Tunnels management and inspection policy

1. Introduction

This policy document sets out the main roles and responsibilities of the various parties involved in the delivery of safe and effective tunnel management on the state highway network and the requirements for the inspection of infrastructure used to manage and control the tunnels.

Specifically the inspection procedures cover the mechanical and electrical equipment, intelligent transport systems (ITS), all monitoring and control systems associated with the functioning of a tunnel and building elements in tunnels and associated control buildings. These procedures have been developed from the Highways England documents BD 53/95 *Inspection and records for road tunnels*\(^{(1)}\) and BA 72 *Maintenance of road tunnels*\(^{(2)}\) and the now superseded FHWA-IF-05-002 *Highway and rail transit tunnel inspection manual*\(^{(3)}\).

Inspection procedures for the tunnel structures and associated service buildings and plant rooms are covered under the NZ Transport Agency policy S6 *Bridges and other highway structures inspection policy*\(^{(4)}\) (NZTA S6).

2. Coverage of this policy

For the purposes of this policy, tunnels shall be as defined in the NZ Transport Agency’s *Guide to road tunnels*\(^{(5)}\). Specifically:

- Any covered roadway less than 80m in length is considered an underpass and is therefore not covered by this policy.

- Any tunnel between 80m and 240m in length shall be subject to the requirements of this policy, if there is mechanical ventilation or a fixed fire suppression system installed, or if it is otherwise deemed to be subject to the requirements of this policy by the Transport Agency’s National Structures Manager.

- For all tunnels over 240m in length, the requirements of this policy shall apply.

3. Personnel and roles

3.1 Tunnel Manager

For each tunnel, the Transport Agency will appoint a Tunnel Manager.

The Tunnel Manager shall be consulted during preliminary and subsequent tunnel design stages to give a whole of asset life overview of the tunnel, its role within the wider road network (by liaison with the Operations Manager) and its operation and maintenance.

Subsequent to construction and for existing tunnels covered by this policy the Tunnel Manager shall be responsible for that tunnel’s management; for ensuring the relevant safety documentation, including the risk analyses and real-time operational plans undertaken by the Operations Manager, are
prepared; and receive and act upon the findings of inspection and testing reports as necessary (refer section 8.1).

The principal duties of the Tunnel Manager are to ensure that:

- The fire and life safety systems of the tunnel, as determined by the risk assessment process, are serviceable and available. If they are not, and require a pre-defined degraded operational mode, the Tunnel Manager shall ensure that the Operations Manager is informed as soon as possible.

- All statutory obligations are maintained current, and that the specified systems that are subject to building warrant of fitness (BWoF) under the Building Act 2004, and any other systems required to comply with relevant statutory legislation are maintained for compliance unless an official departure is obtained.

- A tunnel asset management manual is prepared and maintained (with associated plans and documentation). See the *Guide to road tunnels* for details.

- Periodic emergency event exercises for tunnel staff, operators and the emergency services are carried out and exercise event reports are prepared and any follow up actions are closed out.

- Reporting is completed at least every three years via the tunnel lifecycle asset management plan for the tunnel equipment in accordance with the *State highway annual plan instructions manual*.

The safe real-time operation of the network including the tunnel and approaches will always be the responsibility of the Operations Manager.

Some tunnel control systems (for example servers, workstations, video walls, DYNAC, SIDER, DVTEL, Vidsys and the fibre backbone network), including hardware, software, licensing, maintenance and performance, may be managed directly by the Transport Agency. The Tunnel Manager shall support the Transport Agency in the management of these assets.

### 3.2 Safety Officer

The Transport Agency will designate a Safety Officer for each tunnel.

The Safety Officer shall be independent in respect of road tunnel safety issues or day to day operations and shall not be under instructions from their employer in respect of those issues.

The role objective for the Safety Officer is to carry out planned audits, in order to monitor that a consistent approach towards the application of safety principles and processes is achieved and that the levels of residual safety risks are well defined and acceptable to the Transport Agency.

The Safety Officer shall carry out audits (at least every two years) that confirm levels of compliance with the safety aspects of this policy, and specifically that:

- the required operational plans, safety plans, risk registers, fire life safety qualitative risk assessments (QRAs), processes for implementation and evaluation of emergency operations are in place
• coordination with the emergency services and incident and accident
evaluation is occurring
• operational staff and relevant emergency services are trained in relation
to the operational plans (organisation of training exercises for this
purpose, and ensure that such exercises are held at regular intervals)
• the tunnel’s systems and equipment are maintained and repaired to the
required compliance standards, levels of service or within agreed degraded
modes in accordance with the tunnel asset management manual
• long term asset management and safety improvement plans are in place.

Further guidance on key documentation required for tunnels is contained in
the *Guide to road tunnels*[^5].

When requested by the Transport Agency, the Tunnel Manager or the
Operations Manager, the Safety Officer shall assist with:

- the evaluation of any significant incident or accident
- advice on the design or commissioning of new or modified systems, or
equipment that affect the safe operation and maintenance of that tunnel.

### 3.3 Regional Performance Manager

Regional Performance Managers are the Transport Agency managers
responsible for the inspections, maintenance and operations of all aspects of
the state highway network, including tunnels, within their region.

### 3.4 Operations Manager

The day to day real-time operations of tunnels and their systems (including
but not limited to incident and emergency response coordination, fault and
alarm monitoring) is the responsibility of the regional Transport Operations
Centre (TOC) or Local Tunnel Operational Control Room. Each TOC or Local
Tunnel Operational Control Room will appoint an Operations Manager.

The Operations Manager shall be responsible for the safe real-time operation
of the network including the tunnel and all approaches and exits and for
ensuring that:

- sufficient staff are available to carry out the functions of the day to day
  running of tunnels operations and incident response
- operational and emergency procedures for when the tunnel is open, are in
  place and maintained, and for preparing and managing a general
  operations plan and any associated operational procedures and plans
  (refer to the *Guide to road tunnels*[^5] for detail)
- incident coordination and liaison is undertaken with emergency response
teams (incident response teams, New Zealand Fire Service, New Zealand
Police, Order of St John, Wellington Free Ambulance, Civil Defence)
- operator training and development is undertaken
- incident and accident data is collected and routine reports on trending
  and data are sent to the Tunnel Manager and the Transport Agency

[^5]: NZTA S8: 2017
• fault and alarm reporting is sent to the tunnel maintenance teams in line with agreed fault reporting and level of service timescales

• incident and accident debriefs and reporting is undertaken. Within one month of a significant tunnel accident or incident occurring, the Operations Manager shall prepare a debrief incident report that records the circumstances of the incident and send the debrief incident report to the Regional Performance Manager, Tunnel Manager, Safety Officer and relevant emergency services for their investigations and reporting.

Some tunnel control systems (for example servers, workstations, video walls, DYNAC, SIDERA, DVTEL, Vidsys and the fibre backbone network), including hardware, software, licensing, maintenance and performance, may be managed directly by the Transport Agency. The Operations Manager shall support the Transport Agency in the management of these assets.

### 3.5 Tunnel Inspection Engineer

For each tunnel or tunnel maintenance contract an individual shall be designated the Tunnel Inspection Engineer. This engineer shall have experience of supervision of M&E equipment installation, operation, inspection and maintenance in tunnels, and shall be able to evaluate the physical condition as well as the operational condition and performance of M&E equipment and building elements in tunnels. They will also be aware of applicable standards, codes and guidelines for tunnel construction and operation pertaining to M&E features.

The Tunnel Inspection Engineer shall:

(a) maintain overall management and technical supervision of the tunnel M&E equipment and building element inspection and maintenance programme scheduled by the Tunnel Manager;

(b) take responsibility for the technical competence of all personnel or contractors involved in M&E equipment and building element inspections and maintenance activities;

(c) take responsibility for the integrity of all M&E equipment and building elements in the tunnels advised by the Tunnel Manager;

(d) take responsibility for consulting with specialist staff and contractors when necessary; and

(e) review or appoint design engineers to review relevant M&E equipment and building element inspection reports.

The roles and responsibilities of the Tunnel Inspection Engineer may be carried out by or delegated to others (eg where a tunnel maintenance manager is in place), provided that these roles and duties are fully documented in the tunnel asset management manual in line with this policy.
4. **Scope of inspections**

   Inspection requirements for tunnels are listed below:

4.1 **Tunnel mechanical and electrical (M&E) equipment**

   All equipment and systems associated with operations, plant monitoring and control, traffic, communications and safety including:

   - ventilation
   - lighting
   - fixed fire suppression systems, drainage and pumping
   - fire safety and emergency response systems and alarms
   - communication and traffic control systems, including CCTV and AVID systems, remote controls and closures, traffic barriers, public address and radio rebroadcast
   - tunnel operation and plant control systems
   - monitoring systems (eg air quality, wind speed, noise, sensors, SCADA)
   - power supply and distribution.

4.2 **Tunnel building elements**

   Building elements of tunnels and associated control buildings including:

   - stairs, walkways and ladders, and access systems
   - screeds, roofs, downpipes, gutters, panels, doors, louvres, surface finishes and coatings.

4.3 **Tunnel structure**

   Inspection of all structural parts of the tunnel are covered by NZTA S6[c] including:

   - portals, structural linings, suspended ceilings cladding and panels
   - associated service buildings and plant rooms including water and detention tanks
   - anchors supporting plant and equipment
   - ventilation shafts.

   Other structures adjacent to tunnels such as approach walls are also covered by NZTA S6[c].

5. **Standard of inspection**

   The standard to which inspections shall be carried out is defined in the publication *Inspection manual for highway structures*[7]. Further guidance that is more specific to tunnels can be found in BD 53[c], BA 72[c], FHWA-IF-05-002[c] and FHWA-HIF-15-005 *Tunnel operations, maintenance, inspection, and evaluation (TOMIE) manual*[8].

   Where there may be conflict between these guidance documents and this policy, this policy shall take precedence.
6. Responsibilities for tunnel inspection

6.1 Routine surveillance inspections
These shall be carried out by staff who are competent to identify and report on deficiencies that may occur that could lead to accidents or unnecessarily high maintenance costs. They shall be personnel with either five years of experience in the maintenance of plant and equipment or relevant qualifications.

6.2 General, principal and special inspections
These shall be carried out under the control of the Tunnel Inspection Engineer, who shall determine which personnel shall undertake the inspections. This may include M&E inspectors, building inspectors, design engineers or other specialist staff where identification of faults in the particular tunnel M&E equipment is considered by the Tunnel Inspection Engineer to be outside the competence of the normal inspection staff.

7. Categories and frequencies of inspection
The various categories of inspection and the frequency with which they are to be undertaken are listed in appendix A, and described below. Note that separate requirements for inspection may be included within inspection and maintenance manuals for each tunnel.

The frequency of inspections may be influenced by the environmental and operating conditions within the road tunnel, and the limited life and possible warranty conditions of certain M&E equipment. Additionally in the case of many items of M&E equipment some inspections will not be specifically required because that objective should be accomplished during routine servicing or testing, or may be achieved through inspections required for other purposes. General guidance on equipment inspections during maintenance is set out in chapters 5 to 15 of BA 72(2).

Should an inspection reveal a serious ongoing hazard or defect affecting traffic operation or safety then the Tunnel Manager and Operations Manager shall be informed immediately and any mitigations or degraded mode of operation agreed and implemented.

7.1 Routine surveillance inspection
Routine surveillance inspections are regular, informal inspections for obvious deficiencies that could lead to accidents or unnecessarily high maintenance costs. Common examples include, but are not limited to:

- collision damage
- road settlement
- water seepage
- defective equipment, signals and controls.

Although these may be informal, keeping basic records of routine surveillance inspections is required.

The scope of routine surveillance inspections will depend on whether the tunnel is manned or unmanned and what tunnel informational systems exist and how they are monitored.
The frequency of routine surveillance inspections for building elements of tunnels and associated control buildings (e.g., doors, floors, stairs, ladders, cladding, roofs) shall be determined from asset owner’s manual information, building warrant of fitness (BWoF) requirements and through risk assessment, and agreed with the Principal and Tunnel Manager. The inspections shall identify any obvious loss of in use functionality or safety performance and integrity of the elements.

7.2 General inspection

General inspections are thorough, visual inspections of representative parts of the road tunnel and its equipment. The inspections shall include an assessment of condition of the tunnel M&E equipment and building elements.

The Tunnel Inspection Engineer shall develop specific general inspection requirements and procedures appropriate to each tunnel. These requirements and procedures shall be agreed with the Tunnel Manager.

Guidance of what is typically required for M&E inspections in tunnels can be found in BA 72(2), FHWA-IF-05-002(3), chapter 4, section B, part 2 and chapter 4, section C, part 2, and FHWA-HIF-15-005(8), sections 4.9.4, 4.9.5 and 4.9.6.

7.3 Principal inspection

Principal inspections comprise a closer and more detailed examination of all parts of the tunnel and may involve removal of cladding, casings, mountings to fans etc in order to gain access. The inspections shall include an assessment of condition of the M&E equipment and building elements.

Inspections shall be carried out at intervals agreed with the Tunnel Manager but will normally not exceed the intervals specified in appendix A.

The Tunnel Inspection Engineer shall develop specific principal inspection requirements and procedures appropriate to each tunnel. These requirements and procedures shall be agreed with the Tunnel Manager.

Guidance of what is typically required for M&E inspections in tunnels can be found in BA 72(2), FHWA-IF-05-002(3) and FHWA-HIF-15-005(8).

As part of the principal inspection, reference shall be made to all relevant as-built drawings and operation manuals for maintenance and inspection for the road tunnel.

A principal inspection shall be considered to replace the need for any general inspection due in any one year.

In some cases special access and testing equipment may be required and it may also be necessary to employ specialists. Where specific access requirements or features requiring specific or unusual inspection are identified, they shall be recorded.

The principal inspection report shall refer to and review documents relating to operation, maintenance and safety for compliance with current standards and completeness. Any necessary changes shall be recommended, costed and recorded. The report shall include detailed recommendations for any remedial or refurbishment works, with estimated costs.
7.4 Special inspection

Special inspections comprise a specific examination of a particular area or defect of special concern for which it may be necessary to employ specialists. The criteria and the extent of the inspections shall be agreed with the Tunnel Manager.

A special inspection shall be carried out:

(a) To investigate a specific significant problem, either found during an inspection or known to have occurred on other similar road tunnels.

(b) For the tunnel equipment after flooding.

(c) After a major accident or a fire within or adjacent to the road tunnel to investigate possible damage to the road tunnel, equipment and all safety functions.

(d) Following an earthquake which is likely to have caused damage to any tunnels in the affected area. The inspection shall be carried out as for a general inspection, on those tunnel elements susceptible to earthquake damage.

The criteria and the extent of the special inspection shall be agreed between the Tunnel Inspection Engineer and the Tunnel Manager.

The Tunnel Inspection Engineer shall develop specific special inspection procedures as required outlining the scope and frequency of the inspections and the personnel required. These procedures shall be agreed with the Tunnel Manager and shall be updated as necessary to ensure that the special inspections continue to be appropriate to maintain the tunnel in a safe condition.

The special inspection report shall include detailed recommendations for remedial or refurbishment works with estimated costs.

7.5 Building warrant of fitness (BWoF) inspection

For tunnels and control buildings with ‘specified systems’ (ie life safety systems) installed, inspection, testing and maintenance activities may need to be carried out on behalf of the Transport Agency (the ‘owner’) to comply with the BWoF aspects of the Building Act 2004. Any additional record keeping or administrative activities required for complying with the BWoF shall be arranged by the Tunnel Manager.

Where required an annual BWoF inspection shall be completed by an independent qualified person (IQP).

Where a Tunnel is exempt from BWoF requirements, any alternative compliance management process, additional record keeping or administrative activities required for compliance shall be arranged by the Tunnel Manager.
8. Reporting

8.1 Tunnel inspection

Each inspection shall be reported in a format agreed with the Tunnel Manager. The reports shall contain the details of all inspections and investigations carried out. The reports shall include information on whether or not the part of the road tunnel inspected complies with the level of serviceability required by the operational plans and, if parts of the road tunnel do not comply, a description of how that tunnel fails to so comply and a recommendation of the measures (if any) to be adopted in order to increase that tunnel’s safety shall be provided. Maintenance work, further detailed investigation or changes to the inspection regime shall be recommended as appropriate.

Each report and recommendations shall be sent to the Tunnel Manager.

If the results of any inspection show that emergency action is required, the Tunnel Inspection Engineer shall immediately advise the Tunnel Manager and the Operations Manager, who shall implement agreed appropriate action as necessary.

8.2 M&E equipment database

The Tunnel Manager shall ensure that any changes required to any database of M&E equipment and building elements are undertaken for the specific tunnel.

9. Records

9.1 Tunnel M&E equipment records

The Tunnel Inspection Engineer shall maintain the files of tunnel M&E equipment and building element inspection records and maintenance, so that a continuous history of the M&E equipment in each tunnel is available.

The Tunnel Inspection Engineer shall also maintain, for each tunnel, procedures for tunnel M&E equipment and building element inspections including specific access requirements, equipment requiring specific inspection and frequency of inspection.

9.2 Operational feedback

Information on accidents, incidents, power consumption and costs forms a valuable feedback of tunnel performance that can be used to set future tunnel management policy. The need to obtain such information and how it is presented shall be agreed with the Tunnel Manager.

10. Emergency event exercises

An emergency event exercise for the tunnel operators and incident response team shall be undertaken with the relevant emergency services at frequencies agreed between the Transport Agency and the emergency services. The purpose of the exercises is to demonstrate the correct operation of all safety and emergency equipment for the road tunnel as well as demonstrate the adequacy of response by the emergency services.
11. **Verification of maintenance**

An asset management system shall be instituted to verify that approved maintenance work has been carried out as programmed. The cost, description, quantity and timing of the completed work, other than routine maintenance, shall be recorded on the tunnel files.

12. **Traffic control**

At all times during the work or activities associated with or arising from the implementation of this specification, the Tunnel Inspection Engineer shall take responsibility to ensure all traffic control is carried out in accordance with the *Code of practice for temporary traffic management (CoPTTM)*\(^9\).

13. **References**


(4) NZ Transport Agency (2017) NZTA S6 *Bridges and other highway structures inspection policy*. Wellington.


## Tunnel inspection requirements

Refer also to NZTA S6 for tunnel structure inspection requirements.

<table>
<thead>
<tr>
<th>Category of inspection</th>
<th>Minimum frequency for inspection</th>
<th>Personnel involved (minimum requirements)</th>
<th>Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine Surveillance inspection</td>
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<tr>
<td>M&amp;E equipment</td>
<td>Monthly or as otherwise determined by risk assessment and agreed with the Tunnel Manager</td>
<td>See 6.1</td>
<td>As required</td>
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<tr>
<td>Building elements (eg doors, floors, stairs,</td>
<td>As determined from asset owner’s manual information, building warrant of fitness (BWoF)</td>
<td>See 6.1</td>
<td>As required</td>
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<tr>
<td>ladders, cladding, roofs)</td>
<td>requirements and through risk assessment, and agreed with the Principal and Tunnel Manager, but</td>
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<td></td>
<td>not less than annually.</td>
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<tr>
<td>General inspection</td>
<td>1 year for M&amp;E equipment</td>
<td>M&amp;E Inspector</td>
<td>In a format agreed with the Tunnel Manager</td>
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<tr>
<td></td>
<td>2 years for the tunnel building elements</td>
<td>M&amp;E Inspector or Building Inspector</td>
<td></td>
</tr>
<tr>
<td>Principal inspection</td>
<td>3 years for M&amp;E equipment</td>
<td>M&amp;E Inspector</td>
<td>In a format agreed with the Tunnel Manager</td>
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<tr>
<td></td>
<td>6 years for the tunnel building elements</td>
<td>M&amp;E Inspector or Building Inspector</td>
<td>and engineering report as necessary</td>
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<td>Special inspections:</td>
<td></td>
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<td></td>
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<tr>
<td>For specifically identified problems</td>
<td>As required</td>
<td>As determined by Tunnel Inspection Engineer as applicable</td>
<td>As required</td>
</tr>
<tr>
<td>Flood inspection</td>
<td>Immediately following a flood</td>
<td>M&amp;E Inspector</td>
<td>As required</td>
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<tr>
<td>Following major accident or fire</td>
<td>Immediately following the event</td>
<td>M&amp;E Inspector</td>
<td>As required</td>
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<tr>
<td>Earthquake inspection</td>
<td>Immediately following a significant earthquake</td>
<td>M&amp;E Inspector</td>
<td>As required</td>
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</tbody>
</table>

**NOTE:** Asset database requirements - clause 8.2