



Midlothian Local Development Plan 2 Transport Appraisal – DPTAG DRAFT Final Report

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1 Introduction

1.1 Purpose of this Report

1.1.1 This report provides the transport appraisal evidence to inform the Proposed Midlothian Local Development Plan (MLDP2). The appraisal was undertaken in accordance with Transport Scotland's Development Planning Transport Appraisal Guidance (DPTAG) and is intended to:

- assess the transport implications of the proposed spatial strategy and associated land allocations
- identify existing and future constraints on the transport network
- determine the mitigation measures required to support delivery of the Plan
- provide a robust, evidence-based foundation to inform decision-making and plan development

1.1.2 The report forms part of the technical evidence base supporting the Proposed Plan and demonstrates that the transport impacts of the MLDP2 were appropriately considered through a structured and proportionate appraisal process.

1.2 Policy and Guidance Context

1.2.1 The preparation of Local Development Plans is required to take account of the transport implications of proposed growth and to ensure that development is supported by appropriate and deliverable infrastructure. Transport appraisal therefore plays a key role in demonstrating that the spatial strategy can be accommodated by the transport network in a sustainable and efficient manner.

1.2.2 This appraisal was undertaken in accordance with Development Planning Transport Appraisal Guidance (DPTAG), published by Transport Scotland. DPTAG provides a proportionate and structured framework for assessing the transport impacts of development plans and identifying mitigation where required. It aligns with the principles of the Scottish Transport Appraisal Guidance (STAG), ensuring consistency with wider transport appraisal practice in Scotland.

1.2.3 Within this context, the appraisal:

- identifies transport problems associated with forecast growth
- defines Transport Planning Objectives (TPOs) linked to these problems
- develops and appraises mitigation options
- applies transport modelling and supporting analysis to assess impacts

1.3 Study Area and Scope

1.3.1 The appraisal focuses on the Midlothian Council area and its interaction with the surrounding transport network. In particular, the assessment considers:

- key radial corridors connecting Midlothian to Edinburgh
- the strategic role of the A720 Edinburgh City Bypass and associated junctions
- local junctions and corridors within Midlothian which are sensitive to increases in travel demand

1.3.2 The study captures both local and strategic travel movements, reflecting the strong relationship between Midlothian and the wider South East Scotland transport system.

1.4 Appraisal Framework and Approach

1.4.1 The appraisal was undertaken following the structured process set out in DPTAG, ensuring a transparent and traceable “golden thread” from identified problems through to the development and testing of mitigation measures.

1.4.2 The key stages of the appraisal are:

- **Identification of Transport Problems** - Review of current and forecast conditions to identify constraints and performance issues.
- **Definition of Transport Planning Objectives (TPOs)** - Establishment of clear objectives to address the identified problems.
- **Option Generation** - Development of potential mitigation measures to address the identified issues.
- **Option Appraisal** - Assessment of options against the TPOs using proportionate analytical tools.
- **Modelling and Testing** - Application of strategic transport modelling to quantify the impacts of development and mitigation measures.

1.4.3 This structured approach ensures that all recommended interventions are directly linked to identified problems and are supported by proportionate evidence.

1.5 Transport Modelling Approach

1.5.1 The appraisal is supported by the application of the SEStran Regional Model (SRM), a strategic multi-modal transport model covering Midlothian and the wider South East Scotland region.

1.5.2 The SRM model was used to:

- simulate forecast travel demand associated with the MLDP2
- assess changes in traffic flows, delay and journey times
- evaluate the performance of the transport network under different scenarios
- quantify the impacts of mitigation measures

1.5.3 The modelling is undertaken at a strategic level, providing an appropriate tool for understanding network-wide impacts and identifying key constraints. It does not represent detailed junction design or operational assessment, which would be undertaken at later stages of scheme development.

1.6 Forecast Scenarios

1.6.1 To assess the transport implications of the MLDP2, a series of forecast scenarios were developed as follows:

- **‘Without LDP’ Scenario** - Represents future conditions without the proposed MLDP2 development
- **‘With LDP’ Scenario** - Includes the proposed land-use allocations and associated increase in travel demand, without mitigation
- **‘Mitigated’ Scenario** - Incorporates a package of transport interventions designed to address the impacts of the MLDP2

1.6.2 These scenarios provide a consistent basis for assessing the incremental impact of development and the effectiveness of the proposed mitigation measures.

1.7 Mitigation Strategy

1.7.1 The mitigation package considered in this appraisal focuses primarily on highway-based interventions, including:

- junction capacity enhancements
- network improvements and layout changes
- targeted interventions at identified constraint locations

1.7.2 These measures are intended to reduce delay, improve junction performance and maintain the operational effectiveness of key corridors in the face of increased demand, reflecting a targeted response to the problems identified through the appraisal.

1.8 Sensitivity Testing

1.8.1 In addition to the core scenarios, sensitivity testing was undertaken to assess the potential effects of additional infrastructure interventions including:

- Sheriffhall grade separation
- A701 relief road

1.8.2 The infrastructure interventions were added to the mitigation scenario to provide insight into how these interventions may further influence network performance. Detailed assumptions and results are presented in **Appendix A**.

1.9 Limitations of the Assessment

1.9.1 The appraisal was undertaken using a proportionate, strategic modelling approach, and the following limitations should be noted:

- The assessment focuses primarily on highway network performance, with the public transport network largely held constant within the modelling framework
- The strategic model is designed to capture network-wide trends rather than detailed localised operational conditions.
- The appraisal identifies infrastructure requirements at a high level; further design and feasibility work would be required to develop individual schemes

1.9.2 These limitations are consistent with the stage of plan development and the requirements of DPTAG.

1.10 Structure of this Report

1.10.1 The remainder of this report is structured as follows:

- **Chapter 2 – Approach:** Detailed methodology, data sources and analytical tools
- **Chapter 3 – Impact Assessment:** Transport impacts of the MLDP2 development scenario
- **Chapter 4 – Transport Planning Objectives:** Definition of appraisal objectives
- **Chapter 5 – Mitigation Option Generation:** Development of transport interventions
- **Chapter 6 – Appraisal of Mitigation:** Assessment and modelling results
- **Chapter 7 – Sensitivity:** Assessment and modelling results of sensitivity interventions
- **Chapter 8 – Conclusions:** Summary of findings and implications
- **Appendix A:** Detailed modelling assumptions and outputs

2 Approach

2.1 Overview

- 2.1.1 This chapter sets out the methodology, analytical tools and data used to support the transport appraisal of the Proposed Midlothian Local Development Plan (MLDP2).
- 2.1.2 The approach follows the structured process established in Development Planning Transport Appraisal Guidance (DPTAG), as introduced in Chapter 1, and applies proportionate analysis to:
- assess the transport impacts of the proposed development strategy
 - identify key network constraints and performance issues
 - develop and appraise appropriate mitigation measures
- 2.1.3 The appraisal is supported by a combination of strategic transport modelling, supporting analysis and professional judgement, ensuring that outcomes are evidence-led and proportionate to the scale of development.

2.2 Policy-Led Approach to Appraisal

- 2.2.1 In addition to adhering to DPTAG, the appraisal was undertaken having regard to wider Scottish transport and planning policy objectives, including the promotion of sustainable travel, reduction in car dependency and the transition to a lower carbon transport system.
- 2.2.2 Central to this policy context is the Sustainable Travel Hierarchy, which prioritises:
- walking and wheeling
 - cycling
 - public transport
 - shared transport
 - private car use
- 2.2.3 This hierarchy provides a framework for considering how transport interventions should be prioritised and developed.
- 2.2.4 Within the context of this appraisal, these overarching policy principles were used to:
- inform the identification of transport problems, including constraints on sustainable travel options
 - guide the development of mitigation measures, ensuring that a broad range of interventions is considered
 - provide context for interpreting the results of the modelling, particularly where highway-based interventions are assessed
- 2.2.5 It is recognised that the strategic modelling approach is primarily focused on network performance and highway impacts, with limited representation of changes to public transport, active travel or behavioural responses. As such, the appraisal does not directly quantify all aspects of sustainable travel policy.
- 2.2.6 However, these principles are reflected through the inclusion of connectivity analysis, which provides a complementary assessment of how well different parts of Midlothian are connected to key destinations and opportunities.

2.3 Transport Modelling Approach

- 2.3.1 The appraisal is supported by the application of the SEStran Regional Model (SRM), a strategic multi-modal transport model covering Midlothian and the wider South East Scotland region.
- 2.3.2 The model was used to:
- represent forecast travel demand associated with the MLDP2
 - assess changes in traffic flows, delay and journey times
 - evaluate network performance under different scenarios
 - test the impact of the proposed mitigation package
- 2.3.3 The model operates at a strategic level and is appropriate for:
- identifying network-wide trends
 - assessing the relative performance of scenarios
 - highlighting key locations of constraint
- 2.3.4 The model does not provide a fully detailed representation of individual junction operation or localised design (more appropriate for micro-simulation and junction modelling), and therefore outputs should be interpreted accordingly.

2.4 Connectivity Analysis

- 2.4.1 A connectivity analysis framework was applied to assess the connectivity of communities to key services and destinations, both under current conditions and in future scenarios. The framework operates across multiple geographic scales, from individual postcode locations to more aggregated spatial units, allowing connectivity to be assessed for each origin point within the study area.
- 2.4.2 The analysis was undertaken using the STEP connectivity model, which calculates the components of a typical public transport journey, including walking time, waiting time and in-vehicle travel time. These calculations were based on the underlying road and path network together with public transport timetable data.
- 2.4.3 Journey times were assessed using a percentile-based approach that considers the range of services available within a defined travel window. This approach reflects variations in service frequency and reliability, and avoids results being disproportionately influenced by infrequent express services that may not be representative of typical travel opportunities.
- 2.4.4 The connectivity analysis was used to assess the connectivity of identified development sites to the existing public transport network. This provided an indication of which locations currently benefit from relatively strong public transport connectivity and which locations may require improved services or infrastructure to support sustainable travel patterns.

2.5 Analytical Approach to Problem Identification

- 2.5.1 Changes in transport network performance were identified through a combination of:
- baseline analysis of network performance
 - comparison of forecast scenarios ('Without LDP' and 'With LDP scenario')
 - review of key indicators, including:
 - traffic flows

- junction delay
- queuing and capacity utilisation
- outputs from connectivity analysis, identifying areas of poor connectivity

2.5.2 This approach enables the identification of:

- locations where development growth exacerbates existing constraints
- corridors where journey time reliability is reduced
- areas where network resilience is affected
- areas with limited access to key services and opportunities
- gaps in connectivity for sustainable modes

2.5.3 These findings form the basis for the development of Transport Planning Objectives (TPOs) in Chapter 4.

2.6 Development of Mitigation Measures

2.6.1 Mitigation measures were developed in response to the identified transport problems and are guided by both:

- the evidence generated through the modelling
- the wider policy framework outlined in Section 2.2

2.6.2 The process focuses on:

- targeting interventions at locations of identified constraint
- improving network performance and operational efficiency
- maintaining connectivity to key destinations
- supporting more sustainable patterns of travel where possible

2.6.3 The mitigation package primarily comprises highway-based interventions, reflecting the nature of the identified constraints and the capabilities of the modelling framework. However, the broader assessment framework ensures that the role of sustainable transport and connectivity is considered in the development and interpretation of these measures.

2.7 Supporting Data and Assumptions

2.7.1 The appraisal draws on a range of data sources and assumptions, including:

- SEStran Regional Model (SRM) forecast demand matrices
- development site information associated with the MLDP2
- network coding reflecting existing and committed infrastructure
- data inputs supporting the connectivity analysis

2.7.2 Further detail on the model configuration, scenario development and supporting assumptions is provided in **Appendix A**.

3 Impact Assessment

3.1 Introduction and Scope

3.1.1 This chapter presents the assessment of transport impacts associated with the Proposed Midlothian Local Development Plan (MLDP2). The analysis compares forecast conditions across the defined scenarios to identify how the introduction of development influences:

- network performance (flows, delay and congestion)
- connectivity to key destinations
- the overall functioning of the transport system

3.1.2 The assessment draws on both:

- strategic transport modelling outputs, which quantify changes in traffic flows, delay and network performance
- connectivity analysis, which considers how effectively people can travel between origins and key destinations

3.2 This combined approach provides an understanding of both:

- the efficiency of the transport network (in terms of flows, delay and congestion)
- its effectiveness in enabling movement between origins and key destinations (connectivity)

3.2.1 This distinction is important in ensuring that both network performance and user outcomes are considered in the appraisal.

3.3 Development Scenarios and Land-Use Assumptions

Identified Development Sites

3.3.1 The MLDP2 includes a range of proposed housing and employment land allocations across Midlothian. These allocations form the basis of the With LDP scenario tested within SRM.

3.3.2 Table 3-1 and Table 3-2 present the MLDP2 housing and employment sites included in the With LDP scenario land-use development scenario. For each site, three development scenarios are presented:

- **2027 Total:** Constructed and previously committed development expected to be delivered between 2025 and 2027
- **2037 Do Minimum:** Total constructed and previously committed development by 2037 (including 2027 totals), excluding MLDP2 allocations
- **2037 Do Something:** Full build-out by 2037, including MLDP2 housing and employment allocations alongside all constructed and previously committed development delivered from 2025

Table 3-1: Identified MLDP2 Housing Development Sites included in the 'With LDP scenario land-use development scenario'

Site Reference	Site Name	2027 Total	2037 DM Total	2037 DS Total
h43	Shawfair	453	803	2711
Hs12 & Hs12 SC	Hopefield Farm 2 & Hopefield Farm 2, Safeguarded Capacity	47	47	1032

Site Reference	Site Name	2027 Total	2037 DM Total	2037 DS Total
h38+	South Mayfield Sites	90	90	926
Hs1	Newton Farm	180	593	593
R1	Bilston West	0	0	500
Hs0	Cauldcoats	0	0	430
R13	Pentland Road	0	0	400
Hs1 SC	Newton Farm, Safeguarded Capacity	0	0	360
Hs20	Auchendinny	156	355	355
AHs1	Rosslynlee	136	164	256
R26	Rullion Road	0	0	222
R30	Cauldcoats	0	0	220
Hs16	Seafield Road Bilston	108	108	214
Hs11	Dalhousie	196	209	209
R27	Silurian Road	0	0	200
h44	North Danderhall	196	196	196
h25(AreaD)	Greenlaw and Adjacent Land Area D	135	155	155
R8	Barleyknowe Road	0	0	150
R23	Beeslack	20	20	130
R24	Belwood Crescent	20	20	130
h58	NW Penicuik	98	98	118
R7	Gowkshill Farm	0	0	100
h24	Newbyres	96	96	96
h41	North Mayfield	94	94	94
2022MN1	Former Newbattle High School (Phase 1)	90	90	90
h70	The Grounds of Whitehill House	0	0	84
Hs18	Roslin Institute	75	75	75
2022GB1	Newbyres Crescent	75	75	75
R19	Newton Farm East	0	0	70
R2	Eskdail Street	0	0	65
2018VR1	Fordel	0	0	60
R16	Old School Crescent	0	0	60
Hs10	Dalhousie	50	50	50
R6	Eskbank Station West	0	0	50
AHs5	Wellington School, by Howgate	27	27	46
2021BL3	Moorfoot Place	46	46	46
SSRMW	Small sites - rural Midlothian West	7	7	40
R14	Bogwood Road	0	0	40
R15	Mayfield Place	0	0	40
R17	Scott's Caravans	10	10	40

Site Reference	Site Name	2027 Total	2037 DM Total	2037 DS Total
Hs14	Rosewell North	37	37	37
SSRME	Small sites - rural Midlothian East	6	6	37
Hs19	Roslin Expansion Area	35	35	35
Hs5	Thornybank North	0	0	30
2024MN1	Former Newbattle High School	28	28	28
h59	Crichton Road, Pathhead	26	26	26
AHs3	Belwood Crescent	0	0	25
2018DK2	Wester Cowden Farm	10	10	25
R22	Whippielaw Yard	0	0	25
2023SA1	Newton Church Road	23	23	23
SSD	Small sites - Dalkeith	8	8	20
R4	Easter Langside Drive	10	10	20
R5	Eskbank Station East	0	0	20
R20	Main Street	20	20	20
h69	Whitehill House	0	0	18
SSP	Small sites - Penicuik	3	3	16
h40	Vogrie Road	2	2	16
R25	Dykes Road	0	0	16
R3	Fairfield House	0	0	15
R28	Thornton Farm	0	0	13
2020PK1	Windsor Square	12	12	12
R31	Cauldcoats Steading	0	0	12
SSBL	Small sites - Bonnyrigg/Lasswade	3	3	11
2024VR1	Land 100M South West of Newlandburn House	0	0	10
282	25 Newbattle Road	0	0	8
SSL	Small sites - Loanhead	2	2	7
2023DK1	Glenarch Lodge	3	3	6
2024DK1	120 High Street	2	2	6
SSG	Small sites - Gorebridge	2	2	6
2023VR1	Barley Dean	3	5	5
243	Former garage, Elm Row	3	5	5
2022MN2	Newtongrange Parish Church	0	0	5
SSMN	Small sites - Mayfield/Newtongrange	2	2	5
2022DK1	Land Between 23A and 37 Newmills Road	4	4	4
2017SA1	Land South of Hilltown House	1	4	4
Small sites	Small sites - Rosewell	1	1	4
2019VR2	Airybank House	2	3	3
R29	Whitehill Forge	0	0	3

Site Reference	Site Name	2027 Total	2037 DM Total	2037 DS Total
R32	Silverburn East	0	0	3
SSRB	Small sites - Roslin/Bilston	0	0	2
SSS	Small sites - Shawfair	2	2	2

Table 3-2. Identified MLDP2 Employment Development Sites included in the 'With LDP scenario land-use development scenario'

Site Reference	Site Name	2027 Total	2037 DM Total	2037 DS Total
MSZ	Midlothian Science Zone	0	0	840
Ec3(part)/J28	Straiton North	0	0	360
e32/J11	Sheriffhall South	22	22	152
Ec3 (part)/J27	Pentland Road	0	0	130
e27/J45	Shawfair Park	0	0	129
J49	Melville West	0	0	120
e14/J6	Salter's Park East	0	0	118
e25/J43	Monktonhall	0	0	100
e21/J16	Stobhill Road	0	0	94
Ec4/J18	Ashgrove North	0	0	58
e16/J2	Hopefield	0	0	49
e33/J17	Ashgrove	44	44	44
e15/J4	Sherwood Industrial Estate	0	0	35
e11 part/ J5	Eskbank Station East	0	0	20
J31	Scott's Caravans	0	0	20

3.3.3 The locations of the included development sites are illustrated in Figure 3.1 to Figure 3.3.

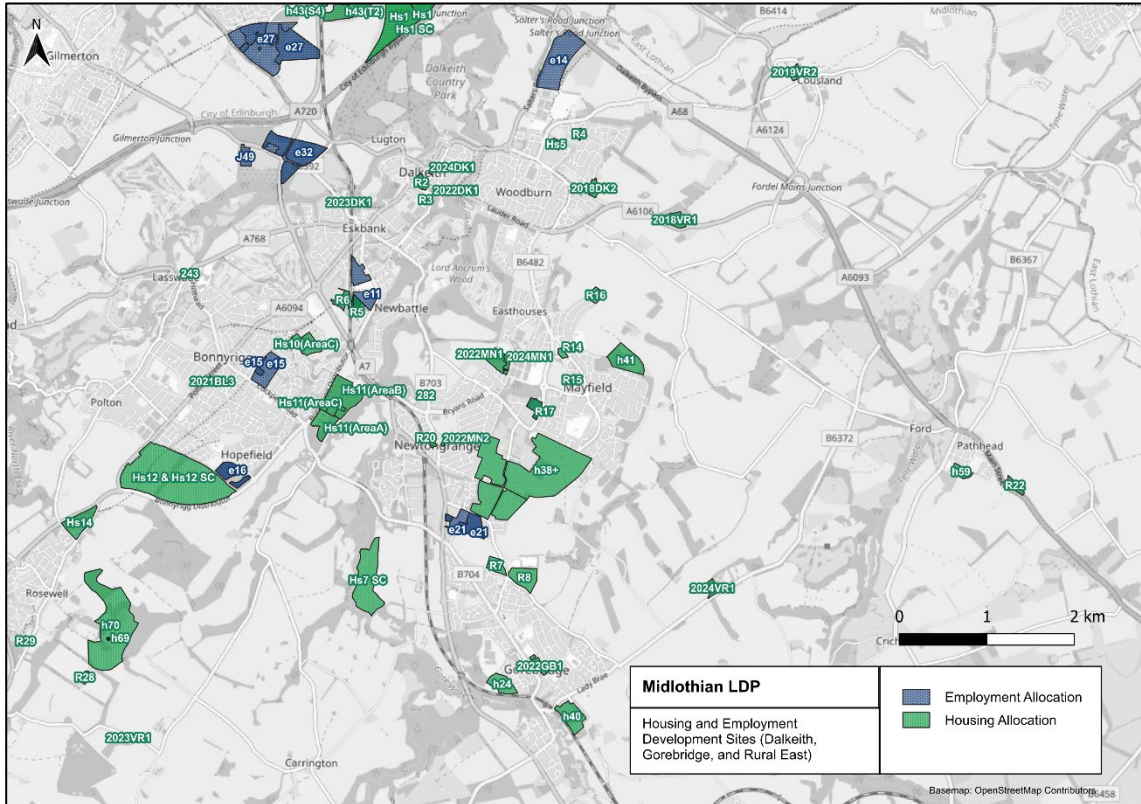


Figure 3.1. Location of Identified MLDP2 Development Sites (Bonnyrigg, Dalkeith, and Gorebridge)

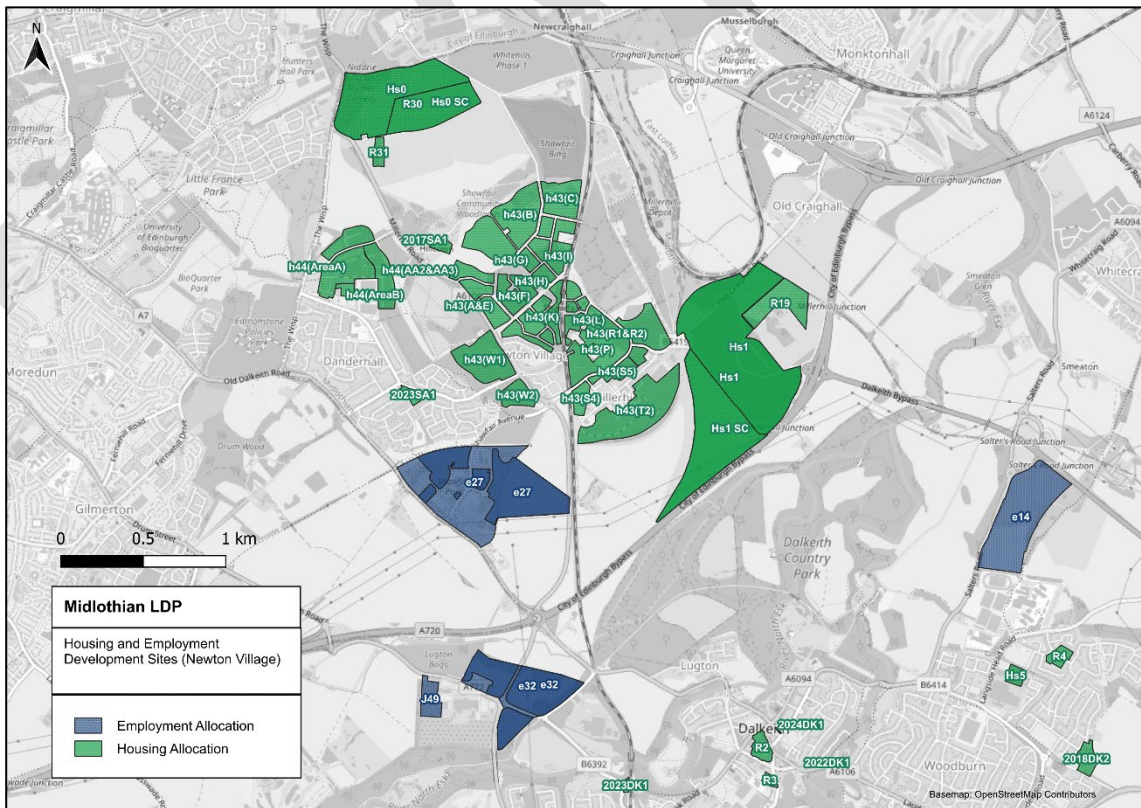


Figure 3.2. Location of Identified MLDP2 Development Sites (Newton Village)

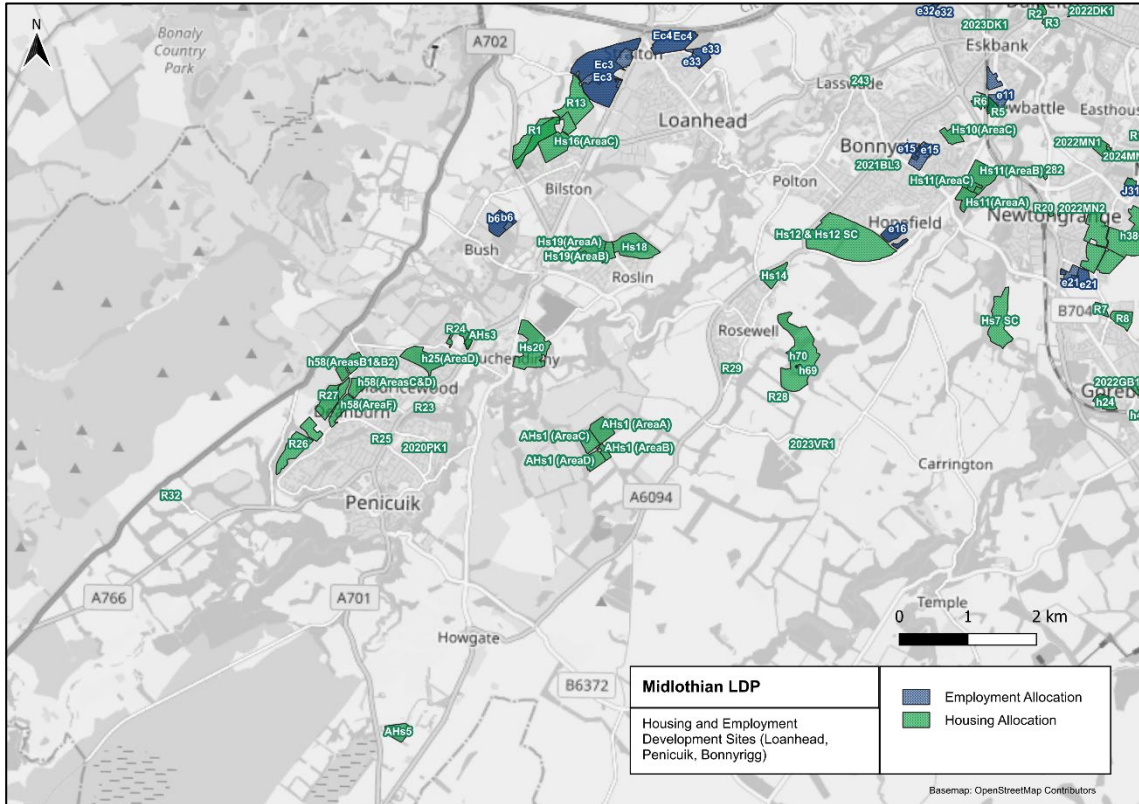


Figure 3.3. Location of Identified MLDP2 Development Sites (Penicuik and Loanhead)

3.3.4 For modelling purposes, development sites are represented within SRM at zonal level. Where sites extend across more than one zone, development quantum was apportioned based on site boundaries and expected trip loading patterns.

3.3.5 A summary of how these sites were aggregated to zones is presented in Table 3-3.

Table 3-3: MLDP2 Development Inclusion by SRM Zone

Zn	Sector	Households			Employment		
		2027 Total	2037 DM Total	2037 DS Total	2027 Total	2037 DM Total	2037 DS Total
246	Loanhead	0.0	0.0	400.0	0.6	0.3	0.3
431	Bonnyrigg	196.0	196.0	209.0	0.0	0.0	0.0
434	Newton Village	1,357.6	1,357.6	1,357.6	368.8	368.8	368.8
435	Newton Village	2,774.3	2,774.3	2,777.3	3,024.4	3,024.4	3,383.1
436	Rural East	474.6	474.6	690.6	61.1	61.1	61.1
437	Rural East	466.9	466.9	466.9	23.6	23.6	23.6
438	Dalkeith	885.4	885.4	925.4	723.5	723.5	841.9
439	Rural East	1,062.8	1,062.8	1,198.8	46.2	46.2	46.2
440	Dalkeith	423.6	423.6	423.6	1,033.1	1,033.1	1,033.1
441	Dalkeith	869.2	869.2	869.2	328.5	328.5	328.5
442	Dalkeith	1,811.7	1,811.7	1,811.7	199.7	199.7	199.7
443	Dalkeith	620.5	620.5	620.5	563.4	563.4	563.4

Zn	Sector	Households			Employment		
		2027 Total	2037 DM Total	2037 DS Total	2027 Total	2037 DM Total	2037 DS Total
444	Bonnyrigg	606.1	606.1	676.1	136.4	136.4	156.4
445	Bonnyrigg	939.0	939.0	939.0	413.8	413.8	448.5
446	Bonnyrigg	2,146.9	2,146.9	2,148.9	1,489.3	1,489.3	1,489.3
447	Bonnyrigg	3,406.2	3,406.2	3,414.2	1,060.1	1,060.1	1,060.1
448	Loanhead	133.8	133.8	136.8	575.7	575.7	753.3
449	Loanhead	995.4	995.4	1,000.4	628.1	628.1	628.1
450	Loanhead	1,376.8	1,376.8	1,376.8	466.2	466.2	466.2
451	Loanhead	1,475.2	1,475.2	1,475.2	169.8	169.8	169.8
452	Loanhead	24.4	24.4	24.4	2,354.7	2,354.7	2,354.7
453	Loanhead	334.3	334.3	334.3	51.1	51.1	51.1
454	Gorebridge	1,384.4	1,384.4	1,464.4	397.9	397.9	397.9
455	Gorebridge	2,379.0	2,379.0	2,425.0	1,606.7	1,606.7	1,626.7
456	Gorebridge	2,872.7	2,872.7	2,976.7	872.2	872.2	966.2
457	Rural South	1,397.1	1,397.1	1,411.1	413.6	413.6	413.6
458	Rural South	1,211.7	1,211.7	1,454.7	247.5	247.5	247.5
459	Rural West	421.0	421.0	560.0	72.2	72.2	72.2
460	Penicuik	1,564.5	1,564.5	1,580.5	146.8	146.8	146.8
461	Penicuik	2,226.8	2,226.8	2,239.8	609.9	609.9	609.9
462	Rural South	2,225.1	2,225.1	2,469.1	822.7	822.7	822.7
463	Dalkeith	1,617.5	1,617.5	1,713.5	1,951.1	1,951.1	1,951.1
464	Loanhead	67.8	67.8	67.8	1,060.4	1,060.4	1,060.4
465	Loanhead	29.2	29.2	29.2	783.7	783.7	783.7
466	Loanhead	43.9	43.9	43.9	527.6	527.6	527.6
467	Bonnyrigg	929.9	929.9	929.9	377.9	377.9	426.9
468	Penicuik	49.7	49.7	49.7	1,077.2	1,077.2	1,077.2
469	Penicuik	1,014.2	1,014.2	1,016.2	571.8	571.8	571.8
470	Penicuik	1,677.9	1,677.9	2,162.9	386.7	386.7	386.7
471	Gorebridge	1,849.3	1,849.3	1,849.3	356.6	356.6	356.6
472	Gorebridge	71.4	71.4	71.4	0.0	0.0	0.0
473	Newton Village	592.8	592.8	592.8	0.0	0.0	0.0
474	Newton Village	180.0	180.0	1,023.0	0.0	0.0	0.0
475	Penicuik	126.4	126.4	126.4	0.0	0.0	0.0
476	Penicuik	156.0	156.0	355.0	0.0	0.0	0.0
477	Loanhead	0.0	0.0	0.0	141.0	141.0	141.0
478	Penicuik	47.0	47.0	1,032.0	0.0	0.0	0.0
479	Dalkeith	0.0	0.0	0.0	139.4	139.4	139.4
480	Newton Village	353.0	353.0	2,196.0	8.2	4.1	4.1
481	Newton Village	0.0	0.0	0.0	202.8	202.8	202.8

Zn	Sector	Households			Employment		
		2027 Total	2037 DM Total	2037 DS Total	2027 Total	2037 DM Total	2037 DS Total
482	Loanhead	26.8	26.8	26.8	121.9	121.9	121.9
483	Penicuik	0.0	0.0	500.0	7.6	3.8	3.8
537	Gorebridge	90.0	90.0	926.0	18.5	9.2	9.2
545	Newton Village	100.0	100.0	515.0	0.0	0.0	0.0
548	Penicuik	0.7	0.7	0.7	0.3	0.3	840.3
549	Newton Village	2.7	1.4	663.4	0.7	0.4	0.4
672	Newton Village	0.0	196.0	196.0	0.0	0.0	0.0
689	Loanhead	0.0	0.0	0.0	0.0	0.0	490.0
694	Dalkeith	65.3	64.0	64.0	1.0	1.9	1.9

3.3.6 A graphic of the location of the various proposed sites and SRM zones is provided in Figure 3.4 for reference.

DRAFT

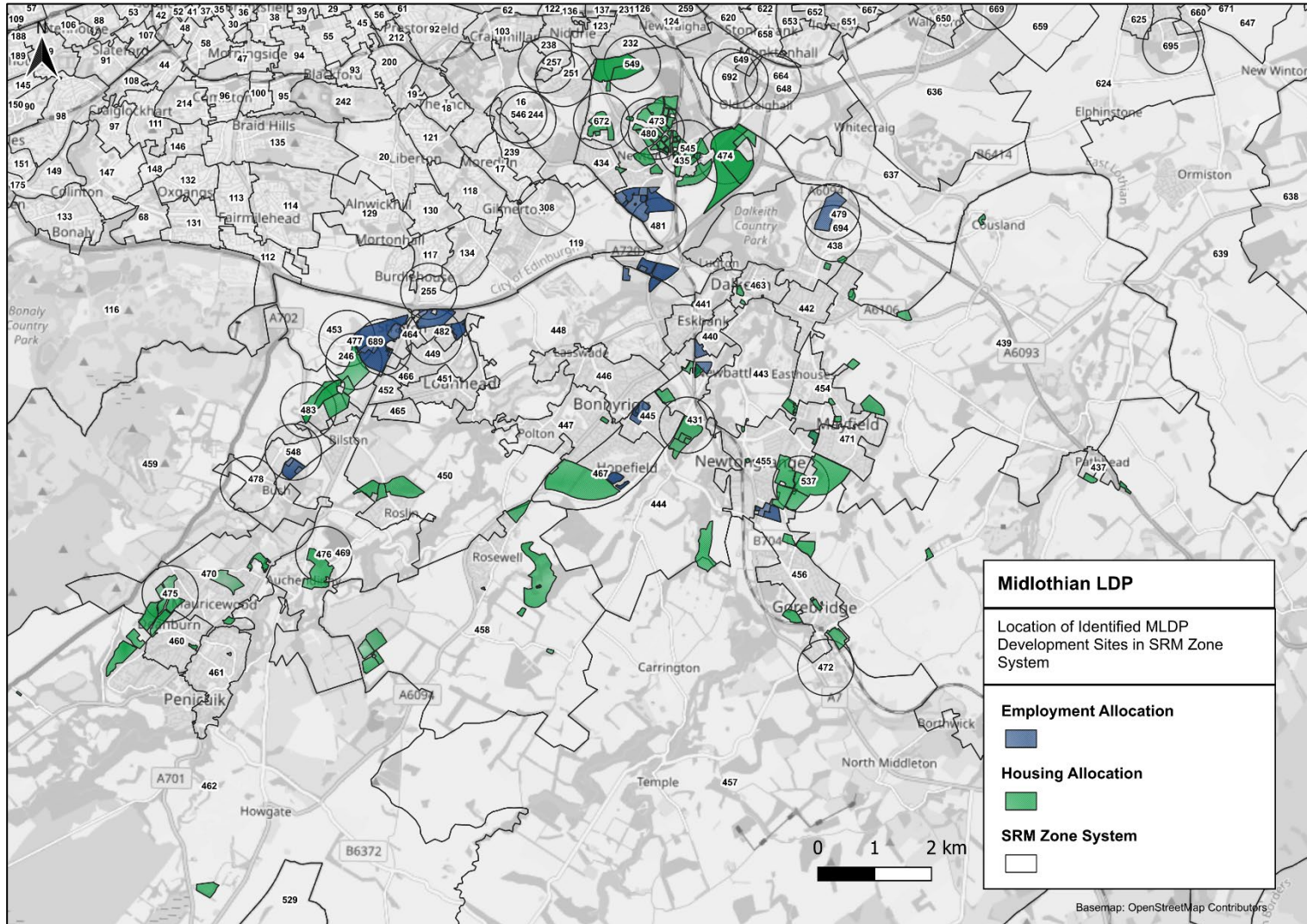


Figure 3.4. Location of Identified MLDP2 Development Sites in SRM Zone System

Land-Use Forecast Inputs

- 3.3.7 The modelling was based on SRM version 4.1.7 (High growth variant), derived from the 2018–2045 sub-national forecasting specification. This reflects wider SEStran-area growth assumptions.
- 3.3.8 Midlothian-specific forecasts were updated to reflect MLDP2 allocations provided by Midlothian Council. These include:
- residential units by site
 - associated population estimates derived using Transport Economic Land Use Model of Scotland (TELMoS) household size assumptions at zonal level
 - employment estimates derived from anticipated land use and employment density assumptions agreed with Midlothian Council
- 3.3.9 Growth assumptions elsewhere in the SEStran area remain consistent with the SRM forecast scenarios.

Summary of Modelled Land-Use Change

- 3.3.10 Table 3.4 summarises the forecast change in households, population and employment within Midlothian under the MLDP2 scenario.

Table 3-4: MLDP2 Summary – Modelled Land-use

Attribute	2027 With LDP scenario	2027 Without LDP (versus 2027 With LDP scenario)			2027 With LDP scenario (versus 2027 Without LDP)		
	Actual	Actual	Difference	% Change	Actual	Difference	% Change
Households	47,284	48,315	+1,031	+2%	55,945	+7,630	+16%
Population	104,138	106,401	+2,263	+2%	123,177	+16,776	+16%
Jobs	26,623	26,623	0	0%	28,825	+2,202	+8%

- 3.3.11 The spatial distribution of housing and employment growth across SRM zones is illustrated in the figures below.

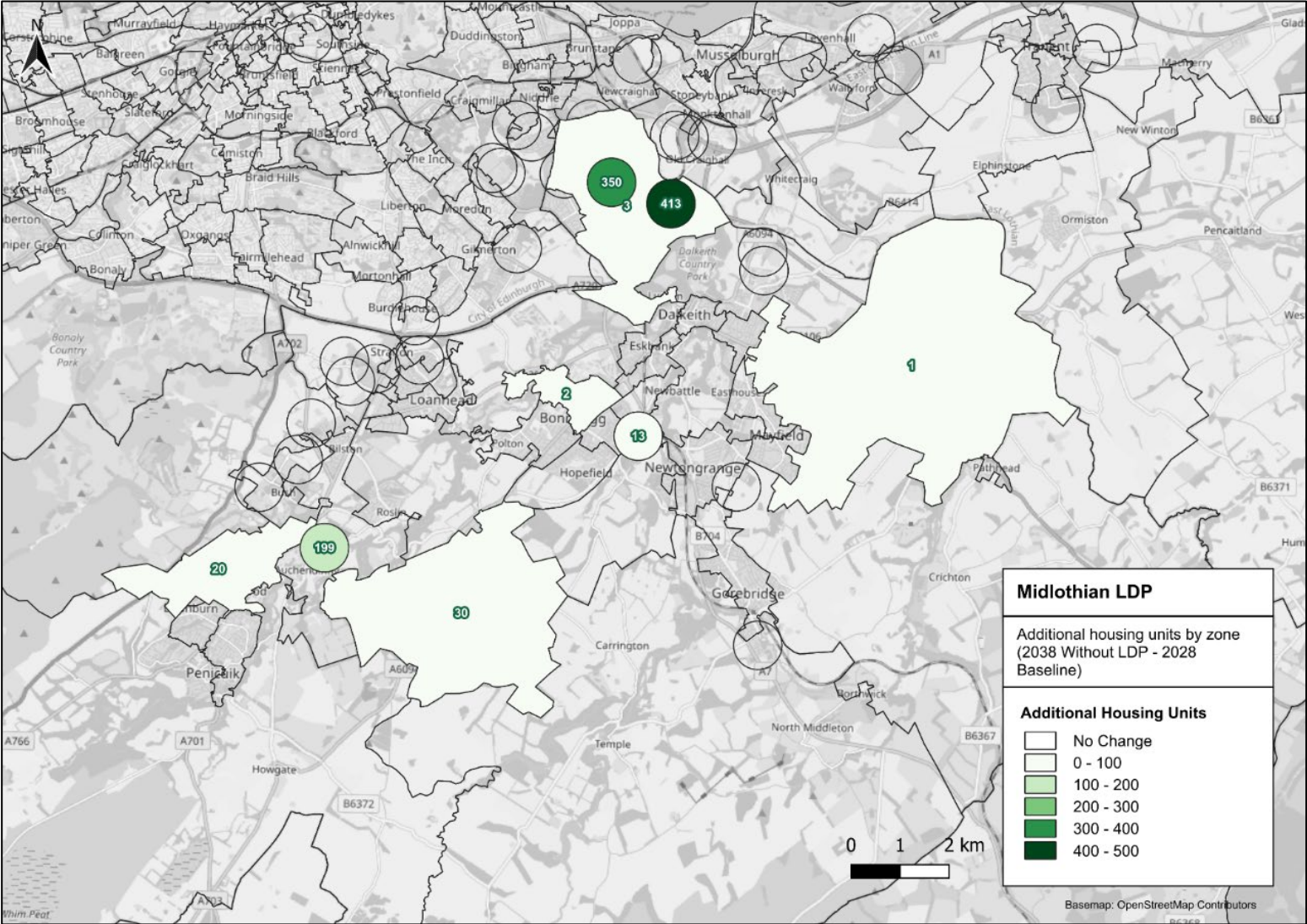


Figure 3.5. Change in the number of housing units between the '2037 Without LDP' and '2027 Baseline' scenarios, by SRM zones (abs values indicated in bold)

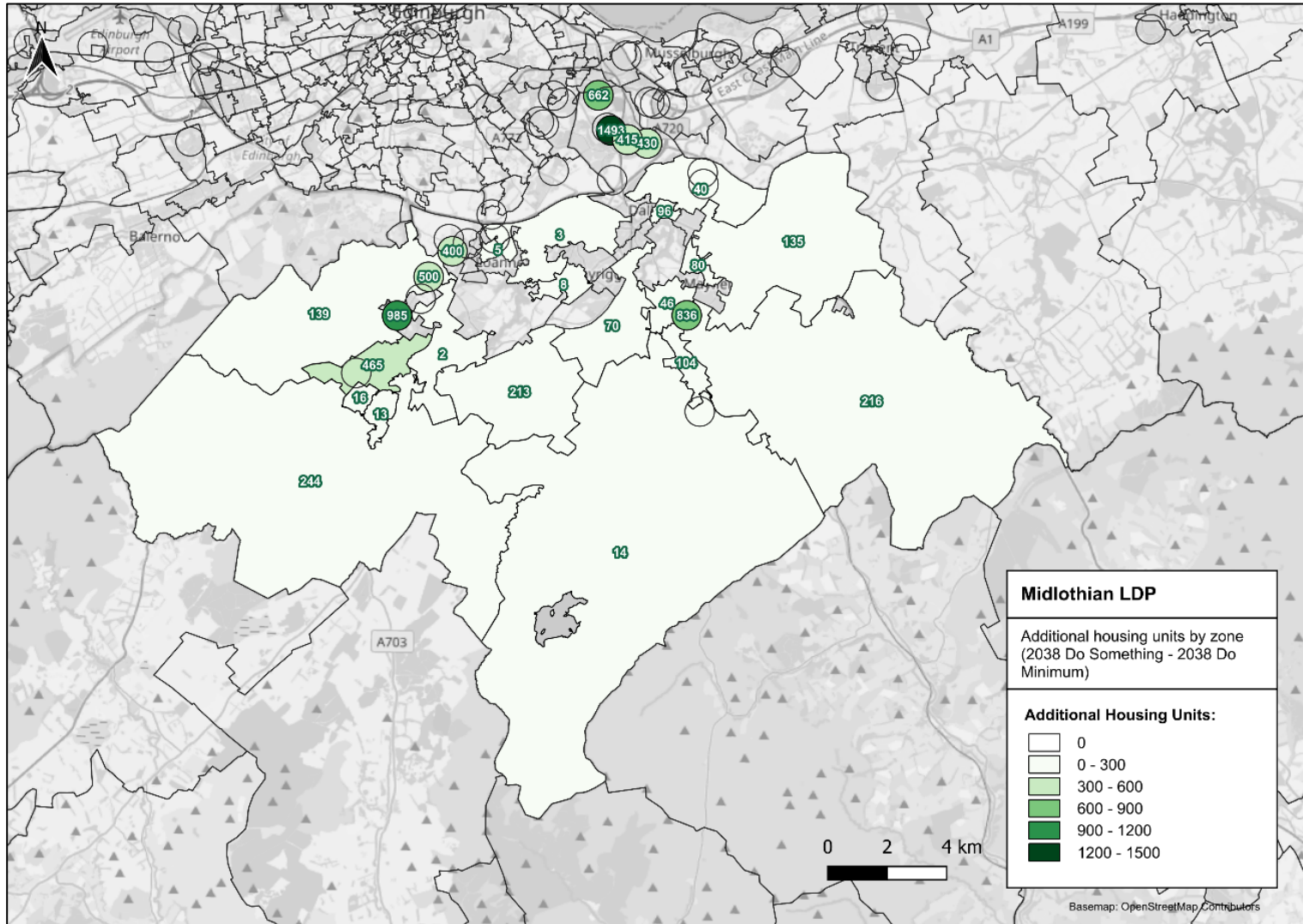


Figure 3.6. Change in the number of housing units between the '2037 Without LDP' and '2037 With LDP scenario' scenarios, by SRM zones (abs values indicated in bold)

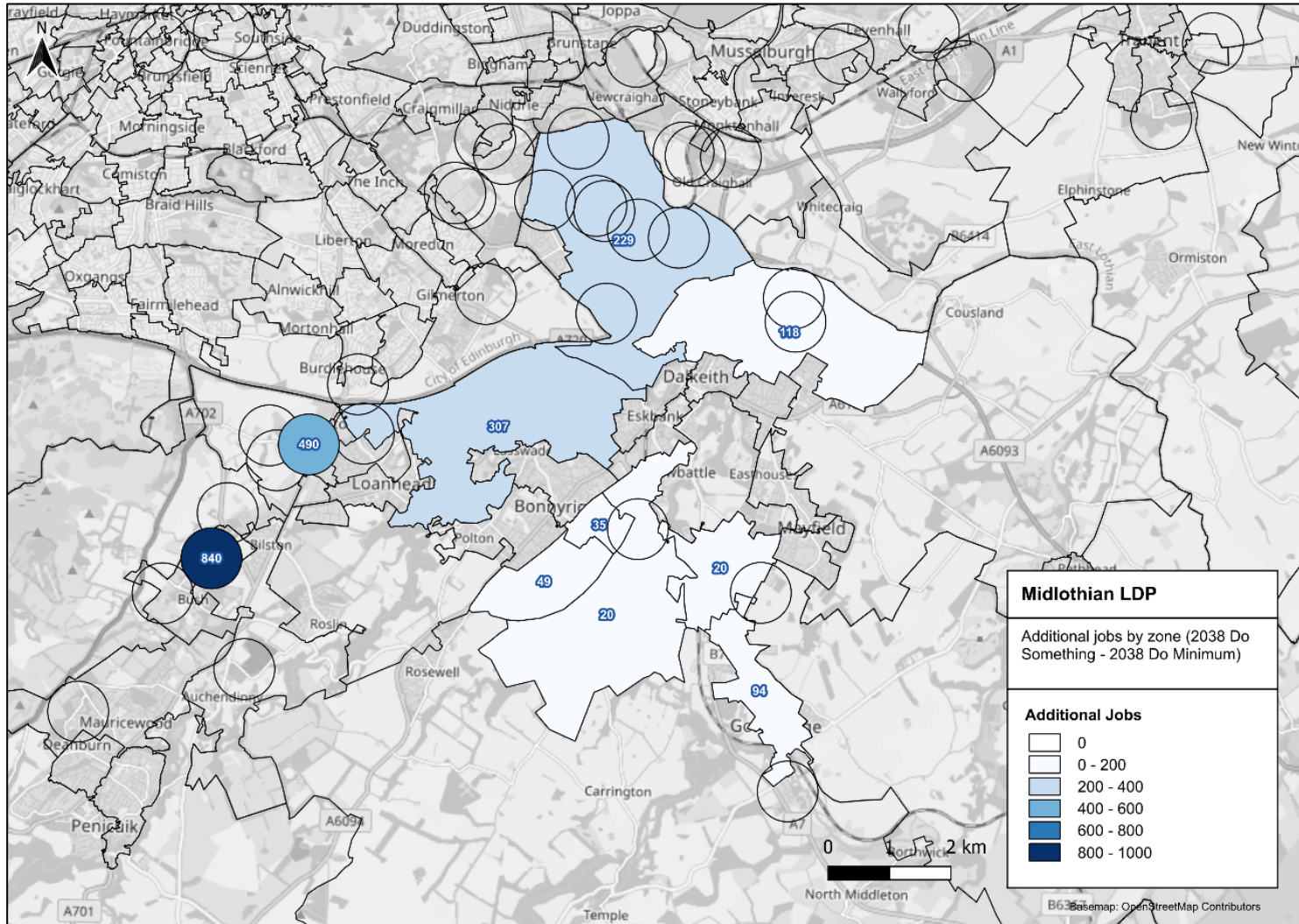


Figure 3.7. Change in the number of jobs between the '2037 Without LDP' and '2037 With LDP scenario' scenarios, by SRM zones (abs values indicated in bold)

3.4 Transport Infrastructure Assumptions

Base Network

- 3.4.1 The assessment utilised the updated 2025 SRM transport network, developed through Transport Scotland’s LATIS Lot 1 programme. This 2025 transport network incorporates:
- road network updates reflecting schemes delivered since the 2018 model Baseline including:
 - Signalisation of junction and new bus-only segregated left-turn lane at the A71 / B7031 Junction
 - Introduction of new Duntarvie Castle Road and Shale Road associated with development area in Winchburgh
 - Signalisation of A702 / A703 Seafield Moor Road / Old Pentland Road Junction at Hillend
 - a full update of public transport services using February 2025 NAPLAN timetable data including:
 - Introduction of Cameron Bridge and Leven rail stations and associated park and ride facilities

Committed Infrastructure

- 3.4.2 Committed transport schemes expected to be delivered prior to the forecast years were included within all future-year scenarios.

Table 3-5: Future Year Transport Infrastructure Changes

Infrastructure Type	Description
Highway	Upgraded layout at A92 / A921 Redhouse Roundabout and A921 Rosslyn Street associated with new development area
Highway	Signalisation of Gallatown Roundabout
Highway	Priority junction at A702 / Bush Loan upgraded to a roundabout
Highway	New distributor road between B9080 west of Winchburgh and B8020 north of Broxburn
Highway	New A71 Bypass north of Wilkieston
Highway	New link between B1348 Edinburgh Road and B671 / Alder Road Roundabout
Public transport	Introduction of Winchburgh Station and associated Park and Ride site

- 3.4.3 These schemes form part of the baseline against which MLDP2 impacts were assessed.
- 3.4.4 Two infrastructure schemes that were widely discussed in the area – Sheriffhall Grade Separation and the A701 Relief Road – were not included within the core scenario, as they are not currently committed or funded within the plan timescale. These schemes were therefore considered separately as part of the sensitivity testing presented in Chapter 7.

3.5 Forecast Scenarios Tested

- 3.5.1 In accordance with DPTAG principles, a reference case and a development case were prepared to isolate the impacts of the MLDP2. The following scenarios were modelled:

2027 Baseline

- Land Use: 2025 land-use plus constructed and committed development
- Infrastructure: Rebased 2025 network plus committed schemes expected by 2027

2037 Without LDP (Reference Case)

- Land-Use: 2025 land-use plus constructed and committed development (excluding MLDP2 allocations)
- Infrastructure: Rebased 2025 network plus committed schemes
- This represents the future network in the absence of the MLDP2

2037 With LDP scenario (Development Case)

- Land-Use: 2025 land-use plus constructed and committed development, plus full build-out of identified MLDP2 housing and employment allocations
- Infrastructure: Rebased 2025 network plus committed schemes

2037 Development Case + Mitigation

- Land-Use: 2025 land-use plus constructed and committed development, plus full build-out of identified MLDP2 housing and employment allocations
- Infrastructure – Rebased 2025 network plus committed schemes + any mitigation identified as part of this assessment

2037 Sensitivity Scenario

- Land-Use: 2025 land-use plus constructed and committed development, plus full build-out of identified MLDP2 housing and employment allocations
- Infrastructure – Rebased 2025 network plus committed schemes + any mitigation identified as part of this assessment + the following schemes:
 - Sheriffhall Grade Separation; and
 - A701 Relief Road.

3.5.2 The remainder of this chapter focuses on the assessment of the With LDP scenario to identify transport pressures and constraints arising from the spatial strategy.

3.6 Connectivity Assessment

3.6.1 A connectivity assessment was undertaken to establish the baseline level of public transport provision serving each proposed housing and employment allocation, and to understand the extent to which sites can support travel by sustainable modes.

3.6.2 The assessment distinguishes between:

- physical proximity to public transport infrastructure
- the quality and frequency of services available, which ultimately determine how effectively those services support travel between origins and destinations

3.6.3 This enables a more robust understanding of whether sites are likely to:

- support sustainable travel patterns
- generate a higher reliance on private car use without intervention

Bus Stop Access

- 3.6.4 A walk catchment was applied based on a range of walk distance parameters aligned to the Scottish Government Urban / Rural Classification of settlements. This varies from 400m in urban areas to 800m in more rural areas to represent reasonable walking distance to bus services.
- 3.6.5 Catchments were calculated using actual road and path networks rather than straight-line (“crow-flies”) distances. Site centroids were used to represent development locations.
- 3.6.6 It is recognised that some large or currently undeveloped sites may not yet contain internal road or path networks. In such cases, accessibility may be slightly understated. However, this approach provides a robust and consistent baseline assessment.
- 3.6.7 Of the 114 housing sites assessed:
- 81 sites (71%) are within 800 metres of an existing bus stop
 - 33 sites (29%) fall outside this catchment
- 3.6.8 Of the 87 employment sites assessed:
- 70 sites (80%) are within 800 metres of an existing bus stop
 - 17 sites (20%) fall outside this catchment
- 3.6.9 This indicates that while a majority of sites are located within reasonable walking distance of bus stops, a minority would require intervention to achieve acceptable levels of public transport connectivity.
- 3.6.10 The figure below illustrates those sites that have access to a stop within 800-metres (indicated with a green dot) and those falling outwith this catchment (red dot).



Figure 3.8. Bus Stop Access (800 Metres)

3.6.11 While the majority of sites are located within walking distance of bus stops, proximity alone does not indicate service quality or suitability for supporting sustainable travel patterns. Service frequency is therefore considered below.

Bus Stop Frequency

3.6.12 Service frequency was assessed across six daily time periods to capture commuter, inter-peak and evening conditions.

3.6.13 Frequency levels were categorised by services per hour to reflect practical usability and attractiveness for sustainable travel.

Table 3-6: Housing Sites - Level of service at bus stops

Time Slice	Services per hour						one service per 1-2 hours	one service per 2-3 hours	Less frequent than every 3 hour(s)
	12 to 20	8 to 12	6 to 8	4 to 6	2 to 4	1 to 2			
05:30-07:30	0	0	23	30	38	26	4	2	4
07:30-09:30	0	22	11	30	34	4	16	8	0
09:30-15:30	1	23	12	24	47	10	6	4	0
15:30-18:30	0	23	11	42	27	17	3	3	1
21:00-23:00	1	22	13	25	51	7	8	0	0
00:00-24:00	0	0	15	32	26	23	3	6	0

Table 3-7: Employment Sites - Level of service at bus stops

Time Slice	Services per hour						one service per 1-2 hours	one service per 2-3 hours	Less frequent than every 3 hour(s)
	12 to 20	8 to 12	6 to 8	4 to 6	2 to 4	1 to 2			
05:30-07:30	0	0	10	20	27	8	2	0	0
07:30-09:30	0	8	16	10	20	11	2	0	0
09:30-15:30	1	23	18	6	16	2	1	0	0
15:30-18:30	0	11	17	27	4	6	2	0	0
21:00-23:00	1	19	19	8	17	3	0	0	0
00:00-24:00	0	0	7	14	27	6	2	1	0

3.6.14 Across the day, on average:

- 55% of housing sites are served by at least one bus every 30 minutes
- 30% have access to between two and four services per hour
- 24% have access to between four and six services per hour
- 8% have access to less than one service per hour

- 3.6.15 Higher frequency services are concentrated within established corridors and settlements with existing public transport infrastructure. Lower-frequency services are typically associated with peripheral or more rural locations.
- 3.6.16 Service frequency reduces during early morning and late evening periods, which may constrain connectivity for shift-based employment or non-standard working hours.
- 3.6.17 Employment sites show a slightly lower overall level of service:
- 47% are served by at least one bus every 30 minutes across the day
 - 3% are served by less than one bus per hour
 - three sites, although within walking distance of bus stops, currently have no active services calling at those stops
- 3.6.18 This indicates that, while many employment sites are physically proximate to bus infrastructure, the operational service level may not be sufficient to support high public transport mode share without intervention.
- 3.6.19 These results demonstrate that service provision is uneven across the study area and is strongly influenced by proximity to established public transport corridors. Sites located within these corridors are more likely to support sustainable travel patterns, whereas those on the periphery are more likely to rely on private car travel in the absence of service enhancements.

Connectivity Insight

- 3.6.20 The connectivity assessment demonstrates that, while many proposed development sites are located in proximity to existing public transport infrastructure, there is significant variation in the level of service provided.
- 3.6.21 Sites within established corridors benefit from higher-frequency services capable of supporting regular travel, whereas more peripheral locations are typically served by lower-frequency services that may not provide a viable alternative to the private car for many journey types.
- 3.6.22 This highlights the importance of considering both availability and quality of service when assessing connectivity and the likely travel behaviour associated with development locations.

Connectivity Assessment Summary

- 3.6.23 The connectivity assessment indicates that the majority of MLDP2 sites benefit from some level of existing public transport provision. However, a material proportion of sites are either:
- located beyond reasonable walking catchments
 - served by low-frequency services that limit their practical usability
- 3.6.24 These sites present a higher risk of car-based travel demand unless supported by targeted interventions to improve public transport provision, internal connectivity or active travel links.
- 3.6.25 This evidence provides a key input to the identification of transport problems and informs the development of mitigation measures in subsequent chapters.

3.7 Strategic Modelling Impacts

- 3.7.1 The assessment of transport impacts associated with the Proposed MLDP2 demonstrates that the scale and distribution of planned growth will materially increase travel demand and place additional pressure on parts of the transport network that are already forecast to experience constraint.

3.7.2 The findings presented below are drawn from the SRM, with full technical outputs contained in Appendix A. This section focuses on identifying where material changes occur and where transport problems are forecast to arise, providing the evidence base for subsequent option development.

Overall Change in Travel Demand

3.7.3 The Proposed With LDP scenario results in a significant uplift in travel demand compared with the 2037 Without-LDP Reference Case. The scale of housing growth — which is set by the Scottish Government — is the primary driver of this increase, with employment allocations across Midlothian contributing to a lesser extent.

3.7.4 By 2037, relative to the Without LDP scenario:

- households increase by 16% (+7,630 households)
- population increases by 16% (+16,776 people)
- employment increases by 8% (+2,202 jobs)

3.7.5 This growth translates into:

- a 13% increase in daily trip productions (+14,700 trips)
- a 5% increase in daily trip attractions (+3,749 trips)

3.7.6 The larger increase in trip productions relative to attractions reflects Midlothian's location and role within the wider city region, and the assumption that current employment patterns will continue, with Midlothian remaining a significant net exporter of workers. This reinforces demand on external corridors connecting Midlothian to key employment centres, particularly Edinburgh, and increases reliance on a relatively limited number of strategic routes.

3.7.7 All Midlothian sectors experience growth in trip making, with the largest absolute increases occurring in Danderhall, Shawfair, Dalkeith, Bonnyrigg, Loanhead and Gorebridge — locations accommodating the greatest concentration of development.

Problem emerging: The MLDP2 introduces a clear step-change in travel demand beyond background growth, increasing pressure particularly on outbound commuter corridors and peak-period movements.

Changes in Trip Distribution

3.7.8 In addition to increasing overall trip volumes, MLDP2 alters the spatial distribution of travel demand. The redistribution of travel demand reinforces existing movement patterns rather than fundamentally changing them.

3.7.9 Residential growth strengthens radial commuting patterns toward Edinburgh, while new employment allocations increase movements into Midlothian from neighbouring authorities, which is reflective of Midlothian's place within the wider city region.

3.7.10 The modelling predicts increased pressure on:

- strategic radial routes to Edinburgh
- approaches to the City of Edinburgh Bypass
- the A1 corridor
- east–west routes linking development areas to Musselburgh, Tranent and Dalkeith
- connections to town centres and key interchange nodes

3.7.11 These impacts are most pronounced in AM and PM peak periods, reflecting commuting behaviour.

Problem emerging: Existing strategic corridors and junctions that already carry high peak-period demand experience further concentration of traffic flows, increasing vulnerability to delay and reliability issues, and impacting on local road network through displacement of strategic transport.

Modal Split

3.7.12 Both car and public transport trips are predicted to increase in absolute terms under the With LDP scenario.

3.7.13 Public transport trips grow at a slightly faster rate than background growth, resulting in a modest increase in public transport mode share (typically 1–2 percentage points across Midlothian sectors).

3.7.14 This reflects:

- the location of development within reach of existing bus and rail corridors
- increased relative attractiveness of rail services as road congestion worsens
- proximity to the Borders Railway corridor

3.7.15 However, the car remains the dominant mode for most journeys.

3.7.16 The modelling does not demonstrate a transformational modal shift; rather, it shows incremental improvement in public transport share without fundamental change in travel behaviour.

Problem emerging: While development is relatively well located in accessibility terms, the current network and service assumptions are insufficient to materially reduce car dependency. Without intervention, additional growth risks locking in higher car-based travel patterns.

Impacts on the Road Network

3.7.17 Increased travel demand results in higher traffic flows across much of the network.

3.7.18 The most notable increases occur:

- on approaches to the City of Edinburgh Bypass including Sheriffhall, Biggar, Millerhill, and Straiton
- on routes serving major development clusters
- at key northern Midlothian junctions such as Lasswade Road / Wadingburn Road, A702 / A703 at Hillend, and Gilmerton Road Roundabout

3.7.19 These higher flows lead to:

- increased delay
- longer queues at junctions
- greater peak-period congestion
- re-routing onto secondary and local roads

3.7.20 The modelling indicates that the MLDP2 primarily exacerbates existing capacity constraints rather than creating entirely new congestion locations, intensifying pressure at known network pinch points. In several cases, junctions forecast to operate under stress in the 2037 Without LDP scenario experience further deterioration once development is added.

Problem emerging: Network resilience reduces at known pressure points, increasing the risk of reliability impacts, rat-running and wider network inefficiencies.

Journey Times and Network Performance

- 3.7.21 Between the 2027 baseline and the 2037 Without LDP scenario, total vehicle journey time across Midlothian increases by 19%, reflecting background growth pressures.
- 3.7.22 The introduction of the MLDP2 results in a further 5% increase in total vehicle journey time.
- 3.7.23 Average AM peak vehicle speeds are predicted to:
- fall by 7% between 2027 and 2037 without the LDP
 - fall by a further 13% once LDP development is introduced
- 3.7.24 Journey time increases are most evident on strategic corridors connecting Midlothian to Edinburgh.
- 3.7.25 Public transport journey times increase slightly; however, the more significant constraint emerges in terms of rail crowding, particularly in peak periods.

Problem emerging: Even without the LDP, congestion worsens significantly by 2037. The Plan intensifies these pressures, particularly in peak periods, while rail capacity constraints limit the ability to accommodate additional mode shift.

Vehicle Kilometres and Carbon Emissions

- 3.7.26 Model outputs indicate an increase in total vehicle kilometres between the 2027 baseline and 2037 Do Minimum scenario, reflecting growth in overall travel demand. However, when LDP2 development is introduced, vehicle kilometres per capita are generally reduced relative to the Do Minimum, suggesting that development locations may support shorter or fewer vehicle trips.
- 3.7.27 Total transport-related CO₂ emissions also increase in absolute terms. However, emissions per capita fall by approximately 0.8% compared with the 2037 Without LDP scenario.
- 3.7.28 This improvement reflects:
- concentration of development in relatively accessible locations
 - increased public transport use
 - some reduction in average trip length
- 3.7.29 While this represents improved relative carbon efficiency, it does not offset the overall growth in emissions arising from increased population and trip making.

Problem emerging: The MLDP2 performs better per capita than the reference case but does not deliver absolute emission reductions. Additional intervention would be required to align growth with national decarbonisation trajectories.

3.8 Identification of Transport Problems

- 3.8.1 In accordance with the principles of DPTAG, this section defines the transport problems arising from the Proposed MLDP2. Problems are identified by comparing the 2037 With LDP scenario against the 2037 Without LDP reference case, thereby isolating the impacts attributable to the Plan.

3.8.2 The assessment demonstrates that while background growth alone places increasing pressure on the transport network by 2037, the introduction of the MLDP2 materially intensifies these pressures in specific locations and corridors.

Problem 1: Increased Outbound Commuter Demand

3.8.3 The MLDP2 generates a 13% increase in trip productions relative to the 2037 Without LDP scenario, compared with a 5% increase in attractions. This imbalance reflects the scale of residential growth relative to employment growth and results in proportionately higher outbound travel demand from Midlothian to employment elsewhere.

3.8.4 Most additional outbound trips are directed towards Edinburgh and other external employment centres, reinforcing existing peak-period commuting patterns, assuming that travel behaviour remains consistent with the patterns forecast in the model.

Implication: Increased pressure on strategic radial corridors, particularly in the AM peak.

Problem 2: Intensification of Congestion on Strategic Corridors

3.8.5 The modelling identifies measurable increases in vehicle flows on key approaches to:

- the City of Edinburgh Bypass
- the A1 corridor
- principal northbound radial routes
- key east–west distributor routes

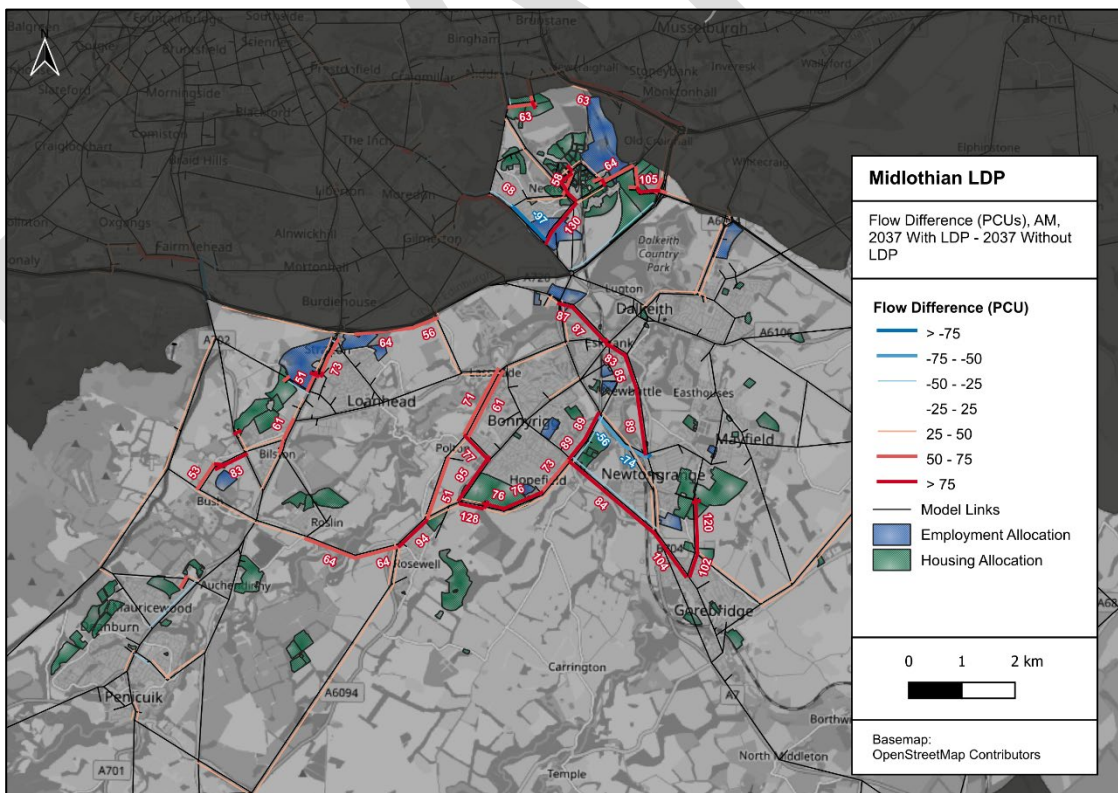


Figure 3.9: Actual Flow Difference, AM, 2037 Without LDP vs 2037 With LDP scenario

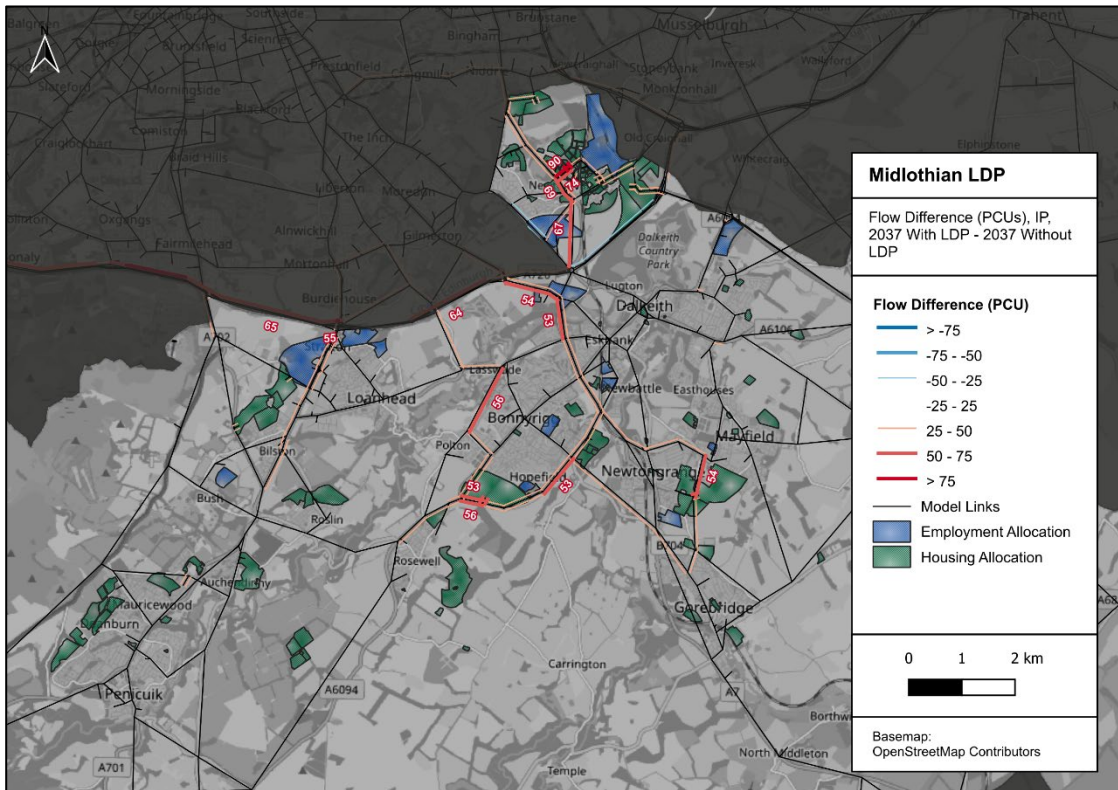


Figure 3.10: Actual Flow Difference, IP, 2037 Without LDP vs 2037 With LDP scenario

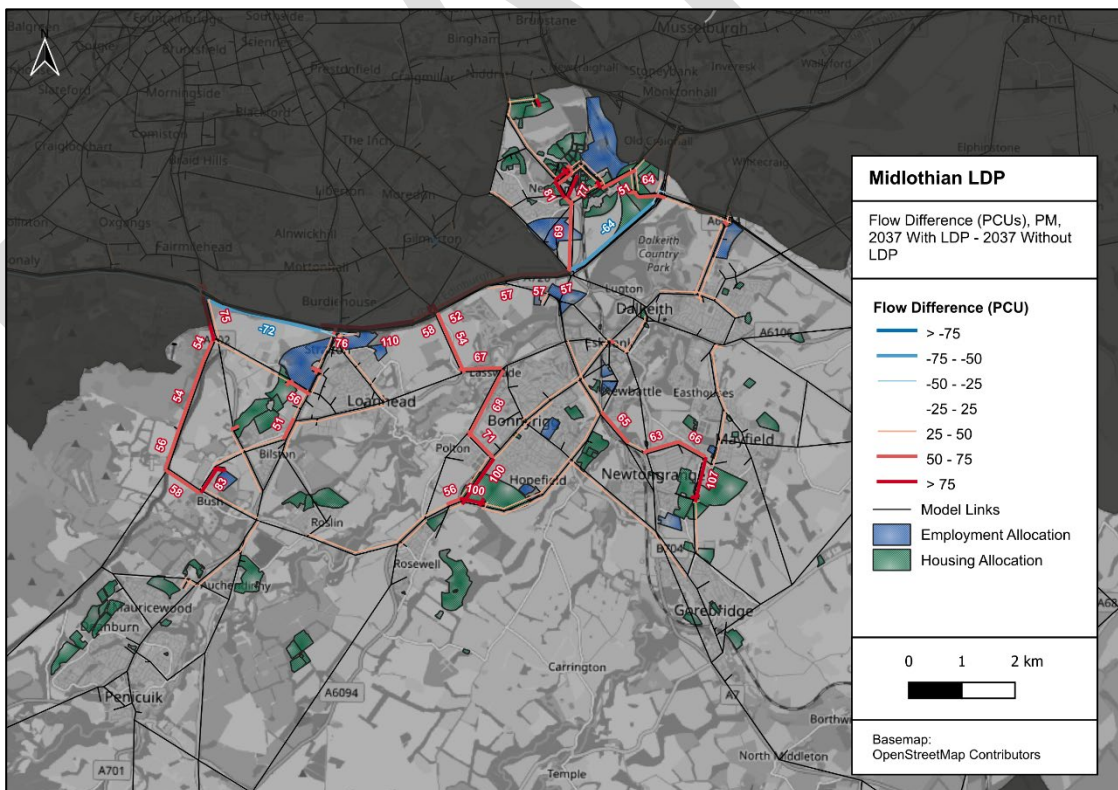


Figure 3.11: Actual Flow Difference, PM, 2037 Without LDP vs 2037 With LDP scenario

3.8.6 Figures 3.8 to 3.10 demonstrate that traffic growth attributable to the MLDP2 is concentrated on established strategic corridors, particularly in northern Midlothian.

3.8.7 These increases in flow translate into higher levels of delay at several key junctions.

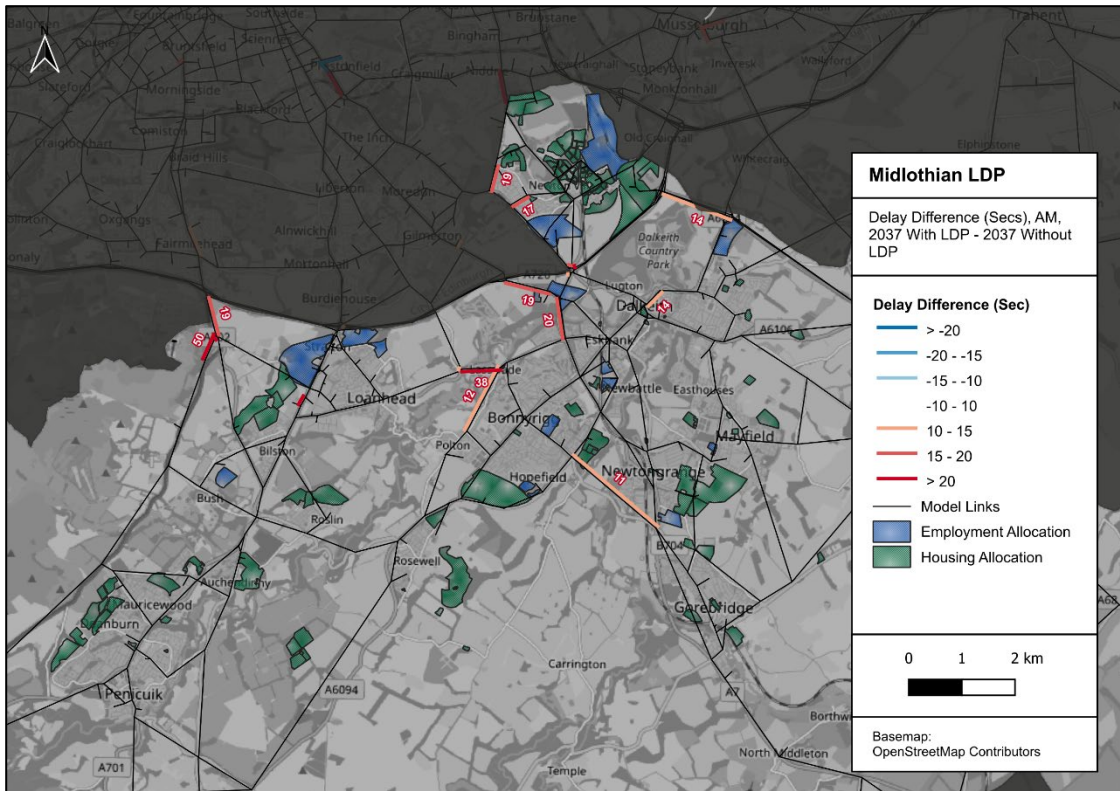


Figure 3.12: Delay Difference, AM, 2037 Without LDP vs 2037 With LDP scenario

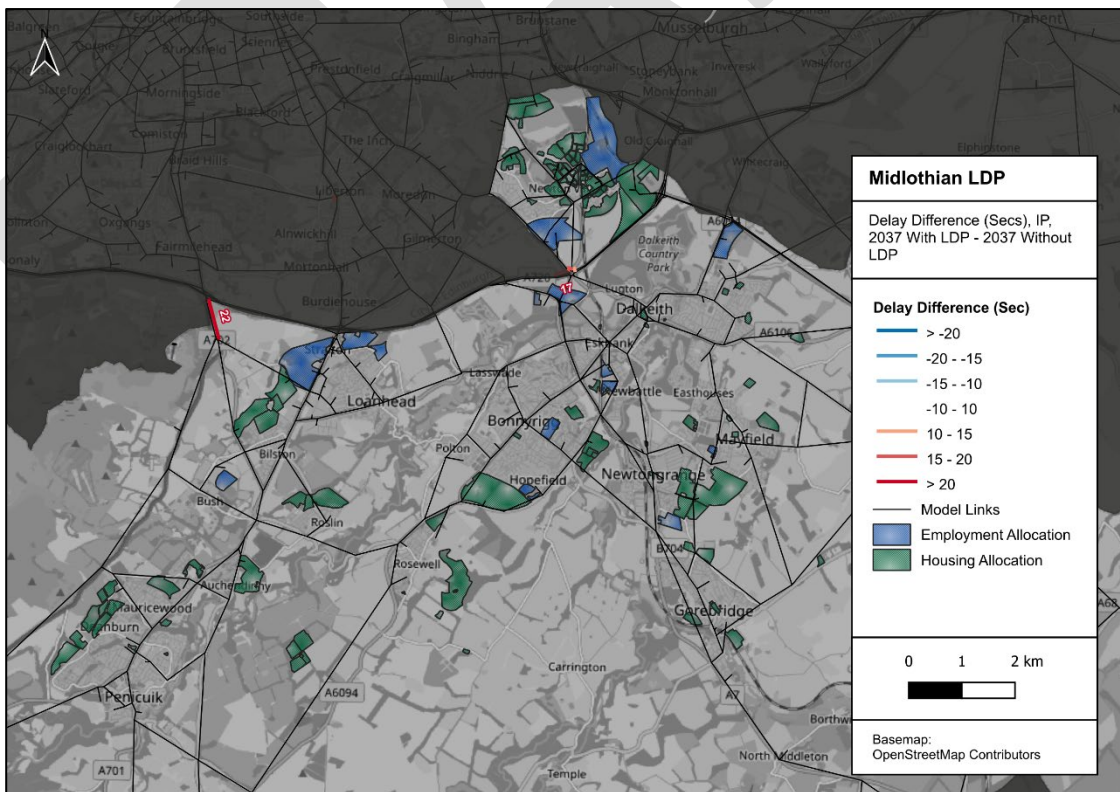


Figure 3.13: Delay Difference, IP, 2037 Without LDP vs 2037 With LDP scenario

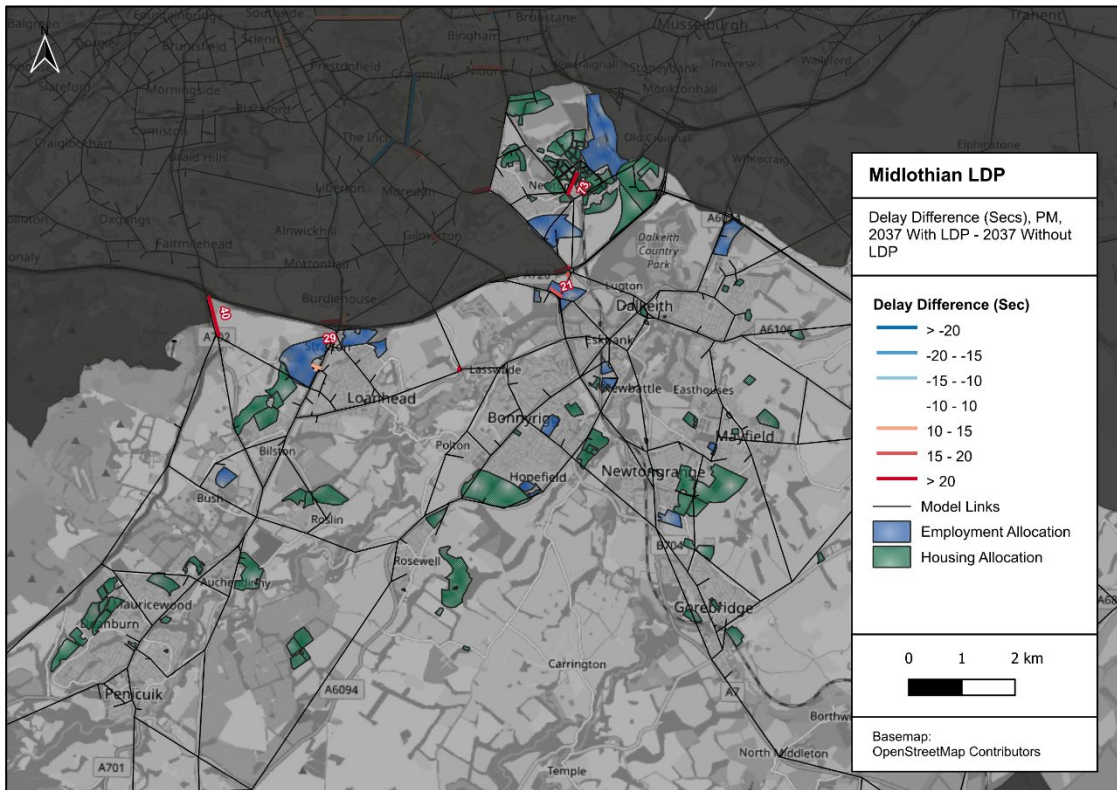


Figure 3.14. Delay Difference, PM, 2037 Without LDP vs 2037 With LDP scenario

3.8.8 The delay figures show that junctions already forecast to operate under stress in the reference case are predicted to experience further deterioration under the With LDP scenario.

Implication: The MLDP2 exacerbates existing capacity constraints rather than creating entirely new congestion locations. This reduces network resilience, increases journey time variability, and raises the likelihood of re-routing onto secondary and local roads.

Problem 3: Deterioration in Network Performance and Reliability

3.8.9 Between 2027 and 2037 (Without LDP), total vehicle journey time across Midlothian is predicted to increase by 19%. The introduction of the MLDP2 is predicted to result in a further 5% increase.

3.8.10 Average AM peak vehicle speeds are predicted to reduce by:

- 7% between 2027 and 2037 without the LDP
- A further 13% once LDP development is introduced

3.8.11 These changes indicate a reduction in overall network efficiency and increasing vulnerability to disruption, particularly on corridors connecting Midlothian to Edinburgh.

Implication: Even in the absence of the MLDP2, congestion is forecast to worsen. The Plan compounds these pressures, further reducing journey time reliability.

Problem 4: Limited Modal Shift and Rail Capacity Constraints

3.8.12 The modelling shows modest increases (typically 1–2 percentage points) in public transport mode share across Midlothian sectors.

- 3.8.13 Rail services, particularly during peak periods, experience increased crowding under the With LDP scenario, indicating that capacity constraints may limit the ability to accommodate further modal shift.

Implication: Without intervention, there is a risk that additional growth will reinforce existing patterns of car dependency, limiting the ability to achieve wider policy objectives relating to sustainable travel.

Problem 5: Increased Total Vehicle Kilometres and Absolute Emissions

- 3.8.14 Total vehicle kilometres travelled increase under the With LDP scenario.
- 3.8.15 Although transport-related CO₂ emissions per capita reduce slightly (approximately 0.8%), total emissions increase in absolute terms due to population growth.
- 3.8.16 This reflects improved relative carbon efficiency but does not deliver absolute emission reductions.

Implication: The MLDP2 performs better than the reference case on a per-capita basis but does not achieve absolute emission reductions, indicating that additional measures would be required to align with national decarbonisation objectives.

3.9 Consolidated Problem Statement

- 3.9.1 The Proposed MLDP2 introduces a material increase in travel demand that:
- intensifies congestion on strategic radial corridors
 - exacerbates existing junction capacity constraints, particularly in northern Midlothian
 - reduces peak-period speeds and network resilience
 - increases rail crowding and constrains further modal shift
 - increases total vehicle kilometres and absolute transport emissions
- 3.9.2 While development is generally located within areas that have some level of existing public transport provision, the analysis shows that:
- improvements in mode share are modest
 - connectivity is variable across sites
 - and existing network constraints limit the ability to accommodate growth efficiently
- 3.9.3 As a result, the scale of development proposed generates transport pressures that cannot be fully addressed without targeted intervention.
- 3.9.4 The transport problems identified above provide the evidence base for the setting of Transport Planning Objectives (TPOs) and the development and appraisal of options in the following chapters.

4 Transport Planning Objectives

4.1 Context and Purpose

- 4.1.1 Transport Planning Objectives (TPOs) were defined to articulate the transport outcomes sought through delivery of the MLDP2 spatial strategy.
- 4.1.2 The TPOs were established in light of the transport problems identified in Section 3.8 to ensure clear alignment with the evidence base and the principles of DPTAG.
- 4.1.3 The TPOs therefore provide a structured response to the forecast impacts of growth, particularly:
- increased outbound commuter demand
 - intensified congestion on strategic corridors
 - reduced network performance and resilience
 - limited modal shift
 - growth in vehicle kilometres and carbon emissions
- 4.1.4 The objectives were aligned with the wider vision and spatial strategy of the MLDP2 and informed by relevant national, regional and local transport policy. In accordance with DPTAG, they avoid duplicating national policy aims except where a specific local transport outcome is required.
- 4.1.5 In line with the STAG principle of proportionality, the appraisal framework combined qualitative assessment with targeted quantitative indicators derived from the SRM and the connectivity analysis.

4.2 Transport Planning Objectives

- 4.2.1 The TPOs are set out in Table 4.1 below, together with their intended outcomes and associated performance indicators.

Table 4-1: Transport Planning Objectives

Objective	Intended Outcomes	Key Performance Indicators
<p>TPO 1: Reduce the Need to Travel and Support Sustainable Connectivity</p> <p>To ensure that the spatial distribution of development supports access to key services and employment opportunities by sustainable modes, thereby limiting unnecessary travel growth</p>	<p>A proportional increase in the percentage of households with sustainable-mode access to key services</p> <p>Improved connectivity between new housing and employment locations</p> <p>Improved connectivity between new employment and existing housing locations</p> <p>Containment of average trip lengths where possible</p>	<p>Connectivity Software (STEP):</p> <ul style="list-style-type: none"> • Overall connectivity score (percentage of households with sustainable access to key services and employment) <p>SEStran Regional Model:</p> <ul style="list-style-type: none"> • Average trip length • Internalisation of trips within Midlothian
<p>TPO 2: Maximise the Use of Existing Public Transport Infrastructure</p>	<p>Increased proportion of population with access to high-frequency public transport</p>	<p>Connectivity Software (STEP):</p> <ul style="list-style-type: none"> • Public transport journey times from new development

Objective	Intended Outcomes	Key Performance Indicators
<p>To locate development where it can make effective use of existing bus and rail provision, supporting increased public transport mode share and limiting additional car-based demand on constrained corridors</p>	<p>Increased public transport trip volumes and mode share</p> <p>Efficient use of existing rail and bus infrastructure</p>	<ul style="list-style-type: none"> Frequency and accessibility of bus services <p>SEStran Regional Model:</p> <ul style="list-style-type: none"> Total number of public transport trips Overall public transport mode share Rail station boarding and alighting volumes Public transport revenue
<p>TPO 3: Protect the Performance and Resilience of the Transport Network</p> <p>To ensure that development does not materially worsen congestion, delay or reliability on the strategic and local transport networks</p>	<p>No significant deterioration in network performance relative to the reference case</p> <p>Containment of additional delay at known pressure points</p> <p>Maintenance of journey time reliability on key corridors</p>	<p>SEStran Regional Model:</p> <ul style="list-style-type: none"> Total time lost due to congestion (system-wide) Change in delay at key junctions Average queue lengths at key junctions Average journey times on strategic corridors Car and bus journey times to Edinburgh city centre Average AM peak speeds
<p>TPO 4: Support Carbon Efficiency and Climate Objectives</p> <p>To ensure that development is delivered in a way that improves transport carbon efficiency and supports wider decarbonisation ambitions.</p>	<p>No increase in transport-related CO₂ emissions per capita relative to the reference case</p> <p>Reduction in vehicle kilometres per capita compared to the 2027 baseline</p> <p>Improved carbon efficiency of new development patterns</p>	<p>STAG criteria</p> <p>SEStran Regional Model:</p> <ul style="list-style-type: none"> Vehicle kilometres per capita Tonnes of CO₂ equivalent from forecast trips Public transport mode share

4.3 Relationship to Identified Problems

4.3.1 The TPO framework provides a structured mechanism to test whether the MLDP2 spatial strategy — and any subsequent mitigation options — respond effectively to the transport problems identified in Section 3.8.

4.3.2 In particular:

- **TPO 1** responds to increased outbound commuter demand and trip growth
- **TPO 2** addresses limited modal shift and rail capacity pressures
- **TPO 3** targets forecast deterioration in network performance and congestion hotspots
- **TPO 4** addresses growth in vehicle kilometres and carbon emissions

4.4 Summary

- 4.4.1 The appraisal framework combines strategic multi-modal modelling with detailed connectivity analysis to provide a proportionate and evidence-based assessment of the transport implications of the MLDP2.
- 4.4.2 By explicitly linking the TPOs to the problems identified through modelling, the approach aligns with DPTAG and STAG principles and provides a transparent basis for the development and appraisal of transport options in subsequent chapters.

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5 Mitigation Option Generation

5.1 Introduction

- 5.1.1 The preceding chapters set out the forecast transport conditions associated with delivery of the MLDP2, including the impacts of planned growth on travel demand, network performance and connectivity.
- 5.1.2 The analysis presented in Chapter 3 identified a number of locations where the introduction of MLDP2 development is forecast to intensify existing transport pressures, particularly in relation to junction delay, queuing and congestion on key strategic corridors.
- 5.1.3 In response to these findings, a range of potential mitigation measures was identified. The mitigation options were developed with reference to the Transport Planning Objectives (TPOs) set out in Chapter 4 and were intended to:
- address the transport problems identified through the modelling and connectivity analysis
 - demonstrate that the MLDP spatial strategy can be delivered without unacceptable impacts on the transport network
 - support sustainable travel patterns and improve connectivity by public transport
 - align with relevant national and regional transport policy and guidance
- 5.1.4 In developing these options, cognisance was taken of the Sustainable Travel Hierarchy and wider Scottish transport policy objectives relating to reducing car dependency and supporting sustainable travel. Accordingly, the option generation process has considered both infrastructure-led interventions to address immediate network constraints and measures to improve connectivity by public transport, recognising the different roles these play in supporting the MLDP2 strategy.
- 5.1.5 The options presented in this chapter represent initial strategic interventions identified through the appraisal process. They inform the subsequent STAG Preliminary Options appraisal and do not represent final design solutions. Further feasibility, design development and engagement with infrastructure providers would be required before any measures could be taken forward for implementation.

5.2 Maintaining Road Network Performance

- 5.2.1 The strategic modelling results presented in Chapter 3 indicate that a number of junctions and corridors are forecast to experience increased congestion and delay under the 2037 'With LDP scenario' scenario. These locations are also critical in determining overall network connectivity, with delays at key junctions affecting the ability to travel efficiently between Midlothian and key destinations, particularly during peak periods.
- 5.2.2 These impacts are primarily associated with increased peak-period traffic demand and are concentrated on key corridors connecting Midlothian to Edinburgh, particularly those associated with the A720 Edinburgh City Bypass and the principal radial routes feeding into it.
- 5.2.3 Figure 5.1 identifies the principal locations where modelling indicates increased delay and queuing under the With LDP scenario.

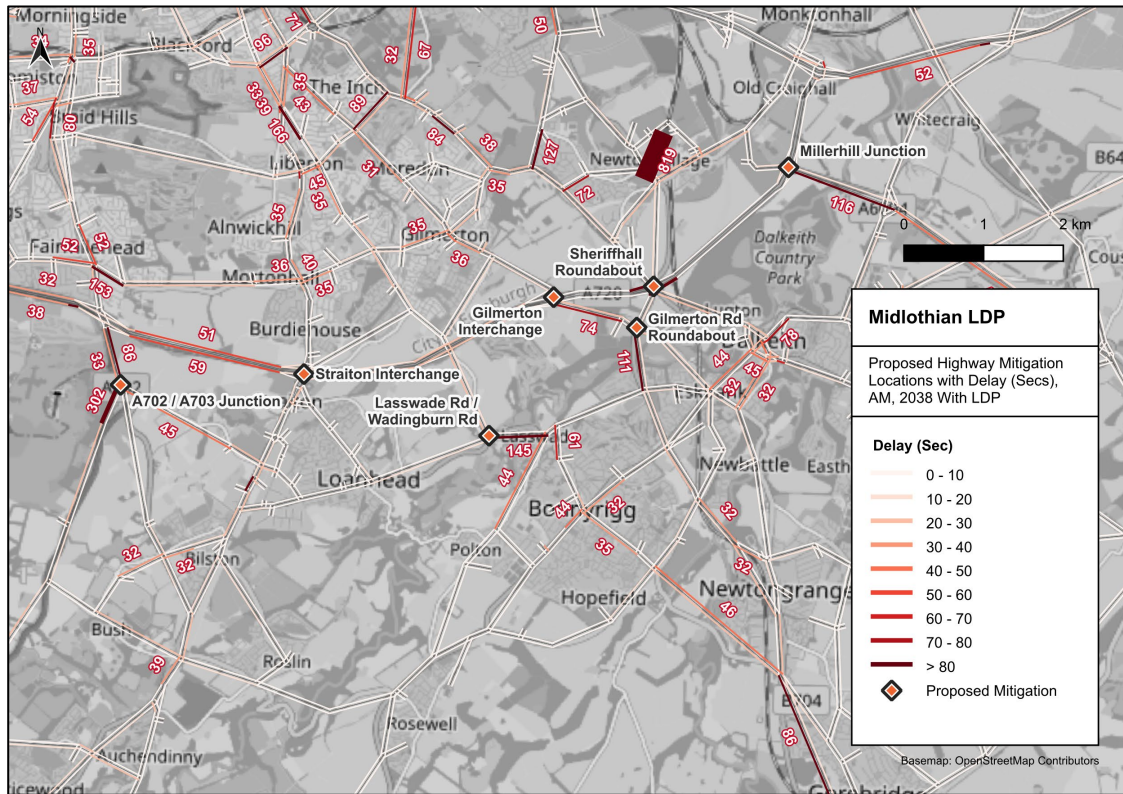


Figure 5.1: Proposed Mitigation Locations with modelled delay (sec) in 2037 With LDP scenario (AM).

- 5.2.4 Several of the identified locations lie on, or near, the Edinburgh City Bypass. This corridor plays a critical role in accommodating orbital and radial movements around the city and provides key access routes for traffic travelling between Midlothian and the wider regional road network.
- 5.2.5 Deterioration in operational performance at these locations therefore has implications not only for local traffic movements but also for the wider strategic network.
- 5.2.6 Addressing these issues would primarily support delivery of **Transport Planning Objective 3: Protect the Performance and Resilience of the Transport Network**, by reducing additional delay and helping to maintain reliable journey times on key corridors.
- 5.2.7 It should also be noted that congestion at these junctions affects both general traffic and bus services operating on the same corridors. Measures which improve junction capacity and reduce queuing can therefore also support **Transport Planning Objective 2: Maximise the Use of Existing Public Transport Infrastructure**, by improving bus journey time reliability.
- 5.2.8 A summary of the proposed mitigation at each of these locations is presented in Table 5-1.

Table 5-1: Proposed Mitigation Locations and Options

Location	The Problem	Proposed Mitigation
A702 / A703 (Biggar Interchange)	Junction operates at or near capacity in peak periods (geometry issues), with additional demand from nearby development resulting in disproportionate increases in delay and queueing	<ul style="list-style-type: none"> • A new roundabout junction to the south of the intersection between the A702, A703 and Old Pentland Road • Bypass lane (NB) from the A702 (Biggar Road) to the westbound A720 slip road. This will require longer slip road to accommodate the merge

Location	The Problem	Proposed Mitigation
Straiton Interchange	High existing traffic volumes combined with forecast growth result in increased peak-period congestion and reduced operational efficiency	<ul style="list-style-type: none"> Extend the left turn lane on the EB off slip Partial signalisation of the roundabout with Stop lines on the EB off slip and circulatory lanes assuming the roundabout is large enough
Gilmerton Road Roundabout and Interchange	There is heavy traffic throughout this area today and new developments in Dalkeith and Bonnyrigg will increase flows through these locations, worsening existing delays	<p>Potential for a bypass lane from A7 (NB) to Gilmerton Road (WB) but this will have:</p> <ul style="list-style-type: none"> impacts on the adjacent roundabout (Dobbies Garden Centre) require change to the southern roundabout of the Gilmerton interchange - visibility to right is poor on the Gilmerton Road (WB) approach so a larger roundabout positioned further south of the A720 may be needed to improve capacity of this approach
Lasswade Road junction with Wadingburn Road	This junction prioritises more local movements between Bonnyrigg, Loanhead, and Gilmerton, avoiding the need to use the Edinburgh Bypass. Additional delays here could also potentially send more people on to the strategic network, increasing issues at other junctions	Additional lane on WB approach to the junction
Millerhill Interchange - A68 (WB) approach to A720	The A68 is a key arterial route for traffic from the south east, and increased delays and queues would impact travellers from Midlothian and beyond	A68(WB) to A720 Bypass dedicated slip road (bypassing the eastern junction. This will require longer slip road to accommodate the merge

5.2.9 The proposed interventions focus on locations where the modelling identifies the greatest increases in delay and where improvements to junction capacity and operation are most effective in supporting network performance. By targeting these key nodes, the mitigation package seeks to address the principal constraints identified in Chapter 3 and maintain both network efficiency and connectivity.

5.3 Public Transport Mitigation

5.3.1 The connectivity analysis presented in Section 3.5 identified variation in the level and quality of public transport provision serving development sites. While many sites are located within reasonable proximity to bus infrastructure, service frequency and coverage varies, and in some locations may constrain the ability to support sustainable travel patterns.

5.3.2 In response, a range of potential public transport mitigation measures were considered as part of the option generation process, complementing the highway interventions set out in Section 5.2.

Scope of Public Transport Mitigation

5.3.3 Public transport mitigation was considered across both bus and rail modes, reflecting their respective roles in supporting connectivity to Edinburgh and within Midlothian.

5.3.4 Potential interventions identified include:

- Bus network measures, such as:
 - extension or diversion of existing services to serve new development areas – for example:
 - extension of Lothian Buses Route 33 from its current terminus at Millerhill to serve the proposed development area at Newton Farm. The extended route would operate via the new development area in Shawfair and Shawfair Railway Station
 - extension of Lothian Buses Route 49 from its current terminus at Fort Kinnaird Retail Park to serve the proposed development area at Caldercoats
 - introduction of an additional stop on Lothian Buses Route 15 along Seafield Moor Road to provide access to development sites at Bilston West
 - introduction of new stops to improve physical accessibility to services
 - potential introduction of new or enhanced services where existing provision is insufficient
- Rail-based measures, such as:
 - capacity enhancements (e.g. longer carriages or increased service frequency) on the Borders Railway corridor
 - improved integration between new development areas and rail stations

5.3.5 These interventions are intended to support:

- **TPO 1:** Reduce the Need to Travel and Support Sustainable Connectivity, by improving access to key destinations by public transport
- **TPO 2:** Maximise the Use of Existing Public Transport Infrastructure, by increasing the attractiveness and usability of existing services

These interventions therefore complement the highway measures by addressing connectivity constraints and supporting more sustainable patterns of travel over time.

Delivery Context and Constraints

5.3.6 It is important to recognise that the delivery of public transport services sits largely outwith the direct control of Midlothian Council.

- Bus services are operated on a commercial basis (primarily by Lothian Buses and other operators), and changes to routes, frequencies or service patterns are subject to operator decision-making unless directly subsidised by the public sector.
- Rail services and capacity enhancements are controlled at a national level, with infrastructure and rolling stock decisions led by Transport Scotland and rail industry partners.

5.3.7 As such, while the LDP can identify where enhanced public transport provision would support sustainable development, the implementation of these measures would require engagement with operators and national agencies, and may be subject to wider funding, operational and policy considerations.

5.3.8 The Council could, in principle, take a more direct role (for example through supported bus services); however, this would represent a strategic policy and funding decision beyond the scope of this appraisal.

Other Studies

- 5.3.9 Public transport provision within Midlothian does not operate in isolation and is strongly influenced by wider regional travel patterns and corridor-based movements to and from Edinburgh.
- 5.3.10 At present, there are ongoing studies under the SEStran programme considering:
- strategic public transport enhancements
 - bus priority and infrastructure improvements
 - corridor-level interventions on routes serving Midlothian
- 5.3.11 These studies are directly relevant to the corridors identified in this appraisal and may influence or support improvements to public transport connectivity and journey time reliability for Midlothian-based trips.
- 5.3.12 The identification of public transport mitigation within this chapter should therefore be considered in the context of this wider, coordinated regional approach, rather than as a standalone set of council-led interventions.

Infrastructure Led

- 5.3.13 While service provision is operator-led, there are opportunities for the planning process to support delivery through infrastructure provision and safeguarding, including:
- provision of new bus stops within or adjacent to development sites
 - safeguarding of corridors to enable future service routing
 - design of site layouts to accommodate efficient bus penetration
 - integration with existing rail stations and interchange points
- 5.3.14 These measures can improve the deliverability and commercial viability of future services, even where services themselves are not directly specified or controlled through the LDP.

Treatment in this Appraisal

- 5.3.15 The public transport measures identified are conceptual and were not explicitly tested within the transport model at this stage. This reflects the high-level nature of the appraisal and the dependency on third-party operators for service delivery. These measures would be subject to further development, engagement and assessment in subsequent stages.

Summary

- 5.3.16 Public transport mitigation was identified as an important component of supporting sustainable travel patterns within the MLDP2 strategy.
- 5.3.17 However, in contrast to highway interventions, these measures:
- are not directly deliverable by the Council in isolation
 - require collaboration with operators and regional partners
 - are subject to wider funding and operational considerations
- 5.3.18 As such, they are presented as supporting and enabling measures, rather than a defined or committed mitigation package, and were excluded from the modelled mitigation scenario at this stage.

- 5.3.19 Overall, the mitigation options identified in this chapter represent a proportionate response to the transport problems identified in Chapter 3. The focus is on addressing key network constraints while also supporting improved connectivity by more sustainable modes where possible. These options form the basis for the appraisal presented in Chapter 6.

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6 Appraisal of MLDP2 Transport Mitigation

6.1 Appraisal Purpose and Context

Purpose of the Appraisal

- 6.1.1 This chapter presents the appraisal of transport mitigation measures identified to address the transport impacts associated with the MLDP2. The appraisal was undertaken in accordance with STAG to provide an objective and consistent assessment of how effectively the proposed mitigation package responds to the transport problems identified earlier in this report.
- 6.1.2 The appraisal constitutes a STAG Preliminary Options Appraisal, providing an initial, proportionate assessment of the performance of the mitigation measures against the defined TPOs and the STAG appraisal criteria. The results inform the development of the Strategic Case and Socio-Economic Case within the Five Case Model framework.¹
- 6.1.3 The purpose of the appraisal is therefore to determine the extent to which the proposed mitigation measures:
- address the transport problems arising from the MLDP2 spatial strategy
 - support delivery of the defined Transport Planning Objectives
 - align with wider national and regional transport policy
 - perform positively against the STAG appraisal criteria

Policy and Strategic Alignment

- 6.1.4 Consistent with STAG requirements, the appraisal was undertaken with reference to relevant national policy frameworks, including:
- **The National Transport Strategy 2 (NTS2)**² priorities of reducing inequalities, taking climate action, delivering inclusive economic growth, and improving health and wellbeing
 - **The Place Principle**³, which promotes collaborative, people-centred approaches to place-based decision making and seeks to ensure that transport interventions respond to the needs and characteristics of local communities
- 6.1.5 The appraisal therefore considers not only the transport performance of mitigation measures, but also their broader contribution to sustainable development and place-based outcomes. In this context, the appraisal also considers the extent to which the mitigation package supports a shift towards more sustainable travel patterns, recognising that infrastructure-led interventions focused on network performance may not, in isolation, deliver the outcomes sought through national policy.

Evidence Base

- 6.1.6 In line with the proportionality principle within STAG, the appraisal is supported by targeted quantitative evidence derived from strategic modelling outputs and connectivity analysis, ensuring that conclusions are clearly grounded in the underlying evidence base.
- 6.1.7 The appraisal draws on the following analytical inputs:

¹ <https://www.transport.gov.scot/publication/guidance-on-the-development-of-business-cases-march-2016/4-the-five-case-model/>

² <https://www.transport.gov.scot/publication/national-transport-strategy-2/>

³ <https://www.gov.scot/publications/place-principle-introduction/>

- strategic highway and public transport modelling undertaken using the SRM
- public transport connectivity analysis undertaken using STEP

6.1.8 Further details of the modelling methodology and outputs that inform the appraisal are provided in Appendix A – SRM Modelling Outputs.

6.2 Appraisal Framework and Scoring

Appraisal Criteria

6.2.1 In accordance with STAG, the mitigation measures were assessed against the following appraisal dimensions:

- the Transport Planning Objectives (TPOs) defined in Section 4
- the STAG appraisal criteria, comprising:
 - Environment
 - Climate Change
 - Health, Safety and Wellbeing
 - Economy
 - Equality and Accessibility
- Equality Impact Considerations, as discussed in Section 4.5
- alignment with established policy objectives, as outlined in Section 4.6
- practical considerations relating to feasibility, affordability and public acceptability

6.2.2 Together, these criteria provide a structured framework for assessing the overall performance of the mitigation package and identifying the relative strengths and weaknesses of individual measures.

Assessment Scale

6.2.3 Consistent with established STAG practice, the appraisal was undertaken using a seven-point qualitative assessment scale, reflecting the relative magnitude and significance of impacts.

6.2.4 The scale applied within the appraisal is defined as follows:

- **Major benefit** (√√√) - Significant positive impacts which, depending on their scale, are likely to be a key factor in determining whether an option should be progressed.
- **Moderate benefit** (√√) - Positive impacts of moderate scale which may not determine an option's suitability in isolation but could contribute materially when considered alongside other impacts.
- **Minor benefit** (√) - Small positive impacts which are worth noting but are unlikely to materially influence the overall appraisal outcome.
- **Neutral** (O) - No material positive or negative impact anticipated.
- **Minor negative impact** (X) - Small disbenefits which are unlikely to materially influence the decision-making process but should be acknowledged.
- **Moderate negative impact** (XX) - Negative impacts of moderate scale which may influence option performance when considered alongside other impacts.
- **Major negative impact** (XXX) - Significant disbenefits which may represent a substantial constraint on the suitability of an option.

- 6.2.5 The application of this scale supports transparent comparison between mitigation measures and assists in identifying where more detailed analysis may be required through subsequent STAG Detailed Options appraisal if taken forward.

6.3 Summary of Modelled Mitigation Outcomes

- 6.3.1 The transport modelling results for the 2037 'With LDP scenario' and 'Mitigated' scenarios indicate that the proposed highway mitigation package delivers targeted improvements in network performance but does not fully resolve all forecast transport pressures associated with planned growth.

Network Performance and Junction Operation

- 6.3.2 The mitigation package is shown to reduce delay and queuing at several of the most constrained junctions, particularly those where interventions were directly targeted. The largest improvements are observed at locations such as:
- A702 / A703 (Biggar Interchange)
 - Gilmerton Road Roundabout and Interchange
- 6.3.3 At these locations, the introduction of additional capacity and revised junction layouts reduces peak period queuing and improves throughput.
- 6.3.4 However, improvements are not uniform across the network, reflecting the interaction between localised interventions and wider demand patterns:
- some junctions continue to experience residual delay and congestion, particularly under peak-period conditions
 - at certain locations, benefits are more pronounced in one peak period (AM or PM) than the other, reflecting directional demand patterns and differing network interactions
- 6.3.5 Overall, the mitigation package reduces the severity of congestion at key nodes, but does not eliminate congestion across the network, particularly at strategic interfaces with the A720 Edinburgh City Bypass.
- 6.3.6 Figures 6.1 through 6.6 illustrate the mitigation impacts on flows and delay across the network.

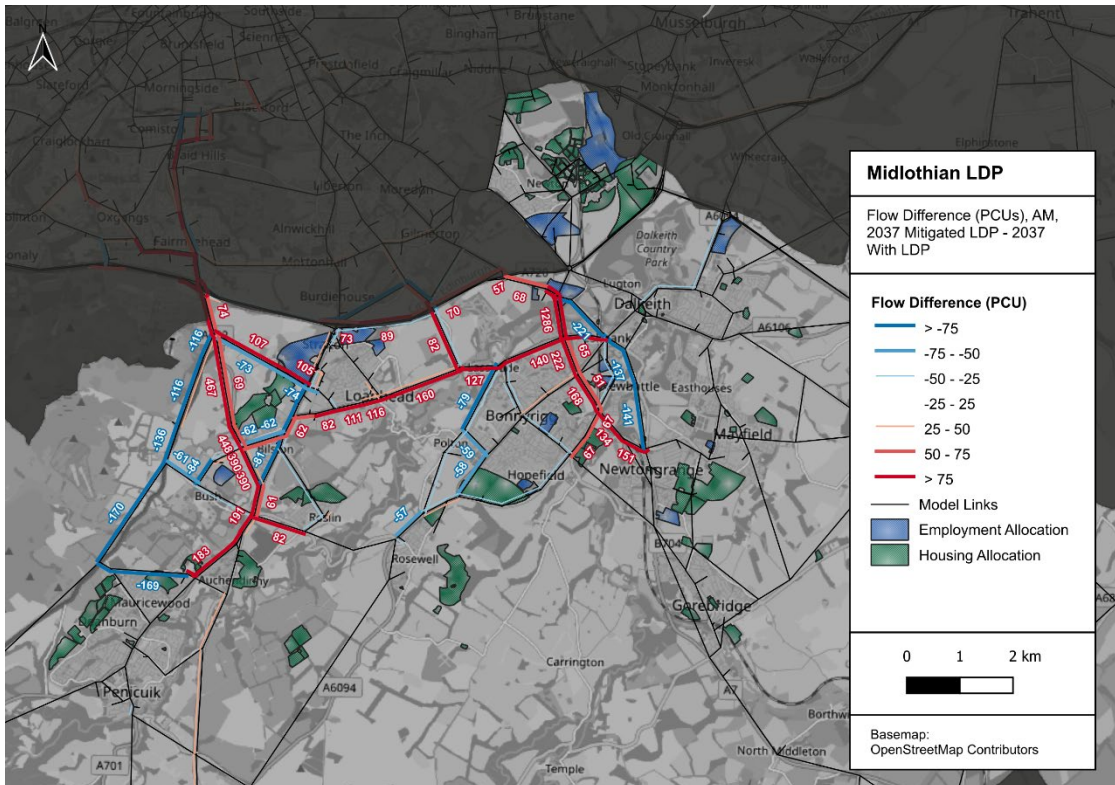


Figure 6.1: Actual Flow Difference, AM, 2037 Mitigated LDP vs 2037 With LDP scenario

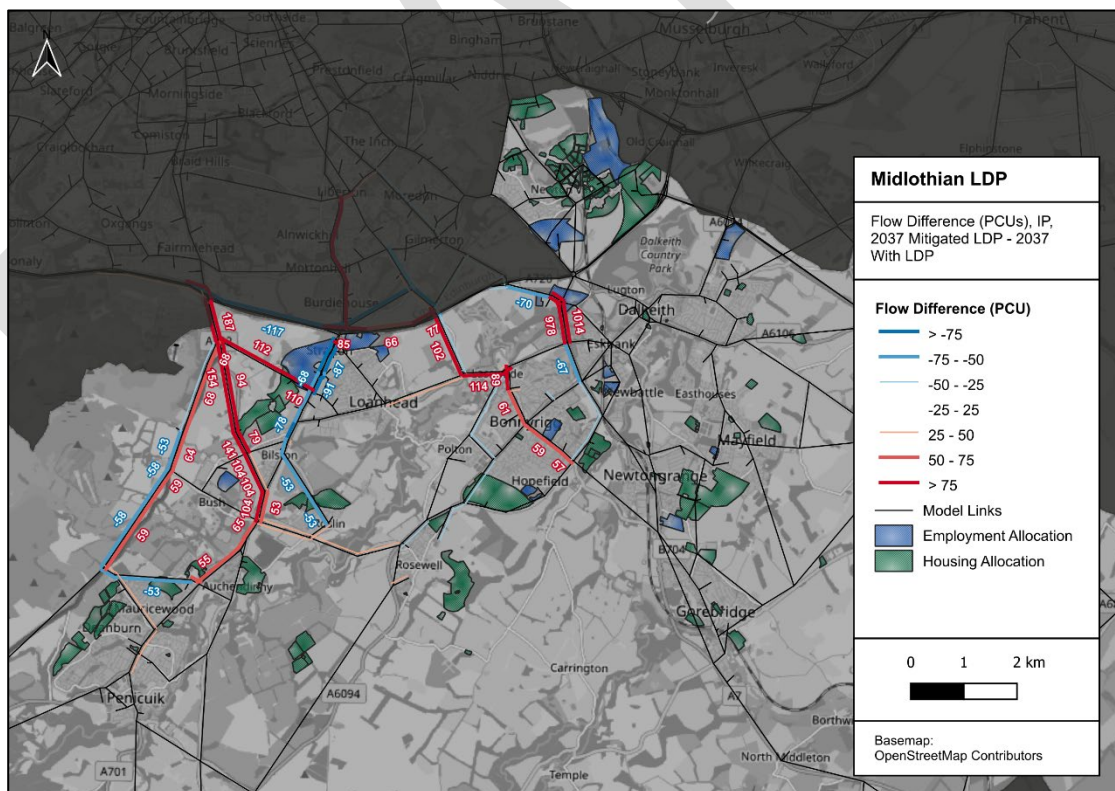


Figure 6.2: Actual Flow Difference, IP, 2037 Mitigated LDP vs 2037 With LDP scenario

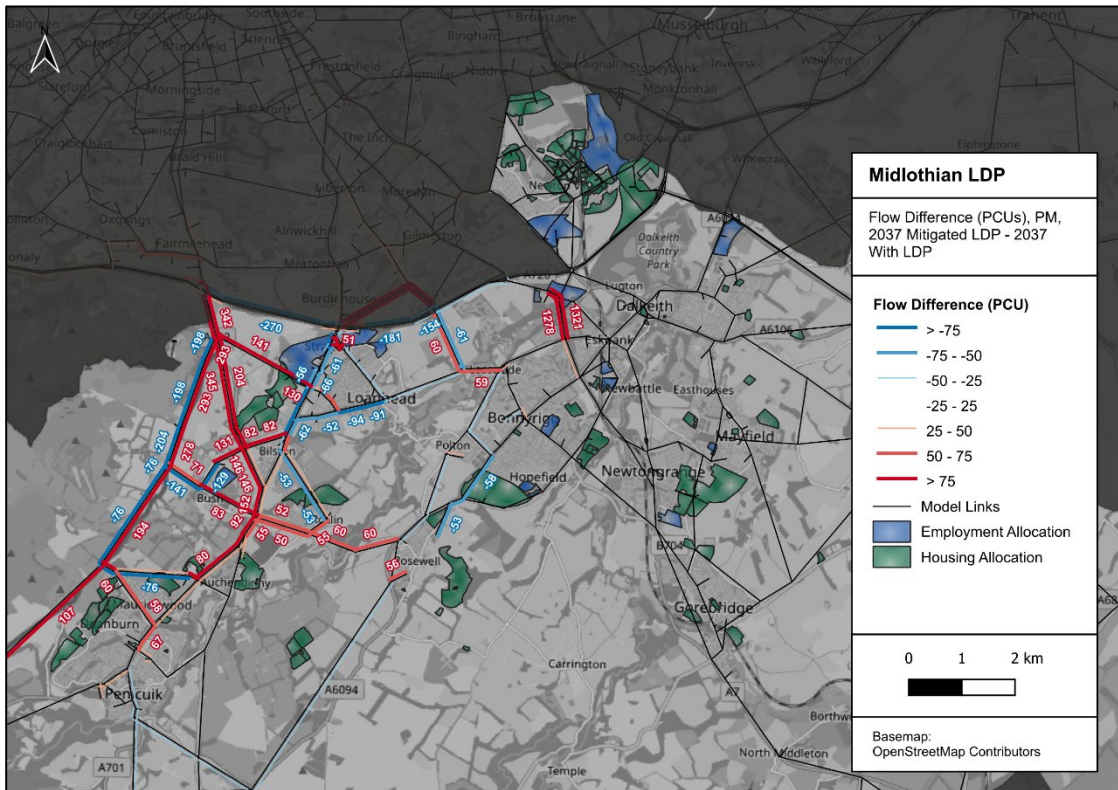


Figure 6.3: Actual Flow Difference, PM, 2037 Mitigated LDP vs 2037 With LDP scenario

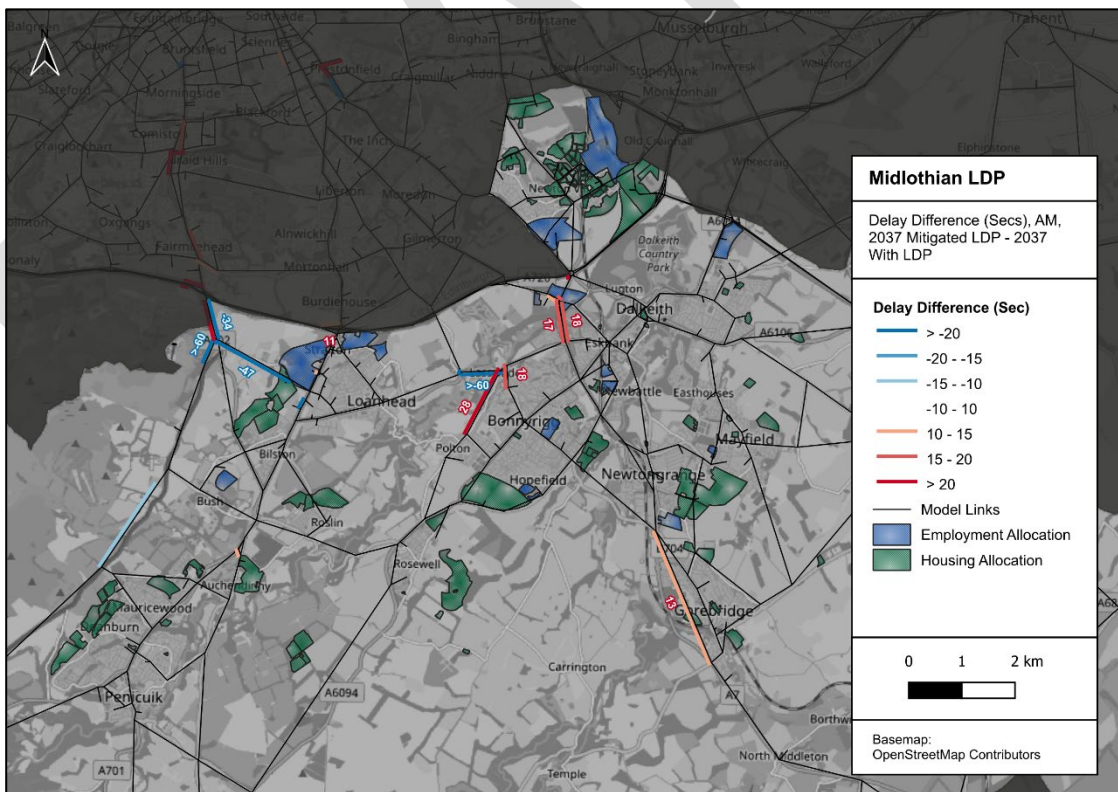


Figure 6.4: Delay Difference, AM, 2037 Mitigated LDP vs 2037 With LDP scenario

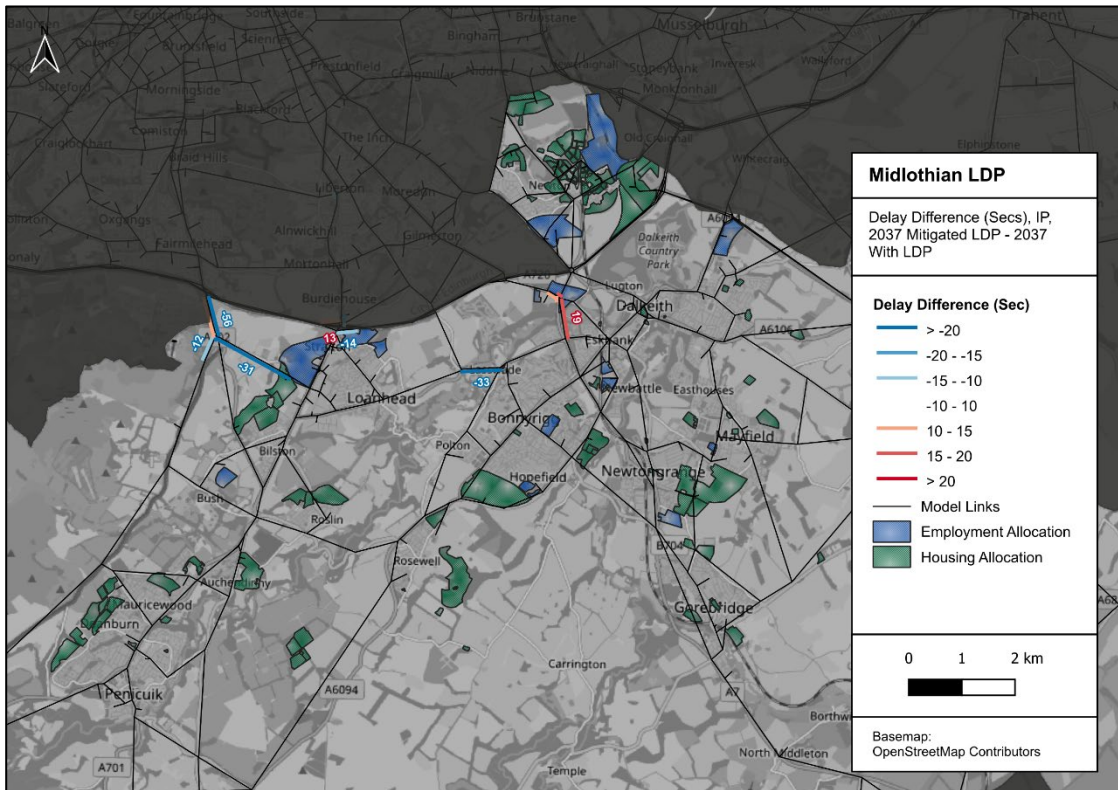


Figure 6.5: Delay Difference, IP, 2037 Mitigated LDP vs 2037 With LDP scenario

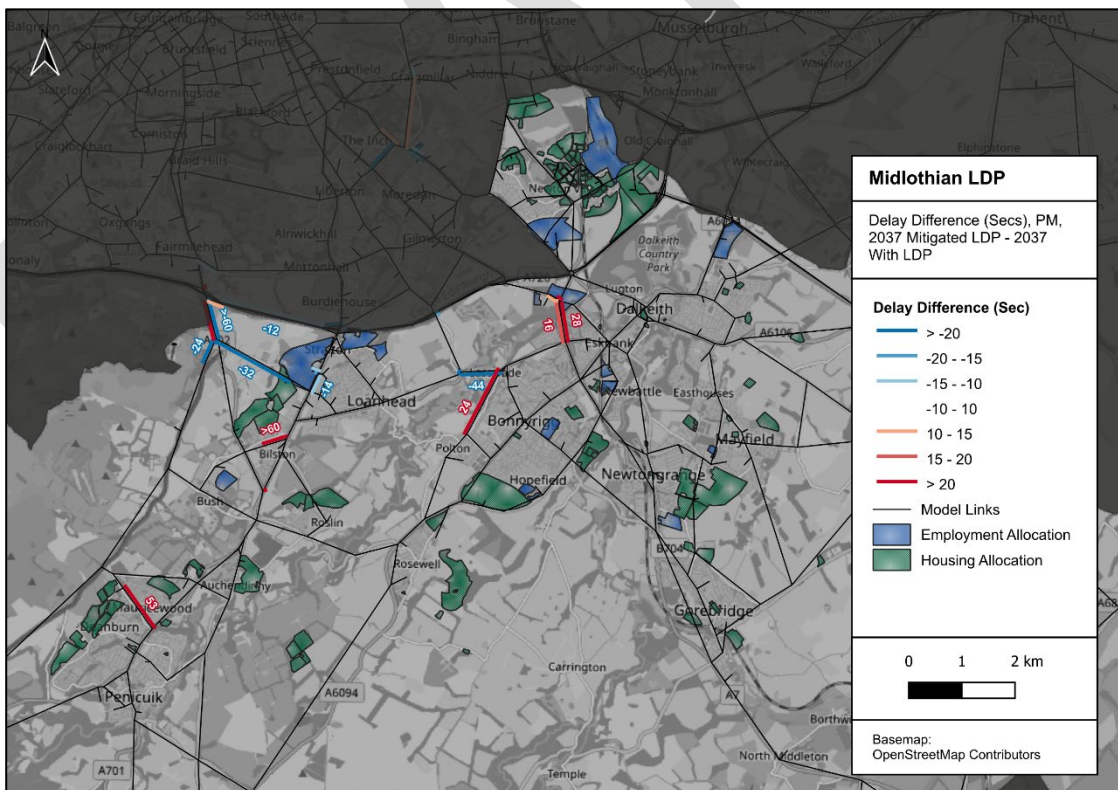


Figure 6.6. Delay Difference, PM, 2037 Mitigated LDP vs 2037 With LDP scenario

6.3.7 These changes in delay also translate into improvements in connectivity, with more reliable journey times at key junctions supporting more efficient travel between Midlothian and key destinations, particularly along strategic corridors.

Strategic Network Impacts

- 6.3.8 The modelling indicates that the mitigation measures help to maintain the operational performance of key corridors, particularly those connecting Midlothian to Edinburgh.
- 6.3.9 In doing so, the package supports:
- improved journey time reliability on key commuter routes
 - reduced propagation of delays from local junctions onto the wider strategic network
- 6.3.10 Nevertheless, the A720 corridor and its associated junctions remain key constraints within the network, reflecting both the scale of forecast demand growth and the corridor's critical role in accommodating regional movements.

Mode Choice and Public Transport

- 6.3.11 The modelled results show limited change in public transport usage between the 'With LDP scenario' and 'Mitigated' scenarios.
- 6.3.12 This reflects the fact that:
- the mitigation package is focused on highway interventions, and
 - the public transport network was unchanged within the modelling framework
- 6.3.13 As a result, improvements in highway performance do not translate into improved public transport connectivity or mode shift within the modelled scenario:
- improvements to road network performance may marginally reduce the relative attractiveness of public transport in some corridors
 - existing constraints on public transport capacity and coverage remain unchanged, limiting the ability of the network to accommodate significant additional demand by sustainable modes

Traffic Levels and Environmental Indicators

- 6.3.14 At a network level, the mitigation scenario results in:
- an increase in vehicle kilometres (approximately +9.5%)
 - an associated increase in transport-related emissions (approximately +7%)
- 6.3.15 These results indicate that improvements in network efficiency are partially offset by increased vehicle activity, resulting in a net increase in emissions.

Overall Interpretation

- 6.3.16 The modelling demonstrates that the mitigation package:
- performs effectively as a targeted highway intervention, reducing delay and improving resilience at key junctions
 - supports the continued operation of the strategic road network under forecast growth conditions
- 6.3.17 However:
- residual congestion remains, particularly in peak periods and at key strategic interfaces
 - public transport outcomes are largely unchanged, reflecting the absence of tested service enhancements

- vehicle kilometres and emissions increase, highlighting a tension with wider climate objectives

6.3.18 Overall, the mitigated scenario represents a partial response to the identified transport challenges. While it improves network performance, it does not fully address the underlying growth in travel demand or achieve a material shift towards more sustainable travel patterns.

6.3.19 This highlights the need for complementary measures if wider policy objectives relating to sustainable travel and decarbonisation are to be achieved.

6.4 STAG Appraisal

6.4.1 This section presents a structured appraisal of the mitigation package against the Transport Planning Objectives (TPOs), which reflect policy intentions, and the STAG criteria.

<ul style="list-style-type: none"> • A702 / A703 (Biggar Interchange): new roundabout and northbound bypass lane to A720 westbound slip • Straiton Interchange: extended left-turn lane and partial signalisation • Gilmerton Road Roundabout & Interchange: potential bypass lane and associated interchange amendments • Lasswade Road / Wadingburn Road: additional westbound approach lane • Millerhill Interchange (A68 WB to A720): dedicated bypass slip road 			
<p>The package is intended to address forecast delay, queuing and resilience issues at strategic junctions and approaches associated with growth under MLDP2, particularly around the Edinburgh City Bypass interfaces.</p>			
Transport Planning Objectives			
TPO 1 – Reduce the Need to Travel and Support Sustainable Connectivity	○		The package is focused on highway capacity and operational performance. It does not directly reduce the need to travel or materially improve connectivity by sustainable modes (e.g. public transport or active travel). As such, it does not change underlying trip-making drivers or improve the ability to travel between origins and destinations without reliance on the private car.
TPO 2 – Maximise the Use of Existing Public Transport Infrastructure	○		Model outputs indicate only small changes in public transport trips and mode share under the mitigated scenario, with negligible differences overall. Notably, the modelling indicates that road network performance improvements can reduce rail station usage (particularly Shawfair) due to improved highway generalised costs, while peak crowding constraints remain a limiting factor without rail capacity interventions. On that basis, the package does not strengthen use of existing public transport infrastructure and may marginally weaken the relative attractiveness of rail and bus-based connectivity in some corridors.
TPO 3 – Protect the Performance and Resilience of the Transport Network	✓✓		The mitigated scenario shows material reductions in delay at several key junctions, indicating improved network performance and resilience at known pressure points. For example, total AM junction delay reduces substantially at A702/A703 (from 758 to 97) and at Gilmerton (from 159 to 33), and PM delay also reduces at multiple locations including A702/A703 (from 526 to 148) and Gilmerton (from 154 to 36). While not all junctions improve equally in all periods, the package delivers a clear overall improvement in operational performance at the targeted nodes.
TPO 4 - Support Carbon Efficiency and Climate Objectives	○		The mitigated scenario results in a slight increase in emissions per capita relative to the “With LDP scenario” scenario (0.981 to 0.982 tCO ₂ e per capita), consistent with highway journey time improvements marginally increasing highway attractiveness. Overall, the package therefore performs neutral to slightly negative against carbon and climate objectives: it improves network efficiency and reduces delay but does so through capacity/attractiveness effects that increase vehicle activity and associated emissions.
STAG Criteria			
Environment	○	Biodiversity and Habitats	Across the package, multiple junction widening and slip/roundabout works imply land take and construction activity adjacent to existing road corridors. Effects are likely to be localised but cumulatively adverse, subject to detailed design and mitigation.
	○	Geology and Soils	Earthworks, drainage and pavement works at multiple sites will disturb soils locally. Impacts are expected to be manageable through standard construction controls, but the cumulative package effect is adverse overall.
	○	Land Use	Several measures (e.g., roundabout/slip changes) are likely to require land take beyond the existing highway boundary at some locations. While not expected to be major in strategic terms, the

			package increases the likelihood of interface impacts with adjacent land uses compared with a single-site intervention.
	○	Water, Drainage and Flooding	Additional impermeable surfacing across multiple locations increases runoff risk unless mitigated through appropriate drainage/SuDS. No specific flood constraints are identified in the draft for these locations, but drainage will be a design requirement.
	X	Air Quality	Reduced queuing and stop-start conditions at the targeted junctions may reduce localised idling emissions; however, the package increases vehicle kilometres and increases emissions overall, indicating a net adverse air quality direction at the strategic level.
	○	Historic Environment	No direct impacts on designated assets are identified at this appraisal stage. Effects are anticipated to be limited, subject to confirmation through detailed design and screening.
	○	Landscape	Physical enlargement of highway infrastructure at several prominent nodes will introduce localised landscape and townscape change. Effects are expected to be modest in scale but adverse overall.
	○	Noise and Vibration	A small increase in traffic activity (veh-km increase) would tend to increase noise exposure in some locations, partially offset by smoother traffic flow and reduced acceleration/deceleration at junctions.
	○	Overall Environment Impact	
Climate Change	X	Greenhouse Gas Emissions	Modelled outputs show a small increase in emissions per capita under mitigation (0.981 to 0.982 tCO ₂ e per capita), and total emissions increase by 1,232 tCO ₂ e (+7%). This indicates the package performs negatively against climate action objectives, as efficiency and delay reductions translate into increased vehicle activity overall.
	○	Vulnerability to the effects of Climate Change	The package does not materially change exposure to climate hazards relative to the baseline network, although it will require design that considers drainage and extreme weather performance at each location.
	○	Potential to adapt to the effects of Climate Change	There is opportunity to incorporate adaptation through drainage design and materials, but this is not an intrinsic outcome of the option at this stage.
	○	Overall Climate Change Impact	
Health, Safety and Wellbeing	✓	Accidents	Reducing delay, queuing and complex stop-start conditions at major junctions can improve operational safety by reducing conflict and driver frustration at known congestion points. The package's material reduction in delays at key nodes supports a modest beneficial direction.
	○	Security	No material changes anticipated.
	○	Health Outcomes	The package primarily supports car-based movement and does not deliver active travel improvements. Increased vehicle kilometres would tend to be adverse for health outcomes overall.
	○	Access to Health and Wellbeing Infrastructure	The package does not materially change access to health services by sustainable modes. Any time savings for car users are not expected to materially alter accessibility patterns at the plan level.
	○	Visual Amenity	Physical widening/expansion at multiple junctions is likely to reduce local visual amenity, albeit within transport-dominated environments.
	○	Overall Health, Safety and Wellbeing Impact	
Economy	✓✓	Transport Economic Efficiency (TEE)	The package delivers clear operational benefits at key nodes, with significant reductions in delay at several junctions (e.g., A702/A703 and Gilmerton) in AM and PM periods. These reductions translate into improved journey time reliability and reduced congestion costs for highway users in the affected corridors.
	✓	Wider Economic Impacts (WEIs)	By improving resilience on strategic approaches and junctions associated with access to the City Bypass, the package supports more reliable access to key employment areas and logistics corridors. Benefits are positive but primarily network-performance-driven rather than transformational.
	✓	Overall Economy Impact	

Equality and Accessibility		Public Transport Network Coverage	No direct change to service coverage is included. Modelled public transport outcomes under mitigation are negligible overall.
	○	Active Travel Network Coverage	No active travel enhancements are included and junction enlargement can increase severance and reduce comfort for non-motorised users if not mitigated through design.
	○	Comparative Access by People Group	As benefits are primarily realised by highway users, there is limited evidence that the package improves connectivity for non-car households or groups with restricted access to private vehicles.
	○	Comparative Access by Geographic Location	Targeted congestion relief at strategic junctions improves access reliability for communities and movements that depend on these corridors. Benefits are modest and focused on locations served by these nodes.
	○	Overall Equality and Accessibility Impact	
Implementability Criteria			
Feasibility	✓		The package comprises conventional highway interventions, generally feasible in engineering terms. However, several components (e.g., bypass slips, signalisation, interchange geometry changes) may carry site-specific constraints (land, standards, tie-ins) that need to be confirmed through design development. The A702 / A703 junction is likely to have higher feasibility constraints based on the topography of the area and constrained space. Delivery would also require coordination with Transport Scotland due to the strategic nature of several locations, particularly along the A720 corridor.
Affordability	○		Costs are likely to be materially higher than any single intervention due to the multi-site nature of the package, but still within the typical range of junction improvement programmes. However, the cost of the junction mitigation at the A702 / A703 could increase significantly due to space constraints. Indicative cost estimates using benchmark projects are ⁴ : <ul style="list-style-type: none"> • Large Roundabout (340m circumference): £15M–£17M • A702 to A720 Bypass Lane (152m): £3.3M–£3.8M • A720 Slip Road Widening (297m): £5.7M–£6.5M • Straiton Roundabout Signalisation: £3.7M–£4.3M • A7 NB to Gilmerton WB Bypass (307m): £8.2M–£9.2M • New Gilmerton Roundabout + Links: £24M–£27M • Lasswade Road WB Lane Addition: £4.7M–£5.3M • A68 WB to A720 Slip: £11M–£13M
Public Acceptability	✓		Congestion and reliability improvements are typically supported by highway users and businesses. However, acceptability risks may arise due to land take, construction disruption, and climate/perceived induced demand impacts.
Option Overview			
The combined mitigation package performs strongly against network performance and economic criteria, delivering material delay reductions at targeted strategic junctions and improving operational resilience at known pressure points. However, the package may have negative impacts against climate change objectives. Model outputs indicate a small increase in emissions per capita under mitigation (0.981 to 0.982 tCO ₂ e per capita), and an increase in vehicle kilometres (+9.5%) and total emissions (+7%). Overall, the package represents a pragmatic highway-performance response to forecast MLDP2 congestion pressures, but it is not a sustainable connectivity solution on its own and would benefit from complementary measures (e.g., bus priority / demand management / active travel mitigation at enlarged junctions) if alignment to NTS2 climate outcomes is to be strengthened			

6.5 Appraisal Overview

6.5.1 This chapter has presented a proportionate STAG appraisal of the proposed transport mitigation package identified to support delivery of the MLDP2 spatial strategy. The appraisal has drawn on evidence from strategic modelling and connectivity analysis to assess the extent

⁴ Feasibility estimates (±30%) based on UK benchmarks (Transport Scotland, National Highways, SPON). Includes construction, fees (10–12%) and contingency (20–30%).

to which the mitigation responds to the transport problems identified in Chapter 3 and supports delivery of the Transport Planning Objectives.

Key Findings

- 6.5.2 The appraisal demonstrates that the mitigation package performs most strongly in relation to network performance and economic efficiency.
- The modelled results indicate that the package delivers targeted reductions in delay and congestion at key junctions, particularly at locations where interventions were directly aligned to identified capacity constraints.
 - These improvements support Transport Planning Objective 3, by helping to maintain the operational performance and resilience of the strategic and local road network under forecast growth conditions.
 - In doing so, the package also provides wider economic benefits, improving journey time reliability and supporting access to key employment areas and regional transport corridors.
- 6.5.3 However, the appraisal also highlights a number of important limitations:
- Residual congestion remains, particularly at key interfaces with the A720 Edinburgh City Bypass and during peak periods, reflecting the underlying scale of growth in travel demand.
 - The mitigation package is predominantly highway-based, and as such delivers limited improvement in sustainable travel outcomes, with minimal change in public transport use under the modelled scenario.
 - The modelling indicates an increase in vehicle kilometres and associated emissions, demonstrating that while the package improves operational efficiency, it does not deliver a reduction in overall traffic activity or align fully with longer-term climate objectives.
- 6.5.4 Overall, the mitigation package represents a partial but necessary response to the transport impacts of the MLDP2. It is effective in addressing identified capacity and resilience issues but does not, in isolation, deliver sustainable connectivity outcomes or fully offset the increase in travel demand associated with planned growth.

Implications for the LDP2

- 6.5.5 Within the context of the LDP process, these findings are significant.
- 6.5.6 The appraisal demonstrates that:
- the proposed spatial strategy can be supported by a defined package of transport mitigation, consistent with the infrastructure-first principle set out in national policy and development planning guidance
 - there is clear evidence of the type and scale of intervention required to enable delivery of the Plan without unacceptable impacts on the transport network
 - however, it also demonstrates that additional measures, particularly in relation to public transport, demand management and active travel, are likely to be required over time to align delivery of the Plan with wider national policy objectives
- 6.5.7 As such, the transport appraisal supports the LDP2 by:
- identifying deliverable infrastructure requirements associated with the Plan
 - demonstrating a credible pathway to managing network performance impacts
 - highlighting where additional or complementary measures (particularly in relation to public transport and demand management) may be required over time

- 6.5.8 This aligns with the role of DPTAG within the LDP process, which is not to define a final scheme, but to demonstrate that development is supported by proportionate, evidence-based and deliverable transport interventions.

DRAFT

7 Sensitivity Tests

7.1 Overview

7.1.1 Sensitivity testing was undertaken to understand how the network responds to alternative assumptions regarding major infrastructure interventions that are not currently committed but may be delivered in the future. These tests are intended to:

- assess the robustness of the core mitigation strategy
- understand the extent to which additional infrastructure could address residual constraints
- identify where longer-term or strategic interventions may be required beyond the baseline mitigation package

7.1.2 This chapter draws together the key findings from the transport modelling, interpreting the flow and delay differences presented in the preceding figures and supported by the detailed outputs in Appendix A.5. The analysis considers both the core mitigation scenario and the sensitivity tests undertaken to reflect uncertainty in future infrastructure delivery, including Sheriffhall grade separation and the A701 relief road.

7.1.3 The results should be considered in the context of the wider modelling framework, recognising that the assessment focuses on changes in network performance between the 'With LDP scenario' and 'Mitigated' scenarios. The sensitivity tests therefore provide a complementary assessment to the core modelling, helping to distinguish between localised mitigation effects and wider strategic network constraints.

7.2 Network Performance – Flow and Delay Changes

7.2.1 Given the expected localised impact of the variations associated with the Sensitivity Scenario, changes in flow and delay (against the Mitigated Scenario) are the most suitable approach to evaluating their impact.

7.2.2 Figure 7.1, Figure 7.2, and Figure 7.3 present the change in road traffic flow, clearly showing improvements in the area, with higher flows on the City Bypass and approaching network, as well as the A701 Relief Road being well utilised. This indicates that the additional infrastructure increases the attractiveness of the strategic network, resulting in a reallocation of trips from secondary and local routes onto higher-capacity corridors.

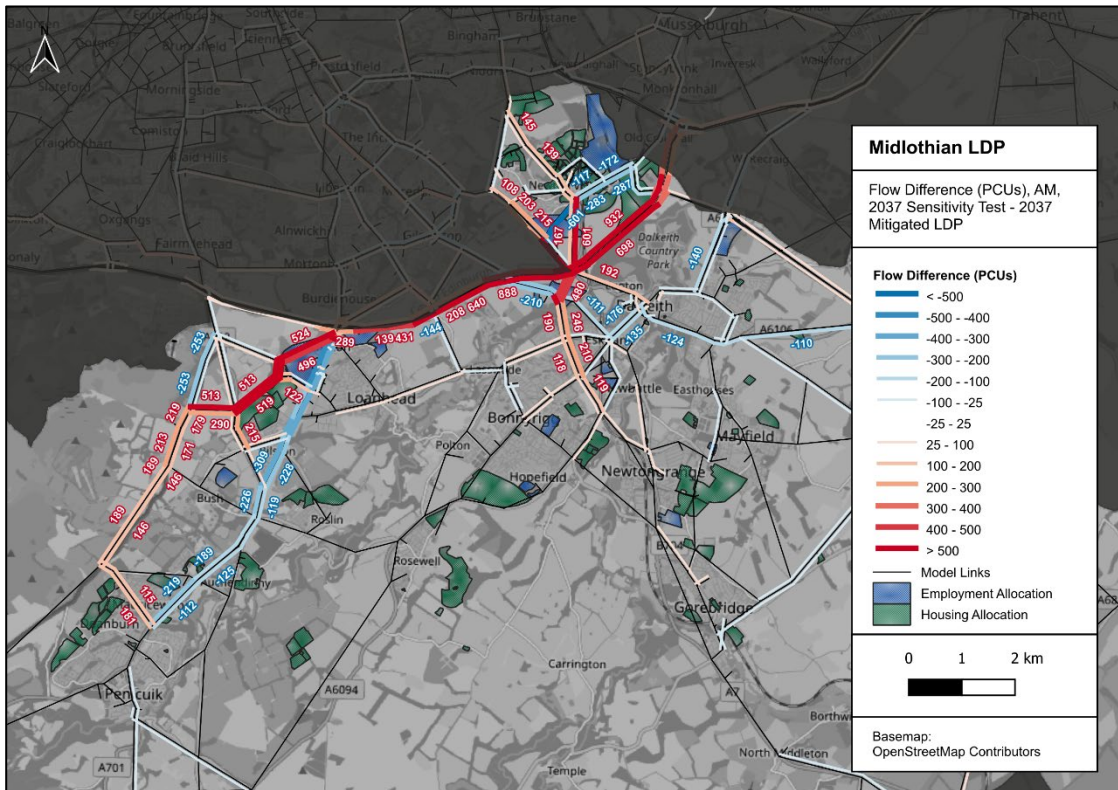


Figure 7.1: Actual Flow Difference, AM, 2037 With LDP scenario vs 2037 Sensitivity

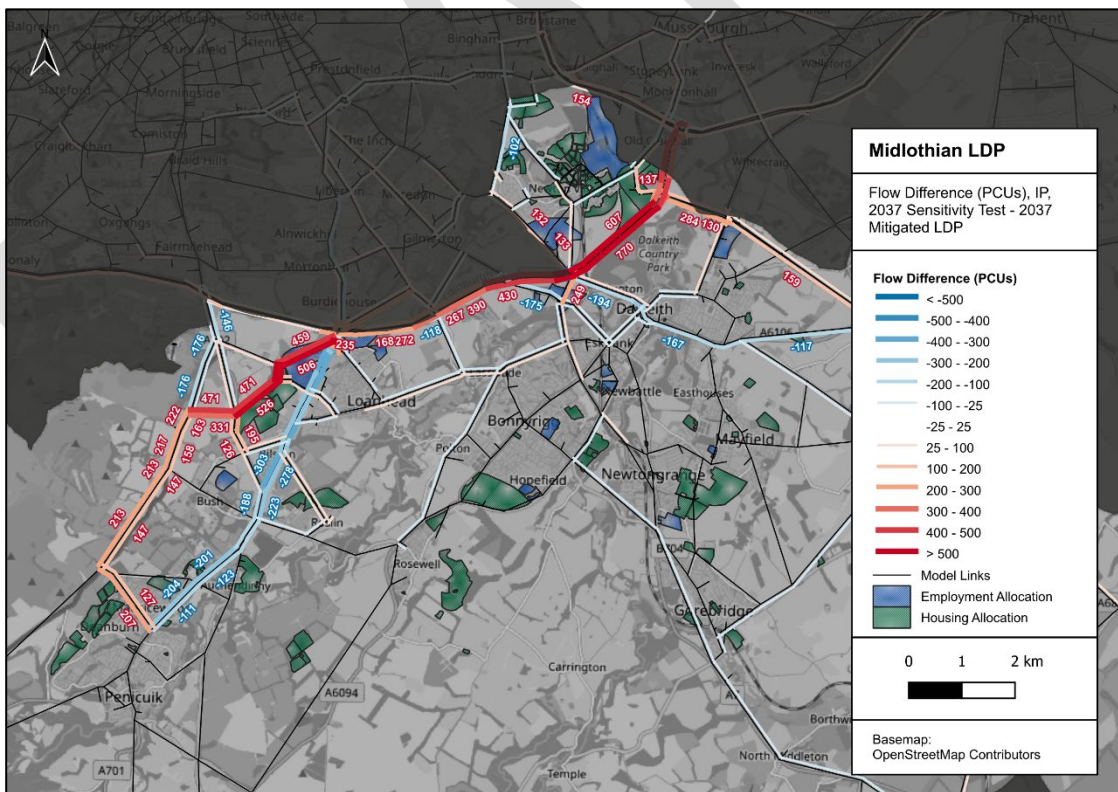


Figure 7.2: Actual Flow Difference, IP, 2037 With LDP scenario vs 2037 Sensitivity

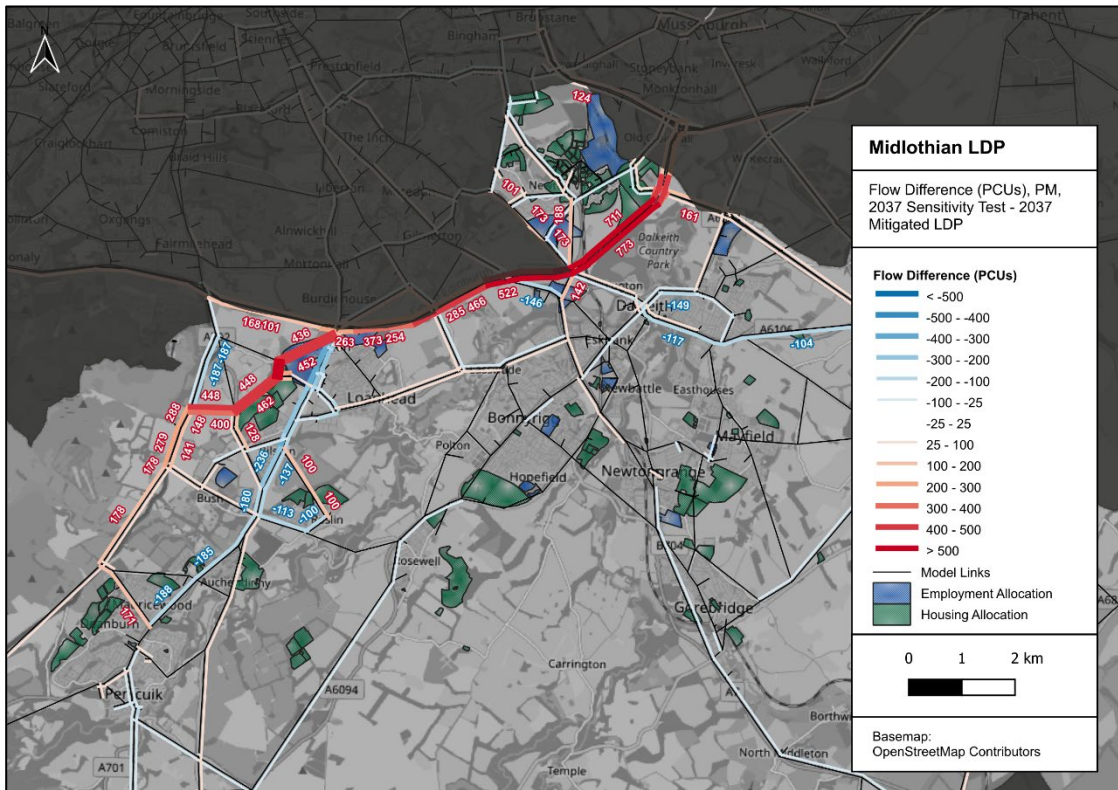


Figure 7.3: Actual Flow Difference, PM, 2037 With LDP scenario vs 2037 Sensitivity

7.2.3 The change in delay is presented for each time period in Figure 7.4, Figure 7.5, and Figure 7.6. While there are clear improvements in the immediate vicinity of Sheriffhall and the A701 Relief Road, the reallocation of traffic onto higher-capacity routes results in increased pressure at downstream junctions, particularly at Millerhill and Gilmerton.

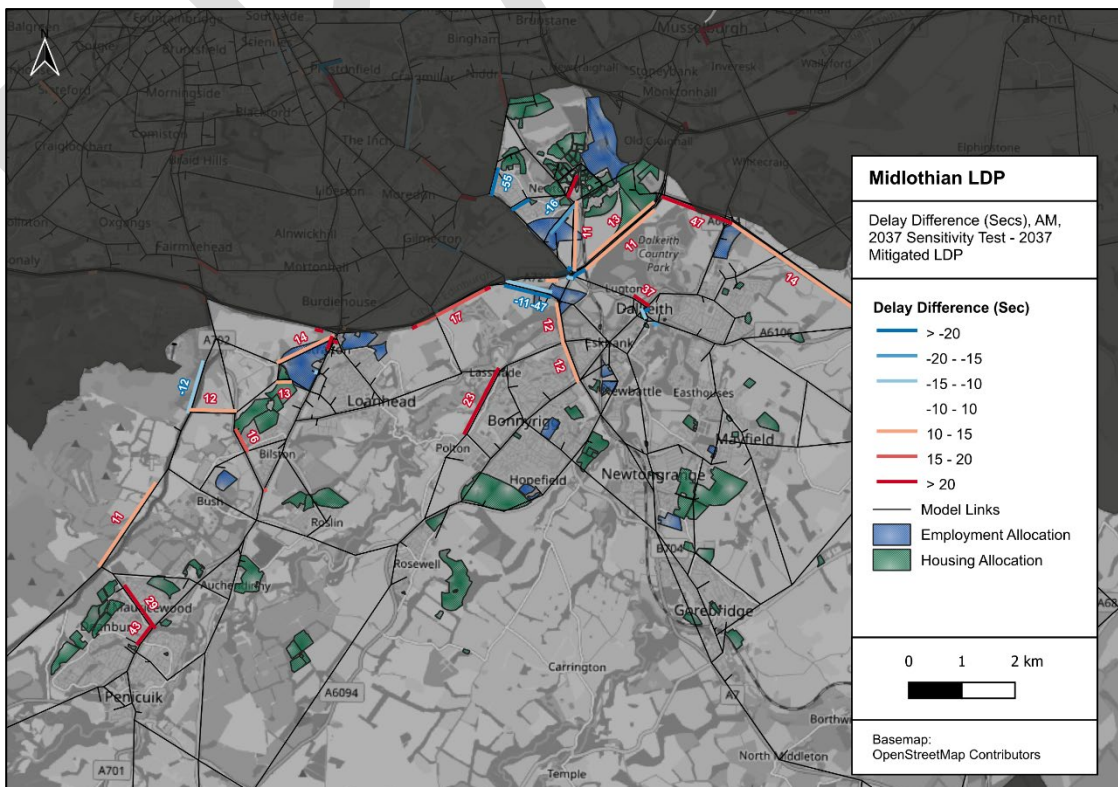


Figure 7.4: Delay Difference, AM, 2037 With LDP scenario vs 2037 Sensitivity

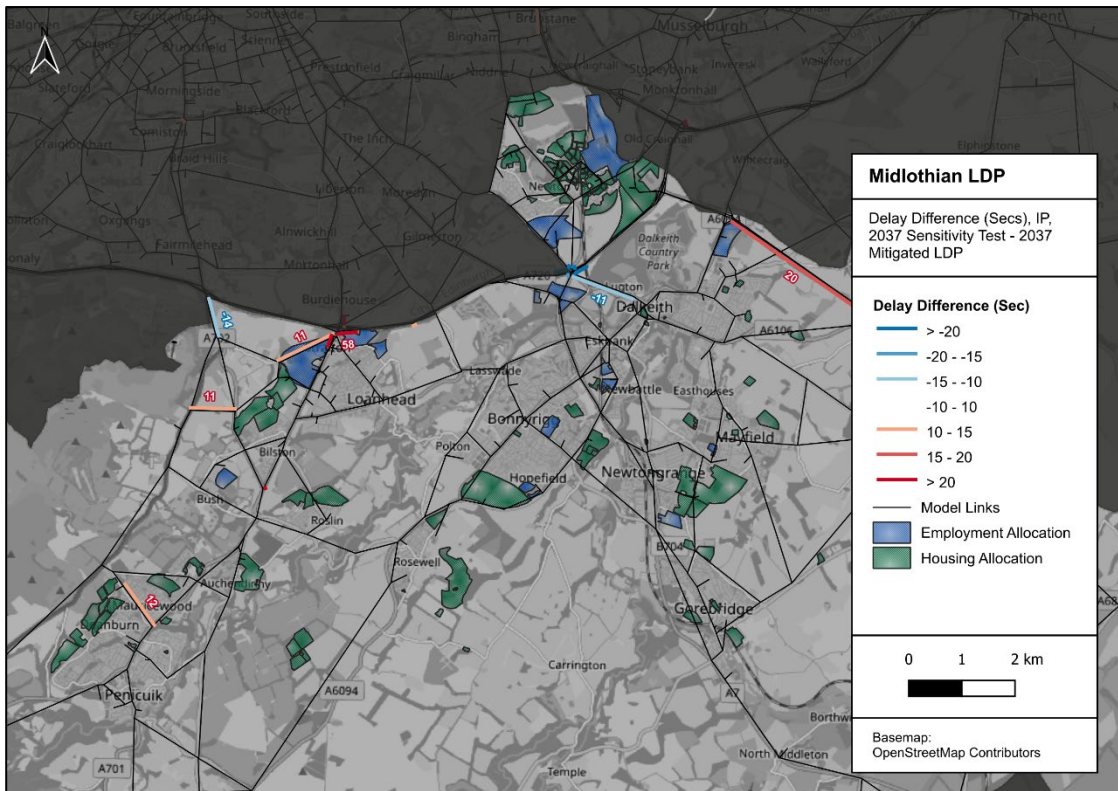


Figure 7.5: Delay Difference, IP, 2037 With LDP scenario vs 2037 Sensitivity

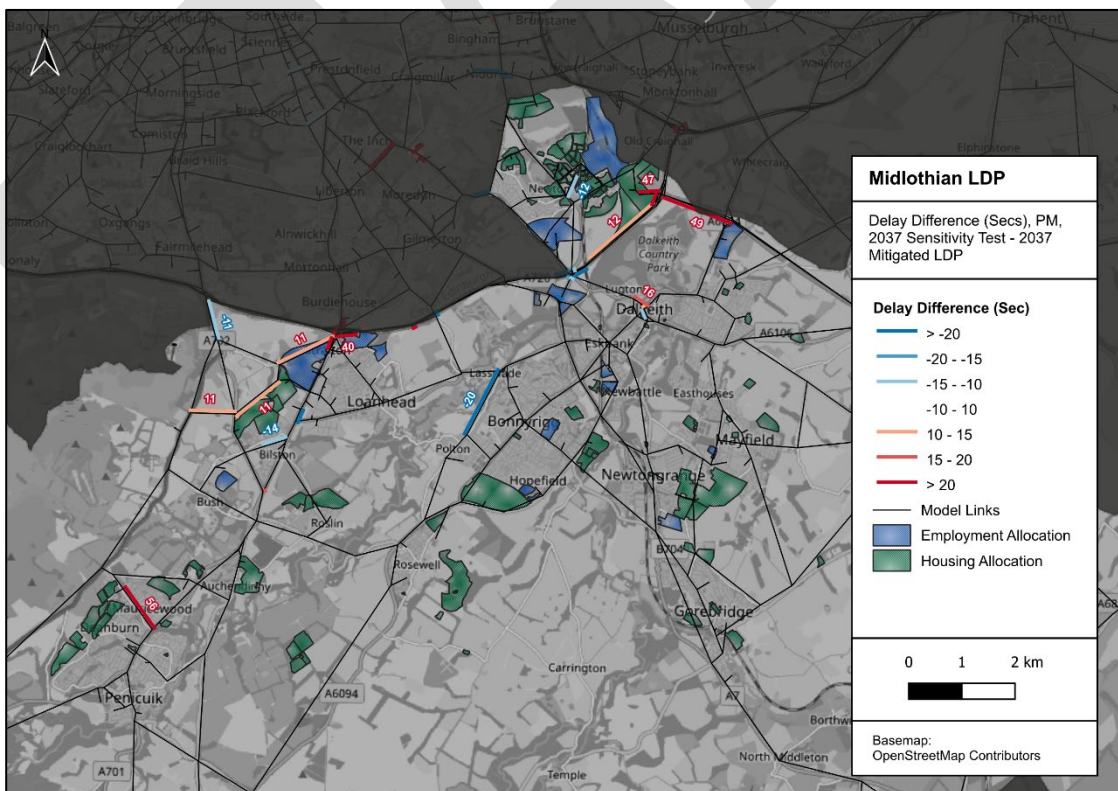


Figure 7.6. Delay Difference, PM, 2037 With LDP scenario vs 2037 Sensitivity

7.2.4 These changes in flow and delay also translate into changes in connectivity across the network. Reduced delay at key junctions improves journey times and network efficiency; however, increased congestion at downstream locations can offset these benefits. This demonstrates that improvements in connectivity depend on the performance of the wider network rather than isolated interventions.

7.3 Junction Performance and Network Resilience

7.3.1 The appendix provides detailed junction-level performance summaries for flow, delay and queuing. These show that:

- many junctions experience reduced delay in one or both peak periods, with some locations showing substantial improvements relative to both the 'Without LDP' and 'With LDP scenario' scenarios
- queue lengths generally reduce where delay reductions are achieved, indicating improved operational efficiency at key nodes
- in some locations, particularly where flows increase significantly, residual delay remains, reflecting the interaction between increased demand and available capacity

7.3.2 This reflects the interaction between increased demand and available capacity, where improvements at one location can result in the redistribution of pressure elsewhere in the network.

7.3.3 Importantly, the modelling indicates that the mitigation measures:

- improve throughput at constrained junctions
- reduce the propagation of delay across the network
- contribute to improved journey time reliability on key corridors

7.3.4 Nevertheless, the persistence of congestion in certain areas highlights the limits of the mitigation package in accommodating the full extent of forecast growth.

7.4 Strategic Network Effects

7.4.1 At a network level, the combined effect of the interventions is to:

- maintain operational performance on key radial routes into Edinburgh
- reduce the intensity of congestion at specific pressure points
- allow additional trips associated with the LDP to be accommodated more efficiently

7.4.2 However, the modelling also indicates that:

- the A720 corridor remains a critical constraint, with limited capacity to absorb additional demand
- the mitigation package leads to an increase in total vehicle kilometres, reflecting both traffic reassignment and the improved attractiveness of the network for longer-distance trips

7.4.3 This reinforces the conclusion that while the proposed measures are necessary to support the LDP, they are not sufficient in isolation to deliver a fully unconstrained network. This indicates that, while strategic infrastructure improvements can enhance performance locally, they do not remove the underlying growth in travel demand or the resulting pressure on the wider network.

7.5 Summary of Key Findings

7.5.1 Drawing together the evidence from the modelling and supporting analysis, the sensitivity testing demonstrates that:

- the mitigation package delivers targeted improvements in delay and queuing, particularly at key junctions
- flow redistribution indicates more efficient use of the network, with traffic moving onto higher-capacity routes
- however, this redistribution also results in increased pressure at downstream locations and strategic interfaces
- residual congestion remains, particularly on corridors such as the A720
- network performance improvements are variable by location and time period, reflecting demand patterns and network interactions
- sensitivity testing demonstrates that additional infrastructure interventions can further improve performance, particularly at strategic bottlenecks, but do not fully resolve system-wide constraints

7.5.2 Overall, the modelling confirms that the proposed mitigation measures are an important component in supporting delivery of the LDP. However, the sensitivity testing demonstrates that:

- continued pressure on the transport network is expected under forecast growth conditions
- additional strategic infrastructure can provide further improvements, particularly at key bottlenecks
- a combination of interventions, including demand management and enhanced sustainable transport provision, is likely to be required to achieve long-term transport and policy objectives

8 Conclusions

8.1 Summary

- 8.1.1 This report has presented a comprehensive transport appraisal of the Proposed Midlothian Local Development Plan 2 (MLDP2), undertaken in accordance with Development Planning Transport Appraisal Guidance (DPTAG). The appraisal has followed a structured and evidence-led approach, linking identified transport problems to clearly defined Transport Planning Objectives (TPOs) and the development and testing of mitigation measures through strategic modelling and supporting analysis.
- 8.1.2 The findings provide a robust technical evidence base to inform plan-making and demonstrate how the transport implications of the MLDP2 spatial strategy can be understood in terms of both network performance and connectivity and addressed at a strategic level.

8.2 Key Findings

Growth in Demand and Travel Patterns

- 8.2.1 The MLDP2 introduces a significant increase in travel demand driven primarily by residential growth. By 2037, households and population are forecast to increase by approximately 16%, with employment increasing by around 8%.
- 8.2.2 This growth results in a corresponding increase in travel demand, including:
- a 13% increase in trip productions and a 5% increase in attractions
 - strengthening of outbound commuting patterns, particularly towards Edinburgh
- 8.2.3 The imbalance between productions and attractions reinforces Midlothian's role as a net exporter of labour, placing increased pressure on radial corridors and peak-period movements, particularly those connecting Midlothian to Edinburgh.

Network Performance and Constraints

- 8.2.4 The transport modelling demonstrates that the introduction of MLDP2 development exacerbates existing capacity constraints across the network, rather than creating entirely new pressure points.
- 8.2.5 Key impacts include:
- increased flows, congestion, delay and queuing at strategic junctions and corridors.
 - a further 5% increase in total vehicle journey time beyond background growth.
 - reductions in peak-period speeds and declining journey time reliability.
- 8.2.6 Pressure is particularly concentrated on:
- approaches to the A720 Edinburgh City Bypass
 - strategic radial corridors
 - major junctions in northern Midlothian
- 8.2.7 These findings indicate a reduction in overall network resilience and an increased risk of congestion-related disruption and reduced reliability of journeys across the network. These changes also result in a deterioration in connectivity, with longer and less reliable journey times affecting the ability to travel efficiently between key origins and destinations.

Public Transport and Mode Share

8.2.8 While public transport use increases in absolute terms, the modelling shows only modest improvements in mode share, typically in the range of 1–2 percentage points.

8.2.9 This reflects:

- relatively good connectivity of some development sites
- increased congestion improving the relative attractiveness of rail

8.2.10 However:

- the private car remains the dominant mode
- rail services experience increased crowding, particularly in peak periods

8.2.11 This indicates that, without further intervention, the MLDP2 will not result in a fundamental shift away from car dependency or significantly improve connectivity by sustainable modes.

Carbon and Environmental Outcomes

8.2.12 The appraisal identifies mixed outcomes in relation to carbon emissions:

- total vehicle kilometres and overall emissions increase
- emissions per capita decrease slightly (approximately 0.8%)

8.2.13 This reflects increased efficiency and improved connectivity but does not offset absolute growth in emissions. Accordingly, the MLDP2 does not, in isolation, achieve alignment with long-term decarbonisation objectives.

8.3 Performance of the Mitigation Strategy

Effectiveness of Highway Mitigation

8.3.1 The modelled mitigation package demonstrates that targeted highway interventions can reduce congestion and improve operational performance at key locations.

8.3.2 Notable outcomes include:

- significant reductions in delay at key junctions such as A702/A703 and Gilmerton
- improved throughput and localised resilience
- better management of peak-period demand at constrained nodes

8.3.3 These improvements support the continued functioning of the network and maintaining connectivity across key corridors under forecast growth conditions.

Residual Impacts

8.3.4 Despite these benefits, the mitigation package does not fully resolve all issues:

- residual congestion remains, particularly at strategic interfaces such as the A720
- network pressures persist during peak periods
- improvements are uneven across locations and time periods

8.3.5 This reflects the scale of growth and the limitations of targeted infrastructure interventions in addressing system-wide demand increases and the resulting pressure on strategic corridors.

Sustainable Transport Outcomes

8.3.6 The mitigation package is predominantly highway-focused and does not materially improve sustainable transport outcomes.

- public transport usage and mode share remain largely unchanged
- no significant improvement in active travel or behavioural change is demonstrated

8.3.7 In addition, improved road performance leads to:

- increased vehicle kilometres
- increased emissions at the network level

8.3.8 This highlights a clear tension between improvements in network efficiency and wider climate and policy objectives.

8.4 Sensitivity Testing

8.4.1 Sensitivity testing incorporating additional infrastructure (including Sheriffhall grade separation and the A701 Relief Road) demonstrates that:

- further localised improvements in flow and delay can be achieved
- traffic is redistributed across the network, reducing pressure in some locations
- new or intensified pressures can emerge downstream

8.4.2 These results confirm that while major infrastructure can provide additional benefits, it does not fully eliminate network constraints or the underlying growth in travel demand driving these impacts.

8.5 Limitations of the Assessment

8.5.1 The conclusions drawn from this appraisal should be considered in light of the following limitations:

- the use of a strategic model, which captures network-wide trends rather than detailed local conditions
- a modelling framework in which the public transport network is largely held constant
- the absence of detailed testing of public transport or behavioural interventions

8.5.2 These limitations are consistent with the stage of development planning and the requirements of DPTAG but indicate areas where further work will be required at subsequent stages.

8.6 Overall Conclusion

8.6.1 The transport appraisal demonstrates that the MLDP2 spatial strategy results in a substantial increase in travel demand, which intensifies existing pressures on the transport network.

8.6.2 The proposed mitigation package provides a necessary and effective response at key locations, improving network performance and enabling the Plan to be supported in transport terms. However, it represents a partial solution, addressing operational constraints at key locations but not fully resolving underlying demand pressures or delivering wider sustainable transport outcomes.

8.6.3 In particular, the appraisal demonstrates that:

- highway interventions improve performance and resilience at key locations, but do not eliminate congestion across the wider network
- sustainable transport outcomes and improvements in connectivity by non-car modes remain limited without additional interventions
- absolute emissions increase, despite improvements in carbon efficiency, indicating misalignment with long-term climate objectives

8.6.4 Overall, the MLDP2 is capable of being supported by a defined package of transport mitigation, consistent with the infrastructure-first principle. However, the appraisal demonstrates that a broader, multi-modal approach will be required over time to:

- support greater modal shift away from the private car
- improve connectivity to key destinations by sustainable modes
- and align development with national climate and transport policy objectives

8.7 Implications for the Local Development Plan

8.7.1 The findings of this appraisal provide clarity on both the opportunities and constraints associated with the MLDP2:

- the Plan can be delivered with identified infrastructure interventions
- there is a clear evidence base for the scale and location of mitigation required
- additional complementary measures, particularly in relation to public transport, demand management and active travel, will be necessary beyond the core mitigation package

8.7.2 This reinforces the role of the transport appraisal in supporting a proportionate, evidence-based and deliverable development strategy, while recognising that continued intervention, monitoring and collaboration will be required to respond to future growth and evolving policy requirements.

Appendix A Application of SEStran Regional Model

A.1 Overview

- A.1.1 The SEStran Regional Model (SRM) was used to inform the Appraisal of the implications of housing and economic land allocations on the transport network.
- A.1.2 The SRM version applied is that provided from the 2018-2045 sub national forecasting specification (SRM12_v4.1.7_High) by Transport Scotland.

SRM Model Dimensions

- A.1.3 Forecast traffic demand matrices were prepared based on SRM traffic forecasts for defined scenarios.
- A.1.4 A review of SRM was undertaken based on initial application and model outputs to check the suitability of the model to be used to support the MLDP2 Appraisal and Assessment. Reflecting the strategic nature of the model and its intended purpose, this identified some weaknesses in terms of the relative coarseness of the zone system and road network in Midlothian. In discussion with Midlothian Council and Transport Scotland, it was considered that SRM provides sufficient information for the network assessment and to identify an initial list of required mitigation interventions.
- A.1.5 Some amendments were made to both network representation and the representation of the development plan scenario for Midlothian Council to ensure that the Proposed Plan is suitably represented at the strategic level. Otherwise, no changes were made to SRM for the MLDP2 modelling assessment.
- A.1.6 The SRM is representative of average weekday travel movements within which the following time periods are modelled:
- average weekday (AM) morning peak: 07:00-10:00;
 - average weekday (IP) inter peak: 10:00-16:00; and
 - average weekday (PM) evening peak: 16:00-19:00.
- A.1.7 Individual factors are applied by mode and period to create an 'average' peak hour within each peak period.
- A.1.8 The model as provided contained a 2018 Baseline year, as well as several forecast year scenarios, differentiated by year and also policy scenario. The key scenarios which were utilised in this study as a starting point are highlighted in red in Table A-1.

Table A-1: List of Supplied SRM Scenarios

Year	Network	Demand	TELMoS	Model Name
2018	RC18	BS18A	0	2027 Baseline
2025	FTH25	YA25_High	YA	2025 "Without Policy"
2030	FTH30	YA30_High	YA	2030 "Without Policy"
2035	FTH35	YA35_High	YA	2035 "Without Policy"
2040	FTH40	YA40_High	YA	2040 "Without Policy"
2045	FTH45	YA45_High	YA	2045 "Without Policy"
2025	FTIb25	YC25B_Low	YC	2025 "With Policy"
2030	FTL30	YC30_Low	YC	2030 "With Policy"
2035	FTL35	YC35_Low	YC	2035 "With Policy"
2040	FTL40	YC40_Low	YC	2040 "With Policy"
2045	FTL45	YC45_Low	YC	2045 "With Policy"

- A.1.9 From these starting scenarios a further set of bespoke scenarios were developed which considered changes in land use (demand) and supply (networks) for each year.
- A.1.10 Two new forecast networks were prepared based on the 2025 FTH25 coding which included the infrastructure changes noted in Table 3-5. The only other difference between these scenarios was in the values of time.
- A.1.11 Demand for three scenarios was generated through a series of pivots which varied by geography as noted below in Figure A.1.



Figure A.1: Approach to Demand Derivation by Scenario and Region

- A.1.12 A series of bespoke SRM modelled scenarios were then prepared based on combinations of new planning data and supply networks, as noted in Table A-2.

Table A-2: List of MLDP2 SRM Scenarios

Year	Network	Demand	Planning Data Scenario	Model Name
2027	MLP06	MLR27H	MLR	2027 Baseline
2037	MLP07	MLR37H	MLR	2037 Without LDP
2037	MLP07	MLS37H	MLS	2037 With LDP scenario
2037	MLP12	MLS37H	MLS	2037 Mitigated
2037	MLP13	MLS37H	MLS	2037 Sensitivity

A.1.13 The road assignment model includes five assigned vehicle types and journey purposes as follows:

- Car In-Work;
- Car Non-Work Commuter;
- Car Non-Work Other;
- LGV; and
- HGV.

A.1.14 The PT assignment model includes three assigned PT purposes as follows:

- PT In-Work;
- PT Non-Work Commute; and
- PT Non-Work Other.

Sector System

A.1.15 For the purposes of analysing the LDP scenarios, a matrix sector system was prepared as illustrated in Figure A.2 and presented in Table A-3. A sector system combines a number of zones together for the purpose of reporting. This sector system represents Midlothian via nine sectors and aggregates the other local authorities within the SRM modelled area. In addition to these, the external trips (all movements to/from outwith the SRM area) were included in a single sector.

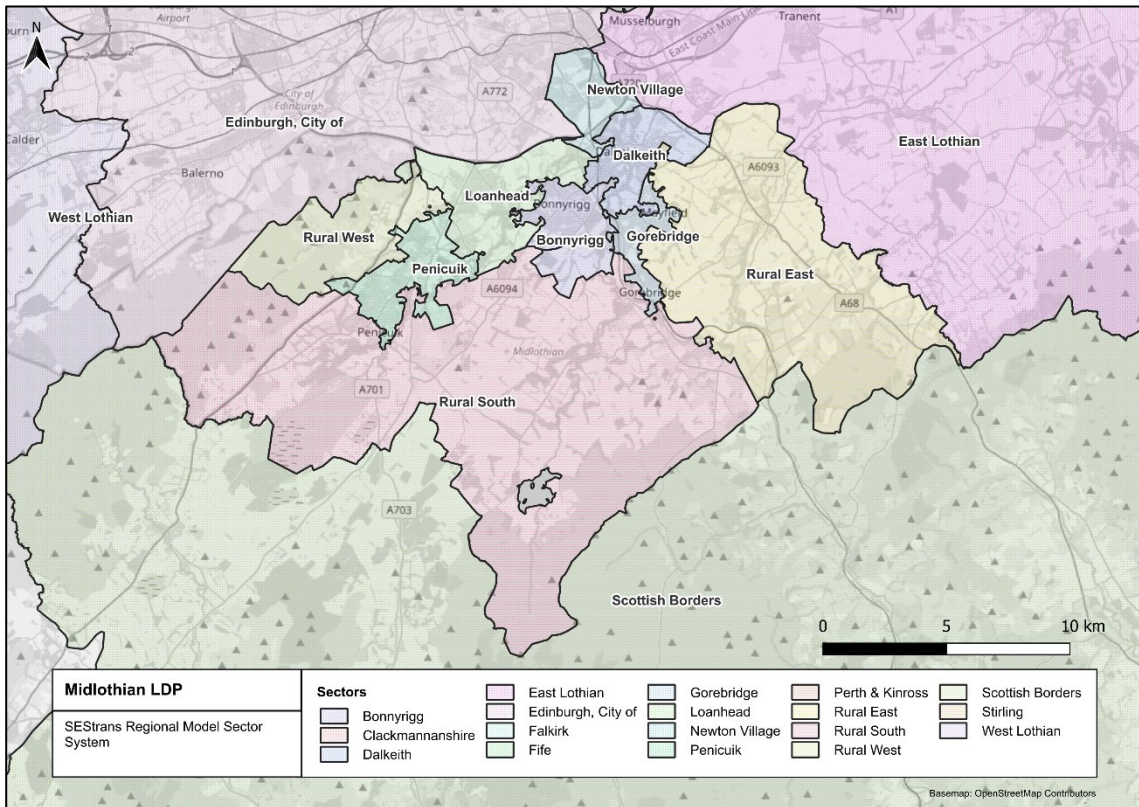


Figure A.2: SRM Zone Sector System (Midlothian)

Table A-3: Sector System

Sector	Sector Name	Sector	Sector Name
1	Newton Village	10	Edinburgh, City of
2	Dalkeith	11	Scottish Borders
3	Bonnyrigg	12	East Lothian
4	Loanhead	13	West Lothian
5	Gorebridge	14	Falkirk
6	Penicuik	15	Clackmannanshire
7	Rural West	16	Fife
8	Rural South	17	Perth & Kinross
9	Rural East	18	Stirling

Key Corridors

A.1.16 The following key corridors were defined in the SRM for the MLDP2 Appraisal:

- A68 Fala Village to the City of Edinburgh Bypass;
- A7 Falahill to the City of Edinburgh Bypass;
- A701 Leadburn and Seafield Moor Road to Hillingdon
- A702 Carlops to the City of Edinburgh Bypass; and
- the City of Edinburgh Bypass between Old Craighall and Fairmilehead.

A.1.17 The location of these key corridors is illustrated in Figure A.3.

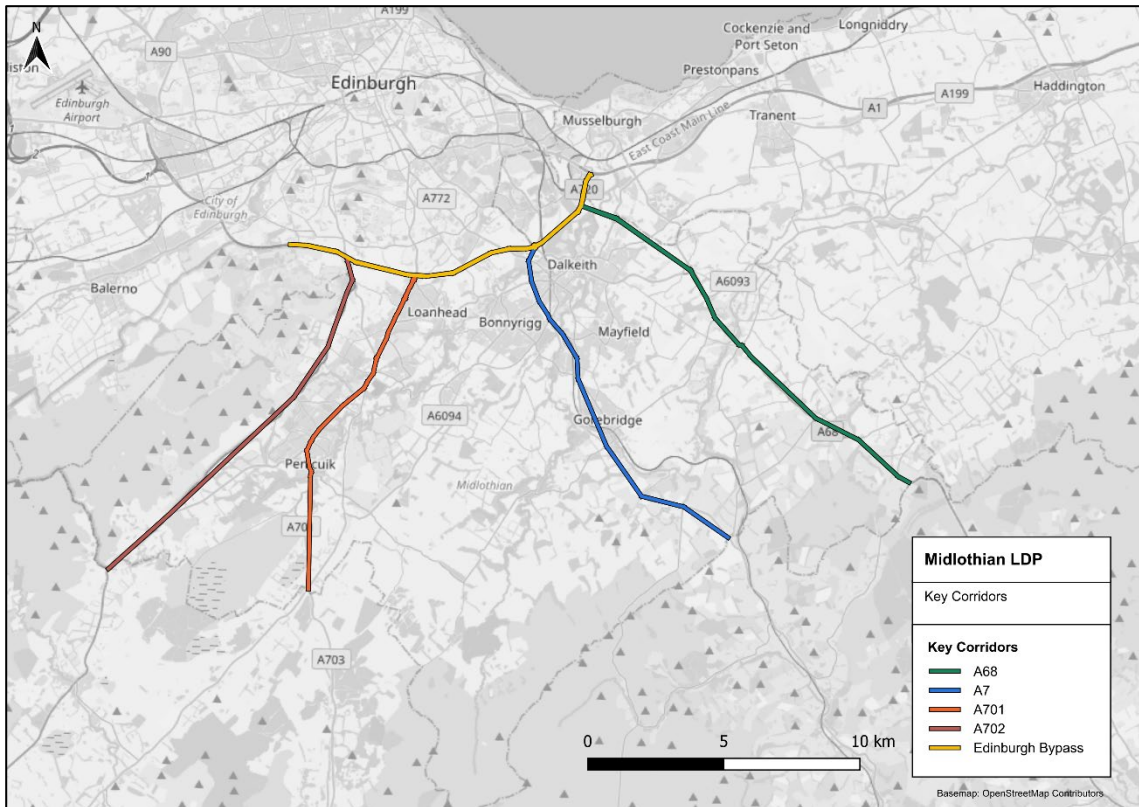


Figure A.3: SRM Key Corridors

SRM Observations for MLDP2

A.1.18 The initial application of SRM for the MLDP2 demonstrated intuitive responses of acceptable degrees of magnitude at the strategic level. However, there were instances in the model outputs where delays and capacity issues were found at locations where this would not be expected. These included (for example):

- “dummy” nodes – (Nodal points on the road network to improve the visual representation of the links) capacity constraints at dummy nodes resulting in higher V/C (volume / capacity) values than preceding and following road network segments; and
- diverges – delays and capacity issues at dual carriageway diverges, due to shared lane capacity reductions.

A.1.19 These issues were reviewed and were not considered to impact on the key model comparisons between MLDP2 scenarios.

A.2 LDP2 Travel Demand Forecasts

A.2.1 This section describes the forecast travel demand and network impacts predicted from the SRM trip end model, which is independent of supply network and represents overall daily amounts of travel demand by all modes.

A.2.2 As noted in Table A-2, only three explicit travel demand scenarios were prepared reflecting:

- 2027 Baseline;
- 2037 Without LDP2; and

- 2037 With LDP scenario2, noting this demand is applied to three separate supply networks including:
 - 2037 Reference Case network, MLP07;
 - 2037 mitigated network, MLP12; and
 - 2037 sensitivity network, MLP13;

SRM Trip Rates

- A.2.3 The SRM has an implied set of trip rates within all zones, and as such trip making relating to new development is broadly in line with the respective zones into which they are allocated. However, on analysing the outputs of the initial LDP scenario, it was apparent that the absolute level of trips generated and attracted was not of the order which would be expected from some of the developments. This could be partly explained by the application of future year household densities from TELMoS, which may underestimate MLDP2 population growth at some locations.
- A.2.4 Agreement is sought on appropriate uplift factors for the trip rates adopted in the model.

Trip Productions and Attractions

- A.2.5 As noted above, planning data was treated uniquely in two modelled regions, i.e., Midlothian local authority and the remaining modelled area. Between the 2027 Baseline and 2037 Without LDP scenario, only modest growth was included in Midlothian, reflecting those committed developments discussed above in Section 3.2. The remaining modelled area has had the entirety of forecasting planning data included in the first stage (2037 Without LDP), while there is no associated uplift once the LDP is introduced.
- A.2.6 Table A-4 shows the actual productions and attractions which were introduced in each area of the model. Note that attractions in the SRM are weights as opposed to absolute trips. These weights were generated based on both employment and population data and were also rebalanced as a total to overall productions, and therefore there are predicted changes outside Midlothian as a consequence of the LDP being introduced.

Table A-4: Summary 12-hour Trip Productions and Attractions by SRM Region

Sector	2027 Baseline	2037 Without LDP (versus 2027 Baseline)			2037 With LDP scenario (versus 2037 Without LDP)		
	Actual	Actual	Diff	% Diff	Actual	Diff	% Diff
Productions							
Midlothian	98,177	100,245	2,068	2%	114,955	14,710	15%
Elsewhere	1,469,752	1,478,972	9,220	1%	1,478,972	0	0%
Total	1,567,929	1,579,217	11,288	1%	1,593,927	14,710	1%
Attractions							
Midlothian	64,303	64,533	230	0%	68,220	3,686	6%
Elsewhere	1,017,754	1,040,471	22,717	2%	1,042,734	2,263	0%
Total	1,082,057	1,105,005	22,947	2%	1,110,954	5,949	1%

- A.2.7 A further breakdown by sector within Midlothian is provided in Figure A.4 and Figure A.5 for productions and attractions respectively. All bars have an absolute total at the end for reference. The 2037 Without LDP shows percentage change from the 2027 Baseline while the 2037 With

LDP scenario provide a percentage change from the 2037 Without LDP scenario, allowing readers to identify the scale of change introduced at each step.

- A.2.8 As expected, there are generally modest changes in productions introduced within Midlothian between the 2027 Baseline and 2037 Without LDP scenarios as only developments actively under construction were included. The largest change here is in Newton Village. Attractions have a larger change as there are more people throughout the SEStran area, and some of these visit Midlothian for various reasons, hence the change in attractions is slightly higher.
- A.2.9 Comparing the impact of the LDP (2037 With LDP scenario versus 2037 Without LDP) highlights much larger changes in productions across most sectors, but typically smaller increase in attractions in absolute and percentage terms.

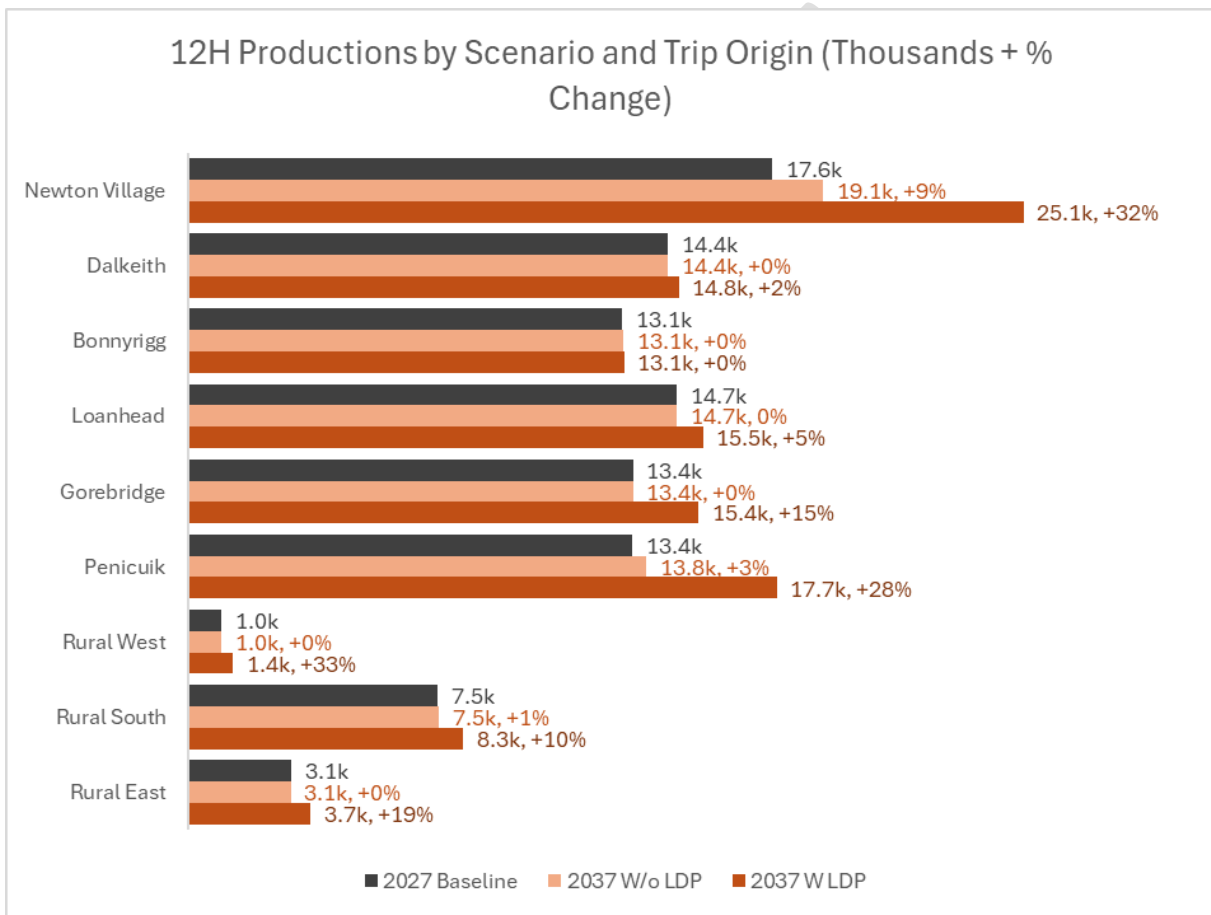


Figure A.4: Summary 12-hour Trip Origins

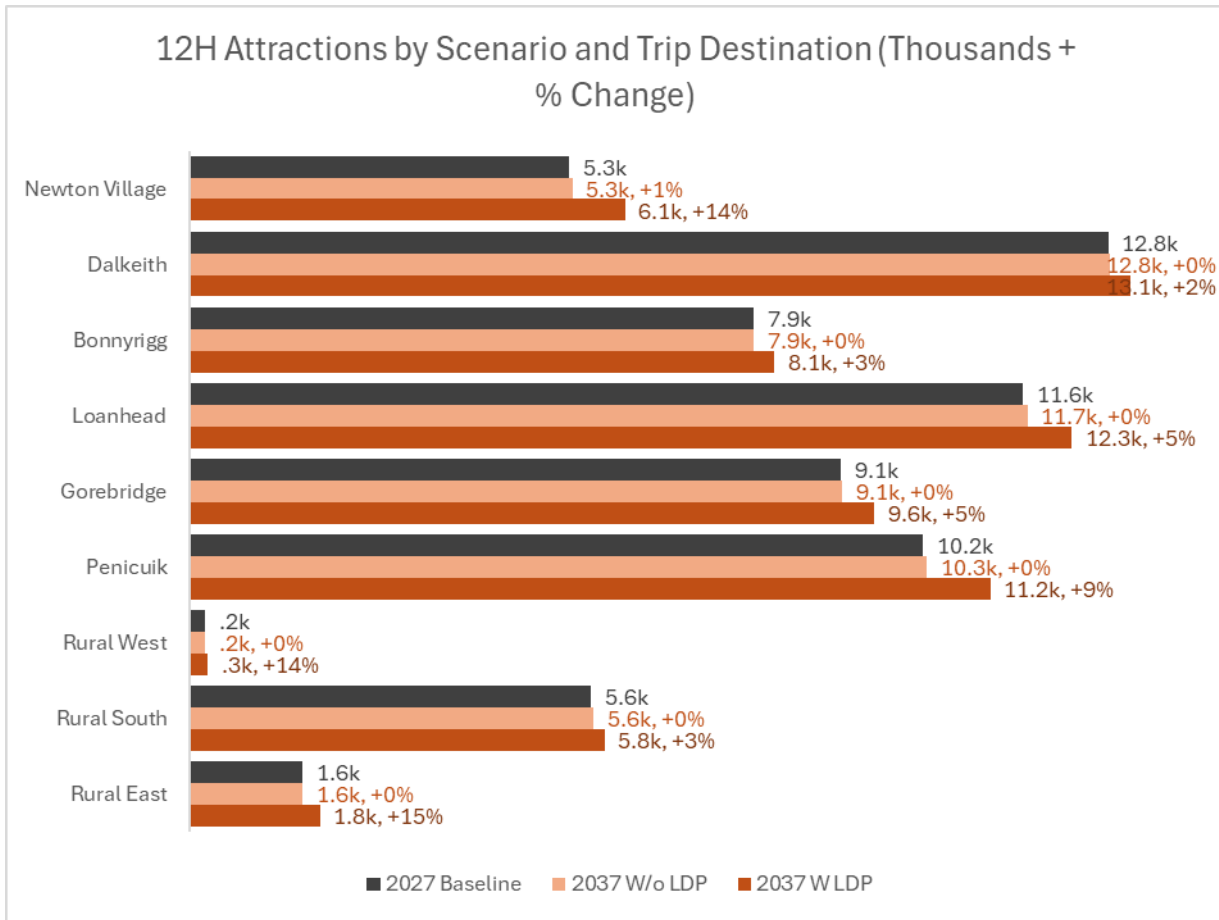


Figure A.5: Summary 12-hour Trip Destinations

A.3 LDP2 Impact on Transport Network

A.3.1 This section describes the forecast travel demand and network impacts predicted from the SRM, which includes a cost response from the supply network and the impact of mode and destination choice. Three scenarios are considered, with differences always presented pivoting between the directly preceding scenario:

- 2027 Baseline;
- 2037 Without LDP; and
- 2037 With LDP scenario.

Trip Origins and Destinations

A.3.2 Productions and attractions are converted within the model to directional trips as origins and destinations. As an example of the difference, a production is typically associated with the home end of a person but in the evening peak (PM) a standard commuter will typically travel from work (their origin) to home (their destination). SRM presents trips by time period in origin destination format within the assignment models, and the totals will change from productions and attractions, particularly when considering directions.

A.3.3 The forecast number of car and public transport trips in terms of total origins and destinations by Midlothian sectors is presented in Figure A.6 and Figure A.7 respectively, presented as a 12-hour total. Inspection of these values reveals a predicted increase in trips by mode in all sectors within Midlothian, which is in line with the land-use forecasts, particularly the population projections which drive the travel demand forecasting procedures in SRM.

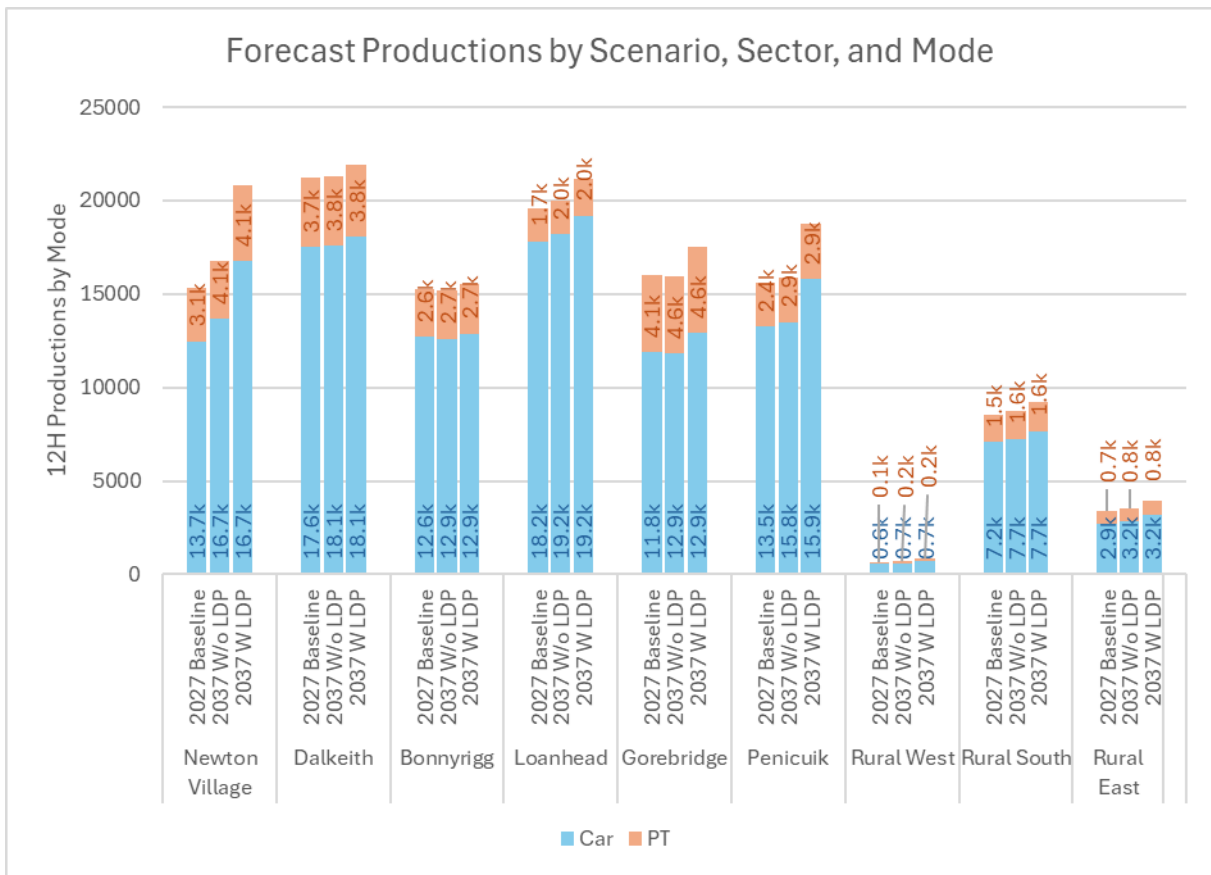


Figure A.6: Forecast Productions by Scenario, Sector, and Mode

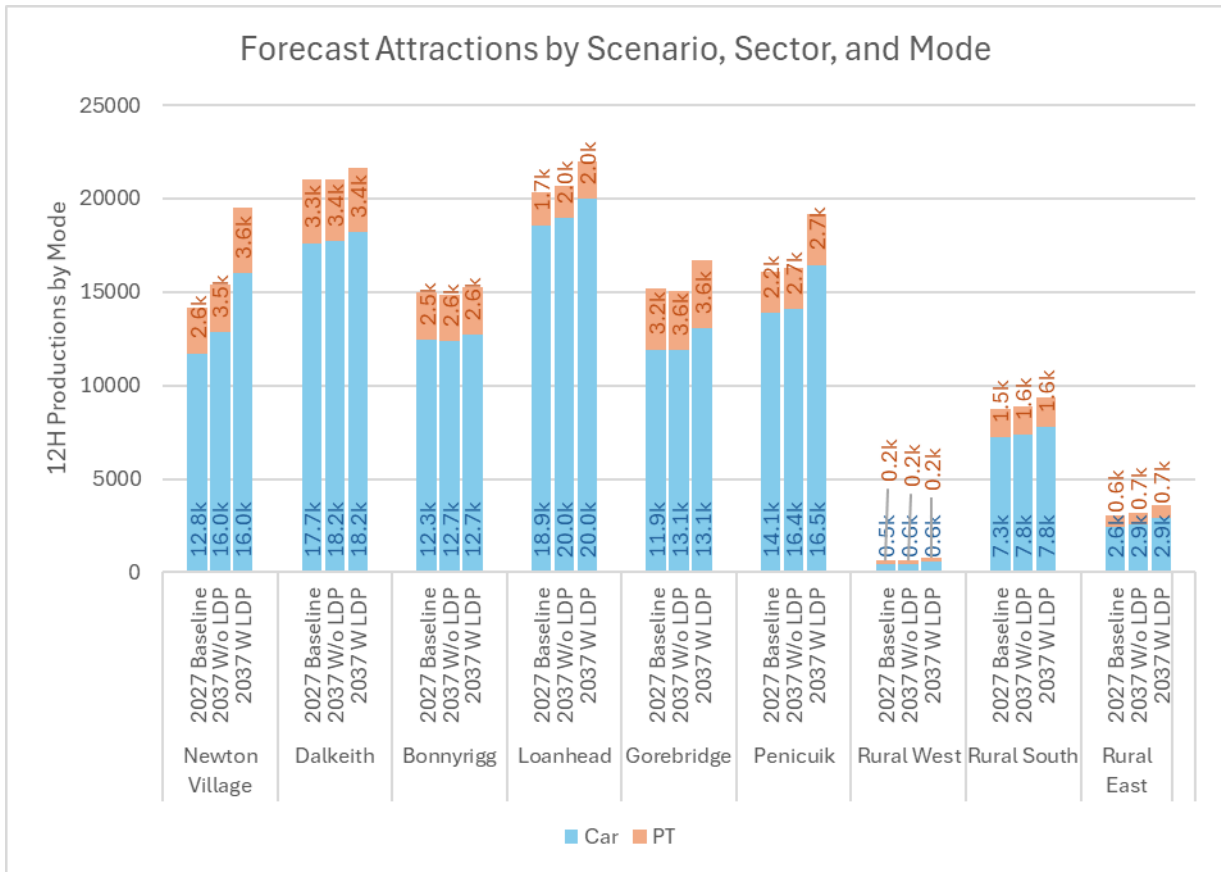


Figure A.7: Forecast Attractions by Scenario, Sector, and Mode

A.3.4

A summary of the public transport origins and destinations by Midlothian sector is provided in Table A-5: and Table A-6 respectively. This metric is an indicator (**total number of trips by PT**) within TPO2, and it is clear that the new sites introduce more public transport trips.

Table A-5: Summary 12-hour Public Transport Origins by Midlothian Sector

Sector	2027 Baseline	2027 Without LDP			2027 With LDP scenario		
	Actual	Actual	Difference	% Change	Actual	Difference	% Change
Newton Village	2,868	3,100	232	8%	4,080	980	32%
Dalkeith	3,754	3,710	-44	-1%	3,837	127	3%
Bonnyrigg	2,555	2,581	25	1%	2,669	89	3%
Loanhead	1,737	1,747	10	1%	1,984	237	14%
Gorebridge	4,164	4,116	-48	-1%	4,575	459	11%
Penicuik	2,338	2,378	39	2%	2,947	569	24%
Rural West	125	123	-2	-1%	158	35	28%
Rural South	1,471	1,465	-5	0%	1,559	93	6%
Rural East	685	684	-1	0%	770	85	12%

Table A-6: Summary 12-hour Public Transport Destinations by Midlothian Sector

Sector	2027 Baseline	2037 Without LDP			2037 With LDP scenario		
	Actual	Actual	Difference	Actual	Actual	Difference	Actual
Newton Village	2,453	2,579	126	5%	3,506	927	36%
Dalkeith	3,388	3,294	-95	-3%	3,423	130	4%
Bonnyrigg	2,532	2,495	-37	-1%	2,585	90	4%
Loanhead	1,774	1,739	-35	-2%	1,992	252	15%
Gorebridge	3,261	3,185	-76	-2%	3,632	447	14%
Penicuik	2,179	2,197	18	1%	2,742	545	25%
Rural West	155	150	-5	-3%	194	44	29%
Rural South	1,526	1,501	-24	-2%	1,604	103	7%
Rural East	648	639	-9	-1%	723	84	13%

Public Transport Mode Share

- A.3.5 Figure A.8 and Figure A.9 present the modelled public transport mode share by origin and destination, expressed as a percentage for each defined sector, for each scenario. It should be noted that this excludes non-motorised modes, which are not modelled in SRM. Public transport mode share is typically predicted to increase in each sector between scenarios although not always, for example in Loanhead between the 2027 baseline and 2037 without LDP scenarios. It must be highlighted this does NOT mean there are less public transport trips, it means that the increase in road trips associated with those locations rises greater than the increase in public transport trips.
- A.3.6 This metric is an indicator (**overall proportions of trips by PT**) within **TPO2**, and in all sectors the proportion of public transport trips increase once the LDP is introduced.
- A.3.7 Noting that there is no change in network infrastructure between the scenarios, the key drivers for any projected change in mode share would be:
- the ease of access to existing public transport in locations where new developments are included
 - any changes to congestion as part of the secondary impact of increased development traffic on the roads

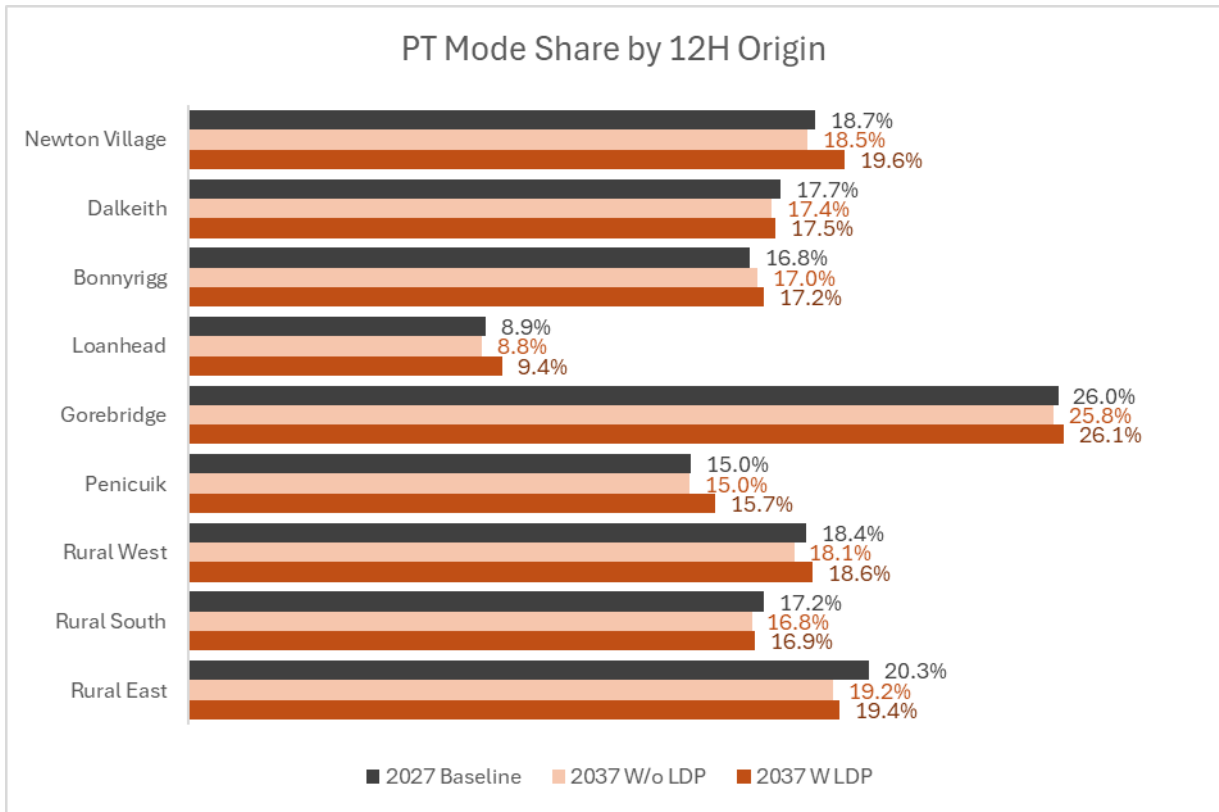


Figure A.8: Public Transport Mode Share by Origin

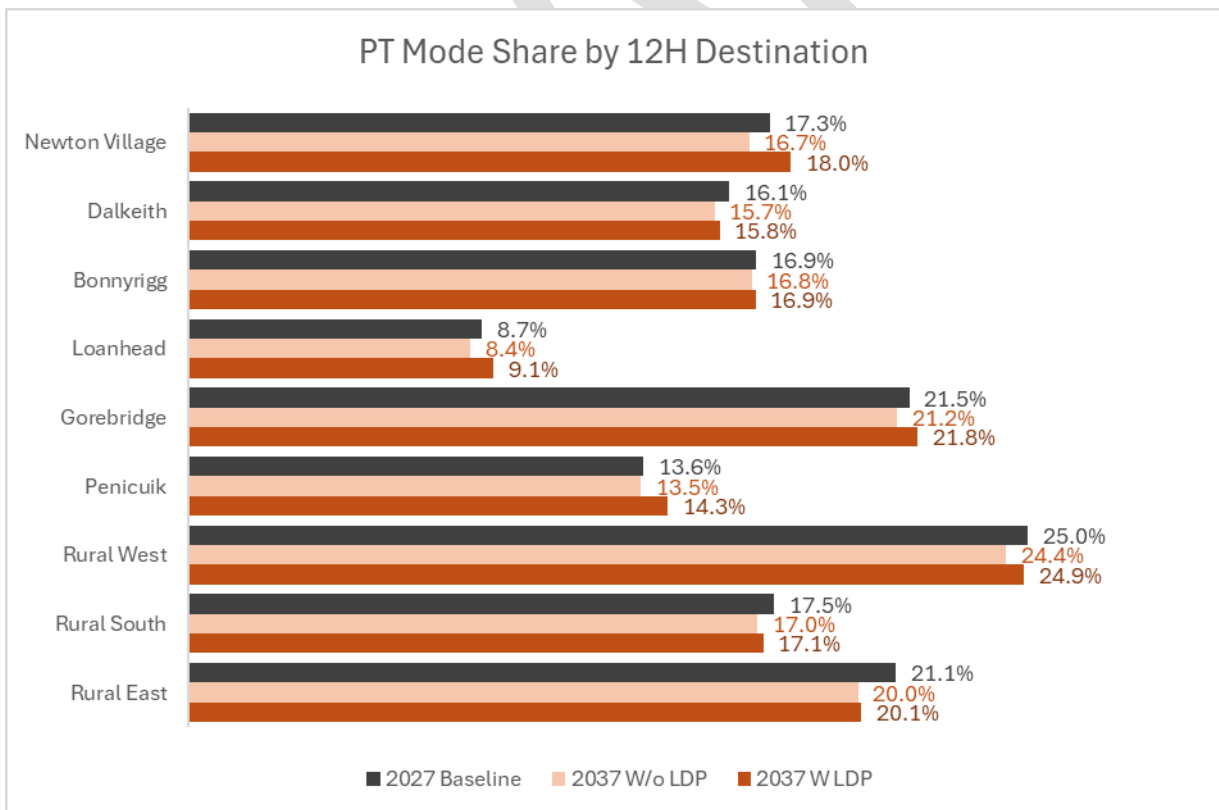


Figure A.9: Public Transport Mode Share by Destination

- A.3.9 Figure A.10 shows the daily boardings and alighting’s on Borders Rail which would likely be the most relevant rail stations for any new developments to enter the network. As noted in Table 4-1, **passenger boarding and alighting volumes at rail stations** are an indicator within **TPO2**, and each station in the area shows an increase in usage once the LDP is introduced.
- A.3.10 There is a general increase across the Borders Rail line predicted between the 2027 baseline and 2037 without LDP scenarios and also as the LDP is introduced. The largest percentage changes are observed in Shawfair and Newtongrange which aligns closely with the scale of developments introduced in those sectors.

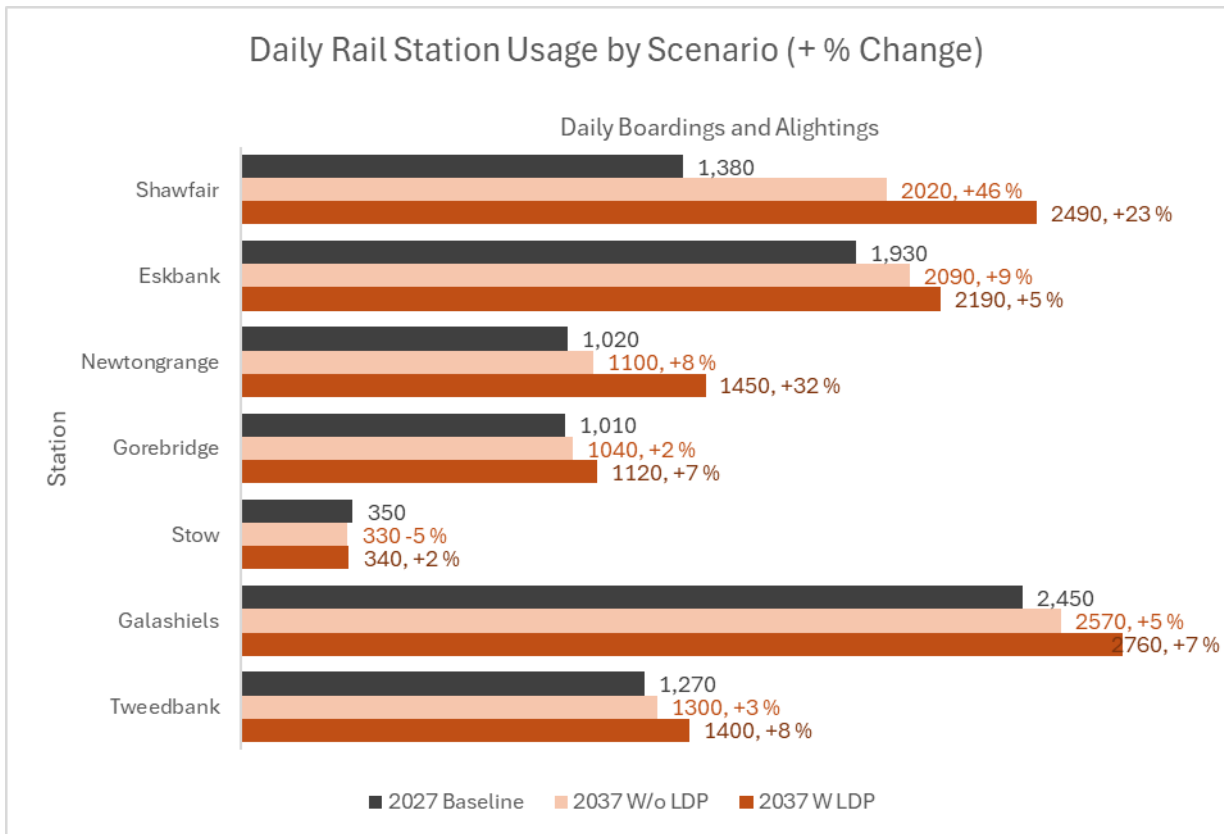


Figure A.10: Daily Patronage by Rail Station

- A.3.11 A key focus is the potential crowding on Borders Rail as the key rail service facilitating travel between Edinburgh and Midlothian. The most constrained services will be those which are used by commuters, e.g., the AM trains headed towards Edinburgh (Figure A.11) and the PM services headed outbound from Edinburgh (Figure A.12).
- A.3.12 The morning services in particular show considerable crowding in the later forecast years with almost all seats predicted to be taken from Newtongrange onwards, with the crush capacity being exceeded on the last sections of the line past Brunstane. PM services are not predicted to be as busy, which likely reflects a shallower travel peak.

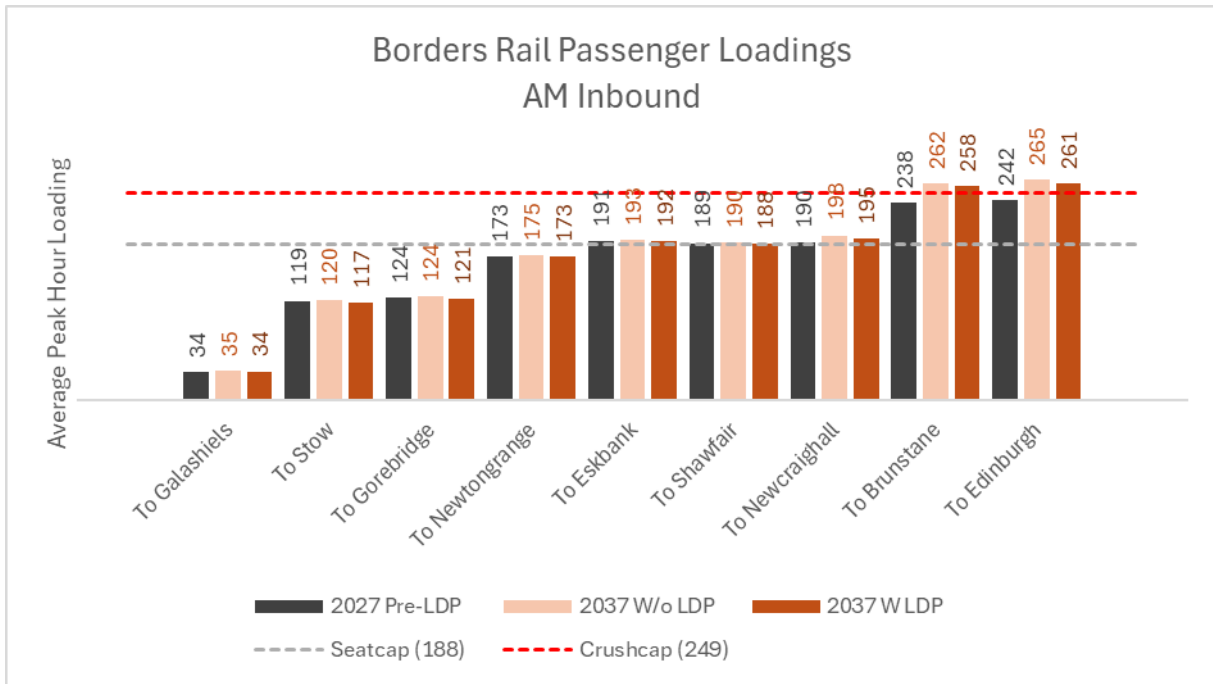


Figure A.11: Borders Rail Passenger Loadings (AM Inbound)

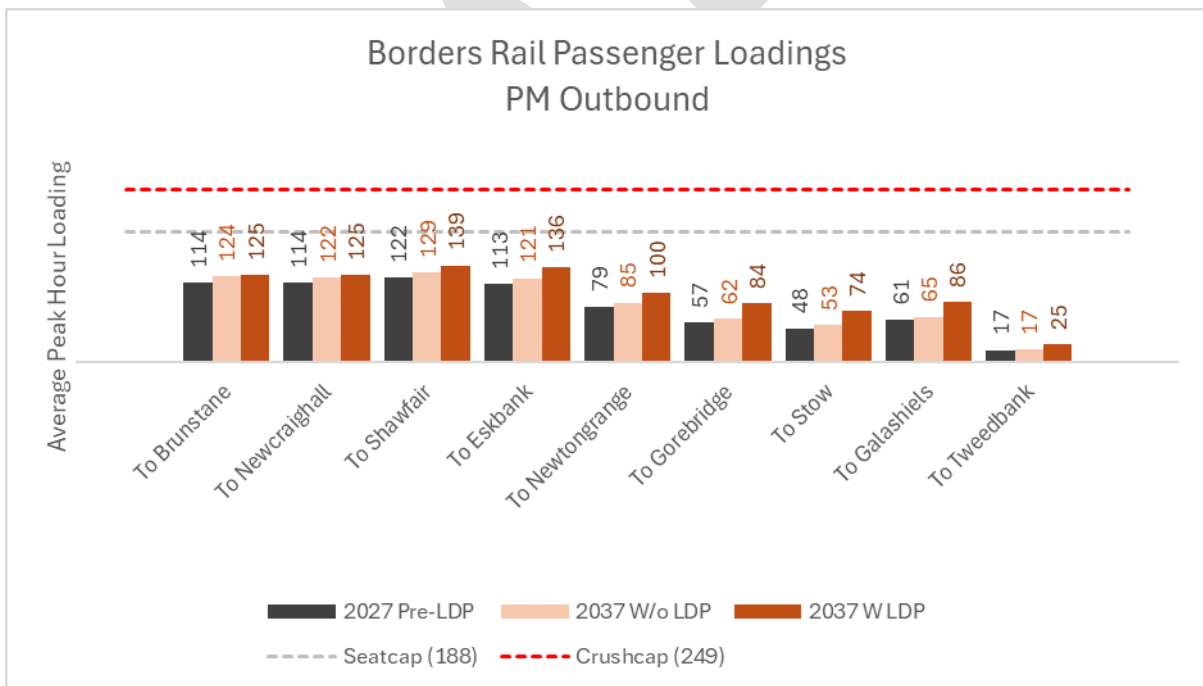


Figure A.12: Borders Rail Passenger Loadings (PM Outbound)

Travel Demand on Network

A.3.13

Total VehKms per capita, compared to 2027 base case is a metric within TPO4 highlighted in Table 4-1, and a summary of the vehicle km by year is presented in Figure A.13 for an average weekday. This shows a predicted increase in vehicle distance that correlates with the increase in travel demand between the 2027 baseline and 2037 without LDP scenarios. However, there is generally a reduction in vehicle km per capita once the LDP is introduced which means on average the new LDP sites would be expected to make shorter or fewer vehicle trips.

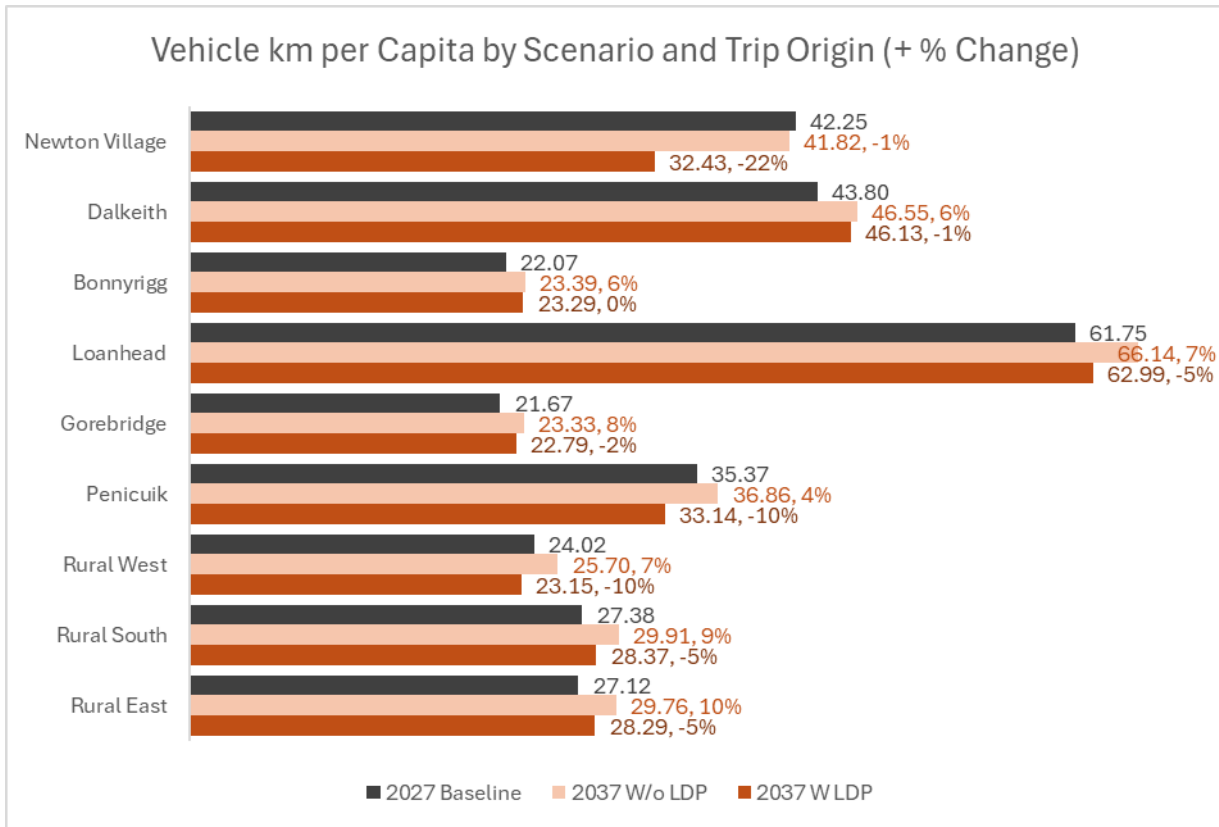


Figure A.13: Vehicle km per Capita by Scenario and Trip Origin (+ % Change)

A.3.14

Total public transport-based distance, in kilometres, for each scenario is shown in Figure A.14 for an average weekday. This shows an increase in passenger distance that correlates with the increase in travel demand associated with MLDP2 development sites.

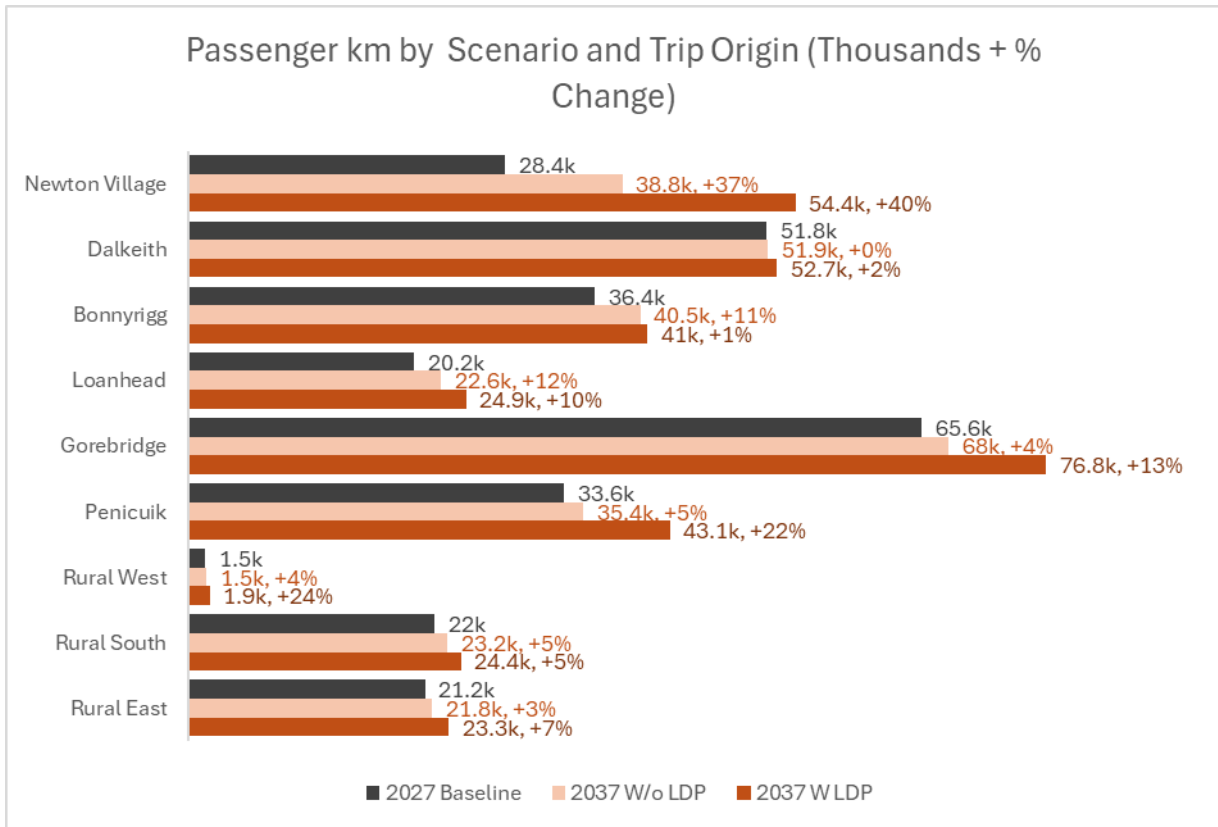


Figure A.14: Passenger Distance by Scenario and Trip Origin (Thousands kms + % Change)

Key Junction Performance

A.3.15 Preserving the performance of the network is the focus of TPO3, and as part of the evaluating metrics to assist this a summary of performance of key junctions is provided here across 4 measures:

- flow through the junctions;
- delay at the junctions;
- queue lengths at the junctions; and
- volume over capacity (V/C) at the junctions.

A.3.16 These tie in directly with two of the measures outlined in TPO3, specifically:

- **Change in delay at key junctions; and**
- **Average queue lengths at key junctions.**

A.3.17 These measures are summarised for each arm in the morning and evening peaks in a separate document (Appendix B), but a shorter summary is provided here for the overall junction performance. The location of these key junctions is illustrated in Figure A.15.

Table A-8: Summary of PM Flow Performance Across Key Junctions

Junction	2027 Baseline	2037 Without LDP		2037 With LDP scenario	
	Flow	Flow	Flow Change	Flow	Flow Change
A702 / A703	1,979	2,059	80	2,173	114
Straiton Interchange (South Roundabout)	7,142	7,059	-83	7,148	89
Gilmerton Road Roundabout and Interchange	3,159	3,216	57	3,261	44
Lasswade Road junction with Wadingburn Road	1,888	1,922	35	2,005	82
Sheriffhall Roundabout	6,990	7,204	215	7,277	72
Millerhill Interchange - A68 (WB) approach to A720	1,933	2,268	335	2,299	31
Old Craighall Roundabout	4,753	5,072	320	5,110	38

A.3.19 Table A-9 and Table A-10 provide a summary of the total delay at each of the junctions, which is expected to increase significantly over time at all locations in both peaks. The additional LDP traffic is predicted to further worsen delays at all junctions.

Table A-9: Summary of AM Delay Performance Across Key Junctions

Junction	2027 Baseline	2037 Without LDP		2037 With LDP scenario	
	Delay	Delay	Delay Change	Delay	Delay Change
A702 / A703	495	621	127	758	137
Straiton Interchange (South Roundabout)	69	75	6	75	0
Gilmerton Road Roundabout and Interchange	121	137	16	159	22
Lasswade Road junction with Wadingburn Road	176	187	10	239	53
Sheriffhall Roundabout	816	979	163	1,045	66
Millerhill Interchange - A68 (WB) approach to A720	38	90	52	104	15
Old Craighall Roundabout	74	109	35	118	9

Table A-10: Summary of PM Delay Performance Across Key Junctions

Junction	2027 Baseline	2037 Without LDP		2037 With LDP scenario	
	Delay	Delay	Delay Change	Delay	Delay Change
A702 / A703	457	476	19	526	51
Straiton Interchange (South Roundabout)	187	239	52	280	41

	2027 Baseline	2037 Without LDP		2037 With LDP scenario	
Junction	Delay	Delay	Delay Change	Delay	Delay Change
Gilmerton Road Roundabout and Interchange	99	130	30	154	24
Lasswade Road junction with Wadingburn Road	108	108	0	147	39
Sheriffhall Roundabout	702	826	124	874	49
Millerhill Interchange - A68 (WB) approach to A720	32	44	11	47	3
Old Craighall Roundabout	152	160	8	160	0

A.3.20 Aligned with the increased delay at junctions the queues are expected to increase in all scenarios, as shown in Table A-11 and Table A-12.

Table A-11: Summary of AM Queue Performance Across Key Junctions

	2027 Baseline	2037 Without LDP		2037 With LDP scenario	
Junction	Queue	Queue	Queue Change	Queue	Queue Change
A702 / A703	128	176	48	205	29
Straiton Interchange (South Roundabout)	378	647	269	840	193
Gilmerton Road Roundabout and Interchange	177	250	73	279	29
Lasswade Road junction with Wadingburn Road	75	110	35	123	13
Sheriffhall Roundabout	445	702	257	767	65
Millerhill Interchange - A68 (WB) approach to A720	106	160	54	171	11
Old Craighall Roundabout	413	596	183	647	51

Table A-12: Summary of PM Queue Performance Across Key Junctions

	2027 Baseline	2037 Without LDP		2037 With LDP scenario	
Junction	Queue	Queue	Queue Change	Queue	Queue Change
A702 / A703	125	168	43	192	24
Straiton Interchange (South Roundabout)	752	966	214	1,194	228
Gilmerton Road Roundabout and Interchange	322	433	111	481	48
Lasswade Road junction with Wadingburn Road	195	265	70	305	40
Sheriffhall Roundabout	997	1,396	399	1,578	182

Junction	2027 Baseline	2037 Without LDP		2037 With LDP scenario	
	Queue	Queue	Queue Change	Queue	Queue Change
Millerhill Interchange - A68 (WB) approach to A720	236	336	100	374	38
Old Craighall Roundabout	883	1,219	336	1,344	125

A.3.21 The final comparison for key junctions is volume over capacity, as shown in Table A-13 and Table A-14. These summaries illustrate that certain junctions are already anticipated to be significantly over capacity in the 2027 baseline (A702 / A703 and Sheriffhall). Considering the background growth (2037 Without LDP) shows slight decreases in performance across most junctions, with Millerhill illustrating the largest increase, while finally the introduction of the LDP has only small impact on V/C due to the underlying conditions.

Table A-13: Summary of AM V/C Performance Across Key Junctions

Junction	2027 Baseline	2037 Without LDP		2037 With LDP scenario	
	V/C	V/C	V/C Change	V/C	V/C Change
A702 / A703	107	112	5	116	4
Straiton Interchange (South Roundabout)	58	60	2	61	1
Gilmerton Road Roundabout and Interchange	76	75	-1	78	2
Lasswade Road junction with Wadingburn Road	78	80	2	84	3
Sheriffhall Roundabout	114	116	3	117	1
Millerhill Interchange - A68 (WB) approach to A720	72	82	10	84	3
Old Craighall Roundabout	61	66	5	68	2

Table A-14: Summary of PM V/C Performance Across Key Junctions

Junction	2027 Baseline	2037 Without LDP		2037 With LDP scenario	
	V/C	V/C	V/C Change	V/C	V/C Change
A702 / A703	105	107	2	112	5
Straiton Interchange (South Roundabout)	72	74	2	76	1
Gilmerton Road Roundabout and Interchange	91	92	2	94	2
Lasswade Road junction with Wadingburn Road	79	79	1	82	3
Sheriffhall Roundabout	111	114	3	116	2

	2027 Baseline	2037 Without LDP		2037 With LDP scenario	
Junction	V/C	V/C	V/C Change	V/C	V/C Change
Millerhill Interchange - A68 (WB) approach to A720	66	81	15	83	2
Old Craighall Roundabout	62	68	6	68	1

Forecast Change in Journey Times

A.3.22 **TPO3** is focussed on limiting the impact of new development on the overall performance of the transport network and had identified three journey time metrics to evaluate this:

- **Time lost due to congestion – system-wide;**
- **Average journey times on key corridors and sectors on strategic road network; and**
- **Car and bus journey times to Edinburgh city centre.**

A.3.23 Figure A.16 shows the average time lost due to congestion per vehicle (in minutes) during each modelled period. The PM is predicted to experience the highest delays, with time lost due to congestion rising from 4.90 minutes in the 2027 scenario to 5.63 minutes without LDP and 5.68 minutes With LDP scenario in 2037. Overall, the differences between the 2037 scenarios with and without the LDP are minimal, and both indicate higher congestion compared to the 2027 baseline.

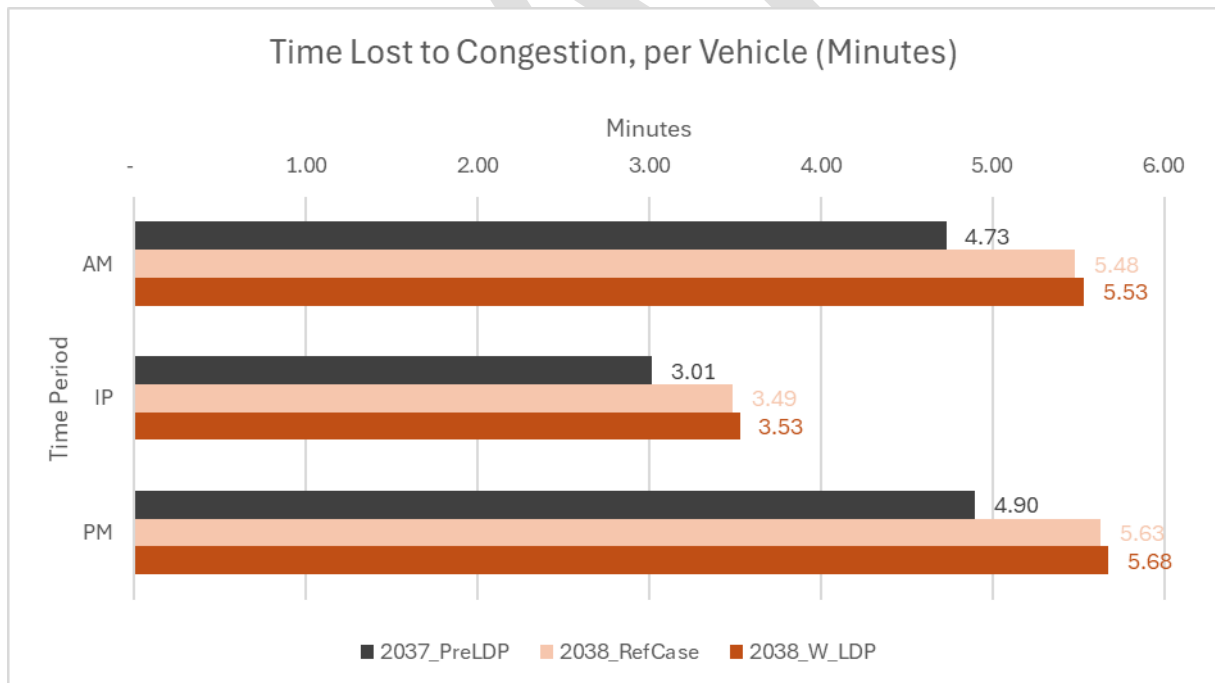


Figure A.16: Time lost due to congestion, per vehicle

A.3.24 Figure A.17, Figure A.18, and Figure A.19 highlight the end to end journey time routes on key routes in minutes for each scenario, with the overall journey time provided as a label in the 2027 Baseline scenario as well as the difference from the previous scenario (in seconds) as a label on the 2037 scenarios. Improvements in journey time are highlighted in green text while increases of over a minute are flagged in red.

A.3.25 The largest changes occur between the 2027 Baseline and 2037 Without LDP scenarios, particularly on the City Bypass in all peaks but also on some arterial routes in Midlothian in the morning peak. The impact of the LDP shows increases are all within one minute of the overall journey time.

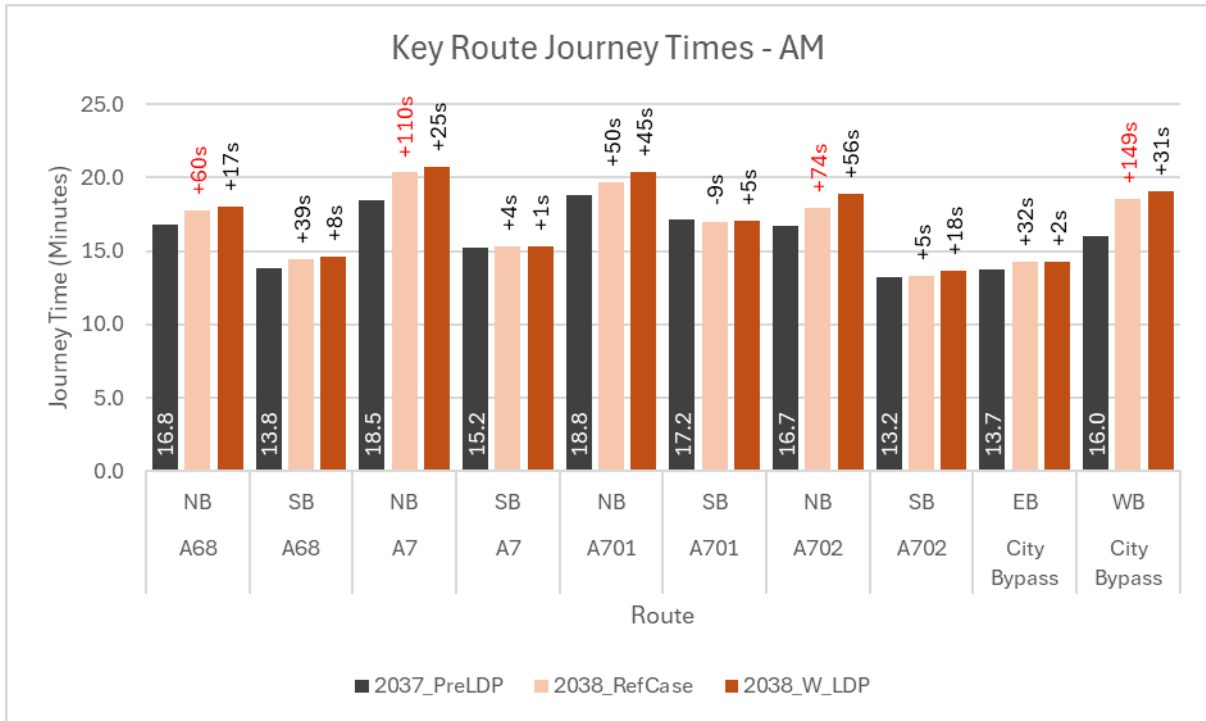


Figure A.17: Key Route AM Journey Times by Scenario with Differences (Minutes)

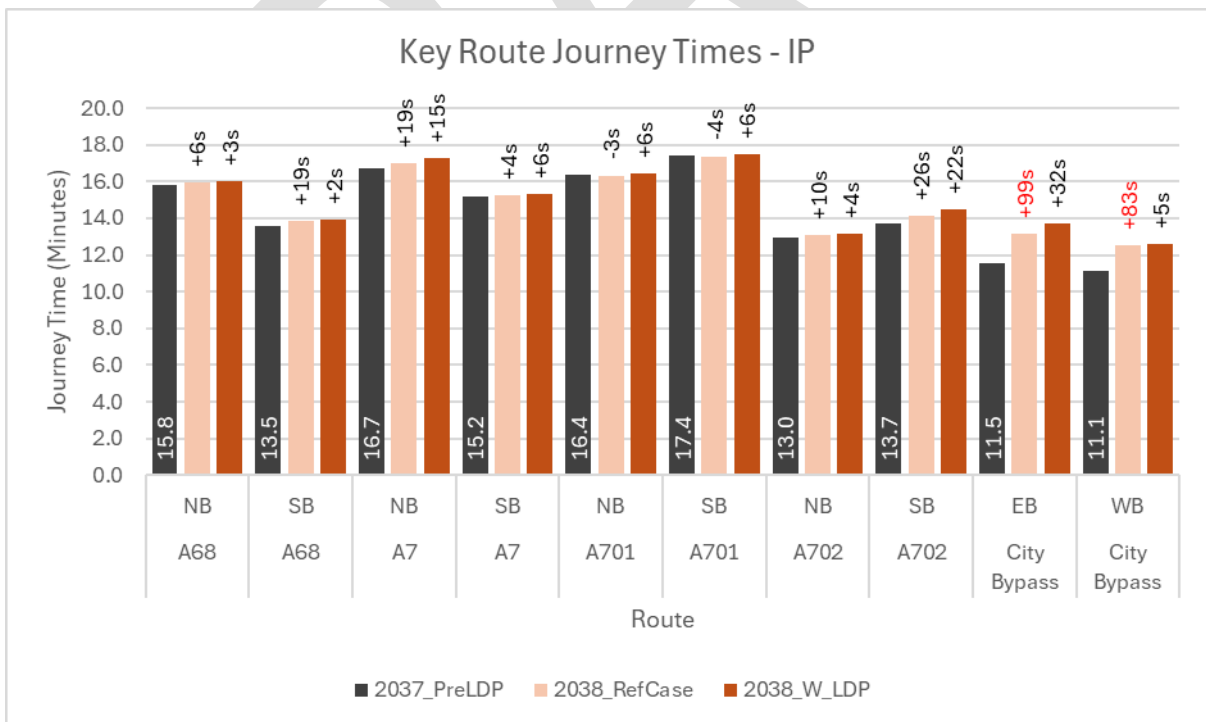


Figure A.18: Key Route IP Journey Times by Scenario with Differences (Minutes)

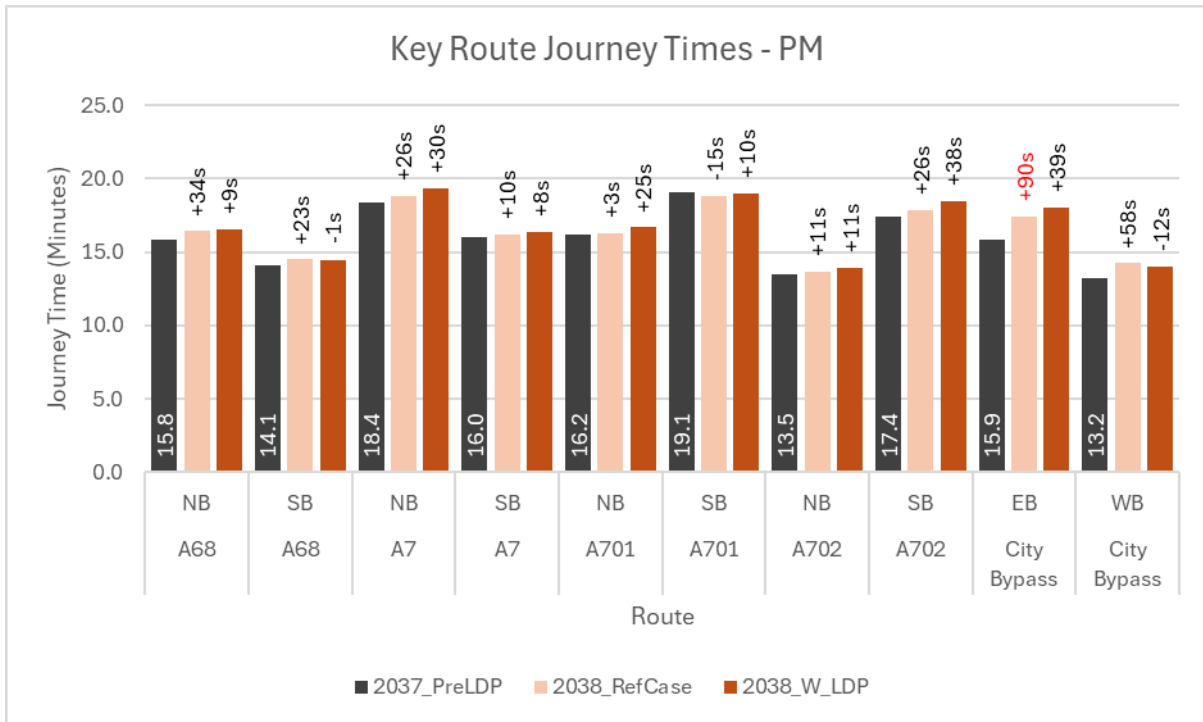


Figure A.19: Key Route PM Journey Times by Scenario with Differences (Minutes)

- A.3.26 Figure A.20 and Figure A.21 summarise the forecast journey times between the model sectors in Midlothian and Edinburgh City Centre (which is represented as St James Quarter) for highway flows in the AM peak towards Edinburgh and PM Peak towards Midlothian. Likewise, Figure A.22 and Figure A.23 show forecast journey times for the same journeys and peak periods by public transport. These figures are based on the commute user class within the model.
- A.3.27 For highways, the largest forecast increases are between the 2027 Baseline and 2037 Without LDP Scenario, with increases between 30 seconds and 164 seconds in the AM peak. In the PM, the increases in journey times are smaller with most Midlothian sectors forecasting increases of less than 60 seconds. The largest changes are associated with developments introduced in the Newton Village sector. When comparing the 2037 With and Without LDP scenario, only Newton Village in the AM peak had a forecast increase in highways journey time of more than 60 seconds.
- A.3.28 For public transport trips, the changes in journey times in both periods are relatively small. Most sectors are forecast to have journey time increases of less than 60 seconds. When comparing the 2037 With and Without LDP scenario, only Bonnyrigg in the AM peak had a forecast increase in public transport journey time of more than 60 seconds.

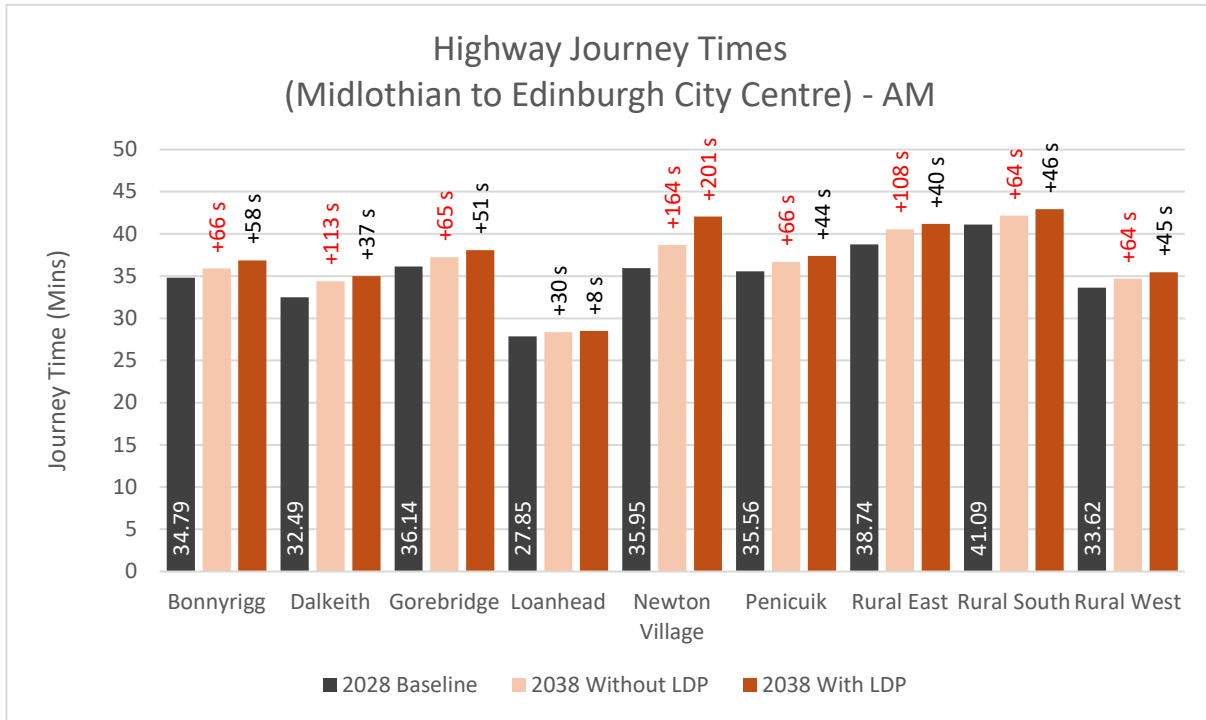


Figure A.20: Highway Journey Times (Midlothian Sectors to Edinburgh City Centre), AM Peak

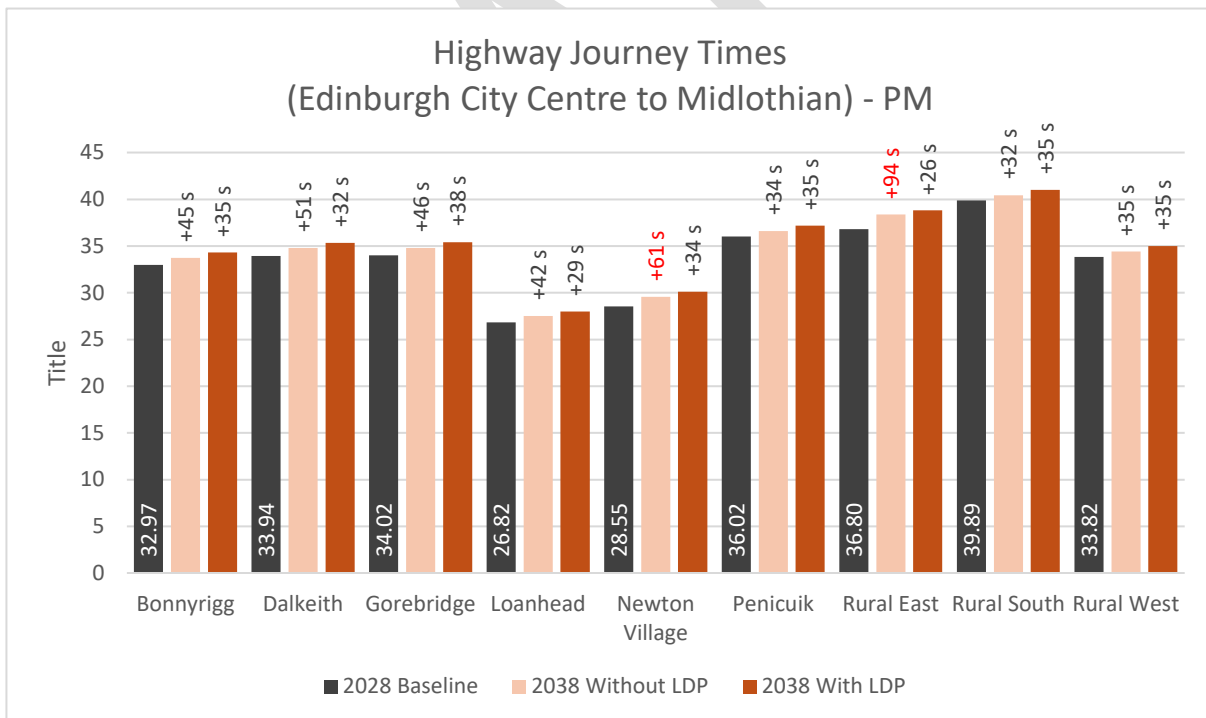


Figure A.21: Highway Journey Times (Edinburgh City Centre to Midlothian Sectors), PM Peak

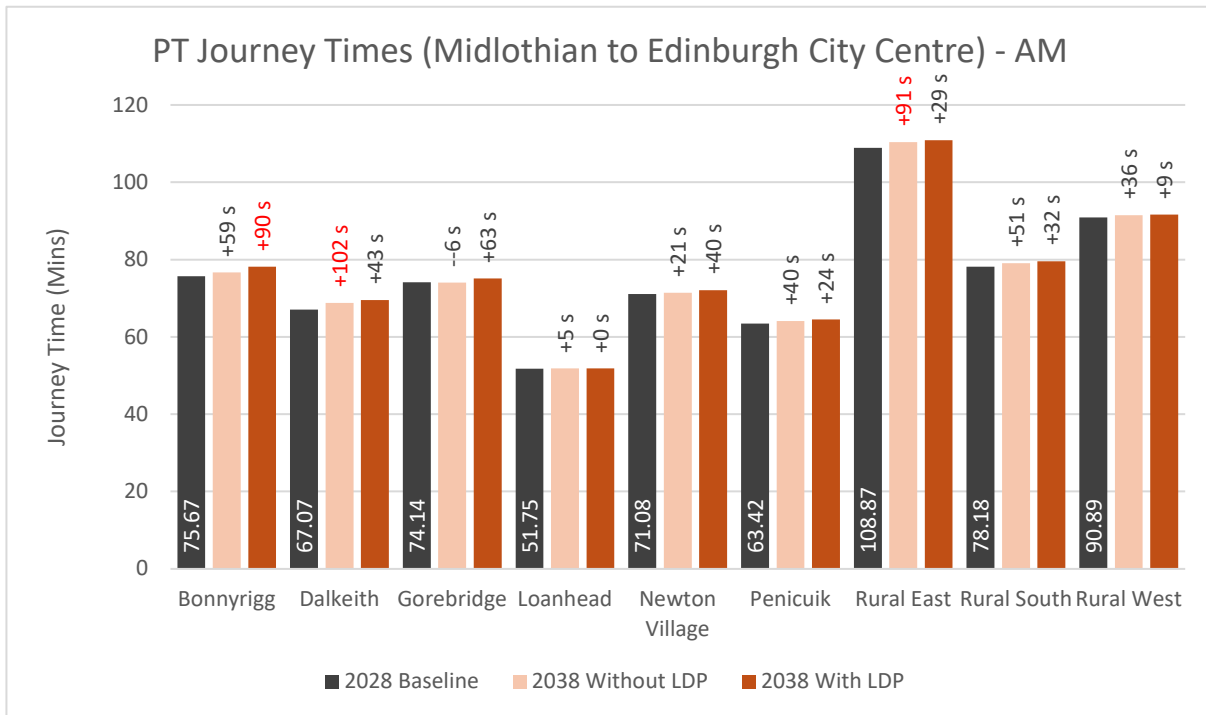


Figure A.22: Public Transport Journey Times (Midlothian Sectors to Edinburgh City Centre), AM Peak

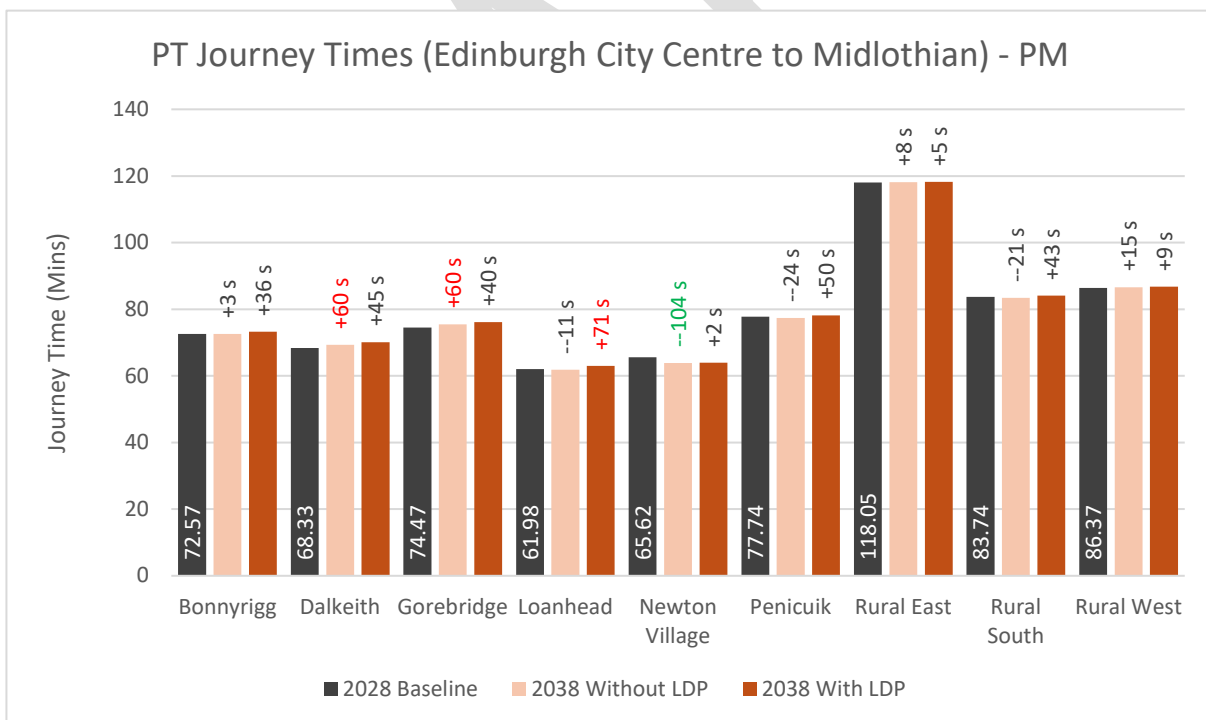


Figure A.23: Public Transport Journey Times (Edinburgh City Centre to Midlothian Sectors), PM Peak

Forecast Change in Revenue

A.3.29

New developments would be expected to include additional travel demand on public transport, and a way of evaluating the performance is through analysing the impact on revenue that the LDP will introduce through additional journeys. This metric was identified within **TPO2**. A summary of the expected revenue and more importantly by change in estimated daily revenue is provided for each sector and scenario in Figure A.24 based on the origin zone.

- A.3.30 Note that SRM has had no validation on the revenue results in the base year model and therefore a certain amount of caution should be maintained when looking at absolute values, but to have consideration of percentage changes between scenarios.
- A.3.31 The results show an increase in all sectors and scenarios as might reasonably be expected based on the increased population, with the largest increases in Newton Village, Penicuik, and Rural East.
- A.3.32 No change was made to bus services in the model to reflect new developments at this stage, i.e., there are no services rerouted to target specific developments and no stops were added, but changing these assumptions may lead to increased public transport connectivity and therefore increased revenue.

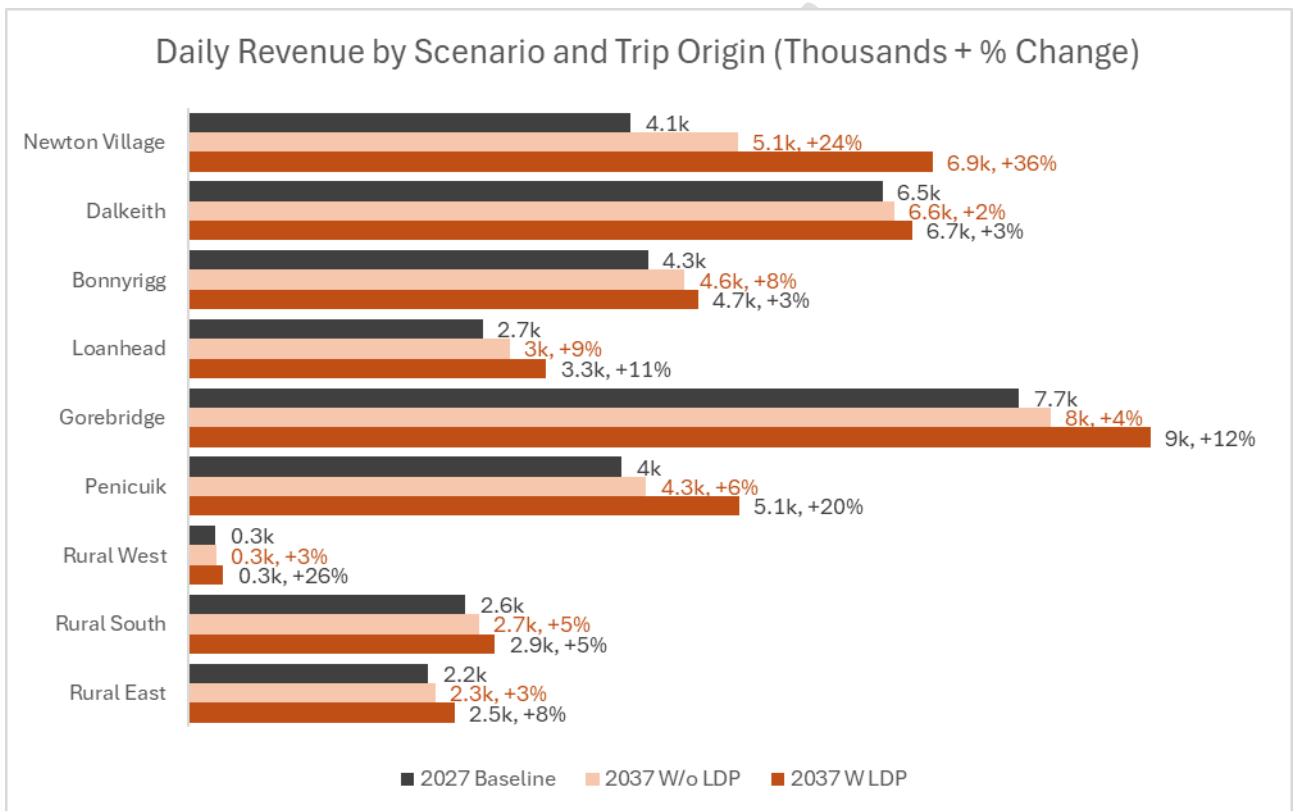


Figure A.24: Passenger Revenue by Scenario and Trip Origin (Thousands kms + % Change)

Carbon Emissions

- A.3.33 As outlined in **TPO4**, evaluation of the carbon emissions as total **tonnes of CO₂ equivalent from forecast trips** were identified as a metric to understand the impact of the LDP.
- A.3.34 Following completion of the modelling, the forecast outputs were processed using the DfT Vehicle Emission Carbon Tool (VECAT) to estimate total greenhouse gas emissions in tonnes of carbon dioxide equivalent (tCO₂e) for each scenario, both with and without the LDP. Inputs to the tool included model link flows by vehicle type, together with the corresponding link speeds and distances. The resulting total emissions were then normalised by the total population input to the model in each scenario to derive emissions per capita. Table A-15 shows a marginal reduction in tCO₂e per capita in the scenario with the LDP, indicating a very minor decrease in average traffic-related emissions per person.

Table A-15: Carbon Emissions per Capita by Scenario

Scenario	tCO ₂ e	Population	tCO ₂ e per capita
2027 Baseline	1,926,818	1,754,181	1.098
2037 Without LDP	1,128,136	1,768,690	0.638
2037 With LDP scenario	1,130,681	1,785,467	0.633
Difference	2,545	16,776	-0.005

A.4 Mitigated Impact on Transport Network

A.4.1 As with Section A.3, this section describes the forecast travel demand and network impacts predicted from the SRM, which include both a cost response from the supply network and the impact of mode and destination choice. Three scenarios are considered, with differences always presented pivoting between the directly preceding scenario:

- 2037 Without LDP;
- 2037 With LDP scenario; and
- 2037 Mitigated.

Trip Origins and Destinations

A.4.2 Figure A.25 and Figure A.26 present the forecast number of car and public transport trips in terms of total origins and destinations by Midlothian sectors respectively, presented as a 12 hour total. Given the consistent demand between the 2037 With LDP scenario and Mitigated scenarios, there is next to no difference in the overall totals, and similarly negligible change in breakdowns by mode.

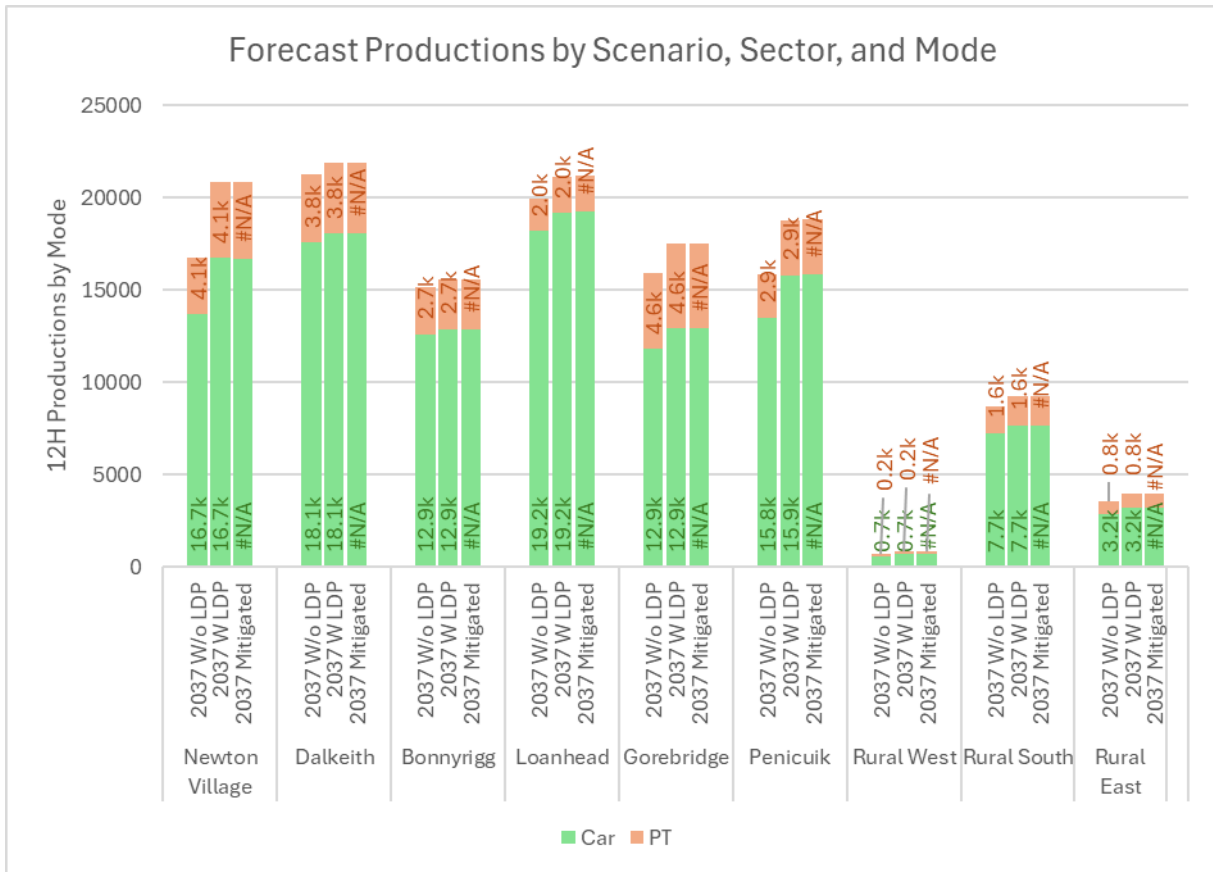


Figure A.25: Forecast Productions by Scenario, Sector, and Mode

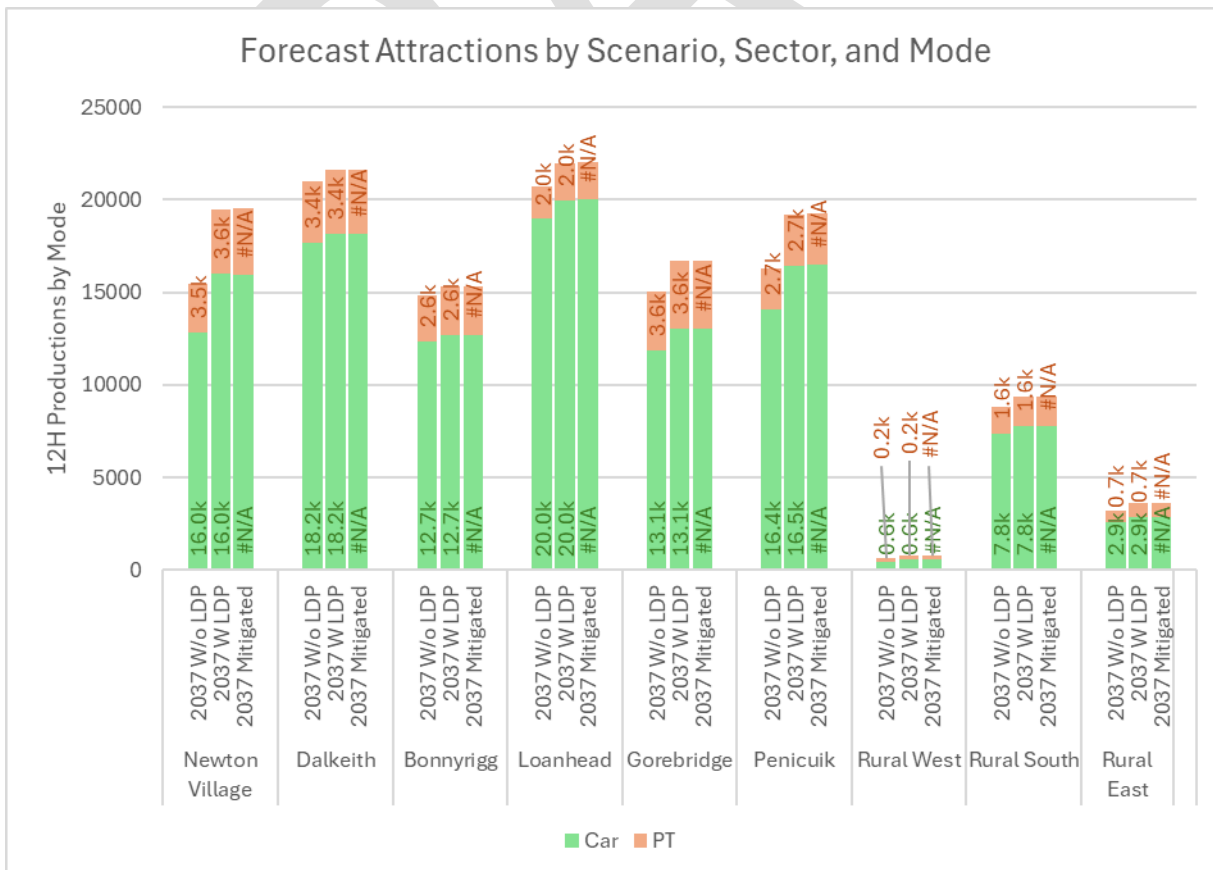


Figure A.26: Forecast Attractions by Scenario, Sector, and Mode

8.7.3 A summary of the public transport origins and destinations by Midlothian sector is provided in Table A-16 and Table A-17 respectively. Only minimal changes are introduced by the mitigations, although overall there are slightly more public transport trips.

Table A-16: Summary 12-hour Public Transport Origins by Midlothian Sector

Sector	2037 Without LDP	2037 With LDP scenario			2037 Mitigated		
	Actual	Actual	Difference	% Change	Actual	Difference	% Change
Newton Village	3,100	4,080	980	32%	4,147	67	2%
Dalkeith	3,710	3,837	127	3%	3,833	-4	0%
Bonnyrigg	2,581	2,669	89	3%	2,669	-1	0%
Loanhead	1,747	1,984	237	14%	1,986	1	0%
Gorebridge	4,116	4,575	459	11%	4,572	-3	0%
Penicuik	2,378	2,947	569	24%	2,943	-4	0%
Rural West	123	158	35	28%	158	0	0%
Rural South	1,465	1,559	93	6%	1,556	-2	0%
Rural East	684	770	85	12%	769	0	0%

Table A-17: Summary 12-hour Public Transport Destinations by Midlothian Sector

Sector	2037 Without LDP	2037 With LDP scenario			2037 Mitigated		
	Actual	Actual	Difference	% Change	Actual	Difference	% Change
Newton Village	3,506	927	36%	3,567	3,567	61	2%
Dalkeith	3,423	130	4%	3,417	3,418	-5	0%
Bonnyrigg	2,585	90	4%	2,584	2,584	-1	0%
Loanhead	1,992	252	15%	1,993	1,993	1	0%
Gorebridge	3,632	447	14%	3,627	3,628	-4	0%
Penicuik	2,742	545	25%	2,738	2,739	-4	0%
Rural West	194	44	29%	194	194	0	0%
Rural South	1,604	103	7%	1,600	1,601	-3	0%
Rural East	723	84	13%	722	723	0	0%

Public Transport Mode Share

A.4.3 A summary of the modelled public transport mode share by origin and destination is provided in Figure A.27 and Figure A.28 for each scenario. As noted above, these comparisons exclude non-motorised modes which are not modelled in SRM. As with the results above, only small changes are introduced by the mitigations, with Newton Village showing the only non-negligible change (an increase of 0.3%).

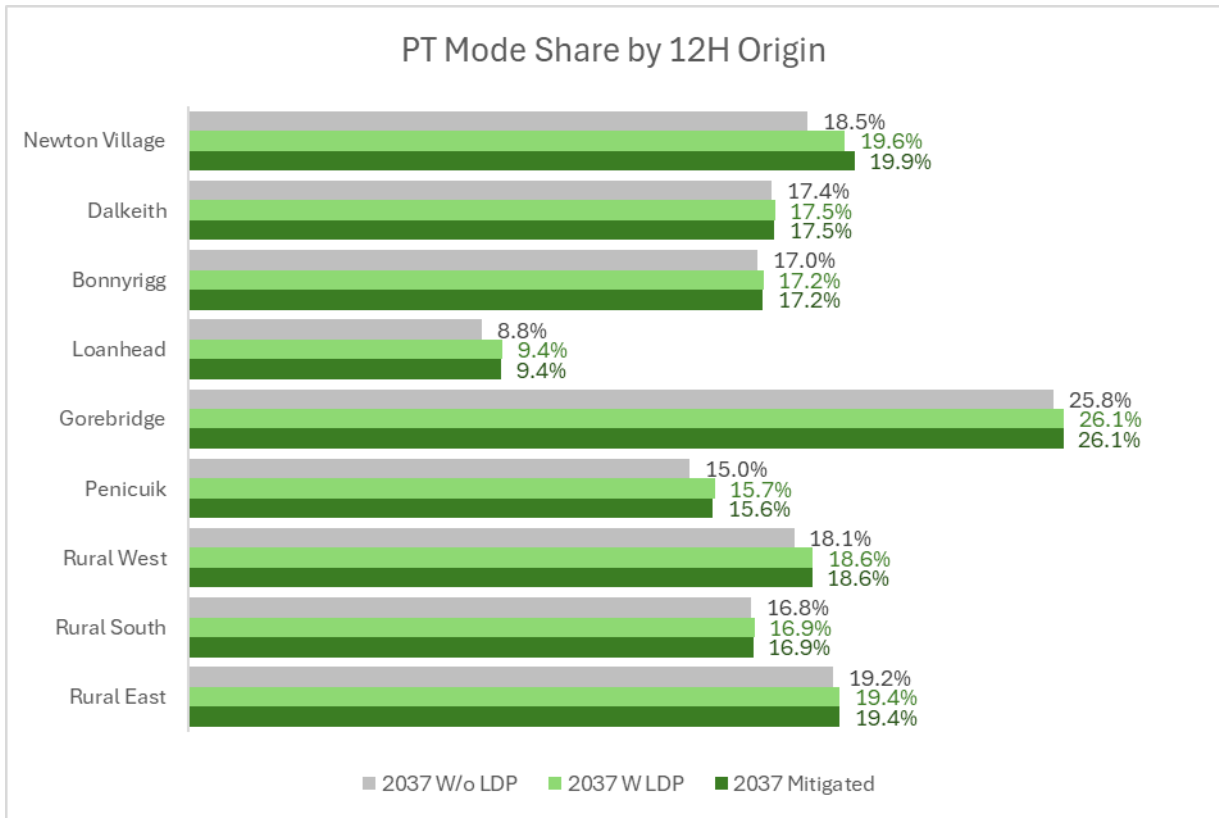


Figure A.27: Public Transport Mode Share by Origin

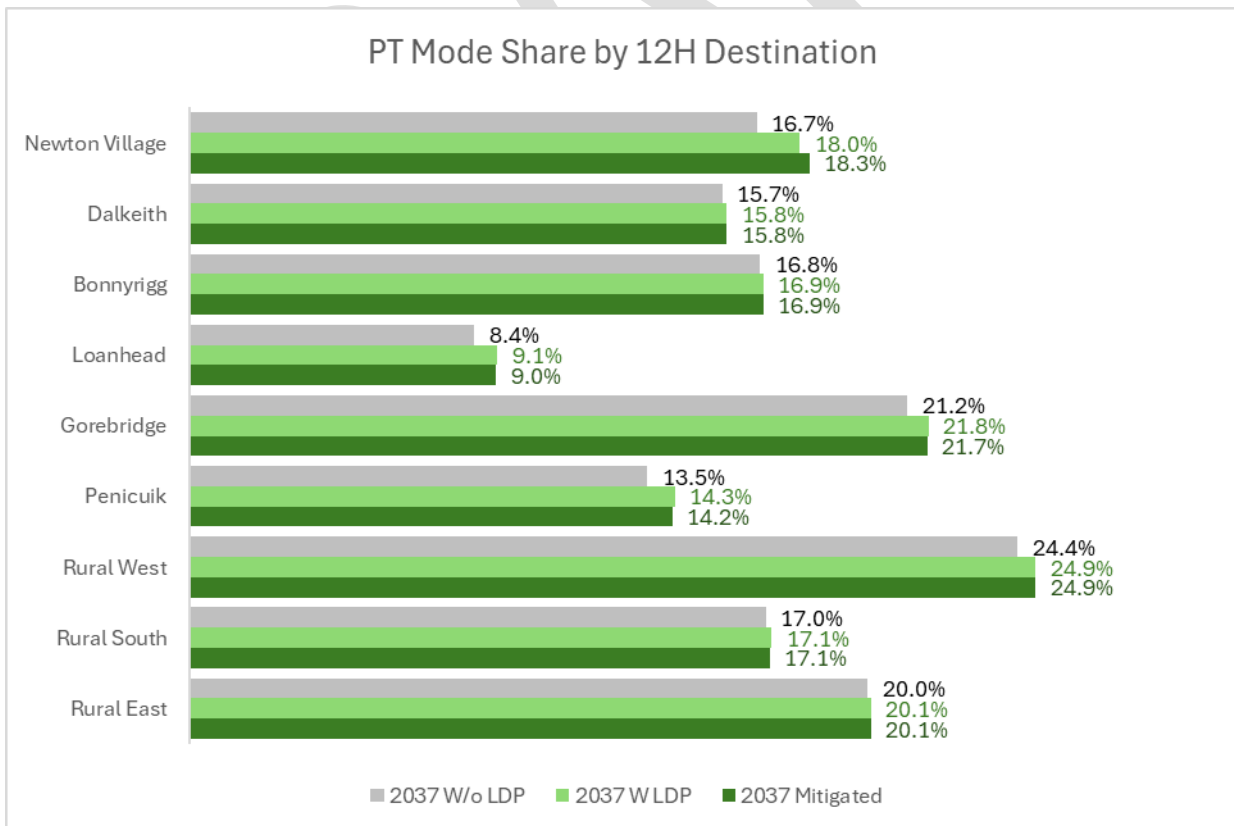


Figure A.28: Public Transport Mode Share by Destination

- A.4.4 Figure A.29 shows the daily boardings and alightings on Borders Rail. The mitigations show limited impact on station usage, suggesting the improvements on the road are not enough to offset the comparable journey time by rail. A similar trend is demonstrated in Figure A.30 and Figure A.31 which show the passenger loadings for typical Borders Rail services in the AM and PM periods in the most utilised directions.
- A.4.5 No mitigation was assumed at this point with regards increased the capacity of trains through either increasing carriages or services, but the model highlights a potential constraint of patronage and therefore an opportunity to increase capacity.

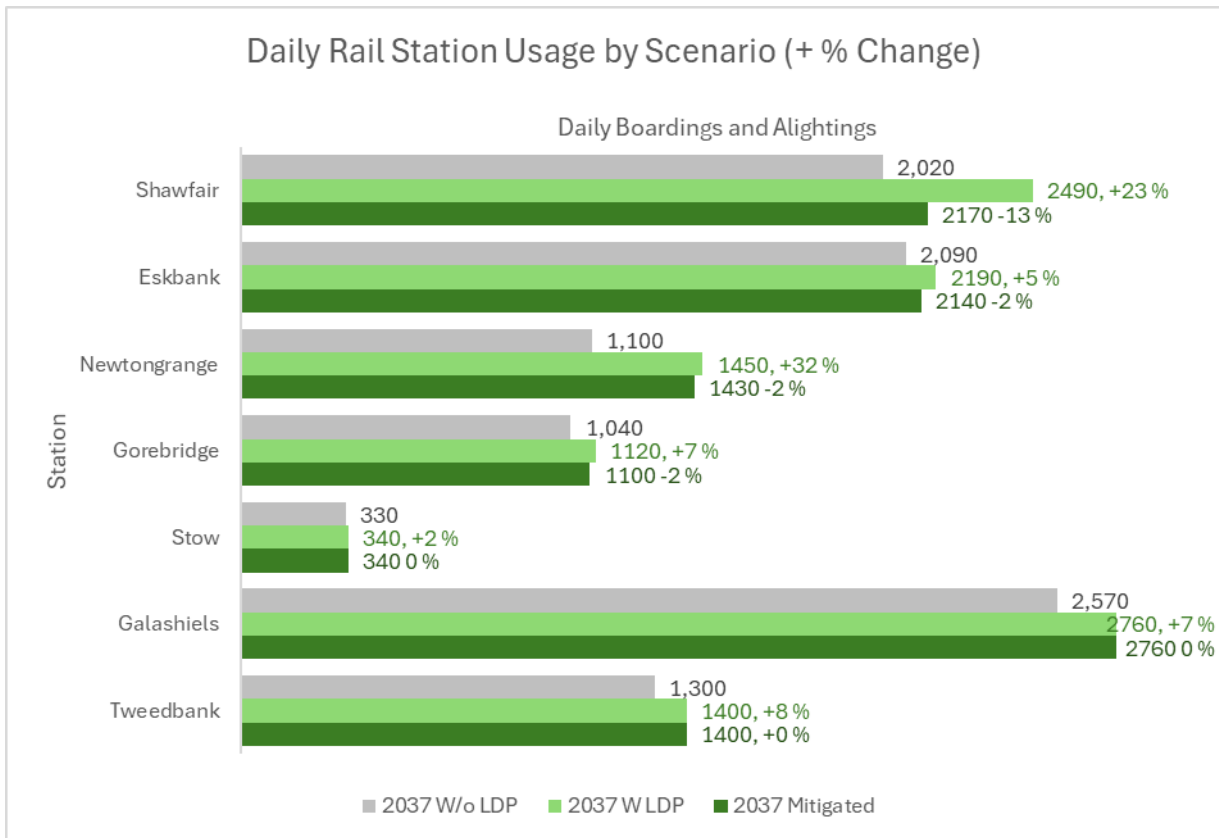


Figure A.29: Daily Patronage by Rail Station

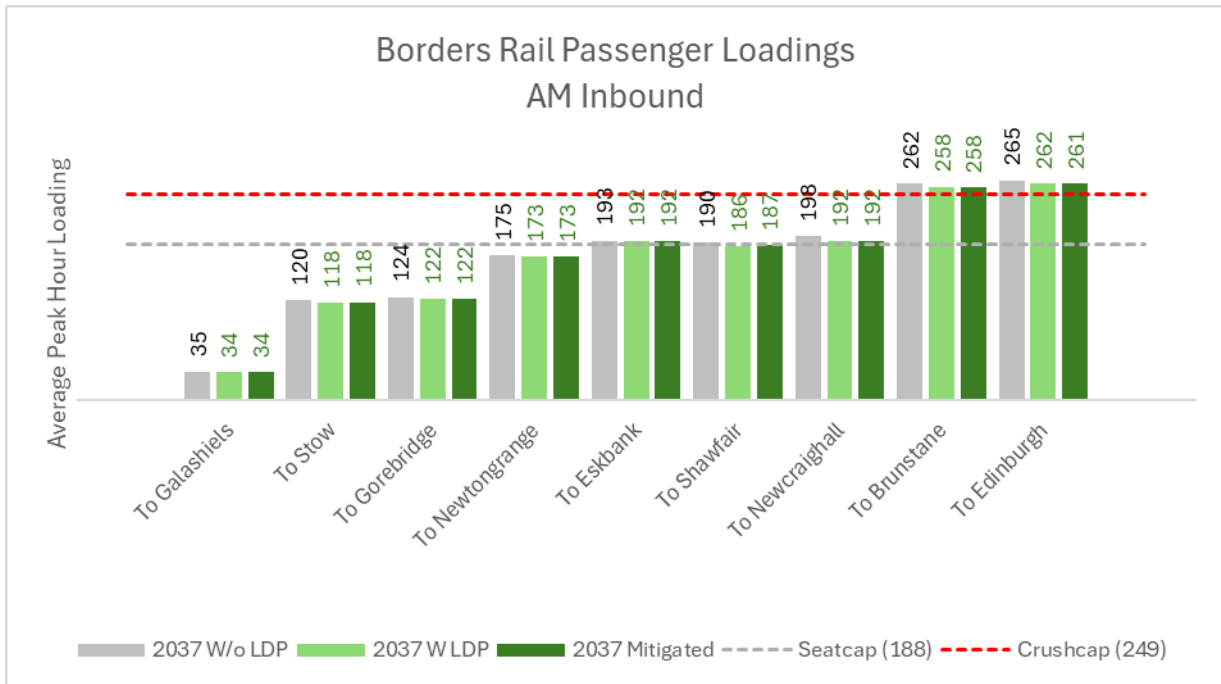


Figure A.30: Borders Rail Passenger Loadings (AM Inbound)

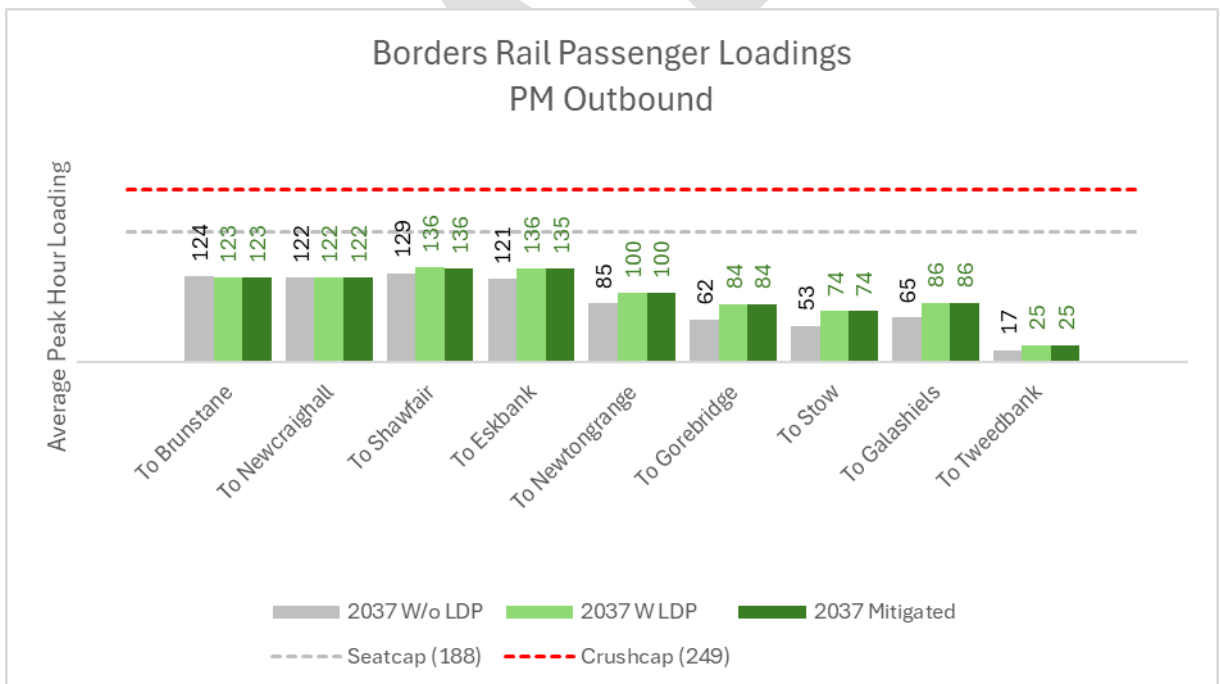


Figure A.31: Borders Rail Passenger Loadings (PM Outbound)

Travel Demand on Network

A.4.6

A summary of the vehicle km by year is presented in Figure A.32 for an average weekday alongside a summary of passenger km in Figure A.33. The mitigation shows limited impact on either the vehicle distance or passenger km, although both show lower vehicle km and passenger km per capita once the LDP is introduced.

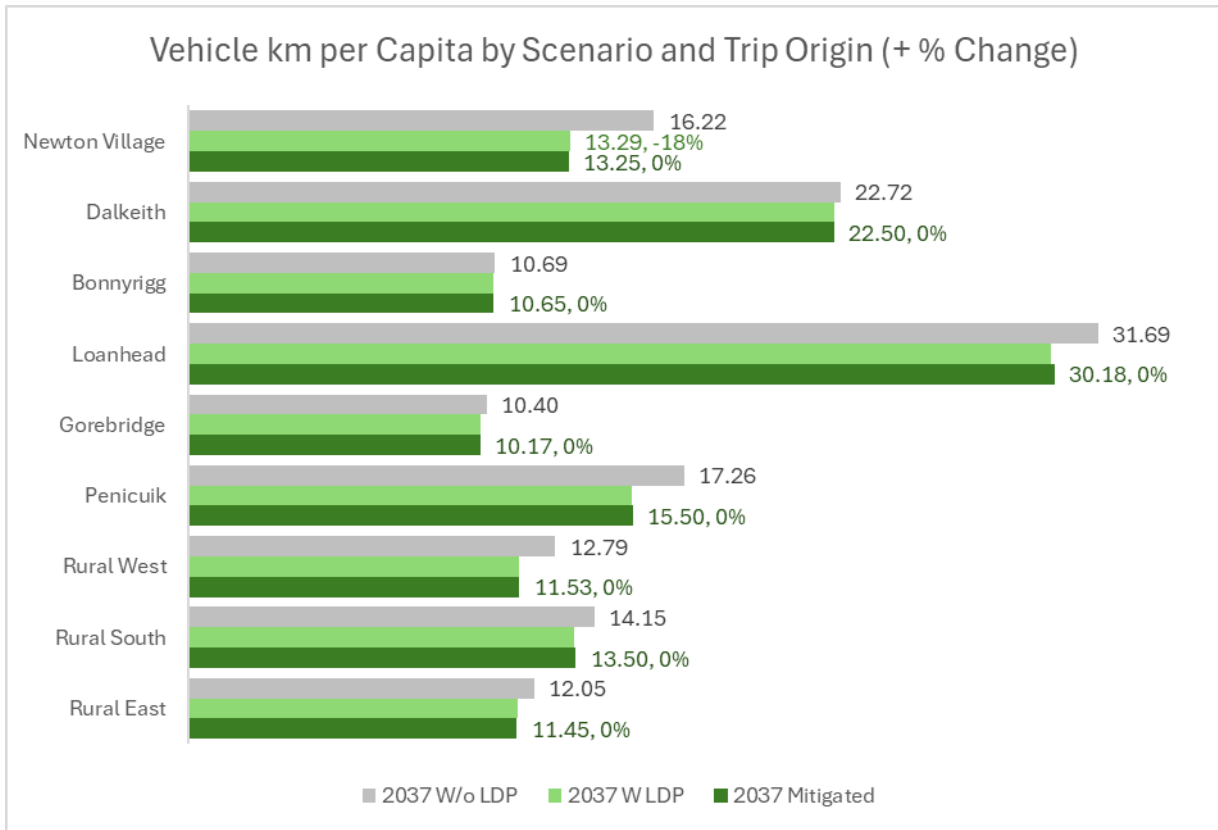


Figure A.32: Vehicle km per Capita by Scenario and Trip Origin (+ % Change)

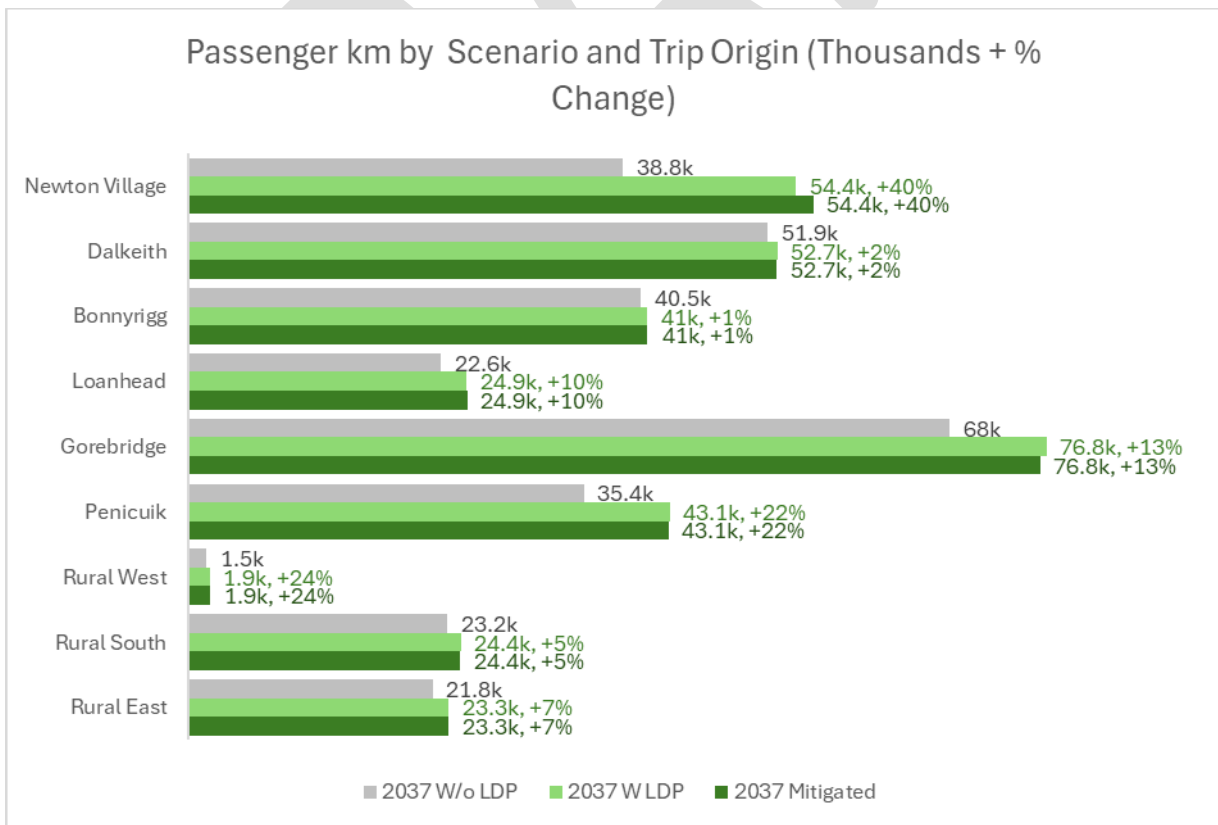


Figure A.33: Passenger Distance by Scenario and Trip Origin (Thousands kms + % Change)

Key Junction Performance

A.4.7 A summary of the performance at key junctions is presented here following the introduction of mitigations. As discussed in Table 5-1, several mitigations are implemented at these junctions so it is expected that there should be a material improvement in performance.

A.4.8 Table A-18 and Table A-19 summarise the flows through the junction in each time period, and generally the mitigations offer significant improvements at all locations, with the exception of A702 / A703. However, this increase of traffic is not necessarily an issue as shown in the next set of results.

Table A-18: Summary of AM Flow Performance Across Key Junctions

Junction	2037 Without LDP	2037 With LDP scenario		2037 Mitigated	
	Flow	Flow	Flow Change	Flow	Flow Change
A702 / A703	2,194	2,266	72	2,617	351
Straiton Interchange (South Roundabout)	6,548	6,653	105	6,488	-165
Gilmerton Road Roundabout and Interchange	2,843	2,918	76	930	-1,989
Lasswade Road junction with Wadingburn Road	1,723	1,784	61	1,909	126
Sheriffhall Roundabout	6,937	6,982	45	6,991	9
Millerhill Interchange - A68 (WB) approach to A720	2,136	2,207	71	2,198	-9
Old Craighall Roundabout	4,971	5,046	75	5,039	-7

Table A-19: Summary of PM Flow Performance Across Key Junctions

Junction	2037 Without LDP	2037 With LDP scenario		2037 Mitigated	
	Flow	Flow	Flow Change	Flow	Flow Change
A702 / A703	2,059	2,173	114	2,672	499
Straiton Interchange (South Roundabout)	7,059	7,148	89	7,197	49
Gilmerton Road Roundabout and Interchange	3,216	3,261	44	801	-2,460
Lasswade Road junction with Wadingburn Road	1,922	2,005	82	1,991	-14
Sheriffhall Roundabout	7,204	7,277	72	7,258	-19
Millerhill Interchange - A68 (WB) approach to A720	2,268	2,299	31	2,302	3
Old Craighall Roundabout	5,072	5,110	38	5,122	11

A.4.9 Table A-20 and Table A-21 provide a summary of the total delay at each of the junctions, with all junctions showing a marked improvement in one or both time periods.

Table A-20: Summary of AM Delay Performance Across Key Junctions

Junction	2037 Without LDP	2037 With LDP scenario		2037 Mitigated	
	Delay	Delay	Delay Change	Delay	Delay Change
A702 / A703	621	758	137	97	-661
Straiton Interchange (South Roundabout)	75	75	0	85	10
Gilmerton Road Roundabout and Interchange	137	159	22	33	-126
Lasswade Road junction with Wadingburn Road	187	239	53	85	-154
Sheriffhall Roundabout	979	1,045	66	1,065	19
Millerhill Interchange - A68 (WB) approach to A720	90	104	15	99	-5
Old Craighall Roundabout	109	118	9	123	5

Table A-21: Summary of PM Delay Performance Across Key Junctions

Junction	2037 Without LDP	2037 With LDP scenario		2037 Mitigated	
	Delay	Delay	Delay Change	Delay	Delay Change
A702 / A703	476	526	51	148	-378
Straiton Interchange (South Roundabout)	239	280	41	221	-58
Gilmerton Road Roundabout and Interchange	130	154	24	36	-118
Lasswade Road junction with Wadingburn Road	108	147	39	78	-69
Sheriffhall Roundabout	826	874	49	859	-16
Millerhill Interchange - A68 (WB) approach to A720	44	47	3	47	0
Old Craighall Roundabout	160	160	0	162	1

A.4.10 Aligned with the reduced delay at junctions the queues are expected to decrease in almost all scenarios, as shown in Table A-22 and Table A-23.

Table A-22: Summary of AM Queue Performance Across Key Junctions

Junction	2037 Without LDP	2037 With LDP scenario		2037 Mitigated	
	Queue	Queue	Queue Change	Queue	Queue Change
A702 / A703	176	205	29	210	5

Junction	2037 Without LDP	2037 With LDP scenario		2037 Mitigated	
	Queue	Queue	Queue Change	Queue	Queue Change
Straiton Interchange (South Roundabout)	647	840	193	598	-242
Gilmerton Road Roundabout and Interchange	250	279	29	264	-15
Lasswade Road junction with Wadingburn Road	110	123	13	132	9
Sheriffhall Roundabout	702	767	65	718	-49
Millerhill Interchange - A68 (WB) approach to A720	160	171	11	166	-5
Old Craighall Roundabout	596	647	51	642	-5

Table A-23: Summary of PM Queue Performance Across Key Junctions

Junction	2037 Without LDP	2037 With LDP scenario		2037 Mitigated	
	Queue	Queue	Queue Change	Queue	Queue Change
A702 / A703	168	192	24	266	74
Straiton Interchange (South Roundabout)	966	1,194	228	901	-293
Gilmerton Road Roundabout and Interchange	433	481	48	430	-51
Lasswade Road junction with Wadingburn Road	265	305	40	263	-42
Sheriffhall Roundabout	1,396	1,578	182	1,581	3
Millerhill Interchange - A68 (WB) approach to A720	336	374	38	374	0
Old Craighall Roundabout	1,219	1,344	125	1,344	0

A.4.11

Table A-24 and Table A-25 summarise the volume over capacity ratio at each of the junctions, and as might be expected given the previous results these all show no net detriment and in some cases a marked improvement (A702 / A703 and Gilmerton Road Roundabout). These improvements typically reduce the V/C ratio below the 2027 Baseline, improving not just the impact of the LDP but the underlying position.

Table A-24: Summary of AM V/C Performance Across Key Junctions

Junction	2037 Without LDP	2037 With LDP scenario		2037 Mitigated	
	V/C	V/C	V/C Change	V/C	V/C Change
A702 / A703	112	116	4	58	-58

Junction	2037 Without LDP	2037 With LDP scenario		2037 Mitigated	
	V/C	V/C	V/C Change	V/C	V/C Change
Straiton Interchange (South Roundabout)	60	61	1	58	-3
Gilmerton Road Roundabout and Interchange	75	78	2	52	-26
Lasswade Road junction with Wadingburn Road	80	84	3	73	-11
Sheriffhall Roundabout	116	117	1	117	0
Millerhill Interchange - A68 (WB) approach to A720	82	84	3	84	-1
Old Craighall Roundabout	66	68	2	68	0

Table A-25: Summary of PM V/C Performance Across Key Junctions

Junction	2037 Without LDP	2037 With LDP scenario		2037 Mitigated	
	V/C	V/C	V/C Change	V/C	V/C Change
A702 / A703	107	112	5	67	-45
Straiton Interchange (South Roundabout)	74	76	1	71	-4
Gilmerton Road Roundabout and Interchange	92	94	2	67	-27
Lasswade Road junction with Wadingburn Road	79	82	3	64	-18
Sheriffhall Roundabout	114	116	2	115	-1
Millerhill Interchange - A68 (WB) approach to A720	81	83	2	83	0
Old Craighall Roundabout	68	68	1	68	0

Forecast Change in Journey Times

- A.4.12 The time lost to congestion per vehicle is presented for each of the three scenarios in Figure A.34, and highlights negligible differences between the three scenarios.

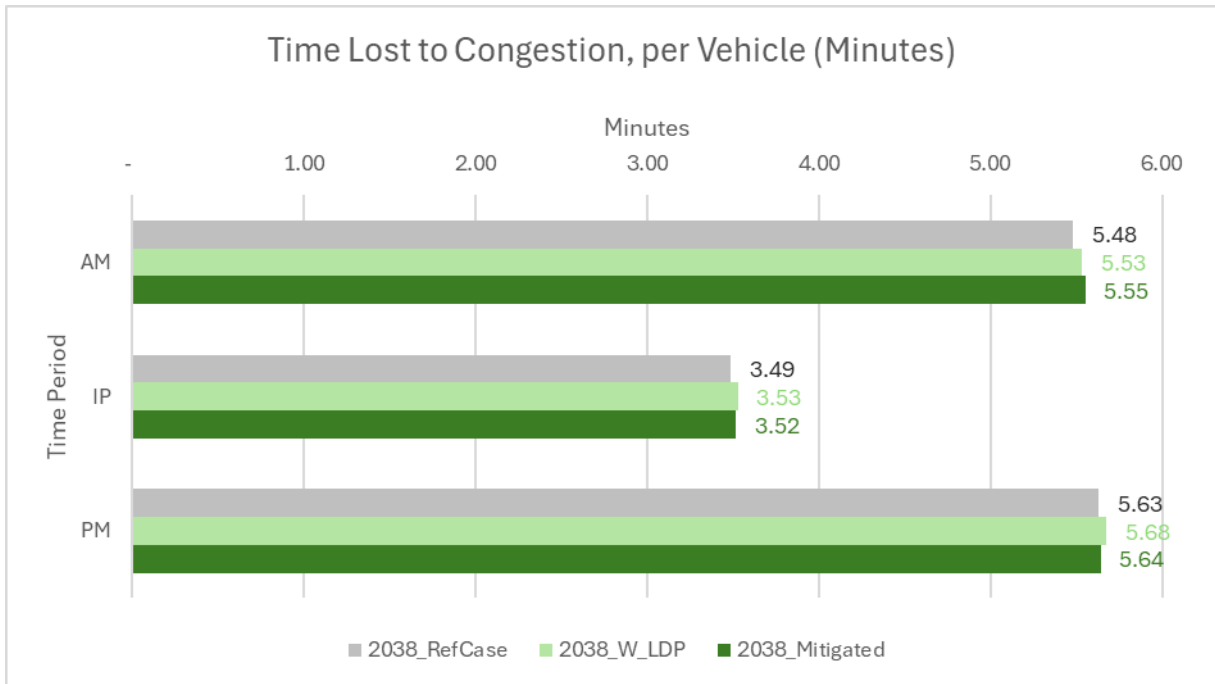


Figure A.34: Time lost due to congestion, per vehicle

A.4.13 Figure A.35, Figure A.36, and Figure A.37 summarise the end to end journey time on key routes in minutes for each scenario, with the overall journey time provided as a label in the 2037 Without LDP scenario as well as the difference from the previous scenario (in seconds) as a label on the other scenarios. Large improvements in journey time are highlighted in green text while increases of over a minute are flagged in red.

A.4.14 The mitigations typically offer improvements on each of the routes in all time periods, with the notable exception being the WB City Bypass in the morning peak.

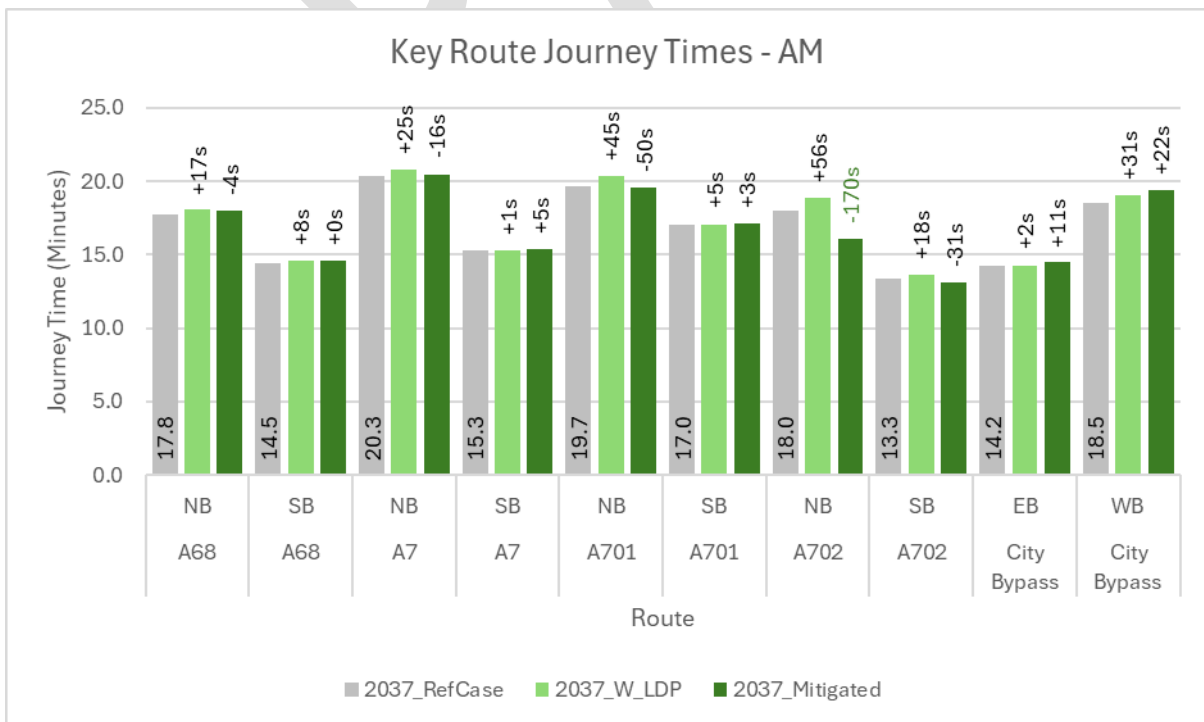


Figure A.35: Key Route AM Journey Times by Scenario with Differences (Minutes)

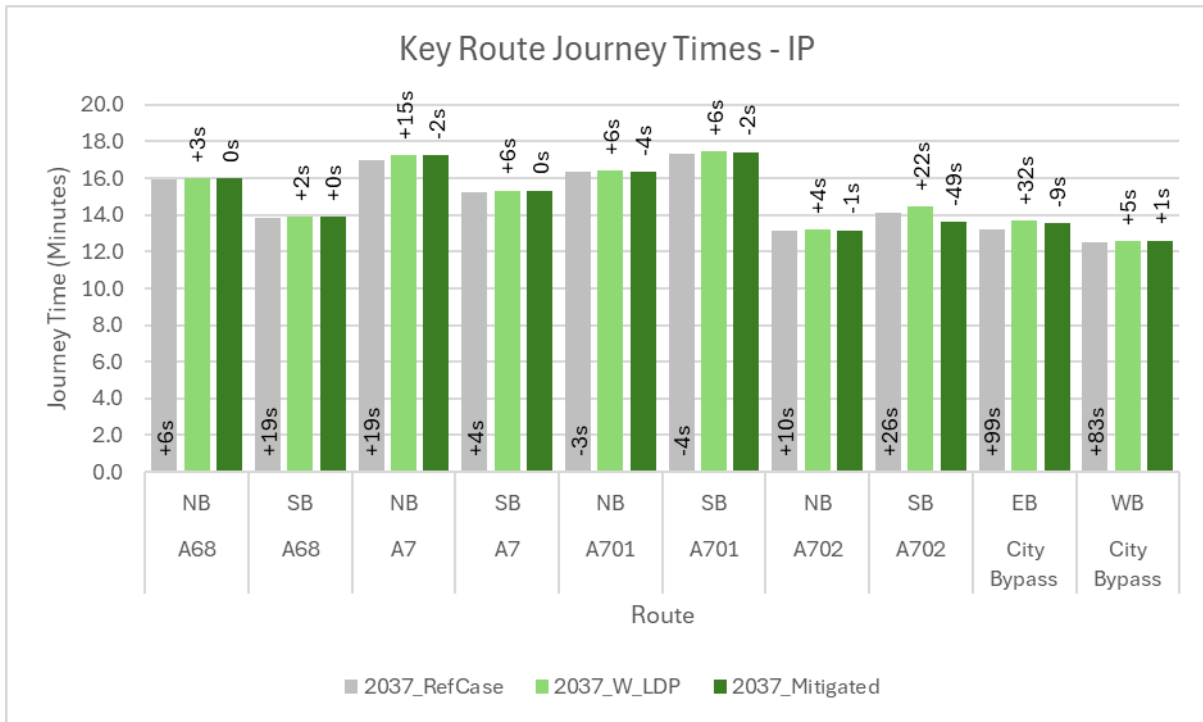


Figure A.36: Key Route IP Journey Times by Scenario with Differences (Minutes)

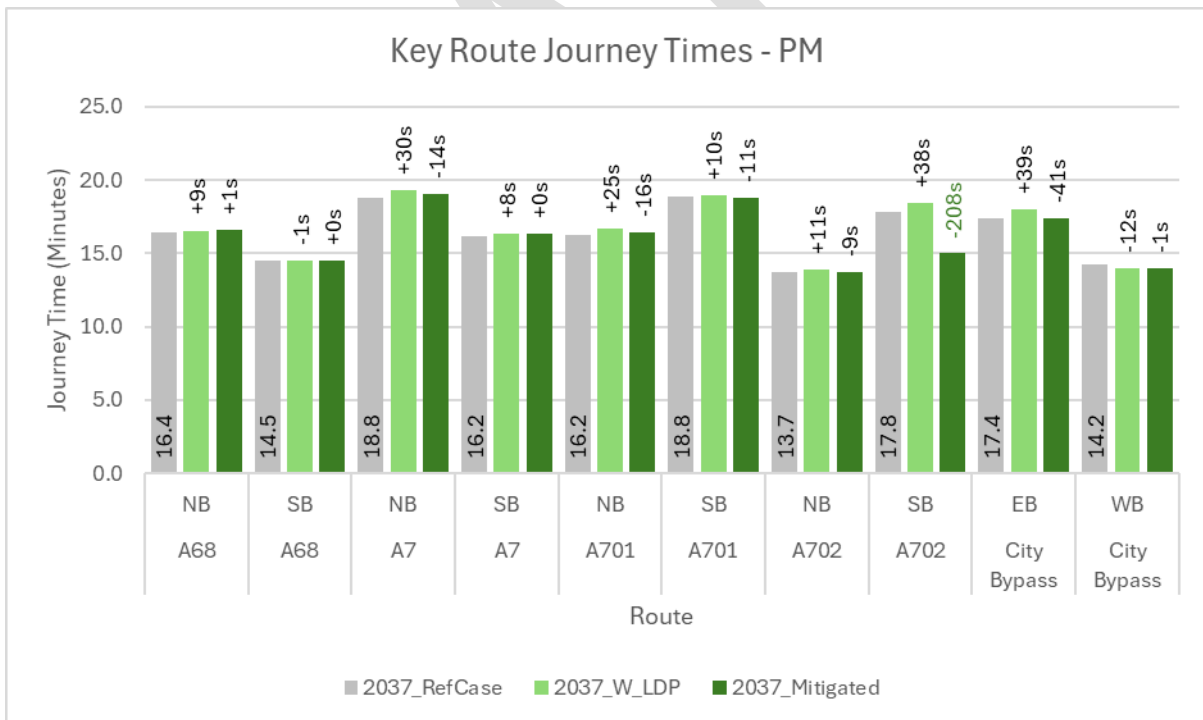


Figure A.37: Key Route PM Journey Times by Scenario with Differences (Minutes)

- A.4.15 General journey times by sectorised movements from regions in Midlothian to Edinburgh City Centre in the morning peak are presented in Figure A.38, with the reverse movements presented in Figure A.39 for the evening peak.
- A.4.16 Likewise, Figure A.40 and Figure A.41 show forecast journey times for the same journeys and peak periods by public transport. These figures are based on the commute user class within the model.

- A.4.17 The changes here are generally less pronounced than the key route information presented above, and no changes larger than 30 seconds are introduced by the mitigations in the morning peak. In the evening peak both Bonnyrigg and Gorebridge see improvements of 30 seconds through mitigations on the road network.
- A.4.18 Changes in the public transport journey times are generally smaller again.

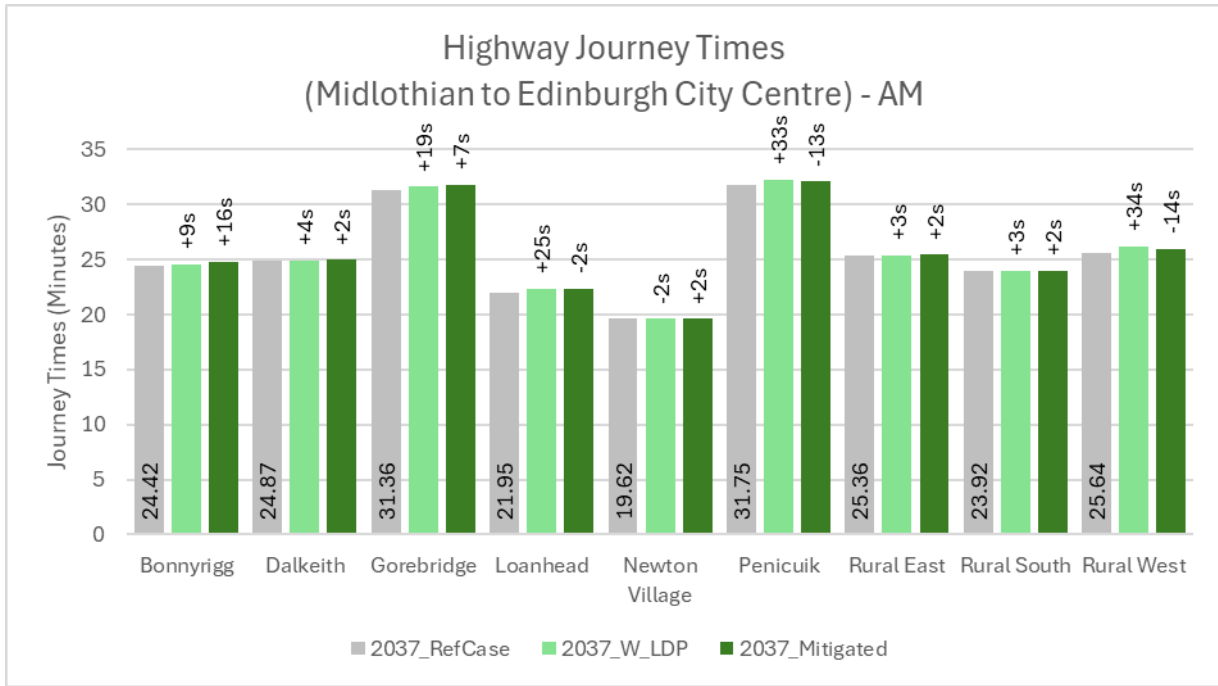


Figure A.38: Highway Journey Times (Midlothian Sectors to Edinburgh City Centre), AM Peak

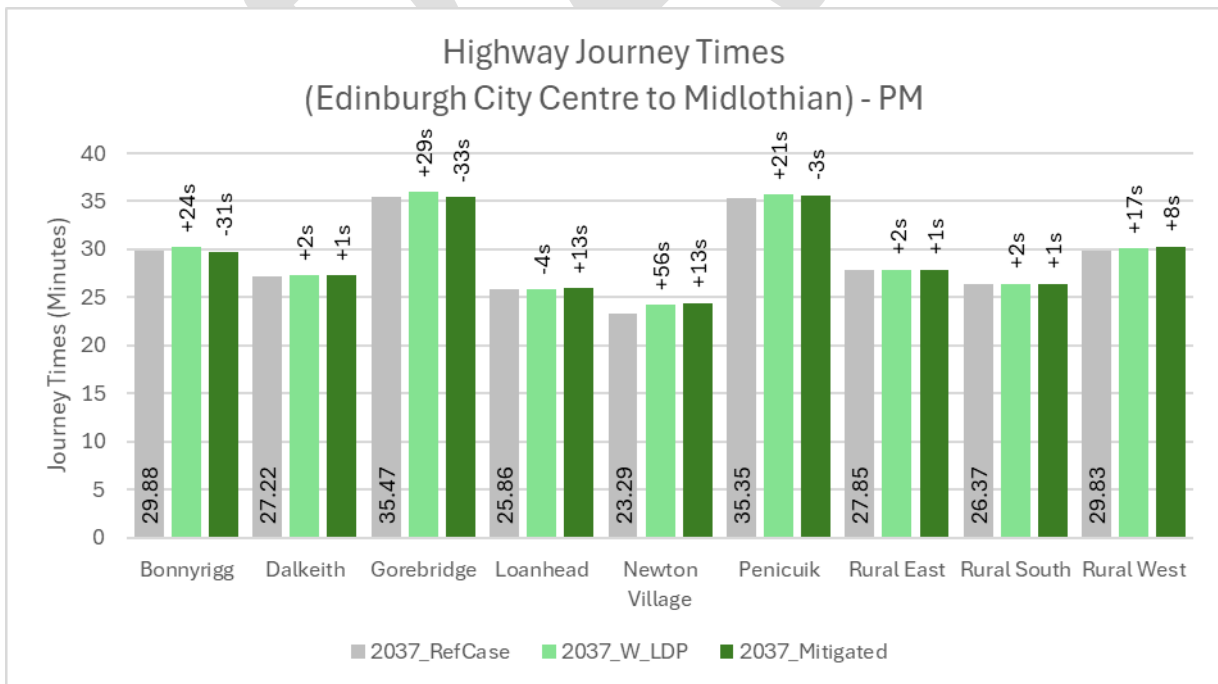


Figure A.39: Highway Journey Times (Edinburgh City Centre to Midlothian Sectors), PM Peak

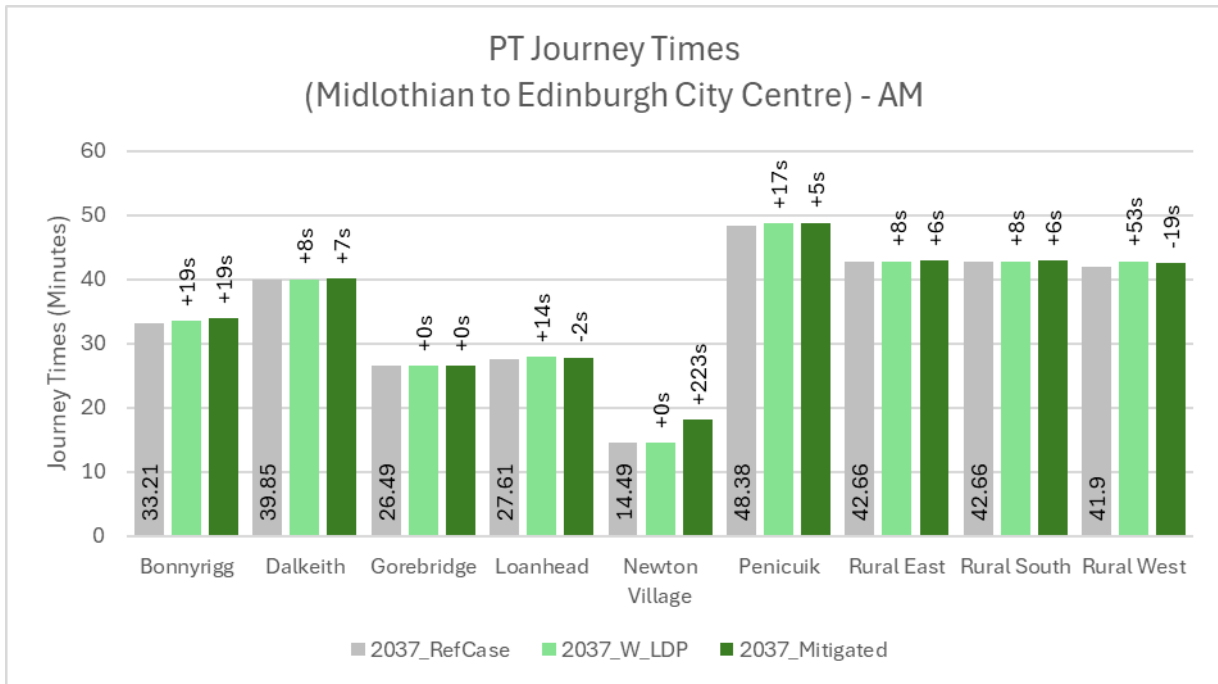


Figure A.40: Public Transport Journey Times (Midlothian Sectors to Edinburgh City Centre), AM Peak

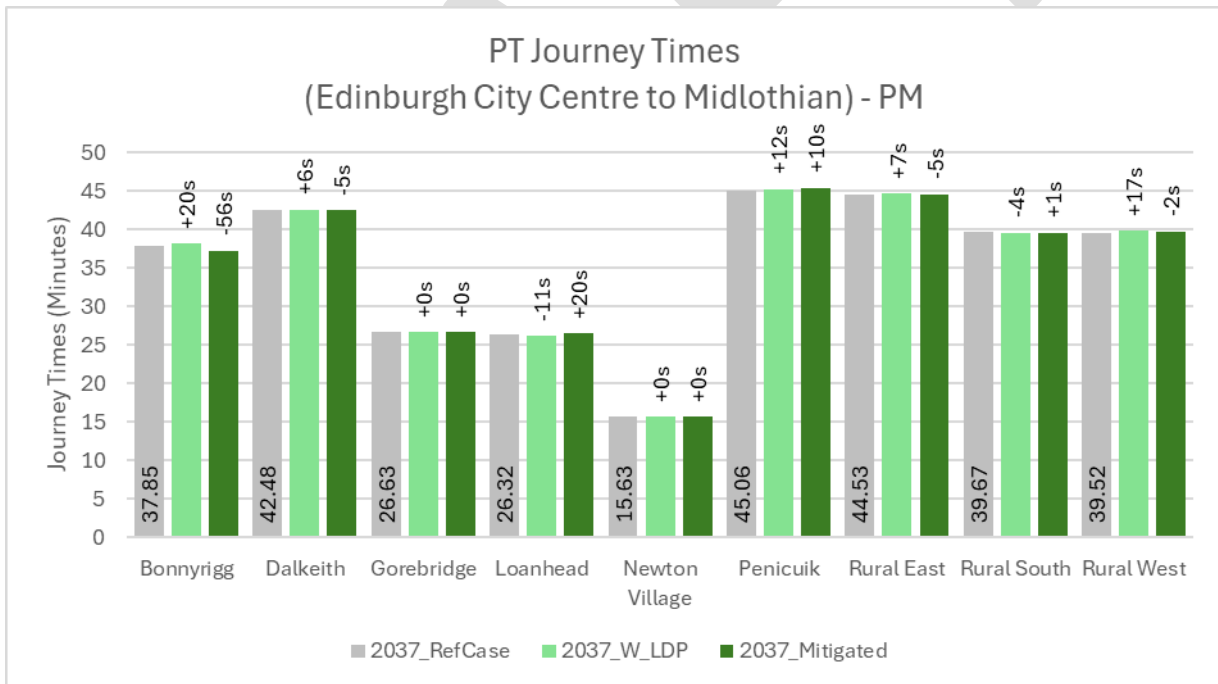


Figure A.41: Public Transport Journey Times (Edinburgh City Centre to Midlothian Sectors), PM Peak

Forecast Change in Revenue

A.4.19

Figure A.42 highlights the impact of the LDP and then mitigations on public transport revenue. Given the limited impact of mitigations on public transport usage, the associated impact on revenue is of a similar magnitude, i.e. negligible.

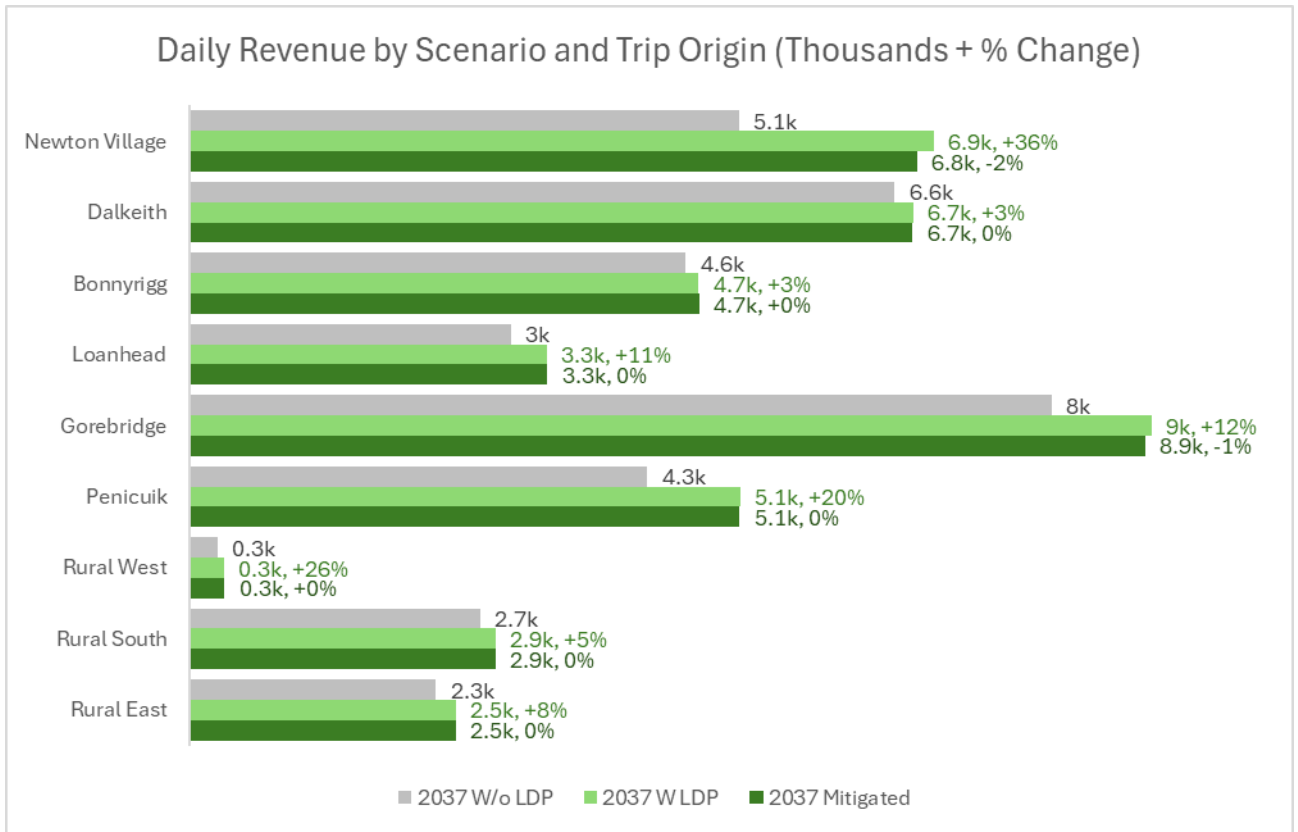


Figure A.42: Passenger Revenue by Scenario and Trip Origin (Thousands kms + % Change)

Carbon Emissions

A.4.20 A summary of the carbon emissions per capita associated with the three scenarios is presented in Table A-26. There are decreases in carbon due to the mitigations which improve road journey times and hence increase mode share.

Table A-26: Carbon Emissions per Capita by Scenario

Scenario	tCO2e	Population	tCO2e per capita
2037 Without LDP	1,128,136	1,768,690	0.638
2037 With LDP scenario	1,130,681	1,785,467	0.633
2037 Mitigated	1,111,151	1,785,467	0.622
Difference	-19,530	0	-0.011

A.5 Sensitivity Test Impact on Transport Network

A.5.1 As with Section A.4, this section outlines the forecast travel demand and network impacts predicted from the SRM, which include both a cost response from the supply network and the impact of mode and destination choice. Three scenarios are considered, with differences always presented pivoting between the directly preceding scenario:

- 2037 With LDP scenario;
- 2037 Mitigated; and

- 2037 Sensitivity Scenario.

Trip Origins and Destinations

A.5.2

Figure A.43 and Figure A.44 present the forecast number of car and public transport trips in terms of total origins and destinations by Midlothian sectors respectively, presented as a 12-hour total. Given the consistent demand between the three scenarios, there is next to no difference in the overall totals, and similarly negligible change in breakdowns by mode.

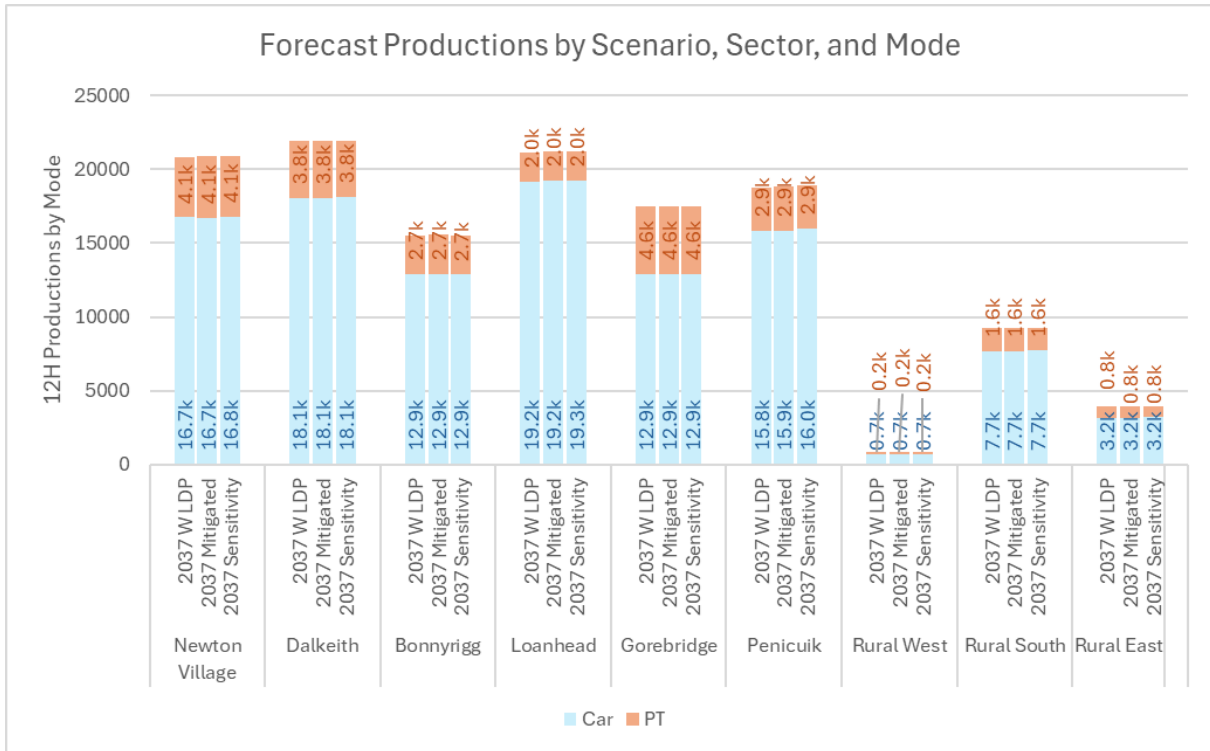


Figure A.43: Forecast Productions by Scenario, Sector, and Mode

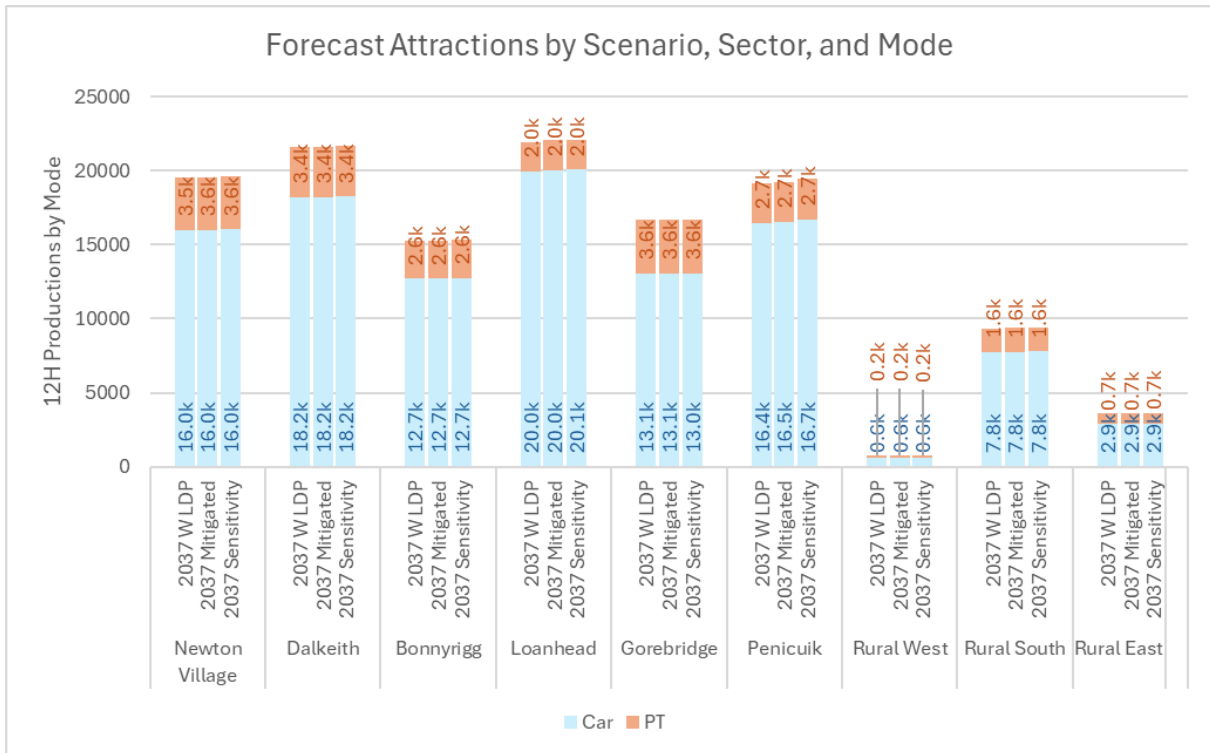


Figure A.44: Forecast Attractions by Scenario, Sector, and Mode

8.7.4 A summary of the public transport origins and destinations by Midlothian sector is provided in Table A-27 and Table A-28 respectively. Only minimal changes are introduced by the Sensitivity scenario.

Table A-27: Summary 12-hour Public Transport Origins by Midlothian Sector

Sector	2037 With LDP scenario	2037 Mitigated			2037 Sensitivity		
	Actual	Actual	Difference	% Change	Actual	Difference	% Change
Newton Village	4,080	4,147	67	2%	4,142	-5	0%
Dalkeith	3,837	3,833	-4	0%	3,836	3	0%
Bonnyrigg	2,669	2,669	-1	0%	2,672	3	0%
Loanhead	1,984	1,986	1	0%	1,979	-7	0%
Gorebridge	4,575	4,572	-3	0%	4,581	10	0%
Penicuik	2,947	2,943	-4	0%	2,937	-6	0%
Rural West	158	158	0	0%	157	0	0%
Rural South	1,559	1,556	-2	0%	1,557	0	0%
Rural East	770	769	0	0%	770	1	0%

Table A-28: Summary 12-hour Public Transport Destinations by Midlothian Sector

Sector	2037 With LDP scenario	2037 Mitigated			2037 Sensitivity		
	Actual	Actual	Difference	% Change	Actual	Difference	% Change
Newton Village	3,506	3,567	61	2%	3,563	-4	0%
Dalkeith	3,423	3,418	-5	0%	3,422	4	0%
Bonnyrigg	2,585	2,584	-1	0%	2,588	3	0%
Loanhead	1,992	1,993	1	0%	1,987	-5	0%
Gorebridge	3,632	3,628	-4	0%	3,636	8	0%
Penicuik	2,742	2,739	-4	0%	2,734	-5	0%
Rural West	194	194	0	0%	193	0	0%
Rural South	1,604	1,601	-3	0%	1,601	1	0%
Rural East	723	723	0	0%	724	1	0%

Public Transport Mode Share

A.5.3

A summary of the modelled public transport mode share by origin and destination is provided in Figure A.45 and Figure A.46 for each scenario. These comparisons exclude non-motorised modes which are not modelled in SRM. As with the results above, only small changes are introduced by the sensitivity.

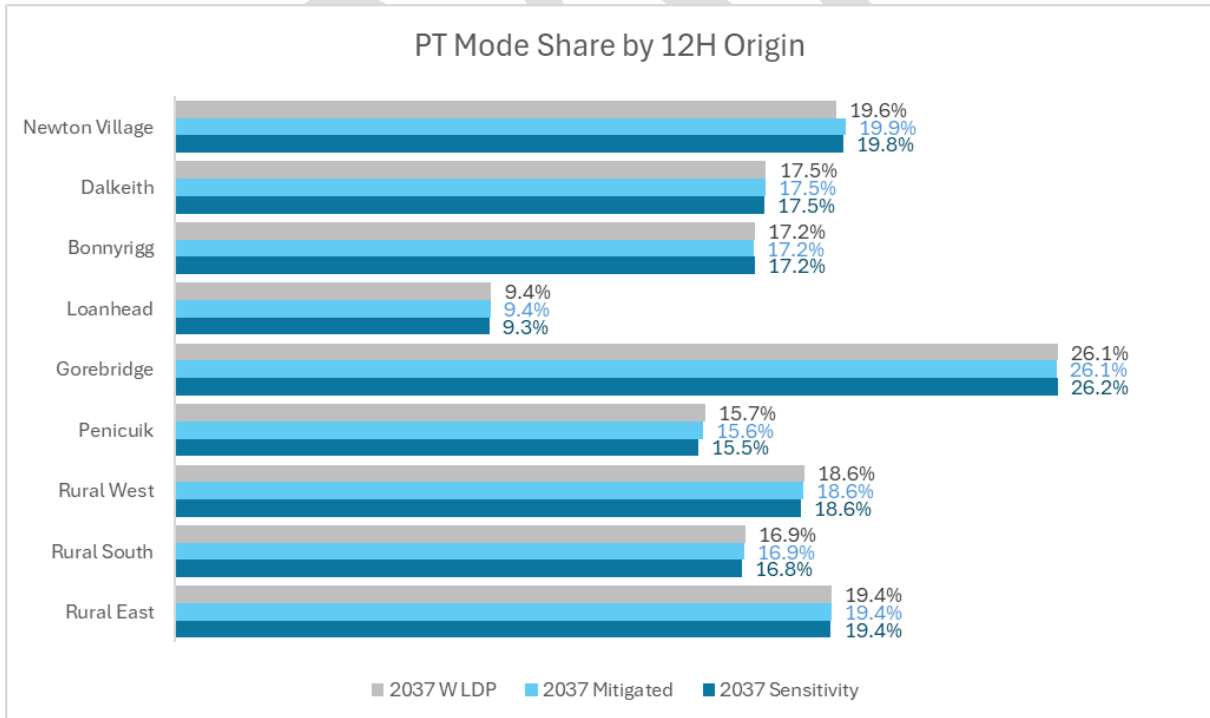


Figure A.45: Public Transport Mode Share by Origin

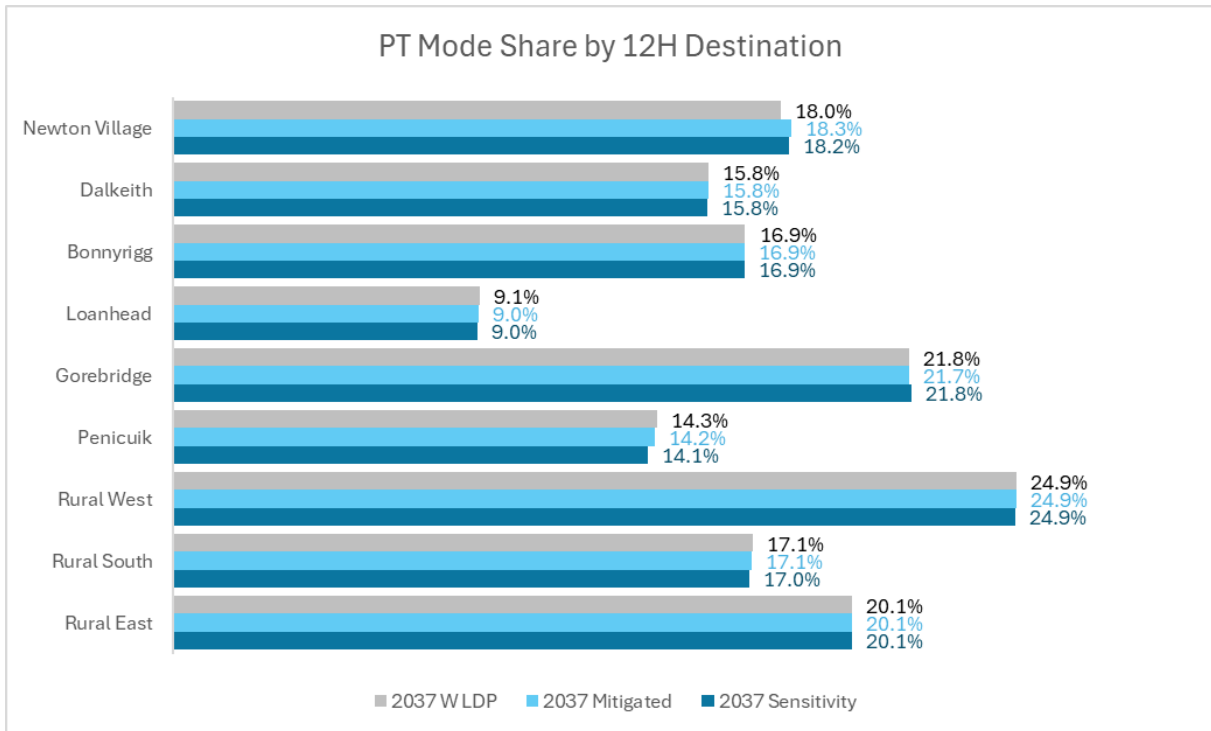


Figure A.46: Public Transport Mode Share by Destination

A.5.4

Figure A.47 shows the daily boardings and alightings on Borders Rail. The Sensitivity scenario introduces little to no change in station usage. This reflects the relatively congested services in the peak periods, as demonstrated in Figure A.48 and Figure A.49 which show the passenger loadings for typical Borders Rail services in the AM and PM periods in the most utilised directions. As noted previously, these services are expected to exceed the seated capacity which would lead to a less desirable travel experience.

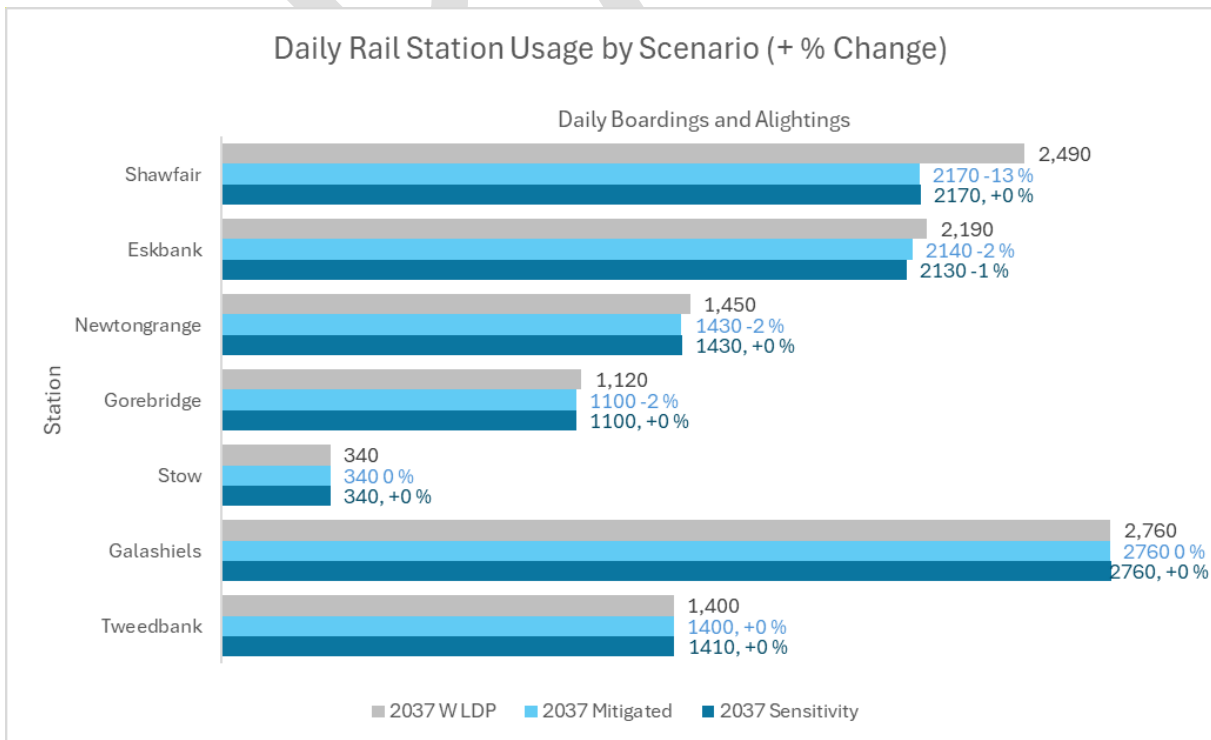


Figure A.47: Daily Patronage by Rail Station

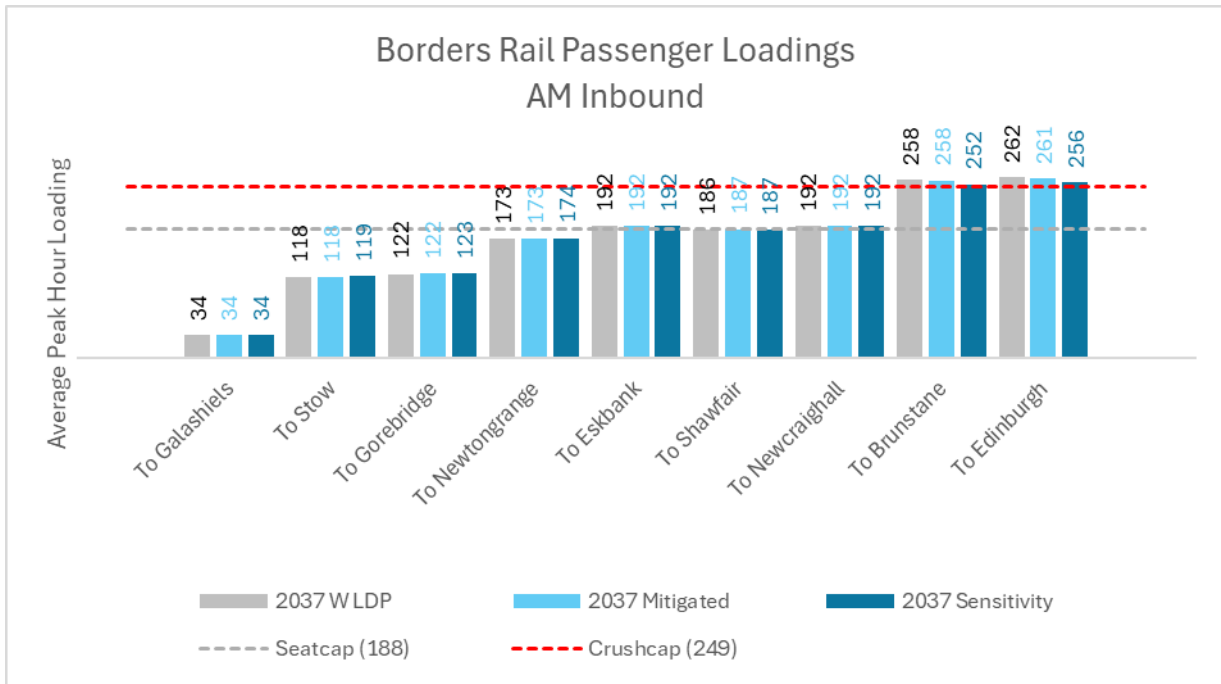


Figure A.48: Borders Rail Passenger Loadings (AM Inbound)

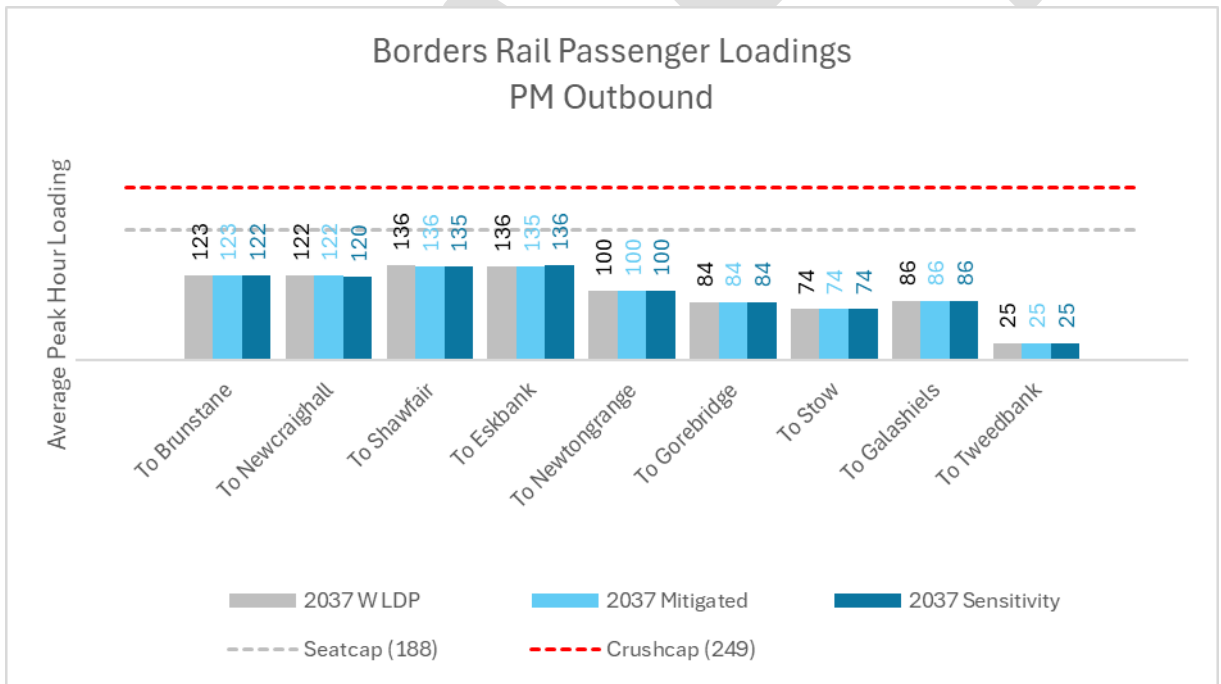


Figure A.49: Borders Rail Passenger Loadings (PM Outbound)

Travel Demand on Network

A.5.5

Figure A.50 summarises the vehicle km for an average weekday alongside a summary of passenger km in Figure A.51. There is little difference in either metric due to moving to the Sensitivity scenario, and the largest change presents in Penicuik (an increase of 2%).

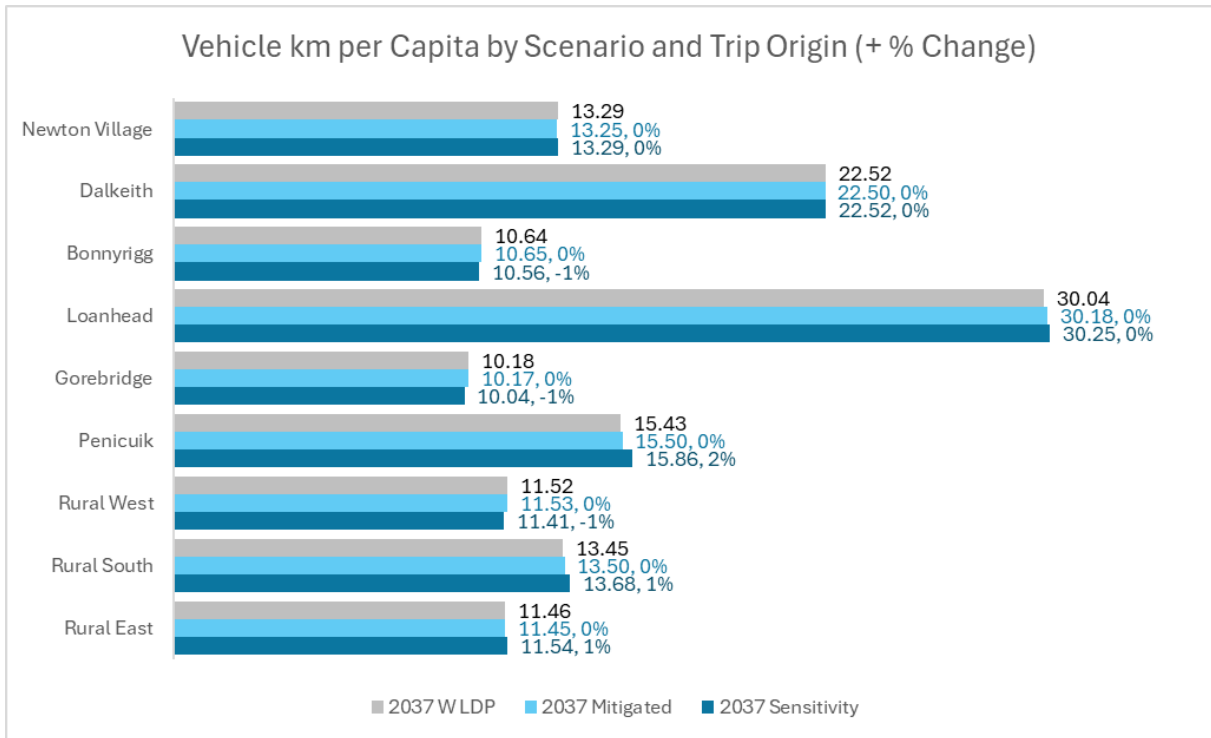


Figure A.50: Vehicle km per Capita by Scenario and Trip Origin (+ % Change)

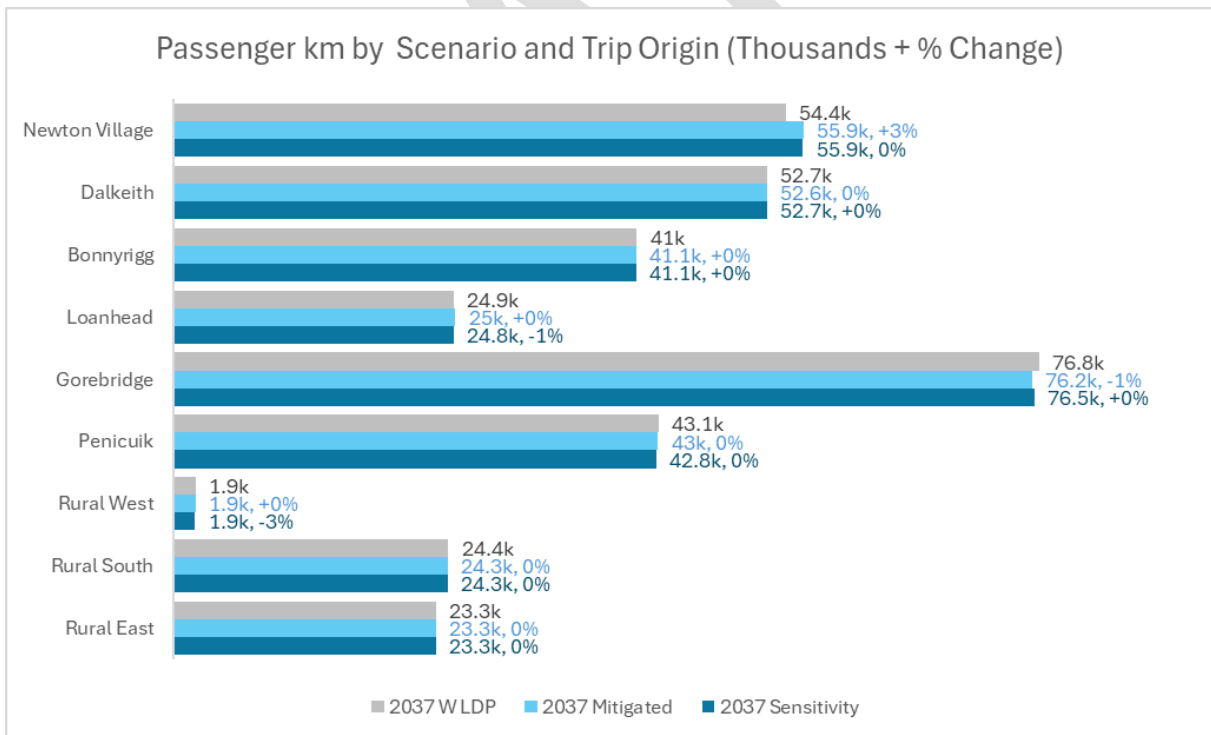


Figure A.51: Passenger Distance by Scenario and Trip Origin (Thousands kms + % Change)

Key Junction Performance

A.5.6

A summary of the performance at key junctions is presented here for the three infrastructure scenarios. Unlike the previous results in this section of the appendix, junction performance is extremely localised and clearly demonstrates the impacts of mitigations as well as the changes in the network introduced in the Sensitivity scenario.

A.5.7 The flows passing through each junction in each time period are summarised in Table A-29 and Table A-30, and generally the Sensitivity show significant increases at all locations, with the exception of A702 / A703. However, this increase of traffic is not necessarily an issue as shown in the next set of results.

Table A-29: Summary of AM Flow Performance Across Key Junctions

Junction	2037 With LDP scenario	2037 Mitigated		2037 Sensitivity	
	Flow	Flow	Flow Change	Flow	Flow Change
A702 / A703	2,266	2,617	351	2,278	-339
Straiton Interchange (South Roundabout)	6,653	6,488	-165	7,038	550
Gilmerton Road Roundabout and Interchange	2,918	930	-1,989	1,404	475
Lasswade Road junction with Wadingburn Road	1,784	1,909	126	1,876	-33
Sheriffhall Roundabout	6,982	6,991	9	9,080	2,089
Millerhill Interchange - A68 (WB) approach to A720	2,207	2,198	-9	2,370	171
Old Craighall Roundabout	5,046	5,039	-7	5,466	427

Table A-30: Summary of PM Flow Performance Across Key Junctions

Junction	2037 With LDP scenario	2037 Mitigated		2037 Sensitivity	
	Flow	Flow	Flow Change	Flow	Flow Change
A702 / A703	2,173	2,672	499	2,392	-280
Straiton Interchange (South Roundabout)	7,148	7,197	49	7,589	392
Gilmerton Road Roundabout and Interchange	3,261	801	-2,460	933	132
Lasswade Road junction with Wadingburn Road	2,005	1,991	-14	2,043	52
Sheriffhall Roundabout	7,277	7,258	-19	8,317	1,059
Millerhill Interchange - A68 (WB) approach to A720	2,299	2,302	3	2,590	288
Old Craighall Roundabout	5,110	5,122	11	5,535	414

A.5.8 Table A-31 and Table A-32 provide a summary of the total delay at each of the junctions, with Sheriffhall and A702/A703 showing a marked improvement in both time periods, and increases in delay at Straiton due to the addition of the link road. Millerhill also demonstrates an increase in delay due to the improvements at neighbouring locations, but collectively the network improves even when considering these increases.

Table A-31: Summary of AM Delay Performance Across Key Junctions

Junction	2037 With LDP scenario	2037 Mitigated		2037 Sensitivity	
	Delay	Delay	Delay Change	Delay	Delay Change
A702 / A703	758	97	-661	73	-25
Straiton Interchange (South Roundabout)	75	85	10	195	111
Gilmerton Road Roundabout and Interchange	159	33	-126	45	11
Lasswade Road junction with Wadingburn Road	239	85	-154	82	-3
Sheriffhall Roundabout	1,045	1,065	19	109	-956
Millerhill Interchange - A68 (WB) approach to A720	104	99	-5	148	49
Old Craighall Roundabout	118	123	5	160	37

Table A-32: Summary of PM Delay Performance Across Key Junctions

Junction	2037 With LDP scenario	2037 Mitigated		2037 Sensitivity	
	Delay	Delay	Delay Change	Delay	Delay Change
A702 / A703	526	148	-378	122	-26
Straiton Interchange (South Roundabout)	280	221	-58	405	184
Gilmerton Road Roundabout and Interchange	154	36	-118	40	4
Lasswade Road junction with Wadingburn Road	147	78	-69	76	-3
Sheriffhall Roundabout	874	859	-16	516	-343
Millerhill Interchange - A68 (WB) approach to A720	47	47	0	106	60
Old Craighall Roundabout	160	162	1	213	52

A.5.9

Aligned with the reduced delay at junctions the queues are expected to decrease in almost all scenarios, as shown in Table A-33 and Table A-34.

Table A-33: Summary of AM Queue Performance Across Key Junctions

Junction	2037 With LDP scenario	2037 Mitigated		2037 Sensitivity	
	Queue	Queue	Queue Change	Queue	Queue Change
A702 / A703	205	210	5	184	-26

Junction	2037 With LDP scenario	2037 Mitigated		2037 Sensitivity	
	Queue	Queue	Queue Change	Queue	Queue Change
Straiton Interchange (South Roundabout)	840	598	-242	545	-53
Gilmerton Road Roundabout and Interchange	279	264	-15	107	-157
Lasswade Road junction with Wadingburn Road	123	132	9	108	-24
Sheriffhall Roundabout	767	718	-49	271	-447
Millerhill Interchange - A68 (WB) approach to A720	171	166	-5	135	-31
Old Craighall Roundabout	647	642	-5	545	-97

Table A-34: Summary of PM Queue Performance Across Key Junctions

Junction	2037 With LDP scenario	2037 Mitigated		2037 Sensitivity	
	Queue	Queue	Queue Change	Queue	Queue Change
A702 / A703	192	266	74	207	-59
Straiton Interchange (South Roundabout)	1,194	901	-293	923	22
Gilmerton Road Roundabout and Interchange	481	430	-51	323	-107
Lasswade Road junction with Wadingburn Road	305	263	-42	232	-31
Sheriffhall Roundabout	1,578	1,581	3	715	-866
Millerhill Interchange - A68 (WB) approach to A720	374	374	0	371	-3
Old Craighall Roundabout	1,344	1,344	0	1,119	-225

A.5.10 Table A-35 and Table A-36 summarise the volume over capacity ratio at each of the junctions, with Sheriffhall showing large reductions and neighbouring junctions at Gilmerton and Millerhill showing small increases.

Table A-35: Summary of AM V/C Performance Across Key Junctions

Junction	2037 With LDP scenario	2037 Mitigated		2037 Sensitivity	
	V/C	V/C	V/C Change	V/C	V/C Change
A702 / A703	116	58	-58	52	-5
Straiton Interchange (South Roundabout)	61	58	-3	66	7

Junction	2037 With LDP scenario	2037 Mitigated		2037 Sensitivity	
	V/C	V/C	V/C Change	V/C	V/C Change
Gilmerton Road Roundabout and Interchange	78	52	-26	84	32
Lasswade Road junction with Wadingburn Road	84	73	-11	69	-3
Sheriffhall Roundabout	117	117	0	63	-55
Millerhill Interchange - A68 (WB) approach to A720	84	84	-1	97	13
Old Craighall Roundabout	68	68	0	73	6

Table A-36: Summary of PM V/C Performance Across Key Junctions

Junction	2037 With LDP scenario	2037 Mitigated		2037 Sensitivity	
	V/C	V/C	V/C Change	V/C	V/C Change
A702 / A703	112	67	-45	65	-2
Straiton Interchange (South Roundabout)	76	71	-4	87	15
Gilmerton Road Roundabout and Interchange	94	67	-27	79	12
Lasswade Road junction with Wadingburn Road	82	64	-18	66	1
Sheriffhall Roundabout	116	115	-1	76	-39
Millerhill Interchange - A68 (WB) approach to A720	83	83	0	98	15
Old Craighall Roundabout	68	68	0	74	6

Forecast Change in Journey Times

A.5.11 The time lost to congestion per vehicle is presented for each of the three scenarios in Figure A.52, and highlights negligible differences between the three scenarios.

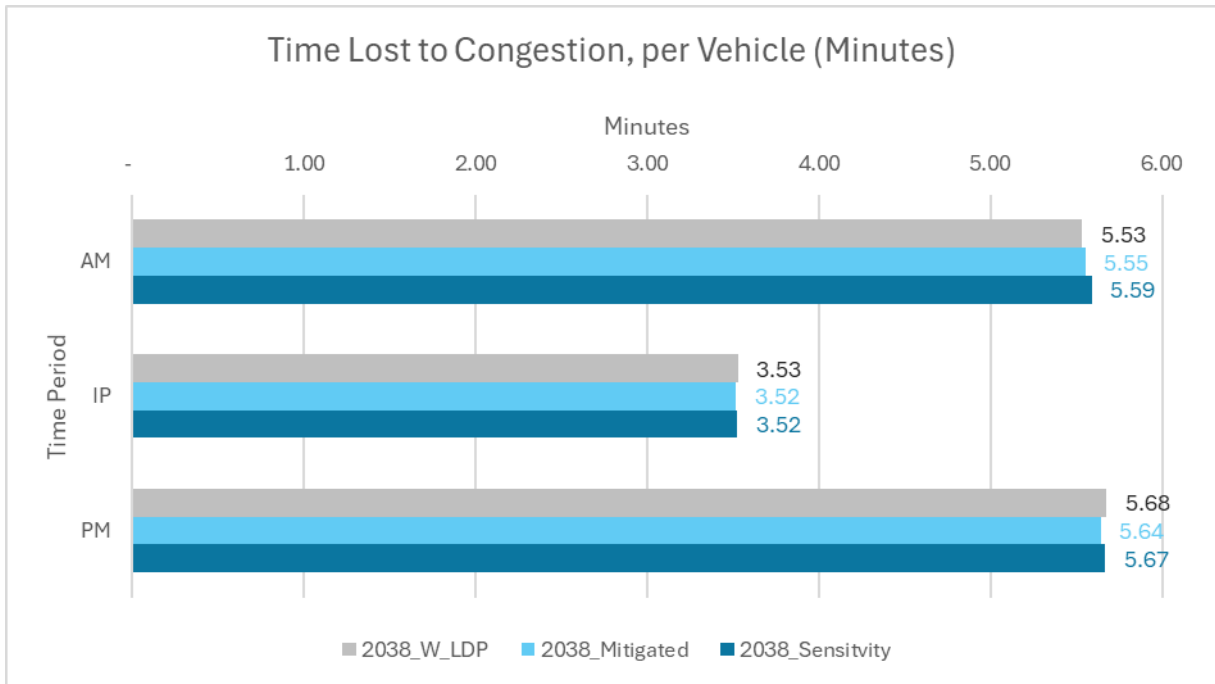


Figure A.52: Time lost due to congestion, per vehicle

A.5.12 Figure A.53, Figure A.54, and Figure A.56 summarise the end to end journey time on key routes in minutes for each scenario, with the overall journey time provided as a label in the 2037 With LDP scenario as well as the difference from the previous scenario (in seconds) as a label on the other scenarios. Large improvements in journey time are highlighted in green text while increases of over a minute are flagged in red.

A.5.13 The sensitivity scenario shows large improvements on the A7, A701, and City Bypass in each time period, although there is an increase in journey time predicted on the A68 NB which corresponds to the additional traffic on the mainline of the City Bypass at Millerhill Junction.

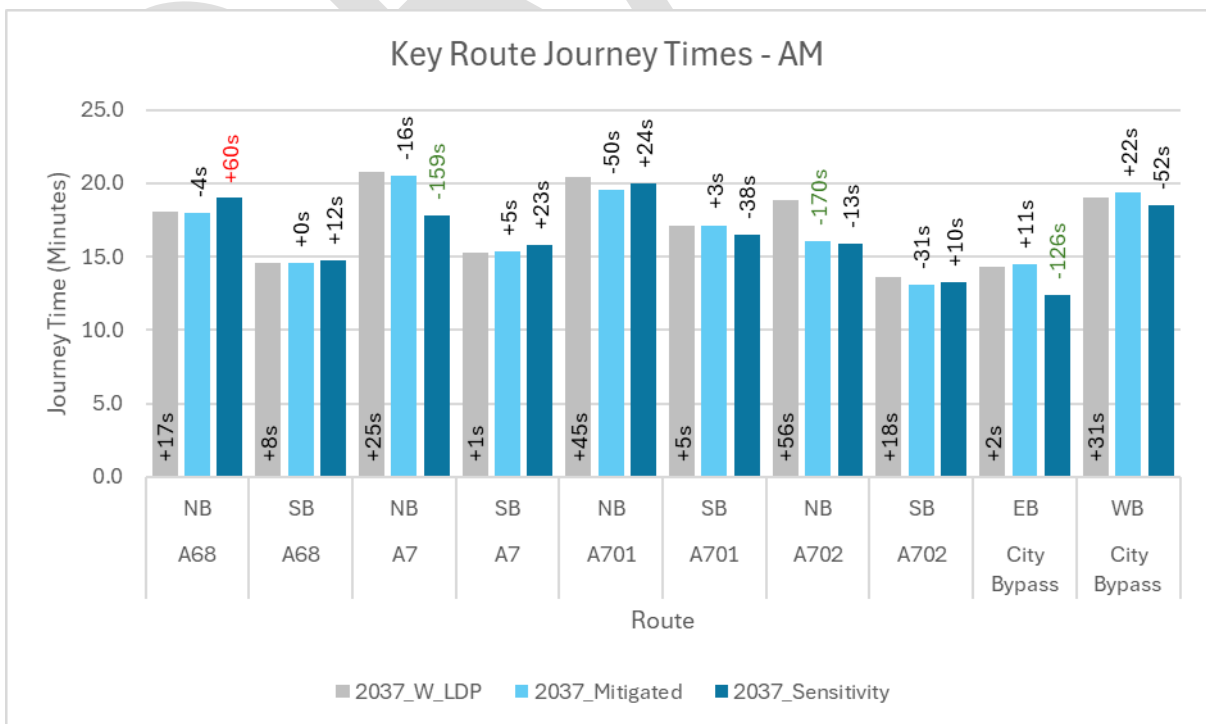


Figure A.53: Key Route AM Journey Times by Scenario with Differences (Minutes)

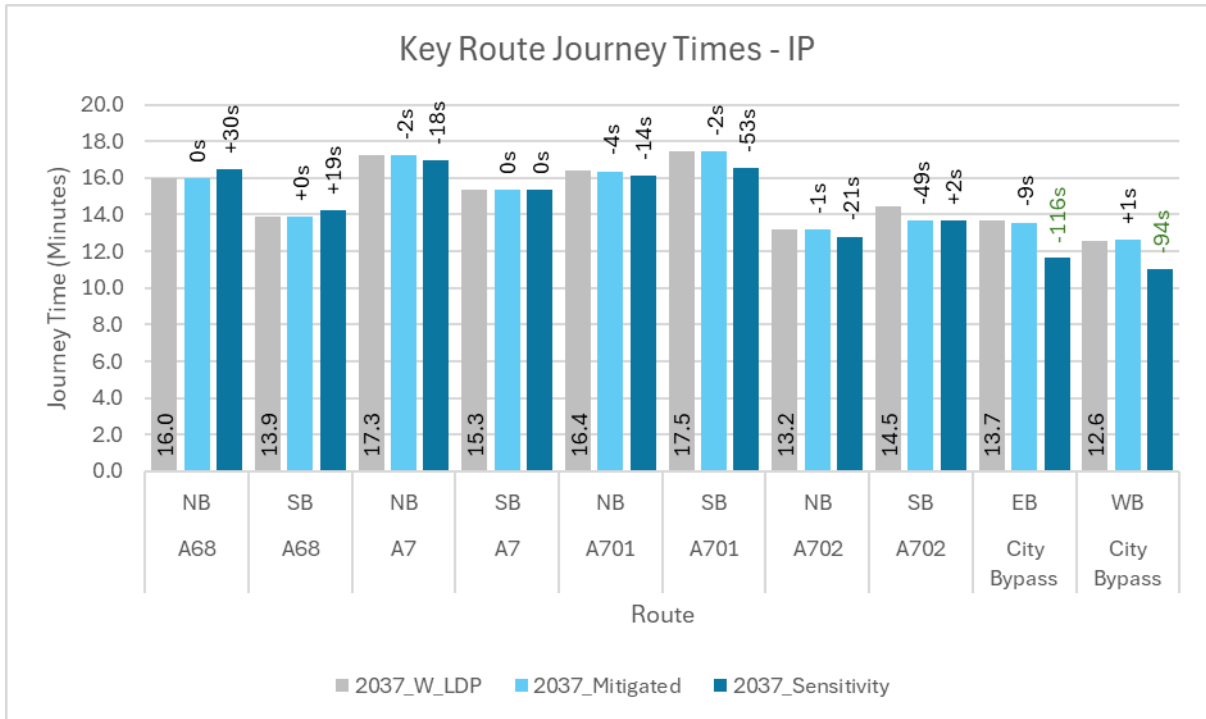


Figure A.54: Key Route IP Journey Times by Scenario with Differences (Minutes)

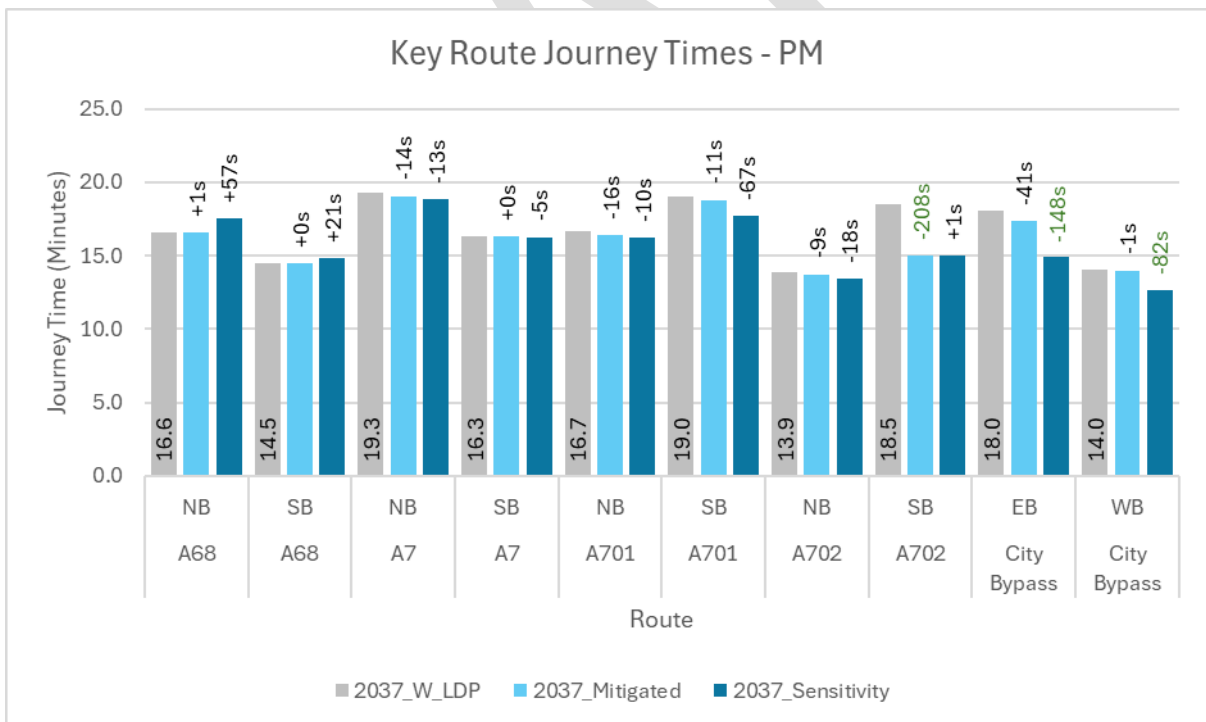


Figure A.55: Key Route PM Journey Times by Scenario with Differences (Minutes)

A.5.14 Figure A.56 and Figure A.57 present general journey times by sectorised movements from regions in Midlothian to Edinburgh City Centre in the morning and evening peak respectively.

- A.5.15 Likewise, Figure A.58 and Figure A.59 show forecast journey times for the same journeys and peak periods by public transport. These figures are based on the commute user class within the model.
- A.5.16 The largest improvements here are from the rural west, which has now introduced the A701 Relief Road to improve traffic flow throughout that area. Dalkeith and Loanhead see an increase in general journey times in the evening peak as a consequence of increased traffic in the area due to network improvements. Changes in the public transport journey times are generally smaller in magnitude than the road-based equivalents.

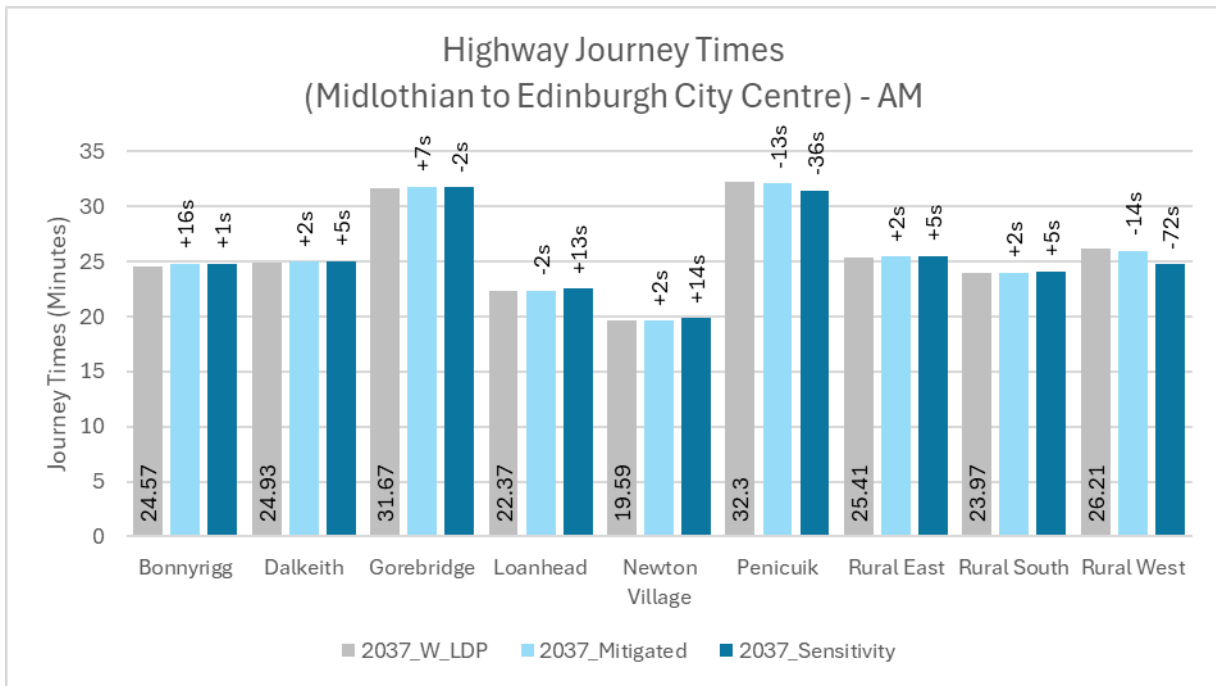


Figure A.56: Highway Journey Times (Midlothian Sectors to Edinburgh City Centre), AM Peak

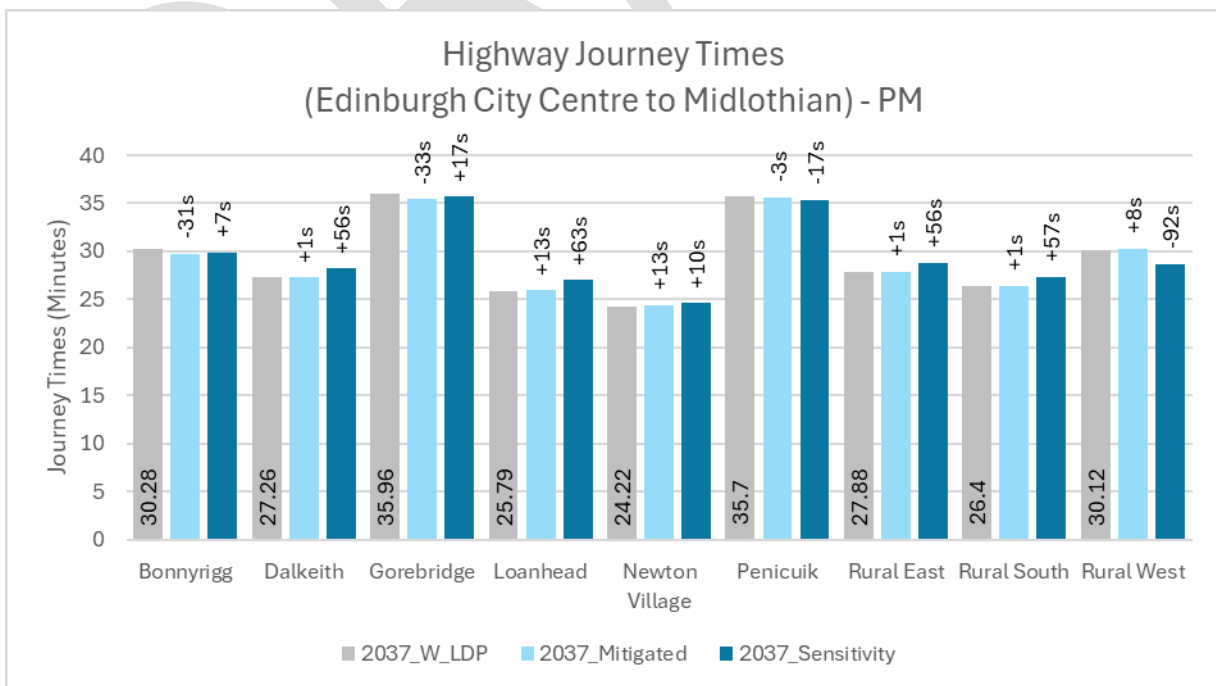


Figure A.57: Highway Journey Times (Edinburgh City Centre to Midlothian Sectors), PM Peak

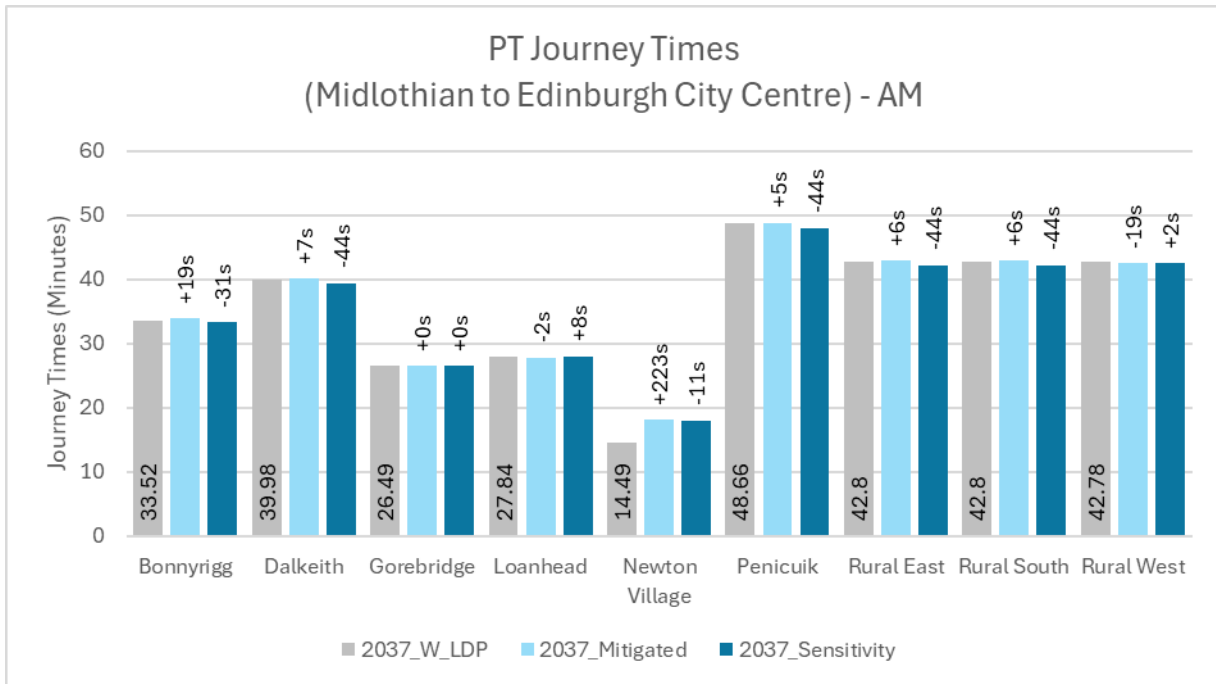


Figure A.58: Public Transport Journey Times (Midlothian Sectors to Edinburgh City Centre), AM Peak

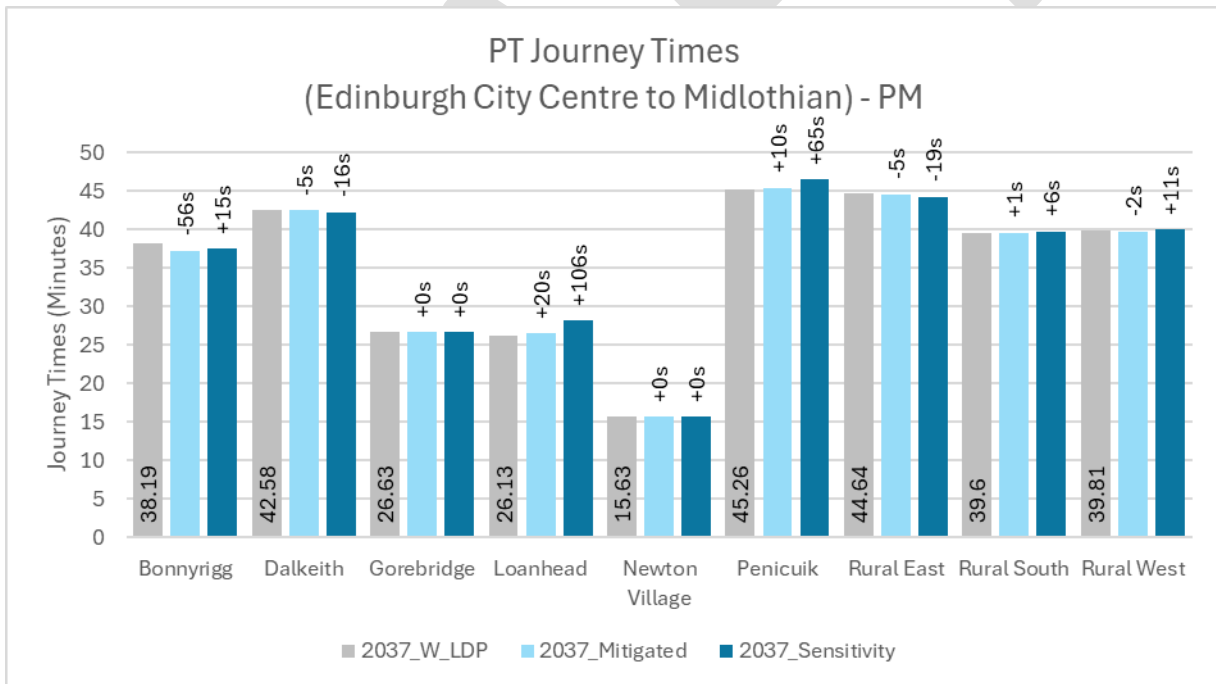


Figure A.59: Public Transport Journey Times (Edinburgh City Centre to Midlothian Sectors), PM Peak

Forecast Change in Revenue

A.5.17

A summary of the overall network revenue for each scenario is presented in Figure A.60. Given the limited impact of the sensitivity scenario on public transport usage, the associated impact on revenue is of a similar magnitude, i.e. negligible.

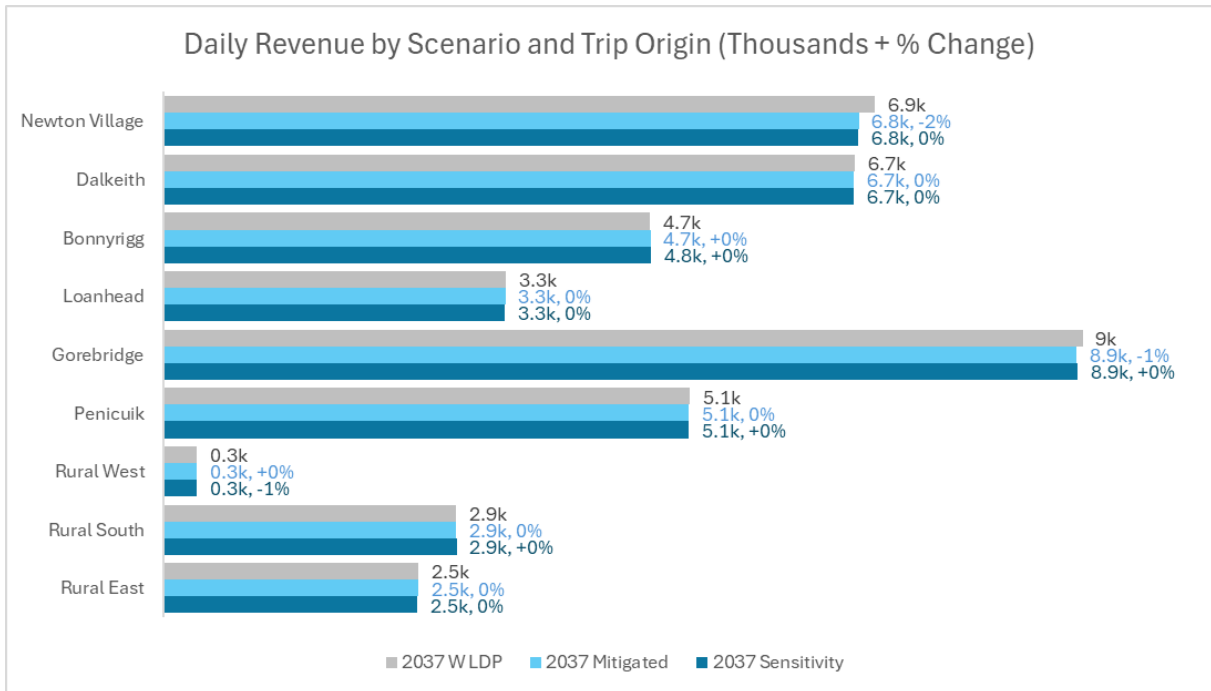


Figure A.60: Passenger Revenue by Scenario and Trip Origin (Thousands kms + % Change)

Carbon Emissions

A.5.18

A summary of the carbon emissions per capita associated with the three scenarios is presented in Table A-37. There are increases in carbon due to the mitigations and interventions which improve road journey times and hence increase mode share.

Table A-37: Carbon Emissions per Capita by Scenario

Scenario	tCO ₂ e	Population	tCO ₂ e per capita
2037 With LDP scenario	1,130,681	1,785,467	0.633
2037 Mitigated	1,111,151	1,785,467	0.622
2037 Sensitivity	1,136,301	1,785,467	0.636
Difference	25,150	0	0.014

Appendix B Key Junction Performance

- A.5.19 Supplied as a separate spreadsheet:
- Appendix_B_Key_Junction_Flows.xlsx

DRAFT