

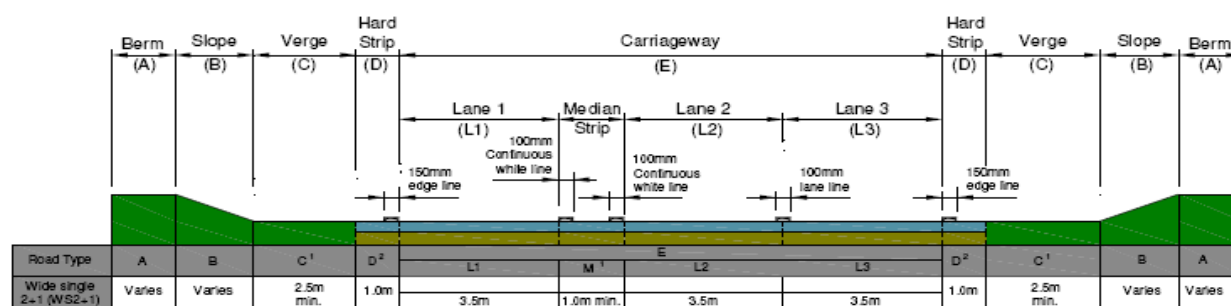
7. Changes to WS2+1 Standard

7.1 Introduction

7.1.1 In April 2007, Transport Scotland issued a revised draft standard, Version 4.0, for the Design of Three Lane Wide Single Carriageways. This Standard sets out the design principles and factors that should be considered by Design Organisations in developing a Wide Single Carriageway 2+1 road.

7.1.2 On reviewing this document, it became apparent that the main changes which may affect the performance of the 2+1 route options were in the widened carriageway cross section (from 12m to 13.5m) and shortened changeover sections (non-conflicting changeover reduced to 50m from 150m and conflicting changeover now 300m from 350m) allowing for additional overtaking opportunities. The new prescribed cross section can be seen below in Figure 7.1.

Figure 7.1 – Revised 2+1 Cross Section



7.1.3 In order to determine what affect the changes in the new draft standard would have on the 2+1 options sensitivity tests were carried out on the Yellow route only.

7.2 Design Changes

7.2.1 Using the existing Yellow horizontal design for Option 3.4 (Yellow 2+1R), the alignment was altered to reflect the new carriageway cross section and changeover layouts.

7.2.2 Following discussions with the Standards, Traffic and Environment (STE) division of Transport Scotland, it was agreed that in order to minimise the changes in carriageway cross section throughout the bypass gradients of up to 4% would be accepted on the 2+1 sections. This resulted in minimal changes to the vertical design of the Yellow route in order to reduce the gradient at the northern end of the bypass to <4% thus removing the need to change to the climbing lane cross section prescribed in TD9.

7.3 Cost Estimates

- 7.3.1 The cost estimate for the Yellow S2+1R was revisited in order to reflect the widened carriageway cross section and increase in cut in order to obtain acceptable gradients at the northern extent of the route. The revised cost estimate summary can be seen below in Table 7.1.

Table 7.1 – Revised Yellow 2+1R Option Cost Estimate Summary

Yellow		
Component (£'000s)	Revised 2+1	Original 2+1
Preparation	1,515	1,390
Construction	14,478	13,272
Contingency	2,172	1,991
Land	127	122
Optimism Bias	7,993	7,327
Sub-Total	26,285	24,103
VAT	4,600	4,218
Total	30,885	28,321

7.4 Traffic Modelling and Economics

Testing of New WS2+1 Design Standards

- 7.4.1 As these changes to design standards occurred part-way through the economic assessment, they were not incorporated into the already-constructed Paramics models. A further test was therefore conducted to measure the potential impact of these changes on the economic benefits of the Maybole Schemes.
- 7.4.2 As previously discussed, the Yellow Route Options demonstrate the highest economic benefits. Of the Yellow Route Options, only 3.3 and 3.4 incorporated WS2+1 sections, with Yellow 3.4 consistently generating more benefits than 3.3 in all previous economic tests. The Yellow 3.4 model was therefore re-coded in Paramics incorporating these new design standards. The new layout and associated vertical geometry was developed by Atkins.
- 7.4.3 The changes to the model as a result of the new standards included the addition of an effective extra 200m of overtaking opportunities on the bypass compared to the original Yellow 3.4 model. The vertical geometry of the northern section of the bypass was also altered to ensure that no gradients over $\pm 4.0\%$ were present.
- 7.4.4 Total Scheme costs for the revised 3.4 design were estimated to be £26,285,000, compared to £24,103,000 for the original 3.4 design⁸⁶. This increase is largely due to the wider cross-section, which results in greater costs for excavation etc.

⁸⁶ These totals include 44% Optimism Bias on Preparation, Contingencies, Supervision and Construction Cost.

- 7.4.5 The Yellow 3.4 Option incorporating the new WS2+1 standard was run in Paramics using the Sensitivity Test No. 1 demands (outlined in Section 6.6). The results from this Paramics run were input into TUBA. Note that NESA and QUADRO were not run for the new WS2+1 option, as the results would be expected to differ negligibly from the original Yellow 3.4.
- 7.4.6 The economic results from the Yellow 3.4 Option incorporating the new WS2+1 standard were compared to those from the previous Yellow 3.4 Option. Note that both models were run with the Sensitivity Test No. 1 demands, and so are directly comparable. Table 7.2 and Table 7.3 show the economic results from both models, to Government and Funding Agency.

Table 7.2 – Comparison of Option 3.4 with and without new WS2+1 Design Standards – Cost to Government

Scheme Option	Present Value of Benefits (PVB) (£m)	Present Value of Costs (PVC _G) (£m)	Net Present Value (NPV _G) (£m)	Benefit to Cost Ratio (BCR _G)
Option 3.4 Old WS2+1 Standards	272.56	24.33	248.23	11.2
Option 3.4 NEW WS2+1 Standards	271.97	26.03	245.94	10.4

Table 7.3 – Comparison of Option 3.4 with and without new WS2+1 Design Standards – Cost to Funding Agency

Scheme Option	Present Value of Benefits (PVB) (£m)	Present Value of Costs (PVC _{FA}) (£m)	Net Present Value (NPV _{FA}) (£m)	Benefit to Cost Ratio (BCR _{FA})
Option 3.4 Old WS2+1 Standards	272.56	21.76	250.79	12.4
Option 3.4 NEW WS2+1 Standards	271.97	23.45	248.52	11.5

- 7.4.7 Table 7.2 and Table 7.3 show that the BCR_G for Option 3.4 (sensitivity test no. 1) falls from 11.2 to 10.4 when the new WS2+1 standards are incorporated. Similarly, the BCR_{FA} falls from 12.4 to 11.5. This difference between the Old and New WS2+1 Standard is due to the increased cost associated with the wider cross-section, which has a significant effect on the BCR.
- 7.4.8 PVB's remain very similar between the old and new WS2+1 standard. The benefits generated from the extra 200m of overtaking lane on the bypass have not made any significant difference to the output from the Paramics model. This suggests that these benefits are extremely minimal, and have been offset by slight changes in gradient and alignment within the model itself.
- 7.4.9 This test of the new WS2+1 design standards show that the calculated BCR of options 3.3 and 3.4 produced in Table 6.15 and Table 6.21 are likely to be slightly optimistic.
- 7.4.10 In summary, incorporating the new WS2+1 design standards into the schemes which include WS2+1 sections appears to have a negative effect on the calculated BCRs.