TNZ P/24 NOTES: 2008

NOTES FOR THE PERFORMANCE BASED SPECIFICATION FOR TRAFFIC SIGNS

CONTENTS

1. SCOPE

The Performance Based Specification for Traffic Signs builds on the legal requirements for traffic signs in New Zealand and the Manual of Traffic Signs and Markings, Part 1: Traffic Signs, Transit New Zealand / Land Transport New Zealand (MOTSAM). These requirements are described in these notes, but are not prescribed in the Specification, other than by reference to the relevant document. These notes do not give complete coverage of all the legal requirements and those contained within MOTSAM relating to traffic signs and so contractors must therefore be aware of the obligations and requirements contained in these documents.

The Specification sets out the performance requirements for the traffic signs but does not describe how signs should be designed, manufactured, installed or maintained to meet the criteria contained within.

2. RELATED DOCUMENTS

- TNZ P/24, Performance Based Specification for Traffic Signs, Transit New Zealand
- RSMA Compliance Standard for Traffic Signs, Road Sign Manufacturers' Association 2008
- AS/NZS 1170 Structural design actions
- AS/NZS 1906.1:2007 Retroreflective materials and devices for road traffic control purposes. Part 1: Retroreflective materials
- MOTSAM Manual of Traffic Signs and Markings, Part 1: Traffic Signs, Transit New Zealand / Land Transport New Zealand

3. DEFINITIONS

CIL	Coefficient of Luminous Intensity
Clear zone	The clear zone is the desirable unobstructed roadside area available for the recovery of errant vehicles that have left the travelled way.
Signs	In these notes the word "sign" shall be interpreted as including all the components that make up a sign, including the foundation, support posts, sign panel, brackets, fittings and fastenings.
Specification	In these notes the word "Specification" shall be interpreted as referring to the Transit New Zealand Performance Based Specification for Traffic Signs, TNZ P/24.
ULS	Ultimate Limit State, as defined in AS/NZS 1170.

4. COMPLIANCE

Signs will be deemed to comply with *TNZ P/24 Performance Based Specification for Traffic Signs* if they are:

- designed, manufactured, installed and maintained as described in an approved Standard (such as the *RSMA Compliance Standard for Traffic Signs 2008*); or
- posted on the Transit New Zealand website as complying; or
- established as complying by an independent professional opinion supported by calculations and test evidence and/or a reasoned argument based on similarity to an approved product and approved on application to the Transit New Zealand National Operations Manager.

5. SIGN FACE DESIGN

Legal requirements dictate dimensions, shapes, colours and locations of regulatory traffic signs. MOTSAM includes these signs and requirements, and expands on them, giving detailed descriptions of all the traffic signs that are used on the State Highway network in New Zealand.

Section 1 of MOTSAM outlines a number of general criteria that include: SIZE (Section 1.3), COLOUR (Section 1.4), LETTERING (Section 1.5), LEGENDS (Section 1.6) and CONSTRUCTION (Section 1.11). The latter sections of MOTSAM prescribe size, colour, reflectivity, lettering, legend and construction requirements of individual signs in detail.

6. VISIBILITY

Visibility of a sign is affected by a number of factors including the sign position and orientation on site, road/site geometry, vehicle headlamps, the driver, and the signface size, colour, brightness and contrast. The Specification assesses only two attributes of sign materials – luminance and contrast. It is assumed that the sign is correctly designed and installed so that other factors important in making the sign visible, such as the class of reflective material and the location of the sign on site, have already been correctly accounted for.

6.1 Performance Criteria

a. Retroreflectivity illuminates signs at night. The performance of retroreflective material, however, degrades with time and weathering. It is important to understand the loss in performance of the retroreflective material at a given site where a sign will be located to ensure that the material will still meet the retroreflective criteria near the end of the intended life. Initial values for the 'Coefficient of Luminous Intensity' (CIL), that are specified in the AS/NZS 1906.1:2007, should be available from the manufacturers of the retroreflective material. The CIL can be measured on site using a reflectometer.

b. Luminance contrast ratios are measured for fully reflectorised signs to ensure that there is adequate night-time contrast of the lettering or legend and background. The CIL of each material used in the sign can be measured using a reflectometer.

c. The colourfastness requirement within this specification is intended to ensure acceptable contrast is maintained in the sign, as well as maintaining the appearance of the sign.

7. DURABILITY

Durability relates to the visibility, strength, rigidity and impact performance of a sign over an extended period of time. Strength and rigidity criteria should be met over a long period of time provided the initial design and materials used in construction are appropriate. Visibility performance, however, will often degrade over time due to natural weathering and environmental degradation. This might include fading, reduction in retroreflectivity, peeling, wrinkling and accumulation of dirt on the sign face. Thus, regular inspections and maintenance may be required to ensure visibility performance criteria are met.

The intended design life of the support structures are defined according to the importance of the sign type and expected life in service. The "importance level" of a structure is related to the consequences of failure and is reflected in the probability of exceeding a limit state. The "design working life" is a reference time period. It is used to select the probability of exceedance of different actions. It does not mean that when the design working life is reached the structure will fail nor does it mean that the design working life has to correspond exactly with the intended useful life or with the durability of the construction materials.

8. STRENGTH AND RIGIDITY

8.1 Design Loads

With the "importance level" and the "design working life" determined, the annual probability of exceedance of an action is obtained from AS/NZS 1170.0 Table 3.3, with the average recurrence interval used in AS/NZS 1170.2 Table 3.1 to obtain the required Regional Wind Speed for design.

The minimum design wind pressure specified approximates the limit for truck induced wind pressures for road side sign structures adjacent to the carriageway. It also corresponds to the minimum health and safety limit in the code and thus provides a level of personal safety.

Charts are included in the RSMA Compliance Standard for the selection of typical post sizes for signs with panel area less than or equal to 4.7m^2 located at the roadside. Design to AS/NZS 1170 is required for signs at an elevation greater than 500m above sea level, in steep terrain, or signs with dimensions not covered by the charts (see chart notes). The charts show typical solutions for a range of materials and cross-section shapes but are not intended to restrict the designer if other materials and cross-section shapes are available provided the design is based on AS/NZS 1170 and the factors adopted in the Specification.

8.2 Load Factors and Strength Reduction Factors

In extreme events it is desirable to have a controlled failure mechanism. For example, posts should fail in flexure before the sign panel to post connection fails, or the foundation fails. To ensure this type of failure mechanism load factors and strength reduction factors have been specified for the design of the connections to the sign panel and for the design of the post foundations.

8.3 Serviceability Limits - Rigidity

Where two-post mounting is required, it is good practice in minimising wind deflection to place the posts equidistant from each end by one-sixth (1/6) or one- fifth (1/5) of the overall sign width. Where this is not possible the wind loading requirements of the sign specification may not be met and additional support channels may be required.

8.4 Foundation Design

The foundation and soil type need to be considered in conjunction with the post and sign panel for compliance with the impact performance requirements of this standard.

8.5 Resistance to Twisting

Twist Test Method
When testing the twist performance of a sign, the sign panel shall be attached to a post in the same manner as that used in service. Where the sign is mounted in a framework, which will itself be securely fixed to, or form part of the supporting structure, the composite structure including the mounting post shall be attached to the sign during testing. For signs supported on a single axis or at one end, the post shall be supported horizontally and must be free to deflect under test load.

A test load of 625N shall be applied at a rate of between 6N/s and 8N/s at the extremity of the sign so as to provide maximum torque about any axis of rotation. The sign shall be loaded with the test load at its extremity for a period of 5 minutes. The rotation of the sign shall be measured whilst under the load and 5 minutes and 10 minutes after removal of the load.

9. IMPACT PERFORMANCE REQUIREMENTS FOR SIGN SUPPORTS

For the impact requirements for signs the performance is specified using the American standard, NCHRP Report 350, discussed below. The concept of 'frangible posts' remains relevant to the requirements and is clearly defined; however it forms only one of the criteria that are evaluated. Other factors that must be considered are the forces that are imparted to the vehicle as the post yields or breaks away and the trajectory of the sign if it breaks away from the foundation.

Definition of Yielding and Breakaway Supports
The term **yielding** support refers to those supports that are designed to remain in one piece and bend at the base upon vehicle impact. The anchor portion remains in the ground and the upper assembly passes under the vehicle.

The term **breakaway** support refers to support systems that are designed to break into two parts upon vehicle impact. The release mechanism for a breakaway support can be a slip plate, plastic hinges, fracture elements or a combination of these. Breakaway supports are designed to separate from the anchor base upon impact. Breakaway designs include supports with frangible couplings, supports with weakened sections, bolted sections and slip base designs. Breakaway supports are classified by their ability to properly separate from the base upon impact from one

direction (unidirectional) or from any direction (multi-directional). Large signs, requiring multiple supports separated by 2100mm or more, often use a hinged breakaway mechanism with a horizontal slip base.

9.1 Impact Requirements for Signs

NCHRP Report 350
NCHRP Report 350 sets out a number of specific performance criteria relating to likelihood and severity of injury to occupants in a vehicle that impacts roadside furniture/structures, including signs. The report describes test methods and conditions that are used to measure these criteria and assess the impact performance of the sign being evaluated. Importantly, the test methods do not assess individual components of a sign but the whole sign, including foundations. Thus, a component that has been tested and approved for use in one sign, may not meet the performance criteria when used in a significantly different sign.

Documentation to support compliance with NCHRP 350 may be required upon request.

10. MANUFACTURING

Section 1.11.3, Sign Panel Backs, in MOTSAM shall include all stiffening, joining systems, fittings and fastenings mounted to the back of the sign panel.

11. INSTALLATION

11.1 Positioning

Ground Installation
On tangent sections, position signs so that the vertical axis is plumb, and the horizontal axis is at an angle of 95° with the traffic lane which the sign serves as referred to in Section 1.10 of MOTSAM.

On horizontal curve sections, position the sign so that the vertical axis is plumb and the horizontal axis is at an angle of 95° with a straight line between the sign and the point at which the sign is to be read.

Support structures shall be permanently secured and free standing in the ground in accordance with Section 8.4 of the Specification, without supplementary props or supports.

Overhead Signs
Where the road gradient approaching the sign is +2.0% or greater, position the sign so the vertical axis is parallel to a plumb-line and the horizontal axis is at right angles to the road.

Where the road gradient approaching the sign is less than +2.0%, the sign should be positioned so its horizontal axis is at a right angle to the road, and the vertical axis of the signface is inclined to face upward at a rate of 3mm per 300mm of vertical sign surface for each one percent the road gradient differs from +2.0%.

Cleaning Considerations
Careful sitting may reduce the fouling of a sign and consequent maintenance/cleaning costs. Full advantage of the height range allowable in the Transit New Zealand/Land Transport New Zealand Manual of Traffic Signs and Marking should be taken to keep signs above traffic spray.

12. MAINTENANCE

12.1 Cleaning

It is essential that sign faces should be kept clean in order to be effective and, to ensure this, frequent and regular cleaning programmes should be maintained. The frequency will naturally depend on the site and the time of the year, but it should be remembered that, particularly with retroreflective signs, the efficiency of retroreflective media falls rapidly with the accumulation of dirt.

Cleaning Recommendations
Frequent cleaning will maintain sign faces in better condition than infrequent attempts to remove substantial accumulations of dirt. In industrial areas and on roads with high traffic volume where the dirt may be greasy and more adherent, frequent cleaning is essential.

Signs should be flushed with clean water to remove loose dirt particles, and then washed with a soft brush or sponge using a non-abrasive dilute neutral cleaner. Signs should be washed from the top down and rinsed thoroughly with clean water to remove all traces of the cleaner.

Tar, oil, crayon, lipstick, diesel smut and bituminous material can be removed with mild solvents, in accordance with the sign manufacturer's recommendations. Avoid screen-processed areas. After solvent wipe, wash with neutral detergent and water, and then rinse with clean water.

Strong solvents and alkaline preparations should not be used for cleaning signs. Apart from the possible effects of such materials on the hands of the workmen involved, residue left to dry and concentrate on reflective sheeting and painted surfaces can be very damaging.

Transparent protective overlay films, which are designed to facilitate the cleaning, and maintenance of signfaces may be used in accordance with the sheeting manufacturer's recommendations.

12.2 Repairs

Covering Signs Temporarily
If it is necessary to cover the sign face temporarily following erection, use caution since some coverings may cause permanent damage to the sign face following exposure to moisture, sunlight etc. Porous cloth covers, which are folded over the sign edges and secured at the back of the sign, are recommended. Do not use tape, paper, plastic or sheet metal covers.