DESIGN BULLETIN #14/2003

Best Practices for Centreline/Crown Shift on Divided Highways

Summary: Over a number of years the department has developed some practices to address the need for thicker pavement structures and wider shoulders on the right hand side (looking in the direction of travel) on divided highways. These practices improve cost-effectiveness by allowing thinner pavements to be placed on the left lane of the twinned highway and/or deferring the need for grade-widening by allowing the right shoulder width to be increased through reduction of the left shoulder width. Both of these practices are achieved by shifting the physical crown line and/or allowing the painted centreline to be offset from the physical crown line.

Background: This problem has evolved for several reasons as follows:

1. Most divided highways are constructed through twinning of an existing 2 lane undivided highway. The two lane highway normally has equal shoulder widths on both sides however the desired shoulder width on a four lane divided highway is 2m on the median side and 3m on the right hand side. Also, the suggested minimum shoulder widths on existing divided highways (i.e. the 3R/4R trigger for widening of a divided highway) is 0.3m on the median side and 1.8m on the right hand side. Consequently it is desirable to shift the centreline while twinning a highway.

2. On rural divided highways, there is a traffic loading distribution of 85/15 on the right travel lane versus median travel lane. Therefore there is a need for greater pavement structural depth on the right lane versus the median (left) lane. When pavement overlays are required, there is usually a greater need on the right lane than the median lane. If a 0.5m tolerance between physical crown and painted crown is acceptable, then a difference of 20mm in ACP overlay depth can be used in the design. If the right lane requires a 100 mm overlay (typical) then an 80 mm overlay can be placed on the median lane. This applies to tangent sections only. Superelevated sections would require the same thickness across the entire roadway. The construction cost savings on the tangent section due to reduced thickness of 20 mm on a 5.7m width is approximately $8,000 per kilometer.

Current Practices and Recommendations:

The department's current practice in regard to shifting the centreline on existing divided highways is not documented in the Design Guide or other publications. This is because there is limited application of this practice and it is desirable to assess each proposal on the merits of the project conditions. The current practice is as follows:

1. A 0.5 m difference in lateral placement of the painted line versus the physical crown is acceptable. Shifts exceeding 0.5 m are generally not acceptable because one of the wheel-paths may be on top of the pavement joint (generally the old joint). Also, a shift exceeding 0.5 m may

make snow clearing operations more difficult.

2. Where there are advantages for pavement structural design, the 0.5 m shift may be used at the pavement overlay stage.

3. At the twinning stage of two-lane rural highways or the construction of new divided highways, a special cross-section (Figure C-8.1g (December 2002) from Design Bulletin #10/2003) is used to allow for the difference in structural depth between the median and right hand lanes. However, the painted centreline and the physical crown are at the same location at the finished pavement stage.

4. Where an existing divided highway is relatively narrow, such that the shoulder on the right hand side would be less than 2 m, a shift in the painted centreline is desirable up to a maximum of 0.5 m. As the suggested minimum shoulder widths on divided highways are 0.3 m on the median side and 1.8 m on the right hand side, the ability to shift the centreline is key to preserving the functionality of the roadway through it's life cycle. Shifting of the centreline may be done to increase the width of the right shoulder (as shown in Figure 1) or to allow for a thick/thin overlay (as shown in Figure 2).

5. In areas where a shift in centreline is not desirable due to curvature or intersectional treatments for example, a gradual transition back to the typical cross-section at a rate of 200:1 or flatter is recommended.

Implementation of Bulletin:

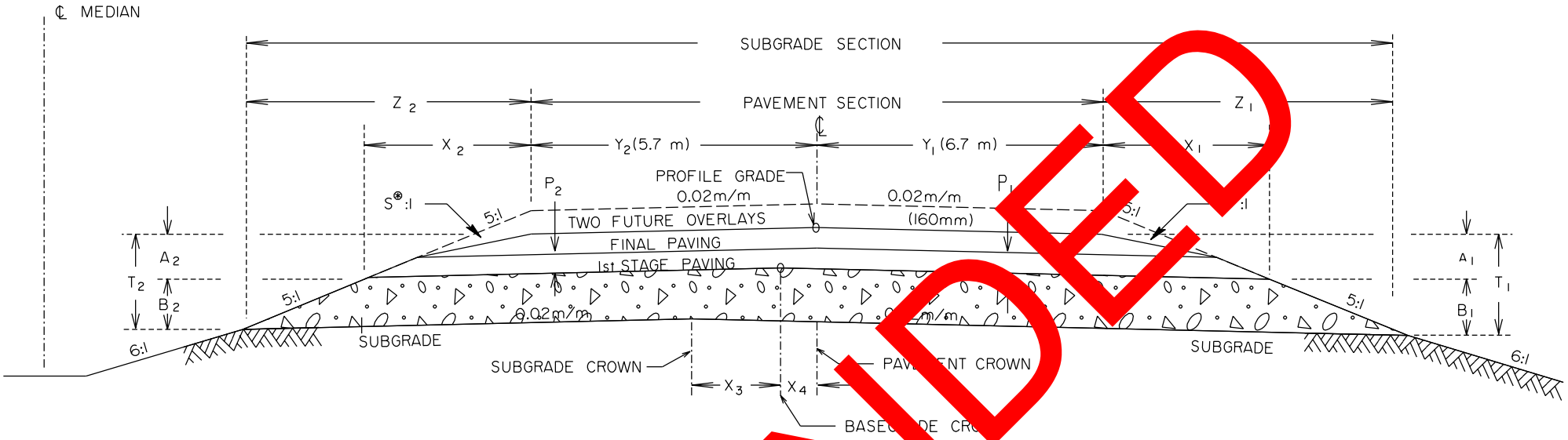
The recommendations contained in this bulletin are effective immediately. Designers should be aware that a 0.5 m tolerance on the lateral placement of the centre paint line is acceptable and should be used where advantageous on projects. As this practice results in a roadway cross-section that is non-standard, designers should always inform and obtain concurrence from the project sponsor when this practice is proposed.

Contacts:

Any questions regarding this bulletin should be directed to Technical Standards Branch (Attention: Bill Kenny or Vijay Ghai, fax 780 422 2846).

Attachments: (Click figures for attachments)

Figure C-8.1g (December 2002) from Design Bulletin #10/2003
Figure 1 - Schematic drawing showing shift of painted centreline to increase right shoulder width.
Figure 2 - Schematic drawing showing physical crown centreline shift to allow for thinner structure on the median side.



NOTES:

* THE PROFILE GRADE IS ON THE CENTRELINE OF THE FINISHED TRAVEL LANES.
* SUPERELEVATION IS NORMALLY ATTAINED BY ROTATING INDIVIDUAL ROADWAYS ABOUT THE CENTRELINE OF TRAVEL LANES.

SUBGRADE AND SURFACING DIMENSIONS

® FOR PAVEMENT SIDES[illegible] DETAILS REFER TO FIG. C-8.1c (NEW CONSTRUCTION) AND FIG. C-8.1d (WIDENING).

A_1, A_2 = THICKNESS OF ACP (1st STAGE + FINAL STAGE PAVING)
B_1, B_2 = THICKNESS OF BASE
$T_1 = A_1 +$ [illegible] $= A_2 +$
P_1, P_2 = THICKNESS OF [illegible] PAVING

NOTE:
THIS DRAWING MAY BE USED TO CALCULATE THE REQUIRED SUBGRADE WIDTH BASED ON SURFACING THICKNESS ON FOUR LANE DIVIDED HIGHWAYS.

EXAMPLE: IF A_1 = 220mm, A_2 = 200mm, B_1 = [illegible]0mm, [illegible] = 350mm
P_1 = 100mm, P_2 = 80mm
T_1 = 620mm, T_2 = 550mm, Y_1 = 6.70m, AND Y_2 = 5.70m

$$X_3 = \frac{B_1 - B_2}{40} = \frac{400 - 350}{40} = 1.25\text{m}$$;(OFFSET DISTANCE FROM SUBGRADE CROWN TO BASECOURSE CROWN)

$$X_4 = \frac{P_1 - P_2}{40} = \frac{100 - 80}{40} = 0.5\text{m}$$;(OFFSET DISTANCE FROM BASECOURSE CROWN TO PAVEMENT CROWN)

$Z_1 = 5(T_1 + 0.16) = 5(0.62 + 0.16) = 3.9\text{m}$
$Z_2 = 5(T_2 + 0.16) = 5(0.[illegible] + 0.16) = 3.55\text{m}$

∴ TOTAL SUBGRADE WIDTH = FINISHED PAVEMENT + Z_1 + Z_2
= 5.7 + 6.7 + 3.9 + 3.55
= 19.85 m

No.	REVISIONS	BY	DATE
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Alberta TRANSPORTATION

FIGURE C-8.1g

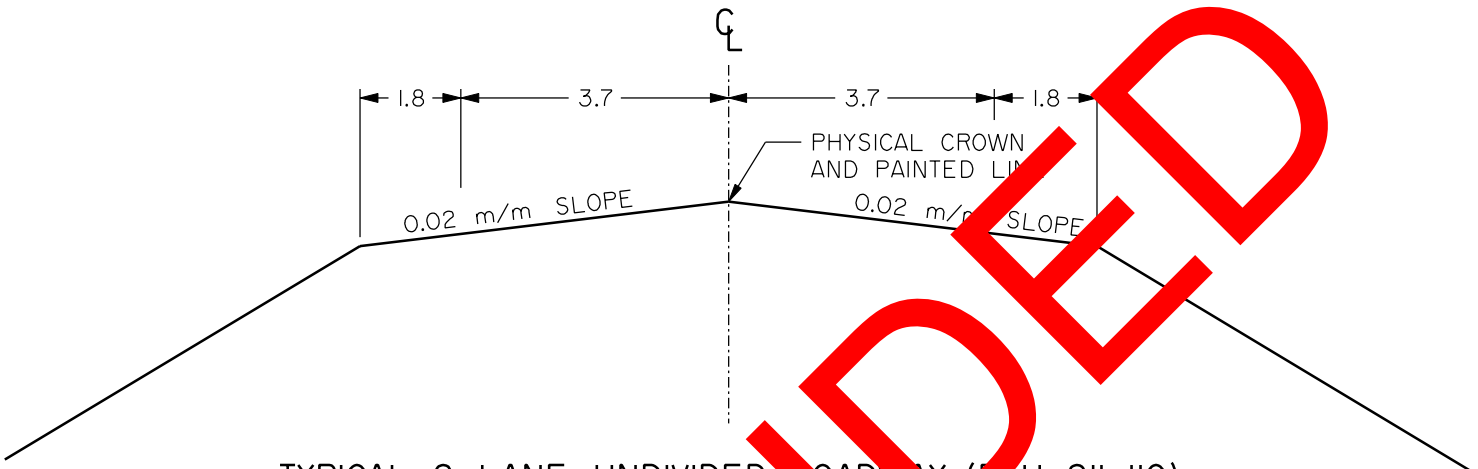
Date: DECEMBER 2002

TYPICAL PAVEMENT DESIGN FOR FOUR-LANE DIVIDED HWY RFD-412.4-130 & RAD-412.4-120

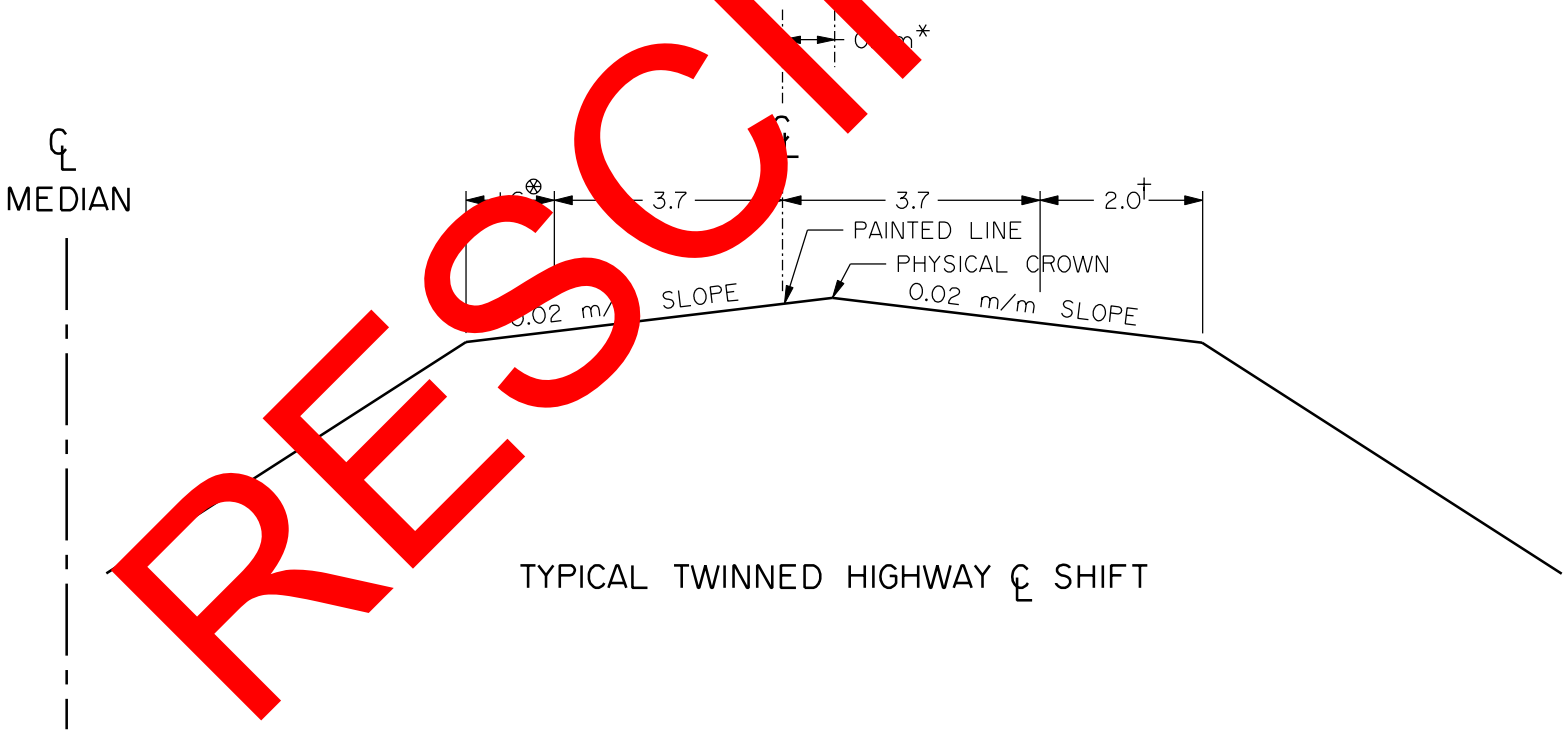
Prepared By: T.N.	Checked By: BK	Scale: N.T.S.	PAGE C- 95

FIGURE I
SCHEMATIC OF SHIFT OF PAINTED CENTRELINE TO INCREASE RIGHT SHOULDER WIDTH

NOT TO SCALE



TYPICAL 2 LANE UNDIVIDED ROADWAY (RAU-211-110)



TYPICAL TWINNED HIGHWAY ℄ SHIFT

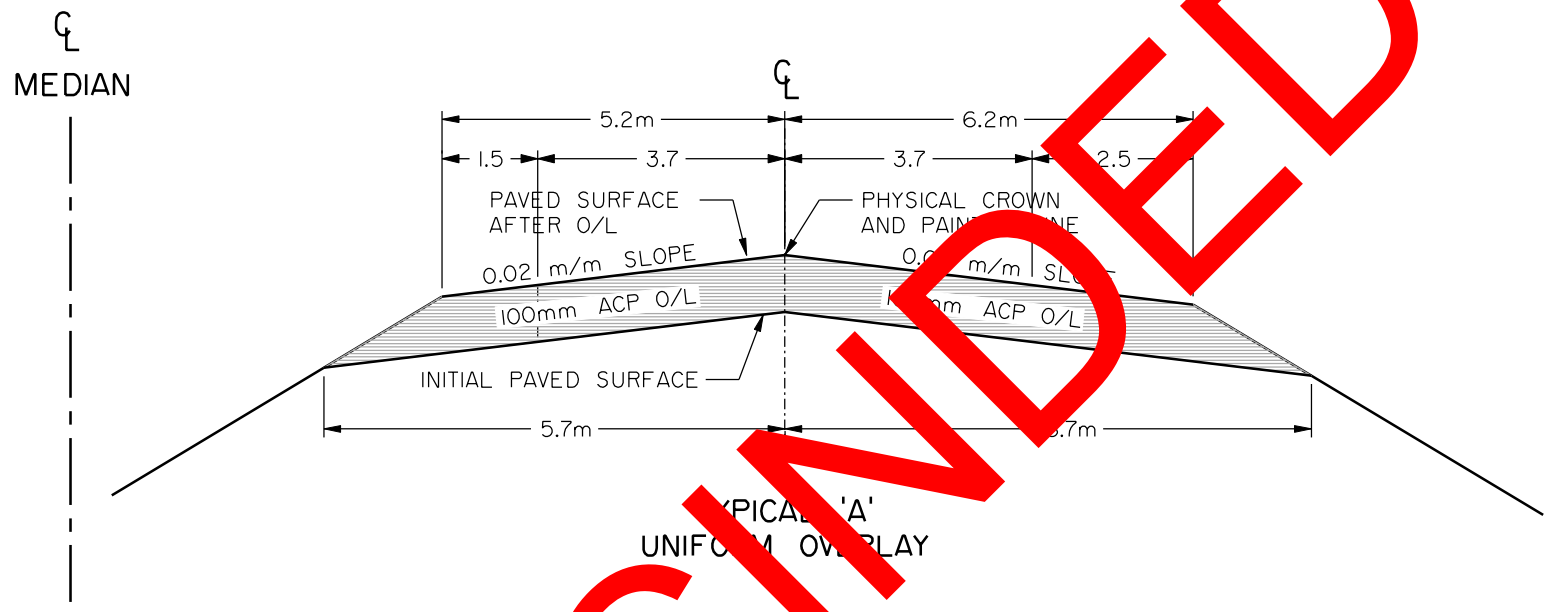
* MAXIMUM CENTRELINE SHIFT (FROM PHYSICAL CROWN TO PAINTED CROWN) = 0.5m.

† IT IS DESIRABLE TO ACHIEVE A MINIMUM RIGHT SHOULDER WIDTH OF 2m (THE 3R/4R MINIMUM IS 1.8m).

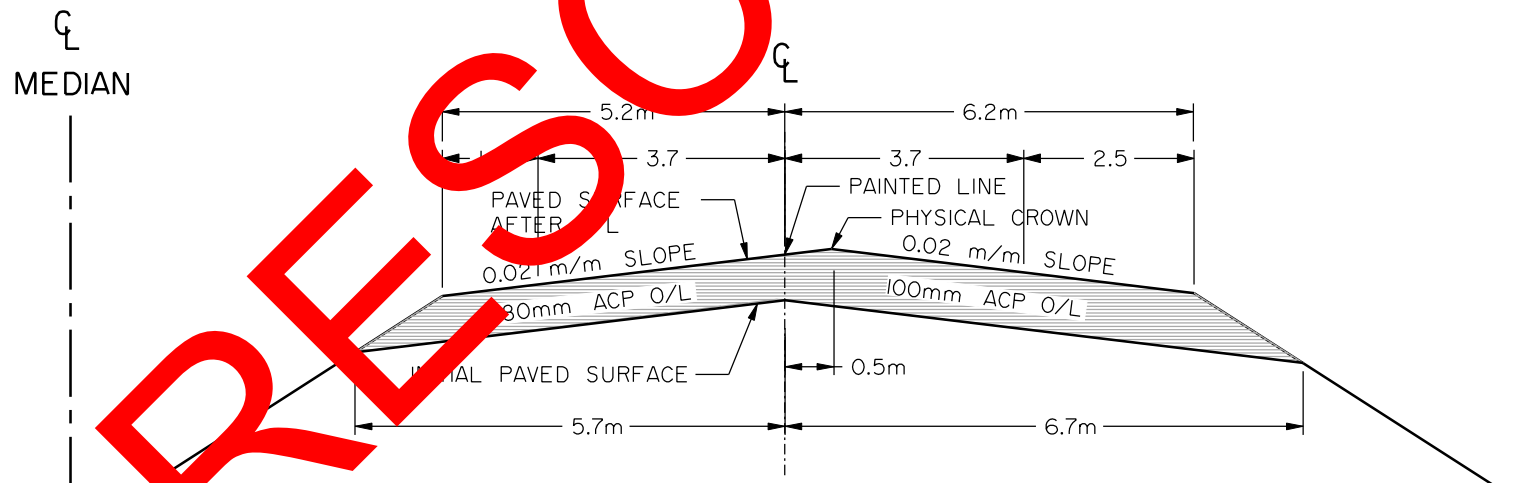
⊛ THE LEFT SHOULDER MAY BE REDUCED TO 0.3m AS REQUIRED.

FIGURE 2
DIVIDED HIGHWAY OVERLAY TYPICALS

NOT TO SCALE



TYPICAL 'A'
UNIFORM OVERLAY



TYPICAL 'B'
THIN/THICK OVERLAY
SCHEMATIC OF PHYSICAL CROWN SHIFT
TO ALLOW THINNER STRUCTURE ON THE MEDIAN SIDE