

## **G      Outline Construction Methodology (Construction Strategy)**

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Project Number: CRMM 0431  
Project Name: East Rhyl Coastal Defence

**BALFOUR BEATTY UK**

# **OUTLINE CONSTRUCTION METHODOLOGY**

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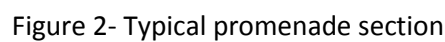
#### A. Document revision record

Issue	Date	Description of amendment
03	21.08.2018	Updated contents page; Review section 3.3- delivery routes to site; update summary of bulk construction and edit table 2; update figure 5; add figure 15- removal of existing groynes; add figure 19- typical excavation profile/section of work when construction the toe; add figure 20- re-use of the excavated material and protection of the new rock toe during construction; add section 4.10- Maintenance of standard of protection (SoP) during removal of old wall and placement of new; add section 6.2- promenade closure and public re-routing; update section 5.2- noise and vibration monitoring; update section 5.3- air quality management; update section 5.5- fuel/chemical storage.
04	04.12.2018	Update transport routes to site. Remove reference to two options. Section 3.3, fig 4; Add additional information on site compound entrance off Marine Drive- add figure 12a.

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This 3D visualization shows a river channel with cross-sections at various points along its length. The cross-sections are labeled with values: 4.5, 4.11, 4.7, 4.9, 4.11, 4.5, 4.7, 4.9, 4.11, 4.4, and 4.5. A red dashed line indicates the channel's plan view, showing its meandering path. The background shows a landscape with a road, buildings, and a large circular structure, possibly a water treatment tank.

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### 3. Programme, resource and logistics

#### 3.1 Programme and working times

The scheme is currently being developed under a pre-construction agreement which is forecasted to come to an end once permission has been received from Denbighshire council to proceed around May 2019. Following a stage of brief procurement, initial site mobilisation will take place in May 2019 and construction completion is expected around 20 June 2022. A high level programme has been developed and included in Appendix 1 for reference at this stage.

To enable day to day planning the following work patterns are expected:

Reference	Description of work	Working time
1	All work subject to beach access	Due to location in the tide, this work will take place around the daily tidal window as the access is permitted once the tide is out. It is therefore inevitable for these works to be irregular and more in sync with the tidal patterns along this coastline.
2	Promenade works	These works will take place during regular working hours of 07.00 to 19.00.
3	Site mobilisation works	These works will take place during regular working hours of 07.00 to 19.00.
4	Supply of materials to tidal works from storage compounds	As this is linked to the supply of tidal work activities it is envisaged that these works will take place in synchrony with the tidal patterns as noted in bullet 1.

Table 1- Working hours

#### 3.2 Resource

The project is procured through the SCAPE public-sector partnership under the National Civil Engineering and Infrastructure framework. SCAPE mirrors Balfour Beatty's (BB) recognition of how we identify and address social, environmental and economic concerns on our projects. Apart from a target to deliver our projects on time and on budget, we share a notable focus on people and suppliers through our SCAPE key performance indicators (KPI's). To this end we have a key focus on;

- local supplier and local labour spend
- SME engagement and spend
- Fair payment

A variety of opportunities are presented through the technical build complexity of the project, as such it offers a combination of a very limited scope in terms of coastal specialism as far as the intertidal works are concerned and a more general civil engineering approach to the works outside the intertidal zone. The project would offer opportunity to a varied group of suppliers and subcontractors. Technical compliance, quality requirements and availability will dictate the radius of the project resource footprint.

BB envisages a peak permanent staff contingent of 15 white collar and 35 blue collar workers during the delivery of the scheme. This excludes visiting service contractors and deliveries to site.

Accommodation of the staff is elaborated in section 4.2 and the proposed construction plant for the core construction activities are listed in Appendix 2.

### 3.3 Delivery routes to site



Figure 4- Principal access route to site from A55

A number of viable transport routes to the site have been explored. One principal route has been identified for access to site from the A55 North Wales Expressway.

This principal route assumes exit off the A55 at Junction 27 on the A525, then left onto Ffordd Abergele. Continue to St. Asaph Avenue, take a right turn here towards Kinnel Bay. Connect with the A548 which becomes Ffordd Abergele (right turn) and then carry on along West Parade, then East Parade until the marine drive which will take you to the project location.

This route is considered as the principal supply artery into site from the A55 as this avoids Rhyl town centre as far as is practically possible by due to the westerly direction. The site routes will be communicated to site contractors at an early stage of engagement.

Should the primary route into site be disrupted through planned or unplanned events then traffic shall adhere to diversions put in place by DCC highways or relevant Authority on the day or the period this may apply.

These initial views on transport to site will be explored and shared during community engagement sessions. Supply routes to the project will be reviewed on a regular basis to ensure outside influences such as new construction projects using the same road network and planned road maintenance works are taken into account before they occur. Though the construction phase of any development will have an impact on the surrounding community, including safety, environmental and congestion impacts on the road network, BB will ensure that the transport strategy limits the impact of freight movements.

Safety and sustainability leadership will inform our Construction Management Plan and BB will implement measures to ensure;

- Safety
- Safe culture
- Safe vehicles
- Safe drivers
- Sustainability

### 3.4 Summary of bulk construction materials

Ref.	Description	Quantity	Unit	Likely Origin	
				Outside Wales	Within Wales
1	Rock armour stone 3t to 6t	99600	t	40%	60%
2	Filter layer stone 0.3t to 1t	66120	t	40%	60%
3	Geotextile (HPS14 or similar)	28600	m <sup>2</sup>	100%	0%
4	Quarry run core	7000	t	0%	100%
5	Readymixed concrete	2350	m <sup>3</sup>	0%	100%
6	Hydraulically bound subbase material	750	m <sup>3</sup>	50%	50%
7	Pre-cast concrete wall sections	201	No	100%	0%
8	Pre-cast concrete access step units	63	No	100%	0%
9	Reinforcing steel to concrete (excluding pre-cast elements)	163,000	kg	0%	100%
<b>Weighting</b>				<b>48%</b>	<b>52%</b>

Table 2- Bulk materials anticipated and potential supply split

## 4. Construction

### 4.1 Sequence of work

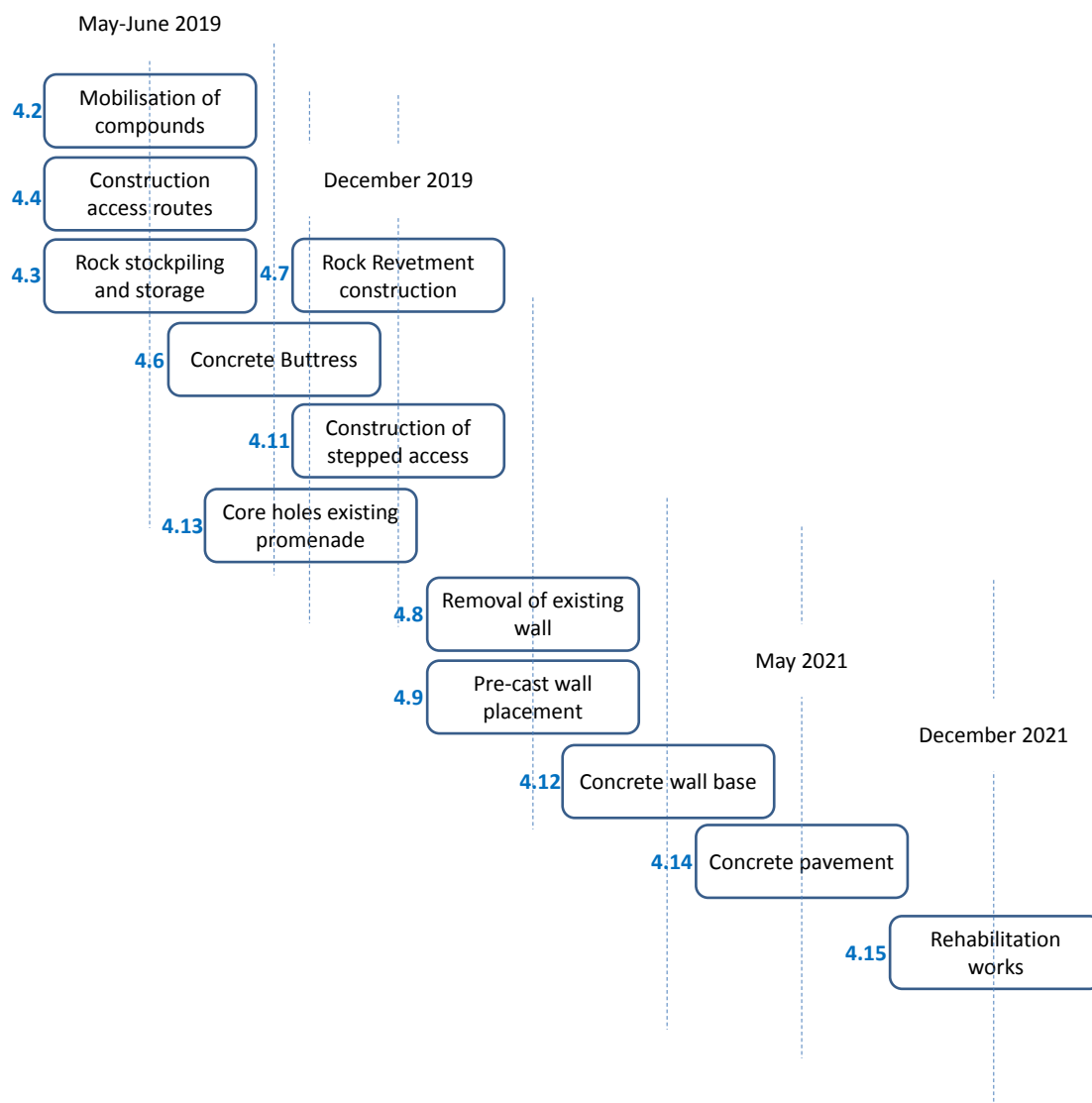


Figure 5- Sequence flowchart based on likely start of activity

### 4.2 Mobilisation of compounds

2 Locations have been identified for the office accommodation and materials storage into site. Location 1 will be used as the main site for materials import into site and major plant mobilisation. Location 2 will be used for the site office establishment and smaller construction plant access. The former location is off East Parade Marine drive and the latter is leading off Garford Road.



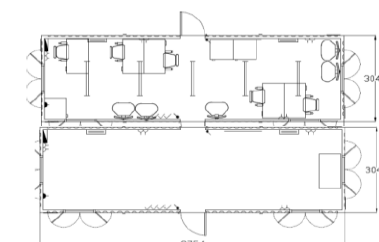
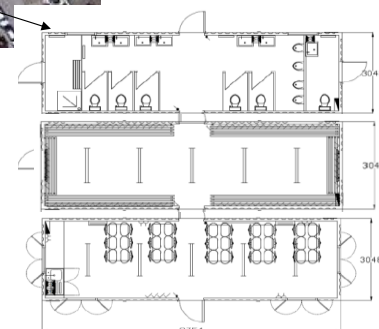
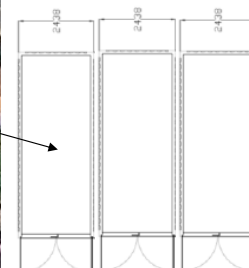
Figure 6- Compound locations

The two compounds locations will be set up such that the welfare and accommodation is suitably sized appropriate to the activity at each location. It is anticipated that a provisional permanent site staff contingent of 15 people and a peak of 35 blue collar workers will be required for completion at the scheme. This number excludes visiting delivery drivers and general servicing requirements through the project.

The main materials compound will predominantly house the specialist construction staff and serve as the intermediate delivery area for rock into site. This will also be the main transit area into site. There will be a small car park provision here in order to minimise the effect of potential nuisance parking on the nearby public roads by the work force. The work activities anticipated in setting this compound up is summarised in figure 7 below.



1. Site welfare
2. Car parking area
3. Stores
4. Main site access from Marine drive- subject to section 184 application
5. Hardstanding area- used for main rock delivery and processing
6. Exit onto top promenade to site supply route
7. Perimeter fence



#### Activities intended for mobilisation site cabins at Compound 1

- Main access off east parade Marine Drive
  - Set-up designated site routes including signage
  - Locate existing services
  - Removal of existing hedgerow- provision of road access into compound
  - Relocate existing street furniture and fixings
  - Profile/excavate existing surface at entrance
  - Drop kerb line
  - Import and place sub-base
  - Import and place base
  - Pave/concrete entrance
- Compound and perimeter
  - Set up perimeter fence
  - Strip and bund topsoil
  - Import and pace hardstanding
- Welfare and stores
  - Level and preparation locally for cabins
  - Establish and fit-out welfare and stores
  - Connect water to mains
  - Connect electricity to mains
  - Services to site cabins- connection and testing

Figure 7- Materials compound mobilisation activity

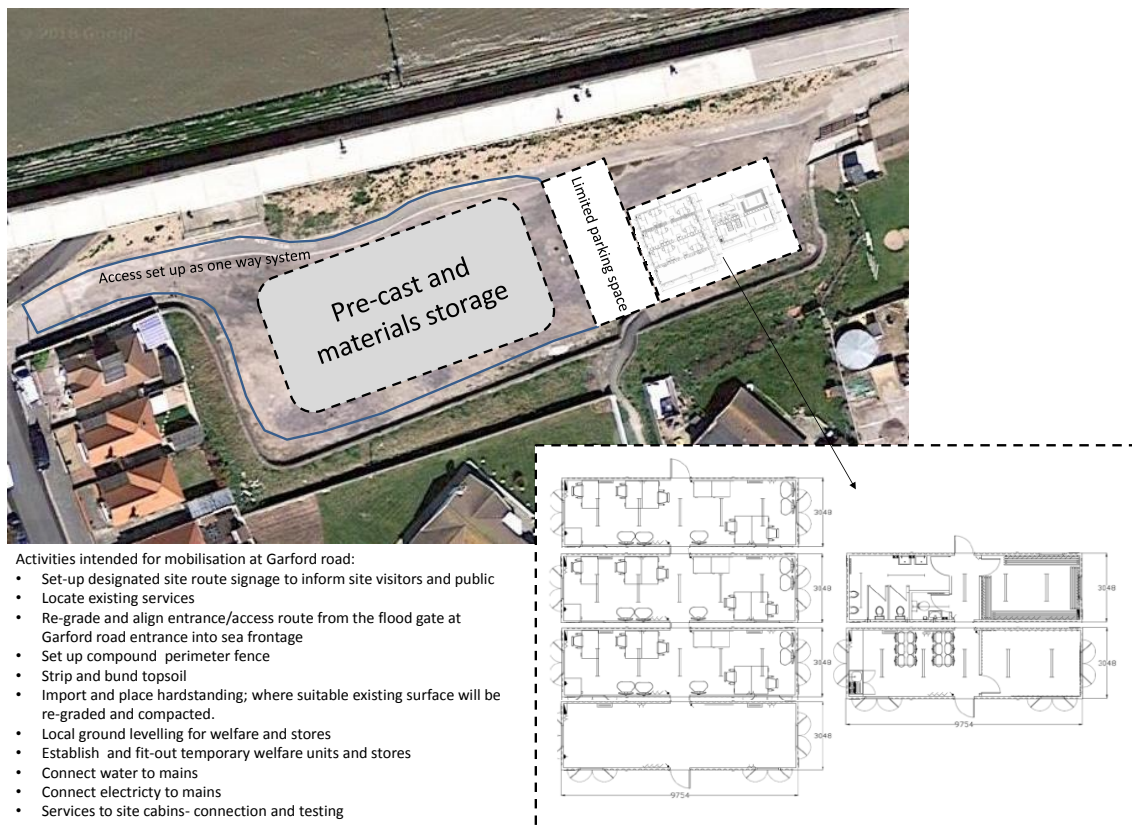


Figure 8- Outline compound set-up at Garford Road

The compound at Garford road will accommodate most of the office staff and as such will have a limited amount of car parking space. It is also envisaged that a large percentage of the pre-cast elements will be delivered here. Due to the long duration of the project, the compound will be sustained by mains power, sewage and water. Applications will be made accordingly in advanced of site mobilisation. The work activities involved in setting up this compound is summarised in figure 8.

#### 4.3 Rock stockpiling and storage

Advanced stockpiling at main materials compound off marine drive: Initial rock production and stockpiling is required over a period of 5½ months to ensure the revetment construction progress unhindered once this construction activity commence. The rock armour and rock fill layer material is intended to be delivered by road and initially stockpiled in the materials storage compound (location 1, figure 6).

The rock armour stockpile will create a buffer to allow rock to be drawn from the stockpile to suit the production rate required for the main rock revetment construction works and will continue to be imported at a similar rate for the duration and requirement of the works thereafter.

The rock will be loaded directly onto wagons after being selected and graded at the quarry and will therefore, be deemed as a clean product, free from fines and contaminants. However; should any of the rock become contaminated, it will be washed down prior to delivery and/or placement to prevent any possible pollution to the marine environment.

Upon arrival to site, the rock will be offloaded by means of a suitably sized tracked excavator fitted with a hydraulic grab positioned at the compound and temporarily stored.

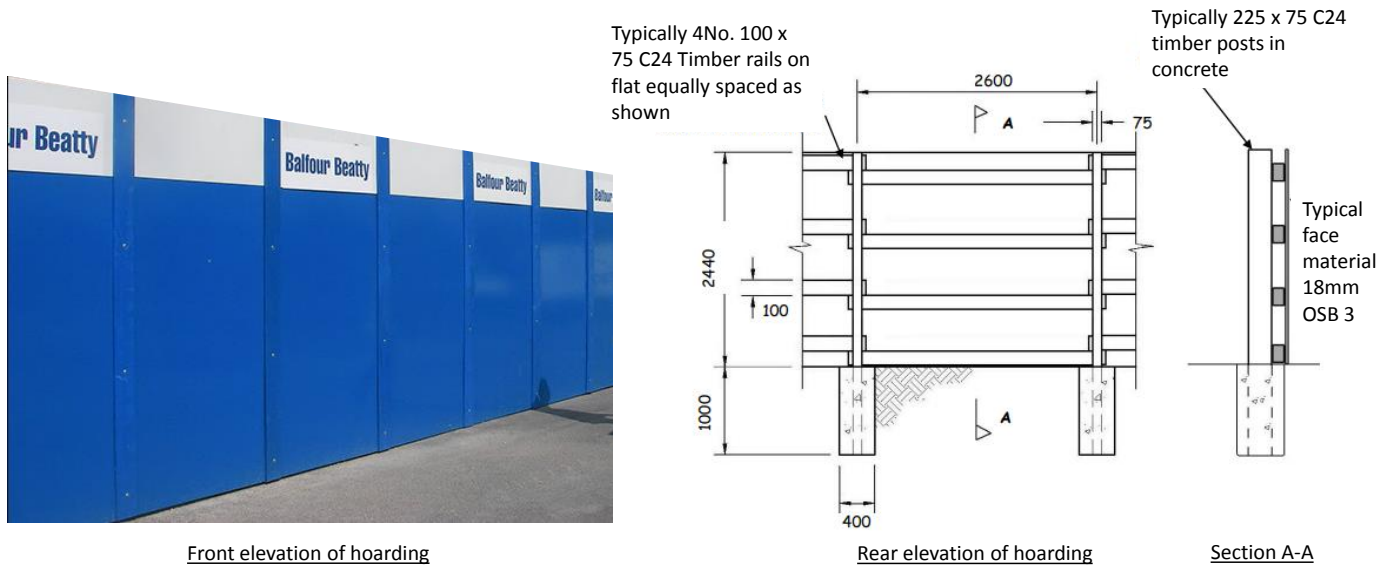


Figure 9- Typical hoarding, intended for materials storage compound

To aid with noise, dust and general safety, this compound perimeter will consist of solid faced hoarding typical to figure 9, above. The outward facing side of the hoarding could dually be used as a project information canvas. Maintenance and inspection of the hoarding will take place in line with BB temporary works requirements. Further dust supersession will be used during rock processing and stockpiling if deemed necessary by the site supervision. Materials stockpiling during the construction period: The rock will be delivery via the haul route from the materials compound to the beach area. A second suitably sized tracked excavator fitted with a hydraulic grab will be positioned on the foreshore to organise and assemble relevant rock fill and rock armour stockpiles in preparation for use within the works.



Typical temporary sorting and storage of rock armour near the work face, before placement in correct formation/density. This allows work efficiency as the stockpiles are sorted in the correct packing/density order such that it makes for ease of placement and minimal re-work once rock is placed in final revetment formation

Figure 10- Typical rock armour storage near work face

#### 4.4 Construction of access routes to site location

Two compounds will be established as noted in 4.2 above. The materials storage compound (location 1) will give rise to the major transport route for servicing the project. These access points and proposed travel route is indicated in figure 11.

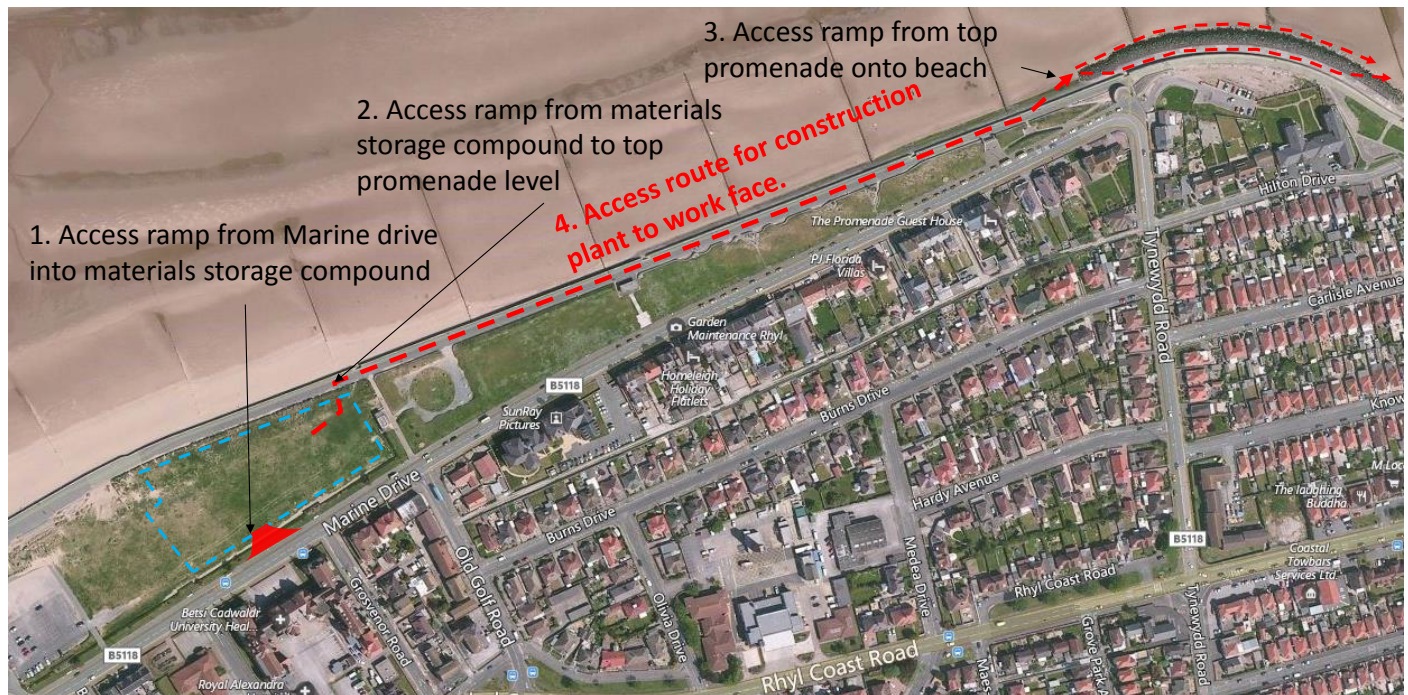


Figure 11- Access points from materials storage compound location and associated routes to works face

The proposed main access from Marine Drive will be located as indicated in figure 11 and 12a. Consideration will be given to the direction in which site traffic approach the site to minimise any impact on existing public road users. In this case we will explore the feasibility to dictate incoming construction traffic to approach from the west and departing traffic to leave in the opposite direction.

Advance road signage will be erected as agreed with Denbighshire County Council Highways department under the relevant application process. All existing services will be identified in the area before works commence. The exiting topsoil shall be stripped and banded for future rehabilitation work. Consideration will be given to replant mature affected mature hedges with an attempt to reinstate on completion of the works.

All existing services once located will be protected or diverted where required. The new entrance profile will be cut and filled to formation (see figure 12b). The existing kerbline will be suitably dropped as indicated to facilitate HGV access into site. The base layer shall be formed as indicated and then concreted over. The concrete running surface shall have an antiskid finish. This final road entrance construction detail shall be subject to a section 184 application post planning and before commencement of this particular construction element. This entrance shall be gated; additionally it will be pedestrian friendly as such pedestrian right of way will be enforced here.

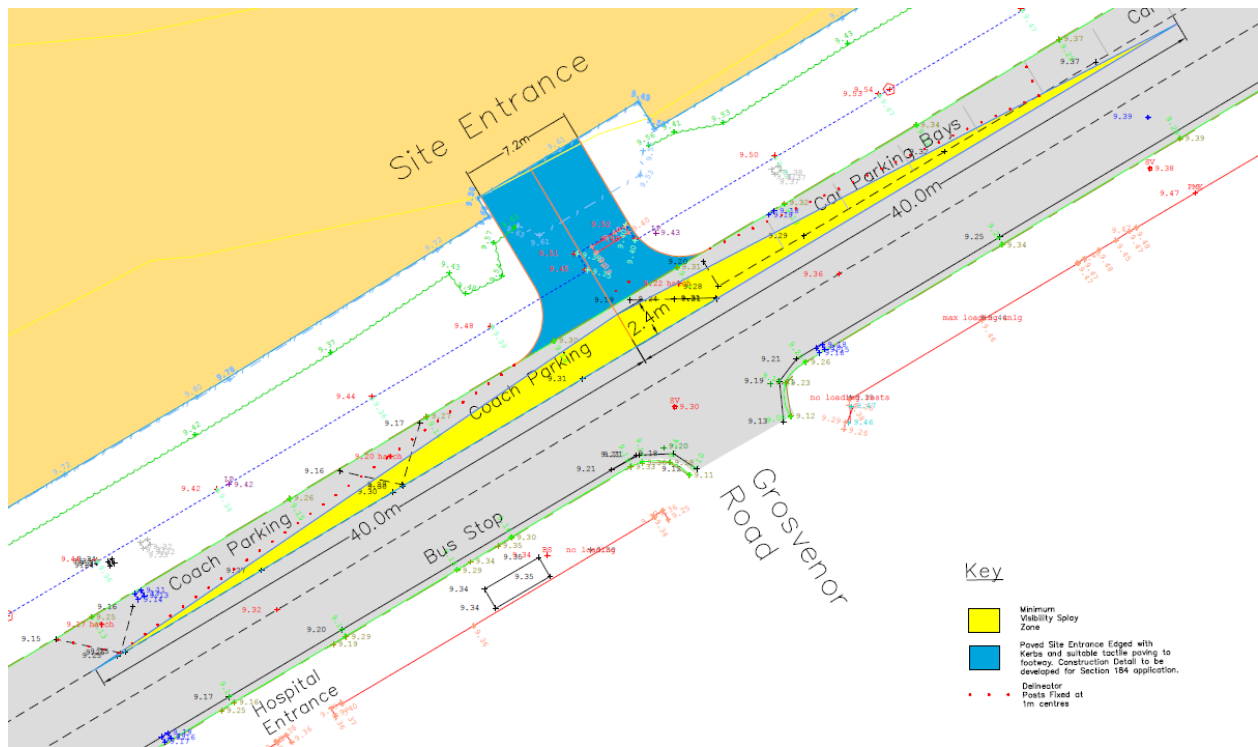


Figure 12a- Citing of materials compound entrance off Marine Drive

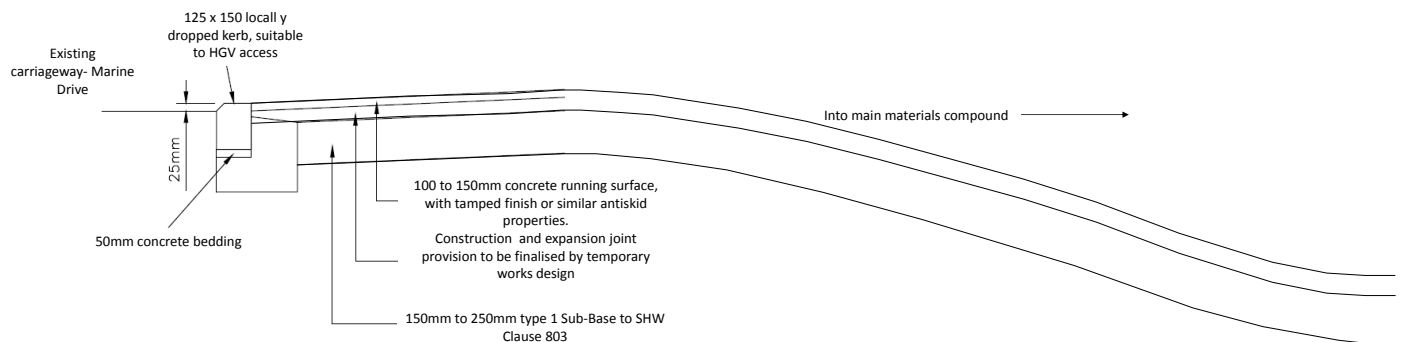


Figure 12b- Proposed access from marine drive into materials compound

Once the access is formed at the entrance; focus will shift to the access ramp from this materials compound to the top promenade. Here the access provision will adequately sized to provide construction vehicle access in and out of the compound onto the site haul route. The entrance will be evenly graded and treated with a base layer capped with concrete. This access will also be gated. It is anticipated that the top promenade will be closed off to pedestrian access from this point and will be diverted at a mutually agreed point with Denbighshire County Council (DCC) before this access point.

A third construction plant access is required from the top promenade level down to the beach, this access will be located near splashpoint (see figure 13) and within the CDM area of the site. A temporary slipway access will be constructed here to accommodate the height difference between the top promenade and the lower steps to the beach. Subject to temporary works design evolution; this could be shaped as a gabion retained slipway which is capped with a concrete running surface.



Figure 13- Temporary gabion retained slipway access near splashpoint

Once onto the beach level this can be used by construction vehicles to get to the required faces. Where identified, a bulldozer will be used to increase the sand depth as required by using beach won material to maintain a passable beach access way. The correct depth of platform (see figure 14) will be maintained at all times as stipulated in the temporary work guidance.

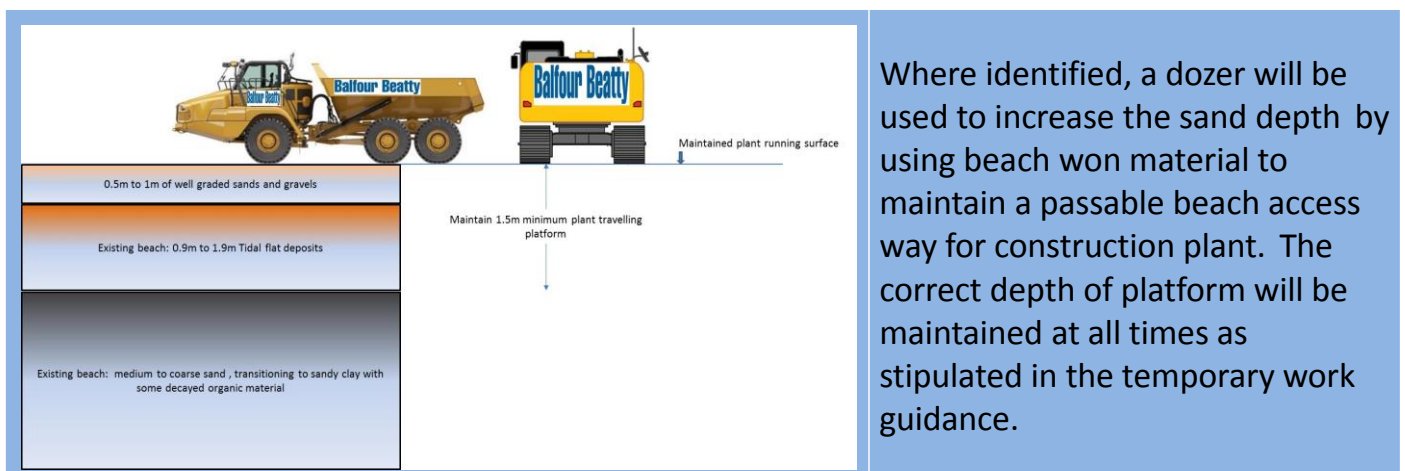


Figure 14 - Management of beach levels for plant access

#### 4.5 Removal of existing groynes

Existing groyne construction resembles a typical king pile and plank arrangement, with most of the planks above sand level missing due to wear over the years. Some of these existing timber goynes extend beyond the proposed footprint of the new revetment works. Consequently these groynes require removal to revetment formation level

(see figure 15 below). It is envisaged that this operation will take place as part of the preparatory work ahead of filter layer and quarry run construction.

Excavate and reduce the existing beach level immediate to the designated groyne until it is exposed to formation level of the new revetment. All material will be cast to one side so that it can be used to reinstate the beach to the level it was before works commenced.

All visible existing groyne planks will be removed as the excavation around the groyne position progress. As the groyne posts remain standing these posts shall be saw cut where appropriate or removed by means of excavator with specialist grab attachment. All off cuts will be placed in the timber skip provided on site. Work will take place in manageable sections according to the available tidal window.

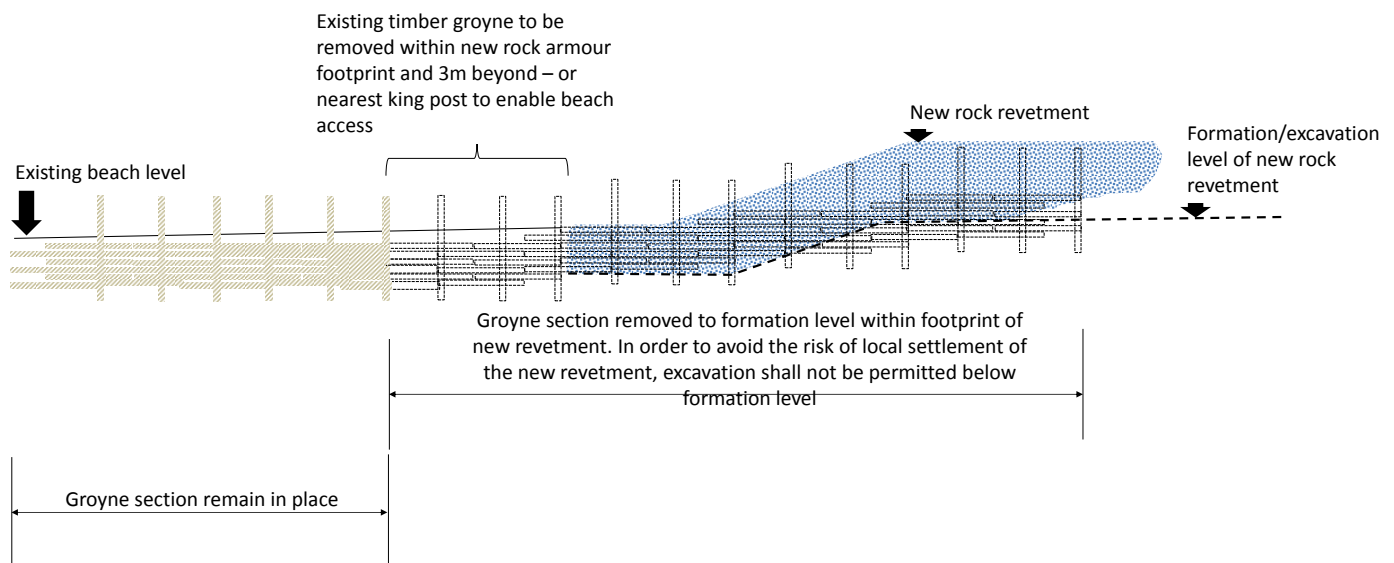


Figure 15- Removal of existing groynes

#### 4.6 Concrete buttress

The concrete buttress will be progressed ahead of the rock revetment works. It is assumed that minimal to no work is required to the existing re-curve wall face prior to concreting. A number of single pan formwork panels shall be made up intended for repetitive use throughout this operation. Once fabricated, these formwork panels will be lifted and handled by machine only.

After the formwork has been erected (see figure 16), the formwork will be filled by utilising a concrete skip or by pumping the concrete into place. The means of placement will be dictated by the access and volume to be placed on the day. Access to the works will be via the existing top promenade area.

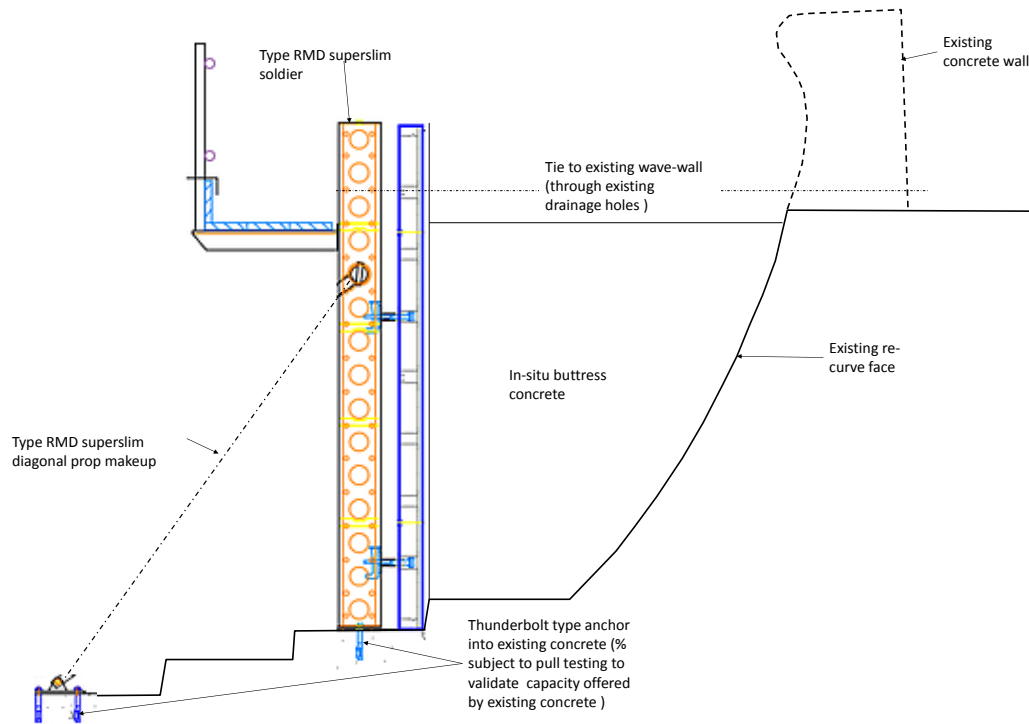


Figure 16- Single sided formwork for buttress concrete

#### 4.7 Rock revetment construction

It is anticipated that the initial rock supply will be established at the western compound. Most of the rock will be delivered and stored near the work face on the beach (see fig 10) and the general construction will commence from the toe and then up the slope.

The first section of rock revetment to be done will be as a trial panel of set agreed dimensions. It is anticipated that this trial panel will be completed to full height design height. Primary rock armour shall comply with European grading 3-6t in accordance with BS EN 13383-1:2002.

Prior to commencement of the excavation, the ground levels shall be reduced by a bulldozer or excavator which will work alongside the revetment team and be no more than 3 shifts ahead of the installation team.

It will also be used to ensure beach levels are maintained as set out in section 4.4.

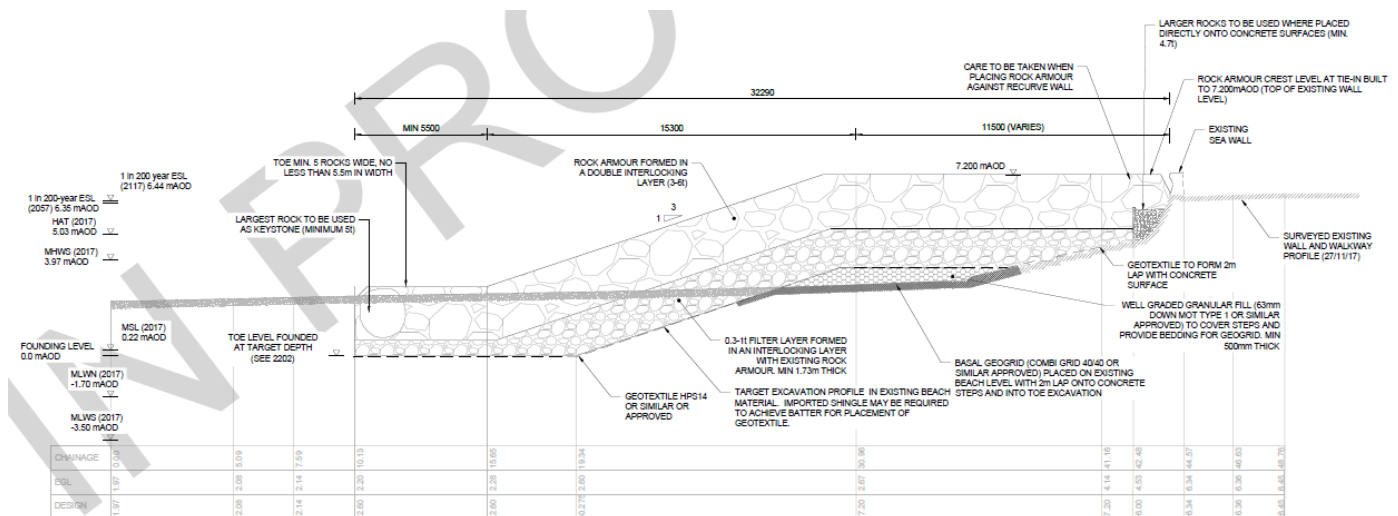


Figure 17- Typical defence section

Excavation to formation at the designated shift location will be completed using excavators which will be used to reduce the dig area further. Dump trucks, will be used to move the excavation arisings beyond the extents of the dig where it will remain unless used for backfilling of the toe. GPS machine control will be used to control accurate excavation to formation level profile.

The roll of geotextile will be connected on to the lifting spool and will be placed on to the dumper/trailer and transported to the work area. At the work face, the roll will be attached to the excavator (figure 18) and the free end weighted or held in position by the second machine.

The textile will be laid directly onto the formation and once the intended excavation extent has been covered the roll will be cut using an appropriate cutting tool. Lap widths will be sprayed onto the geotextile showing the 1m lap. To ensure that the geotextile can be recovered for the following shift rock/sand will be loosely placed onto the lap section at the end of each shift to protect and enable the recovery of the end to continue.



Figure 18- Typical geotextile placement

The filter layer will be transported to the work area either by dump trucks and tipped onto the beach and then placed using the excavator bucket onto the geotextile. The filter layer will be placed such to achieve an even distribution of rock sizes, thus avoiding uneven concentrations of smaller sections of rock sizes. The under layer will

be surveyed to ensure that the layer has been placed as the correct tolerances regarding density and minimum thickness and final height.

Graded piles of armour stone will be stockpiled on the beach near the work face in the correct grading and known weight of material. Rocks will be moved from the stockpiles and placed one at a time onto the recently placed filter layer stone using an excavator with grab attachment or bucket. The toe profile will be constructed first, ensuring that the largest rock of at least 5.5t is placed at the front face. Once formed the final rock level shall be accurately surveyed using GPS excavator or total station.

On confirmation that the as built profile is within the tolerances set out in the specification and sufficient measurements have been taken to calculate accurate volumes, the as dug sand/shingle beach material will be used to cover the toe up to existing beach level. Once the armour has been covered by a minimum thickness of material, the excavator will be positioned onto the toe and will continue to place armour stone to the crest.

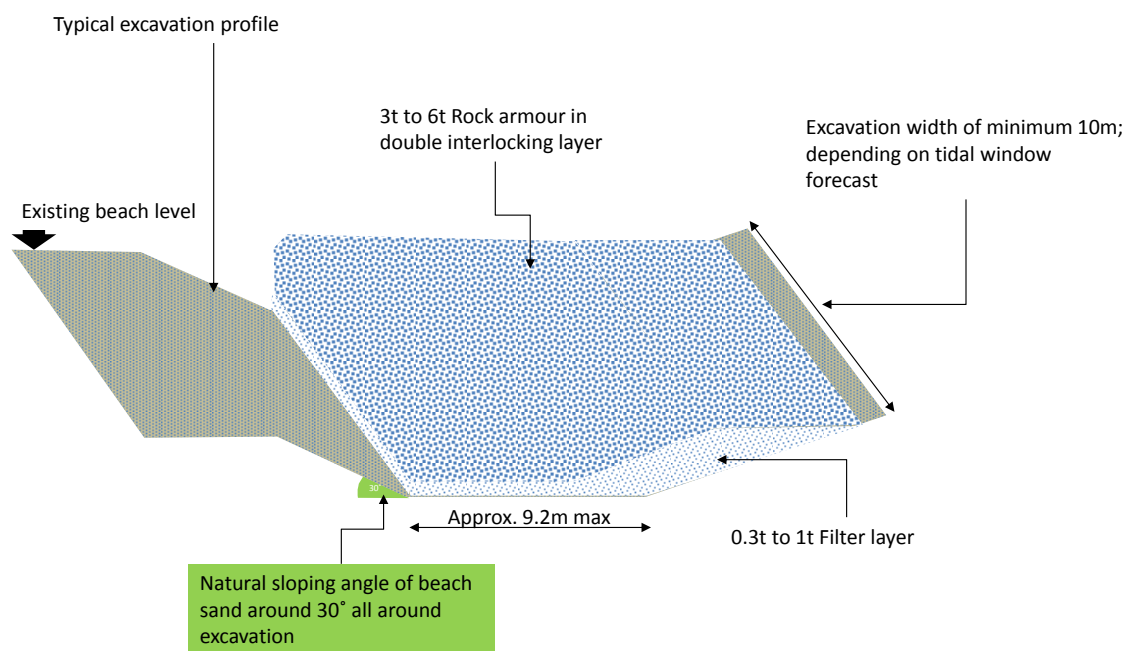
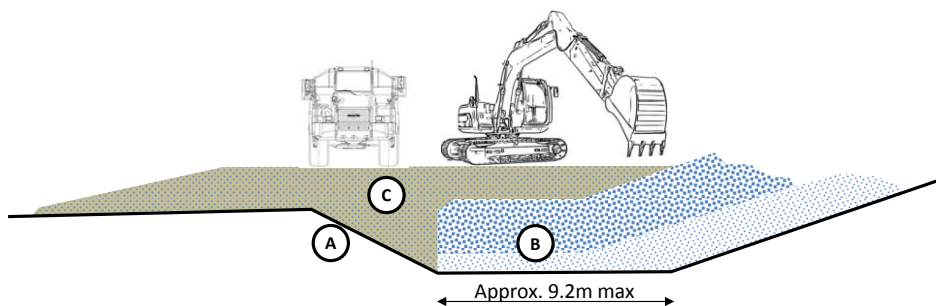


Figure 19- Typical excavation profile/section of work when constructing the toe

The final completed section of revetment once sufficient armour stone has been placed will be surveyed to confirm the actual packing density for acceptance. Any areas of works which do not meet the required finish or are found to be outside of the tolerances set out in the specification will be reworked until they have found to be satisfactory. All broken or damaged rocks will be picked from the revetment or left within the stockpile and on completion will be loaded into a dump truck and tipped in the main rock storage area.

Machine equipped with GPS shall be calibrated regularly. The data model profile of the typical revetment construction layers (figures 17, 19, 20) will be uploaded to digging and placement excavators and the operators' cab display will indicate the applicable cross section to build to. Plan and traffic light tolerance envelopes shall be pre-set and can be viewed live as the revetment is built up.

Further confirmation and compliance shall be sought by recording as-builts of placed volumes using high resolution drone images referenced to known points. These digital images will be inspected to visually check specification compliance (e.g. broken rocks) and void size and remedial actions will be carried where required. On completion, a final drone survey creates an as built record.



- A. Excavation is completed to formation level on the tidal shift after initial reduction has been achieved by a dedicated team as described above.
- B. Geotextile is placed as described, followed by the filter layer and the rock armour stone.
- C. Excavated sand will be re-used to form the a minimum 1m protection layer over the new rock toe to allow access for construction plant; in completion of the revetment slope.

Figure 20- Re-use of the excavated material and protection of the new rock toe during construction

#### 4.8 Removal of exiting sea wall

The removal of the existing wall will be undertaken as the new pre-cast wall is placed. This shall be done in such a means as to maintain the standard of protection provided by the existing wall throughout the construction phase. Two methods have been identified for removal of this wall and would be used interchangeably.

Method 1: Diamond track saw cutting has been identified as one of the methods for cutting the existing wave-wall down to formation level. Once positioned the track mounted wall saw head travels along horizontally to suit desired cut line. The diamond saw blade is attached to a saw head mechanism and rotated at high speed to form the cut. The saw blade cuts the concrete in small increments, using a series of passes until the entire section width has been cut through successfully. The cut is wedged as it is formed to prevent the blade getting stuck during the cutting and removal process. The track saw is over-viewed and controlled remotely by the operator. The blade is kept irrigated at all times during the curing process to eliminate dust nuisance.

Set up track for saw at desired level of cut



Fix motor and blade

Fix cover to blade



Figure 21- Simplified explanation for track saw set up

Method 2: The section of the wall and promenade surface to be profiled to desired formation will be identified. The existing primary wall can be broken down by mechanical means where identified. This will be in the form of attachments to the excavator in use. This will function on the principle of grinding or pinching the concrete gradually to the desired profile. As this is essentially breaking of existing hard standing and concrete to desired formation,

control measures for dust and noise will be in place. The works area will be an exclusion zone accessible to authorised personnel only.

The wall and existing surface will be broken down as required and the resulting spoil stockpiled. This will be transported away to temporary storage or used as backfill/hardstanding in the compound maintenance. Road wagons or 9t dumpers will be used to cart the spoil away.

#### 4.9 Pre-cast wall placement

All pre-cast elements will be produced off-site and transported into site either to Garford Road compound or Main materials compound and transported along the internal site to the Garford road compound. A minimal number of pre-cast units will be stored on site to ensure at least a full week's production of units is available to place at any time.

Pre-cast units will be installed by means of excavator or crawler crane with the use of a bespoke lifting frame which will be attached to the hook of the crane resource in use on the day. All lifting operations will require a lift plan completed by trained and competent person before any works involving lifting can take place. Once the designated means of crane is set up in accordance with manufacturer's instructions, the crane resource will be located at the position shown on the lift plan and designated exclusion zones set-up accordingly.

Tag lines will be attached to the frame for ease of control whilst unloading or placing units. Delivery wagons (or tractor and trailer) will bring the requested units to the designated work area.

As per lift plan, the delivery wagon will pull into the correct position for the crane to receive the pre-cast unit and disengage its engine. Using a set of podium steps, the slinger/signaller will access the back of the wagon and then slowly bank the crane ready to lift the pre-cast unit from the delivery wagon.

Once the load has been secured to the crane and verified, the slinger/signaller will then dismount the frame and trailer and move to a position of safety before he begins to manoeuvre the crane and place the unit. The crane will slew the load to the required location and lower the load until just clear off the ground at which point the placement team operatives time are operatives allowed to position themselves around the unit ready for final manoeuvre and adjustment.

Nylon packers are set to the correct position and height as dictated by the setting out drawings. The pre-cast unit will be lowered onto these packers and checked for line and level, if adjustment is required the unit is lifted slightly and the operatives, using a hooked road pin, will remove the shims, alter as required and replace in the original location. The unit will then be lowered back down and re-checked. Once the unit is within tolerance the frame or lifter will be removed. Temporary works will then be installed according to accepted design.

This operation will be repeated until a sufficient section for the shift is completed.

Formwork will be set up around the base footprint of the units placed for that shift and consequently allow the pre-cast units to be grouted in place by filling the void underneath the units.

The grout skip will be attached to the crane or excavator and filled from ready mixed concrete trucks.

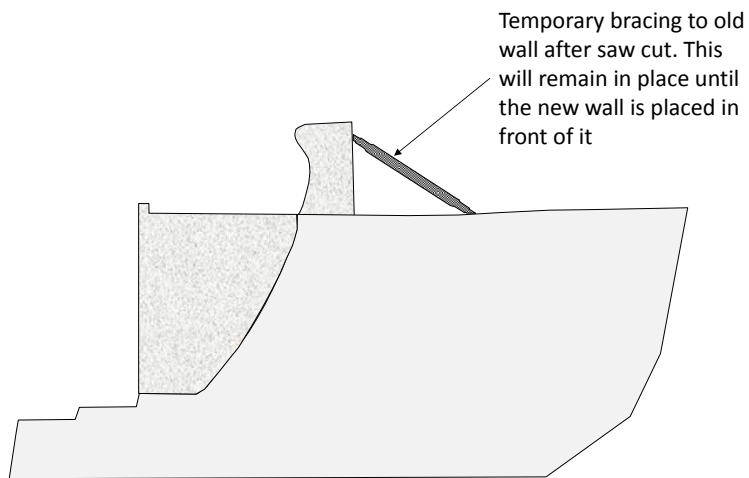
As per all lifting activities, operatives will remain outside the exclusion zone whilst the skip is being slewed into position. Only when the skip has been lowered to a safe height above ground shall the operative emptying the skip enter the exclusion zone.

Pour grout from the grout skip filling any voids or gaps under the unit

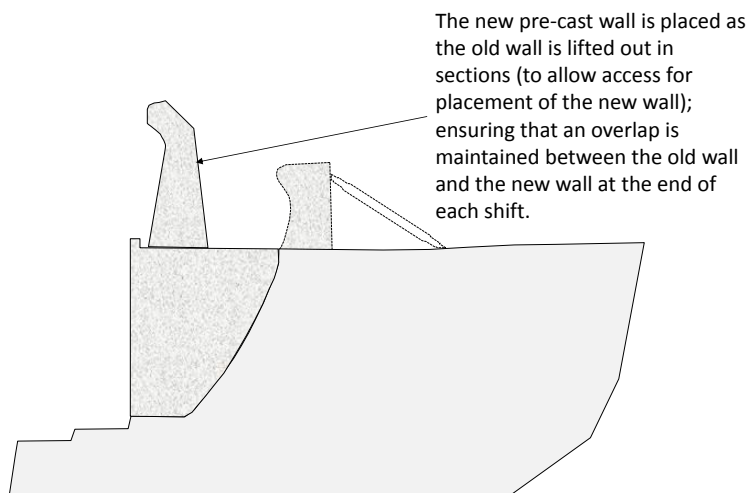
Once the skip has been emptied, under the control of the slinger/signaller, return back to the ready mix wagon and re-fill.

#### 4.10 Maintenance of standard of protection (SoP) during removal of old wall and placement of the new

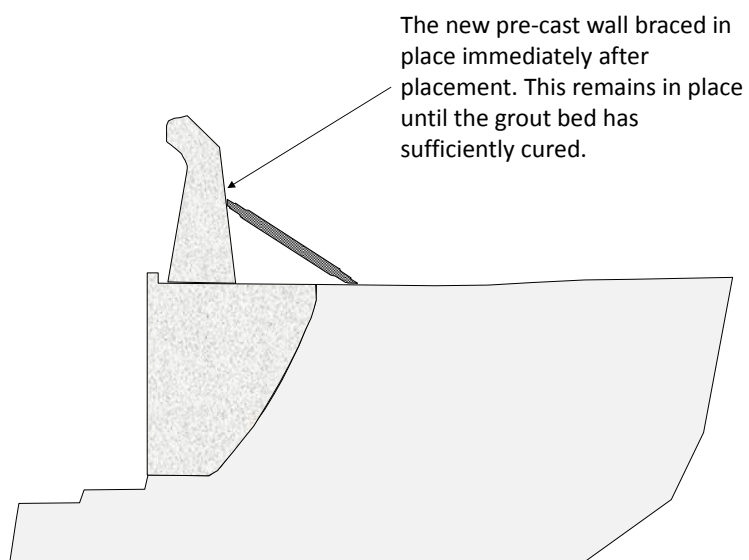
The pre-cast placement and the removal of the old wall will be sequenced such that the height of current SoP is maintained at all times. Stages explained below:



As the existing wall is cut in small work sections it is left in place and braced to ensure that it remains a viable means of maintaining SoP until the new wall is placed. Cutting of the existing wall shall mirror the new wall placement sequence and thus be ahead by 4 shifts at most.



As placement of the new wave-wall occur, the existing wall and temporary bracing is removed just in time ahead of the new wall placement.



Once placed, the new wall is braced in place until the grout bed is sufficiently cured to allow the wall to function on its own as temporary flood protection. There will always be an overlap between the new wall and the remainder of the old wall to ensure that there is no break in the SoP at the end of each shift.

Figure 22- Sequence for cutting of old wall and placement of new wave-wall

#### 4.11 Construction of stepped access point

3 access steps are required through the scheme. Two methods are being explored for forming the concrete foundations to these access steps.

Method 1- It is foreseen that the concrete foundation of the steps can be formed inside a temporary sheet pile arrangement. An open cofferdam will be formed to allow excavation inside the sheet piles to correct design profile. Once the correct formation is achieved then concrete will be placed to the desired profile of the step foundation. This work will be done in small manageable sections permitted by the tidal window. The extent of the piling required is suited to the use of an excavator mounted vibratory hammer. These piles will be extracted once the concrete has sufficiently cured.

Method 2- An alternative to above will be the use of drag boxes. These will be used in a similar manner to contain the excavation and act as a temporary former to the concrete foundation as it is formed in small manageable sections as above.

Once the concrete foundation is formed, the pre-cast steps will be placed by a crane similar to section 4.9.



Method 1



Method 2

Figure 23- 2 methods for constructing access step foundation

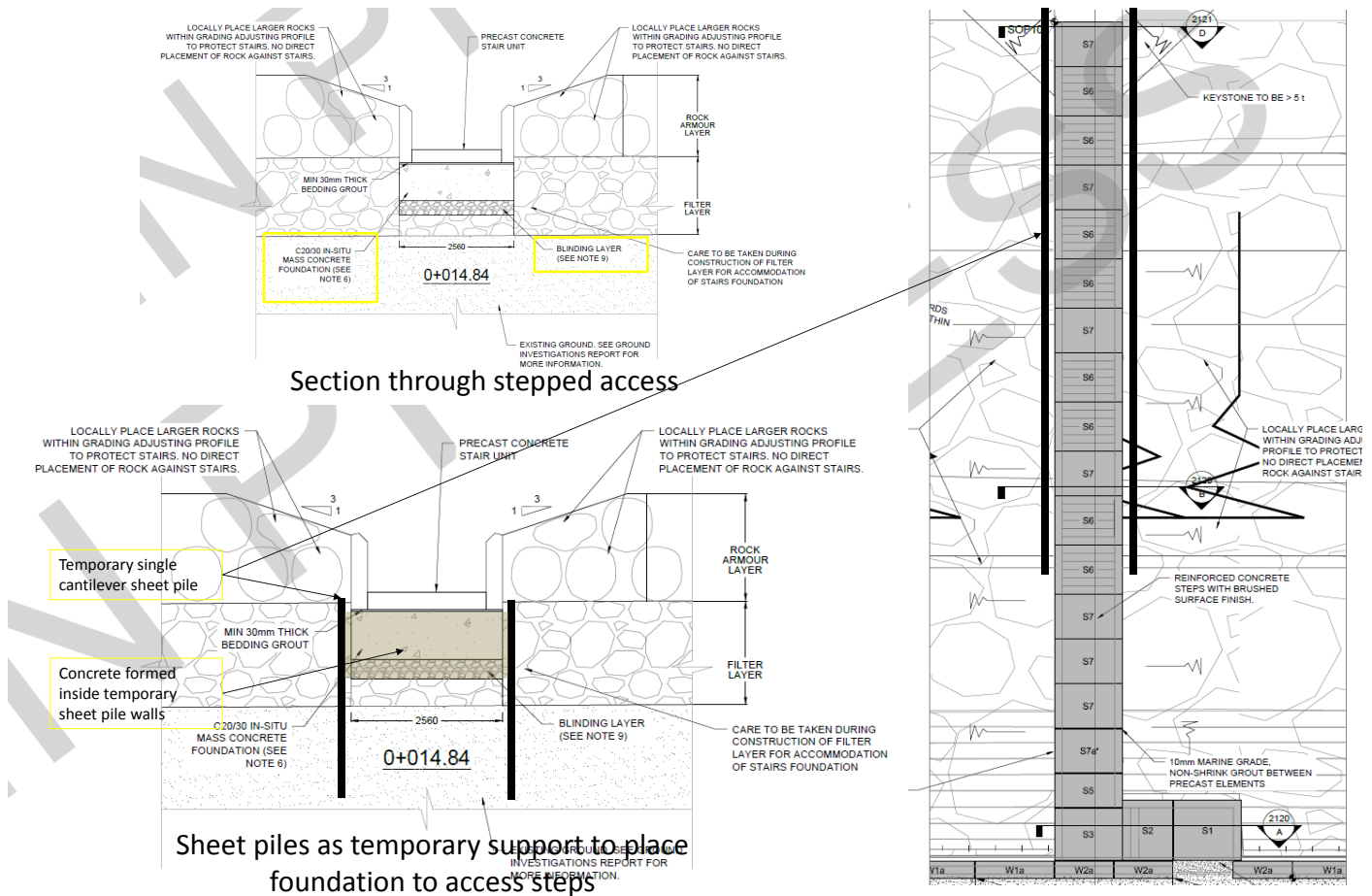


Figure 24- construction of access step concrete foundation

#### 4.12 Concrete wall base

Site delivery access and egress will be via Garford road onto the top promenade where required.

Where excavation is required to form a foundation or the like, an excavator or digger shall be used to dig it. The sides of the excavation shall be neatly excavated to provide adequate working space.

Where large slabs are constructed, a blinding layer will be cast to provide a clean and level working platform.

The re-bar shall be pre-fabricated in the designated compound closest to the work area. This shall be pre-fabricated on frames to ensure safe lifting during transport. Some in-situ steel fixing will be required.

Manual handling risk shall be considered at all time and reinforcement will be handled by mechanical means.

Formwork will be made up on site or proprietary shutters will be procured. In both cases, the formwork should be built to ensure that the concrete is formed to the requisite dimensions as well as providing the required surface finish. Formwork should be securely fixed and all fixings needed for erecting subsequent formwork should be included.

Where proprietary formwork are in use this will be fixed in accordance with the manufacturers recommendations. Heavy formwork shall be handled by machine.

Concrete will be placed by; discharge directly from the wagon to the structure, dumper transport from wagon to structure, concrete skip or pumping into position. All transport routes shall be clear and safe for access.

The correct surface finish will be applied in accordance with contract specifications. Where electric floats are used, these will be in good working order and used by experienced operatives. The fresh concrete will be over-sprayed with a curing agent after initial settlement.

#### 4.13 Core holes to existing promenade

There is a requirement for 75Ø holes to be cored through the existing pavement concrete at 750mm centres (figure 21). This will be achieved by means of diamond drilling. This is a quieter solution and offers minimal vibrations when compared to breaking and other destructive methods. The rig also reduces the amount of vibration which you would get when hand drilling.

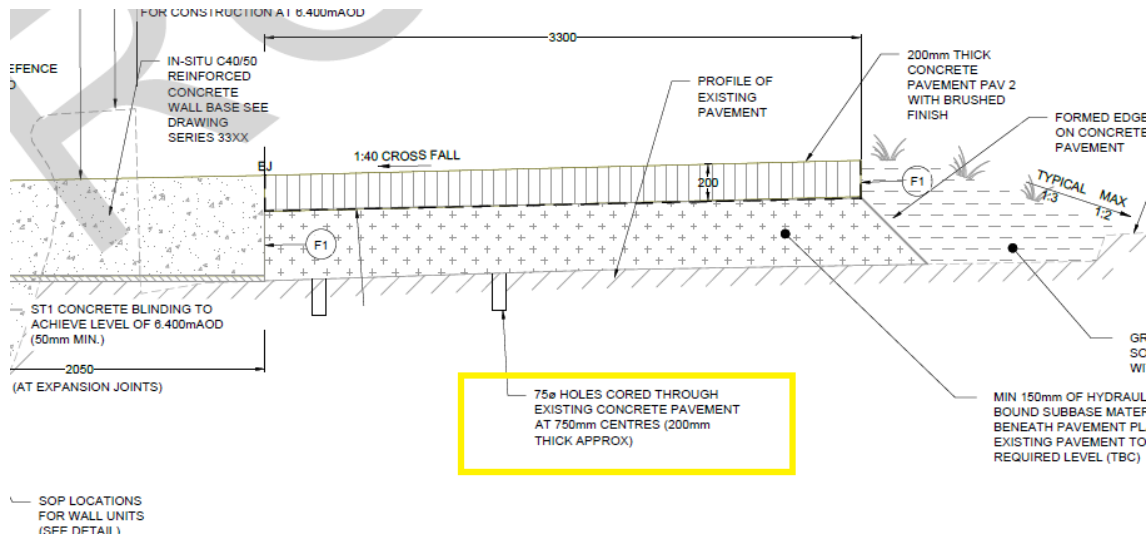


Figure 25- Pavement section with 75Ø holes to be cored



The drill rig will be set up at the designated drill location and fixed vertically with the required drill attachments. The equipment will be set up complete with in-line dust suppression.

Figure 26- Diamond drill rig set-up and coring

#### 4.14 Concrete pavement

Concrete to the pavement areas will take place in the same way as in section 4.11.

#### 4.15 Site demobilisation and rehabilitation on completion of construction

All land areas and railways earmarked for temporary use during the construction phase will be re-habilitated and restored to original or pre-agreed condition with the DCC. Precondition surveys will be conducted where required and photo records kept as record prior to commencement of work in any area subject to temporary use and to be returned on completion of construction.

The end result of all restoration shall be in line with the pre-condition surveys and photographic records or as otherwise agreed between BB and DCC.

Known areas of impact at time of writing are:

- Top promenade to the west between the Main mobilisation site and the slipway
- Temporary access ramps- in particular gabion slipway
- Main materials compound
- Compound at Graford Road
- Access into site from marine drive

### 5. HSQE

#### 5.1 General HSQE arrangements

A project management plan (PMP) will be produced for the project this PMP and its appendices are a mandatory requirement which between them discharges our statutory, contractual and company responsibilities for the production of a Construction Phase Plan, a Project Quality Plan and a Project Sustainability Plan.

The PMP provides high levels controls required on the project and unless contractual obligations dictate otherwise, it will always be accompanied by the following plans as a minimum; Construction Phase Plan, Project Quality Plan and Project Sustainability Plan which form part of appendices to the PMP.

Construction Phase plan: Is required under CDM. BB will use this document to identify the hazards and assess the risks relating to the construction phase of this project. The CPP is developed for managing health and safety during the build. The CPP is the foundation for good management and clarifies; who does what, who is responsible for what, the hazards and risks which have been identified and how the works are controlled. Construction will not commence until the CPP is completed and accepted. For all but the simplest of projects the plan may not be sufficiently developed to cover all of the work

The CPP is a live document and will be reviewed at regular intervals and, where necessary, amended to reflect changes in the scope of work or programme changes where the planned interface of trades may alter.

The project quality plan: The aim of the project quality plan is to define our specific approach to quality management and defect-free delivery on this project. It details the quality controls to be implemented throughout the project in order to provide assurance that our work meets the agreed company, statutory, regulatory and contractual requirements and is delivered defect free.

The PQP is a core appendix to the Project Management Plan (PMP). It is updated and controlled as part of the PMP and requires completion and control across the Balfour Beatty Gated Business Lifecycle.

Project sustainability plan: The purpose of this document is to define the project specific approach to the management of sustainability, environmental compliance and delivery social value outcomes of project activities.

The plan details the sustainability and environmental control measures applied to operational activities to ensure that risks are mitigated and opportunities realised.

Safe access and egress will be part for each risk assessments for each activity. Unauthorised entry to work areas will be of high priority at all times.

## 5.2 Noise and vibration monitoring

Advance noise and vibration monitoring will be established as a means to baseline the natural seasonal noise and vibration patterns. This monitoring will continue through the construction process to assess any adverse impact. We will record noise and vibration patterns at source where this becomes a necessity by risk assessment to prevent any negative impact.

Best Practicable Means (as defined in S72 of the Control of Pollution Act 1974) shall be used to reduce noise levels at all locations at all times. Where residential occupiers are likely to be affected by noise, the hours of noisy work shall be restricted to between daylight hours only- as is the case for the top promenade works.

## 5.3 Air quality management

Dust suppression with regards to rock processing shall take place as described in section 4.3. A road sweeper shall be used to clean public access routes on-, and immediately off-site. Mobile water bowsers shall be used on elsewhere on site as a means of irrigation/dust suppression where required.

## 5.4 Waste management

Waste management will take place in line with BB procedure. Chain of custody of any waste stream must be recorded at all times. All waste materials to be either placed into the relevant storage disposal container situated within the main site compound or removed from site by the individual sub-contractor and disposed of in the appropriate manner.

## 5.5 Fuel/chemical storage

Site storage of fuel and chemicals shall be above any flood water level and where possible away from high-risk locations, such as 10m of a water course or 50m of a well. Refuelling of plant and equipment will only be permitted at designated refuelling areas. Fuel shall be pumped into machines to minimise the risk of spillage. No refuelling shall take place on the beach area at any time. Small plant will be taken from the works face (when on the beach) and refuelled at a designated fuel area established above the mean high water level.

All refuelling and bulk deliveries shall be supervised at all times.

The relevant emergency prevention oil spill kits will be available at the following locations and operatives shall be trained in the correct use thereof. Care will be taken not to refuel plant close to any watercourse.

Any spillages shall be contained and reported to the Foreman and Environmental Department.

Biodegradable oils shall be used in construction plant where practicable and possible.

Alternatives to COSHH substances will always be sought before proposing any harmful substances to be used in construction. Operatives involved in works subjected to COSHH must receive a COSHH briefing and correct PPE and training (if required) before commencing work. COSHH substances shall be stored in a locked container and kept in a well ventilated area. Best practice and company guidelines must be followed regarding storing of different COSHH substances together.

## 6. General

### 6.1 Safe working around tidal patterns

The working hours and construction elements undertaken are detailed in section 3.1.

Non tidal work: 7.00 to 19.00- Monday to Friday and weekend by prior agreement.

Tidal work: All tidal work schedules will be assessed 2 weeks in advanced and the operatives notified of the working times. Working times/windows will be briefed to all personnel prior to commencement of works allowing for weather conditions, tide height and tide times. It is anticipated that works will be continued until 3 hours before the anticipated high tide times dependant on which section of the structure is being worked on at the time.

Lone working will not be permitted on any tidal working shift.

Beach work areas will be cordoned off using rope and pins and temporary signs. The promenade and work area on the beach is closed to the members of the public however the perimeter must be by BB operatives due to the public nature of the environment. Site vehicle will be positioned on the beach outside the perimeter during the works and in the event that members of the public approach the operation the site personnel will turn them away. In the event that people persist in entering the work area the patrol vehicle will radio to all plant operators to stop work until the member of the public has safely left the area.

There will be no public access along the top promenade. Pedestrians interface will only be on the beach. Gated access control will be enforced at plant crossing and public interface. Plant to be escorted to and from the work locations whilst in a public area.

### 6.2 Promenade closure and public re-route

Proposed promenade closure and potential alternative routes are detailed figure 27 and 28 below:



Figure 27- Promenade closures and alternative routes from the west



## 6.6 Public interface

As a coastal contractor operating within the domain of public beach areas like the East Rhyl sea front; public interface becomes a crucial part of our daily operations. We share our construction site with locals a seasonal visitors, resulting in direct exposure to public scrutiny.

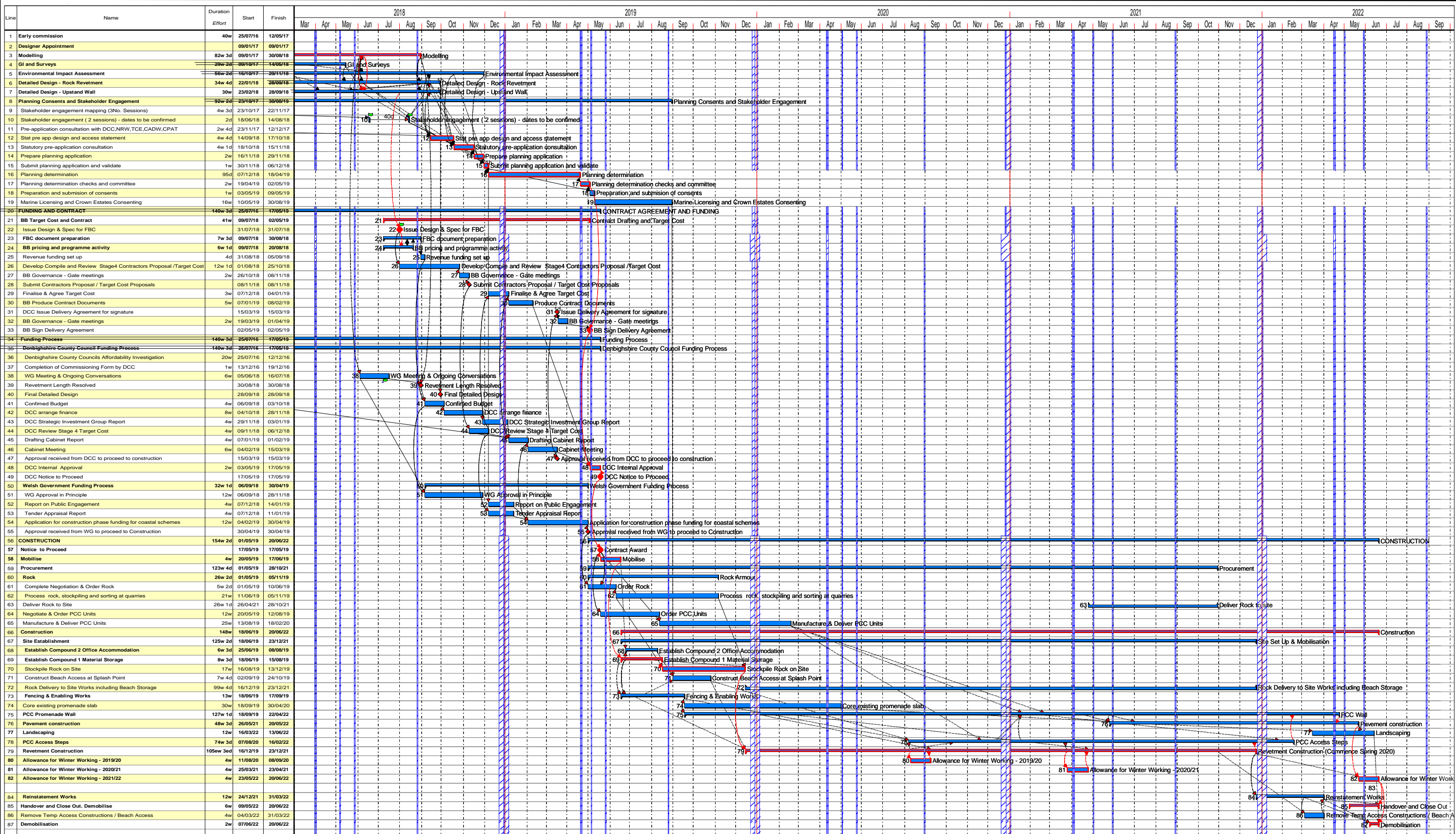
Dealing with the public and public safety during construction and keeping a safe site out of working hours becomes crucially important aspects to our business when undertaking works of this nature.

### Mitigation against risks

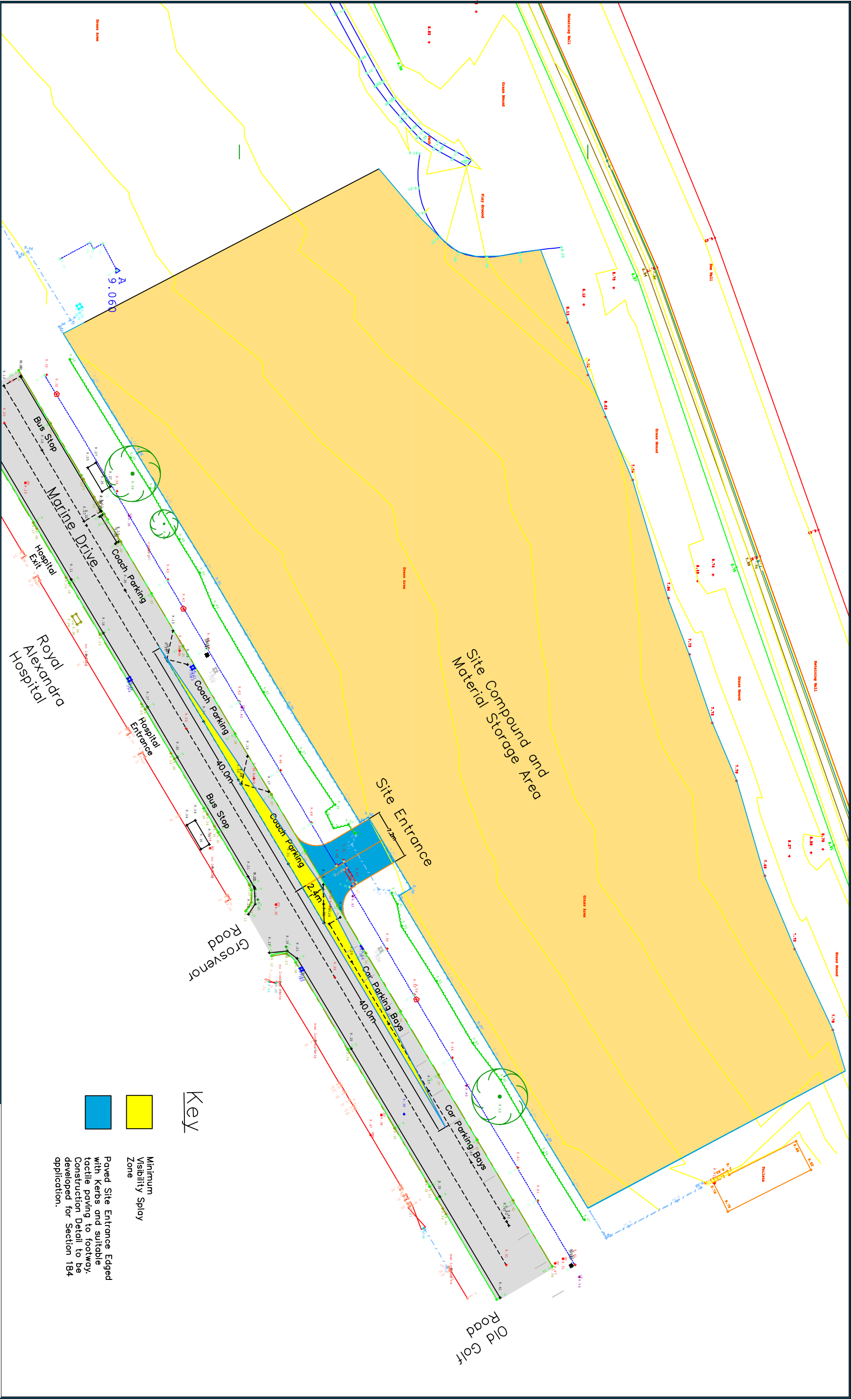
- Signage shall be placed at site accesses to indicate different site access accurately to delivery drivers
- Signage shall be posted in accordance with the Highway Code
- Deliveries to the site areas shall be supervised by a banksman at all times
- Work on beach- All work areas shall be excluded by means of rope and pins. This will be placed around the work perimeter. Warning signs will be placed around this area to inform the public of any dangers. A banksman will be in place at all times to supervise plant movement. All operatives shall be aware of the safe working window allowed for each tidal shift. This shall be communicated to them by the supervisor
- All shared access and interface points between construction plant and public shall be regulated by banksman at all times
- All work areas shall be left in a safe, clean and tidy state after completion of each shift
- Operatives shall always be kind towards the public
- Where members of the public require any project specific information; they should be referred to our available information centres/public liaison officer
- Operatives will report to their supervisor;
  - Unsafe actions
  - Near misses- no matter how minor the incident
  - Complaint from the public

### Appendices

1. Outline programme of works for reference
2. Proposed plant in use
3. Citing of proposed materials compound access off Marine Drive



Appendix 2- Proposed plant in use																			
	Construction Activity																		
	Mobilisation of compound 1	Mobilisation of compound 2	Rock stockpiling and storage in compound	Rock stockpiling and storage on beach	Construction of access routes				Removal of existing groynes	Concrete buttress	Rock revetment construction	Removal of existing sea wall	Pre-cast wall placement	Construcion of stepped access points	Concrete wall base	Core holes to existing promenade	Concrete Pavement	Graded grass bank	General site rehabilitation
					1. Access from marine drive in materials compound	2. Access ramp from materials compound to top promenade	3. Access ramp from top promendade onto beach	Beach haul road											
Construction plant	<b>Backhoe/digger loaders</b> 8t to 10t Digger loader																		
															1		1		
	<b>Wheel loaders</b> 20t Wheel loader																		
	<b>Tracked excavators</b> 14t Racked excavator 20t Tracked excavator 30t Tracked excavator 35t Tracked excavator																		
		1		1	1	1	1		1		2			2					
		1			1			1	1		1		1						
	<b>Wheeled Excavators</b> 14t Wheeled excavator 17t Wheeled excavator																		
			1			1	1	1		1		1			1		1		
	<b>Excavator attachments</b> Excavator mounted vibratory hammer- for sheet piling Rock wheel (fitment up to 22t excavator) Rock grab (suited to 6t rock armour) Selector grab Hydraulic hammer (pecker) Plate compactor Muncher																		
				1	2				1		1		1		1				
	<b>Bulldozers</b> Bulldozer 16 to 18t (D61 type)																		
									1		1								
	<b>Site dumpers</b> 3t Site dumper 6t Site dumper																		
		1	1			1	1	1		1	1	1	1		1		1		
	<b>Dump trucks</b> 28t Articulated dump truck 40t Articulated dump truck																		
				4				1	1		3								
	<b>Telescopic handlers</b> 2.5t Telehandler 4t Telehandler																		
	<b>Compaction equipment</b> Double drum walk behind loader 2t twin drum sit on roller																		
						1	1												
	<b>Piling rigs</b> Telescopic leader rig (24 to 35m leader length)																		
	<b>Crawler Cranes</b> 50t lattice boom crawler crane 80t lattice boom crawler crane 100t lattice boom crawler crane																		
														1		1			
	<b>Mobile cranes</b> 50t All terrain mobile crane																		
		1	1																
	<b>Pumps</b> Hydraulic submersible pump (trailer mounted) Hydraulic submersible pump																		
								1		1		2			1				
	<b>Concrete pumps</b> 30m concrete pump 40m concrete pump																		
											1					1		1	
	<b>Lighting towers</b> VT2 lighting tower 7m VT Hybrid LED lighting tower																		
		2	2					2		1		3			2				
		1	1																
	<b>Tractors</b> 120 to 200HP Tractor																		
								1			1			1	1	1		1	
	<b>Trailers</b> > 10t carry capacity																		
								1			1	1		1	1	1		1	
	<b>Track saws (complete with dust seppression)</b> 1000 to 1.8m diamond blade track saw																		
												1							
	<b>Wheel wash system</b> Rhina ecowash (20000 l min capacity)																		
		1																	
	<b>Trailer mounted water bowzers and dust seppression systems</b> Water bowser Water bowser with dust supression (e.g. Mist Cannon)																		
	1	1		1							1					1			
<b>Fuel tanks</b> Static fuel tank- red diesel Mobile fuel tank- red diesel																			
	1																		
<b>Concrete coring</b> Rig mounted diamond drill (Typical to Hilti DD120)																			
																3			
<b>Small tools</b> Concrete skip Electric concrete screed Petrol generator																			
										1			1		1		1		
												1				1			



							Drawn:	Date:	Scale:	Project/Title: East Rhyl Coastal Defence – Location of Site Compound and Material Storage Entrance	
							DCJ	21-11-18	1:500		
							Designer:	Checked:			
B	21-11-18	Visibility Distance now 40m	DCJ				Status:	PRELIMINARY		Drawing No: CRMMO431-LSS-001	Revision: B
A	13-11-18	Preliminary	DCJ								
Rev.	Date	Description	Drawn	Chk.d							

Regional Civils

NWDU - Cheadle

5000 Lakeside, Cheadle Royal Business Park, Cheadle, Cheshire SK8 3AX.

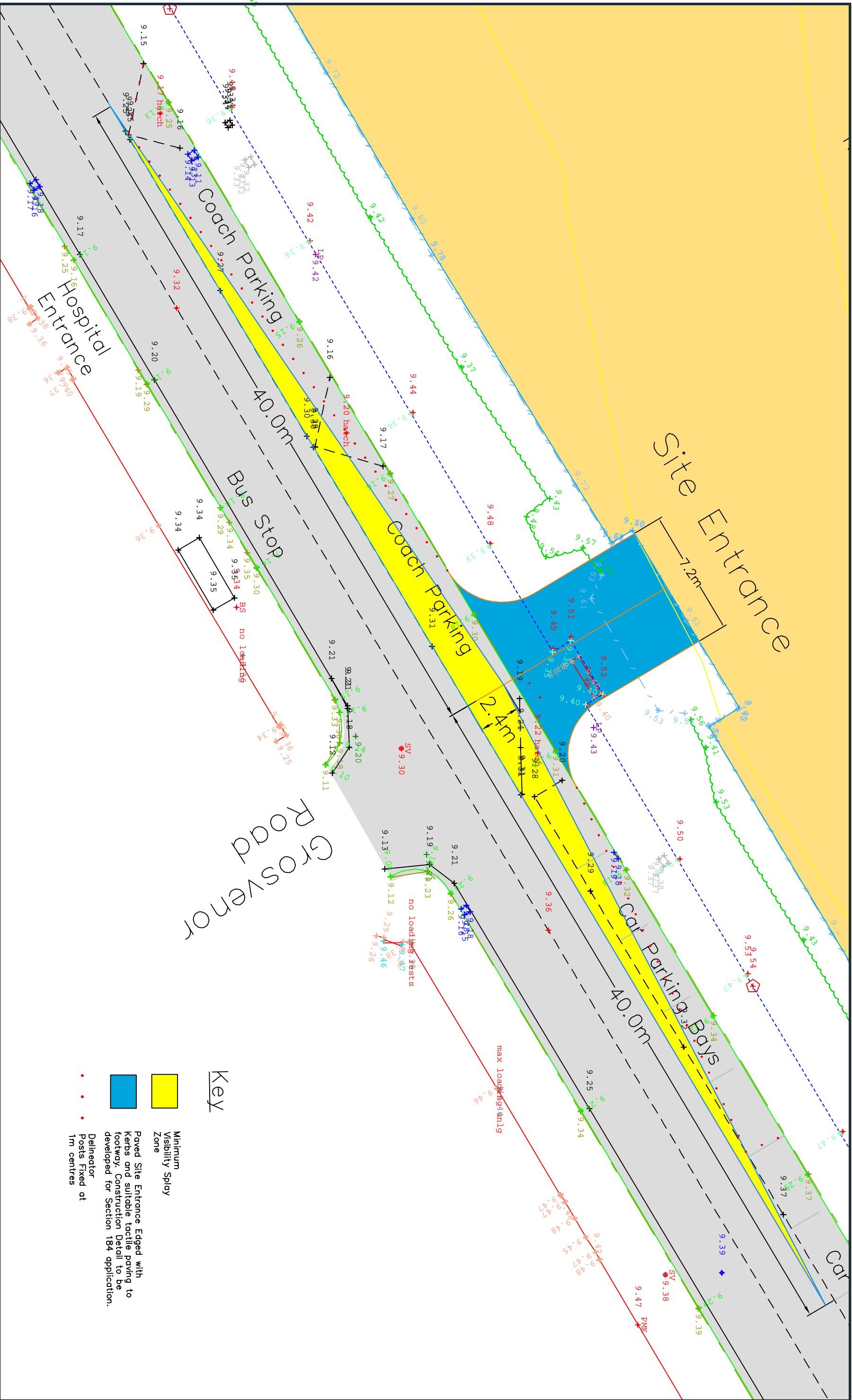
Drawing No:

CRMMO431-LSS-001

Revision:

B

Balfour Beatty



				Drawn:	DCJ	Date:	21-11-18	Scale:	1:200	Project/Title:	East Rhyl Coastal Defence – Site Compound Entrance Delineation of Visibility Splay Zone
				Designer:		Checked:					
				Status:							
A	21-11-18	Preliminary	DCJ	Chk.d						Drawing No:	CRMMD431-LSS-002
Rev.	Date	Description	Drawn	Chk.d						Revision:	A