

PERFORMANCE BASED SPECIFICATION FOR TRAFFIC SIGNS

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1. SCOPE

This specification sets out the requirements for the design, manufacture, installation and maintenance of permanently installed traffic signs used on the state highway network. Signs shall comply with the legal requirements for traffic signs in New Zealand and MOTSAM Part 1, excluding Section 1.11.1, Construction - General Requirements. This specification does not cover the following types of signs:

- flexible sign faces
- internally illuminated signs
- variable message signs

Minimum levels of performance are specified with respect to:

- Visibility
- Durability
- Strength
- Safety

2. RELATED DOCUMENTS

Manual of Traffic Signs and Markings - Part 1: Traffic Signs. (MOTSAM-Part1)	Transit New Zealand / Land Transport New Zealand
AS/NZS 1170	Structural design actions
AS/NZS 1906.1:2007	Retroreflective materials and devices for road traffic control purposes. Part 1: Retroreflective materials
AS/NZS 3845:1999	Road Safety Barrier Systems
NCHRP Report 350	Recommended Procedures for the Safety Performance Evaluation of Highway Features (NCHRP 350)
NZBC – B1/VM4, 2000	New Zealand Building Code
RSMA Compliance Standard for Traffic Signs 2008	Road Sign Manufacturers' Association
State Highway Geometric Design Manual	Transit New Zealand
TNZ M/23	Specification for Road Safety Barrier Systems

3. DEFINITIONS

Clear zone	The clear zone is the desirable unobstructed road side area available for the recovery of errant vehicles that have left the travelled way.
Intended life	The “intended life” is the period of time a sign shall meet the performance requirements specified, and includes the effects of normal environmental degradation expected at the site, but excludes accidental or wilful damage and the effects of extreme weather events.

Signs	In this specification 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.
Standard	In this specification the word “Standard” shall be interpreted as a Transit approved document that provides a means of compliance with this specification.
ULS	Ultimate Limit State, as defined in AS/NZS 1170.

4. COMPLIANCE

Signs designed, manufactured, installed and maintained as described in an approved Standard will be deemed to comply with this Specification. One such Standard is the *RSMA Compliance Standard for Traffic Signs 2008* (see www.rsma.org.nz).

Other Standards may be approved for use on State Highways on application to the Transit New Zealand National Operations Manager.

4.1 Alternative Means of Compliance

Compliance of signs or sign components with this Specification may be established by an independent professional opinion supported by calculations and test evidence and/or a reasoned argument based on similarity to an approved product. Matters to be covered by the opinion should include the materials of construction, sign face material, structural and impact performance, design life and wind loading.

4.2 Right of Review

Transit New Zealand reserves the right to seek alternative opinions or test evidence on the compliance of any element of a sign. Where this information, or resulting conclusions, are in conflict with the submitted compliance documentation, the sign will not comply with the Specification until the supplier has satisfied Transit New Zealand of the fitness for purpose of the sign.

5. SIGN FACE DESIGN

All sizing, lettering, legends and colours shall comply with MOTSAM.

6. VISIBILITY

- a. i Classes 2 and 2A retroreflective sheeting shall attain at least 50% of the coefficients of retroreflection that are specified in AS/NZS 1906.1:2007 in Tables 2.4 and 2.3 respectively.
- ii Classes 1W and 1 retroreflective sheeting shall attain at least 80% of the coefficients of retroreflection that are specified in AS/NZS 1906.1:2007 in Tables 2.1 and 2.2 respectively.

- b. When viewed during the night, from a vehicle with headlights clean, aligned, in proper working order and on low beam, individual colours within the sign shall have uniform retroreflective properties. Night-time inspections shall be made either from a moving vehicle or from a stationary vehicle at a distance of 35 metres from the sign. The vehicle headlights should be clean, aligned, in proper working order and on low beam.
- c. A fully reflectorised sign (i.e. one which has white legend on a coloured background) shall attain Luminance Contrast Ratios not less than those specified in Appendix B4.1, AS/NZS 1906.1:2007.
- d. The sign shall meet the colour requirements of Clause 2.2.2 of AS/NZS 1906.1:2007.
- e. When viewed under normal daylight conditions, no evidence of cracking, crazing, peeling, lifting from the substrate, delamination, blistering, chalking, or wrinkling shall be observed. Day time inspections shall be made either from a moving vehicle approaching the sign at a speed which represents normal traffic flow, or from a stationary vehicle at a distance of 25 metres directly in front of the sign.

7. DURABILITY

7.1 Performance Criteria

The requirements of Sections 6, 7, 8 and 9 shall be met throughout the intended life of the sign.

7.2 Intended Life

The intended life of the sign, given below in Section 7.2 (a), (b), (c) and (d), shall commence on the date marked on the back of the sign as specified in Section 10.2.

- a. The intended life of signs with classes 2 and 2A retroreflective sheeting shall be 7 years.
- b. The intended life of signs with classes 1 and 1W retroreflective sheeting shall be 12 years.
- c. Fluorescent material shall meet the fluorescent requirements of colour (to Section 2.2 of AS/NZS 1906.1:2007) for 5 years but shall remain retroreflective for 12 years.
- d. The intended life of signs with non-retroreflective properties shall be 10 years.

8. STRENGTH AND RIGIDITY

8.1 Design Loads

The structural design of the sign system shall comply with the criteria and procedures specified in AS/NZS 1170 and as modified below.

Reliability Requirements for Ultimate Limit States

The following return periods are to be applied for wind:

Sign Type	Importance Level	Average Recurrence Interval (Years)	Probability of exceedance during the design life
Overhead signs, VMS signs	2	500	10%
Large Roadside Signs (panel area > 4.7m ²)	2	250	10%
Small Roadside Signs (panel area ≤ 4.7m ²)	1	50	18%

Calculation of Wind Actions

The wind actions shall be calculated from AS/NZS 1170.3 based on:

- Non-directional wind speed, with $M_d = 1.0$
- Minimum terrain category 2 (for Overhead and VMS Signs)
- Effects of shielding ignored, with $M_s = 1.0$
- Minimum site wind pressure of 800 Pa
- Design wind speed ≥ 30 m/s

8.2 Load Factors and Strength Reduction Factors

Sign Panel to Post Connections

Sign panel to post connections shall be designed for a force that is at least equivalent to 1.25 times the force used for the design of the supporting post.

Sign Post Foundations

The foundations shall be designed in accordance with the accepted principles of soil mechanics, taking into account the soil properties of the foundation material and due account of the water table and sloping ground.

- i. For roadside signs with an area less than 4.7m² a soil strength reduction factor of not more than 0.6 shall be adopted.
- ii. For signs with an area greater than 4.7m² and signs over a carriageway a lower soil strength reduction factor of between 0.45 to 0.6 may be appropriate depending on the level of site investigation and construction control (refer to NZBC – B1/VM4, 2000).
- iii. Where not specifically designed, the minimum support post planting depth shall be one fifth of the mounting height, but not less than 1 metre depth.

8.3 Serviceability Limits - Rigidity

For the design of the posts of signs with an area less than 4.7m² the serviceability limit state deflection should not exceed $h/20$ calculated at the top of the sign (ignoring foundation rotation), where h is defined as the free cantilever length. Deflections of large sign supports shall be subject to specific design. Parking and median mounted signs with a high probability of impact may be designed with a lower rigidity requirement than that specified above.

Deflection of sign panels relative to their supports shall be limited to a maximum temporary deflection of $L/40$ of the appropriate span when subjected to the serviceability design wind pressure, where L is defined as the span between supports, or between the support and the panel edge. The relative deflection of adjacent sign panels, in multi-panel signs, shall not exceed 1.0 mm when subjected to the serviceability design wind pressure.

8.4 Foundation Design

Foundations shall be designed in accordance with the principles of structural statics and accepted principles of soil mechanics, taking due account of the mechanical properties of particular foundation materials.

Foundations shall not protrude more than 100mm above finished ground level. The foundation should be constructed flush with or below the ground profile and the bottom flange of the stub shall not exceed 100mm above the ground profile over a 1.5m length. See Figure 1.

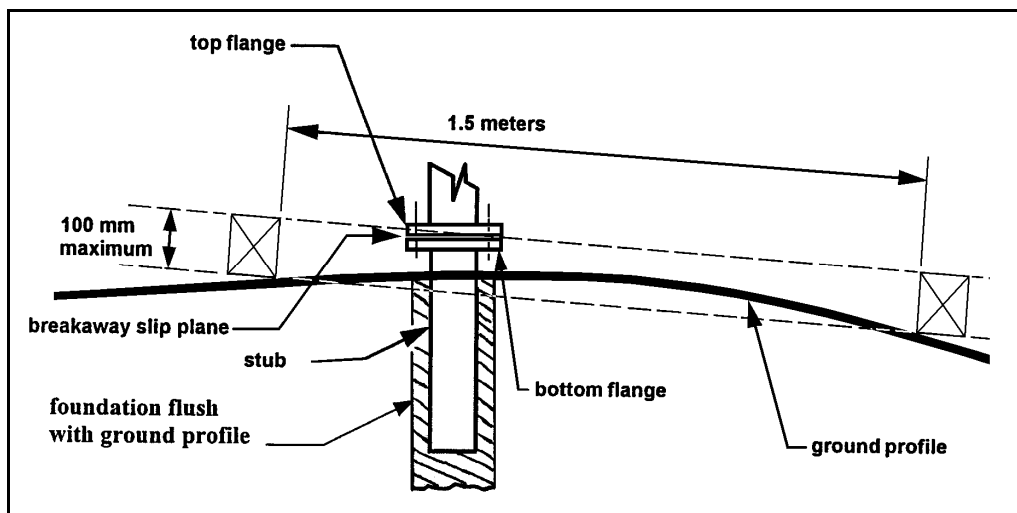


Figure 1: Breakaway Support Maximum Stub Height

8.5 Resistance to Twisting

The sign foundation, construction, clamping arrangements and installation of signs to single posts shall not allow twisting about any axis of rotation greater than 5° residual rotation of the sign by reason of permanent set or slippage.

9. IMPACT PERFORMANCE REQUIREMENTS FOR SIGN SUPPORTS

Signs in the roadside clear zone shall meet the impact requirements of section 9.1 or as otherwise specified below.

9.1 Impact Requirements for Signs

Signs located in the roadside clear zone shall be designed, manufactured, installed, and maintained to comply with NCHRP Report 350, test level 3.

9.2 Signs in the Clear Zone Protected by Other Means

Signs that do not comply with Section 9.1 may not be used in the clear zone unless shielded by:

- a. a road safety barrier system in compliance with AS/NZS 3845:1999, Road Safety Barrier Systems, and TNZ M/23, Specification for Road Safety Barrier Systems except, where the vehicle operating speed does not exceed 70 km/h, NCHRP Report 350, Test Level 2, shall apply as a minimum. In all cases, sign supports shall be located clear of the space required for the dynamic deflection and the proper performance of the barrier;

or

- b. a fixed impact attenuator, designed to resist both end-on and side impact by vehicles, in compliance with NCHRP Report 350, Test Level 3 except, where the vehicle operating speed does not exceed 70 km/h, NCHRP Report 350, Test Level 2, shall apply as a minimum.

9.3 Impact Performance in Urban and Other Low Speed Areas

The road controlling authority may decide that in specific situations the risk of injury to pedestrians and cyclists from breakaway type signposts exceeds that of the vehicle occupants, in the event of a crash, and so specify that Section 9 does not apply.

10. MANUFACTURING

10.1 Tolerances

Unless otherwise specified on the drawings tolerances on blank dimensions shall be as follows:

- a. Overall dimensions of blank: $\pm 3\text{mm}$ or 0.5 percent of dimension, whichever is the greater.
- b. Holes: Size, tolerance - 0, + 1mm.
Hole centre dimension (geometric position): mating hole centres, tolerance $\pm 1\text{mm}$. Non-mating hole centres, tolerance $\pm 3\text{mm}$.
- c. Maximum allowable warp, twist or departure from flatness, except for any departures prescribed by the drawing to increase stiffness: 3mm/metre.
- d. Blank squareness: In the case of a single panel sign, no corner of the panel shall be more than 2mm from its theoretical position relative to other corners.

In the case of multi-panel signs, adjacent panels shall be rectangular and fit together so that any gap between panels is not less than 1.0mm and not more than 1.5mm wide along the edge of the join.

- e. All permanent signs to have radius corners finished in accordance with sign layouts.
- f. All edges shall be smooth and true.

10.2 Identification Marking

All permanent signs shall be permanently identified on the back of the sign with the manufacturer's name, month and year of manufacture. The label shall enable the manufacturer to trace the retroreflective sheeting manufacturer's name, and class of sheeting.

Identification marking size shall be a maximum of 5000mm² and shall be of the same durability as the intended life of the sign.

11. INSTALLATION

11.1 Positioning

Signs shall be positioned and mounted to comply with the legal requirements for traffic signs in New Zealand and MOTSAM.

Where discretion is available within these requirements regarding the location, orientation and mounting of a sign, the State Highway Geometric Design Manual shall be used, with due regard to visibility, safety and maintenance peculiarities of the site.

12. MAINTENANCE

12.1 Cleaning

The surface of the sign face material shall be capable of having road dirt and grime readily removed from it. Signs shall be cleaned in a manner and frequency that maintains the performance requirements of Section 6 of this Specification at all times.

12.2 Repairs

Signs that are damaged shall be repaired to meet or exceed the performance requirements of this Specification.