Technical Note 165

Survey Marks
(TMR Surveying Standards)

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Government

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1 Purpose of technical note

This technical note provides interim advice on standardised naming of survey marks and the correct application of feature codes to the different types of survey marks. This advice is intended to set standards and provide clarity in the *TMR Surveying Standards*. The requirements of a Type C survey mark are presented to standardise specifications. The information contained in this technical note is in addition to information currently in the Standards. Once implemented, surveys for the Department of Transport and Main Roads will benefit from greater uniformity and rigour.

2 Background

Surveys for the department are spatially positioned using project survey control. This survey control is a hierarchical system from highly accurate datum marks to less accurate temporary station marks. Currently no standard naming of survey marks exists which subsequently allows surveyors to use any name they want.

Each of the different types of survey control has a unique feature code associated with it. The field situation in which to use the majority of these codes is well defined however a small number were open to different interpretations.

Type C marks have been used on departmental surveys for many years, typically as Permanent Survey Marks and Bench Marks. Specifications were previously detailed in earlier versions of the Standards but have been absent for a number of years.

This technical note will address and resolve these three issues.

3 Application

3.1 Survey mark naming

When using SURVEY TRAVERSE feature codes, the Survey Mark Name as stated below in Table 3.1 shall be used.

Note: In Table 3.1, xxxx typically represents the numerical component of the survey mark name. Additional alpha characters may be used in the xxxx part of the name only as shown below.

Table 3.1: Survey mark naming

Feature Code	Survey Mark Name	Description	Example mark name	Explanation of example
PBMK	BMxxxx	Original BM benchmarks, as per shield or backing plate	BM45M	original 45 mile benchmark
			BM BS	original bridge site bench mark
	MRxxxx	New or original MR benchmarks, as per shield or backing plate	MR23.5K	Main Roads benchmark at chainage 23.5 km
	QTxxxx	Original QT benchmarks, as per backing plate	QT34K	original QT benchmark at chainage 34 km
	TBMxxxx	New or original temporary bench marks	TBM12.7K	temporary bench mark at 12.7 km
PGCP	GCxxxx	Ground control point	GC7014	ground control station 7014
PISO	STNxxx	Instrument station – other mark	STN145	secondary instrument station 145
PISP	STNxx	Instrument station – primary mark	STN12	primary instrument station 12
POPP	RMxx	Offset/recovery mark	RM126	recovery mark 126
PPMK	PMxxxxxx	Permanent survey mark	PM123456	permanent survey mark 123456

Survey marks are the only surveyed features that may have an alphanumeric point ID/number (vide *TMR Surveying Standards*, Schedule 1 – Section 3.1 Point Identifier) apart from PQAP coded marks in the SURVEY QUALITY model. All other surveyed discrete points shall have a unique numeric point ID/number.

Feature code PFSC (Fixed Survey Control in SURVEY DATUM model) shall always be duplicated with a SURVEY TRAVERSE feature code (usually PPMK) and as such, shall also have the same Survey Mark Name.

As PISO and PISP share the same survey mark name (alpha component), the series of numeric identifiers used for PISO's shall be separated from the series of numeric identifiers used for PISP's. For example: PISP's start at STN1 and PISO's start at STN100.

3.2 Survey feature code use

Table's 3.2a and 3.2b contain descriptions of the field situation where each survey control feature code shall be used.

Table 3.2a – SURVEY DATUM

Model: SURVEY DATUM	
Feature Code	**Description of field situation**
PFSC	onsite fixed position survey control, generally 1km spaced Permanent Survey Marks

Table 3.2b – SURVEY TRAVERSE

Model: SURVEY TRAVERSE	
Feature Code	**Description of field situation**
PBMK	Bench Mark or Temporary Bench Mark
PCPP	original survey chainage peg or non-permanent chainage reference point
PGCP	ground control point – target or grid of points for ground control of photogrammetry, mobile laser scanning or airborne laser scanning
PISO	Instrument station used only to locate the ground surface or "other" points (i.e 0.050 m relative uncertainty for position or height) {vide *TMR Surveying Standards*, Part 2, Section 1.3.1.4}
PISP	Any instrument station used to locate feature points (other than or in addition to the ground surface)
POPP	Recovery mark
PPMK	Permanent Survey Mark
PRFP	permanent reference mark (ARMIS chainage reference marker)
PSMK	an unknown or unidentified existing survey mark, or existing mark that is potentially a survey mark
TL_	Any direct connection between survey marks to show linage (where the progressive mark has been observed or coordinated from)

3.3 Example Survey Control naming and feature coding

The following table and diagram show example survey mark naming and feature coding for SURVEY DATUM and SURVEY TRAVERSE models. Some marks require multiple feature codes.

SURVEY DATUM marks would generally be exported from GNSS adjustment software and imported into the Ground and Feature Model processing software.

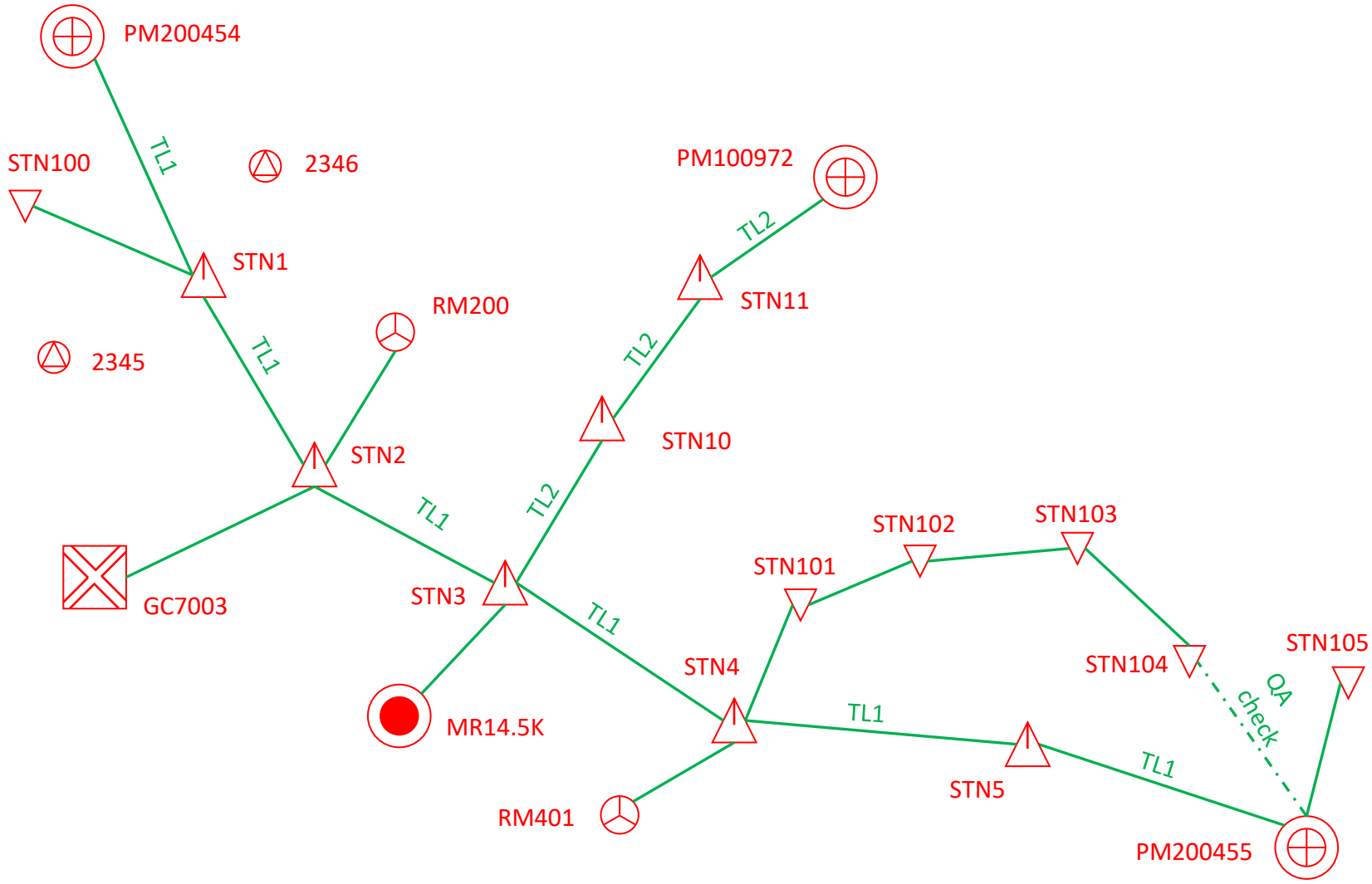
Table 3.3: Example Survey Control naming and feature coding

Survey Mark Name	SURVEY DATUM feature code	SURVEY TRAVERSE feature code	SURVEY TRAVERSE feature code	SURVEY TRAVERSE feature code	Comment description example
PM200454	PFSC	PPMK	TL1		PM200454 Type C
STN1		PISP	TL1		STN1 Star pkt
STN2		PISP	TL1		STN2 Star pkt
STN3		PISP	TL1	TL2	STN3 Screw in conc
STN4		PISP	TL1		STN4 Screw in conc
STN5		PISP	TL1		STN5 Star pkt
PM200455	PFSC	PPMK	TL1		PM200455 Type C
STN10		PISP		TL2	STN10 Star pkt
STN11		PISP		TL2	STN11 Screw in kerb
PM100972	PFSC	PPMK		TL2	PM100972 O.Brass Plaque
2345		PSMK			O. Screw in kerb
2346		PSMK			O. Nail in conc
STN100		PISO			STN100 dumpy peg
RM200		POPP			RM200 Star pkt
RM401		POPP			RM401 Star pkt
STN101		PISO			STN101 swamp peg
STN102		PISO			STN102 dumpy
STN103		PISO			STN103 dumpy
STN104		PISO			STN104 dumpy
STN105		PISO			STN105 G.I.N
MR14.5K		PBMK			O.MR14.5K Type C
GC7003		PGCP			O.GC7003 Star pkt

Notes for Table 3.3 and Diagram 3.3:

- PFSC symbols have been left off the diagram for visual simplicity
- Where TL lines have no feature code shown, the TL's have been created onscreen during processing (they may also be coded in the field)
- As the side traverse of STN101 to STN104 features more than two marks and has been used to locate hard surfaces; services or structures, it shall connect back to the main traverse (or end on and be adjusted to a primary control mark)
- Original has been abbreviated to O. to shorten comments (e.g O. Nail in conc)
- Connection lines are not required to PSMK's but may be used.

Diagram 3.3: Example of Survey



4 Type C survey mark

Type C is the preferred mark type to be used as a Permanent Survey Mark (PSM) or Benchmark (BM) for rural and remote surveys excepting areas of black or unstable soils where deep driven marks are to be used. Sections 4.1 and 4.2 together with Figure 4 set the requirements for a Type C mark.

4.1 Mandatory requirements

The following requirements are mandatory and may not be varied.

A departmental Type C mark is a 2.44 m galvanised heavy duty star picket, driven to full length or refusal, with a protective collar and cap. The highest point of the star picket shall be at least 0.075 m below ground level. The picket shall have been driven a minimum of 1.0 m into the ground at refusal and be vertically and horizontally stable to be considered a PSM or BM. The top of the picket shall have an obvious high point and be in good condition (not split, bent or mushroomed). The horizontal reference point shall be clearly defined by centre punching. Ideally the horizontal and vertical reference points will be coincident. This can be achieved by using a star picket cap with an internal concave void when hammering the mark in, or by cutting off the “wings” of the star picket after it’s driven in place.

For protection and ease of use, the picket shall be encased by a protective collar. A concrete lid (paver or pre-cast) will be used to cap the collar. The collar lid should be flush with the ground so as not to be disturbed, damaged or constitute a hazard.

A stainless steel or aluminium tag stamped with the ID number of the mark shall be permanently attached to the star picket.

A star picket backing post shall be placed behind the mark. A star picket witness post shall be placed on the road side of the mark to help protect the mark. PSM’s are to have backing and witness posts painted with red and white bars. BM’s are to have the backing post and witness posts painted with black and white bars.

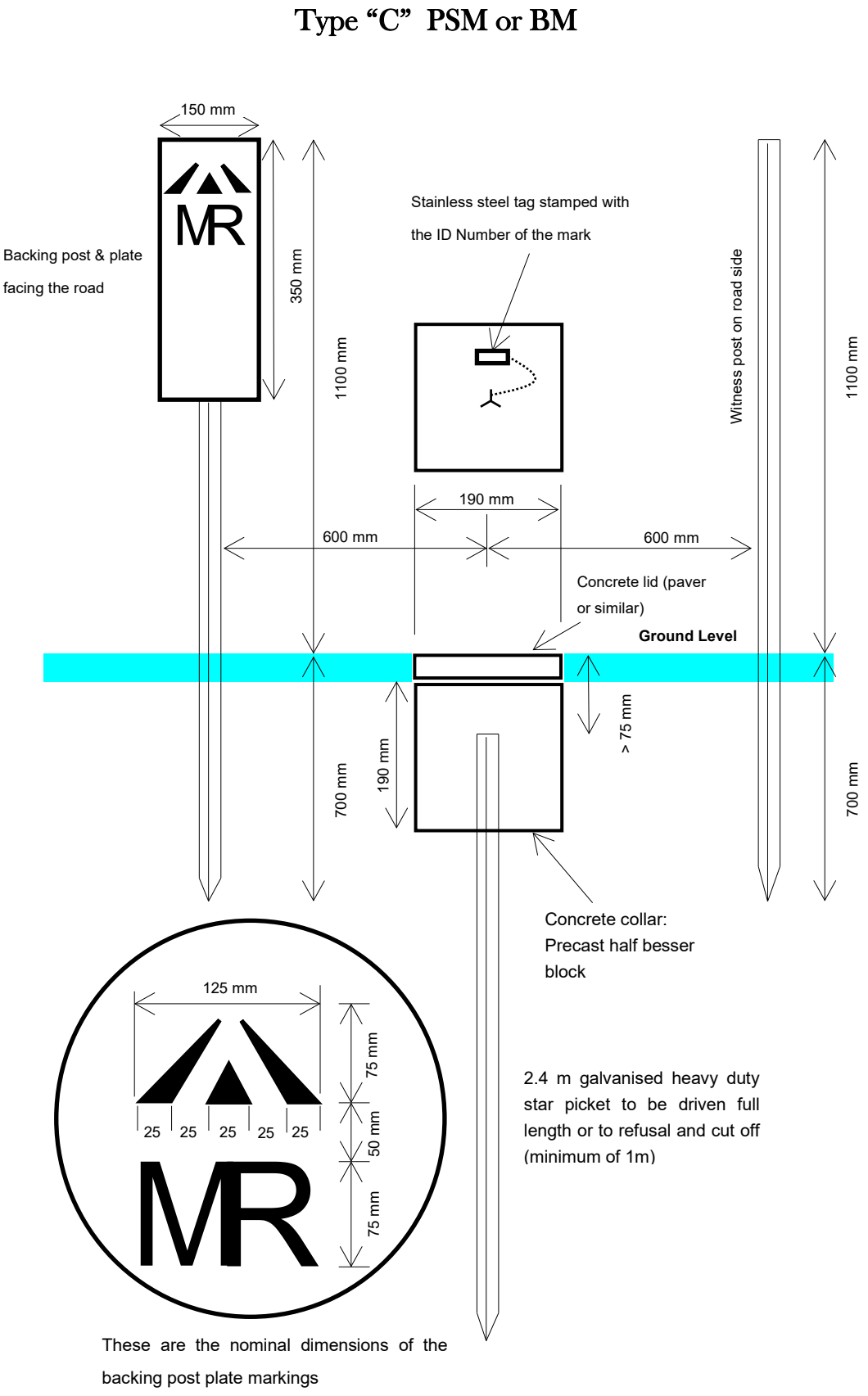
Figure 4 shows the configuration and various measurements required.

4.2 Mandatory but variable requirements

The following four requirements are mandatory, however they may be varied by the responsible survey Project Manager from the department.

- The protective collar shall be a concrete collar in the form of a precast half besser block.
- The backing post shall have a MR plate facing the road and securely bolted to the post in two places.
- A second witness post on the road side of the mark may be used to offer greater protection if deemed necessary. The witness posts shall form a triangle around the mark with the backing post.
- A second stainless steel or aluminium tag stamped with the ID number of the mark shall be attached to the backing plate or collar for easy identification.

Figure 4 Type "C" mark



5 References

ICSM, *Guideline for the Installation and Documentation of Survey Control Marks – Special Publication 1*, Version 2.2, Intergovernmental Committee on Survey and Mapping, Canberra, Australia

Transport and Main Roads, *Transport and Main Roads Surveying Standards, Part 1 – General Information*, Department of Transport and Main Roads, Brisbane, Australia

Transport and Main Roads, *Transport and Main Roads Surveying Standards, Part 2 – Geomatic Types*, Department of Transport and Main Roads, Brisbane, Australia

Transport and Main Roads, *Transport and Main Roads Surveying Standards, Schedule 1 – Code, Linestyles and Examples*, Department of Transport and Main Roads, Brisbane, Australia