NZRF ROADMARKING

QUALITY ASSURANCE

GUIDELINE

NZRF:QAP002 - Rev 3

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This document provides guidelines for ISO 9001 auditors of roadmarking companies providing roadmarking services to the New Zealand Transport Agency.

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0. INTRODUCTION

0.1. Background

New Zealand Transport Agency (NZTA) documents used by Road Controlling Authorities (RCA's) to manage roadmarking contracts require evidence of compliance with an approved quality system for roadmarking works. An approved quality system is defined as compliance with ISO 9001 including the technical requirements of NZRF:QAP002 (QAP002).

QAP002 was developed in 1989 to assist roadmarking contractors providing services to RCA's to develop robust documented systems which would eventually meet the requirements of ISO 9002. The mandatory requirements of QAP002 when introduced, were slightly less stringent than ISO 9002, in accordance with the policy of stepwise development of quality assurance capability in the roadmarking industry. QAP002 aligned quality assurance requirements to the roadmarking industry and specified relevant technical requirements.

NZTA and the NZRF recognise the importance of auditor familiarity with the technical aspects of roadmarking and have facilitated the development of auditor guidelines against the elements of ISO 9001:2008. QAP002 comprises guidelines for both External and Internal Auditors carrying out audits of roadmarking operations in New Zealand.

The guideline sections of the document contain two aspects of relevance for assessment against ISO 9001:

(a) Reference directly or indirectly relevant NZTA documents and technical specifications which may be called up in contract documentation. Since roadmarkers are expected to be familiar with these specifications, in-depth explanations are generally not included in the guidelines.

(b) Guidelines on industry practices to be taken into account by the auditor. If alternative practices are used, the applicant should be able to substantiate their fitness for purpose. An example is the use of measurement of applied material thickness as validation of substantiated computer-based control rather than as a direct process control method.

NOTE: The guidelines are limited to technical and contractual issues related to roadmarking, as a supplement to ISO 9001 checklists used by auditors. The statement "Refer to ISO 9001" appears where there is no specific roadmarking material input.

0.2. Responsibilities

The NZRF is responsible for review, revision and issue of this document. Review and amendment are to be conducted in consultation with NZTA and other parties nominated by NZTA.

NZTA is responsible for endorsement of the criteria of QAP002 as a contractual requirement for roadmarking contracts.

0.3. Roadmarking Process

The following description is aimed at providing an outline of the process for provision of roadmarking services on a contractual basis.

0.3.1. Contract Methods

Roadmarking is generally carried out as a contracted service arrangement between the roadmarking contractor and an RCA. A normal contract arrangement has the RCA appoint an Engineer to the contract. The contract is managed under the conditions in New Zealand Standard Specification NZS 3910.

An alternative is where the roadmarking contractor enters into a subcontract arrangement with another contractor who is the Head Contractor, in a supply arrangement with the RCA.

Contracts are normally method-based or performance-based. In a method-based approach the roadmarking contractor carries out work in accordance with methods specified in the contract documents, e.g. NZTA P 22. In a performance-based approach the roadmarking contractor designs and operates a marking system aimed at satisfying the performance criteria specified in the contract specifications, e.g. NZTA P 20.

The contract term is commonly three years (although may be 1 + 1) for method-based contracts, and either 5 or 10 years for performance based contracts. At any time contractors may hold a number of contracts with some just starting and others reaching conclusion.

Work is typically secured by a tendering process. Tendering usually involves the development of a tender submission which includes a description of the company's attributes, a methodology statement and a price. NZTA operates a pre-qualification scheme aimed at simplifying the tendering process which places the contractor on an appropriate list after acceptance of certain criteria.

0.3.1.1. Contract Management

1. The RCA develops a Request for Tender for either maintenance of existing markings or the installation of new markings. NZTA Specifications are commonly used to describe roadmarking requirements. The Conditions of Contract are generally those described in NZS 3910
2. A Request for Proposal (RFP) / Request For Tender (RFT) is advertised
3. The Contractor prepares a tender, based on the RFP/RFT. The tender includes a description of the planned methodology and a price for the work which may be carried out in part by subcontractors. The Contractor submits their tender to the RCA before the tender closing date
4. Tenders are evaluated by the RCA and the tender is let to a contractor that meets their specified requirements, typically those contained in NZTA Procurement Manual (previously CPP Manual) (The process may be price driven)
5. On acceptance of the contract, the Contractor develops and submits a Contract Quality Plan (CQP) which describes how the contractor plans to satisfy the requirements of all relevant specifications and legislative requirements. The CQP, which includes a Specification Review Schedule (SRS), Job Plan and Work Instructions, is submitted and agreed to by the RCA before commencement of work
6. The Contractor enters into a supply arrangement with marking material suppliers for material and any subcontractor for services as specified in contract documents or the CQP
7. The RCA and Contractor meet prior to commencement of work ("kick-off" meeting) to facilitate acceptance of the submitted CQP and finalise the work programme

8. The Contractor commences work in accordance with CQP
9. The Contractor submits their Claim for Payment at agreed intervals, typically monthly
10. RCA staff review claims / completed work and make appropriate payments (claims relate to work carried out on method-based contract and at an agreed rate on performance-based contracts)
11. On completion of the work package (typically three years for maintenance work, or five or ten years on performance-based contracts), the contractor submits the Final Claim
12. RCA staff review claims / completed work and make appropriate payment
13. The RCA retains specified monies until the end of the Defects Liability Period, after which they pay these out, provided the agreed works meet the specified requirements.

0.3.2. Format of Markings (Design) To Be Applied

The format, or design, of the markings on roads in New Zealand is described by the legislation contained in the Land Transport Rule: Traffic Control Devices 2004 (TCD) Rule. Note: the TCD rule applies equally to all locations to which the public have access.

Traditionally, the requirements for roadmarking were communicated via the Manual of Traffic Signs and Markings (MOTSAM) Part II. MOTSAM is being progressively converted to Traffic Control Specifications.

0.3.3. Method Selection

For method-based contracts, the methods used are expected to be in accordance with the appropriate specification.

For performance-based contracts, the methods to be used are described in the Methodology section of the CQP.

0.3.4. Material Selection

All materials applied to roadways in New Zealand should be selected from those that have been tested and approved to be applied in accordance with requirements described in NZTA Specifications.

There are NZTA Specifications relating specifically to both method-based and performance-based or warranted work.

A comprehensive description of the products in common use in New Zealand is provided in Section Eight of the NZRF Safety Health and Environment Guide.

0.3.5. Application Processes

The most commonly applied marking materials are paint and raised pavement markers (RPM's).

An outline description of the application processes follows:

0.3.5.1. Temporary Traffic Management

The single greatest hazard encountered by roadmarking workers is contact with a motor vehicle sharing their work space.

For roadmarking contractors, the only realistically practical method for the management of the traffic hazard under the requirements of the HSE Act is to identify and minimise its effects. (Roadmarking contractors do not have the ability to eliminate or isolate the hazard.)

The management of traffic flows around the work-sites is usually specified in accordance with the NZTA Code of Practice for Temporary Traffic Management (CoPTTM), or the Road Controlling Authorities Forum Local Roads Supplement to the NZTA CoPTTM document.

0.3.5.2. Paint Application

Painted pavement marking is a specialised operation requiring a paint applicator, specialised paint and appropriately trained staff.

1. Painted pavement markings are applied by an applicator that sprays paint from a fixed nozzle, connected to a high pressure paint pump, while the applicator is propelled at a uniform speed. Glass beads are surface applied to the wet paint using a bead gun mounted directly behind the paint gun(s)
2. An appropriate applicator is selected for the work to be carried out. Type A applicator (truck mounted equipment) is used for longitudinal markings, Type B applicator (modified tractor or golf cart, purpose built operator mounted vehicle or purpose built pedestrian controlled device) is used for transverse and minor markings
3. The paint and bead materials are loaded into tanks on the applicator. Additional material may be carried on a support vehicle
4. The applicator is set up in accordance with standard set-ups to achieve the required target dry-film thickness and glass bead application rate. The paint and bead application rates required to achieve contract requirements are pre-determined by NZTA/NZRF T 8 testing and certification
5. A trial application is made on the start of marking on a steel plate. The wet-film thickness measurement is taken from a "test plate" using a wet film gauge and dry-film thickness estimated using percentage solids by volume of paint
6. Settings and / or application speed are altered as appropriate
7. The operator follows the existing markings (or set-out spots in the case of new work) in such a manner as to superimpose the new paint over the existing markings while maintaining the desired application speed
8. At regular intervals, test plates are taken at the frequency stated in the CQP, typically at least once for each work package per day, for subsequent dry-film thickness measurement
9. The painted marking is protected until dry using 450mm cones.

0.3.5.3. Raised Pavement Marker Installation

Installation of Raised Pavement Markers (RPM's) is a specialised operation, requiring the heating of a bituminous material to approximately 180^{o}C, and appropriately trained staff.

1. The RPM adhesive applicator is selected for the work to be carried out. While modified trucks using specialised heaters and gun are used for highway work, small kettles may be used for situations where a small number of RPM's are to be applied. NZTA have stated their intent to initiate a certificate scheme similar to NZTA/NZRF T 8 for applicators
2. The hot-melt adhesive is heated in accordance with the manufacturer's recommendations. The normal working range of bituminous hot-melt is in the range of 165 to 220^{o}C
3. The temperature is monitored using temperature gauge(s) to ensure that the temperature control system is working as intended and material is not over-heated
4. Once the material is at the desired application temperature, the outlet of the hot-melt dispenser is positioned over the desired location for the RPM and sufficient adhesive is discharged to secure the RPM without significant wastage. Application rates are highly dependent on the texture depth of the pavement

5. The RPM is positioned central in the hot-melt and pressed into it. The RPM must rest on the pavement surface, with the retro-reflective element facing square to the traffic flow. It must be secured by sufficient adhesive that it contacts the four corners of the RPM and does not spread out from the RPM by more than approximately 10mm
6. The RPM is protected from traffic for at least 1 minute to ensure a good bond.

0.3.5.4. Machine Applied Thermoplastic

Thermoplastic pavement marking is a specialised operation requiring a powered thermoplastic applicator, thermoplastic pre-melter, specialised thermoplastic material and appropriately trained staff.

1. Thermoplastic pavement markings are typically applied by an applicator that extrudes molten thermoplastic from a fixed gate or shoe, while the applicator is driven at a uniform speed
2. An appropriate applicator is selected for the work to be carried out. Applicators can be a modified truck, a purpose built operator mounted vehicle or purpose built pedestrian controlled device
3. The thermoplastic is brought up to temperature using a pre-melter before being loaded into the applicator
4. The applicator is set-up in accordance with standard set-ups to achieve the required target film thickness and glass bead application rates. The material application rates are pre-determined by NZTA T 12 testing and certification
5. For plain markings or audio-tactile profile markings (ATP), a trial application is made on the start of a marking on a steel plate. For plain markings, the film thickness measurement is taken from a test plate using a gauge. For ATP markings, the block height is measured by a special gauge and other dimensions by ruler / tape measure
6. For structured markings, a trial application is made on a pre-weighed length of heavy Kraft paper. The paper is re-weighed to determine the application rate
7. Settings and / or application speed are altered as appropriate
8. The operator follows the existing markings (or set-out spots in the case of new work) in such a manner as to superimpose the new marking over the existing markings while maintaining the desired application speed
9. A test plate, and / or Kraft paper sample is taken at the frequency stated in the CQP, typically at least once for each work package per day, for subsequent thickness / application rate determinations
10. The marking is protected until set using 450mm cones.

0.3.5.5. Machine Applied Cold Applied Plastic

Cold applied plastic (CAP) pavement marking is a specialised operation requiring a powered CAP applicator, specialised CAP material and appropriately trained staff. CAP is a high solids liquid which requires a catalyst to set.

1. CAP pavement markings are typically applied by an applicator that extrudes CAP from a fixed gate or shoe, while the applicator is driven at a uniform speed
2. An appropriate applicator is selected for the work to be carried out. Applicators can be a modified truck or purpose built operator mounted vehicle or pedestrian controlled device
3. The applicator is set-up in accordance with standard set-ups to achieve the required target film thickness and glass bead application rate. The applicator application rates are pre-determined by NZTA T 12 testing and certification
4. For plain markings or audio-tactile profile markings (ATP), a trial application is made on the start of a marking on a steel plate. The film thickness measurement is taken from a test plate using a gauge. For ATP markings, the block height is measured by a special gauge and other dimensions by ruler / tape measure

5. For structured markings, a trial application is made on a pre-weighed length of heavy Kraft paper. The paper is re-weighed to determine the application rate
6. Settings and / or application speed are altered as appropriate
7. The operator follows the existing markings (or set-out spots in the case of new work) in such a manner as to superimpose the new marking over the existing markings while maintaining the desired application speed
8. A test plate, and / or Kraft paper sample is taken at the frequency stated in the CQP, typically at least once for each work package per day, for subsequent thickness / application rate determinations
9. The marking is protected until set using 450mm cones.

0.3.6. Quality Control

Direct measurement of critical physical dimensions of pavement markings such as their thickness is precluded by the production method and location of the marking.
It is for this reason that the accepted method of process monitoring includes:

1. Process validation
2. Monitoring of application process
3. Sampling of output
4. Measurement and monitoring of performance characteristics

0.3.6.1. Process Validation

The capabilities of paint applicators are validated by testing in accordance with the NZTA/NZRF T 8 - Specification for Roadmarking Applicator Testing. The programme described by T 8 includes registration of applicators which have met industry accepted standards of performance.

The capabilities of long-life marking material applicators are assessed and certified under the NZTA T 12 Specification.

A list of currently certified applicators and a copy of the registered certificate is available on the NZRF website – www.nzrf.co.nz

Note: Contracts for ATP may require a representative of the RCA to observe the application of a trial section prior to the commencement of the contract works.

0.3.6.2. Monitoring Of Application Process

Operators of applicators are provided with standard set-ups under which the applicators are to be operated. These set-ups should have been determined from, or are related to, the results of the T 8 and T 12 testing and certification.

The operators and assistants routinely monitor and control a number of process conditions and outputs such as applicator speed, paint pressure, and line width.

Ambient environmental conditions are monitored during the application of long-life roadmarking products.

0.3.6.3. Sampling of Output

In addition to the routine monitoring, test plates are taken by placing a steel plate ahead of the applicator to obtain a sample for evaluation of wet-film thickness by the use of comb style wet-film gauges.

Additional plates are taken at specified intervals for subsequent dry-film thickness determinations using eddy-current type dry-film measuring instruments. These plates form a critical part of the recognised quality record system.

0.3.6.4. Measurement And Monitoring Of Performance Characteristics

Performance characteristics of the applied markings, such as night-time visibility under both dry and wet conditions (R_L & R_W), daytime visibility (Qd) and skid resistance (BPN) are evaluated following installation.

Night-time visibility is determined using an instrument (retroreflectometer) which is designed to replicate the appearance of the line to a car driver while illuminated by a car's headlights.

Day-time visibility is determined by either an instrument (retroreflectometer capable of measuring Qd) or by the limiting distance at which it can be seen.

Retroreflectivity is determined in accordance with the requirements of NZTA Specification NZTA T 16 Determination of Retroreflectivity.

Mobile instruments are used to monitor the retroreflectivity of entire networks on performance based contracts. These vehicles also take photographic images at regular intervals.

Skid / slip resistance are determined using a British Pendulum Tester or "Griptester".

The height of the top of the ATP block above the pavement surface is determined using a simple taper wedge device. The effectiveness of audio-tactile markings (ATP) can be evaluated by a panel of three people in a vehicle driven along the marking.

0.3.7. Occupational Health And Environmental Management Systems

The New Zealand Roadmarkers Federation has developed a Safety, Health and Environment Guide – NZRF CoP001aimed at providing a framework for the safety, health and environment controls required by the industry. NZRF CoP001 is commonly referred to as "the yellow folder".

In addition to NZRF CoP001, the NZRF manages the Roadmarking Notes system which is a series of documents aimed at advising the industry of changes to legislation and providing interpretations of current requirements causing confusion.

0.3.7.1. Temporary Traffic Management

The single greatest hazard encountered by the Roadmarker is coming into contact with a motor vehicle sharing their work place.

For roadmarking contractors, the only practical method for the management of the traffic hazard under the requirements of the HSE Act is to identify and minimise its effects. (Roadmarking contractors do not have the ability of either eliminating or isolating the hazard in the normal course of their activities.)

Temporary traffic management practices are carried out in accordance with the requirements of NZTA Code of Practice for Temporary Traffic Management (CoPTTM) on State Highways and the RCA Forum Local Roads Supplement to CoPTTM. The Local Roads Supplement (LRS) was produced by the RCA Forum to enable temporary traffic management on local roads to be more suited to local conditions and circumstances.

Staff are trained for appropriate temporary traffic management duties, i.e. Traffic Controller (TC) and Site Traffic Management Supervisor (STMS) under the NZTA Traffic Management Registration Scheme.

0.3.7.2. Health and Safety

In addition to the traffic hazard, there are a number of other hazards associated with roadmarking. The highest risks are associated with the pressurised fluids and the handling of solvents, peroxides and hot materials.

A comprehensive description of the hazards associated with roadmarking in New Zealand and appropriate practices is provided in NZRF CoP 001.

Section 7 of NZRF CoP 001 provides a list of the commonly occurring hazards and the industry accepted control methods.

The NZRF has produced a "Paint Injection Card" which is carried by all operatives. This card provides guidance on the hazard and sets out the treatment regime for the medical staff treating the injury.

A number civil and construction industry health and safety training and certification schemes are in place.

0.3.7.3. Environmental Management

Many of the materials associated with roadmarking are hazardous to the environment and / or ecotoxic.

Staff are made aware of the hazards to the environment associated with using these materials, and provided with appropriate spill kits along with training in their use.

0.3.7.4. Transport of Dangerous Goods

The application of most marking materials involves the transport of hazardous goods on roads. This requires drivers of certain vehicles carrying hazardous goods above particular limits to have "D" endorsements on their Driver Licences and to be familiar with the requirements of the Dangerous Goods Rule.

1. PURPOSE

The purpose of NZRF QAP002 is to provide a basis for robust and consistent assessment and certification of the quality management system implemented by a roadmarking contractor.

QAP002 provides an interpretation of the mandatory requirements for quality system certification of roadmarking contractors, with information on practices aimed at achieving compliance with the specification and descriptions of industry practice.

1.1. SCOPE

QAP002 describes the elements of a documented system used by roadmarking contractors to demonstrate their ability to:

1. Consistently provide pavement marking services that meet their customer requirements, and
2. Meet applicable statutory and regulatory requirements, and
3. Meet the requirements of ISO 9001.

The quality system requirements in this document reference, or imply reference to a number of documents including NZTA specifications for roadmarking. However compliance with QAP002 does not constitute evidence of compliance with those specifications.

2. REFERENCES

AS/NZS ISO 9001:2008	Quality systems – Requirements
NZS 3910	Conditions of contract for building and civil engineering construction
NZTA CoPTTM	NZTA Code of Practice for Temporary Traffic Management
NZTA M 7	Roadmarking Paints
NZTA M 7 Notes	Roadmarking Paints - Notes
NZTA M 12	Raised Pavement Markers
NZTA M 12 Notes	Raised Pavement Markers - Notes
NZTA M 20	Long-Life Roadmarking Materials
NZTA M 20 Notes	Long-Life Roadmarking Materials - Notes
NZTA P 20	Performance Based Roadmarking
NZTA P 22	Reflectorised Roadmarking
NZTA QG Notes	Guideline on the Roles of the Client, Consultant, and Contractor in Quality Assurance
NZTA/NZRF T 08	Roadmarking Paint Applicator Testing
NZTA T 12	Long-Life Pavement Marking Applicator Testing
NZTA T 16	Determination of Retroreflectivity
NZTA T 17	Determination of Heavy Metal Content of Glass Beads Intended for Use in Pavement Marking,
NZTA Q 3	NZTA Specification for Normal Quality Assurance Level Contracts
NZTA TQS2	NZTA Quality Standard TQS2
NZTA MOTSAM Part II	NZTA Manual of Traffic Signs and Markings Part II – Pavement Markings
NZTA Procurement Manual	NZTA Procurement Manual
NZRF CoP 001	NZRF Health, Safety and Environment Guide

NZRF Line Removal Guide	NZRF Line Removal Guide
NZRF Materials Guide	NZRF Roadmarking Materials Guide
NZRF TTM Guide	NZRF Guide to the Management of Traffic Hazard While Roadmarking – Issued as Section Nine of CoP 001

3. DEFINITIONS

Contractor
Any roadmarking contractor, whether a company, partnership or individual, and whether or not a member of the NZRF

CQP
Contract Quality Plan - document specific to a contract which describes how the contractor intends to manage and administer the contract in compliance with the requirements of the contract documents

Customer
Any organisation obtaining or seeking roadmarking services supplied by a contractor

NZRF
New Zealand Roadmarkers Federation Inc

NZTA
New Zealand Transport Agency

Procurement Procedures
NZTA Procurement Procedures - procurement procedures approved by NZTA for use by approved organisations when purchasing physical works and professional services. In addition to the mandatory procedures, which must be followed to be eligible for NZTA funding, the manual provides guidance on the application of these procurement procedures

RCA
Road Controlling Authority - The authority responsible for roading within its jurisdiction, e.g. NZTA for the national State Highway system; District or City Councils for roads within Local Government regions including roads within urban boundaries.

SRS
Specification Review Schedule – Table outlining how the contractor plans to achieve the requirements each relevant specification. The requirements for SRS's are contained in Section 4.2 of NZTA TQS2.

4. ASSESSMENT GUIDELINES

The following information is aimed at providing guidance for Internal and External Auditors conducting audits or reviews of roadmarking documented systems. The headings will in general following section numbers of ISO 9001 sections 4 to 8.

4.1. GENERAL REQUIREMENTS

Industry requirements for documented management systems are described in a number of NZTA Specifications, principally NZTA TQS2 and NZTA Q 3, the corresponding contract document and the referenced process specification, e.g. NZTA P 22.

Guidance on the application of these documents is provided by NZTA QG Notes – Guideline on the Roles of the Client, Consultant, and Contractor in Quality Assurance.

4.2. DOCUMENTATION REQUIREMENTS

4.2.1. GENERAL

Although the extent of the quality management system documentation can differ from one organisation to another, the variation will principally be due to the size of the organization and type of activities carried out by that organisation.

Roadmarking organisations vary dramatically in both size and scope of services provided. The industry generally requires marking crews to travel extensively to carry out work. This may be short term, or crews may operate from remote depots. The operation of such sites will invariably involve the storage and handling of materials.

The products applied can be limited to paint, but may include long-life marking materials such as thermoplastic or cold-applied plastic (CAP).

Documented systems need to address all of the issues related to the complexity of the products and services being provided and the range of activities carried out.

The ISO 9001 Certification scope statement may need to include the following, depending on activities being undertaken:

1. Application of painted pavement markings to roads and carparks
2. Application and removal of raised pavement markers
3. Application of thermoplastic pavement markings to roads and carparks
4. Application of cold-applied plastic pavement markings to roads and carparks
5. Application of painted pavement markings to sports courts and playgrounds
6. Application of coloured surfaces to roads and carparks
7. Application of high friction surfacing to roads
8. Removal of obsolete pavement marking by permanent overlay
9. Removal of obsolete pavement marking by abrasive blasting
10. Removal of obsolete pavement marking by water milling

4.2.2. QUALITY MANUAL

The documented management system needs to cover all areas of the roadmarking operation. Areas of operation requiring inclusion are:

1. Painted marking installation on roads and carparks
2. Raised pavement marker installation and removal on roads and carparks
3. Thermoplastic marking installation on roads and carparks
4. Cold-applied plastic marking installation on roads and carparks
5. Painted marking installation on playgrounds and sports courts
6. Coloured surfaces to roads and carparks
7. High friction surfacing to roads
8. Removal of obsolete pavement marking by permanent overlay
9. Removal of obsolete pavement marking by abrasive blasting
10. Removal of obsolete pavement marking by water milling

The scope of the quality manual needs to address all issues associated with the operation of a separate operation from a remote location either temporarily or permanently. Items needing consideration are:

1. Supervision
2. Selection of materials and methods used on performance-based contracts
3. Maintenance and validation of plant
4. Management of materials and associated records
5. Communication of work instructions
6. Temporary Traffic Management practices
7. Quality Records

The scope of the quality manual also needs to address all issues associated with any subcontracting of services where this may occur, e.g. line removal, installation of long-life markings, pavement marking at remote locations, etc.

Where work is carried out by a subcontractor not having an approved quality system, the Contractor needs to either:

1. Require the subcontractor to apply the Contractor's quality procedures (this will require appropriate training), or
2. Provide adequate work instructions, supervision and verification of the subcontractor's work to establish and confirm ongoing compliance with the contract and contract quality system requirements.

Where work is carried out by a subcontractor having an approved quality system, the Contract Quality Plan for the work package needs to define the activities as described by TQS2 for the subcontractor.

4.2.3. CONTROL OF DOCUMENTS

The document control system needs to recognise and reflect the fact that contracted work packages commonly involve the use of Specifications and Standards that may be superceded during the course of the contract.

The system needs to either manage this by way of applying for “contract variations” or by ensuring that the correct versions are available for use in the appropriate contract packages.

Where superceded specifications are used for a particular contract, they shall be clearly identified with the contract used for and prevented from inadvertent use on alternative contract packages.

The issue of work instructions to workers referring to the Traffic Control Devices Rule (TCD) needs to reflect the environment in which they work and the transitional nature of the presentation of the Rule by a variety of documents, i.e. Manual of Traffic Signs and Markings (MOTSAM) Part II, Traffic Notes and TCD Manual.

4.2.4. CONTROL OF RECORDS

The Contractor needs to identify the quality records required by client specifications, and also those needed to provide evidence of compliance with QAP certification requirements. This is usually done using the Specification Review Schedule contained in the appropriate Contract Quality Plan.

Records relevant to each contract need to be retained in a manner such that they can be made available to the client on request.

Contract records are commonly held by an assigned "Contract Manager".

Quality records as a minimum include:

- Calibration schedules and records
- Contract management records
- Corrective action requests and registers
- Inspection and test records
- Internal audit reports
- Materials Diary
- NZTA/NZRF T 8 & NZTA T 12 test results
- Personnel training files
- Roadmarking daily log of settings and equipment changes
- Subcontractor records
- Test plates

Associated health and safety and environmental management records include:

- Hazards Register
- Hazardous Substances Register
- Register of Pressure Equipment

Test plates substantiate inspection and test measurements. Test plates need to clearly identify the work package, the date, the location at which it was taken, the associated applicator and operator responsible. Test plates need to be retained for the period specified in the contract quality plan (normally a minimum of three months) unless otherwise defined.

Applicator validation records need to be retained in accordance with the requirements as described by NZTA/NZRF T 8 or NZTA T 12.

5. MANAGEMENT RESPONSIBILITY

Refer to ISO 9001

5.1. MANAGEMENT COMMITMENT

Refer to ISO 9001

5.2. CUSTOMER FOCUS

Identifying the actual customer can be difficult with roadmarking. In addition to the RCA Engineer, individual ratepayers and road-users are customers who will communicate their dissatisfaction via "action-lines".

Contracts managed under NZS 3910 have an Engineer appointed to the contract who acts as the RCA's representative. On larger contract packages, there may also be an "Engineer's Representative" appointed to act as liaison person and data collector. The Engineer may be an RCA staff member, or in the case of NZTA and a number of RCA's a member of a consultancy employed specifically to manage the contract.

The role of the Engineer in relation to quality systems is provided in the NZTA Document NZTA QG Notes - Guideline on the Roles of the Client, Consultant, and Contractor in Quality Assurance. This document is available from the NZTA website; http://www.nzta.govt.nz/resources/qa-level-contracts/docs/qa-level-contracts-guideline-on-roles-notes.pdf

For NZTA contract packages, the consultant acting as the Engineer routinely advises the contractor of the results of the regular appraisals of the contractor's performance under the NZTA Performance Assessment by Coordinated Evaluation (PACE) system.

5.3. QUALITY POLICY

Refer to ISO 9001

5.4. PLANNING

5.4.1. QUALITY OBJECTIVES

Due to the size and style of management of roadmarking companies, quality objectives are commonly found in the company business plan rather than being presented separately.

5.4.2. QUALITY MANAGEMENT SYSTEM PLANNING

The emphasis on quality management system planning is largely focused on the requirement for the production of CQP's for each main contract held.

The purpose of the CQP is to describe the activities, resources and methodologies relating to the specific requirements of the contract. For smaller packages of work the CQP may be referred to simply as the Job Plan.

Overall planning is required to ensure efficient and effective use of resources across all contract packages held by the contractor and to ensure that lessons learnt on one contract are applied on other or future contracts.

5.5. RESPONSIBILITY, AUTHORITY AND COMMUNICATION

5.5.1. RESPONSIBILITY AND AUTHORITY

Roadmarking company organisational structures are typically flat due to their size and single lines of control. They are commonly set out in an Organisation Chart.

The responsibilities and authorities for quality, health and safety, and environmental management are typically defined by means of functional descriptions within an overall job description.

Such job descriptions commonly form part of each individual worker's employment contract and are kept on file in a Personnel Register.

5.5.2. MANAGEMENT REPRESENTATIVE

Refer to ISO 9001

5.5.3. INTERNAL COMMUNICATION

"Tool-box" meetings are commonly used as the formal method of communicating quality, health and safety, environmental management and company issues within roadmarking organisations.

Crew briefing is commonly carried out at the start of shifts, or at the beginning of a new task.

Supervisors commonly visit work sites to communicate directly with work crews and to view work.

Roadmarking activities commonly see small teams spread throughout a relatively wide area which requires wide use of mobile phones, using voice and / or text messaging.

Methods used to manage instructions to workers need to recognise and reflect that individual contract packages may have different contractual, quality control and reporting requirements.

5.6. MANAGEMENT REVIEW

5.6.1. GENERAL

As roadmarking tends to be of a seasonal nature with less work being carried out over the winter period, due to inclement weather and new contracts being let in June / July, there is a tendency for senior management to conduct their reviews in the second quarter of each year.

5.6.2. REVIEW INPUT

In addition to those items required by ISO 9001, the contractor should include RCA performance measures such as NZTA PACE results.

5.6.3. REVIEW OUTPUT

Refer to ISO 9001

6. RESOURCE MANAGEMENT

6.1. PROVISION OF RESOURCES

Generally all paint and long-life marking applicators are required to be certified in accordance with either NZTA/NZRF T 8 and / or NZTA T 12. The list of currently certified applicators is found on the NZRF website www.nzrf.co.nz

All contracts contain minor and transverse markings and therefore all require Type B activity.

Due to the slower work rate of Type B paint applicators, contractors holding maintenance contracts with significant urban areas require many more Type B paint applicators than Type A paint applicators.

Tender submissions made under the NZTA Procurement Manual procedures have a section on "Resources" in the "Non-Price Attributes" section. Review of Resources" of a sample of tender submissions should provide a good representation of resources available to the contractor.

As many roadmarking products are hazardous and / ecotoxic, there is a legislative requirement for the provision of hazardous goods storage and handling facilities, refer to section 6.3

6.2. HUMAN RESOURCES

6.2.1. GENERAL

The application of roadmarkings often involves driving significant distances and working during the hours of darkness. In addition, the requirement of re-installing markings on resealed roads within a short time frame, typically within 24 hours, can place significant demands on the efficient and safe use of operational staff work hours.

The Work Time and Logbooks (Rule 62001) introduced in 2007 applies without exemption to Roadmarkers. NZRF Roadmarking Note 5 describes the requirements.

A number of roles within the roadmarking activity require specific training and certification.

6.2.2. COMPETENCE, TRAINING AND AWARENESS

The industry has a significant problem with literacy and numeracy. A recent survey of the civil infrastructure sector indicated that of the people involved; 40% had left the education system without any form of qualification and that 40% have literacy and / or numeracy difficulties. These statistics would apply equally to roadmarking. The percentages applying to roadmarking assistants are likely to be considerably higher.

Most roadmarking training is gained on the job from skilled and experienced senior staff.

Contractors may or may not subscribe to Site Safe and / or Operate Safe health and safety training and certification schemes.

Nationally recognised qualifications for roadmarking operational staff are available from InfraTrain, the Industry Training Organisation (ITO) for the infrastructure industry. They are designed to be stand-alone and can be entered at any level, although they are structured to provide a pathway for people wanting to progress from Assistant to Senior Operator level.

There are currently three NZQA National Certificates for roadmarking:

- National Certificate in Roadmarking (Assistant)
- National Certificate in Roadmarking (Operator)
- National Certificate in Roadmarking (Senior Operator).

Roles requiring relevant training and certification

The following list is not exclusive:

1. The person responsible for the storage of hazardous goods at any depot is required to hold an Environment Risk Management Agency (ERMA) Approved Handler certificate for all the items described by the Hazardous Goods Register for that depot
2. The person assigned as the “Controller” of pressure equipment as required by the Pressure Equipment, Cranes and Passenger Ropeways (PECPR) regulations is required to have evidence of having the appropriate skills and experience
3. The person developing Temporary Traffic Management Plans (TMP) for submission for RCA approval is required to hold at least a Non-Practising Site Traffic Management Supervisor (STMS) Warrant Card for the Level of roads covered by the TMP
4. Drivers of applicators and transport vehicles are required to hold a Licence for the appropriate class of vehicle being driven
5. Drivers of all vehicles transporting hazardous goods by road are required to have Dangerous Goods (D) Endorsements. Operatives may also hold ERMA Approved Handler certification
6. The drivers of forklifts used to load and unload vehicles are required to have the appropriate class of licence with the Forklift (F) Endorsement

7. All personnel supervising or altering temporary traffic management are required to hold a Practising STMS Warrant Card for the Level of road they are working on
8. All personnel acting as traffic controllers on sites are required to hold a Practising Traffic Controller (TC) Warrant Card for the Level of road they are working on
9. Personnel acting as "First Aiders" are required to have had appropriate First Aid Training in the last two-years
10. Personnel conducting NZTA/NZRF T 8 and T 12 testing are required to be registered with the T 8 / T 12 Registrar
11. Personnel required to carry out service work on pressure equipment are required by the PECPR regulations to be able to demonstrate competency and experience.

In addition, clients may require further certification such as Site Safe, Driver Safe and / or Operate Safe for access onto work-sites.

Casual or temporary staff are commonly employed at busier times of the year or for special projects. Such staff need to be properly inducted into workforce and receive briefings on industry specific hazards such as paint injection and bitumen / thermoplastic burns.

The personnel records should include:

- staff identification and their basic personnel details
- date employment commenced and length of service
- experience to date in roadmarking and their current level of relevant skills
- training received to date and training required to reach a specified standard
- briefing in safety related aspects of their work, as required by the Health and Safety in Employment Act 1992.

Training Records need to include:

- New Zealand Qualifications Authority (NZQA) Unit Standards and Qualifications
- Attendance of First Aid Courses
- Attendance of Fire & Rescue Courses
- Driver Licence Classes
- Hazardous Goods Endorsements on Drivers Licences
- NZTA TC and STMS Warrant Cards
- ERMA Approved Handler Certificate
- Site Safe Card
- Forklift Training Courses
- Attendance Certificates from any Private Training Establishment, e.g. NZIHT
- Attendance Certificate for Employer Courses on Health & Safety etc

6.3. INFRASTRUCTURE

Materials Storage & Handling

Due to the type of materials, i.e. flammable and potentially explosive, being stored at roadmarking depots, access needs to be strictly controlled. Attention needs to be paid to the storage of hazardous and ecotoxic materials in accordance with the requirements of the Hazardous Substances and New Organisms (HSNO)Act.

For each and every depot a Location Test Certificate and an Approved Handler for all materials being held in stock is required. A Hazardous Goods Register needs to be maintained by the person holding the Approved Handler status for that depot. Safety Data Sheets are required for all hazardous materials, and these need to be filed such that they can be readily accessed in the case of an emergency. Short form Safety Data Sheets need to be provided to operational staff using the material.

Items such as catalysts used with CAP must be segregated from other materials during storage and transport. Catalyst may be required to be "tracked" throughout entire process of receipt to mixing with CAP. Material may require Approved Handler status.

Attention is also required to ensure that appropriate materials handling equipment is available which ensures that applicators and transport vehicles can be loaded and unloaded safely and efficiently. 200L drums of paint individually weigh in excess of 250kg.

Appropriate spills kits need to be provided in convenient locations.

Such facilities need to be duplicated at remote depots operated away from the main depot. Particular attention needs to be taken with regard to receipt and storage of hazardous goods, handling of materials and secure parking of vehicles carrying hazardous goods.

NZRF Roadmarking Note 11 provides guidance material on the requirements of the HSNO Act.

Plant and Equipment storage and maintenance

Appropriate garaging and hard-stand areas are required for all plant and equipment which may be adversely affected by inclement weather conditions.

Appropriate facilities need to be available to facilitate routine maintenance and servicing of vehicles and applicators.

Where repairs or modification to pressure equipment are carried out in-house, the person carrying out such work needs to be appropriately trained and experienced in accordance with the Department of Labour Pressure Equipment Code of Practice and the PECPR Regulations.

Section Seven of the NZRF CoP001 provides guidance on the requirements for maintenance of typical roadmarking equipment.

Office and Support Facilities

The typically wide-spread nature of the work requires an efficient personal communications system, typically using mobile phones.

Efficient and effective processing of monthly claims for payment requires computer systems with effective backup facilities.

Application Plant and Equipment

There needs to be sufficient applicators available for each of the contracts held by the contractor. The applicators need to be certified under NZTA/NZRF T 8 and NZTA T 12 over the entire period of the contract works.

The sharing of equipment across contracts requires good management and efficient liaison between contract managers and operational staff.

Hazardous Goods pouches are required on all vehicles carrying hazardous goods in excess of the limits stated in Schedules included in Transport of Dangerous Goods Rule. Vehicles need to be equipped with First Aid Kits and appropriate Spills Kits.

Transport and support vehicles

Type B paint applicators and non-truck mounted long-life marking material applicators require vehicles to transport them or to tow trailers used to carry them.

Contracts containing significant rural work will typically require significant marking material transport support services. The operation of such vehicles is likely to require the contractor to operate a Transport Service Licence.

Temporary Traffic Management

If temporary traffic management services are not contracted in, the contractor will need to have appropriately equipped vehicles for such duties. These vehicles need to be fitted with equipment which complies with the NZTA Code of Practice for Temporary Traffic Management (CoPTTM).

6.4. WORK ENVIRONMENT

Contractors need to have systems in place to limit the risk of applying markings under unsuitable conditions or having the performance of markings adversely affected by inclement weather conditions during the curing period.

Note: One of the marking material suppliers, Damar Industries, provides their customers with a weather forecasting website to assist with planning work around periods of inclement weather conditions.

For optimal performance and for roadmarking systems to remain effective for reasonable periods, the atmospheric and surface conditions ideally need to be within certain bounds, for example:

- Road surface dry
- Substrate prepared by hand / mechanical brooming or use of high velocity / high pressure air blowing to remove loose paint, dust and dirt
- Road and air temperatures should be 10^{o}C and rising
- Relative humidity should be 85% Rh and decreasing.
- Paint should not be applied if dew is expected in 2 hours
- No precipitation in the 24hrs following application.

Note: When it comes to drying, waterborne paints are much more sensitive to atmospheric conditions.

While Type A paint applicators are fitted with equipment to clean the road in advance of marking, this equipment is not designed for the removal of significant quantities of loose material or road-kill.

Type B paint equipment requires appropriate hand-sweeping equipment.

7. PRODUCT REALISATION

7.1. PLANNING OF PRODUCT REALISATION

Planning steps taken need to reflect all of the items identified in section 7.5.1.

7.2. CUSTOMER RELATED PROCESSES

7.2.1. DETERMINATION OF REQUIREMENTS RELATED TO THE PRODUCT

A documented tender preparation process needs be in place, including methods to ensure that:

- Tendering information received is adequate for preparing the tender submission
- Sufficient applicators certified to NZTA/NZRF T 8 or NZTA T 12 are available, or can be sourced, to complete the work in the required time frame
- Appropriately trained and experienced operators are available, or can be sourced, to complete work in the required time frame
- Appropriately qualified staff are available, or can be sourced, to meet TTM and materials handling requirements
- Appropriate NZTA approved materials are available and can be applied using proposed equipment
- All requirements for subcontract services are identified
- The tender submission bid package adequately describes equipment, materials and any subcontractors proposed
- The work package is in agreement with Specifications.

The use of a Specification Review Schedule (SRS) in accordance with Section 4.2 of NZTA TQS2 facilitates the development of appropriate strategies and the effective development of the Methodology section of the Tender Submission. The SRS is then available for inclusion in the CQP required in the event of a successful bid.

Where work is carried out by a subcontractor not having an approved quality system, the Contractor should:

1. Require the subcontractor to apply the Contractor's quality procedures (this will require appropriate training), or
2. Provide adequate work instructions, supervision and verification of the subcontractor's work to demonstrate compliance with the contract and contract quality system requirements.

Where work is carried out by a subcontractor having an approved quality system, the Contract Quality Plan for the work package needs to identify the activities as described by TQS2-for the subcontractor.

Clear responsibility and authority for tender submission should be recorded. A check list for tender preparation is recommended. Records should be kept regarding queries arising out of these checks.

Documented procedures need to be in place to ensure that any clarification of contract requirements and changes to the Request For Tender (RFT) through Notice to Tenderer (NTT) are effectively managed and that appropriate records are maintained by the Contractor.

Where it is necessary to meet with the customer for clarification of tender requirements or following award of the contract, minutes of the meeting should be kept.

Any differences between tender requirements and final contract documents should be resolved with the customer and recorded.

7.2.2. REVIEW OF THE REQUIREMENTS RELATED TO THE PRODUCT

A documented contract review process needs to be in place, including methods to ensure that:

- Any differences between the contract requirements and the tender are identified and appropriate actions are defined
- Availability and suitability of resources proposed continue to match contract requirements
- All subcontract arrangements have been clarified and clearly defined.

7.2.3. CUSTOMER COMMUNICATION

Documented procedures need to be in place to ensure that adequate records of contract particulars are maintained and the authorised representatives are named for the customer, the Contractor and any subcontractors.

Documented procedures need to be in place to ensure that any subsequent clarification of contract requirements and variations to the contract through Notice to Contractor (NTC) are effectively managed and that appropriate records are maintained by the Contractor. Changes to the contract need to be reflected by appropriate and timely changes to the Contract Quality Plan.

The contact details for the Client, Engineer, and Contractor's representatives recorded in the CQP need to be current and readily available to all appropriate staff.

Role of Engineer to the Contract / Consultant with Regard to Quality

The role of the auditor must complement that of the Engineer to the Contract (or the Consultant). Reference should be made to the related NZTA document NZTA QG Notes Guidelines for the Roles of the Client, Consultant and Contractor in Quality Assurance.

The Consultant should focus on the CQP and its expected outcomes. The Engineer/Consultant's role is to provide quality surveillance activities. In the event of significant non-conformance by the Contractor, the Consultant is expected to check that appropriate corrective action has been implemented.

7.3. DESIGN AND DEVELOPMENT

7.3.1. DESIGN AND DEVELOPMENT PLANNING

Major packages of work are tendered for and subject to formal contracts. Tenders describe the equipment, materials, and methods to be used.

Smaller packages of work are normally subject to quotation and acceptance of offer on the basis of standard conditions.

Documented procedures need to be in place to ensure that all orders for services provided by the contractor are documented and agreed with the client.

Procedures need to be in place to:

1. Ensure that capability exists to meet client requirements prior to acceptance of contracts or orders
2. Identify and evaluate potential hazards and risks to people, property or the environment
3. Ensure that such hazards and risks are addressed when preparing tenders and / or on acceptance of tender

4. Ensure that the company has the necessary human, physical and financial resources

7.3.2. DESIGN AND DEVELOPMENT INPUTS

Tender Preparation

Tenders are normally prepared using a template or checklist aimed at ensuring that tender submissions meet the requirements and best reflect the company's abilities and resources.

An effective system needs to be in place to ensure that all Notices to Tenderer (NTT's) are accepted and processed such that tender submission fully matches the client's requirements.

Marking Materials

Marking materials for pavement marking used are selected from those that have been tested and approved in accordance with the requirements of the appropriate NZTA Specification. The principal specifications are:

1. NZTA M 7 Roadmarking Paints
2. NZTA M 12 Raised Pavement Markers
3. NZTA M 20 Long-Life Roadmarking Materials

Approvals Listings are provided in the latest version of the associated Notes, i.e.

1. NZTA M 7 Notes
2. NZTA M 12 Notes
3. NZTA M 20 Notes

Further requirements are found in:

1. NZTA P 20 Performance Based Roadmarking
2. NZTA P 22 Reflectorised Roadmarking
3. NZTA P 30 Specification for High Performance Roadmarking
4. NZTA T 17 Determination of Heavy Metal Content of Glass Beads Intended for Use in Pavement Marking,

Descriptions of the materials used and the relevant information including application conditions are provided in the NZRF Roadmarking Materials Guide.

7.3.3. DESIGN AND DEVELOPMENT OUTPUTS

On acceptance of the contract, a Job Plan or a CQP needs to be prepared for the contract works, including proposed inspection and test activities. The contents of the plans are, as a minimum, to be as described by NZTA TQS2.

Where specified in the contract these plans are to be submitted to the Engineer for acceptance. The plan needs to describe responsibilities for control of subcontractors including approval of subcontracted work and acceptance of work records.

The Contractor needs to maintain records of client approval of selected subcontractors and subcontracted work.

For each pavement marking type within the work package, target consumption rates need to be determined. Procedures are to be in place to ensure that these values are available to all relevant personnel and client representatives.

Customer details should be clearly recorded, together with contract references, award date, roadmarking constraints and expected completion date.

There should be evidence of effective job planning, in regard to both general requirements and contract specifics.

For routine work, a standard job plan may be used in conjunction with details of completion dates, programme and special requirements. The plan should include management and supervisory responsibilities for the work, equipment requirements, materials and products to be used, methods to be used, the sequence of work, the frequency of inspection and testing and the records that should be kept.

The job plan should be supported by documented work instructions detailing responsibilities, methods and records to be kept, in particular for the following:

- Equipment servicing and pre-use preparation
- Setting up and testing of equipment
- Setting out work
- Application and placement methods.

7.3.4. DESIGN AND DEVELOPMENT REVIEW

Submission Review

Prior to the submission of the tender package it needs to be reviewed by a senior member of staff to ensure that it is complete and that:

- It matches the requirements of the request for tender
- The Company is capable of satisfying the requirements
- The tendered price satisfies the requirements of the business plan

Note: Typically there is also a checklist provided by the RCA to facilitate complete tender packages.

Checklists are commonly used by contractors, an example of this is as follows:

Tender Specifications	***Tender Attributes***
❑ *Tender Application Form*	❑ *Relevant Experience*
❑ *Pricing Schedule*	❑ *Track Record (Includes Updated Client References)*
❑ *Current Work Commitments*	❑ *Technical Skills (Includes Updated Staff and Skill Levels)*
❑ *Contact Numbers and Personnel*	❑ *Resources (Includes Updated Flowchart, Plant and Machinery Schedule)*
❑ *ISO 9001 Certificate*	❑ *Management Skills (Includes Updated Staff and Skill Levels)*
❑ *Health and Safety Certificate*	❑ *Methodology*
❑ *Health and Safety Policy*	❑ *Quality Policy*
❑ *NZTA T 8 / T 12 Certificates*	❑ *Quality Management*
❑ *Non-Conformance Report*	❑ *Health and Safety*
❑ *Corrective Action Report*	❑ *Traffic Management*
❑ *Material Test Certificates*	❑ *Public Safety*
❑ *Client References*	❑ *Public Relations*
❑ *Contract Completion Certificates*	❑ *Communication*
❑ *Draft Program of Works*	❑ *Programming*
❑	❑ *Method Selection*
❑ ❑	❑ *Monitoring, Reporting and Auditing*

Contract Review

Prior to the acceptance of the contract, a senior member of staff needs to review it thoroughly to ensure that:

- The Company is still capable of satisfying the requirements
- The tendered price still satisfies the requirements of the business plan.

7.3.5. DESIGN AND DEVELOPMENT VERIFICATION

Refer to ISO 9001

7.3.6. DESIGN AND DEVELOPMENT VALIDATION

Refer to ISO 9001

7.3.7. CONTROL OF DESIGN AND DEVELOPMENT CHANGES

Any subsequent additions to the contract scope should be recorded together with the date of authorisation and reference to documentation of the addition.

Where the customer does not formally confirm the additional work by Contract Variation, the Contractor should confirm the agreement by letter, facsimile, or email.

7.4. PURCHASING

7.4.1. PURCHASING PROCESS

A documented material control process must be in place including requirements for:

- material specification
- delivery acceptance
- handling, storage and stock control

Roadmarking Systems & Stock Control

Roadmarkings consist of a combination of products, e.g. waterborne paint and glass beadsSystems need to be in place to ensure that the correct materials are purchased and controlled such that they are used only on the required work and not inadvertently used with the wrong materials on an incorrect job.

Particular attention needs to be paid to the control of glass beads and other retroreflective media having special coatings to promote adhesion to materials such as CAP or waterborne paint systems. The use of beads having the wrong coating at best would be an unnecessary cost and in the worst case lead to premature failure of the marking system.

Subcontract Services

The use of subcontractors is relatively common in roadmarking. Some of the services which may be subcontracted are:

- Temporary traffic management
- Line removal by abrasive blasting or water milling
- Plant and machinery maintenance
- Non-routine paint application in remote locations
- Application of long-life markings, high friction or coloured surfaces

In contracted work, the use of subcontractors is tightly controlled with the subcontractors and their activities being limited to that described in the contract documents. Where subcontractors are required, they need to be selected on the basis of their ability to work closely with contractors staff to meet client requirements in a safe and effective manner.

The selection of subcontractors, approval of subcontracted work and the acceptance of related work records should be limited to a senior manager and / or those having delegated authority.

7.4.2. PURCHASING INFORMATION

All roadmarking material must be in accordance with the relevant contract / NZTA Specification.

Evidence of NZTA approval for the materials used (or proposed) on contracts held or sought needs to be maintained on the contract file. e.g. listing in M 7 Notes..

Where alternative materials are to be used, evidence of the Engineer's approval needs to be gained prior to use.

Indication of Contractor approval of products and suppliers should as a minimum be the Managers initials and date of review/approval.

The following should be monitored by the Contractor:

- Adequate definition of contractual requirements specified on purchase orders
- Evidence that thinners, primers and adhesives are suited to the use intended
- Materials data and Safety Data Sheets are available for all roadmarking materials
- Purchase orders and subcontractor work specifications are verified by a responsible person.

Records of compliance testing by paint manufacturers, and other relevant suppliers, are to be maintained by the Contractor. A file needs to be maintained which contains all of the relevant Paint Batch Certificates required by NZTA M 7.

To facilitate the correct determination of dry film thickness values from wet film values in the field, the percentage of solids by volume provided on the Batch Certificate needs to be provided in a timely manner to all field staff.

Where thinners are used to dilute paint prior to and during application, proof of compatibility with the respective paint(s) needs to be maintained by the Contractor. A record of the method of dilution, including the maximum dilution rate specified by the paint manufacturer, and the quantities used / actual dilution rate, must be maintained by the Contractor. Procedures need to be in place to ensure that correct values and methods are available to all relevant personnel and client representatives.

Where primers are required to be used with pavement marking application, evidence of compatibility with the substrate and material being applied needs to be maintained by the Contractor.

7.4.3. VERIFICATION OF PURCHASED PRODUCT

Brief work instructions including a list of checks required for purchased goods need to be prepared and staff must be trained in their application.

Responsibility for acceptance of purchased products and materials should be defined. Documentation needs to be retained to substantiate compliance with product or material standards.

Incoming product and material that is yet to be checked should be kept in a defined area, separated from product and material that has already been checked for use.

Any products or materials released for urgent or immediate use needs to be positively identified and recorded so that action can be taken if subsequent checks show that wrong or defective material has been used.

Checks before storage or the commencement of usage of materials or products should establish that material:

- Are as ordered
- Has no obvious defects or damage
- Are clearly labeled with identification batch number and date of manufacture
- Is compatible or otherwise clearly marked so as to avoid accidental mixing or misuse

Records of stock receipts need to be maintained, with provision for appropriate details as below:

Paint, cold-applied plastic, thermoplastic and beads

- Description of colour
- Manufacturer's brand name and type designation
- Manufacturer's batch number(s)
- Month and year of manufacture
- Quantity delivered of each batch
- Date received
- Date of issue for marking.

Other roadmarking materials

- Manufacturer's brand name and type designation
- Quantity received
- Date received
- Date of issue for marking.

Work instructions for receipt of goods should include details on identification, segregation and return of defective materials or products. Clear labelling methods should be included to prevent inadvertent use of non-accepted purchased goods.

7.5. PRODUCTION AND SERVICE PROVISION

7.5.1. CONTROL OF PRODUCTION AND SERVICE PROVISION

The documented process needs to be effective and must include methods to ensure that:

- Work is carried out in accordance with the programme described in the contract
- Appropriate numbers of appropriate types of applicators are available for the work planned
- Applicators are certified in accordance with NZTA requirements
- Applicators are only operated by appropriately trained and experienced staff
- Traffic management systems are in place and effective during the entire marking process
- Markings applied are in accordance with the Traffic Control Devices Rule
- Application rates match those specified by the contract documents
- Marking material being applied match those specified in the contract documents

- Markings are not applied under conditions which have an adverse effect on marking life and/or performance
- Installed markings are not adversely affected by premature trafficking
- All dilution of paint / addition of catalyst is in accordance with manufacturers specifications
- Markings are not applied over incompatible substrates or materials
- Storage and handling of Hazardous Goods complies with HSE and ERMA requirements
- The requirements described in materials data sheets, and Safety Data Sheets are complied with
- Any incomplete / non complying part of the work package is clearly identified and completion/ remedial action planned
- Marking performance is verified in accordance with contractual requirements at appropriate time(s)
- Work package is completed in full before claim for payment is made.

Work instructions need to be in place which ensure that traceability of materials is maintained throughout the pavement marking process. Materials records are to be maintained in accordance with NZTA P 22 and NZTA P 14.

Where remote materials depots (including transport delivery points) are used in the performance of the contract, specific procedures shall be developed and maintained to ensure that the above requirements are met for each depot.

7.5.2. VALIDATION OF PROCESSES FOR PRODUCTION AND SERVICE PROVISION

A documented pavement marking equipment verification control process needs to be in place and needs to include methods to ensure that:

- Process capabilities are known for each application process and applicator
- Applicator set-up details are developed and communicated to all appropriate personnel
- Paint applicators are routinely tested and verified in accordance with NZTA/NZRF T 8
- Long-life applicators and pre-heaters are routinely tested and verified in accordance with NZTA T 12
- Traffic control equipment is in accordance with RCA Specifications, i.e. – NZTA CoPTTM-as appropriate
- Raised pavement marker adhesive heaters and application systems are routinely tested and verified in accordance with documented systems
- Maintenance is in accordance with documented schedules

The verification methods need to cover the full range of expected application conditions. Verification needs to include the upper limit of application speeds for each particular material and line width.

Where automated and / or computerised systems are used, appropriate verification and maintenance procedures need to be developed and implemented. Where paint dry film thickness values are determined arithmetically, the verification method needs to take into consideration variations in the values for percentage of solids by volume and the effects of dilution by thinners. The procedures need to ensure that all control parameters are understood and control mechanisms appropriately validated.

In the development and establishment of verification and maintenance procedures and associated service intervals, the following must be taken into consideration:

- Process capability requirements
- Equipment type
- Conditions of use, and
- Frequency of use.

Where alternative pavement marking materials and / or processes are to be used, verification methods need to be developed by the Contractor, and approval gained from the RCA / Client. The approval needs to be recorded in the CQP.

For each applicator, set-up guidelines and operating instructions need to be available for the complete range of pavement marking parameters and appropriate environmental conditions, modified for the different brands / types of product applied by the Contractor. These initial set-up guidelines need to be established from verification and process control records appropriate to the brand/type of material, environmental conditions and the pavement marking requirements.

The set-up guidelines need to cover the range of materials applied by that applicator, e.g. for paint applicator: 180 µm, 220 µm and 300 µm for range of paints from low solids alkyd to waterborne paint. **Note:** The differences in volume solids of paint have a significant and linear impact on marking speeds.

Outputs of surface applied material, such as drop-on glass beads, need to be set up by weighing beads discharged under fixed conditions and the output(s) determined for the proposed applicator speed(s). Alternatively, volume measures may be used where the bulk density of the material is known. Bead outputs need to be determined for each line width and change of marking conditions.

Applicators must be set-up and operated in accordance with these guidelines by operators trained in the use of the relevant equipment.

Records need to be maintained which demonstrate that adequate preparations have been undertaken prior to roadmarking application. The records need to include evidence of equipment/material checks and work site preparations.

The roadmarking process needs be controlled at all times in compliance with RCA requirements.

Adequate work instructions need to be provided to operators and supervisors to ensure effective process control. A documented pavement marking control process needs to be in place and shall include methods covering:

- Site preparation and recording details
- Pavement marking
- Application of surface applied materials such as "drop-on" glass beads
- Installation of raised pavement markers
- Control of associated subcontract services such as temporary traffic management, line removal, etc.

A Materials Record and / or Contract Diary in conformance with NZTA P 22 and P 14 requirements needs to be used to record materials used by location and details of work completed.

Documented methods need to be in place to record that ensure that:

Prior to leaving for site

- Clear specifications and work instructions relevant to work to be done were available
- All required products and materials were available
- Sufficient skilled and appropriately trained personnel were available
- Applicator(s) were suitably equipped and capable of meeting job requirements
- Suitably equipped attendant and Traffic Control vehicle(s) were available
- correct safety equipment was available

Prior to commencement of work

- Road and weather conditions were suitable for work to commence and continue
- Health and safety requirements (traffic control and other regulatory requirements) had been met
- Pavement marking protection system was in place and was effective
- Equipment set up methods had been followed, including:
    - equipment set-up in accordance with set-up guidelines
    - mixing of paint
    - filling and monitoring of thermoplastic pre-heating tanks
    - filling of thermoplastic applicator tanks
    - weather conditions including temperature and general observations, recorded at the start of marking and at any significant changes.

Pre-run applicator trials need to be carried out on a suitable test area, with test plates taken, to check visually that the line produced is to specification regarding width, cover, edge definition, bead application and film thickness at the proposed marking conditions.

Where there is a requirement to alter settings and / or application speeds, a test plate needs to be taken to measure the wet-film thickness and compare the theoretical dry film thickness with the target value. Changes required from the original set up shall be recorded in a daily log, together with relevant thickness or output measurements observed. The settings for commencement of work need to be recorded and signed by an appropriately trained person.

For longitudinal line work, test plates are to be taken at the commencement of the work, at regular intervals during the course of the work, and following alteration to settings or equipment.

Glass bead consumption rates need to be used by operators and supervisors to monitor average bead application rate for appropriate line types / quantities. Target consumption rates required to achieve NZTA P 22 requirements for paint or long-life markings are to be available for comparison with actual values. Bead deposition needs be checked visually against a standard sample or description.

Operational staff need to be provided with a description of the conditions which limit effective application of drop-on beads.

7.5.3. IDENTIFICATION AND TRACEABILITY

The identification of materials used on roadmarkings provided by the contractor needs to be in accordance with the requirements of the relevant NZTA Specifications.

Roadmarking application specifications such as NZTA P 22 have specific recording requirements.

Procedures should be in place to facilitate the recording, as a minimum, by date:

1. Descriptions of materials used,
2. Details of work,
3. Location of work, and for:
    - Paint - paint manufacturer's name, paint designation (class and type), volume of paint used for roadmarking including percentage of thinners if added, and whether recorded volume is before or after thinning
    - Thermoplastic – thermoplastic material grade, manufacturer's name, batch number, resinous primers (if used), date of manufacture and mass of thermoplastic material used for roadmarking;
    - CAP – volume of both material and catalyst
    - Glass beads – type and quantity used, in kgs and coatings

Procedures need to be in place to "track" relevant materials, e.g. CAP catalyst, as required by the Hazardous Substances and New Organisms Act.

7.5.4. CUSTOMER PROPERTY

As all markings are applied directly onto, or removed from, the customer's property the contractor needs to take particular care not to damage or misuse the road surfaces.

The removal of inadvertent spills, etc are covered by appropriate clauses in contract documents, such as NZTA P 22.

The repairs required following the removal of RPM's are covered by appropriate clauses in contract documents such as NZTA P 14

<u>Line Removal</u>

Effective line removal is managing the fine balance between leaving "residual markings", and creating "ghost markings", or causing pavement damage.

Descriptions of the accepted methods of line removal are provided in the NZRF Line Removal Guide.

7.5.5. PRESERVATION OF PRODUCT

Pavement markings are to be protected during application to prevent damage or deterioration prior to drying or setting.

Allowing the markings to be trafficked prematurely has a dramatic effect on both the performance and the durability of newly applied markings. Surface applied glass beads are either displaced or rolled in the marking material making them ineffective as retroreflective elements.

Workers need to have been trained in the correct method of testing the dryness of markings using the "thumb-screw" test prior to lifting closures and allowing markings to be trafficked.

7.6. CONTROL OF MONITORING AND MEASURING EQUIPMENT

Refer to ISO 9001

8. MEASUREMENT, ANALYSIS AND IMPROVEMENT

8.1. GENERAL

Refer to ISO 9001

8.2. MONITORING AND MEASUREMENT

8.2.1. CUSTOMER SATISFACTION

Refer to ISO 9001

8.2.2. INTERNAL AUDIT

Refer to ISO 9001

8.2.3. MONITORING AND MEASUREMENT OF PROCESSES

In addition to other process control methods, paint consumption rates should be used by operators and supervisors to monitor average dry film thickness for appropriate line types / quantities. Target consumption rates need to be available for comparison.

Calculated outputs or wet film thickness should not be used in isolation. Verification of outputs and computer displayed dry film thickness need to be carried out at defined intervals such that the consistency of the results obtained can be demonstrated. The frequency of verification is to be determined from documented process capability studies.

8.2.4. MONITORING AND MEASUREMENT OF PRODUCT

A documented inspection and testing process needs to be in place and should include methods covering:

- Test Methods
- Sampling Rates
- Test Plates
- Calibration of Applicator Equipment including applicator computers
- Traceability to Applicator/Operator
- Identifying Non-Conforming Markings

Documented methods need to be developed and maintained to ensure that applied markings consistently conform to specifications through in-process sampling, inspection and testing, providing a basis for process control. Records which give evidence that the marking has been tested to defined acceptance criteria must be established and maintained.

The acceptance criteria need to be as defined by relevant NZTA Specifications / contract documents as appropriate. Methods need to be in place to ensure that operational staff and those conducting testing and monitoring know and understand the measuring methods and the appropriate acceptance values.

Note: Although NZTA P 22 relates to method-based contracts it still requires that the retroreflectivity performance is verified visually after one month and before two months from installation.

Appropriate equipment needs to be held and maintained for each application characteristic, e.g.:

- Wet-film gauges for operational staff to determine application rates
- Elcometer or equivalent for dry film thickness
- Elcometer or equivalent for long-life (high film-build) film thickness
- Block height measuring devices e.g. wedges
- Tape measures and rulers for line width
- Tape measures and measuring wheels for set-out and line spacing
- Trip and / or distance meters for linear quantities marked
- Weighing scales or volume measures for output determinations of beads and long-life material
- Retroreflectometer for retroreflectivity measuring, R_L, R_W and Qd
- Temperature gauges/probes for hot-melt materials such as RPM adhesive and thermoplastic
- Volume measures for thinners (if used).

Dry film thickness measuring equipment needs to be readily available such that plates can be measured as soon as practical after marking or for validation of other film thickness control methods. This requirement applies particularly where the work package is performed from a remote depot.

Dry film thickness determination needs to be carried out in accordance with the method as described by NZTA T 8. Sampling material thickness measurements in no less than three longitudinal zones on a test plate is required to provide evidence of adequate evenness of deposition. The zone averages or individual values must be recorded. Each zone average must be within the allowed tolerance. The flatness error for markings must be within the specified tolerance, as any significant lack of flatness has a significant impact on the embedment of retroreflective elements / beads.

Appropriate environmental monitoring equipment needs to be used when long-life marking materials are being applied. Equipment is needed for (includes but is not limited to):

- Air temperature
- Ground temperature
- Humidity
- Pavement moisture
- Wind speed

Measuring Equipment Calibration & Control

The Contractor needs to establish and maintain lists of equipment used in the control of roadmark application and the inspection, measuring and test of markings. These lists should identify, for each piece of equipment:

- An appropriate calibration method
- The required calibration frequency
- Relevant calibration dates, and
- Results of calibration.

In determining the calibration methods and frequency, the Contractor should consider conditions of use, frequency of use, accuracy required and resources available.

Appropriate standards should be available for checking the integrity of the key equipment (i.e. standard weights for the scales, shims for dry film thickness meter, temperature probe for hot melt material temperature control equipment). These standards should be verified by an appropriate external agency. The calibration of the device(s) used to verify the systems used to pre-heat and apply thermoplastic should be traceable to national or international standards.

Appropriate set-up and application procedures should be available on site for use by trained personnel.

Test Plates

Test plates are described by NZTA/NZRF T 8 and NZTA T 12. Test plates are to be placed on the road surface in such a manner as to provide a representative sample of the work being carried out.

Retained test plates are to be filed in a retrievable system for a minimum of six (6) months from completion of the contract. Test plates and related records relevant to the particular contract are to be made available to the Engineer on request.

Approval for completed work should not be given before results from test plates are available for consideration. Compliance of test plates should not be regarded as grounds for approval if visual inspection of the markings shows inadequacies.

8.3. CONTROL OF NONCONFORMING PRODUCT

The approval status of completed markings must be clearly identified. The Contractor needs to establish and maintain documented methods for identifying requirements for removal and rework where roadmarkings have not been approved and for carrying out removal, rework and re-inspection.

Daily work records need to identify those markings that are complete but await final approval, those that have been inspected but have rework requirements and those that have been approved for handover to the customer.

Markings not in conformance with NZTA P 22: “Nonconforming Markings” should be identified for rework to bring them into compliance.

Records should include:

- Type and location of markings completed, identifiable to contract
- Supervisor(s) responsible for setting out and for roadmarking
- Inspection dates, cross referenced to records
- Re-work required, rework location and dates of re-inspection
- Completion and acceptance dates
- Signatures of those responsible for acceptance to NZTA P 22 and other contract requirements.

8.4. ANALYSIS OF DATA

Roadmarkers need to collect and analyse data to

- Monitor and measure processes
- Monitor and measure marking performance in performance-based contracts
- Monitor and measure high performance markings carrying a warranty

- Demonstrate the suitability and effectiveness of the documented system, and monitor effectiveness of improvement initiatives
- Demonstrate compliance with the requirements of the Health and Safety in Employment Act and associated Regulations.

CQP's are used to identify the verification, validation, monitoring, and inspection and test activities specific to the relevant contract. A senior staff member needs to be responsible for the review of the CQP's for appropriateness of statistical techniques.

Where electronic spreadsheets are used, these need to be verified and validated by the use of standard sets of data for which the outputs are known. The holder of the spreadsheet should hold records of all such validations.

Because roadmarkings by their nature and environment produce significant variations in physical and performance characteristics, robust evaluation requires the determination of mean values.

Sampling rates

The frequency of inspection and test, in particular taking of test plates, and relevant control points needs to be described in documented inspection and test plans. These plans must be included in CQP or Job Plans.

Retained test plates should be taken for inspection and test at least once per shift or after any significant change in process or set-up. The frequency of inspection and test needs to be increased for new operatives or if there are reasons to expect alteration in the process.

NZTA Specifications such as NZTA P20, NZTA P30, and NZTA T16 specify sampling rates and techniques.

8.5. IMPROVEMENT

8.5.1. CONTINUAL IMPROVEMENT

A formal procedure needs to be established for investigating system deficiencies, investigating the causes of non-conforming markings, taking appropriate action, analysing underlying causes, initiating preventive measures and following up on the implementation of procedural changes.

Clear responsibility should be defined for recording information and taking action on:

- Customer complaints, including both customer and road user complaints
- Roadmarking setting up or application problems
- Applicator or equipment deficiencies
- Difficulties with products or materials used in roadmarking
- Data and information gathered on performance based contracts
- Review of past marking approval where inspection procedures, test standards or equipment calibration are found to be defective.

There should be evidence of assessment and analysis of problems, with appropriate action being taken to correct work methods, material supply or other contributory causes.

Analysis should be aimed at establishing consistency of application characteristics, e.g. dry film thickness, thickness variation, bead spread, edge definition, retroreflectivity, etc. In investigation of application problems, the characteristics chosen for analysis should depend upon the type and characteristics of the application system used.

8.5.2. CORRECTIVE ACTION

Refer to ISO 9001

8.5.3. PREVENTIVE ACTION

Refer to ISO 9001

9. APPENDICES

9.1. APPENDIX 1 – GUIDELINE LIST OF STANDARDS AND SPECIFICATIONS

NZTA Traffic Control Devices Manual

- NZTA Traffic Control Devices Rule Part 9, Level Crossings (*previously RTS 10*)
- NZTA Traffic Control Devices Rule Part 10, Motorways and Expressways (Also known as: Manual of Traffic Signs and Markings (MOTSAM) - Part 3: Motorways and Expressways; MOTSAM 3)
- NZTA Traffic Control Devices Rule Part 13 Parking Control

NZTA Traffic Notes - Requirements

- Traffic Note 1 Pedestrian Crossings
- Traffic Note 28 Pedestrian Crossings and School Crossing points with Speed Limits of 60kph or more

NZTA Traffic Notes - Guidelines

- Traffic Note 11 No Passing Lines against Flush Medians
- Traffic Note 42 Work sites at or near level crossings
- Traffic Note 49 Limit Line and Give Way Markings

NZTA Traffic Notes - Information

- Traffic Note 17 Traffic Control Devices on Private Roads
- Traffic Note 21 Signs and Markings for Passing lanes
- Traffic Note 25 Retroreflective Raised Pavement Markers
- Traffic Note 29 School Crossing Points (Kea Crossings)
- Traffic Note 36 Land Transport Rule: Traffic Control Devices 2004
- Traffic Note 50 Marking and Signing of Roundabouts
- Traffic Note 55 Review and replacement of the Manual of Traffic Signs and Markings

NZTA Manuals & Guidelines

- NZTA Procurement Manual
- NZTA RTS4 Guidelines for Flush Medians
- NZTA RTS5 Guidelines for Rural Roadmarking and Delineation
- NZTA RTS9 Guidelines for Signing and Layout of Slip Lanes
- NZTA Code of Practice for Temporary Traffic Management (CoPTTM)
- NZTA Manual of Traffic Signs and Markings (MOTSAM) – Part II: Markings
- NZTA SM051 Location Reference Management System (LRMS) Manual
- NZTA TQS2 (SP/M/034) Quality System for Road Construction, Road Maintenance and Structures Physical Works Contracts having Normal QA Level

NZTA Specifications & Manuals

- NZTA C Series to SOMAC List - General Maintenance
- NZTA M 7 - Specification for Roadmarking Paints
- NZTA M 7 Notes - Notes on the Specification for Roadmarking Paint (provides list of approved materials)
- NZTA M 12 - Specification for Raised Pavement Markers
- NZTA M 12 Notes – Notes on the Specification for Raised Pavement Markers (provides list of approved materials)
- NZTA M 20 - Specification for Long-Life Roadmarking Materials
- NZTA M 20 Notes – Notes on the Specification for Long-Life Roadmarking Materials (provides list of approved materials)
- NZTA M 24 - Specification for Audio Tactile Profiled Roadmarkings
- NZTA M 24 Notes – Notes on the Specification for Audio Tactile profiled Roadmarkings
- NZTA P 12 - Specification for Pavement Marking
- NZTA P 12 Notes – Notes on the Specification for Pavement Marking
- NZTA P 14 – Specification for the Installation of Raised Pavement Markers
- NZTA P 14 Notes – Notes on the Specification for the Installation of Raised Pavement Markers
- NZTA P 20 (Pilot) – Specification for Performance Based Pavement Marking
- NZTA P 22 - Specification for Reflectorised Pavement Marking
- NZTA P 30 - Specification for High Performance Roadmarking
- NZTA P 30 Notes - Notes on the Specification High Performance Roadmarking
- NZTA Q 3 – Specification for Normal QA Level Contracts
- NZTA QG Notes – Guidelines on the Roles of the Client, Consultant and Contractor in Quality Assurance
- NZTA T 3 Standard Test Method for the Determination of Texture Depth By the Sand Circle Method
- NZTA T 4 Description of Test Locations on Highways
- NZTA T 8 Roadmarking Paint Applicator Testing
- NZTA T 12 Long-Life Pavement Marking Applicator Testing
- NZTA T 16 Determination of Retroreflectivity
- NZTA T 17 Determination of Heavy Metal Content in Glass Beads intended for pavement Marking

NZ Guidelines

- Hillary Commission / SPARC – Sport – Dimensions for playing areas

National & International Specifications

- AS 1906.3 – Retroreflective materials and devices for road traffic control purposes – Raised pavement markers (retroreflective and non-retroreflective)
- AS/NZS 2009 – Glass beads for roadmarking
- AS 4343: 2005 Pressure Equipment – Hazard Levels
- AS/NZS 2890 – Parking facilities – Part 6 Off street parking for people with disabilities
- AS/NZS 3661 – Slip resistance of pedestrian surfaces
- AS/NZS 3788 – Pressure equipment, in service inspection
- AS 4049.4 – Paints and related materials – Pavement marking materials – High performance pavement marking systems

- AS 4049.5 Australian Standard AS 4049.5 Guidelines for the performance assessment of pavement markings.
- AS4343 2005 – Pressure Equipment – Hazard Levels
- AS/NZS ISO 9001:2008 Quality Management Systems – Requirements
- EN 1436 Roadmarking Materials – Road marking performance for road users
- NZS 3910 Conditions of contract for building and civil engineering construction
- NZS 3915 Conditions of contract for building and civil engineering construction (where no person is appointed to act as engineer to the contract)
- NZS 4503: 2005 Hand Operated Fire-Fighting Equipment
- NZS 4801 – Occupational health and safety management systems – Specifications with guidance for use
- NZS 5433 Part 1 :2007 Code of Practice for the Transport of Hazardous Substances on Land, 2007
- NZS 5467 Code of Practice for Light Trailers
- SNZ HB76 – Dangerous Goods – Initial Emergency Response Guides

9.2. APPENDIX 2 – GUIDELINE LIST OF LEGISLATION APPLICABLE TO PAVEMENT MARKING

Acts

- Construction Contracts Act 2002
- Hazardous Substances and New Organisms Act 1996
- Health and Safety in Employment Act 1992
- Health and Safety in Employment Amendment Act 2002
- Industry Training Act 1992
- Injury Prevention, Rehabilitation, and Compensation Act 2001
- Resource Management Act 1991
- Road User Charges Act 1977
- Summary Offences Act 1981
- Transport Act 1962 - Driving Hours and Logbooks
- Transport Services Licensing Act 1989

Regulations

- Dangerous Goods (Class 3 – Flammable Liquids) Regulations 1985
- Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways) Regulations 1999 - (PECPR Regulations)
- Health and Safety in Employment Regulations 1995
- Heavy Motor Vehicle Regulations 1974
- Land Transport (Driver Licensing) Rule 1999
- Traffic Regulations 1976

Rules

- Land Transport Rule 32008/1 - External Projections Rule 2001
- Land Transport Rule 41001 - Vehicle Dimensions and Mass 2002
- Land Transport Rule 45001/1 -Dangerous Goods 2005
- Land Transport Rule 54002 - Traffic Control Devices 2004

- Land Transport Rule 62001 – Work Time and Logbooks
- Land Transport Rule: Vehicle Dimensions and Mass Amendment 2005

Approved Codes of Practice

- Code of Practice for the Management of Substances Hazardous to Health (MOSHH)
- LNZTA Safe Loading and Towing
- LTSA Truck Loading Code
- OSH Approved Code of Practice for Manual Handling
- OSH Approved Code of Practice for the Management of Noise in the Workplace
- OSH Guideline Hot Work on Drums and Tanks
- OSH Guidelines for Guarding Principles and General Safety for Machinery
- OSH Guidelines for the Provision of Facilities and General Safety in the Construction Industry

Industry Guides

- NZ Roadmarkers Federation Inc. Safety, Health and Environment Guide
- NZ Roadmarkers Federation Inc. Roadmarking Materials Guide
- NZ Roadmarkers Federation Inc. Line Removal Guide
- Roading New Zealand Safe Handling of Bituminous Materials used in Roading