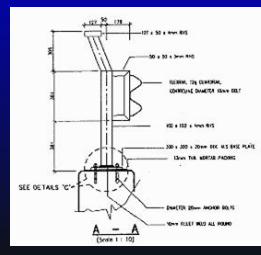
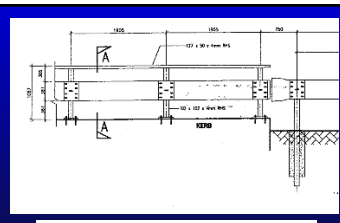
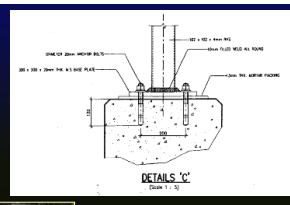
Type of Parapet







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What to look for during inspection of Parapet?

- Look for cracks, delamination and spalling.
- Look any sign of misalignment or tilting.
- Look paint deterioration and corrosion.
- Look for loose connection of nuts.
- Look for any collapse due impact of vehicles.
- Look for any loss of anchor bolts.
- Look for any missing members.
- Checking of the parapet height.

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Jenis Kerja Pembaikan dan Penyenggaraan Parapet?

- Cleaning with water jet to all contaminated surface of concrete parapet.
- Patching with shrinkage compensated mortar to all spalled surface.
- Sealing of all worn out expansion gap with polysulphide sealant.
- V-groove patching with shrinkage compensated mortar to all cracks.
- Repainting of all corroded steel railing members.
- Replacement of all collapsed steel railing caused by impact damage.
- Replacement of all lost and badly corroded bolts and nuts of steel railing.

Penyenggaraan Expansion Joint




Apakah yang anda perlu ketahui?




Operational Requirements for joints:-

- Possess good riding characteristics.
- Not a skid hazard or danger.
- Silent and vibration free.
- Be properly sealed and water tight.
- Capable of absorbing various types and range of movement ,vibration and loading without being extruded or expelled from its original position.
- Riding surface of joint must be able to withstand wear & tear and be durable against attack form any petroleum products.
- Facilities easy inspection, maintenance and repair.

Installation Issue

- Detail method statement.
- Detail drawing as per site condition.
- Detail Material Specifications.
- Material Test Reports.
- Traffic Management Plan (TMP).
- Supervision.
- Product Warranty.
- Full Detail Installation Report
- Transfer of technology.

Adakah warranty itu penting?

Cambridge Dictionary

A written promise from a company to repair or replace a product that develops a fault within a particular period of time, or to do a piece of work again if it is not satisfactory.

Warranty Issue

- Duration of warranty.
- Type of warranty.
- How to warrant the warranty.
- Default in not full filling the warranty.
- Penalty for not full filling the warranty.

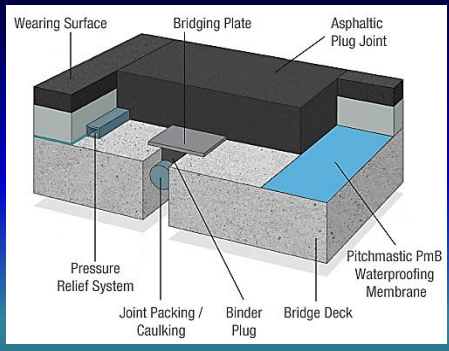
Contoh - Warranty Contents

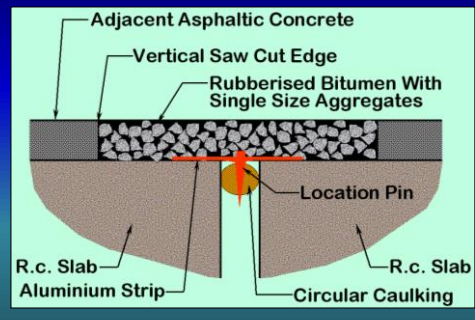
- All movement joints shall be warranted against all defects and malfunction from the date of completion of the installation.
- All defects occurring during the warranty period are to be made good by the Contractor or the manufacturer. The warranty is to be provided jointly and severally by the Contractor and the Manufacturer.

Maintenance Issue

- What type of maintenance shall be provided during the warranty durations?
- How the maintenance be carried out according to the method statement?
- What is the maintenance process?
- Which component is under replacement warranty?
- Which component is under wear and tear process?
- Who shall oversee the overall maintenance process?
- How many cycle of inspection shall be carried out per year?
- Who should be doing the reporting about the defects found?
- Who should verified the maintenance done?

Asphaltic Plug Joint



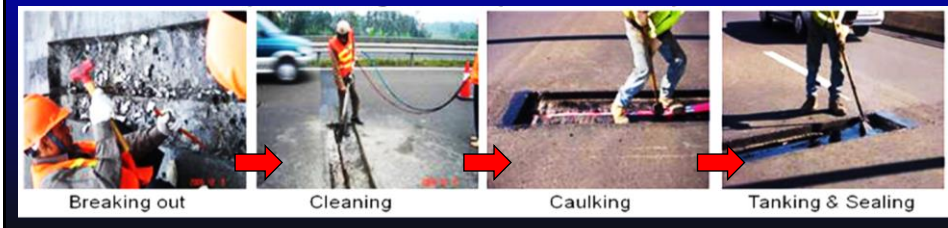


Typical 3D and Sectional View of Asphaltic Plug Joint

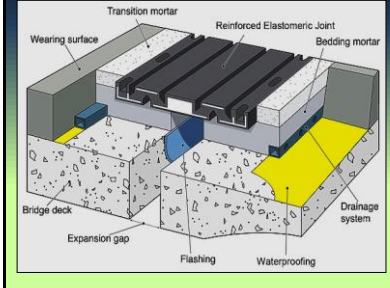
Asphaltic Plug Joint

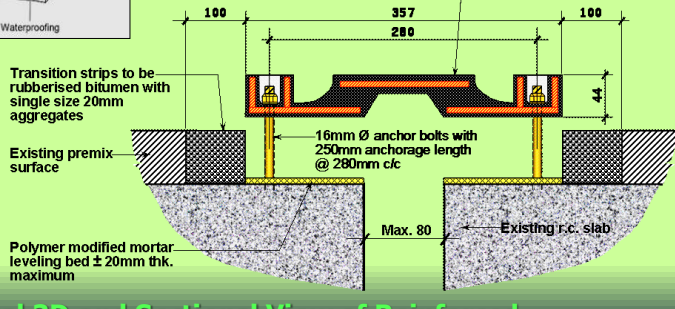
No	Type of Expansion Joint	Components	Type of defects	Causes of defects	Items to be considered prior to installation
1	Asphaltic Plug Joint	• Asphaltic Plug Joint Gap Plate • Circular Caulking • Locating Pin • Pressure Relief System (optional) • Binder coat	• Bleeding • Spalling • Settlement • Leaking • Longitudinal dan transverse Cracks • Debonding • Delamination • Rutting • Raveling • Shoving/Pushing • Segregation	• Poor mix proportion. • Poor surface preparation of the substrate. • Water intrusion. • Poorly cut adjacent premix. • Tension cracks caused by oversize expansion gap. • Reflective cracks caused by gap plate. • Loss of asphalt binder. • Loss of fine and coarse aggregates. • Un-control vehicle speed and breaking force.	• Installation Depth 50→75mm • Installation Width ± 500mm • Installation Length • Expansion Gap <50mm • Traffic Flow • Speed Limit • HGV Count (Similar to AADT) • Installation condition • Installation procedure • Working Temperature Range • Radius of Any Bend • Maximum Gradient • Maximum Skew Angle <25°

Asphaltic Plug Joint Replacement Sequence



Reinforced Elastomeric Joint





Typical 3D and Sectional View of Reinforced Elastomeric Joint

Reinforced Elastomeric Joint

No	Type of Expansion Joint	Components	Type of defects	Causes of defects	Items to be considered prior to installation
2	Reinforced Elastomeric Joint	• Reinforced Elastomeric Joint • Transition Epoxy Mortar • Anchor Bolts • Polymer Modified Bedding Mortar • Rubberised Anchor Bolt Cap • Flashing (optional) • Drainage System (optional)	• Wearing of elastomer top surface • Rupture and tear-off • Delamination of elastomer/ metal plate interface • Exposed reinforce plates • Loosen anchor bolts • Corrosion of anchor bolts • Breaking and cracking of transition epoxy mortar • Joint lift caused anchor bolt failures • Water leak • Anchor bolt cover pad missing • Debris in the grooves	• Poor mix proportion of transition epoxy mortar. • Poor installation of anchor bolts. • Poorly cut adjacent premix. • Wrong finished level of elastomer and transition epoxy mortar • Tension cracks of elastomeric runner caused by oversized expansion gap. • Unchecked defective products. • Debonding of transition epoxy mortar. • Poor surface preparation of the substrate for bedding mortar. • Debris restrict joint movement. • Un-control vehicle speed and breaking force.	• Installation Depth 40→110mm • Installation Width 500→1100mm • Installation Length usually 1000mm/module • Expansion Gap 80→200mm • Anchor bolt length 250→330mm • Finished level of elastomer and transition epoxy mortar • Traffic Flow • Speed Limit • HGV Count (Similar to AADT) • Installation condition • Radius of Any Bend • Maximum Gradient • Maximum Skew Angle <25°

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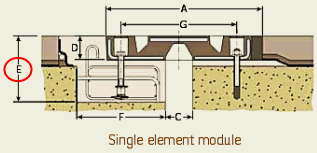
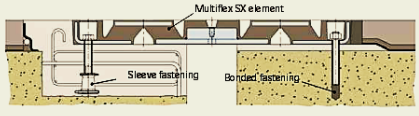
Reinforced Elastomeric Joint

Technical data sheet

There are two different designs, the single module joint and the bridged joint. They have different movement capacities.



Single element module



Double element module

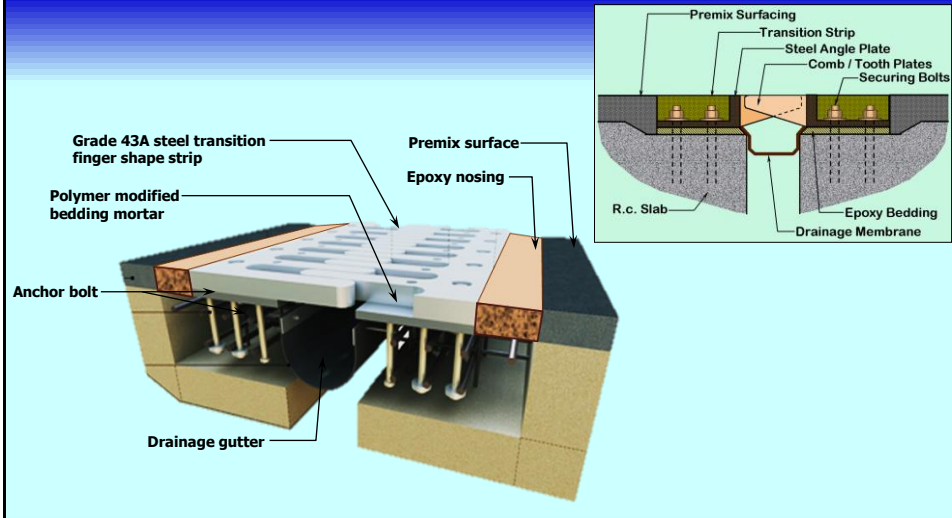
Type	Design	Movement	Dimensions							Weight of one element (kg/m)
			Length	A	D	G	C	E	F	
SX 80	single	±40	2000	275	42	220	50	195	213	27
SX 100	single	±50	2000	355	46	280	60	200	238	35
SX 120	single	±60	2000	390	53	300	70	190	257	29
SX 160	single	±80	2000	470	78	370	90	200	288	87
SX180	single	±90	2000	500	82	400	100	210	298	96
SX 200	double	±100	2000	895	60	795	110	220	452	128
SX 220	double	±110	2000	800	69	700	120	230	400	152
SX 250	double	±125	2000	1040	69	940	135	230	512	244
SX 270	double	±135	2000	890	78	790	150	245	431	179
SX 320	double	±160	1250	1275	82	1165	220	320	588	244
SX 350	double	±175	1000	1105	100	980	220	335	502	318

Dimensions in mm

Prepared and presented by : Tan Chee Kean 93

Reinforced Elastomeric Joint

Cantilever Comb Or Tooth Joint



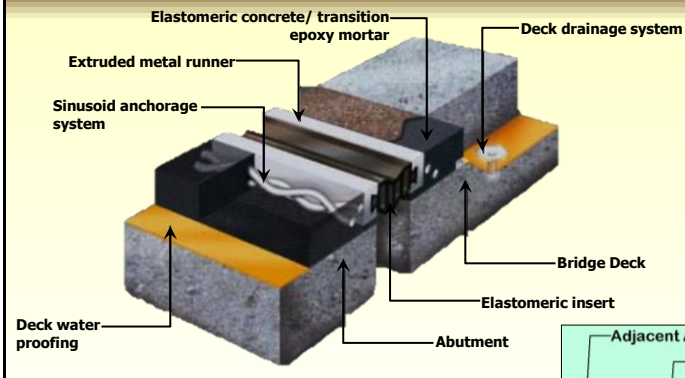
Typical 3D and Sectional View of Cantilever Comb Or Tooth Joint

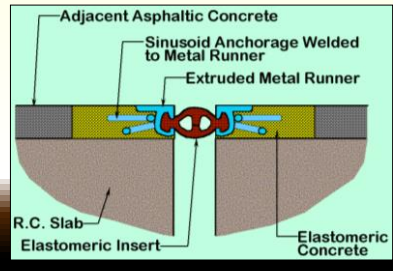
Cantilever Comb Or Tooth Joint

No	Type of Expansion Joint	Components	Type of defects	Causes of defects	Items to be considered prior to installation
1	Cantilever Comb Or Tooth Joint	• Grade 43A steel transition finger shape strip • Anchor bolt • Epoxy nosing • Drainage gutter • Polymer Modified Bedding Mortar (needed as per site condition)	• Steel transition finger broken or fracture • Loosen anchor bolts • Corrosion of anchor bolts • Breaking and cracking of transition epoxy mortar • Water leak • Debris in the grooves and gutter	• Poor mix proportion of transition epoxy mortar. • Poor installation of anchor bolts. • Poorly cut adjacent premix. • Wrong finished level of steel strip finger. • Unchecked defective products. • Debonding of transition epoxy mortar. • Poor surface preparation of the substrate for bedding mortar. • Debris restrict joint movement.	• A special and pre-designed of bridge deck where the joint seated • Installation Depth • Installation Length • Installation Width • Expansion Gap • Module Width and Length • Anchor bolt size and length • Installation procedure • Radius of Any Bend • Maximum Gradient • Maximum Allowable Skew Angle

Cantilever Comb Or Tooth Joint

Elastomeric Elements In Metal Runners Joint





Typical 3D and Sectional View of Elastomeric Elements In Metal Runners Joint

Elastomeric Elements In Metal Runners Joint

No	Type of Expansion Joint	Components	Type of defects	Causes of defects	Items to be considered prior to installation
1	Elastomeric Elements In Metal Runners Joint	• Elastomeric concrete • Deck drainage system(optional) • Sinusoid anchorage system • Extruded metal runner • Elastomeric insert • Deck water proofing	• Rupture of elastomeric insert • Delamination, spalling breaking and cracking of transition epoxy mortar • Water leak • Debonding form adjacent premix • Debris in the grooves	• Poor mix proportion of transition epoxy mortar. • Poor installation of sinusoid anchorage system. • Poorly cut adjacent premix. • Wrong finished level of extruded metal runner • Unchecked defective products. • Poor surface preparation of the substrate for bedding mortar. • Debris restrict joint movement. • breaking force.	• A special and pre-designed of bridge deck where the joint seated • Installation Depth • Installation Length • Installation Width • Expansion Gap • Module Width and Length • Installation procedure • Radius of Any Bend • Maximum Gradient • Maximum Allowable Skew Angle

Repair Process for Elastomeric Elements In Metal Runners Joint




Kandungan Laporan Pemeriksaan Kejadian

- **Pastikan data-data atau maklumat berikut terkandung dalam penyediaan laporan kerosakan:-**
  - Structure number
  - Date and time of occurrence
  - Inspector Name
  - Type of defects
  - Related photographs
  - Dimensional sketches


Terima Kasih
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