



Appendix B(ii) LCC Retaining Walls
Retaining Walls Value for Money Technical Note

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Lancashire County Council

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Acronyms and Abbreviations

AADT	Annual Average Daily Flow
BCR	Benefit-to-Cost Ratio
DfT	Department for Transport
HGV	Heavy Goods Vehicle
LCC	Lancashire County Council
LGV	Large Goods Vehicle
PSV	Public Service Vehicle
PVB	Present Value of Benefits
PVC	Present Value of Cost
RRN	Resilient Route Network
VfM	Value for Money
WebTAG	DfT's web-based Transport Appraisal Guidance

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1. Introduction

1.1 Background

This technical note presents the value for money assessments undertaken to support a DfT Maintenance Challenge Fund application by Lancashire County Council (LCC). The application comprises several schemes/clusters of schemes relating to the maintenance of critical retaining walls adjacent to key roads including components of the Resilient Route Network (RRN) in Lancashire. Many of these retaining walls suffer from deteriorating conditions and are considered high priority for improvement, being located in steep valleys and often running directly adjacent to water courses. The rationale for intervention is therefore underpinned by a requirement to undertake pre-emptive maintenance to these retaining walls, in order to ensure that key roads (including components of the RRN) do not suffer from long-term closure in response to retaining wall failure.

Based on this approach, three options have been considered which underpin the analysis presented below:

- **Do Nothing** – culminating in permanent road closure
 - Continued monitoring of retaining walls.
 - Retaining walls collapsing resulting in emergency closures at a high number of the sites by 2025.
 - The impact of following a Do Nothing approach is permanent road closure (2025-2049) in the absence of any long-term or emergency funding.
- **Do Minimum/Reference Case** – culminating in road closures for one year in 2025
 - Continued monitoring of retaining walls.
 - The road is safeguarded using temporary measures and the network is compromised.
 - Management of permitted traffic loading could be implemented by introducing permanent weight restrictions and permanent physical measures such as reduction in the number of lanes.
 - Works carried out in a phased manner over several years.
 - The impact of following a Do Minimum approach is equivalent to temporary road closure (i.e. of up to one year in 2025), whilst funding for major mitigation is sourced/diverted from other priorities and retrospective works are implemented.
- **Do Something/Intervention Case** – pre-emptive action culminating in no road closures and avoidance of all economic costs generated in the Do Nothing and Do Minimum scenarios.
 - Major repairs to the retaining walls.

Given that the Do Nothing option is unrealistic and leaves the roads in an unacceptable state of accessibility, this option has been rejected from further analysis. As a result, the analysis below focuses on the value for money proposition of implementing the Do Something option over the Do Minimum option only.

1.2 Purpose of the report

The report outlines the assumptions and methodology adopted for generating the Present Value of Costs associated with the maintenance of the retaining walls and the Present Value of Benefits of avoided costs associated with long-term road closures. The Value for Money (VfM) assessment of the interventions informs the final selection of schemes taken forward for inclusion in the wider DfT Challenge Fund Business Case and provides direct inputs to the supporting proformas.

1.3 Structure of the Report

The remainder of this technical note is structured as following:

- **Chapter 2 – Site Classification**

This chapter sets out the cluster definitions and the rationale behind the cluster classification.

- **Chapter 3 – Present Value of Costs**

This chapter describes the methodology followed to compute the Present Value of Costs (PVCs) and presents the results in 2010 prices and values.

- **Chapter 4 – Transport User Benefits**

This chapter presents the Present Value of Benefits (PVBs) associated with the interventions on the identified retaining walls, presented in 2010 prices and values.

- **Chapter 5 – Value for Money**

This chapter presents the Benefit-to-Cost Ratio (BCR) that is given by comparing PVB to PVC, which acts as the primary value for money metric driving the business case.

2. Site Classification

Based on the original sift of potential retaining wall schemes, twenty different clusters of retaining wall structures were identified and agreed with Lancashire County Council. The cluster classifications are presented in Table 2-1.

The development of clusters is primarily based on geographical links (schemes located in the same district), shared diversionary routes and the availability of traffic count data. For example, retaining walls that share diversionary routes have been grouped together into a single cluster. Similarly, retaining wall structures that share common traffic count data have also been grouped together into a single cluster.

Table 2-1 Cluster Classifications

Location	Cluster No.	District	Road No.	Cost Estimate	Diversions Route Distance (km)	Diversions Route Description	AADT (7 days Average)	Average Speed on Route
Towngate Ret/Wall	1	Pendle	A56	£30,000	28	B6383 - B6251 - A59 - A682 - B6247 - A6068 - A56	16,294	29 mph
Skipton New Road Ret/Wall		Pendle	A56	£600,000	28	B6383 - B6251 - A59 - A682 - B6247 - A6068 - A56	15,568	41 mph
New Hague East Ret/Wall		Pendle	A56	£300,000	28	Diversion plan for 31041 - B6383 - B6251 - A59 - A682 - B6247 - A6068 - A56	15,568	41 mph
Kelbrook Ret/Wall No. 2		Pendle	A56	£200,000	28	B6383 - B6251 - A59 - A682 - B6247 - A6068 - A56	16,024	n/a
Piercy Bridge South Ret/Wall	2	Rossendale	B6238	£120,000	17	A671 - A681 - B6238	5,452	30 mph
Piercy Bridge North Ret/Wall		Rossendale	B6238	£120,000	17	A671 - A681 - B6238	5,452	30 mph
Ashworth Road Ret/Wall		Rossendale	B6238	£160,000	17	A671 - A681 - B6238	5,452	30 mph
Whitewell Vale Ret/Wall		Rossendale	B6238	£60,000	17	B6238 - A671 - A681	4,706	29 mph
Whitewell Brook Ret/Wall		Rossendale	B6238	£120,000	17	B6238 - A671 - A681	2,834	37 mph
Glen Terrace Ret Wall		Rossendale	A681	£200,000	17	A671 - A681 - B6238	11,801	25 mph

Location	Cluster No.	District	Road No.	Cost Estimate	Diversionsary Route Distance (km)	Diversionsary Route Description	AADT (7 days Average)	Average Speed on Route
Pilkington Canal Ne Ret/Wall	3	Hyndburn	A678	£80,000	12	A678 - A6068 - A56 - A679 - A680 - A678	4,783	39 mph
Pilkington Canal Nw Ret/Wall		Hyndburn	A678	£80,000	12	A678 - A6068 - A56 - A679 - A680 - A678	4,783	39 mph
Station Road (River Ogden) No.1 Ret/Wall	4	Rossendale	U7433	£100,000	6	B6235 - B6232 - A56 - C700 - B6214	1,439	21 mph
Station Road (River Ogden) No.2 Ret/Wall		Rossendale	U7433	£160,000	6	B6235 - B6232 - A56 - C700 - B6214	1,439	21 mph
Bocholt Ret/Wall 1	5	Rossendale	A681	£80,000	2	A687 - A682 - C709	12,678	34 mph
Longholme Ret/Wall		Rossendale	A681	£80,000	2	A687 - A682 - C709	12,678	34 mph
Hall Park Ret/Wall	6	Rossendale	A680	£100,000	7.5	A680 - A56	8,596	34 mph
Hud Hey Ret/Wall		Rossendale	A680	£60,000	3	U7321 - A680 - B6236	8,596	34 mph
Hollands Pies (Blackburn Road) Ret/Wall	7	Rossendale	A680	£120,000	12	A680 - A679 - A56 - A680	11,734	30 mph
Weir Ret/Wall	8	Rossendale	A671	£100,000	31	A671 - A58 - A6033 - A681 - A671	12,698	29 mph

Location	Cluster No.	District	Road No.	Cost Estimate	Diversionsary Route Distance (km)	Diversionsary Route Description	AADT (7 days Average)	Average Speed on Route
Barrowford Bridge Ret/Wall	9	Pendle	A682	£100,000	8	A682 - A56 - A6068 - B6247	13,042	32 mph
Gisburn Road North Ret/Wall		Pendle	A682	£80,000	28	A682 - A59 - B6251 - A56 - B6247 - A682	13,042	32 mph
Blackburn Road Ret/Wall 1	10	Rossendale	B6527	£50,000	8	B6527 - A680 - A681 - C701 - B5627	4,589	33 mph
Planes Wood Ret/Wall	11	Ribble Valley	A671	£300,000	23	A59 - A666 - A6119 - M65 - A678 - A680	18,401	34 mph
Lower Dean Wood Ret/Wall North	12	Burnley	A671	£120,000	3.5	A671 - A6068 - A678 - C554 - A671	12,671	40 mph
Easden Wood Ret/Wall	13	Burnley	A671	£400,000	8	A671 - C653 - A682 - A646 - A671	5,794	44 mph
Calder Head Ret/Wall	14	Burnley	A646	£200,000	28	A646 - A6033 - A681 - A671	5,282	32 mph
Accrington Road Ret/Wall	15	Burnley	A679	£120,000	10	A679 - M65 - A679	13,183	40 mph
Water Edge West Ret/Wall	16	Pendle	C670	£200,000	10	A6068 - U19573 - C671 - U19583 - U3774 - U42950 - C670	803	20 mph
Water Edge East Ret/Wall		Pendle	C670	£60,000	7	U40462 - U20577 - A682 - C670	803	20 mph

Location	Cluster No.	District	Road No.	Cost Estimate	Diversionsary Route Distance (km)	Diversionsary Route Description	AADT (7 days Average)	Average Speed on Route
Victoria Way Ret/Wall No.2	17	Rossendale	U7672	£100,000	1.5	U7672 - U7477 - A681 - U7677	264	15 mph
Victoria Way Ret/Wall No.3		Rossendale	U7672	£100,000	0.5	U7677 - U7678 - A681	264	15 mph
Horncliffe Wood Ret/Wall	18	Rossendale	C701	£160,000	7.5	C701 - B6527 - A680 - A681	4,598	37 mph
Branch Road Ret/Wall	19	Ribble Valley	C571	£100,000	7.6	C571 - C579 - A671 - B6478	1,630	30 mph
Railway Road North Ret/Wall	20	Rossendale	A680	£80,000	7	A680 - A56 - A680	9,414	33 mph

3. Present Value of Costs

The total raw cost estimate for each cluster allowing for Traffic Management, design, services and eco surveys is demonstrated in Table 3-1. Schemes with highest priority are planned to be implemented in 2020 with residual schemes coming forward in 2021.

Table 3-1 - Raw Cost Estimates (in 2019 prices)

Cluster No.	Raw Cost Estimate 2020	Raw Cost Estimate 2021
1	£630,000	£500,000
2	£320,000	£460,000
3	£0	£160,000
4	£260,000	£0
5	£0	£160,000
6	£100,000	£60,000
7	£0	£120,000
8	£0	£100,000
9	£0	£180,000
10	£0	£50,000
11	£300,000	£0
12	£0	£120,000
13	£0	£400,000
14	£200,000	£0
15	£0	£120,000
16	£260,000	£0
17	£200,000	£0
18	£160,000	£0
19	£100,000	£0
20	£0	£80,000

Optimism Bias of 44% has been applied to scheme costs to reflect the well-established and continuing systematic bias for estimated scheme costs and delivery times to be too low and too short, respectively. This

assumption is based on WebTag TAG unit A1.2 for types of projects that belong under the roads' category¹. It should be noted that most evidence for Optimism Bias applies to capital expenditure; a detailed evidence base does not exist for maintenance/operational costs. That said, given the high profile and critical importance of the retaining walls in relation to the functioning of the RRN in Lancashire, optimism bias has been applied to the scheme costs at a rate of 44% as specified above. This rate is deemed appropriate given the location of the retaining wall schemes in steep-sided valleys with adjacent watercourses also.

The final step required to compute the Present Value of Costs is to discount the costs to a 2010 present value and adjust the price base to 2010, as per DfT best practice. To discount to 2010 present values, social time preference values, as set out in WebTag TAG unit A1.2, are applied to the costs. Using the GDP deflator parameters set out within the WebTag Databook, the price base of the costs has been deflated from 2019 prices to 2010 prices.

The Present Value of Costs (PVCs) in 2010 prices and values is presented in Table 3-2.

Table 3-2 - PVCs in 2010 prices and values

Cluster No.	Present Value of Costs (2010 prices and values)
1	£973,175
2	£668,353
3	£135,157
4	£227,318
5	£135,157
6	£138,114
7	£101,368
8	£84,473
9	£152,052
10	£42,237
11	£262,290
12	£101,368
13	£337,893
14	£174,860
15	£101,368
16	£227,318

¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/625380/TAG_unit_a1.2_cost_estimation_jul17.pdf

Cluster No.	Present Value of Costs (2010 prices and values)
17	£174,860
18	£139,888
19	£87,430
20	£67,579
Total	£4,332,258

4. Present Value of Benefits

4.1 Introduction

Based on advice provided by LCC, in the absence of the funding being sought from DfT the retaining walls along various roads will fail by 2025. This would result in closure of key components of the RRN for one year in 2025. The analysis presented below captures the journey time dis-benefits that could materialise as a result of the road closure and subsequent diversion that would occur.

Based on discussion with LCC, it is envisaged that a failure to intervene using DfT Challenge Fund support would result in road closures of one year in 2025. Within this context, the analysis in this chapter addresses the journey time dis-benefits associated with re-routing in response to road closures of one year, as per the “do minimum” scenario. By implementing the proposed interventions needed for the retaining walls, and subsequently avoiding the diversion, the dis-benefits modelled can be viewed as avoided costs, and therefore benefits to highway users.

4.2 Methodology

Traffic flow data was provided in AADT format by LCC. To split out the journey time dis-benefits across the standard vehicle types and subsequently journey purpose a proportionality approach has been adopted. Traffic composition proportions were derived from the DfT’s Road Traffic Statistics² based on the vehicle miles travelled by vehicle type in the North West region. For the purpose of this exercise the miles travelled by motorcycles were excluded. The percentage splits are presented in Table 4-1.

Table 4-1 Traffic composition splits

Vehicle Type	% Proportion
Cars	78.46%
LGVs	14.87%
HGVs	6.15%
PSVs	0.51%

In cases where diversionary routes under the same cluster presented different traffic flows, the highest AADT was used as a proxy for the cluster as a whole to avoid double counting. This reflects the fact that retaining walls in the same cluster were typically along the same stretches of road (hence the availability of common diversion routes and AADT information). Following this approach, AADT by cluster and vehicle split is presented in Table 4-2.

² https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/801190/tra0106.ods

Table 4-2 Vehicle splits by cluster

Cluster No.	7 Day AADT	HGVs	PSVs	Cars	LGVs
1	16,294	1,003	84	12,785	2,423
2	11,801	726	61	9,259	1,755
3	4,783	294	25	3,753	711
4	1,439	89	7	1,129	214
5	12,678	780	65	9,947	1,885
6	8,596	529	44	6,745	1,278
7	11,734	722	60	9,207	1,745
8	12,698	781	65	9,963	1,888
9	13,042	803	67	10,233	1,940
10	4,589	282	24	3,601	682
11	18,401	1,132	94	14,438	2,737
12	12,671	780	65	9,942	1,884
13	5,794	357	30	4,546	862
14	5,282	325	27	4,144	786
15	13,183	811	68	10,344	1,961
16	803	49	4	630	119
17	264	16	1	207	39
18	4,598	283	24	3,608	684
19	1,603	100	8	1,279	242
20	9,414	579	48	7,386	1,400

In the event of road closure under a Do Minimum scenario, the traffic flow identified above will be required to reroute via diversions. This will result in additional journey time. For the calculation of the additional journey time for each cluster, diversion routes were provided by LCC. In cases where diversion routes under the same cluster had different diversion route lengths, the average distance was calculated and utilised. Similarly, the weighted average speed along diversion routes was taken into consideration for schemes with corresponding differences within the same cluster. A conversion factor of 1.61 was adopted to convert speeds from miles per hour (mph) to kilometres per hour (kph).

The added journey times per trip via the diversion routes for each cluster are demonstrated in Table 4-3.

Table 4-3 Added Journey Times per Trip

Cluster No.	Diversion Route Distance (km)	Average Speed (km/hr)	Additional Journey Time per Trip (mins)
1	28	56.11	30
2	17	45.43	22
3	12	62.76	11
4	6	33.8	11
5	2	54.72	2
6	5	54.72	5
7	12	48.28	15
8	31	46.67	40
9	18	51.50	21
10	8	53.11	9
11	23	54.72	25
12	3.5	64.37	3
13	8	70.81	7
14	28	51.50	33
15	10	64.37	9
16	8.5	32.19	16
17	1	24.17	2
18	7.5	59.55	8
19	7.6	48.28	9
20	7	53.11	8

To estimate the journey purpose of the vehicle fleet required to divert, the weekly average journey purpose split by vehicle type has been obtained from WebTag Table A1.3.4³. The percentage splits are presented in Table 4-4 below. The WebTag table however, does not provide the journey purpose split for passenger service vehicles, as such it has been assumed that all trips by PSVs are for commuting trips.

³ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816195/tag-data-book.xlsx

Table 4-4 Journey purpose splits and value of time assumptions by vehicle type

Vehicle Type	Cars			LGVs		HGVs	PSVs
	Work	Commuting	Other	Work	Commuting	Work	Commuting
Purpose Split	5.28%	21.32%	73.39%	88.0%	12.0%	100%	100%
Value of Time (2019)	£16.5/hour	£9.3/hour	£4.2/hour	£11.3/hour	£9.3/hour	£13.4/hour	£9.3/hour

Applying the journey purpose proportions to the total AADT generates the vehicle composition by journey purpose.

In order to monetise the journey time dis-benefits, values of time from WebTag Data Book Table A.1.3.2 have been adopted. The following categories of value of times have been adopted:

- Car driver/passenger – used to proxy “work”
- LGV occupant – used to proxy “work”
- Car and LGV – used to proxy “commuting”
- Car other – used to proxy “other”
- HGV – used to proxy “work”
- PSV Passenger – used to proxy “commuting”

Application of the values of time to the journey time changes generates the economic cost of road closures and subsequent diversions in the Do Minimum scenario. These journey time costs are avoided in the intervention case and therefore represent an estimate of the daily journey time benefits. The analysis has been conducted for a 30-year transport appraisal period (2020-2049), but effectively only captures one year of benefits in 2025, when roads are expected to face closure in the Do Minimum scenario. To annualise the daily journey time dis-benefits an annualisation factor of 365 was applied to all vehicle categories (i.e. cars, LGVs, HGVs, and PSVs).

Finally, the total journey times dis-benefits for each cluster were discounted to 2010 prices using a discount rate of 3.5% in accordance with the HM Treasury Green Book⁴.

The Present Value of Benefits for avoiding a one-year road closure (2025) in 2010 prices and values for each cluster are presented in Table 4-5.

Table 4-5 - PVBs in 2010 prices and values

Cluster No.	Present Value of Benefits in 2010 prices and values (journey times avoided)
1	£13,617,212
2	£7,394,708
3	£1,531,397

⁴ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

Cluster No.	Present Value of Benefits in 2010 prices and values (journey times avoided)
4	£427,822
5	£776,019
6	£1,315,401
7	£5,144,618
8	£14,124,393
9	£11,874,710
10	£1,182,469
11	£12,952,724
12	£1,153,692
13	£1,096,192
14	£4,809,249
15	£3,429,454
16	£355,120
17	£18,314
18	£969,838
19	£429,686
20	£2,077,921

5. Value for Money

This section presents the Level 1 Benefit-to-Cost Ratio (BCR) that was computed in accordance with the DfT WebTAG and HM Treasury Green Book⁵ by dividing PVB by PVC.

The Green Book sets out best practice guidance on assessing and evaluating programmes and projects and recommends that options should be appraised using BCR as the primary metric in reporting the cost-benefit analysis results.

The benefits that have been apportioned relate to journey time savings emerging from avoiding the diversion routes that would be incurred in the Do Minimum scenario, in response to essential road closures after the collapse of retaining walls. These road closures are avoided in the intervention case.

Table 5-1 Benefits of retaining walls' maintenance

Cluster No.	BCR Road closed for one year (2025)
1	14
2	11
3	11
4	2
5	6
6	10
7	51
8	167
9	50
10	28
11	49
12	11
13	3
14	28
15	34
16	2

⁵ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

Cluster No.	BCR Road closed for one year (2025)
17	0.1
18	7
19	5
20	31

5.1 Summary

After undertaking the initial review of potential schemes, it was agreed by LCC that funding will not be sought for schemes presenting low BCR values and lacking strategic importance. As such, clusters 4, 5, 10, 16, 17, 18, 19 and 20 will be excluded from the final business case due to their low BCR values, low priority rating based on RWCI scores poor location and location away from the RRN. Components of some clusters have also been excluded from the final list (i.e. Kelbrook Ret/Wall No. 2 from cluster 1 and Barrowford Bridge Ret/Wall from cluster 9) for similar reasons.

The final analysis shown in Table 5-2 has been fully adjusted to remove the above-mentioned walls/clusters. The revised and final BCRs exclude all site-specific information associated with those walls/clusters that have been sifted out, in terms of traffic flows, average speeds and diversion routes.

Therefore, the economic impacts associated with the final programme of interventions on the residual retaining walls identified by LCC are summarised in Table 5-2 below. The value for money analysis demonstrates that the intervention case has a very high BCR of 26 at an aggregate level. Further, each individual scheme brought forward achieves a BCR of at least 3, and can therefore be categorised as achieving high value for money as a minimum.

Table 5-2 Summary of value for money analysis

Cluster No.	Road closed for one year (2025)
Cluster One	
Present Value of Benefits 2010 prices and values (journey times avoided)	£13,617,212
Present Value of Costs (2010 prices and values)	£804,229
BCR	17
Cluster Two	
Present Value of Benefits 2010 prices and values (journey times avoided)	£7,394,708
Present Value of Costs (2010 prices and values)	£668,353
BCR	11

Cluster No.	Road closed for one year (2025)
Cluster Three	
Present Value of Benefits 2010 prices and values (journey times avoided)	£1,531,397
Present Value of Costs (2010 prices and values)	£135,157
BCR	11
Cluster Six	
Present Value of Benefits 2010 prices and values (journey times avoided)	£1,315,401
Present Value of Costs (2010 prices and values)	£138,114
BCR	10
Cluster Seven	
Present Value of Benefits 2010 prices and values (journey times avoided)	£5,144,618
Present Value of Costs (2010 prices and values)	£101,368
BCR	51
Cluster Eight	
Present Value of Benefits 2010 prices and values (journey times avoided)	£14,124,393
Present Value of Costs (2010 prices and values)	£84,473
BCR	167
Cluster Nine	
Present Value of Benefits 2010 prices and values (journey times avoided)	£11,874,710
Present Value of Costs (2010 prices and values)	£67,579
BCR	176
Cluster Eleven	
Present Value of Benefits 2010 prices and values (journey times avoided)	£12,952,724
Present Value of Costs (2010 prices and values)	£262,290
BCR	49

Cluster No.	Road closed for one year (2025)
Cluster Twelve	
Present Value of Benefits 2010 prices and values (journey times avoided)	£1,153,692
Present Value of Costs (2010 prices and values)	£101,368
BCR	11
Cluster Thirteen	
Present Value of Benefits 2010 prices and values (journey times avoided)	£1,096,192
Present Value of Costs (2010 prices and values)	£337,893
BCR	3
Cluster Fourteen	
Present Value of Benefits 2010 prices and values (journey times avoided)	£4,809,249
Present Value of Costs (2010 prices and values)	£174,860
BCR	28
Cluster Fifteen	
Present Value of Benefits 2010 prices and values (journey times avoided)	£3,429,454
Present Value of Costs (2010 prices and values)	£101,368
BCR	34
Aggregate of Intervention Case Schemes	
Present Value of Benefits 2010 prices and values (journey times avoided)	£78,443,750
Present Value of Costs (2010 prices and values)	£2,977,052
BCR	26

Note: Figures are in 2010 prices and values