

Appendix A3

**GUIDELINES FOR INSTALLATION OF
CURVE WARNING AND
ADVISORY SPEED SIGNS**

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GUIDELINES FOR THE INSTALLATION OF CURVE WARNING AND ADVISORY SPEED SIGNS

1.0 General

CURVE WARNING signs (PW - 16 to PW - 23) combined with PW - 25 CURVE ADVISORY SPEED signs should be erected on the approaches to horizontal curves when warranted by an **advisory speed assessment survey**.

2.0 Advisory Speed Assessment Survey

The **measured advisory speed** V_M is assessed by driving a test vehicle equipped with a ball bank gauge and a calibrated speedometer around the curve at a constant known speed V_O and observing the highest reading B , of the gauge.

V_M is then obtained graphically from Figure A3.1, or by calculation, using the survey values.

The **rounded advisory speed** V_R is also derived from Figure A3.1.

Each of nine permitted values of V_R , ie. 15, 25, 35, 45, 55, 65, 75, 85 and 95 km/h, is matched to a specific 10 km/h range of V_M , eg. $V_R = 15$ km/h covers the range of V_M from 11 to 21 km/h. The nine values of V_R are boldly annotated on Figure A3.1 **and no other values of V_R shall be used**.

Two survey runs should be made in each direction for each curve because advisory speed values can differ by direction.

Two runs in the same direction must produce the same result before that value can be adopted. If the two runs produce differing results a third run must be made to determine which of the previous results is appropriate.

3.0 Warrant for Advisory Speed Signing

Only those curves that meet the warrant given in Table A3.1, also illustrated in Figure A3.2, shall be signed for advisory speed. The criteria for this warrant are the **rounded advisory speed** V_R and the **85th percentile (85%) curve approach speed** V_{85} .

The **85% curve approach speed** V_{85} is an estimate of the speed that only 15% of vehicles would exceed and it is assessed just before the point where vehicles start to slow for the curve.

As a guide:

- The 85% speed on long straights with ample seal width, excellent visibility and sound surface condition is between 110 and 120 km/h (1990 data). 85% speeds drop below this as alignment and other road and roadside development factors become less than ideal.
- The **speed environment** closely approximates the 85% curve approach speed on longer tangents between curves.

- The 85% speed at the exit point of a previous curve can be assumed to be 20% higher than the **rounded advisory speed** for that curve.

Rounded Advisory Speed V_R (km/h)	Signing warranted when V_{85} meets or exceeds these values (km/h)
15	30
25	40
35	50
45	60
55	80
65	90
75	110
85	120
95	130

TABLE A3.1: WARRANT FOR THE ERECTION OF ADVISORY SPEED SIGNS (refer also to Figure A3.2)

When the warrant for signing a curve is met V_R becomes the **curve advisory speed** V_S , adopted for signposting.

Removal of existing advisory speed signs may be considered if V_R does not meet the warrant and, in the opinion of the road controlling authority, the sign has ceased to be of value.

Where advisory speed signing is not warranted, curve warning signs alone may be erected in situations where the curve is deceptive and not obvious to approaching drivers.

Advisory speed signs **should not be erected** when V_M is greater than 101 km/h, ie. V_R would be 105 km/h and **above the legal speed limit**.

4.0 Graphic Design of Signs

Refer to individual sign specifications (PW - 16 to PW - 25) for full details of the graphic layouts of curve warning signs and advisory speed signs.

5.0 Sign Size

The size of curve warning and advisory speed signs should be increased as the degree of hazard increases. To determine the minimum size of sign for a particular application refer to Fig. A3.2.

6.0 Sign Location and Selection Strategy

A curve warning sign should be located where approaching drivers have an uninterrupted view of it over a distance of at least 120 m in rural areas and at least 60 m in urban areas and be in advance of the curve by at least the distance specified in Table A3.2.

Speed Difference between V_{as} and V_s (km/h)	Minimum Distance of Sign in Advance of Curve Tangent Point (m)
20	100
30	120
40	130
50	140
60	150
70	160
80	170

TABLE A3.2: LOCATION OF CURVE WARNING AND ADVISORY SPEED SIGNS

6.1 Isolated Curves

Isolated curves should be signed with a PW - 16, PW - 17, PW - 18 or PW - 19 signs as warranted.

6.2 Two Adjacent Curves

Where two curves are in close proximity the Figure A3.3 decision tree can assist with the application of the sign layout strategy specified below:

- (a) **Sign curves independently** with PW - 16, PW - 17, PW - 18 or PW - 19 signs **displaying the curve advisory speed** if both curves warrant signing, there is just sufficient distance between the curves to erect a sign on the approach to Curve 2, ie. the length of the tangent between the curves exceeds the distance given in Table A3.2, and 120 m of clear visibility to the second sign can be achieved.
- (b) **Sign only Curve 1** with a PW - 16, PW - 17, PW - 18 or PW-19 **sign displaying the curve advisory speed for Curve 1** if:
 - (i) Curve 2 does not warrant signing, or
 - (ii) Curve 1 has a **lower curve advisory speed** than Curve 2, both curves warrant signing but there is insufficient distance between the curves for separate signing.

- (c) **Where both curves have equal curve advisory speeds**, warrant signing and there is insufficient distance between the curves for separate signing, erect a PW - 20 or PW - 21 REVERSE CURVE sign in advance of Curve 1 **displaying the common curve speed**.
- (d) **Where Curve 1 has a greater curve advisory speed than Curve 2**, both curves warrant signing, and there is insufficient distance between the curves for separate signing, then erect a PW - 22 REVERSE CURVE sign **displaying the curve advisory speed of Curve 2** in advance of Curve 1.

6.3 Multiple Curves

Where a succession of three or more curves of varying curve advisory speeds occur over a section of road less than 1 km in length, the curves warrant advisory speed signing, and there is insufficient distance for separate signing between the curves, then a PW - 23 REVERSE CURVES sign, **displaying the curve advisory speed of the first curve**, should be erected.

Where the section of road exceeds 1 km in length, a PW - 24 WINDING ROAD NEXT "___" km sign combination should be used instead of a PW - 23 REVERSE CURVES sign.

Note: *Plotting curve advisory speed values on a photocopy of an aerial photograph of the section of road under consideration will greatly assist in deciding the signing strategy in these situations.*

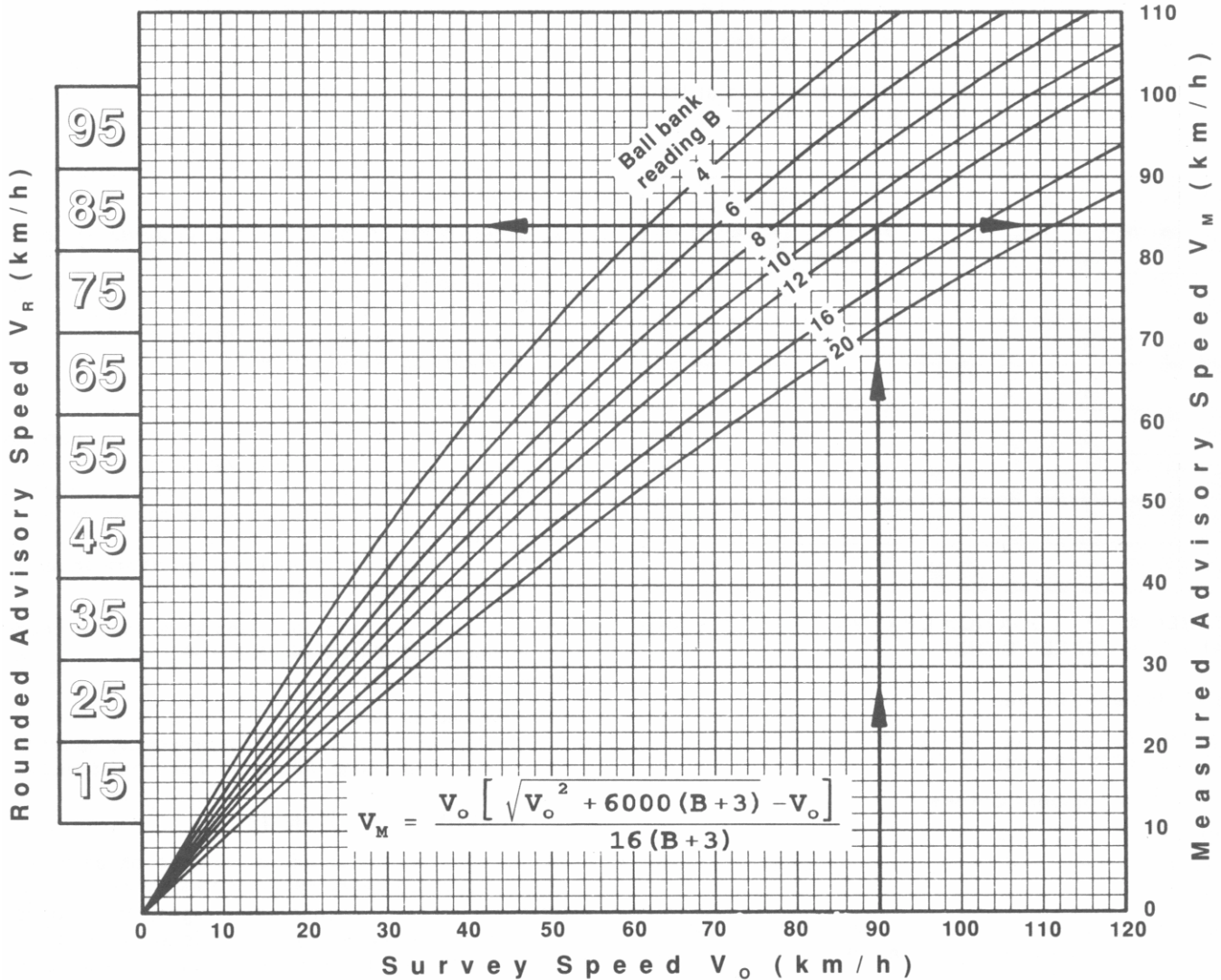
7.0 Horizontal Curve Chevron Sight Board Signs and Chevron Curve Indicator Signs

PW-66 HORIZONTAL CURVE CHEVRON SIGHT BOARD signs should only be erected on horizontal curves where the **curve advisory speed is 15 km/h or where the hazard is such as to warrant Size D signs**, as shown on Figure A3.2. The curve advisory speed shown on the PW curve warning sign must also be shown on the PW-66 signs.

PW-67 CHEVRON CURVE INDICATOR signs are normally used in conjunction with a PW-66 sign to further delineate the curve.

PW-67 signs may also be used on horizontal curves where the installation of a PW-66 sign is not warranted but, in the opinion of the road controlling authority, some additional delineation is required throughout the curve, eg. a long, large deflection angle, horizontal curve.

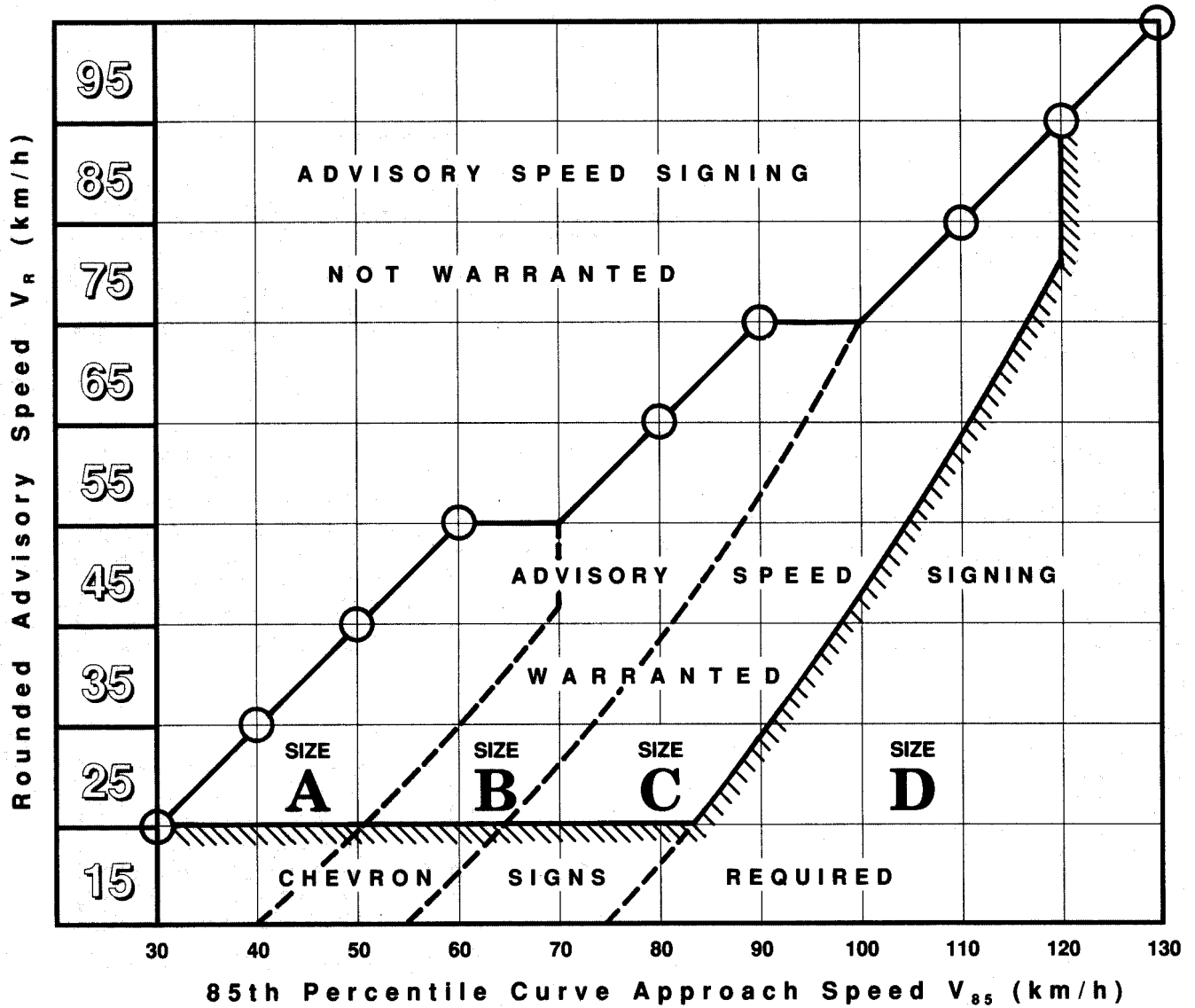
Refer to Section 6: **PERMANENT WARNING SIGNS** of this manual for PW-66 and PW-67 sign specifications.



Example: Observed survey speed, V_o , is 90 km/h and ball bank reading, B , is 12. From the graph, or by calculation, V_M is approximately 84 km/h. From the graph V_R is 85 km/h and this is the value of the **curve advisory speed, V_S , to be sign posted if the warrant given in Table A3.1 is met.**

FIGURE A3.1

DETERMINATION OF ADVISORY SPEED ON HORIZONTAL CURVES



○ Warrant Limits from Table A3.1

Sign Type	Minimum Sign Sizes (mm)			
	A	B	C	D
Curve Warning	600 x 600	750 x 750	900 x 900	1200 x 1200
Advisory Speed	600 x 400	750 x 500	900 x 600	1200 x 800

CURVE WARNING AND ADVISORY SPEED SIGNS ON HORIZONTAL CURVES

SIGNING WARRANT AND SIZE DETERMINATION

FIGURE A3.2

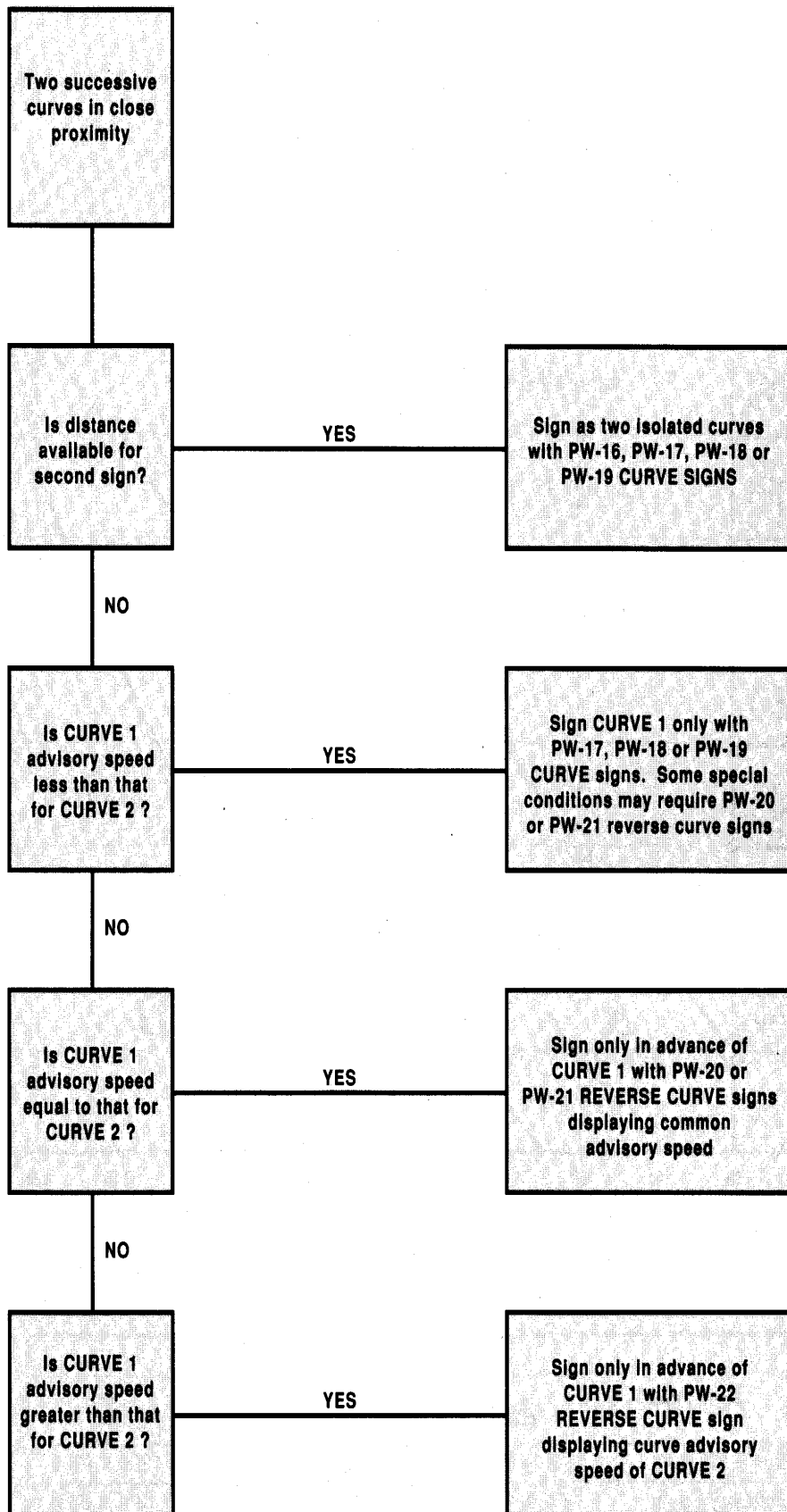


FIGURE A3.3 CURVE WARNING AND ADVISORY SPEED SIGNS
DECISION TREE FOR SIGNING ADJACENT CURVES