

M8 Paramics Ramp Metering Assessment

Scottish Executive Development Department

Executive Summary

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Description:

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1 INTRODUCTION

1.1 Background

- 1.1.1 The Scottish Executive Development Department (SEDD) commissioned SIAS to construct a Paramics model covering a section of the M8 and associated surface network through Glasgow from Junction 12 (Cumbernauld Road) through to Junction 24 (Helen Street).
- 1.1.2 The model was developed to demonstrate the initial testing for further potential ramp metering scenarios (using a modelled ALINEA law and associated algorithms), and to report findings to the SEDD and Glasgow City Council.
- 1.1.3 The modelled period covers the peak period (16:00 – 18:00) and was calibrated and validated to observed data. The calibration and validation of the model has been reported in a separate document (First Draft Ref : TPM8RAMP / 43076).
- 1.1.4 The model was calibrated and validated to observed count data, journey time data, automatic traffic count data and video count data. For the purpose of ramp metering the focus of the model is the influence on the eastbound M8 and the surface street environs. The critical areas for discussion are around Junctions 16, 18 and 19.
- 1.1.5 This report provides a summary of findings and conclusions detailed within "M8 Paramics Ramp Metering Assessment – Final Report", Ref : TPM8RAMP / 47623.

2 SUMMARY

2.1 Model Development

- 2.1.1 SIAS Ltd was commissioned to develop a Paramics model to assess ramp metering control for eastbound traffic on the M8 at Junctions 16, 18 and 19.
- 2.1.2 The base model was validated against observed flow and journey time data, particular attention being given to the representation of ramp metering at Junction 16. The model showed acceptable correlation with observed statistics for ramp signal frequencies, cycle times and resultant platoon sizes, thus confirming that Paramics could reasonably replicate the traffic movements and behaviour at Junction 16.

2.2 Model Application

- 2.2.1 Having developed the base model, it was then used to test the following network scenarios :
- Test (1) Junction 16 Pre-Ramp: represents a model test on the Base network with ramp metering removed from Junction 16 eastbound, thus allowing free flow on the ramp.
 - Test (2) Junction 18: represents a model test on the Base network with additional but independent (i.e. not linked) ramp metering operating at Junction 18 eastbound.
 - Test (3) Junction 19: represents a model test on the Base network with additional and independent ramp metering operating at Junction 19 eastbound.
 - Test (4) Junction 18 and 19: represents a model test on the Base network with additional and independent ramp metering operating at both Junctions 18 and 19 eastbound.
- 2.2.2 Each test network was evaluated with respect to the base model by comparing traffic flows, speeds, journey times and behaviour over strategic sections of the M8. Additionally, surface street conditions were assessed from visual representations of the test simulations.
- 2.2.3 Test (1) shows that without ramp metering at Junction 16 the motorway flow would break down under pressure from uncontrolled and increased merging traffic flow. The negative impact would be felt on the motorway, where speeds would drop and journey times increase. The surface street network around Junction 16 would benefit with less congestion and delay in accessing the M8.
- 2.2.4 The results of Tests (2), (3) and (4) show that additional ramp metering installation at Junction 18, 19 or both would benefit the M8 traffic flow, with higher average speeds, shorter journey times and visibly less traffic congestion. Due to the reduced on-ramp capacity, because of ramp metering, the surface streets would suffer increased congestion. In Test (2) large queues of traffic build up on Sauchiehall Street, Bath Street, St Vincent Street and North Street. In Test (3) extensive queues result on Stobcross Street and Argyle Street. In Test (4) the combined effects of Tests (2) and (3) are evident.
- 2.2.5 It should be noted that for all the tests, the trip matrices (travel demand patterns) remained unaltered. Given the extent of the Paramics network, particularly to the west of the M8, strategic re-routing, although likely to occur with the introduction of ramp metering at Junctions 18 and 19, has not been modelled.

2.3 Findings

- 2.3.1 In developing the Paramics model, best use has been made of observed data in achieving an acceptable representation of the ramp metering installation at Junction 16. Although the current model only provides an approximate representation of the ALINEA Law, it is sufficiently robust to assess the indicative impacts of implementing ramp metering at other motorway junctions.
- 2.3.2 The results of the Paramics tests confirm that the introduction of ramp metering at Junction 16 has improved the flow of traffic on the M8 through smoother merging behaviour and through a reduction in the merging flows. Nevertheless, while motorway flows and average speeds increase there is evidence of greater traffic congestion on the adjacent surface street network.
- 2.3.3 The model tests also show that the introduction of ramp metering at either Junction 18 or 19 would benefit motorway traffic again through smoother merging and reduced merging flows. Although reduced delays on the M8 eastbound would increase the operating capacity of the motorway at peak times, any spare capacity could be taken up by additional or suppressed traffic.
- 2.3.4 The test to assess additional ramp metering at both Junctions 18 and 19 also confirms that without ameliorative measures, the adjacent surface street network would suffer increased congestion with long delays to vehicles awaiting access to the motorway.
- 2.3.5 The Paramics model does not extend far enough to show possible impacts of diversions or re-routing traffic and therefore depicts a worse case scenario. Careful consideration would be required for the ameliorative measures necessary to support additional ramp metering.