

## **NZ Roadmarkers Federation**

### **Contract Management - Site Review Checklist**

This document describes the items relating to roadmarking that should be assessed during site visits conducted by Engineers to the Contract. The elements covered are those that should have been addressed by the Contractor's Quality and Health & Safety systems. The checklist is by no means exhaustive and the Contract Supervisor should add items based on personal experience and specific contract requirements.

The aim of this checklist is to provide assurance that audits conducted of individual pavement marking operations have been completed professionally and objectively, by providing members of audit teams with the appropriate technical information and support.

The checklist is applicable to the evaluation of individual pavement marking operations during:

- 1 Contracts audits by Contract Engineers or their representatives during contract works
- 2 External audits by Quality System Certification Body Auditors
- 3 Internal audits by Head Contractors and individual Contractors.

The users of this checklist should familiarise themselves with:

- 1 The relevant Contract Quality Plan,
- 2 The Traffic Management Plan applying to the work-package(s),
- 3 The Contractors site safety requirements.

## 1 INTRODUCTION

The purpose of this checklist is to provide a basis for assessment during site reviews. In the case of method specification contracts this checklist will assist in ensuring that the contractor has complied with contractual requirements. In the case of performance based contracts this checklist will assist in assessing the competence of the contractor, and in ensuring that contractual requirements are met.

It is aimed at assessing compliance with the requirements of:  
Transit New Zealand quality specifications,  
The Health & Safety in Employment Act 1992,  
The Resource Management Act 1991.

The checklist is intended to provide the grounds on which the Principal can have confidence that the contractor has effective systems in place, and has demonstrated the technical capability to meet their contractual and legislative requirements.

## 2 SCOPE

The checklist covers the operational requirements for the field or site(s) relating to roadmarking operations. The activities covered are:

1. Application of paint and beads,
2. Application of “long-life” pavement marking materials, including thermoplastic
3. Traffic control related to pavement marking, both fixed site and mobile operations

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## 4 REFERENCES

The recommended list of documents that need to be considered are set out at the end of this document. The Auditor should also add to this list any additional material relating to special materials and or special conditions. The documents referred to should be those defined in the contract documents.

## 5 REVIEW AND AMENDMENT

This document has been developed by Quality Surveillance Ltd (QSL) for The New Zealand Roadmarkers Federation Inc (NZRF).

All information contained in it has been prepared in good faith by QSL and the NZRF and is, to the best of their knowledge, correct and complete. While every care has been taken in the preparation of the information provided, no warranty is given by either QSL or the NZRF as to the correctness of the information herein and no liabilities accepted for any statement or opinion, nor for any error or omission.

The writer may be contacted with regard to document content by either contacting the New Zealand Roadmarkers Federation Inc or Quality Surveillance Ltd

**NZ Roadmarkers Federation Inc**

PO Box 13-605

Auckland

Phone 09 625 7470

Fax 09 625 2830

Email [alister@nzrf.co.nz](mailto:alister@nzrf.co.nz)**Quality Surveillance Ltd**

PO Box 34-847

North Shore City

Phone 09 483 8063

Fax 09 482 0660

Email [r.ridings@xtra.co.nz](mailto:r.ridings@xtra.co.nz)

1 REVIEW PREPARATION & CONTRACT INFORMATION	
Contractor & Contract #	
ITEM	COMMENT
<p><b>MARKING DESIGNS</b></p> <p>What is the policy for selection of line type at particular locations? If variations are made to MOTSAM / RTS 5, what are they?</p> <p>Identify:</p> <ol style="list-style-type: none"> <li>Lengths (or proportion of the network) / locations requiring, centre-line only, edge-line only, edge-line and centre-line</li> <li>Line width for edge-lines, centrelines, other</li> <li>What markings and on which roads are required to be reflectorised</li> <li>Any other contract / area specific requirements.</li> </ol>	
<p><b>MATERIAL SELECTION</b></p> <p>What different material types are used on the contract, e.g. chlorinated rubber modified alkyd, waterborne, thermoplastic?</p> <ul style="list-style-type: none"> <li>List the product types and their locations on the network</li> <li>Identify what materials you are planning to review.</li> </ul>	
<p><b>CONTRACT BASIS</b></p> <p>Is the contract method based or performance based?</p> <ol style="list-style-type: none"> <li>If it is performance based, what are the performance criteria? (state criteria and limit values)</li> <li>If methods based what are the materials application rates? (state values for paint, beads etc)</li> </ol>	
<p><b>SPECIFICATIONS USED</b></p> <p>What specifications are referenced for : (note version)</p> <p><u>Materials</u></p> <ol style="list-style-type: none"> <li>TNZ M/7?</li> <li>TNZ M/12?</li> <li>TNZ M13?</li> <li>TNZ M/20?</li> </ol> <p><u>Work Standards</u></p> <ol style="list-style-type: none"> <li>TNZ P/12?</li> <li>TNZ P/14?</li> <li>TNZ P/22?</li> <li>TNZ P/20?</li> <li>Other? (State)</li> </ol> <p><u>Traffic Management</u></p> <ol style="list-style-type: none"> <li>TNZ CoPTTM?</li> <li>NZRF Guide to the Management of Traffic Hazard while Roadmarking</li> <li>Local Roads Supplement to TNZ CoPTTM?</li> </ol>	

<b>2 CONTRACTOR SUPPLIED INFORMATION</b>	
<b>ITEM</b>	<b>COMMENT</b>
<p><b>SITE REVIEW / WORK PACKAGE DETAILS</b>  <i>Identify :</i></p> <ul style="list-style-type: none"> <li>• <i>Work-site &amp; work to be reviewed,</i></li> <li>• <i>Assigned Senior Site Representative and contact details.</i></li> <li>• <i>Site Review meeting site, date and time.</i></li> </ul>	
<p><b>DOCUMENTAION FOR SITE REVIEW</b>                      Copy of relevant sections of :</p> <ol style="list-style-type: none"> <li>1. Work programme / schedule?</li> <li>2. Contract Quality Plan?</li> <li>3. Health &amp; Safety Plan?</li> <li>4. Environmental Management Plan / Spill Response Plan</li> <li>5. Traffic Management Plan?</li> </ol> <p>Any Contract Variations?</p> <p>Any Resource Consents?</p> <p>Note any restraints or special requirements.</p> <p>What work instructions will be on site?</p> <p>What drawings should be on site?</p>	
<p><b>SITE SAFETY</b>                      How will your arrival &amp; presence on site be managed?</p> <p>Confirm generic hazards relating to the operation and the control of these hazards?</p> <p>What PPE is required for you?</p>	
<p><b>MATERIALS</b>                      Confirm the materials to be used.  <i>(obtain Manufacturers Data Sheets)</i></p> <p>Which batch numbers are being used / assigned to job?</p> <p>What is the percentage of solids by volume for these batches?  <i>(obtain Test Certificates)</i></p>	

<b>2 SITE REVIEW CHECKLIST</b>		
<b>ITEM</b>	<b>complies Y/N</b>	<b>COMMENT</b>
<p><b>WORK PACKAGE DETAILS</b>  <i>Provide brief description of :</i></p> <ul style="list-style-type: none"> <li>• Contractor &amp; Contract #,</li> <li>• Work-Site &amp; work being carried out,</li> <li>• Site conditions including traffic count,</li> <li>• Senior Site Representative &amp; Team Members.</li> </ul>		
<p><b>WORK INSTRUCTIONS</b>                      Are there work instructions on site?                      Are these instructions well documented and appropriate?                      Are all site personnel aware of quality standards?</p> <p>Have site personnel been briefed on job requirements and methods to be used?                      Are these methods being applied?</p> <p>Is the plant &amp; equipment on site / available that required to complete the work in accordance with specified requirements?</p> <p>Are drawings the latest version?</p>		
<p><b>PROGRAMME OF WORKS</b>                      Is work being carried out as programmed in schedule and Contract Quality Plan?                      Has the Engineer been advised of any Variations?</p> <p>Is emergency work being carried out within specified time frame?</p> <p>Are there any restraints with regard to time / noise / vehicle counts etc?</p>		
<p><b>SITE SAFETY</b>                      Who is Senior Site Representative for the contractor?                      Who has “control of the place of work”?</p> <p>Has a hazard identification been conducted by Senior Site Representative?                      Has this been recorded?                      Is there a generic list of hazards relating to the operation and the control of these hazards?                      Were you briefed <u>on arrival</u> of the hazards and the site requirements?                      Was this briefing appropriate and adequate?                      Are all site personnel complying with these requirements?                      Do applicator operators and transport drivers have appropriate Hazardous Goods Licences?</p>		

<p>Are there Emergency Procedures Guides available in all vehicles carrying Hazardous Goods? Do vehicles have appropriate placards and labels? Are all materials being transported, transferred and handled safely in accordance with relevant Codes?</p> <p>Are all vehicles compliant with road transport regulations for road safety, registration and road user charges?</p> <p>Is there an approved Traffic Management Plan (TMP) on site? Does the TMP require amendment to suit work-site? Is the site:</p> <ul style="list-style-type: none"> <li>• Fixed?</li> <li>• Short or long term (state term)?</li> <li>• Mobile?</li> </ul> <p>Is site set up and maintained in accordance with TMP and associated diagrams. Is traffic being managed appropriately? Are there any delays or potential for incidents?</p>		
<p><b>ENVIRONMENTAL</b></p> <p>Is the site in accordance with the contractor's environmental management plan/Contract Quality Plan for:</p> <ul style="list-style-type: none"> <li>• Noise reduction?</li> <li>• Gun and tip cleaning/clearing?</li> <li>• Spillage of paint, fuels, oils, etc?</li> <li>• Liaison with other parties?</li> <li>• Resource Consents (Line Removal)?</li> </ul>		
<p><b>MATERIALS</b></p> <p>Do the materials on site comply with contract requirements, i.e.</p> <ul style="list-style-type: none"> <li>• Alkyd/Chlorinated Rubber/ other type of paint?</li> <li>• Correct Brand &amp; Solids Content?</li> <li>• Are RPMS the type and brand specified?</li> <li>• Is long-life marking material the type and brand specified?</li> </ul> <p>What is recorded on drum labels, pallecons, etc? Are there systems in place which ensure traceability of batch information?</p> <p>Is paint being thinned, if so, at what percentage, and what with? Is this thinning in accordance with Manufacturer's stated requirements? Do the methods being used comply with work instructions and does it ensure adequate mixing?</p> <p>Are Materials Safety Data Sheets for paint, thinners and other hazardous materials available on site?</p> <p>Is there evidence that the contractor has considered compatibility with existing markings?</p>		

<p>If materials are being transferred on site, what spill containment methods are available? Are staff aware of waterway protection requirements?</p>		
<p><b>SETTING OUT</b> Is all new work set-out in accordance with:</p> <ul style="list-style-type: none"> <li>• Drawings supplied?</li> <li>• Manual of Traffic Signs &amp; Markings Vol. 2?</li> <li>• Methods described in Contract Quality Plan?</li> </ul> <p>Were set-outs checked prior to application of markings?</p> <p>Are existing markings that are being repainted conforming to Manual of Traffic Signs &amp; Markings (MOTSAM) Vol. 2, RTS4 &amp; RTS5?</p> <p>What process does the Operator use when existing markings do not comply with MOTSAM/RTS?</p> <p>Are repainted markings superimposed on existing markings within 15mm of average centreline of existing markings?</p>		
<p><b>APPLICATION OF MATERIALS</b> <u>Preparations</u> Are there work instructions in place for: (a) Pre-site preparations? (b) Work site preparations? Have these been complied with and are they appropriate?</p> <p>Are there applicator set-up details available for:</p> <ul style="list-style-type: none"> <li>• Line widths?</li> <li>• Different materials/paint types/% thinners?</li> <li>• Bead application rates/speed?</li> <li>• Temperature conditions?</li> <li>• Surface conditions?</li> </ul> <p>Is the applicator being operated in accordance with these?</p> <p>Is the work being carried out within the times and conditions specified in the contract and / or Consents? Are road &amp; weather conditions suitable? (state briefly):</p> <ul style="list-style-type: none"> <li>• Weather, temperature, wind speeds, etc</li> <li>• Vehicle counts and vehicle types</li> <li>• Road widths</li> <li>• Pavement conditions</li> <li>• Any limiting factors such as visibility</li> </ul> <p><u>Support Vehicles / Staff</u> Are appropriate support vehicles/staff available on site or on call, ie:</p> <ul style="list-style-type: none"> <li>• Material transport / transfer?</li> <li>• Thermoplastic pre-heaters?</li> <li>• Line removal?</li> <li>• Specialised traffic control?</li> </ul> <p>Are appropriate and adequate communication systems in</p>		



<p>place between all members of team? Do these systems comply with the TMP?</p> <p><b><u>Paint or Long-life Material Application</u></b> Is paint / material adequately agitated? Is thermoplastic temperature adequately controlled?</p> <p>What is thermoplastic application temperature?</p> <p>Does pattern / applied line:</p> <ul style="list-style-type: none"> <li>• Have sufficient film build?</li> <li>• Uncontaminated by another colour/ unmixed material?</li> <li>• Have good edge definition?</li> <li>• Of correct width &amp; location?</li> <li>• Consistent and even?</li> <li>• Have beads (when specified)?</li> </ul> <p>Do beads start and stop correctly on intermittent lines?</p> <p>Are any recorded application rates within the Target Rate as specified in Contract Quality Plan?</p> <p><b><u>Glass Bead Application</u></b> Is the bead spray pattern:</p> <ul style="list-style-type: none"> <li>• Even, both across and down line/markings?</li> <li>• Covering paint marking without overspray?</li> <li>• Covering segmented markings for entire length?</li> </ul> <p>Are recorded application rates within the required Target Rate? i.e. 275gm/m<sup>2</sup> for P/12</p> <p><b><u>Protection of markings</u></b> What systems are in place to ensure that markings are protected from damage until set or dry? How are contractor's staff testing for dryness?</p> <p>Can contractor demonstrate evidence of :</p> <ul style="list-style-type: none"> <li>• No-pickup time?</li> <li>• Maximised bead retention?</li> <li>• Compatibility with substrate/existing markings?</li> </ul> <p>Are marking protection systems:</p> <ul style="list-style-type: none"> <li>• Covered by the TMP?</li> <li>• Appropriate and adequate?</li> </ul> <p>How are incidences of vehicle tracking managed?</p>		
<p><b>APPLICATION TESTING</b></p> <p><i>It is important that while the operator needs to know what is happening, it is critical that the audit accurately records what is actually happening. Any obvious changes in settings/application speed need to be recorded.</i></p> <p><b><u>Paint/Thermoplastic</u></b> To check the application rate(s), take a test plate during the course of normal application with the beads turned off. <i>Record location and line type on plate</i></p>		

<p>Alternatively the washer method as described in P/12 Notes can be used for paint, or adhesive tape method for thermoplastic.</p> <p>Record nominated speed (and computer generated dry film thickness if available). <i>Record actual speed. Refer to Appendix 2 Applicator Speeds / embedded calculations.</i></p> <p><i>The plate(s) need to be tested for dry film thickness in accordance with TNZ T/8 and /or TNZ P/12, once dry (not for at least two hours for Alkyd paint)</i></p> <p><b>Glass Beads</b> To check the application rate, have the paint turned off, spray beads into suitable container for an appropriate interval. Secure the container and record interval.</p> <p><i>A subsequent off-site weighing will provide the information required to determine the application rate. Refer Appendix 2 Bead Application Rates / embedded calculations. Note: the operator may have alternative method to this.</i></p> <p>A test plate needs be taken also to provide a visual record of the spread and application rate being achieved.</p> <p>Observe completed markings for excess or loose beads.</p> <p><b>Equipment Capabilities</b> Determine and record paint pump(s), thermoplastic extruder make / size / type / estimated output.</p> <p>Request / estimate normal operating wastage values for paint / thermoplastic / beads.</p> <p>Note any apparent operating characteristics / deficiencies of application equipment.</p>		
<p><b>INSPECTION &amp; TESTING</b></p> <p>What inspection and test plans are available on site? Do these comply with Contract Quality Plan?</p> <p>What test equipment is on site for:</p> <ul style="list-style-type: none"> <li>• Paint volumes (paint computer/dip stick)?</li> <li>• Thinners volume?</li> <li>• Set-out?</li> <li>• Width?</li> <li>• Film thickness (both wet &amp; dry)?</li> <li>• Material temperature (thermoplastic)?</li> <li>• Pavement surface conditions (temperature &amp; moisture)?</li> <li>• Relative humidity (waterborne)?</li> <li>• Bead application?</li> </ul> <p>Do applicators have film thickness indicators? If so how is their accuracy verified?</p>		

<p>What acceptance criteria are used, (P/12, P/14, MOTSAM) for:</p> <ul style="list-style-type: none"> <li>• Paint and long-life material application?</li> <li>• Bead application?</li> <li>• RPM Installation?</li> </ul> <p>What is test plate frequency? Do available test plates appear to comply?</p> <p><b>Monitoring</b> What equipment is used to monitor:</p> <ul style="list-style-type: none"> <li>• Retroreflectivity?</li> <li>• Appearance?</li> <li>• Skid resistance of markings?</li> </ul> <p>What monitoring plan exists? Is testing in accordance with this plan?</p>		
<p><b>SITE RECORDS</b></p> <p>Is a copy of the TNZ T/8 or T/12 Certificate in vehicle / on site? – Is it valid? Note the application speeds.</p> <p>Does the Operator have a form of Materials Diary? Does this record;</p> <ul style="list-style-type: none"> <li>• Paint used by class and type, volume used including thinners?</li> <li>• Paint / thermoplastic batch numbers?</li> <li>• Location?</li> <li>• Details of work? (Miscellaneous small markings may be grouped, provided the location is identified.)</li> <li>• Details of any primers or surface preparation?</li> <li>• For thermoplastic, time material loaded into pre-heater, quantities added and the total time that material has been held at temperature?</li> </ul> <p>Note a selection of work with quantities of work and the volumes of materials used for subsequent review. Alternatively request a copy to be provided the very next day.</p> <p>Has site(s) had final inspection by person nominated by contractor? How is this recorded? Have all non-conforming markings been recorded? Have any incidents or accidents been recorded? Does the representative consider the work: Complete? Satisfactory?</p> <p>Notes: Under TNZ P/12:</p> <ul style="list-style-type: none"> <li>• <i>all paint applicators require valid TNZ T/8 Certificates at time of tender,</i></li> <li>• <i>all Long-life product requires valid TNZ T/12 Certificates at time of tender,</i></li> <li>• <i>and Certificates are to be maintained for the period of the contract.</i></li> </ul> <p>TNZ T/8 &amp; T/12 require that certificates must be registered</p>		

<p>to be valid. The NZRF is the registration body. A copy of the register is available from the NZRF Executive Director or from the NZRF Website at <a href="http://www.nzrf.co.nz">www.nzrf.co.nz</a></p>		
<p><b>POST REVIEW EVALUATIONS</b></p> <p><b><u>Applicator Speed</u></b>          Were speeds within acceptable margins of nominated / stated speed? Refer Appendix 2 – Speed Calculations / embedded calculations.</p> <p>Were speeds similar to those on TNZ T/8 Certificates?</p> <p><b><u>Paint / Thermoplastic Application</u></b>          Do selected test plates and / or test plates taken during audit comply with contractual requirements / TNZ P/12 when subsequently measured? Refer Appendix 2 Minimum Paint Film Thickness Calculations / embedded calculations.</p> <p>Do measured film thickness' agree with Target material application rates? Refer Appendix 2 Paint Application Rate Calculations / embedded calculations.</p> <p>.</p> <p>Is the calculated paint pumping requirement within pump capacity. Determined using Appendix 2 Paint Pump Capacity / embedded calculations and pump information.</p>		

<p>Do the results of Materials Record calculations indicate compliance with contractual requirements. <i>Refer to Appendix 2 Paint Application Rate / embedded calculations.</i></p> <p><b><u>Glass Bead Application</u></b></p> <p>Do calculated bead application rate(s) agree with target material application rates and contractual requirements? <i>Refer to Appendix 2 Glass Bead Application Rate / embedded calculations.</i></p> <p>Does the calculated bead gun output match target material application rates and contractual requirements. <i>Refer to Appendix 2 Glass Bead Gun Outputs/ embedded calculations.</i></p>		
<p><b>OTHER</b></p> <p>Were there any incidents / accidents on site during the review? If so note circumstances and actions taken by contractors staff</p> <p>What was the approach and attitude to the review by the contractor and their staff?</p> <p>Was there any apparent difficulty in locating work crews, information, etc.</p>		

## 4 SITE COMPLIANCE WITH REQUIREMENTS

**Site:**

**Auditor:**

**Date:**

### Design Criteria

- Marking Type and location, i.e. MOTSAM, RTS 5, Contract

### Materials

- |   |                                    |
|---|------------------------------------|
| <input type="checkbox"/> Paint Type         | <input type="checkbox"/> Beads     |
| <input type="checkbox"/> Long-life material | <input type="checkbox"/> Aggregate |

### Performance Characteristics

- |  |   |
|--|---|
| <input type="checkbox"/> Daytime visibility      | <input type="checkbox"/> Skid resistance                  |
| <input type="checkbox"/> Retroreflectivity (dry) | <input type="checkbox"/> Retroreflectivity (wet recovery) |

### Preparation of Surface / Marking Conditions

- |  |   |
|--|---|
| <input type="checkbox"/> Extraneous loose material | <input type="checkbox"/> Surface / weather conditions |
|--|---|

### Protection Of Markings Until Set Or Dry

- |   |   |
|---|---|
| <input type="checkbox"/> Bead displacement  | <input type="checkbox"/> Transfer of marking material |
| <input type="checkbox"/> Damage to markings |   |

### Location and Set Out

- |   |  |
|---|--|
| <input type="checkbox"/> Remarking of existing non-compliant markings | <input type="checkbox"/> Smoothness / straightness |
| <input type="checkbox"/> Set-out within tolerance                     |  |

### Application of Materials

- |  |                                    |
|--|------------------------------------|
| <input type="checkbox"/> Paint         | <input type="checkbox"/> Beads     |
| <input type="checkbox"/> Thermoplastic | <input type="checkbox"/> Aggregate |

### Marking Appearance

- |  |   |
|--|---|
| <input type="checkbox"/> Colour / discolouration                   | <input type="checkbox"/> Overspray / transfer / cut-off |
| <input type="checkbox"/> Inconsistencies in material / application |   |

### Application Rates – visual estimates, etc

- |   |                                    |
|---|------------------------------------|
| <input type="checkbox"/> Marking material | <input type="checkbox"/> Aggregate |
| <input type="checkbox"/> Beads            |                                    |

### Dimensional Tolerances

- |   |   |
|---|---|
| <input type="checkbox"/> Gap lengths                | <input type="checkbox"/> Segment lengths                  |
| <input type="checkbox"/> Line width                 | <input type="checkbox"/> Positioning on existing markings |
| <input type="checkbox"/> Separation of centre-lines | <input type="checkbox"/> Proximity of markings to RPM's   |

(Duplicate as necessary for number of sites audited.)

## 5 REFERENCE DOCUMENTS

### TNZ Notes and Guidelines

QG Notes	Guidelines on Roles of the Client, Consultant and Contractor in Quality Assurance
P/12 Notes	Notes for the Specification for Pavement Marking
P/14 Notes	Notes for the Specification for Installation of Raised Pavement Markers
P/20 Notes	Notes for the Specification for Performance Based Roadmarking
M/7 Notes	Notes for the Specification for Roadmarking Paints
M/12 Notes	Notes for the Specification for Raised Pavement Markers
M/13 Notes	Notes for the Specification for Adhesion Agents

### TNZ Specifications & Related Documents

TNZ P/12	Specification for Pavement Marking
TNZ P/22	Specification for Reflectorised Pavement Marking
TNZ P/14	Specification for Installation of Raised Pavement Markers
TNZ P/20	Performance Based Specification for Roadmarking
TNZ T/8	Specification for Roadmarking Paint Applicator Testing
TNZ T/12	Specification for Certification of Long-Life Material Pavement Marking Applicators
TNZ M/7	Specification for Roadmarking Paints
TNZ M/12	Specification for Raised Pavement Markers
TNZ M/13	Specification for Adhesion Agents
TNZ M/20	Specification for Thermoplastic Roadmarking Materials
AS 2009	Glass beads for road-marking materials
MOTSAM Prt2	Manual of Traffic Signs & Markings: Part 2 Road Markings
RTS 4	LTSA Guidelines for Flush Medians
RTS 5	LTSA Guidelines for Rural Road Marking and Delineation
NZS 3910	Conditions of contract for building and civil engineering construction
CoPTTM	Transit New Zealand Code of Practice for Temporary Traffic Management

### Quality & Contractual Documents

TQS2	Quality system for Road Construction, Road Maintenance and Structures Physical Works Contracts having a Normal QA Level
AS/NZS/ISO 9001:2000	Quality management systems - Requirements
NZRF QAP002	Quality Assurance Programme Specifications and Guidelines (referenced by TNZ)

### Industry Guidelines & Codes of Practice

NZRF Roadmarkers Guides: - available on request from the NZRF

- Safety Health & Environment Guide (*provides guidance on HSE and Environment*)
- Guide to the Management of Traffic Hazard while Roadmarking (*provides interpretation of TNZ CoPTTM*)
- Line Removal Guide (*provides guidance on line removal methods*)
- Roadmarking Materials (*provides information on roadmarking materials*)

Local Roads Supplement to TNZ CoPTTM

TNZBCA Safe Handling of Bituminous Materials used in Roading (*relates to RPM Adhesive*)

NZCF Contractors Guide to Health & Safety in the Workplace

Code of Practice for the Management of Substances Hazardous to Health (MOSHH)

CRT&L ITO Operators Handbook for the Transport of Dangerous Goods (DG) by Road (*provides guidance on DG requirements*) – available from the Commercial Road Transport & Logistics ITO

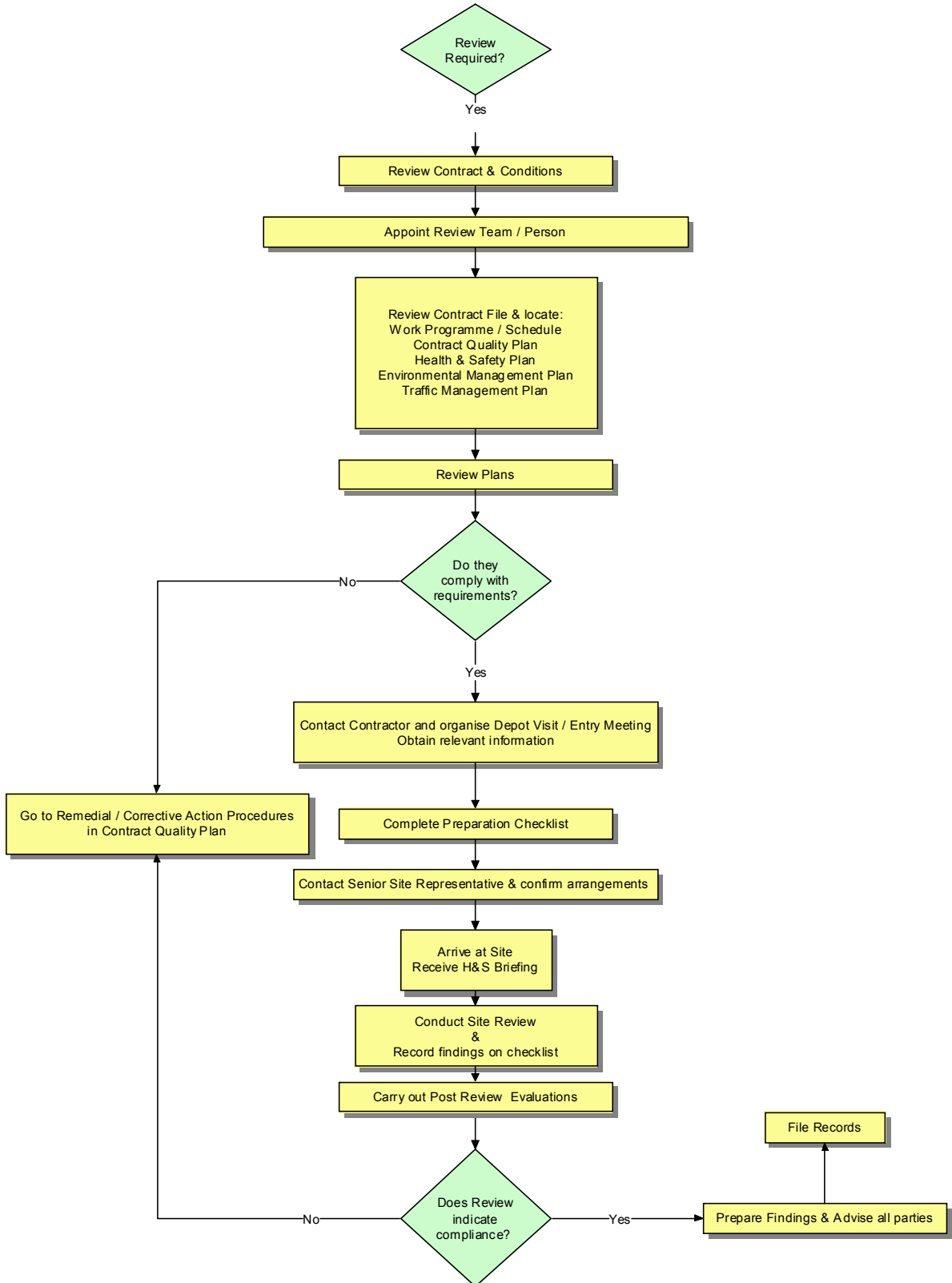
#### Note:

Transit New Zealand supply the latest versions of their Specifications on their WebPages.

National Specifications and Transit Manuals are available from Standards New Zealand.

6 CHECKLIST PROCESS FLOW CHART

SITE REVIEW CHECKLIST PROCEDURE





## 7 ROADMARKING INDUSTRY CALCULATIONS

### Range Of Applicable Calculations

There are a number of calculations that have application to roadmarking operation and supervision. These include but are not limited to:

- A) Speed of Applicator
- B) Required Paint Application Rate, Pumping Ability of Paint Pump and Minimum Paint Film Thickness (MPT)
- C) Required Glass Bead Application Rate and Glass Bead Gun Output

<b>A) Applicator Speed</b>	
Type A (time over 100m / 10 centre-line segments)	360 / time in seconds
Type B (Time to paint Rural Lead Line)	180 / time in seconds
Type B (Time to paint Urban Lead Line)	108 / time in seconds
<b>B) Paint Application Rates</b>	
Paint Required (litres)	$(10 \times A \times DFT) / (VS \times (100-W))$
Paint Pump Capacity Requirement (litres/min)	$(LW \times S \times DFT) / (600 \times VS \times (100-W)/100)$
Minimum Paint Film Thickness (MPT)	$MPT = Pav - (0.45 \times Std Dev)$
<b>C) Glass Bead Application Rates</b>	
Glass Beads Required (kgs)	$(BAR \times A) / (1000 \times (100-W))$
Glass Bead Gun Output (gms/sec)	$(LW \times S \times BAR) / 3600 \times ((100-W)/100)$
Where:	
A = area in square metres	
LW = Line width in mm	
DFT = desired dry film thickness in microns	
S = Speed in kph	
VS = % Solids by Volume	
W = Estimated % Wastage	
BAR = Required Bead Application Rate in gms/m <sup>2</sup>	
Pav = Average of the thirty readings taken on the three zones	
Std Dev = The Standard Deviation of the thirty readings	

### A) SPEED OF APPLICATOR

As the application rates are controlled by the speed of the applicator, the determination of the speed at time of surveillance or test is critical.

Actual road speed for a Type A or B1 can be estimated by timing the interval that it takes the applicator to paint 100metres (10 whole centre-line markings). Speed = 360/time in seconds.

Actual marking speed for Type B applicators can be estimated by timing the interval taken to paint the lead line on intersections.

Speed = 180/time in seconds for Rural Lead Line

Speed = 108/time in seconds for Urban Lead Line

For TNZ T/8 Test the average speed is determined by dividing 118.8 by the time taken to travel the 33 metre strip.

### B) PAINT APPLICATION RATES

Required Paint Application Rate

Required quantity of paint in litres to achieve a desired film thickness is determined by the formula  
 $(10 \times A \times \text{DFT}) / (\text{VS} \times (100 - W))$

Where:

A = area in square metres

DFT = desired dry film thickness in microns

VS = % Solids by Volume

W = Estimated % Wastage

Paint Pump Capacity

The output in litres/min required for a paint pump to apply paint at a rate to match the required application rate is as follows:

$(\text{LW} \times \text{S} \times \text{DFT}) / (600 \times \text{VS} \times (100 - W) / 100)$

Where:

LW = Line width in mm

S = Speed in kph

DFT = Desired Dry Film Thickness

VS = % Solids by Volume

Minimum Paint Film Thickness (MPT)

In accordance with TNZ P/12:2000,

$\text{MPT} = \text{Pav} - (0.45 \times \text{Std Dev})$

Where:

Pav = Average of the thirty readings taken on the three zones

Std Dev = The Standard Deviation of the thirty readings.

**C) GLASS BEAD APPLICATION RATES**Required Glass Bead Application Rate

Quantity required in kgs:

$(\text{BAR} \times A) / (1000 \times (100 - W))$

Where:

BAR = Required Bead Application Rate in gms/m<sup>2</sup>

A = Area in square metres

W = Estimated % Wastage

Glass Bead Gun Output

Output required in grams per second:

$(\text{LW} \times \text{S} \times \text{BAR}) / 3600 \times ((100 - W) / 100)$

Where:

Where LW = Line width in mm

S = Speed in kph

BAR = Required Bead Application Rate in gms/m<sup>2</sup>

W = Estimated % Wastage

## 8 NZQA UNIT STANDARDS

There are three NZQA Unit Standards that relate to calculations in roadmarking. Roadmarking Operators and supervisory staff should hold these units or be able to demonstrate equivalency.

21427 Perform Complex Industry Calculations For Roadmarking Application.

People credited with this unit standard are able to: estimate usage prior to operation; perform calculations for applications; and record calculations.

15932 Perform Quality Assurance Testing And Sampling For Roadmarking.

People credited with this unit standard are able to: take samples of roadmarking applications; take and verify application rates; and identify, report, and remedy non-complying markings.

21431 Demonstrate Knowledge Of Specifications Used For Complex Roadmarking.

This unit is designed for skilled operators, field supervisors, and managers working in the roadmarking industry.

People credited with this unit standard are able to: demonstrate knowledge of roadmarking specifications; and refer to relevant documents for details of roadmarking requirements.

In addition, Unit Standard 21423 is aimed at recognising the skill and knowledge required to complete this checklist.