Phillip Worthing

DEVELOPMENT AT LECKWITH QUAY

B4267 Highway Alignment, Relaxations and Departures

70053561/GW
FEBRUARY 2020

PUBLIC

Phillip Worthing

DEVELOPMENT AT LECKWITH QUAY

B4267 Highway Alignment, Relaxations and Departures

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70053561

OUR REF. NO. 70053561/GW

DATE: FEBRUARY 2020

WSP

1 Capital Quarter
Tyndall Street
Cardiff
CF10 4BZ

Phone: +44 2920 769 200

WSP.com

CONTENTS

APPENDICES

1 BACKGROUND

1.1.1. Leckwith Quay is a 7.7 ha site located between the A4232, Leckwith Road and the River Ely on the outskirts of Cardiff in the Vale of Glamorgan CF11 8AU. The site is under consideration for a mixed-use development consisting of commercial premises and residential dwellings along with associated public open space, amenities and including a realignment of the existing B4267 Leckwith Road link and a new bridge crossing of the River Ely. The existing B4237 runs through the site on a viaduct which is in very poor conditions. The new road alignment has been arranged to allow the existing road to remain open during its construction. The new bridge has been positioned immediately upstream of the existing, listed masonry bridge, which is to be retained to allow pedestrian and cyclist access to the site.

1.1.2. The development is currently split into two parcels on either side of the proposed new bridge crossing referred to as the northern (1.3 ha) and the southern plateaus (6.4 ha). The site extends approximately 890 m along the Ely riverbank in the Vale of Glamorgan (with the opposite bank within Cardiff City Authority) and some 100m inland. A new signalised four arm junction is proposed to allow access to each development parcel.

1.1.3. This technical note examines the proposed geometric alignment of the proposed realignment of the B4237 and the Relaxations and Departures from Standard that would be required to construct the new road whilst keeping the existing route open to traffic.

2 HIGHWAY ALIGNMENT STANDARDS

2.1.1. The existing B4237 over its length through the site is a single carriageway, subject to a 40mph speed limit to a point near the northern bridge abutment, where it reduces to 30mph on the approach to the roundabout junction with the A4232. For the purposes of this assessment a design speed of 70A kph has been assumed for the existing road subject to 40pmh limit and 60kph for the 30mph section on the approach to the junction, in accordance with Table 2.5 of CD109

2.1.2. When referencing CD109 Highway Link Design, the existing and proposed alignments of the B4267 Leckwith Road on the approach to Leckwith Roundabout has been compared with the requirements listed in 2.10. A summary of conforming standards for 70kph and 60kph is provided below for reference.

Stopping Sight Distance	**70kph**	**60kph**
Desirable Minimum	120m	90m
OSBDM	90m	70m
TSBDM	70m	50m
Horizontal Curvature		
Desirable Minimum (5% superelevation)	360m	255m
OSBDM	255m	180m
TSBDM	180m	127m
Vertical Curvature		
Desirable minimum Crest K value	30	17
OSBDM Crest K value	17	10
Absolute Min sag K value	20	13

In addition, CD109 table 5.1 confirms the maximum desirable gradient for a single carriageway all-purpose road should be 6%

3 EXISTING CONDITIONS B4267 LECKWITH ROAD

3.1 HORIZONTAL CURVATURE

3.1.1. The section of road along the existing viaduct section is within a 40mph zone, where measurements taken from the topographical survey indicate a minimum horizontal curvature radius of approximately 180m. This equates to Two Steps Below Desirable Minimum radius for 70kph (with superelevation of 7%.)

3.2 FORWARD VISIBILITY/STOPPING SIGHT DISTANCE

3.2.1. Forward visibility along the viaduct/bridge section of the existing road is generally curtailed by the 'new' vehicle parapet guard rail placed immediately adjacent the kerb lines. In the northbound direction (downhill, towards the A4232 Junction), forward visibility measured to/from the centre of the northbound lane is approximately 90m and equates to a One Step Below Desirable Minimum for 70kph. The forward vision splay crosses the southbound lane of the carriageway. In the southbound direction (uphill, away from the A4232 Junction) forward visibility measured to/from the centre of the northbound lane is limited to approximately 50m minimum, in front of the parapet guard rail. This represents a Three Step Departure Below Desirable Minimum for 70kph

3.2.2. Its apparent that the northbound stopping sight distance to the A4232 junction stop line of at least 90m was achieved with the original highway alignment, however when observing street furniture, and measuring from the topographical survey, directional signs and posts makes this difficult to maintain. Therefore, in reality the alignment currently achieves approximately 70m stopping sight distance, which is One Step Below Desirable Minimum for 60kph.

3.3 VERTICAL ALIGNMENT/GRADIENT

3.3.1. Measuring distances between contours generated using the 3d values in the topographical survey confirm the gradient of the road is between 6% and 7% and is marginally greater than the maximum desirable gradient for AP Single Carriageway at 6%, Table 5.1 CD109 Highway Link Design.

3.3.2. The section of road along the existing viaduct section is within a 40mph zone, where measurements taken from the topographical survey indicate a minimum horizontal curvature radius of approximately 180m. This equates to Two Steps Below Desirable Minimum radius for 70kph (with superelevation of 7%.)

4 PROPOSED B4267 HIGHWAY REALIGNMENT

4.1 INTRODUCTION

4.1.1. The current Masterplan development for Leckwith Quay, incorporates the replacement of the viaduct and river crossing, and provides a new signalised junction which will enable access into the land parcels. The alignment will be repositioned so that the new highway can be built whilst the existing road remain operational. Due to the constraints of the site however, this would require Departures and Relaxations from the standards set out CD109 Highway Link Design since the road ultimately need to tie back into the existing carriageway through the underpass of the A4232.

4.1.2. As part of the development proposal it is proposed that the existing change of speed limit from 40mph to 30mph would be moved southwards to the commencement of the realigned section. Hence this initial assessment against standards has been made on an assumed design speed for the realigned road of 60Akph.

4.2 HORIZONTAL CURVATURE

4.2.1. The proposed realigned section of the highway is constrained by the need to build the new road off-line, the need to maintain the existing listed bridge and the 'gap' between the abutments of the A4232 underpass approach to the roundabout junction. To respect these constraints the proposed alignment therefore can only achieve a minimum horizontal radius of 90m, which equates to a Three Step Departure Below Desirable Minimum radius for 60kph

4.3 FORWARD VISIBILITY/STOPPING SIGHT DISTANCE

4.3.1. The desirable minimum stopping sight distance for 60kph is 90m and with verge widening this can be achieved in the northbound direction and on the approach to the proposed new signalised junction stop lines. In the southbound direction visibility is likely to be constrained by a parapet guardrail and/or cutting face. A forward visibility of 70mph has been assumed in this direction to minimise the extent of verge widening required. This would equate to a Relaxation of One Step Below Desirable Minimum for 60kph.

4.3.2. On the southbound approach to the existing Leckwith Roundabout, forward visibility is constrained by the corner of the A4232 underpass bridge abutment. The visibility constraint is more pronounced with proposed new alignment as the approach angle of the highway is less acute compared to the existing alignment. The instantaneous minimum visibility to the stop-line, measured to/from the centre line of the nearside lane is 52m, although greater visibility is available to the off-side lane and junction signal heads. This would be approximately Two Steps Below Desirable Minimum for 60kph and would require a Departure from Standard to be approved (Section 2 of CD109 does not allow Relaxations for standard on the immediate approach to junctions)

4.4 VERTICAL ALIGNMENT/GRADIENT

4.4.1. A draft vertical alignment has been developed for the proposed realigned highway. The alignment has assumed a maximum 1:100 year + climate change allowance river flood level of 8.11m AOD, a soffit freeboard of 600mm and a bridge deck construction thickness of 1.65m, to define a preferred minimum road level at the proposed bridge crossing of 10.36 (note, the assumed flood level is based on the existing available information and may be subject to change following detailed flood modelling). The vertical alignment has also been designed to tie into existing road levels at the A4232 underbridge, to preserve existing headroom to the over bridge soffit. This requires a steep climb from the underbridge to the new river bridge at a maximum gradient of 8%. Road levels at the northern and southern river bridge abutments will be 9.890m AOD and 11.014m AOD respectively. A maximum longitudinal gradient of 1.5% has been assumed for the extent of the river bridge and the proposed new signalised junction. It should be noted that whilst the bridge soffit levels will be above the estimated 1:100 plus climate change flood level (8.11m AOD), the soffit level at the northern bridge abutment will be 8.33m AOD and therefore it is not possible to maintain a 600mm freeboard across the whole length of the bridge.

4.4.2. This results in a vertical alignment of maximum gradient of approximately 6.5% for the majority of the remaining alignment, which increases to 9.4% at its tie in with the existing highway.

4.4.3. To achieve the above vertical alignment requires minimum crest and sag curves of 6 across the bridge and 1.5 on the immediate approach to the Leckwith roundabout which would depart from the stated minimum standard. Some improvement in vertical alignment may be achieved however following confirmation of flood levels and bridge deck construction and with refinement of the design.

4.5 JUNCTION INTERVISIBILITY

4.5.1. The requirements for vehicle intervisibility at signal-controlled junction is defined in Section 7 of CD123 Geometric design of at-grade priority and signal controlled junctions. The Standard requires that a zone of visibility between each arm of the junction is available from a point 2.5m back from each stop line.

4.5.2. The proximity of the proposed new junction to the river bridge and the requirement for abutment retaining walls with parapets to allow access to the river and abutments and to minimise impact on the adjacent listed masonry bridge, compromises the intervisibilty to and from the northern arm of the junction. A Relaxation of this requirement is therefore required.

5 HIGHWAY ALIGNMENT SUMMARY

Table 1 below, summarises the existing and proposed highway alignment geometry constraints.

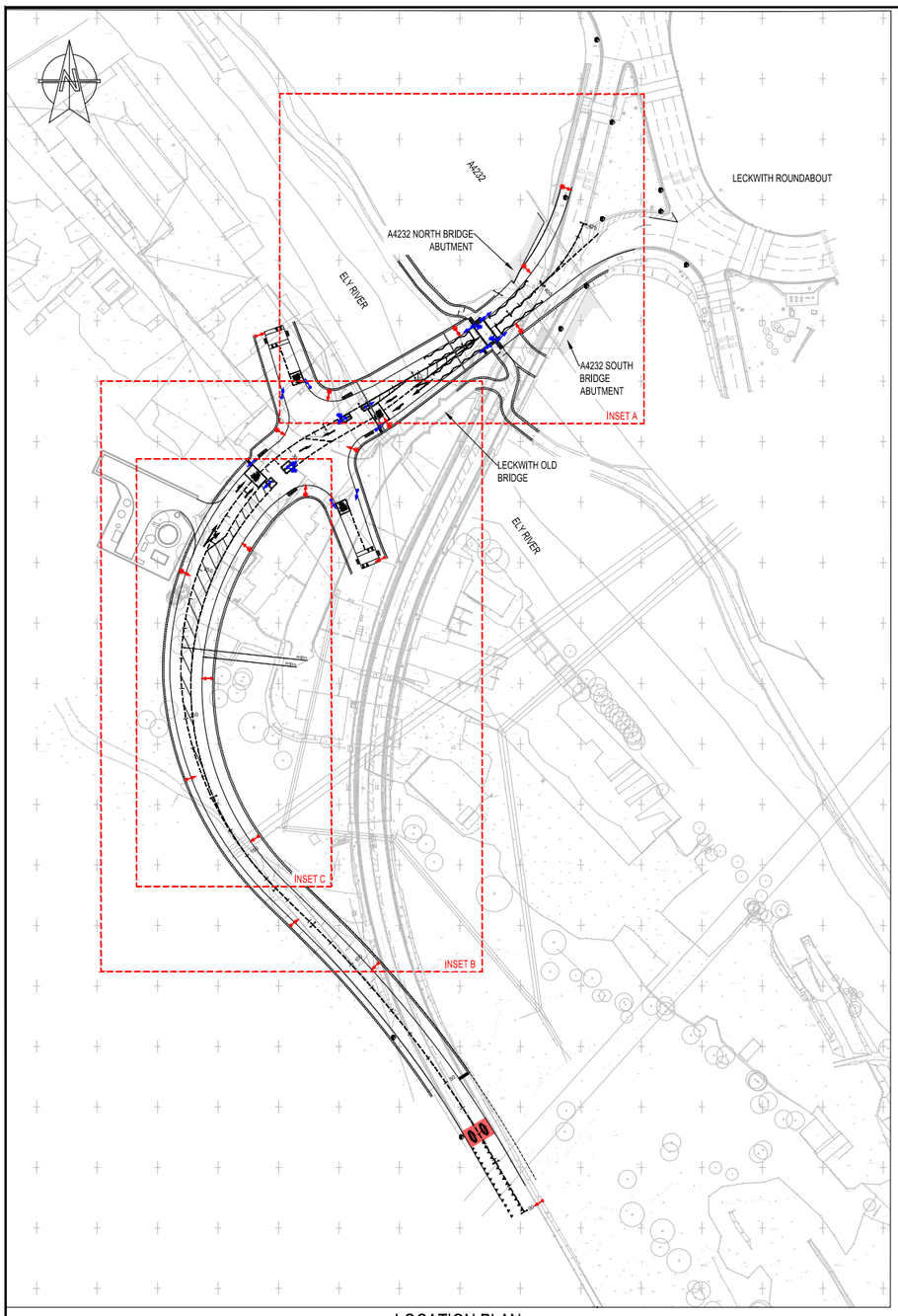
Element	Existing B4262	Proposed B4267	Comments
Speed Limit	40 mph generally 30 mph approach to roundabout)	30mph throughout	Speed limit change to 30mph to be moved to commencement of realigned section.
Design Speed	70A kph generally 60A kph approach to roundabout	60A kph throughout	Reduced speed limit to 30mph for realigned section.
Horizontal Radius	180m minimum (2 step relaxation)	90m minimum (3 step relaxation)	Tighter horiz curvature required to address alignment constraints
Forward visibility	90m northbound (1 step relaxation) 50m southbound (3 step relaxation)	90m northbound (Des. Min.) 70m southbound (1 step relaxation)	Existing visibility constrained by viaduct parapet guardrail. Verge widening on proposed alignment required to achieve stated visibility.
Stopping Sight Distance to Leckwith Roundabout	90m, but reduced to 70m by obstructions	52m minimum to nearside lane	Existing A4232 bridge abutment constrains SSD on proposed alignment. Departure required
Maximum Gradient	6 to 7% 9.4% at tie-in.	6.5% generally, but increasing to 9.4% at tie-in. 8% on southbound approach to new river bridge	Refinement of vertical alignment possible once flood levels and bridge design confirmed may allow improvement
Vertical Design		Min K crest 6 Min K sag 1.5	Departure of K values required on approach to Leckwith Roundabout to allow bridge levels to be developed. Refinement of vertical alignment possible once flood levels and bridge design confirmed.
Junction Intervisibility	N/A	Northern junction arm visibility zone compromised by bridge/retaining wall parapet	Relaxation required

Table 1: Highway Alignment Summary

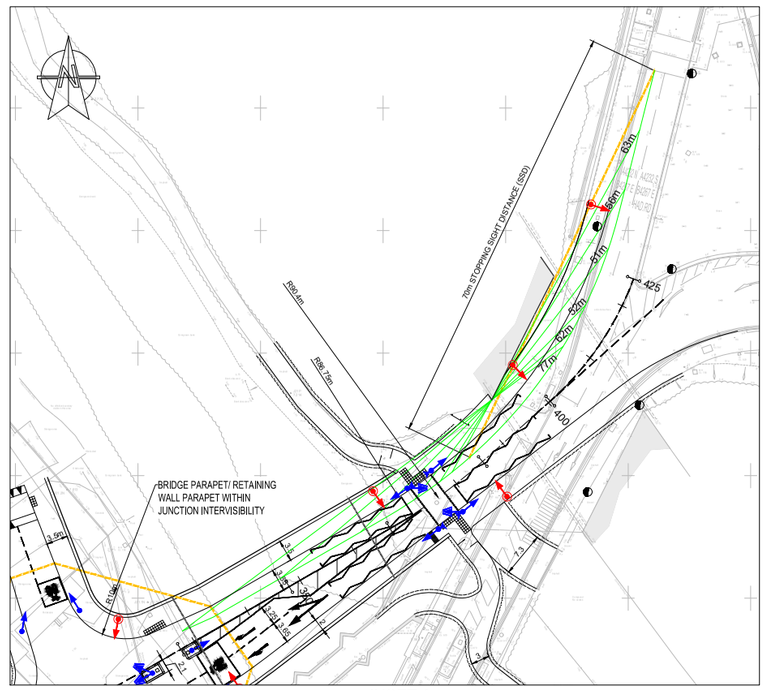
Appendix A : Drawings

DO NOT SCALE

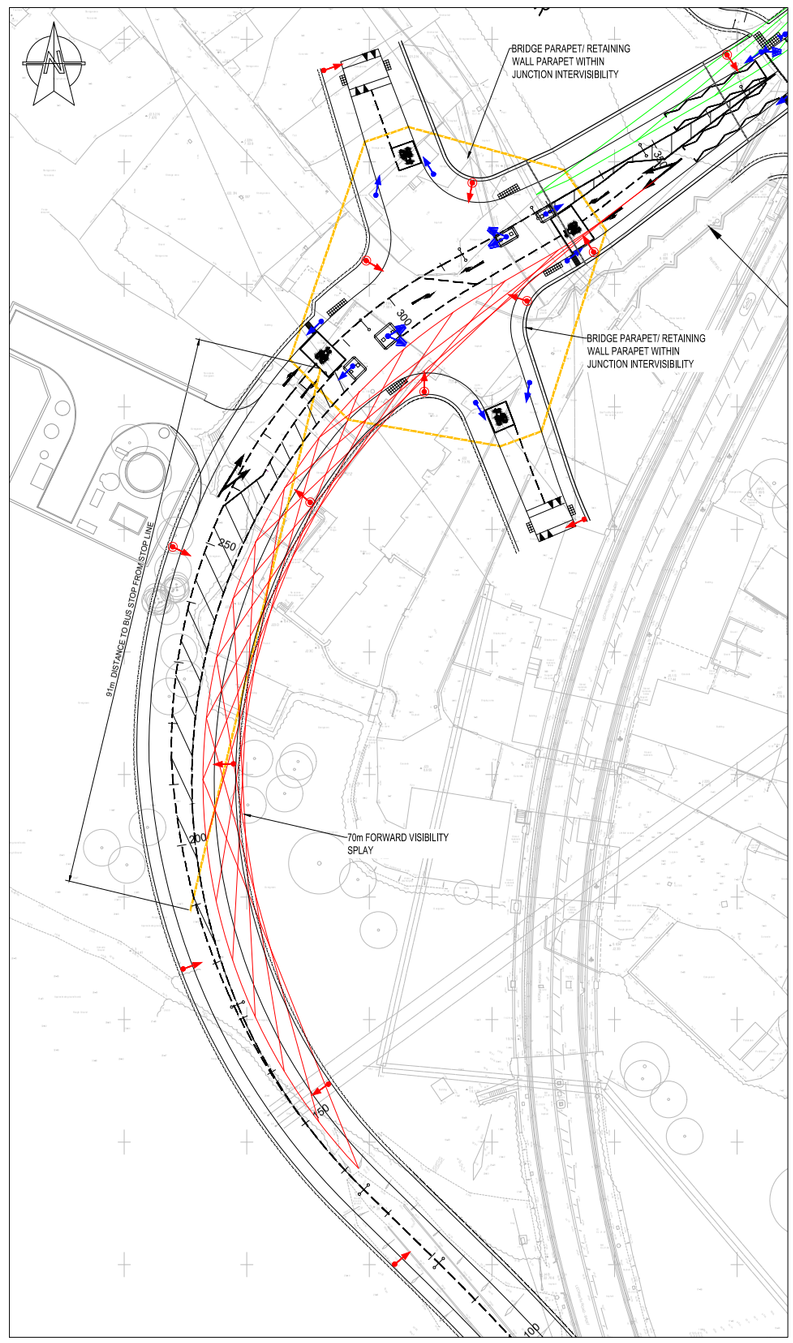
NOTES
1. DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
2. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM (AOD)
3. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
4. THIS DRAWING IS FOR PLANNING PURPOSES ONLY AND IS SUBJECT TO DETAILED DESIGN
5. HIGHWAY GEOMETRY & DESIGN IS SUBJECT TO TECHNICAL APPROVAL OF THE ADOPTING HIGHWAY AUTHORITIES



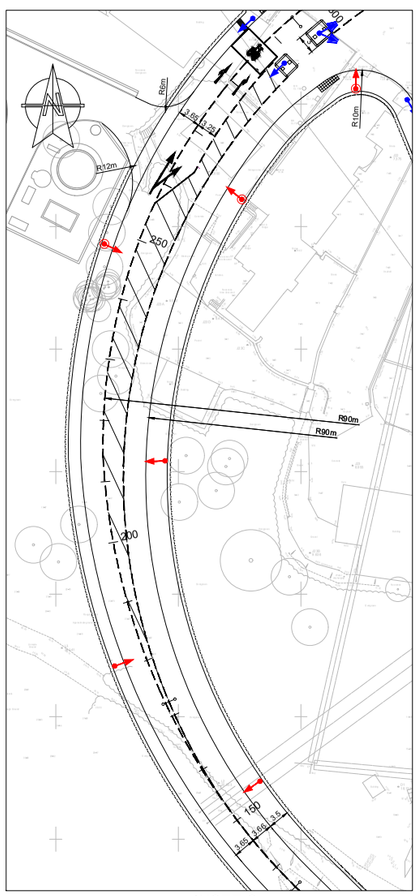
LOCATION PLAN
SCALE 1:1000



INSET A
SCALE 1:500



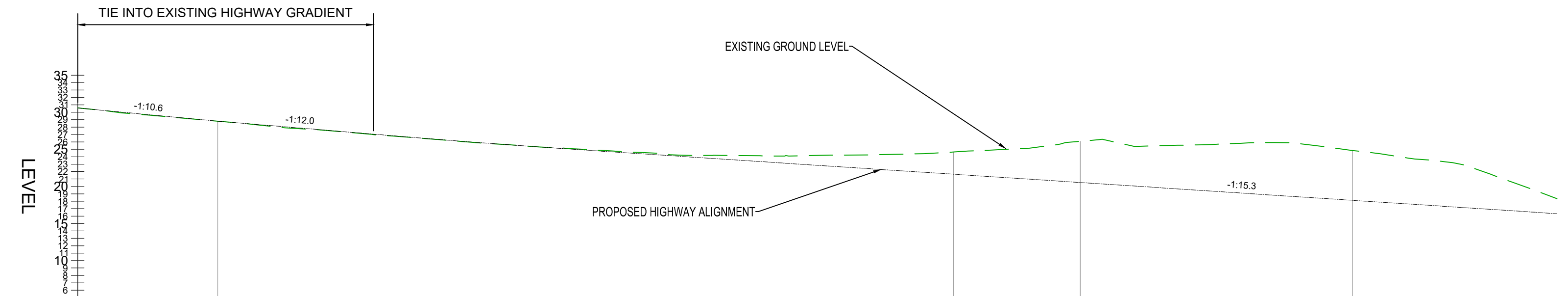
INSET B
SCALE 1:500



INSET C
SCALE 1:500

DRAWING STATUS: FOR PLANNING	1 Capital Quarter, Tyndall St, Cardiff, CF10 4BZ, UK. T+ 44 (0) 292 076 9200 wsp.com	CLIENT: PHILLIPS WORTHING	PROJECT: LECKWITH QUAY	SCALE @ A1: 1:500	CHECKED: SID / APPROVED: GW
		ARCHITECT: LOYN ARCHITECT	TITLE: B4267 LECKWITH ROAD HIGHWAY IMPROVEMENTS HIGHWAY DESIGN VISION SPLAYS, DEPARTURES & RELAXATIONS FROM STANDARDS	PROJECT No: 70053561 / DESIGNED: SID / DRAWN: RLD / DATE: September 19	
				DRAWING No: 70053561-WSP-XX-XX-CE-DR-103	REV: -

DO NOT SCALE



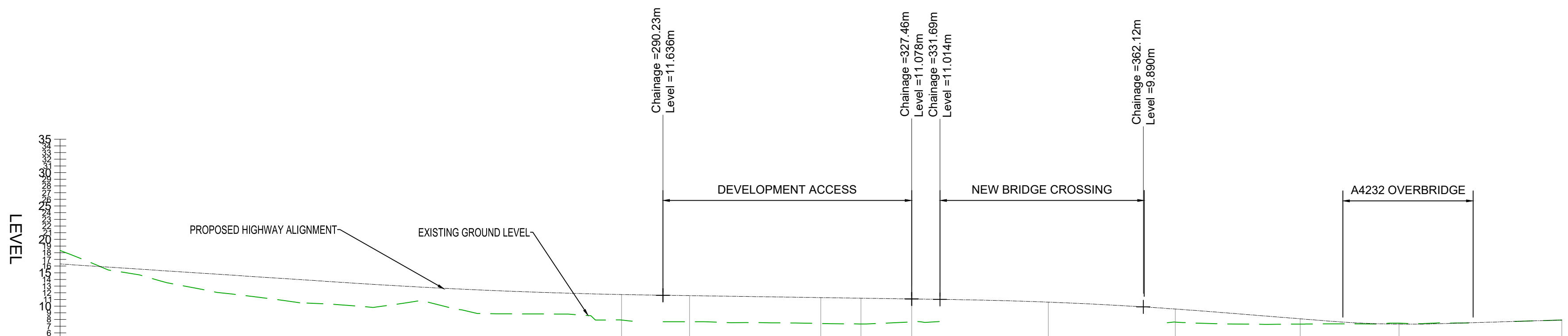
Chainage	Existing Levels	Proposed Levels	Level Difference
00.000	30.585	30.585	0.000
10.000	29.589	29.641	0.053
20.000	28.707	28.709	0.003
30.000	27.782	27.879	0.097
40.000	26.991	27.049	0.058
50.000	26.218	26.242	0.024
60.000	25.501	25.495	-0.006
70.000	24.909	24.807	-0.103
80.000	24.296	24.153	-0.142
90.000	24.152	23.500	-0.651
100.000	24.180	22.848	-1.332
110.000	24.322	22.195	-2.127
120.000	24.744	21.542	-3.202
130.000	25.333	20.889	-4.444
140.000	26.032	20.236	-5.796
150.000	25.575	19.583	-5.992
160.000	25.911	18.930	-6.981
170.000	25.165	18.278	-6.888
180.000	23.802	17.625	-6.178
190.000	21.996	16.972	-5.024
200.000	18.334	16.319	-2.015

Horizontal Geometry: L =18.941 | R: 360.018 L: 99.484 | L =17.116 | R: 93.313 L: 36.813 | R: 90.127 L: 111.674

Vertical Geometry: G =-9.441% L =18.941 | G =-8.303% L =22.063 | R =1690.965 K =16.910 L =30.000 | G =-6.529% L =172.577

ROAD1 (CH.0-200) - LONGSECTION
HORIZ 1:500, VERT 1:500. DATUM: 5.000m

MAIN ROAD - LONGSECTION
SCALE: H 1:500,V 1:500. DATUM: 5.000



Chainage	Existing Levels	Proposed Levels	Level Difference
200.000	18.334	16.319	-2.015
210.000	14.978	15.666	0.688
220.000	12.742	15.013	2.271
230.000	11.294	14.360	3.067
240.000	10.318	13.708	3.389
250.000	10.245	13.078	2.833
260.000	9.456	12.552	3.096
270.000	8.838	12.137	3.299
280.000	8.033	11.833	3.800
290.000		11.640	
300.000	7.547	11.490	3.943
310.000	7.471	11.340	3.869
320.000	7.334	11.190	3.855
330.000	7.603	11.040	3.437
340.000		10.857	
350.000		10.521	
360.000		10.018	
370.000	7.464	9.350	1.886
380.000	7.278	8.557	1.280
390.000	7.359	7.758	0.399
400.000	7.458	7.311	-0.147
410.000	7.481	7.482	0.001
420.000	7.782	7.781	-0.001
424.773	7.924	7.924	0.000

Horizontal Geometry: R: 90.127 L: 111.674 | L =10.176 | R: 98.871 L: 19.653 | L =5.996 | L =7.611 | R: 4105.025 L: 20.445 | L =19.013 | R: 91.470 L: 18.675 | L =14.805 | R: 50.000 L: 24.373

Vertical Geometry: G =-6.529% L =172.577 | R =900.000 K =9.000 L =45.257 | G =-1.500% L =44.925 | R =602.479 K =6.025 L =39.142 | G =-7.997% L =16.787 | R =150.366 K =1.504 L =16.521 | G =2.990% L =18.562

ROAD1 (CH.200-225) - LONGSECTION
HORIZ 1:500, VERT 1:500. DATUM: 5.000m

MAIN ROAD - LONGSECTION
SCALE: H 1:500,V 1:500. DATUM: 5.000

DRAWING STATUS:	FOR PLANNING
	1 Capital Quarter, Tyndall St, Cardiff, CF10 4BZ, UK T+ 44 (0) 292 076 9200 wsp.com
CLIENT:	PHILIP WORTHING
ARCHITECT:	LOYN ARCHITECTS
SITE/PROJECT:	LECKWITH QUAY
TITLE:	B4267 LECKWITH ROAD HIGHWAY IMPROVEMENTS HIGHWAY LONG SECTION
SCALE @ A1:	AS SHOWN
CHECKED:	GW
APPROVED:	GW
PROJECT NO:	
DESIGNED:	SID
DRAWN:	GS
DATE:	February 20
DRAWING No:	70053561-WSP-XX-XX-DR-CE-104
REV:	-

1 Capital Quarter
Tyndall Street
Cardiff
CF10 4BZ

wsp.com