

Highway Asset Preservation Performance Measures for Highway Concessions



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Highway Asset Preservation Performance Measures for Highway Concessions

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APPENDIX Terminology and Interpretation

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1 GENERAL REQUIREMENTS

1.1 Description

The scope of the Concession includes the provision of all products and services associated with the management, planning and delivery of maintenance and rehabilitation activities for the Concession Highway.

Fundamental to the concept, of performance-based supply, is the need for a co-operative, well-managed approach by the contracted parties that ensures all major Concession objectives are consistently monitored and met. In order to achieve this, the Concessionaire is required to develop and implement an ISO certified Quality Management System (QMS) that documents the processes and procedures used to achieve the Asset Preservation Performance Measures (APPMs) detailed in this document.

The Ministry Representative will review the Concessionaire's systems, procedures and records and may inspect the Assets. The Ministry may contract, at its cost, with an independent party to conduct formal inspections of the Concessionaire's performance, annually or as otherwise required by the Ministry Representative. The Ministry quality audit reviews and any commissioned inspections and reviews will provide a direct input into the Ministry's quality audit program for assessing compliance.

The Concession includes all costs to:

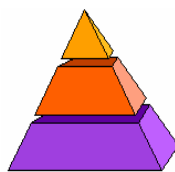
- Maintain and operate the Assets to the minimum contracted standard;
- Rehabilitate the assets to maintain value in perpetuity;
- Manage the integrity of the Assets through a cost effective long term maintenance and rehabilitation strategy;
- Conduct annual asset condition surveys and inspections;
- Provide identification, programming, prioritization and delivery of maintenance and rehabilitation services; and
- Services necessary to achieve the specified Performance Measures.

Innovation is strongly encouraged under the Concession. The Concessionaire is expected to develop innovative ways of providing the Services to achieve the specified outcome.

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1.2 Performance Measures

The Concession will be operated under a performance based Concession Agreement that consists of three levels of Performance Measures, which underpin the technical objectives and outcomes. These include:



- Level 1 – Key Performance Measures (Level of Service)*
- Level 2 – Asset Preservation Performance Measures (Asset Management)*
- Level 3 – Operational Performance Measures (Maintenance Management)*

1.2.1 Level 1 - Key Performance Measures

Key Performance Measures (KPMs) provide principle outcomes in the management of the Concession Agreement and delivery of professional services in the various key performance areas.

1.2.2 Level 2 - Asset Preservation Performance Measures

Asset Preservation Performance Measures (APPMs) define the minimum performance criteria for individual assets during the term of the Concession, with which the Concessionaire must comply. The Concessionaire is required to maintain the road assets to achieve the desired levels of service and maintain or limit the extent of asset consumption. The overriding requirement is to achieve asset preservation that ensures that individual assets are well maintained and achieve or exceed their design life expectations. Assets that have a design life of less than the term of the Concession are to be rehabilitated to ensure that the minimum condition as specified is maintained or exceeded at all time.

1.2.3 Level 3 - Operational Performance Measures

Operational Performance Measures (OPMs) define the minimum performance criteria for individual assets and corridor management requirements. These reflect the Highway Users expectations about the day-to-day serviceability for which the Concessionaire must comply with specified standards and response time requirements.

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1.3 Technical Objectives and Outcomes

Key Performance Measures are set under each asset category but over-riding these, is the primary objective of ensuring the technical success of the Concession through:

- Providing a safe and efficient highway with the highest level of availability to highway users and which satisfies stakeholder expectations;
- Achieving the specified Performance Measures;
- Improving the quality of the highway through improvement in delivery methods.
- Accepting and managing risk;
- Leading the industry in introducing and testing innovative methods and practices;
- Establishing and promoting a co-operative culture which recognizes the aspirations of the Ministry, Highway Users and the Concessionaire; and
- Mitigating against the effects of traffic growth.

1.4 Preventive Maintenance

Proactive preventative maintenance is considered to be in the best interests of both the Ministry and the Concessionaire. Timely and effective measures focused on minimizing consequential damage, inconvenience to the highway users and future costs, are strongly encouraged by the Ministry. It is envisaged such work may include coatings or protective systems to enhance structure durability, clearing culvert inlets and outlets, gravity retention walls, horizontal drainage of slips, diverting of surface water away from areas of instability, soil conservation planting, the use of geotextiles, rip rap protection and in stream channel works.

1.5 Asset Information

Information relating to the extent and condition of the existing assets is contained in the Concession Agreement and Data Room.

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2 KEY PERFORMANCE MEASURES

2.1 General

Key Performance Measures (KPMs) are a set of outcome criteria, against which the Concessionaire's performance is measured. KPMs include measures relating to the management of the Concession and delivery of Asset Management.

2.2 Asset Management

The Concessionaire is required to develop and implement Asset Management practices to limit or maintain the extent of asset consumption, while achieving the Key Performance Measures listed in the following tables. The overriding objective is to preserve the current value, of the individual assets, by maintaining structural integrity during the term of the Concession. Assets that have design lives expiring within the term of the Concession are to be rehabilitated to restore structural capacity and to provide the required level of service.

Sections 2.2.1 to 2.2.6 specify the Key Performance Measures for each major asset category. These KPMs focus on the outcomes derived from implementing appropriate Asset Management practices.

2.2.1 Highway Running Surfaces KPMs

Table 2.2.1: Highway Running Surfaces KPMs	
Item	Key Performance Measure
a. Paved Highway Traffic Lanes	<ul style="list-style-type: none">• Ensure paved highway traffic lanes are safe (free of hazards) and available.• Ensure access at all times for all legal and permitted vehicles.• No traffic delays.• Provide two-way, two-lane access at all times.• Provide acceptable riding comfort for Highway Users.
b. Paved Shoulders	Ensure shoulders are safe and available.
c. Paved Medians	Ensure medians are fully functional, tidy and free-draining.
d. Paved Pullouts & Rest Stop Areas	Ensure pullouts and rest stop areas are safe and available.
e. Paved Entrance/Exit Ramps	Ensure entrance / exit ramps are safe and available.

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Item	Key Performance Measure
f. Paved and Gravel Side Roads	<ul style="list-style-type: none"> • Ensure gravel side roads are safe and available. • Ensure unlimited vehicle usage and access, at all times, for all legal and permitted vehicles. • No traffic delays. • Provide a minimum of two-way, two-lane access at all times. • Provide acceptable riding comfort for Highway Users. • Ensure minimal dust on gravel roads.
g. Management	<ul style="list-style-type: none"> • Ensure inspection, condition survey and updating of the Ministry Highway Pavement Management System (RPMS) is complete and accurate. • Ensure programming of physical works is complete and based upon long term focus. • Ensure best practices and continual improvement are applied.

2.2.2 Bridges and Major Retaining Walls KPMs

Item	Key Performance Measure
Bridges (including decks)	
a. Structure Condition and Function	<ul style="list-style-type: none"> • Ensure that design levels are maintained so that the passage of legal heavy commercial vehicles is not restricted. • Ensure all bridge structures remain safe and functional at all times for the travelling public.
b. Side Protection	Ensure that side protection has adequate strength and is appropriately positioned to provide safe access over the bridge throughout the duration of the Concession.
c. Structure Risk	Manage the probability and consequence of failure throughout the duration of the Concession.
d. Physical Environment	Maintain or enhance the waterway and fisheries features and requirements as existing or set by current permits at each bridge site throughout the duration of the Concession.
e. Management	<ul style="list-style-type: none"> • Ensure inspection, condition survey and updating of the Ministry Bridge Management Information System (BMIS) occurs and is complete and accurate. • Ensure programming of physical works is complete and based upon long term focus. • Ensure best practices and continual improvement are applied.

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Table 2.2.2: Bridges and Major Retaining Walls KPMs	
Item	Key Performance Measure
Major Retaining Walls	
f. Structure Condition and Function	<ul style="list-style-type: none"> • Ensure that there are no impediments to the passage of legal heavy commercial vehicles. • Ensure walls remain safe and functional at all times.
g. Management	Ensure inspection, condition survey and updating of the Ministry BMIS is complete and accurate.
River Protection	
h. Structure Condition and Function	Ensure the existing highway cross-section and traffic lane widths are not reduced throughout the duration of the Concession.
i. Structure Risk	Manage the probability and consequence of failure throughout the duration of the Concession.
j. Management	<ul style="list-style-type: none"> • Ensure inspection, condition survey and updating of the Ministry BMIS is complete and accurate. • Ensure programming of physical works is complete and based upon long term focus. • Ensure best practices and continual improvement are applied.

2.2.3 Major Culverts and Tunnels KPMs

Table 2.2.3: Major Culverts and Tunnels KPMs	
Item	Key Performance Measure
Major Culverts	
a. Structure Condition and Function	<ul style="list-style-type: none"> • Ensure there are no load limitations, either in terms of weight or speed, which compromise the passage of legal heavy commercial vehicles. • Ensure all major culverts remain safe and functional at all times.
b. Structure Risk	Manage the probability and consequence of failure throughout the duration of the Concession.
c. Physical Environment	Maintain or enhance the waterway/fisheries features and requirements as existing or set in current permits at each major culvert site throughout the duration of the Concession.
d. Management	<ul style="list-style-type: none"> • Ensure inspection, condition survey and updating of the Ministry BMIS is complete and accurate • Ensure programming of physical works is complete and based upon long term focus. • Ensure best practices and continual improvement are applied.

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Table 2.2.3: Major Culverts and Tunnels KPMs	
Item	Key Performance Measure
Tunnels	
e. Structure Condition and Function	<ul style="list-style-type: none"> • Ensure that design levels are maintained so that the passage of legal heavy commercial vehicles is not restricted. • Ensure tunnels remain safe and functional at all times for the travelling public.
f. Structure Risk	Manage the probability and consequences of failure throughout the duration of the Concession.
g. Physical Environment	Ensure Highway User comfort requirements at each site are maintained or enhanced throughout the duration of the Concession.
h. Management	<ul style="list-style-type: none"> • Ensure inspection, condition survey and updating of the Ministry BMIS is complete and accurate. • Ensure programming of physical works is complete and based upon long term focus. • Ensure best practices and continual improvement are applied.

2.2.4 Major Sign Structures KPMs

Table 2.2.4: Major Sign Structures KPMs	
Item	Key Performance Measure
a. Structure Condition and Function	Ensure major overhead sign structures remains functional and safe throughout the duration of the Concession.
b. Management	<ul style="list-style-type: none"> • Ensure inspection, condition survey and updating of the Ministry BMIS is complete and accurate. • Ensure programming of physical works is complete and based upon long term focus. • Ensure best practices and continual improvement are applied.

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2.2.5 Drainage and Debris Control Structures KPMs

Table 2.2.5: Drainage and Debris Control Structures KPMs	
Item	Key Performance Measure
a. On Highway This subset includes curbs and gutters, catch basins/sumps and the grates.	To minimize the encroachment of surface water (flowing or ponding) on the highway running surface ensuring road user safety is not compromised. The level of service existing at the commencement of the Concession is to be maintained or enhanced throughout the duration of the Concession.
b. Adjacent Highway This subset includes drainage ditches (lined and unlined), spillways, flumes and all applicable drains.	To minimize the encroachment of surface water collected from the highway and adjacent ground onto the highway running surface and ensure that the highway/highway users are not at risk from scour and/or slope failures. The assets in this subset may require additional capacity to accommodate ice, snow and debris accumulation from natural and snow plough processes being the Concessionaire's responsibility. The level of service existing at the commencement of the Concession is to be maintained or enhanced throughout the duration of the Concession.
c. Under Highway This subset includes culverts less than 3.0 metres, horizontal drains, fish passage features and subsoil systems (pipes or filter layers) to control groundwater.	To convey surface and ground water under the highway without putting the highway and highway users at risk and to meet environmental requirements. The assets in this subset may need to include additional capacity for ice, snow and debris loadings and this is the Concessionaires responsibility. The level of service existing at the commencement of the Concession is to be maintained or enhanced throughout the duration of the Concession.
d. Debris Torrent Structures	To minimize encroachment of flood borne debris onto the traffic way and limiting its effects on highway features and associated structures. The level of service existing is to be maintained or enhanced throughout the duration of the Concession.

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Item	Key Performance Measure
e. Management	<ul style="list-style-type: none">• Ensure drainage and debris control structures inspection, condition survey and updating of the Ministry Roadway Inventory and Maintenance System (RIMS) is complete and accurate.• Ensure programming of physical works is complete and based upon long term focus.• Ensure best practices and continual improvement are applied.

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2.2.6 Electrical Systems KPMs

Table 2.2.6: Electrical Systems KPMs	
Item	Key Performance Measure
a. General	<ul style="list-style-type: none"> Attain 100% compliance with Provincial and Federal electrical safety standards. Ensure a safe, efficient and fully functional electrical system.
b. Lighting	Achieve, as a minimum, the Provincial standards and be consistent with the provincial highway network.
c. Signs	<ul style="list-style-type: none"> Ensure safe, efficient and fully functional signs. Ensure signs are up-to-date and display accurate messages.
d. Traffic Signals	Ensure traffic signals are functional and serviceable.
e. Tunnel and Snowshed Lighting	Ensure safe, efficient and fully functional snow tunnel lighting.
f. Weather Stations	<ul style="list-style-type: none"> Provision of enhanced winter management. Advise highway users and maximise availability of route.
g. Island Flashers	Achieve as a minimum the Provincial standards and be consistent with all the provincial highway network (including future changes to standards).
h. Roadside Facilities This subset includes Rest Areas, Brake check areas, maintenance yards and gravel pits.	Ensure electrical systems of roadside facilities are functional and serviceable
i. Asset Inventory	Maintain an up-to-date electrical asset inventory.
j. Management	<ul style="list-style-type: none"> Ensure programming of physical works is complete and based upon long term focus. Ensure best practices and continual improvement are applied.

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3 ASSET PRESERVATION PERFORMANCE MEASURES

3.1 General

Asset Preservation Performance Measures (APPMs) reflect the overall condition of the Assets of the maintained corridor. The Concessionaire must comply with these measures throughout the term of the Concession at all times.

Table 3.1 outlines the major categories and sub-categories of the APPMs.

Table 3.1: Asset Preservation Performance Measures

Number	Measure	Reference
1	Highway Running Surfaces	Table 3.2.3
2	Structures including: <ul style="list-style-type: none">• Bridges and Major Retaining Walls• Major Culverts and Tunnels• Major Sign Structures	Table 3.3.4
3	Drainage and Debris Control Structures	Table 3.4.4
4	Electrical Control Systems	Table 3.5.2

The APPMs are based on current levels of service established by the Ministry, as determined from road asset condition assessments, performance monitoring, delivery methodologies, and management functions within infrastructure management systems.

APPMs have been developed for each asset category based on the specific requirements associated with each asset type. A standardized format, for the measures, has been adopted for consistency and presentation purposes. Elements of the measures include:

- Feature;
- Asset Preservation Performance Measure;
- Minimum Condition;
- Maximum Response Time; and
- Basis of Measure.

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3.2 Highway Running Surfaces

3.2.1 General

Consistent with a three level approach, standards and performance measures are set to ensure the application of sound asset preservation practices. Given that Highway Running Surfaces and pavements have a relatively short-term life cycle, then measures are targeted to ensure:

- Access and functionality;
- Structurally sound and safe asset condition; and
- No or limited consumption, over time, of the pavement assets.

The APPMs specified herein, provide the outcome emphasis required and focus on three key measures:

- Pavement Roughness;
- Pavement Surface Deterioration; and
- Pavement Rutting.

These measures effectively represent investigation levels for monitoring, maintaining, and reporting asset performance. The measures are consistent with the Ministry's pavement condition rating procedures, condition indices and reporting as per the Roadway Pavement Management System (RPMS) program. Asset condition data obtained from annual pavement condition inspections provides the basis for the performance criteria.

The APPMs are applied to the following Highway Running Surfaces:

- Paved highway traffic lanes;
- Paved shoulders;
- Paved medians; and
- Paved pullouts/rest stop areas/side roads/ entrance and exit ramps.

The Highway Running Surface asset management cycle includes:

- Inspection at the specified interval;
- Rating the condition of the surfaces;
- Programming treatments;

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- Undertaking physical remedial works;
- Inventory updating; and
- Reporting achievements.

These phases are fundamental to maintaining the asset and are consistent with the Province-wide approach that is required.

The Concessionaires delivery of services must be based upon:

- Emphasis on the availability of safe driving conditions across a range of relevant condition measures;
- Outcome based specifications with the Concessionaire given the latitude for treatment selection to control/correct defective condition as per the material requirements defined in the *Highway Maintenance Specifications for Highway Concessions*;
- A life cycle approach to maintenance and rehabilitation is encouraged and in conformance with the performance measures as set;
- Emphasis on program delivery of confirming condition within the prescribed standards and performance measures set on an ongoing basis;
- A mechanism for the Ministry to correct default if the Concessionaire fails to meet the condition criteria on an ongoing basis; and
- That there is a quality management process underpinning the delivery of services.

3.2.2 Asset Condition Data Collection

The Concessionaire is responsible for collecting annual pavement condition data for the purposes of asset management and measuring performance achievement.

The annual data collection is required to be conducted in accordance with Ministry specifications for network level automated pavement surface condition surveys.

All collected data must be provided to the Ministry for input into their pavement management system as per the prescribed Ministry specified data file formats.

3.2.3 Asset Preservation Performance Measures

The Concessionaire is required to comply with the measure criteria including, minimum condition and maximum response times set out in Table 3.2.3.

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Note that in Table 3.2.3 the following abbreviation is used:

- AM - The Concessionaire is required to measure the condition for all traffic lanes, paved pullouts, stop areas, side roads, entrance and exit ramps lanes on an annual basis.

The APPMs presented are in addition to the operational condition requirements as set by the Ministry *Highway Maintenance Specifications for Highway Concessions* and the *Local Area Specifications*.

The Concessionaire must demonstrate through their Quality Management System, the process to achieve the specified outcome.

The asset preservation measures for the main paved traffic lanes are based on maintaining the condition of the pavements consistent with other similar Provincial highways.

Cumulative distributions for roughness, surface deterioration and rutting, have been developed to define the minimum acceptable limits of condition (see Concession highway Local Area Specifications). The Concessionaire is required to maintain the pavements at these condition levels throughout the term of the Concession.

The measures generally use high speed data results, which are reported at 50 metre intervals along the paved travel lane. While these provide an indication of measured condition, field condition verification is required to confirm the condition indicated prior to treatment selection. Where the high speed data condition indication is not reflected on the pavement travel lane, the Concessionaire must provide evidence that the required condition has been achieved.

3.2.4 References and Clarification

The Ministry's *Highway Maintenance Specifications for Highway Concessions* and the *Local Area Specifications* as relevant to pavements apply in full. Other specific references include:

- Ministry Standard Specifications for Highway Construction;
- Ministry Pavement Surface Condition Rating Manual (2002);
- Ministry Pavement Distress Index Model; and
- Ministry Pavement Management System condition data file formats.

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Table 3.2.3 Highway Running Surfaces					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
Paved Traffic Lanes Roughness	RS1	Where roughness exceeds an IRI value of 2.5 over any 50-metre length of traffic lane, excluding concrete bridge deck wearing surface, but including abutments.	1) Confirm that high speed data reflects actual site conditions; 2) Where roughness is confirmed, undertake Physical Works to address non-compliance.	12 months	Longitudinal profile roughness measurements, expressed as International Roughness Index (IRI), collected for each wheel-path as per Ministry survey specifications and averaged. AM
	RS2	Where roughness over any traffic lane exceeds the percent of road lane length limits shown in the Concession Local Area Specification - Cumulative Distribution Curve for IRI.	Undertake Physical Works to address non-compliance.	12 months	
Paved Traffic Lanes Surface Deterioration	RS3	Where pavement surface deterioration, over any traffic lane, exceeds the limits shown in the Concession Local Area Specification - Cumulative Distribution Curve for PDI.	Undertake Physical Works to address non-compliance.	12 months	Pavement surface distress ratings performed in accordance with the Ministry <i>Pavement Surface Condition Rating Manual</i> and the Pavement Distress Index (PDI) calculated according to the Ministry Pavement Distress Index model. AM

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Table 3.2.3 Highway Running Surfaces					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
Paved Traffic Lanes Rutting	RS4	Where pavement rutting deterioration exceeds 20 mm in depth for any 50-metre length of traffic lane.	Undertake Physical Works to address non-compliance.	12 months	Transverse profile roughness measurements, expressed as calculated rut depth in millimetres for each wheel path as per the Ministry survey specifications and averaged.
	RS5	Where rutting exceeds the limits shown in the Concession Local Area Specification - Cumulative Distribution Curve for rutting.	Undertake Physical Works to address non-compliance.	12 months	AM
Paved Shoulders Surface Deterioration	RS6	Where pavement surface deterioration exceed a PDI value of 7.0 over any 50-metre length.	Undertake Physical Works to address non-compliance	12 months	Pavement surface distress ratings performed in accordance with the Ministry <i>Pavement Surface Condition Rating Manual</i> and the Pavement Distress Index (PDI) calculated according to the Ministry Pavement Distress Index model. AM
Paved Medians Surface Deterioration	RS7	Where pavement surface deterioration exceeds a PDI value of 7.0 over any 50-metre length.	Undertake Physical Works to address non-compliance	12 months	Pavement surface distress ratings performed in accordance with the Ministry <i>Pavement Surface Condition Rating Manual</i> and the Pavement Distress Index (PDI) calculated according to the Ministry Pavement Distress Index model. AM

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Table 3.2.3 Highway Running Surfaces				
Asset Preservation Performance Measure	Intervention Criteria	Action	Maximum Response Time	Basis of Measure
Paved Side Roads and Ramps Roughness	RS8	Roughness over any paved side roads, entrance and exit ramps lanes are not to exceed an IRI value of 2.5 for any 50-metre length.	1) Confirm that high speed data reflects actual site conditions; 2) Where roughness is confirmed, undertake Physical Works to address non-compliance	12 months Longitudinal profile roughness measurements, expressed as International Roughness Index (IRI), collected for each wheel-path as per Ministry survey specifications and averaged. Pavement surface distress ratings performed in accordance with the Ministry <i>Pavement Surface Condition Rating Manual</i> and the Pavement Distress Index (PDI).
Paved Pullouts, Rest Stop Areas, Side Roads and Ramps Surface Deterioration	RS9	Pavement surface deterioration over any paved pullouts, rest stop areas, side roads, entrance and exit ramps lanes are not to exceed a PDI value of 7.0 for any 50-metre length.	Undertake Physical Works to address non-compliance.	12 months Transverse profile roughness measurements, expressed as calculated rut depth in millimetres for each wheel path as per Ministry survey specifications and averaged.
Paved Pullouts, Rest Stop Areas, Side Roads and Ramps Rutting	RS10	Pavement rutting deterioration over any paved pullouts, rest stop areas, side roads, entrance and exit ramps lanes are not to exceed 20 mm in depth for any 50-metre length of traffic lane length	Undertake Physical Works to address non-compliance.	12 months AM

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3.3 Structures

3.3.1 General

The APPMs for Structures are targeted to ensure:

- Public and structure safety;
- Structure functionality is at an acceptable level; and
- Structure asset consumption is limited.

Using these factors as the basis, standards and performance measures are set to ensure sound asset management practices are applied for:

- Bridges and Major Retaining Walls;
- Major Culverts and Tunnels; and
- Major Sign Structures.

Given that the Structures have a relatively long-term life cycle (greater than the potential term of the Concession), it is recognised that some asset consumption may occur. It is also recognised that some components of the bridge structures have a relatively short-term life cycle and asset preservation practices will need to be applied not only to meet network serviceability but also to encourage good custodianship and limit asset consumption.

The APPMs developed specifically for Structures are based upon the Ministry's bridge condition rating procedures and performance reporting in terms of the Bridge Management Information System (BMIS) program. Asset condition data obtained from Structure condition inspections provide the input to these measures. The measures have been categorized into the following intervention types:

- Limit Asset Consumption;
- Serviceability; and
- Reactive Response.

These interventional types represent asset consumption progression and reflect the stages for monitoring, managing and reporting asset performance for Structures to ensure that proactive asset management is undertaken.

Table 3.3.1 shows schematically how the APPMs for structures are applied to the following levels of asset management:

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Table 3.3.1: Structures APPM Hierarchy

Structure Sub-Category	Level	Structure Feature	Performance Measure	Intervention Type
<ul style="list-style-type: none"> - Bridges - Major Retaining Walls - Major Culverts and Tunnels - Major Sign Structures 	1	Components	Component Condition Rating	<ul style="list-style-type: none"> • Limit Asset Consumption • Serviceability • Reactive
	2	Structure	Structure Condition Index	<ul style="list-style-type: none"> • Limit Asset Consumption • Serviceability
	3	Stock	Stock Condition Index	<ul style="list-style-type: none"> • Serviceability
	4	Network Components	Extent of Network Component Condition	<ul style="list-style-type: none"> • Limit Asset Consumption • Serviceability

1. **Component** – measures reflect the component condition within the Structure (i.e. all deck joints or bearings for a Structure). The Component Condition Rating is calculated for each component type, in accordance with the process described in the BMIS Data Dictionary.
2. **Structure** – measures reflect the Structure condition as a whole (i.e. a bridge or a major culvert), including all associated components. The Structure Condition Index is calculated, for each Structure, in accordance with the process described in the BMIS Data Dictionary.
3. **Stock** - measures reflect the condition of all common structures by sub-category (i.e. all bridges or all major signs) within the Concession. This overall composite performance measure is termed “Stock Condition Index” and is calculated in accordance with Section 4.0. The condition criteria requirements limit the severity of defects, within each structure sub-category, with emphasis on serviceability.
4. **Network** – measures reflect the network asset condition in terms of various condition criteria across the Concession. Using BMIS inventory and inspection rating data, acceptability criteria for compliance has been defined.

The Structures asset management cycle is fundamental to maintaining structural integrity and consistency with the Province wide approach that is required. Elements of the cycle include:

- Inspection at the specified interval;
- Rating the condition of the structure and elements;
- Inventory updating;
- Programming correction of deficiency;
- Undertaking remedial works; and

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- Reporting achievements

The delivery of services is based upon:

- Emphasis on public and structure safety for the period of the Concession;
- Outcome based specification with the Concessionaire given the latitude for treatment selection to control/correct defective condition as per the material requirements defined in the *Highway Maintenance Specifications for Highway Concessions*
- A life cycle approach to maintenance and rehabilitation in conformance with the performance measures set is encouraged;
- A preventive rather than reactive maintenance/repair strategy is encouraged to limit asset consumption with inspections recommended to facilitate this strategy;
- Emphasis on program delivery of confirming condition within the prescribed standards and performance measures set on an ongoing basis;
- There being a Bridge Structural Engineer nominated to take ownership for the bridge structure assets and the bridge structure management cycle;
- A mechanism for the Ministry to correct default if the Concessionaire fails to meet the condition criteria on an ongoing basis; and
- An effective quality management system.

The Concessionaire has full responsibility for all the remediation activities, including structure replacement should that be required.

Operational standards are detailed in the *Highway Maintenance Specifications for Highway Concessions*, in terms of performance criteria expressed as either intervention levels or response times.

3.3.2 Asset Condition Data Collection

The Concessionaire is responsible for collecting structure condition data for the purposes of asset management and for measuring performance achievement.

Data collection is required to be conducted in accordance with Ministry specifications for the BMIS.

All relevant data is to be, provided to the Ministry for, input into the corporate bridge information management system according to Ministry prescribed BMIS data file formats.

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The Concessionaire will also undertake structure inspections (i.e. in addition to the highway and flood control inspections) following *Significant Natural Events* that affect the Structure sub-categories. Significant Natural Events include but are not be limited to the following:

- Earthquake;
- Rain Storm; and
- Snow.

Refer to the *Local Area Specifications* for criteria defined for the above listed Significant Natural Events.

The maximum response time to complete and report a condition inspection (bridge structures, major culverts and tunnels, and major overhead signs) following a significant natural event is 48 hours. Natural event inspections are to be conducted as per the requirements for a routine condition inspection.

Structure condition inspection is required to be undertaken using format and detail consistent with that specified in the Ministry Bridge Management and Inventory System (BMIS) and *Highway Maintenance Specifications for Highway Concessions* 8-850.

The Concessionaire is required to retain files of structure inspection records and remediation plans so that a continuous history of each structure is available throughout the term of the Concession.

3.3.3 Structures Inspection Management

Structures Inspection Management involves field inspections, which identify and monitor structure condition. Any observed defects are addresses in relevant remediation strategies and subsequently programmed for remediation. The program of Structure Inspections must be managed by a suitably qualified Bridge Structural Engineer, who:

- Has experience in supervising structure construction, structure design, inspection and remediation;
- Maintains overall management and technical supervision of the bridge inspection and remediation program;
- Accepts responsibility for the technical competence of all personnel;
- Accepts responsibility for the structural safety of all Structures; and
- Consults with specialist staff when necessary.

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While the inspector is tasked with identifying defects, it is the Bridge Structural Engineer who is required to interpret the observations and implement appropriate structure remediation strategies to meet the contract performance requirements.

The APPMs are generally structured to include a two-tier condition intervention criterion for each type of structure and/or associated components. The scope of remediation depends on the extent of non-compliance:

- Tier 1 - Marginally substandard condition requiring a planned remediation strategy to be established typically within 12 months; and
- Tier 2 - Substandard condition requiring physical remediation works typically within 12 months.

In order to limit the risks, to the structure and Highway Users, the acceptance of a higher intervention criteria (i.e. higher state of deterioration) will only occur if the Bridge Structural Engineer undertakes further investigations (such as non-destructive testing and evaluation) to clearly understand the structure condition. The extent of investigations and analyses is to increase in sophistication and completeness as higher intervention levels are decided. The Bridge Structural Engineer will plan for this work accordingly.

Specialist staff are to be engaged by the Concessionaire where the defect or deterioration, requires competence outside of the core structures management team.

There are three types of structure inspections as indicated in Table 3.3.2.

Table 3.3.2: Inspection Types

Type	Description	Maximum Inspection Frequencies
Superficial	Focus on road user safety and structure functionality, refer to the Ministry's <i>Highway Maintenance Specifications for Highway Concession 8-850</i>	Refer to the response times in Ministry's <i>Highway Maintenance Specifications for Highway Concessions 8-850</i>
Routine	Focus on a general assessment of condition and developing a remediation program	One year
Detailed	Focus on producing a comprehensive assessment of condition and if necessary undertaking physical testing	Five years

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Structures exhibiting significant deterioration, defects or damage are required to be inspected more frequently with the intervals determined by the Bridge Structural Engineer to meet the Concession performance requirements.

3.3.4 Asset Preservation Performance Measures

The Concessionaire is required to comply with the measures, minimum condition, and maximum response times as set in Table 3.3.4.

The APPMs presented in addition to the operational condition requirements as set by the Ministry *Highway Maintenance Specifications for Highway Concessions* and the *Local Area Specifications*.

The Concessionaire must demonstrate through their quality management system, the process to achieve the specified outcomes.

The method for assessing the performance measure achievement is based on the definitions given in the Bridge Management Information System (BMIS) data dictionary and users manual or as described in Section 4.0.

The minimum condition criteria apply throughout the term of the Concession.

The intervention criteria adopted also reinforce the 'whole of life' approach, encourage proactive preventive remediation strategies and require the Concessionaire to monitor the management of the structures assets.

The actions specified in Table 3.3.4 are to either:

- Undertake Physical Works to achieve the performance measure criteria specified; or
- Develop a remediation strategy reported in the annual asset management plan and incorporated into the annual Five Year Management Plan's capital works program.

Note that in Table 3.3.4 the following abbreviations are used:

- VA - Visual Assessment from a Routine Condition Inspection, Natural Event Inspection or Detailed Condition Inspection.
- BSE - The Bridge Structural Engineer will assess the structure functionality, structure risk and road user risks to determine an appropriate physical works treatment strategy.

For the Network Component Performance Measures specified in Table 3.3.4, the reporting of a "Remediation Strategy" requires the Concessionaire to develop and report in the annual asset management plan, a strategy to limit asset

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consumption within the specified response times. Remediation strategies that may be considered by the Concessionaire include monitoring, special inspection, investigation (that may include testing of materials), re-evaluation of the risk, and physical work remediation (maintenance, rehabilitation, and replacement).

3.3.5 References and Clarification

The Ministry's *Highway Maintenance Specifications for Highway Concessions* as relevant to Bridges, Major Retaining Walls, Major Culverts and Tunnels and Major Sign Structures apply in full.

Other specific references include:

- Ministry Bridge Management Information Systems User Manual;
- Ministry BMIS Operations Manual;
- Ministry BMIS Data Dictionary;
- Ministry Bridge Inspection Manual;
- *fib* Technical Report Bulletin 17: Management, Maintenance and Strengthening of Concrete Structures; and
- Ministry Standard Specifications for Highway Construction.

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Table 3.3.4 Structures					
Asset Preservation Performance Measure	Intervention Criteria	Action	Maximum Response Time	Basis of Measure	
Component					
Condition (Limit Asset Consumption)	S1	For any structure component having a Condition Rating of 3.0 or greater, but less than 3.5:	1) Develop and report a Remediation Strategy for the defect, deterioration or damage; or 2) By the time of the next scheduled Condition inspection have undertaken Physical Works so the structure component has a Condition Rating of less than or equal to 3.0.	12 months	VA BSE
Condition (Serviceability)	S2	For any structure component having a Condition Rating of 3.5 or greater, but less than 4.0:	1) Fully investigate and have in place a remediation strategy for the defect, deterioration or damage; or 2) By the time of the next scheduled Condition inspection have undertaken Physical Works so the structure component has a Condition Rating of less than or equal to 3.0.	12 months	VA BSE
Condition (Reactive)	S3	For any structure component having a Condition Rating of 4.0 or greater:	Undertake Physical Works by the time of the next scheduled condition inspection so the structure component has a Condition Rating of less than or equal to 3.0.	12 months	VA BSE

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Table 3.3.4 Structures					
Asset Preservation Performance Measure	Intervention Criteria	Action	Maximum Response Time	Basis of Measure	
Structure					
Condition (Limit Asset Consumption)	S4	For any structure having a Structure Condition Index of 2.6 or greater, but less than 2.9:	<ol style="list-style-type: none"> 1) Have in place a reported Remediation Strategy for the defect, deterioration or damage; or 2) By the time of the next scheduled condition inspection, have undertaken Physical Works so the Structure Condition Index is less than or equal to 2.5. 	12 months	VA BSE
Condition (Serviceability)	S5	For any structure having a Structure Condition Index of 2.9 or greater:	<ol style="list-style-type: none"> 1) Undertake Physical Works by the time of the next scheduled condition inspection so the Structure Condition Index is less than or equal to 2.5; or 2) Fully investigate and have in place a reported replacement strategy for the structure. 	12 months	VA BSE
Stock					
Condition (Serviceability)	S6	The Stock Condition Index derived as a result of the previous structure inspection is not to exceed that in the Concession Local Area Specification.	By the time of the next scheduled condition inspection have undertaken Physical Works so that all criteria contained in the Concession Local Area Specification is achieved.	12 months	VA BSE

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Table 3.3.4 Structures					
Asset Preservation Performance Measure	Intervention Criteria	Action	Maximum Response Time	Basis of Measure	
Network Components					
Bridges - Coating	S7	Where more than 10% of the total number of steel bridge girders, assessed by total deck area, has a Condition State worse than Poor.	Undertake Physical Works to address painted surfaces in poor condition including corrosion.	12 months	VA
	S8	Where more than 1% of the wearing surface, assessed by total deck area, has a Condition State worse than Poor.	Undertake Physical Works to address unsound wearing surfaces, cracks, and deterioration affecting structure functional life.	12 months	VA
Bridges - Wearing Surface	S9	Where more than 5% of the wearing surface, assessed by total deck area, has a Condition State worse than Fair.	Develop a Remediation Strategy or undertake Physical Works to address defects and/or deterioration causing moderate affect on structure functional life.		
Bridges - Railing and Parapets	S10	Where more than 1% of the railings and parapets, assessed by bridge length, have a Condition State worse than Poor.	Undertake Physical Works to address advanced deterioration, significant defects or structurally damage by impact such that the side; protection functional life is affected.	12 months	VA
	S11	Where more than 5% of the railings and parapets, assessed by bridge length, have a Condition State worse than Fair.	Develop a Remediation Strategy or undertake Physical Works to address defects and/or deterioration causing moderate affect on side protection functional life.		

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Table 3.3.4 Structures					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
Bridges - Deck Joints	S12	Where more than 2% of the total length of deck joints, assessed by (number of spans+1) times total deck area divided by bridge length, has a Condition State worse than Poor.	Undertake Physical Works to address structural damage, ineffective or inoperable joints, and projections affecting road users.	12 months	VA
	S13	Where more than 10% of the total length of deck joints, assessed by (number of spans+1) times total deck area divided by bridge length, has a Condition State worse than Fair.	Develop a Remediation Strategy or undertake Physical Works to address defective joints with potential to create unsafe conditions for road users and reduction to structure functional life.		
Bridges - Bearings	S14	Where more than 2% of the total number of bearings, assessed by total deck area, has a Condition State worse than Poor.	Undertake Physical Works to address structural damage, ineffective or inoperable bearings.	12 months	VA
	S15	Where more than 10% of the total number of bearings, assessed by total deck area, has a Condition State worse than Fair.	Develop a Remediation Strategy or undertake Physical Works to address defective bearings with potential to create unsafe conditions for road users and reduction to structure functional life.		
Bridges - Bank/Bed Scour/Buildup	S16	Where more than 1% of the total number of bridge spans has a bank/bed scour/buildup Condition State worse than Poor.	Undertake Physical Works to address scour, bank or approach instability, river channel blockage, and waterway alignments that cause high risk to the structure.	12 months	VA

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Table 3.3.4 Structures					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
	S17	Where more than 5% of the total number of bridge spans has a bank/bed scour/buildup Condition State worse than Fair.	Develop a Remediation Strategy to address scour, bank or approach instability, river channel blockage, and waterway alignments that cause high risk of erosion to the structure.		
Bridges - Footings/Pilings	S18	Where more than 2% of the total number of bridge spans has a footings/pilings Condition State worse than Fair.	Undertake Physical Works to address inadequate support, unsound, cracked and/or deterioration where structure functional life is affected, and there is potential to cause risk to the structure.	12 months	VA
	S19	Where more than 10% of the total number of bridge spans has a footings/pilings Condition State worse than Good.	Develop a Remediation Strategy or undertake Physical Works to address ground support, no defects and no deterioration causing moderate affect on structure functional life, and there is no potential to cause risk to the structure.		
Bridges - Pier Columns, Walls & Cribs	S20	Where more than 2% of the total number of bridge spans has a pier columns/walls/cribs Condition State worse than Fair.	Undertake Physical Works to address advanced deterioration, significant defects or impact damage where structure functional life is affected and there are moderate structure risks.	12 months	VA
	S21	Where more than 10% of the total number of bridge spans has a pier columns/walls/cribs Condition State worse than good.	Develop a Remediation Strategy or undertake Physical Works to address defects and/or deterioration causing moderate affect on structure functional life, and there is potential for structure risk.		

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Table 3.3.4 Structures					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
Bridges - Caps	S22	Where more than 2% of the total number of bridge caps, assessed by number of spans+1, has a Condition State worse than Fair.	Undertake Physical Works to address advanced deterioration, significant defects or impact damage where structure functional life is affected, and there are moderate structure risks.	12 months	VA
	S23	Where more than 10% of the total number of bridge caps, assessed by number of spans+1, has a Condition State worse than good.	Develop a Remediation Strategy or undertake Physical Works to address defects and deterioration causing moderate affect on structure functional life, and there is potential for structure risk.		
Bridges - Girders	S24	Where more than 1% of the total number of bridge girders, assessed using the total deck area, has a Condition State worse than Fair.	Undertake Physical Works to address advanced deterioration, significant defects and/or impact damage, where structure functional life is affected.	12 months	VA
	S25	Where more than 7% of the total number of bridge girders, assessed using the total deck area, has a Condition State worse than Good.	Develop a Remediation Strategy or undertake Physical Works to address defects and deterioration causing moderate affect on structure functional life, and there is potential for structure risk.		
Bridge s - Sub Deck/Cross Ties	S26	Where more than 2% of the sub deck/cross ties, assessed using the total deck area of bridges, has a Condition State worse than Fair.	Undertake Physical Works to address advanced deterioration, significant defects or impact damage where structure functional life is affected, and there are moderate structure risks; or	12 months	VA

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Table 3.3.4 Structures					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
	S27	Where more than 10% of the sub deck/cross ties, assessed using the total deck area of bridges, has a Condition State worse than Good	Develop a Remediation Strategy or undertake Physical Works to address defects and deterioration causing moderate affect on structure functional life, and there is potential for structure risk.		
Retaining Walls - Foundation	S28	Where more than 2% of the total length of retaining walls has a Condition State worse than Fair.	Undertake Physical Works to address inadequate support, unsound, cracked and/or deteriorated to a state where structure functional life is affected, and there are moderate structure risks.	12 months	VA
	S29	Where more than 10% of the total length of retaining walls has a Condition State worse than Good.	Develop a Remediation Strategy or undertake Physical Works to address ground support, defects and deterioration causing moderate affect on structure functional life, and there is potential to cause risk to the structure.		
Retaining Walls - Structure	S30	Where more than 2% of the total length times average height of retaining walls has a Condition State worse than Fair.	Undertake Physical Works to address advanced deterioration, significant defects or impact damage where structure functional life is affected, and there are moderate structure risks.	12 months	VA

Highway Asset Preservation Performance Measures for Highway Concessions

Table 3.3.4 Structures					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
	S31	Where more than 10% of the total length times average height of retaining walls has a Condition State worse than Good.	Develop a Remediation Strategy or undertake Physical Works to address defects and deterioration causing moderate affect on structure functional life, and any potential for structure risk.		
Major Culverts - Flow Capacity	S32	Where more than 10% of the total inside horizontal width of major culverts has a Condition State worse than Poor.	Undertake Physical Works to address scour, bank or approach instability, river channel blockage or alignment causing high risk to the structure.	12 months	VA
	S33	Where more than 20% of the total inside horizontal width of major culverts has a Condition State worse than Fair.	Develop a Remediation Strategy or undertake Physical Works to address scour, bank or approach instability and river channel blockage or alignment with potential to cause high risk to the structure.		
Major Culverts - Inlet Features (Average condition of Debris Control, Apron, Cutoffs, Wingwalls and Headwalls)	S34	Where more than 10% of the total inside horizontal width of major culverts has a Condition State worse than Poor.	Undertake Physical Works to address structural damage, unstable, ineffective or deteriorated bank protection, debris control features, apron, cut-offs, wingwalls and headwalls.	12 months	VA
	S35	Where more than 20% of the total inside horizontal width of major culverts has a Condition State worse than Fair.	Develop a Remediation Strategy or undertake Physical Works to address bank protection, debris control features, apron, cut-offs, wingwalls and headwalls are damaged, deteriorated or defective with potential to cause high risk.		

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Table 3.3.4 Structures					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
Major Culverts - Outlet Features (Average condition of Bank Protection, Energy Dissipation, Apron, Cutoffs, Wingwalls and Headwalls)	S36	Where more than 10% of the total inside horizontal width of major culverts has a Condition State worse than Poor.	Undertake Physical Works to address structural damage, unstable, ineffective or deteriorated bank protection, energy dissipation features, apron, cutoffs, wingwalls and headwalls.	12 months	VA
	S37	Where more than 20% of the total inside horizontal width of major culverts has a Condition State worse than Fair.	Develop a Remediation Strategy or undertake Physical Works to address bank protection, energy dissipation features, apron, cutoffs, wingwalls and damaged headwalls, and where there is potential to cause high risk.		
Major Culverts - Foundations/ Roadway Over	S38	Where more than 2% of the total length of major culverts has a Condition State worse than Fair.	Undertake Physical Works to address inadequate support, settlement, not sound, cracked and/or deteriorated to a state where structure functional life is affected and there are moderate structure/highway risks.	12 months	VA
	S39	Where more than 10% of the total length of major culverts has a Condition State worse than Good.	Develop a Remediation Strategy or undertake Physical Works to address ground support, settlement, defects and deterioration causing moderate affect on structure functional life and any potential to cause risk to the structure and highway.		

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Table 3.3.4 Structures					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
Major Culverts - Barrel Structure (This criteria is to be applied to roof crown, side walls and floor individually)	S40	Where more than 2% of the total length of major culverts has a Condition State worse than Fair.	Undertake Physical Works to address advanced deterioration, significant defects or debris damage where structure functional life is affected and there are moderate structure risks.	12 months	VA
	S41	Where more than 10% of the total length of major culverts has a Condition State worse than Good.	Develop a Remediation Strategy or undertake Physical Works to address defects, debris damage and deterioration are causing moderate affect on structure functional life and there is potential for structure risk.		
Tunnels - Portal Features (Average condition of Drainage, Doors, Cutoffs, Wingwalls and Headwalls)	S42	Where more than 10% of the total width of tunnels has a Condition State worse than Poor.	Undertake Physical Works to address structural damage, unstable, ineffective or deteriorated drainage systems, doors, cut-offs, wingwalls and headwalls.	12 months	VA
	S43	Where more than 20% of the total width of tunnels has a Condition State worse than Fair.	Develop a Remediation Strategy or undertake Physical Works to address drainage systems, doors, cut-offs, wingwalls and damaged headwalls, deteriorated or defective with potential to cause high risk.		
Tunnels - Floor Wearing Surface	S44	Where more than 2% of the total floor surface area (length x width) of the tunnels has a Condition State worse than Poor.	Undertake Physical Works to address unsound, cracked and deteriorated floor wearing surface to a state where structure functional life is affected.	12 months	VA

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Table 3.3.4 Structures					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
	S45	Where more than 10% of the total floor surface area (length x width) has a Condition State worse than Fair.	Develop a Remediation Strategy or undertake Physical Works to address defects and deterioration causing moderate affect on structure functional life and no affect on road users.		
Tunnels - Side Protection (Average condition of Curbs/wheel guards, median barriers)	S46	Where more than 2% of the total tunnel length has a Condition State worse than Poor.	Undertake Physical Works to address advanced deterioration, significant defects or structural damage by impact such that the side protection functional life is affected.	12 months	VA
	S47	Where more than 10% of the total tunnel has a Condition State worse than Fair.	Develop a Remediation Strategy or undertake Physical Works to address defects and deterioration are causing moderate affect on side protection functional life and no affect on road users.		
Tunnels - Foundations/Fill Over	S48	Where more than 2% of the total length of tunnels has a Condition State worse than Fair.	Undertake Physical Works to address inadequate support, settlement, not sound, cracked and/or deteriorated to a state where structure functional life is affected and there are moderate structure/fill over risks.	12 months	VA

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Table 3.3.4 Structures					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
	S49	Where more than 10% of the total length of tunnels has a Condition State worse than Good.	Develop a Remediation Strategy or undertake Physical Works to address ground support, settlement, defects and deterioration are causing moderate affect on structure functional life and there is potential to cause risk to the structure and fill over.		
Tunnels - Tunnel Structure (This criteria is to be applied to roof and side walls individually)	S50	Where more than 2% of the total length of tunnels has a Condition State worse than Fair.	Undertake Physical Works to address advanced deterioration, significant defects or impact damage where structure functional life is affected and there are moderate structure risks.	12 months	VA
	S51	Where more than 10% of the total length of tunnels has a Condition State worse than Good.	Develop a Remediation Strategy or undertake Physical Works to address defects, collision damage and deterioration are causing moderate affect on structure functional life and there is potential for structure risk.		
Major Signs - Painted/ Galvanized Surfaces	S52	Where more than 10% of the total number of major overhead sign structures has a Condition State worse than Poor.	Undertake Physical Works to address painted/galvanized surfaces that are not in sound condition and/or free of corrosion.	12 months	VA
Major Signs - Foundations/ Footings	S53	Where more than 2% of the total length of major sign structures has a Condition State worse than Fair.	Undertake Physical Works to address inadequate support, instability, not sound, cracked and/or deteriorated to a state where structure functional life is affected and there are moderate structure risks.	12 months	VA

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Table 3.3.4 Structures					
Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
	S54	Where more than 10% of the total length of major sign structures has a Condition State worse than Good.	Develop a Remediation Strategy or undertake Physical Works to address ground support, defects and deterioration are causing moderate affect on structure functional life and there is potential to cause risk to the structure.		
Major Signs - Main Chords & Connections	S55	Where more than 2% of the total length of major sign structures has a Condition State worse than Fair.	Undertake Physical Works to address advanced deterioration, significant defects or impact damage where structure functional life is affected and there are moderate structure risks.	12 months	VA
	S56	Where more than 10% of the total length of major sign structures has a Condition State worse than Good.	Develop a Remediation Strategy or undertake Physical Works to address defects and deterioration are causing moderate affect on structure functional life and there is potential for structure risk.		

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3.4 Drainage and Debris Control Structures

3.4.1 General

The APPMs for Drainage and Debris Control Structures are targeted to ensure:

- Public and structure safety;
- Functionality is at an acceptable level; and
- Asset consumption is limited.

Using these objectives as the basis, standards and performance measures are set to ensure sound asset management practices are applied. While these assets have relatively low cost they provide the important function of reducing water and debris accumulation on the highway, thereby increasing safety and security for road users. Control structures also provide road slopes and structural features protection against scour and debris loadings. Given the drainage and debris control structure assets have a short-term life cycle, then asset preservation practices will need to be applied.

The APPM methodology developed specifically for Drainage and Debris Control Structures follows the same methodology as that outlined in Section 3.3 for Structures.

The condition rating procedure is based on the Ministry's Drainage and Debris Control Structures rating guidelines. This rating procedure is similar to that used for the BMIS inspections and therefore the same condition indices can be calculated and reported. Asset condition data obtained from drainage and debris control condition inspections forms the basis of these measures.

Table 3.4.1 shows schematically how the APPMs are applied to the following specific Drainage and Debris Control Structure features:

- On Roadway – Curb/Gutter Structures;
- Adjacent Roadway - Ditch/Drain Structures;
- Under Roadway – Culvert Structures; and
- Debris Control Structures.

Performance measures have been defined for each feature and are assessed from the condition rating data. The structure condition index is calculated following the BMIS procedures. Similar to Structures, the network condition measure is a network-wide measure that focuses specifically on monitoring the

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extent of the condition for key critical components across the Concession network with percentage criteria for compliance defined.

Table 3.4.1: Drainage and Debris Control Structures APPM Hierarchy

Drainage & Debris Control Structure Feature	Performance Measure	Intervention Types
On Roadway (Curb/Gutter Structures)	Structure Condition Index	Serviceability
	Extent of Network Component Condition	
Adjacent Roadway (Ditch/Drain Structures)	Structure Condition Index	Serviceability
	Extent of Network Component Condition	
Under Roadway (Culvert Structures)	Structure Condition Index	Serviceability
	Extent of Network Component Condition	
Debris Control Structures	Structure Condition Index	Serviceability
	Extent of Network Component Condition	

The APPMs provide the outcome emphasis required and focus on the following types of intervention:

- Limit Asset Consumption; and
- Serviceability

These interventions include monitoring, managing and reporting asset performance to ensure proactive preventive maintenance outcomes are achieved. The serviceability performance measures are applied to each feature and the high value culverts also require the limit asset consumption performance measures to be applied.

The Drainage and Debris Control Structures asset management cycle includes:

- Inspection at the specified interval;
- Rating the condition of the structure and elements;
- Programming correction of deficiency;
- Undertaking remedial works;
- Inventory updating; and
- Reporting achievements.

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The required delivery of services is to be based upon:

- Emphasis on public and structure safety for the period of the Concession;
- Outcome based specification with the Concessionaire given the latitude for treatment selection to control/correct defective condition as per the material requirements defined in the *Highway Maintenance Specifications for Highway Concessions*;
- A life cycle approach to maintenance and rehabilitation in conformance with the performance measures set is encouraged;
- A preventive rather than reactive maintenance/repair strategy is encouraged to limit asset consumption with inspections recommended to facilitate this strategy;
- Emphasis on program delivery of confirming condition within the prescribed standards and performance measures set on an ongoing basis;
- A Bridge Structural Engineer who accepts ownership for the drainage and debris control structure management cycle;
- A mechanism for the Ministry to correct default if the Concessionaire fails to meet the condition criteria on an ongoing basis; and
- A total quality management system, which covers all delivery.

3.4.2 Asset Condition Data Collection

The Concessionaire is responsible for collecting structure condition data for the purposes of asset management and for measuring performance achievement.

Data collection is required to be conducted in accordance with Ministry specifications for Drainage and Debris Control Structures.

All relevant data is to be, provided to the Ministry for, input into the corporate Road Inventory and Maintenance System (RIMS) according to Ministry prescribed RIMS data file formats.

The Concessionaire is required to also undertake structure inspections (i.e. in addition to the highway and flood control inspections) following significant natural events that affect the Structures. Significant natural events include but are not limited to the following:

- Earthquake;
- Rain Storm; and
- Snow Storm.

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Refer to the *Local Area Specifications* for criteria defined for the above listed Significant Natural Events.

The maximum response time to complete and report a Structure condition inspection following a Significant Natural Event is 7 days.

Structure reporting (natural event inspections are to be reported as a Structure Condition Inspection) is required to be undertaken using format and detail consistent with that specified in the Ministry Roadway Information Management System (RIMS) and *Highway Maintenance Specifications for Highway Concessions* 8-830 and 8-840. The Concessionaire is required to maintain files of structure inspection records and remediation so that a continuous history of each structure is available throughout the Concession duration.

3.4.3 Drainage and Debris Control Structures Inspection Management

Due to the large number of Drainage and Debris Control Structures, it is expected their inspection will be undertaken by a number of staff. Some of these inspections will be non-structural, with a focus on maintaining waterway areas, but this asset category includes a range of significant structures that require appropriate structure asset management. Fundamental to this asset management process are structural inspections which provide a basis for assessing structure asset condition. The defects identified enable the development of an asset management strategy. Structure inspections are undertaken at various frequencies and to different standards, depending upon the type of inspection.

The Concessionaire's Bridge Structural Engineer is required to have the skills and experience to fulfill the roles specified. The Concessionaire's drainage structure inspection staff is required to be experienced in construction, inspection and rehabilitation or maintenance of drainage structures.

It is important to understand that while the inspector is tasked with identifying defects it is the Bridge Structural Engineer who is required to interpret the observations and implement appropriate management strategies to satisfy the contract performance criteria.

As a Drainage and Debris Control Structure deteriorates the intervention levels will be sequentially triggered depending upon the asset management strategy implemented. In order to reduce risk to the structures and highway/highway users the acceptance of a structure to a higher intervention level (i.e. a higher level of deterioration) will only be decided if the Bridge Structural Engineer undertakes detailed investigations (such as non-destructive testing or evaluation) to better understand the condition.

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Specialist staff are to be engaged by the Concessionaire where the defect or deterioration requires competence outside of the core structures management team.

There are two type of routine drainage structure inspections:

- Superficial, with a focus on road user safety, waterway maintenance and structure functionality, refer to the Ministry *Highway Maintenance Specifications for Highway Concessions* 8-830 and 8-840; and
- Structure Condition Inspection, with a focus on a general assessment of condition and developing a remediation program, refer also to the Ministry Data Collection Definition.

In this Concession the maximum duration between inspections for the Structures is:

- Superficial – refer to the response times in Ministry *Highway Maintenance Specifications for Highway Concessions* 8-830 and 8-840;
- Structure Condition Inspection – Five years

Structures exhibiting significant deterioration, defects or damage are to be inspected more frequently with the intervals determined by the Bridge Structural Engineer.

3.4.4 Asset Preservation Performance Measures

The Concessionaire is required to comply with the measures, minimum condition, and maximum response times set out in Table 3.4.4.

Note that in Table 3.4.4 the following abbreviations are used:

- VA - Visual Assessment from a Routine Condition Inspection, Natural Event Inspection or Detailed Condition Inspection.
- BSE - The Bridge Structural Engineer will assess the structure functionality, structure risk and road user risks to determine an appropriate physical works treatment strategy.

The APPMs indicated are in addition to the operational condition requirements as set by the Ministry *Highway Maintenance Specifications for Highway Concessions* and the *Local Area Specifications*.

The Concessionaire must demonstrate through their quality management system, the process to achieve the specified outcomes.

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The methods for assessing or calculating the performance measures are based on the definitions given in the Roadway Information Management System (RIMS) Inventory Data - Detailed Meta Data Specifications.

The minimum condition criteria apply throughout the term of the Concession.

The intervention criteria for the culverts also reinforce the 'whole of life' approach, encourage proactive preventive maintenance strategies and require the Concessionaire to monitor the condition performance of this asset type. The Concessionaires performance in managing the Drainage and Debris Control Structures asset group is also to be measured.

The actions specified in Table 3.4.4 are to either:

- Undertake Physical Works to achieve the performance measure criteria specified; or
- Develop a remediation strategy reported in the annual asset management plan and incorporated into the annual Five Year Management Plan's capital works program.

For the Network Component Performance Measures specified in Table 3.4.4, the reporting of a "Remediation Strategy" requires the Concessionaire to develop and report the annual asset management plan, a strategy to limit asset consumption within the specified response times. Strategies that may be considered by the Concessionaire include monitoring, special inspection, investigation (that may include testing of materials), re-evaluation of the risk, and physical work remediation (maintenance, rehabilitation, and replacement).

3.4.5 References and Clarification

The Ministry's *Highway Maintenance Specifications for Highway Concessions*, as relevant to Drainage and Debris Control Structures, apply in full.

Other specific references include:

- Ministry's Drainage and Debris Control Structures Rating Guidelines;
- Roadway Information Management System (RIMS) Inventory Data - Detailed Meta Data Specifications.

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Table 3.4.4 Drainage and Debris Control Structures					
Asset Preservation Performance Measure	Intervention Criteria	Action	Maximum Response Time	Basis of Measure	
Structure					
Condition (Serviceability)	D1	For any structure having a Structure Condition Index of 3.4 or greater, derived as a result of the previous structure inspection.	1) Undertake Physical Works by the time of the next scheduled condition inspection so the Structure Condition Index is less than or equal to 3.4; or 2) Fully investigate and have in place a reported replacement strategy for the structure.	12 months	VA BSE
Network Condition					
On Roadway - Curb/Gutter	D2	Where more than 30% of the total length of curb and gutter has a Condition State worse than Fair for any rating attribute.	Remediation Strategy to address deterioration, defects or damage is at a state with potential to affect structure functionality and cause high risk to the curb or gutter.	12 months	VA
	D3	Where more than 30% of the total number of catch basins/manholes has a Condition State worse than Fair for any rating attribute.	Develop a Remediation Strategy to address deterioration, defects or damage is at a state with potential to affect structure functionality and cause high risk to the catch basin or manhole.	12 months	VA
Adjacent Roadway - Ditch/Drain Structures and Spillways/Flumes	D4	Where more than 5% of the total length of the drainage ditches has a Condition State worse than Fair for any rating attribute.	Develop a Remediation Strategy to address sedimentation, channel blockage, scour, bank or shoulder instability, vegetation growth or alignment with potential to cause high risk to the structure.	12 months	VA

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Asset Preservation Performance Measure		Intervention Criteria	Action	Maximum Response Time	Basis of Measure
	D5	Where more than 5% of the total length of spillways and flumes has a Condition State worse than Fair for any rating attribute.	Develop a Remediation Strategy to address sedimentation, detritus, scour, bank or structure instability, structure deterioration or ground movement and vegetation growth with potential to cause high risk to the structure.	12 months	VA.
Under Roadway - Culverts	D6	Where more than 20% of the total number of culverts has a Condition State worse than Fair or a maintenance rating of "yes".	Develop a Remediation Strategy to address sedimentation, channel blockage or alignment with potential to cause high risk to the structure.	12 months	VA
	D7	Where more than 5% of the total length of culverts has a Condition State worse than Fair for any rating attribute.	Develop a Remediation Strategy to address defects, damage and deterioration are causing moderate affect on feature (including inlet, outlet and barrel) functional life and there is potential for high feature risk.	12 months	VA
Debris Control Structures - Trash Racks and Storage Basins	D8	Where more than 30% of the total number of trash rack features has a Condition State worse than Fair for any rating attribute.	Develop a Remediation Strategy to address defects, damage and deterioration causing a moderate affect on feature functional life and there is potential for high feature risk.	12 months	VA
	D9	Where more than 30% of the total number of storage basin has a Condition State worse than Fair for any rating attribute.	Develop a Remediation Strategy to address defects, damage and deposition/vegetation growth causing a moderate affect on feature functional life and there is potential for high feature risk.	12 months	VA

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3.5 Electrical Systems

3.5.1 General

The Concessionaire will assume responsibility, during the term of the Concession, for managing the serviceability and maintenance aspects of the Electrical Systems.

The electrical performance criteria are to be consistent with the standards and service levels as delivered to the Provincial Network. The Ministry's Electrical Performance-based Maintenance Specifications will apply.

Maintenance and asset management of the Electrical Systems are to be related to the Concessionaire's Quality Management System.

3.5.2 Asset Preservation Performance Measures

The Concessionaire is required to comply with the measures, minimum condition and response times as defined set in the Ministry's *Electrical Performance-based Maintenance Specifications*. The Additional services indicated in the specifications E-110, E-150, E-160 and E-410 will be considered as routine maintenance services and are required to be complied with by the Concessionaire.

The Concessionaire is required to maintain the electrical system assets to achieve the desired levels of service and limit the extent of asset consumption over the term of the Concession. The overriding requirement in terms of APPMs is for the Concessionaire to achieve or exceed the design life expectations based on industry best practices and standards of the electrical system components.

The Concessionaire is required to demonstrate through their quality management system, the process to achieve the specified outcomes.

3.5.3 References

The Ministry's *Highway Maintenance Specifications for Highway Concessions* as relevant to Electrical Control Systems apply in full. Specific references include:

- Ministry Performance-based Electrical Maintenance Specifications
- Ministry Standard Specifications for Highway Construction; and
- Provincial and Federal Electrical Safety Codes.

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APPENDIX Terminology and Interpretation

In this Highway Asset Preservation Performance Measures document, unless the context otherwise requires, terms will have the following meanings:

“**Assets**” mean the physical assets of the Concession Highway infrastructure including highway running surfaces, bridges, major retaining walls, major culverts, tunnels, major sign structures, drainage / debris control structures and electrical systems.

“**Asset Management**” means to provide the desired level of operations, maintenance and rehabilitation services in the most cost effective manner in perpetuity.

“**Asset Preservation Performance Measures**” mean the minimum condition for individual assets during the term of the Concession to achieve the desired levels of service and to limit the extent of asset consumption.

“**Avalanche Control**” means the ability to implement a program of recognizing avalanche areas, the potential for the occurrences of avalanches, and effective control methods required to ensure the safety of the highway users.

“**Basis of Measure**” means the basis of the Asset data collection for the Asset Preservation Performance Measures and any associated response parameters required to be met.

“**Bridge Management Information System (BMIS)**” means a Ministry corporate structure asset management application that is used to maintain inventory and condition data for structures to support the Ministry programs.

“**Bridges**” mean the substructure and superstructure components that function to receive and transmit traffic loads. Decks mean the portion of a Bridge that supports a Highway from the top of the major structural members to the wearing surface and designed to distribute loads evenly across the Bridge.

“**Bridge Structural Engineer**” means a Professional Engineer registered with the Association of Professional Engineers of B.C., specializing in Bridge structural design, construction, maintenance and rehabilitation.

“**Component**” is defined as a group of similar structural asset elements.

“**Component Condition Rating**” means the performance measure that is defined for each structure component and is calculated as per the BMIS Data Dictionary, which refers to it as the “Component BCI”. The Component Condition Rating will range from 1 to 5, with 1 being Excellent Condition and 5 being Very Poor.

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“Condition State – Drainage Structures” means the condition observed or determined from a site inspection of each drainage component, it is recorded as an item/input on an inspection form. There are five Condition States as summarized below:

- 1) Excellent Condition - as-built condition, no observed defects
- 2) Good Condition - normal wear and deterioration
- 3) Fair Condition - minor loss in condition or minor observed defects
- 4) Poor Condition - advanced loss in condition or significant defects
- 5) Very Poor Condition - serious loss in condition or serious defects

The Condition State descriptions vary depending upon the structure attribute and reference is to be made to the RIMS Data Collection Definitions for application of the Condition State to the full range of structure attributes.

“Condition State – Structures” means the condition observed or determined from a site inspection of each structure component, it is recorded as an item/input on an inspection form. There are five Condition States as summarized below:

- 1) Excellent Condition - as-built condition, no observed defects
- 2) Good Condition - normal wear and deterioration
- 3) Fair Condition - minor loss in condition or minor observed defects
- 4) Poor Condition - advanced loss in condition or significant defects
- 5) Very Poor Condition - serious loss in condition or serious defects

The Condition State descriptions vary depending upon the structure component and reference is to be made to the BMIS User Manual for application of the Condition State to the full range of structure components.

“Debris Torrent Structures” mean any structure which by design and or function acts to control the flow of, or contain debris or debris flows, including but not limited to debris impound basins, avalanche berms, avalanche deflector mounds and basins associated with snowsheds. The structures are specific to each site and incorporate one or more of the following features: Trash rack, Lined channel and Deposit area/storage basin.

“Drainage Structures” mean the parts of the infrastructure designed to carry water away from the road base including ditches, culverts, spillways, dyking, flumes, and drains. Drainage Structures are further defined as follows: On highway features: - Curb and gutters, Catch basins (including sumps and grates) and Manholes; Adjacent highway features: Drainage ditches (lined and unlined), Spillways and Half round flumes; and Under highway features: All culverts less than 3m in diameter or span, Trash racks at inlets on minor culverts, Fish passage features and Subsoil systems (pipes or filter layers).

“Electrical Systems” mean the infrastructure designed to be electrically run including but not limited to luminaires, sign lights, structure lights, structure decks and other heating systems, electrical message signs and all components of each of the above.

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“Extent of Network Component Condition” means the performance measure assigned to network components calculated on a percentage basis using BMIS data.

“Highway Maintenance Specifications for Highway Concessions” mean the Highway Maintenance Specifications for Highway Concessions that relate to the operational maintenance and repair of the Highway and Bridge infrastructure and have been aligned with the Ministry of Transportation Highway Maintenance Specifications for the 2003-2004 Highway Maintenance Contracts (February, 2003).

“Highway Running Surfaces” are defined a major asset group that includes paved highway traffic lanes, paved shoulders, paved medians, paved pullouts/rest stop areas/side roads/entrance and exit ramps and paved and gravel side roads.

“Highway User” means any person or persons, regardless of form of transportation, that use any lands or facilities within the jurisdiction of the Ministry of Transportation.

“International Roughness Index (IRI)” – means the measure of the pavement smoothness based on the longitudinal profile of the pavement surface as defined in the World Bank Technical Paper Number 46: Guidelines for Conducting and Calibrating Road Roughness Measurements.

“Key Performance Measures” mean the principle outcomes in the management of the Concession Agreement and delivery of professional services.

“Limit Asset Consumption Intervention” means the first intervention level in the Asset Preservation Performance Measures specified for initiating proactive asset management of the Structures and Drainage and Debris Control Structures.

“Major Culverts” mean structures 3 metres or more in diameter or span constructed of various materials (typically corrugated iron) and required to convey watercourses under the highway.

“Major Retaining Wall” means a structure whose purpose is to structurally retain earth. Major retaining walls are inventoried as structures by the Ministry when the wall face is greater than 45 degrees and the maximum exposed wall height exceeds 2.0m and the primary purpose is not to support bridge abutments and rock fall or avalanche catchment.

“Major Sign Structures” mean overhead sign support structures typically of truss construction with the horizontal members either supported at both ends or cantilevered over the travelled lanes.

“Maximum Response Time” means the maximum permissible period of time within which the Concessionaire must complete the remedial action from the time of observation of the defect or the time of notification of the defect by the Ministry or his representative or the public to the Concessionaire.

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“Minimum Condition” in respect of Asset Preservation Performance Measures means the least permissible standard that the Concessionaire must comply with throughout the term of the Concession.

“Ministry” means the Queen in the Right of the Province of British Columbia as represented by the Minister and The British Columbia Ministry of Transportation.

“Ministry Representative” means a designated representative for the Province of British Columbia as represented by the Ministry and The British Columbia Ministry of Transportation.

“Operational Management” means to provide the services necessary to ensure the day-to-day serviceability of the Concession Highway based on standards and response time performance criteria.

“Operational Performance Measures” mean the minimum condition for individual assets and corridor management requirements reflecting the highway user’s expectations about the day-to-day serviceability.

“Pavement Distress Index (PDI)” means a composite measure of the overall pavement surface condition (i.e. cracking, rutting and defects) based on the combination of specific distress, severity and density condition ratings that exist calculated using a mathematical model.

“Performance Measures” mean the Key Performance Measures, Asset Preservation Performance Measures and Operational Performance Measures.

“Physical Works” means the carrying out of asset maintenance, rehabilitation or remediation activities in order to achieve the Asset Preservation Performance Measure requirements.

“Province” means the Province of British Columbia.

“Quality Management” means to provide the necessary processes and procedures as per ISO 9001 quality management system requirements to ensure the delivery of services required to manage the Concession.

“Quality Management System” means a management system that establishes the organizational structure, procedures, processes and resources for determining and implementing quality management policy.

“Reactive Intervention” means the third intervention level in the Asset Preservation Performance Measures specified for reactive asset management of components in the Structures sub-categories. At this intervention level component condition is lowest, structure and road user risks highest and reactive asset management will need to be applied to remedy the defects, deterioration or damage.

“Remediation Strategy (structures)” means all activities required managing the risks associated with defects (including deterioration and damage) identified from an inspection. In

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general these activities include monitoring, special inspection, investigation (that may include testing of materials), re-evaluation of the risk or physical work remediation. Physical work remediation can include maintenance, repair, rehabilitation and replacement. It is noted the initial risk assessment, made after identifying the defect, will be undertaken as part of the structure inspection work.

“River Protection Works” means those assets that are constructed to protect the highway and associated assets from river attack. The works typically include rock rip rap armouring, impermeable groynes, permeable groynes and vegetation planting

“Road Inventory and Maintenance System (RIMS)” means the Ministry corporate asset management system that maintains road asset and inventory information for the provincial highway network and through its multiple linear referencing provides the basis to integrate with other Ministry asset management systems.

“Roadway Pavement Management System (RPMS)” means the Ministry corporate pavement asset management application that is used for monitoring the condition of paved highways to support the planning, programming and delivery of the annual resurfacing plan.

“Serviceability Intervention” means the second intervention level in the Asset Preservation Performance Measures specified for indicating the minimum acceptable condition limits for structures and stock in the Structures and Drainage and Debris Control Structures. At this intervention level the structure condition is lower than the first intervention level, structure and road user risks are higher and a higher level of structure asset evaluation and management will need to be applied to remedy the defects, deterioration or damage.

“Side Protection” means the railing, parapets or barriers of the bridge structure.

“Snowshed” means a roofed structure that shelters a road from snow slides by directing the snow to run over top.

“Stock Condition Index” means an Asset Preservation Performance Measure for Structures of the same age grouping that is calculated using the algorithm below for each age group for the full age range of the structures in the network. In general terms the Stock Condition Index is the average Structure Condition Index determined for each Structures sub-category and Drainage and Debris Control Structures features in the same age group at the time of the rating inspections.

$$\text{Stock Condition Index}_{(\text{Age}=t)} = \frac{\sum_i^n \text{Structure Condition Index}}{n}$$

Where:

n = the number of structures with “age= t” for which a Structure Condition Index has been determined within a particular Structures sub-category. The Stock Condition Index will range from 1 to 5, with 1 being Excellent Condition and 5 being Very Poor.

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“**Structures**” means a major asset category that includes Bridges and Major Retaining Walls, Major Culverts, Tunnels and Major Sign Structures

“**Structure Component**” means a group of similar elements of a structure, e.g. deck joints, girders, plates, bolts, etc.

“**Structure Condition Index (Structures)**” means an Asset Preservation Performance Measure for Structures that is calculated using the algorithm and weightings defined in the BMIS Users Manual for the Bridge Condition Index for specific structure types.

“**Structure Condition Index (Drainage Structures)**” means an Asset Preservation Performance Measure for Drainage and Debris Control Structures that is calculated by averaging the component condition ratings for drainage structures as follows.

Catch Basin -	the Overall Condition attribute shall be used for the SCI
Curb and Gutter -	arithmetic average of the Cracking, Gouging and Crumbling attribute conditions
Ditch/Drain -	arithmetic average of the Erosion, Bank Sloughing and Vegetation attribute conditions
Spillway/Flume -	arithmetic average of the Pipe/Flume Corrosion, Pipe/Flume Damage, Erosion and Pavement Condition attribute conditions
Culvert -	arithmetic average of the Sag, Corrosion, Breaks, Leakage, Pipe Damage and Erosion and Bank Protection attribute conditions
Debris Control Structure -	arithmetic average of the attribute conditions for the trash racks, lined channels and storage basin/deposit area combination appropriate for each debris control structure

“**Tunnels**” mean any buried structure intended to convey pedestrian, wild life, farm animals or vehicular traffic, with a minimum dimension of 3 metres.