

FOLKESTONE & HYTHE DISTRICT COUNCIL

M20 J12 to J13 Weaving Assessment
Highways England Road Network

APRIL 2021



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VERSION CONTROL

Version	Date	Author	Checker	Approver	Changes
1.0	24/03/2021	JG	DC	JH	First Draft
2.0	20/04/2021	JG	DC	JH	Final for internal review
2.1	26/04/2021	JG	DC	JH	Final

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1 INTRODUCTION

1.1 Background

At the request of Folkestone and Hythe District Council, Arcadis Consulting (UK) Ltd (Arcadis) is providing support to the District Council for their Core Strategy Review. The support being provided as described in this note relates to the Statement of Common Ground between Folkestone and Hythe District Council and Highways England and, specifically, the submission made to the examination by Highways England in a letter dated 3rd July 2020.

Arcadis held a meeting with Folkestone and Hythe District Council and Highways England on Monday the 14th of September to discuss the scope of work required to work towards a Statement of Common Ground between Folkestone and Hythe District Council and Highways England.

Several technical meetings took place since September 2020 to discuss progress towards the agreement of the scope, data sources and assumptions as well as outputs.

1.2 Purpose

The purpose of the study is to present:

- The revised traffic forecast; and
- The DMRB traffic analysis to support the identification of suitable road geometry.

1.3 Weaving Segment Description

The location of the motorway segment between M20 Junction 12 and Junction 13 in the north of Folkestone is indicated in Image 1.

Image 1 – M20 Jct12-Jct13 Weaving Segment Location



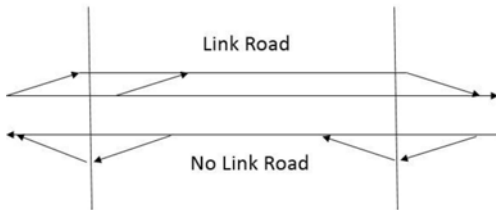
The weaving segment between M20 Junction 12 and Junction 13 is characterised by:

- A Motorway Standard;
- Two lanes in each direction;
- A 70mph speed limit;
- A weaving distance of:
 - 430m eastbound; and
 - 670m westbound.

According to DMRB CD122 Revision 1:

- This section of the M20 is classified as a “Rural road” because the speed limit is 70mph. To be classified as an urban road, the motorway would have to have a speed limit of 60mph or less;
- The minimum length of a weaving section “shall be 2km for motorways; and 1km for all-purpose roads”; and
- If the minimum weaving distance is not possible, a link road should be introduced. As shown in Image 2, a link road is a parallel road enabling traffic to bypass the weaving segment.

Image 2 – DMRB Link Road diagram



Such a technical solution is neither technical practical at this location, nor affordable in the context of the Local Plan.

1.4 Report Structure

This document is composed of:

- Section 2, presenting the updated traffic demand;
- Section 3, detailing the typical DMRB analysis for the weaving section; and
- Section 4, summarising the conclusions.

2 TRAFFIC DEMAND – SCENARIO IDENTIFICATION

2.1 2037 - Core Strategy Review Flows

The weaving analysis prepared using the Do Something 2037 Core Strategy Review revealed that the weaving segment would be at saturation. However, there was a consensus between all parties that the worst-case traffic volumes used for the rest of the study area should be reviewed for this section.

Unlike with other parts of the road network:

- The weaving segment is currently sub-standard and an increase in capacity would require a link road; and
- The section is on the M20 and therefore includes a cumulation of worst-case assumptions.

The following section details a review of traffic volumes within the weaving segment.

2.2 2037 - M20 J12-13 Scenario Refinement (A1/A2/B1)

The review of traffic volumes has been done using a series of updated scenarios. Only one assumption has been updated for each scenario. Image 3 and 4 shows the harmonized traffic volume diagrams for the scenarios detailed below.

Scenario A1 – DS CSR 2037 with AECOM Otterpool Assumptions

Traffic volumes for this scenario are the same as per the rest of the study.

Scenario A2 – A1 with revised Motorway TEMPro Growth Assumptions

The TEMPro growth assumptions for the motorway mainline have been updated in this scenario:

- The TEMPro was updated from using the motorway TEMPro factor (1.3502), to using the Motorway without Folkestone and Hythe Local Plan (1.1019 AM and 1.0984 PM).

Scenario B1 – A2 with recent growth and Otterpool TA Assumptions

A review of the Webtris data for the sections between Junction 13 – Junction 12 indicated that there has not been any growth between the 2016 baseline and 2019. Mainline motorway growth factors from 2019 to 2037 have therefore been used for the 2037 DS CSR B1 Scenarios and 2037. The changes are:

- In the AM peak:
 - 1.1019 becomes 1.0747; and
- In the PM peak:
 - 1.0984 becomes 1.0733.

Furthermore, in the AECOM Spreadsheet model, there are two ways to input development traffic:

- Either traffic volumes are included as per an available transport assessment; or
- A generic trip generation volume has been applied using TRICS value.

Scenario B1, therefore, includes an overwrite of the generic TRICS values by the Otterpool TA external trip generation. The total trip generation has been adjusted to correspond to the Local Plan forecast in 2037.

Image 3 – M20 Junction 12 – 13 AM Traffic Volumes in Vehicles

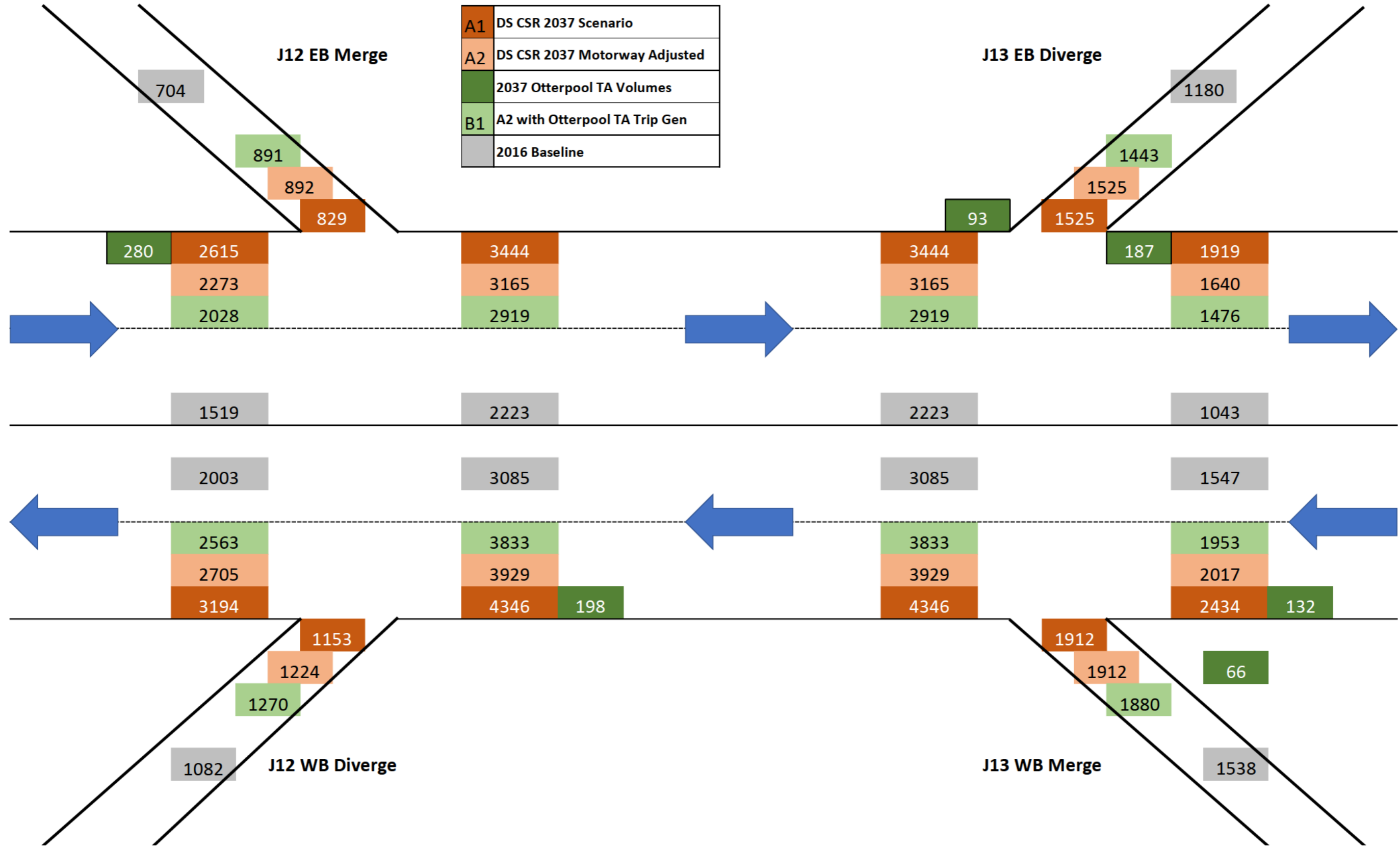


Image 4 – M20 Junction 12 – 13 PM Traffic Volumes in Vehicles



3 TRAFFIC ANALYSIS – SCENARIO B1

3.1 Stage 1 - Degree of Saturation Analysis

A volume to capacity ratio analysis for the M20 mainline was undertaken in order to evaluate the segment degree of saturation in the 2037 DS CSR (Scenario B1). For the purpose of assessing the capacity of each motorway lane, 2330 PCU per hour was selected, as per TAG unit M3.1 paragraph D.3.3. The results of the analysis are presented in Table 1.

From a link capacity point of view, the weaving segments are not saturated in Scenario B1.

Table 1 – M20 Junction 12 – Junction 13 – Scenario B1 Mainline V/C Analysis

Peak Hour	Direction	Capacity (PCU)	Mainline flow	Mainline flow V/C
			(PCU)	DS CSR (B1)
2037 AM	M20 EB	4660	3132	67%
	M20 WB		4069	87%
2037 PM	M20 EB		3771	82%
	M20 WB		3580	78%

3.2 Stage 2 - Weaving Segment Analysis

60mph DMRB Urban Road Weaving Analysis

The M20 at the location of the weaving segment is a 70mph road segment. However, the weaving segment is not to standard and therefore the DMRB calculation cannot be performed. If the speed limit at the weaving segment is 60mph, the road can be classified as “URBAN” and the weaving length requirement can be much shorter. Thus, the weaving analysis has been undertaken assuming an Urban road classification.

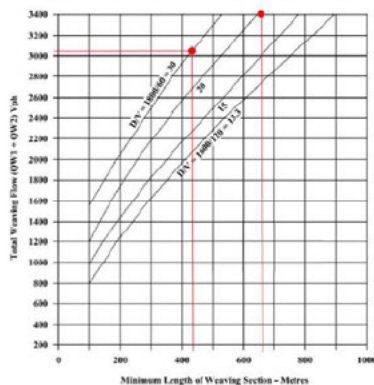
Image 5 plots the two weaving lengths of the existing layout for a motorway standard. The analysis shows that, in slow urban conditions, the weaving traffic can be greater than 2,000 vehicles an hour, which is the saturation flow of a lane.

Image 6 defines the traffic flow terms to identify each stream of traffic. The origin-destination traffic pattern at the location of the study is not known.

Highways England advised, however, that a change in speed limit at this location would not be permitted.

Image 5 – DMRB Weaving Traffic Assessment

Figure 4.6b Minimum weaving section length for urban roads based on design flows



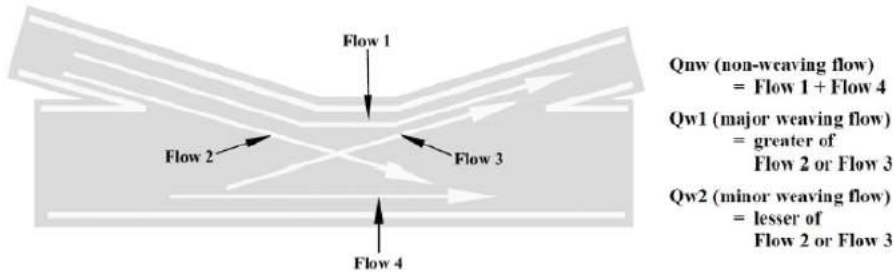
NOTE 1 In Figure 4.6b, D is the hourly flow and V is the design speed of the mainline upstream of the weaving section.

NOTE 2 For urban roads, the design flows are adjusted for uphill gradients and the presence of HGV's by using Table 3.9a.

NOTE 3 When determining the appropriate spacing between successive merges and diverges, it is necessary to consider whether the spacing is sufficient to accommodate the necessary advance directional signage.

Image 6 – DMRB Weaving Flow Terms

Figure 4.7N5 Flow terms used in weaving



Q_{nw} (non-weaving flow)
= Flow 1 + Flow 4
Q_{w1} (major weaving flow)
= greater of
Flow 2 or Flow 3
Q_{w2} (minor weaving flow)
= lesser of
Flow 2 or Flow 3

Weaving Analysis

Weaving analysis has been undertaken for the sections between the M20 Junction 12 and Junction 13 based upon the flows shown in Image 3 and 4. In order to assess the worst-case scenario, it has been assumed that flow 1, is “0” for all scenarios. The summary results for Scenario B1 2037 DS CSR are presented in Table 2.

Table 2 – M20 Junction 12 – Junction 13 – Scenario B1 2037 DS CSR Weaving Analysis

Direction	Period	Flow 1 (Veh.)	Flow 2 (Veh.)	Flow 3 (Veh.)	Flow 4 (Veh.)	N	N (Number of Lanes)
Eastbound	AM	0	812	1525	582	1.968	2
Eastbound	PM	0	1031	1484	1013	2.400	2
Westbound	AM	0	2045	1153	635	2.388	2
Westbound	PM	0	2037	850	470	1.957	2

The results of the weaving analysis indicate that two lanes on the mainline are sufficient in both directions along the M20. These results, however, would only be valid in the context of a 60mph speed limit.

3.3 Stage 3 - DMRB Merge/Diverge Analysis

Merge/Diverge Diagrams

The M20 sections between Junction 12 – Junction 13 Merge/Diverge analysis was updated using 2037 DS CSR B1 Scenario traffic volumes.

The results shown in Image 7 and 8 indicate that all of the merge/diverge types would be a higher classification if the infrastructure was being newly designed for 2037. The merge and diverge assessments are:

- Supposed to be calculated for a design year; and
- Representing free-flowing traffic conditions.

As the current road is an existing highway infrastructure, a review of potential changes to the existing motorway in line with current guidelines was undertaken in conjunction with Highways England.

Image 7 – Scenario B1 Merge Diverge Analysis 2037 AM Peak

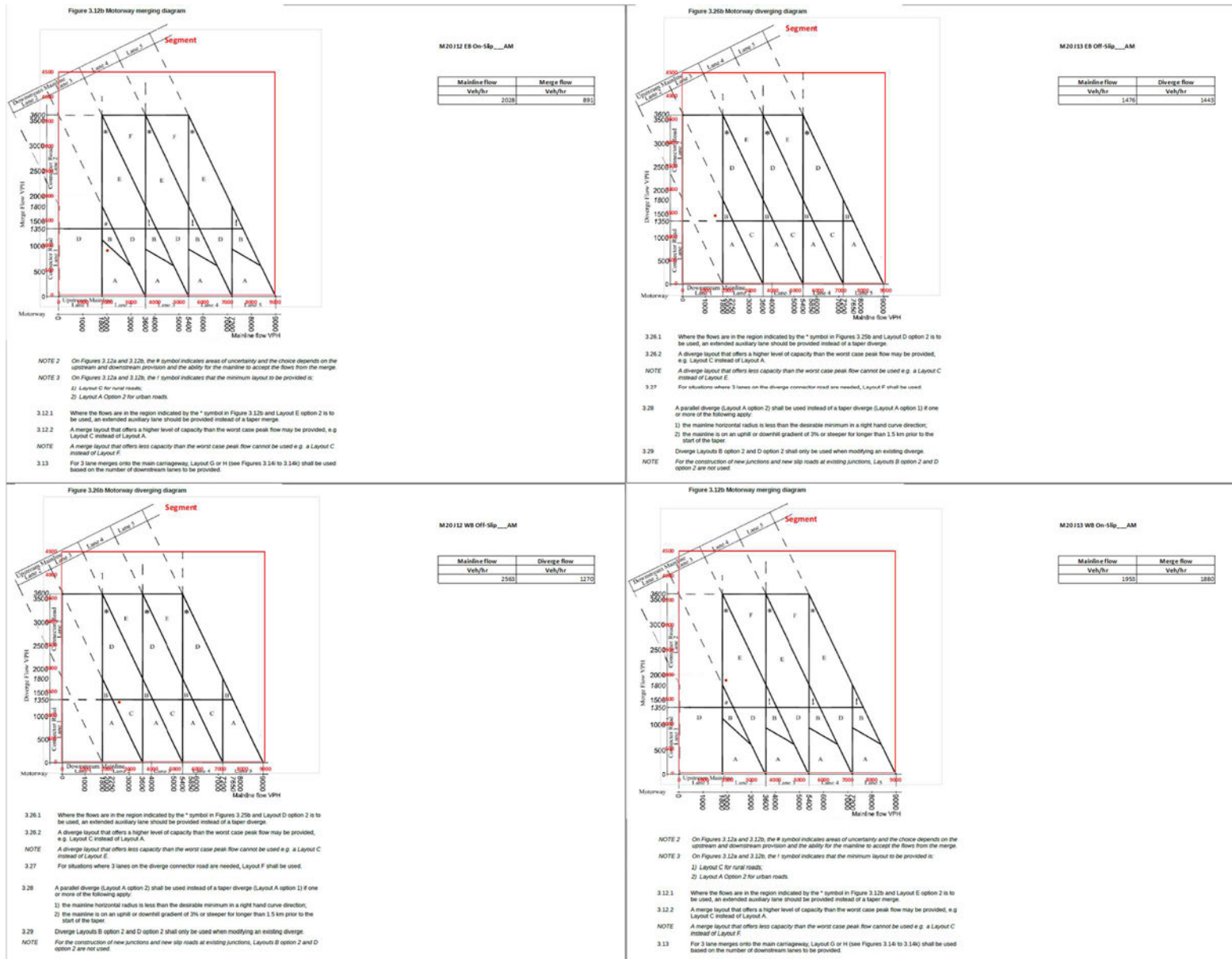
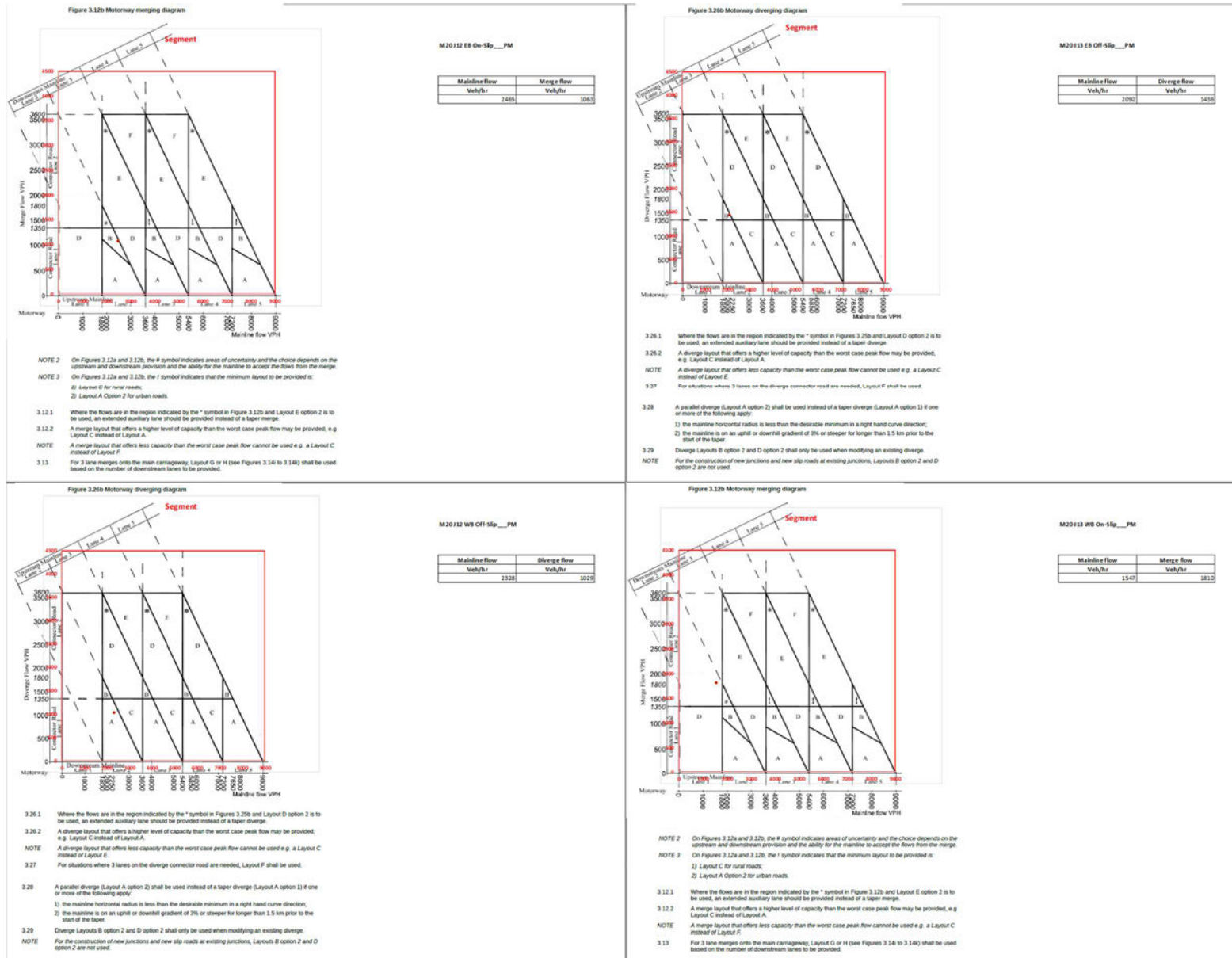


Image 8 – Scenario B1 Merge Diverge Analysis 2037 PM Peak



Highways England Feedback on Road Layout / Classification Changes

Highways England did a review of potential changes to the existing motorway and concluded:

- The speed limit and rural classification would be maintained;
- The road scheme would not consider changes to the motorway mainline; and
- The flexibility existing in the DMRB CD122 for the design of merge and diverge layout for existing motorways should be explored.

The following analysis will therefore focus on review the suitable way forward permitted by the DMRB.

Merge/Diverge Type Selection for Existing Roads

DMRB CD 122 paragraph 3.12 and 3.21 state the merge types that need to be used, however, section E/1 for existing motorways indicate that only one of the three changes below can be considered:

- “The road class in CD 122 Table 3.21 can be relaxed to 'rural all-purpose 120kph'; or
- The CD 122 layout can be substituted as described below:
 - Layout D can be used instead of Layout E1 and E2;
 - Layout B or A1 can be used instead of Layout C;
 - Layout A1 can be used instead of Layout B; or
- Where no lane gains are to be introduced the CD 122 layout can be substituted as described below:
 - Layout B can be used instead of Layout D;
 - Layout C or Layout E3 (see Figure E/1.3) can be used instead of Layout E1 and E2.”

Table 3 below shows the DMRB merge diverge analysis comparison of both motorway and all-purpose roads. The conclusion of the assessment is:

- The all-purpose standard is not suitable, the volume of traffic is too high; and
- The motorway standard does include acceptable alternative layouts.

Table 3 – M20 Junction 12 – Junction 13 – Comparison All-Purpose and Motorway

Period	Direction	Location	Upstream NB of Lanes		Downstream NB of Lanes		Layout Type	
			Motorway	All-Purpose	Motorway	All-Purpose	Motorway	All-Purpose
AM Peak	Eastbound	J12 Merge	2	2	2	2	A	A
	Eastbound	J13 Diverge	2	2	1	1	A	A
	Westbound	J12 Diverge	2	3	2	2	C	C
	Westbound	J13 Merge	2	2	3	3	E (C)	E
PM Peak	Eastbound	J12 Merge	2	2	2	3	B (A1)	D
	Eastbound	J13 Diverge	2	3	2	2	B	D
	Westbound	J12 Diverge	2	2	2	2	A	A
	Westbound	J13 Merge	1	1	2	3	A	E

Highways England indicated that the weaving distance would need to be maintained. The diverge ramps length exit appear to be longer than as per the design standard and could therefore be shortened to compensate the extended merge types.

4 CONCLUSIONS

Workshop Feedback

Following the issue of the first draft of this report, a workshop took place with Highways England and the following way forward was confirmed:

- The concept design would focus on:
 - Eastbound Merge as a type B (parallel merge);
 - Eastbound Diverge as a type A or B;
 - Westbound Merge as a type C; and
 - Westbound Diverge as a type C.

The weaving distances should be maintained.

Conclusions

In conclusion, the traffic volume forecast has been updated following refinement of the future scenario assumptions.

The DMRB provides sufficient flexibility to adjust the existing road layout without the need for a link road or motorway mainline widening.

Highway design further investigation is being undertaken to confirm the feasibility and constructability of the proposed solution.

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