

Central Rhyl Coastal Defences

Carbon review technical note

Project:	Central Rhyl Coastal Defences		
Our reference:	CR-MMD-00-00-TN-EN-3097 (Rev P02)		
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Subject:	Carbon review technical note - changes to material quantities		

1 Introduction

The Central Rhyl Coastal Defences scheme (the Scheme) is a design and build scheme being delivered by Balfour Beatty Civil Engineering Limited (BB) for Denbighshire County Council (DCC). Mott MacDonald Ltd (Mott MacDonald) has been commissioned by BB to support with the development and delivery of the Scheme.

The Scheme, located in the central area of Rhyl waterfront, Denbighshire, North Wales, comprises coastal defence works in the form of scour protection, stepped concrete revetment, promenade raising, sea wall works, access and promenade improvements, and associated tie-in works.

This technical note has been prepared for the purpose of presenting a comparison of material quantities associated with the final design of the Scheme against the reasonable worst-case design used to inform the Scheme's Environmental Statement (ES)¹, and the associated impact of any changes on the emissions resulting from the Scheme. See Appendix A for the material comparison provided by BB on 5 January 2023 to inform this assessment.

A high-level re-assessment was deemed necessary due to some changes in material quantities at the final design stage and to evaluate whether these changes have a material impact on the conclusions of the ES.

2 Methodology and Assumptions

2.1 Methodology

A high-level approach was used for the assessment. The aggregated percentage change in material quantities was used to update the original ES carbon calculations. Rather than a detailed re-assessment following an itemised order, the totalled changes in the quantities of aggregate, sand, concrete and rock armour are taken separately to compute the emission implications.

2.2 Assumptions

1. The assumptions are the same as stated within the ES¹.

¹ Central Rhyl Coastal Defences Environmental Statement Volume 1: Main Text, September 2021, Revision C01.

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2. Precast concrete units' emission factors were selected from the Inventory of Carbon and Energy (ICE) library². The library has a precast emission factor different from in-situ factors, the former being more efficient. For the updates, this uplift in concrete for all the concrete items has been incorporated.

3 Results

The change in emissions associated with the quantity changes of the various materials is summarised in the table below.

Material	% Change in material quantity	Emissions from original assessment (as stated in ES) (tCO ₂ e)	Emissions as for the final Scheme design (tCO ₂ e)	Change in emissions (tCO ₂ e)
Concrete	7	3,347	3,581	234.30
Steel	-13	2,580	2,244	-335.38
Aggregate	22	586	715	129
Rock Armour (and gabion fill)	-38	662	410	-251.53
Total		7,175	6,950	-224
% Change in total emissions		-3%		

There is a net decrease by 3% in the total emissions associated with the Scheme based on the final design when compared to the design used to inform the ES (as highlighted in the table above). The table shows a 7% increase in concrete and a 22% increase in aggregate. This is offset by the decrease in overall steel and rock armour quantities. The biggest change can be attributed to the 13% reduction in steel (combined reinforcement and sheet piles), which is a carbon intensive material. This is supplemented with a 38% reduction in the quantity of rock armour.

4 Conclusion

The re-assessment has shown a 3% net decrease in the total emissions associated with the Scheme based on the final design when compared to the design used to inform the ES, which can be deemed as not significant in line with the methodology considered in the ES. The ES concluded that the emissions associated with the scheme would not materially affect the UK government in achieving their carbon budgets therefore the effects on climate are not considered significant and thus, the conclusions provided in the ES still hold. The assessment undertaken for the final design to compare quantities with the ES, was high-level and looked at the aggregated quantity differences of the main materials. A detailed item by item re-assessment would deliver slightly varied results from those stated in this technical note, although this would not change the conclusion of the ES.

² Inventory of Carbon and Energy database V3 (Embodied Carbon Database)

Appendix A - Material comparison

Material resources required for the Scheme (from ES)	Estimated Quantity (from ES)	Dec 2022 Quantity (from take-off of detailed design)	ES Quantity (Adjusted)	Dec 2022 Quantity (Adjusted)	Explanation of Adjustments	Difference in Material Quantity	Impact on Number of Deliveries**
Fill							
- Widened promenade fill - Crane platform fill (6F2) 6N grade material - Drainage layer - Promenade pavement	27,866 m ³	33,922 m ³	27,866 m ³	33,922 m ³		6,056 m ³	22%
							546
Rock (including Gabion Basket Fill)	27,784 m ³	17,352 m ³	27,784 m ³	17,352 m ³		-10,432 m ³	-38%
							-884
Concrete	7,438 m ³	9,396 m ³	12,982 m ³	13,950 m ³	Volume of precast units included	968 m ³	7%
							326
Textiles							
- Geotextile - Geogrid - Steel mesh/gabion basket facing - Mesh A393	32,730 m ²	23,518 m ²	32,370 m ²	22,672 m ²	A393 mesh removed.	-9,698 m ²	-30%
							Negligible
Steel							
Sheet piles	4,440 m ² *	7,522 m ²	698 t	846 t	Converted to tonnes to account for section thickness and determine overall steel total		
Reinforcement for:							
- RC Pile Cap for sheet pile toe - Revetment top beam - Promenade slab - In-situ concrete for rear seawall	1,024 t	677 t	1,858 t	1,390 t	Steel within precast units and A393 mesh included	-320 t	-13%
							-16
Precast units							
- Precast units for revetment construction - Precast wall units - Precast step unit	1,264 (no.)	1,041 (no.)	Material quantity not compared directly, included in steel and concrete rows above instead.				-112
Other items							
Gabion baskets	270 (no.)	0 (no.)	270 (no.)	0 (no.)		-270 (no.)	-100%
							Negligible

-140 deliveries

Notes:

- ES assumption was 6m long AZ28-700 sheet piles. Final design requires AZ24-700 varying length (5.5m to 7.5m), with smaller quantity of varying length AZ36-700 piles at beach access ramp.
- Fill quantities in Dec 2022 includes new promenade pavement materials (which previously was concrete slab).
- Assumption that 90m² at top of new beach access ramp requires tidal flat deposits removing/replacing (excavation to 0.5m AOD) based on CPTs undertaken in August 2022.

* Incorrectly labelled as m in original ES reporting

** Concrete and steel uses pre-adjustment figures, precast units deliveries considered separately.

Source: Balfour Beatty, 2022. Provided to Mott MacDonald Limited on 5 January 2023