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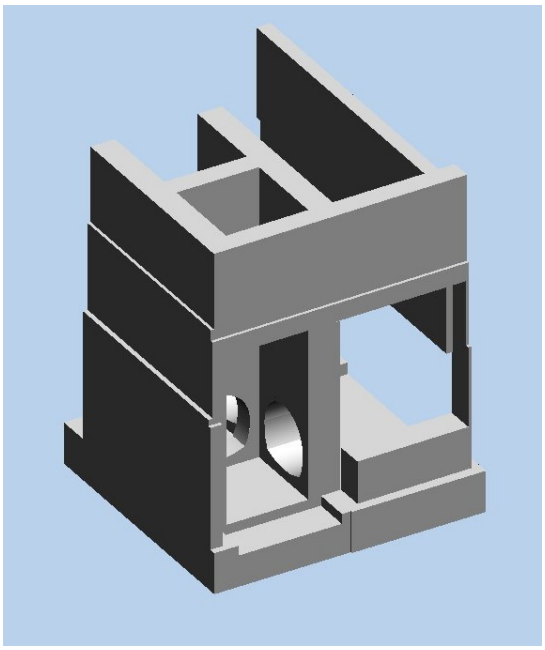
TIDEWAY PROJECT - GREENWICH PUMPING STATION, PENSTOCK CHAMBER

The Tideway Project delivers 25km of Super Sewer under the Thames to intercept old sewers which discharged foul water into the Thames.

Greenwich Pumping Station site lies within the grounds of a fully operational Grade II Listed pumping station. It is situated alongside Deptford Creek and underneath the DLR and the Greenwich main line viaduct. The site is being used to drive the Greenwich connection tunnel to Chambers Wharf and will help tackle the problem of sewage overflow into the Deptford Creek and River Ravensbourne. The tunnel splits from the main Tideway tunnel and goes through other sites at Earl Pumping Station and Deptford Church Street.

Openings were to be formed in the existing penstock chamber masonry to connect the new interception chamber to the existing penstock chamber. The opening would result in loss of lateral support to the existing external walls that resist lateral pressures from soil, water surcharge loads. Analysis of the residual wall indicated that large stresses will occur in the external wall which will lead to cracking in the masonry.

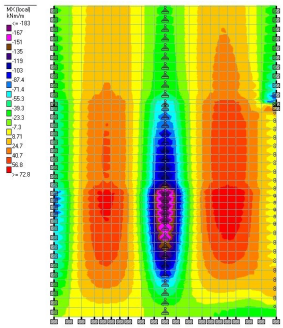
In addition, the interception chamber imposes large horizontal loads on the existing penstock chamber. These loads are opposed by the pressure of the ground and water on the opposite face of the existing chamber, but the introduction of the openings and application of force would change the load path.



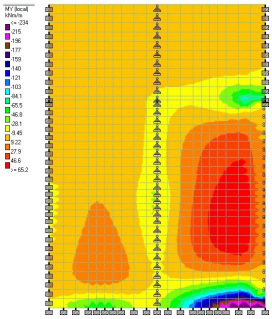
Strengthening works to the penstock chamber masonry were therefore required to ensure that the brick could accommodate the increased stresses and also transfer the loads safely to the ground.

Thames Water required that anchors should be protected from corrosion by encasing in cementitious material that will ensure a **design life of 120 years** in a sewerage environment.

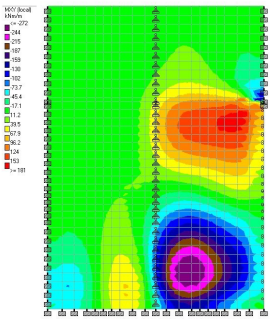
Cintec International were invited to be part of the team consisting of structural engineers Mott MacDonald, contractors CVB (Costain Vinci Bachy), in order to provide knowledge and experience on methods of reinforcing the ageing brick structure to resist the magnitude of shear forces of the chamber under different temporary and permanent conditions: Empty, half-full and full including safety factors.



Horizontal bending forces



Vertical Bending



Torsional Moments

The TDV appointed engineers Mott MacDonald issued force diagrams which analysed the anticipated shear, bending and torsional forces within the already cracked Victorian brickwork. Thereafter Cintec International were able to provide outline design information to allow the client to assess the feasibility of the Cintec solution and potential costs involved.

This strategy being confirmed and approved the next step was to appoint Ramboll UK as engineers to develop the design.

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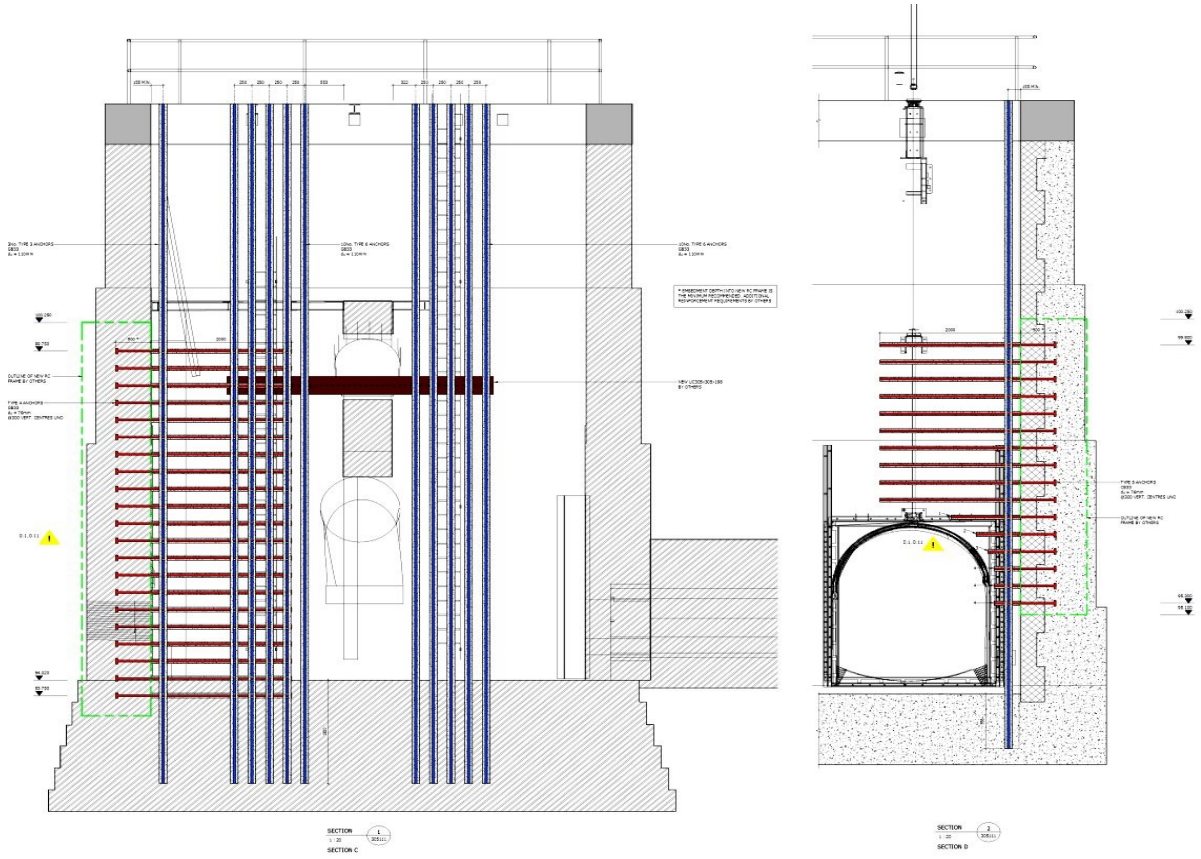
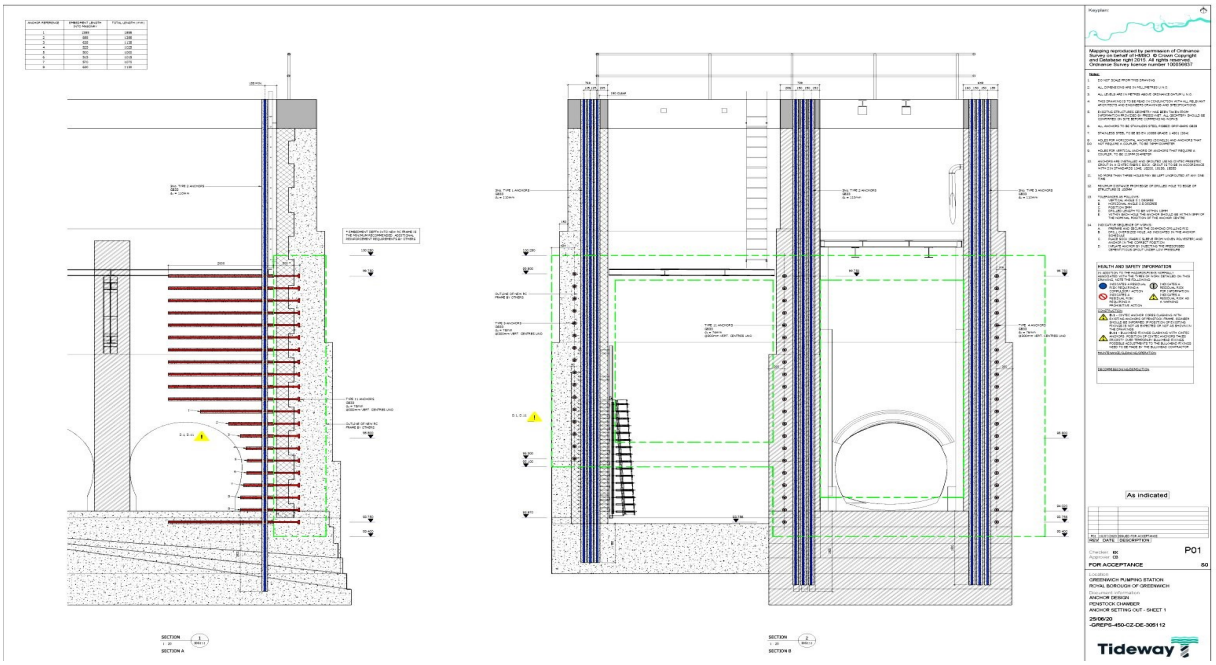
Once appointed Ramboll UK proceeded to use the force data provided by Mott MacDonald and to carry out their own modelling and analysis as a check.

Ramboll then carried out full design on a tight programme and issued an anchor schedule of the many different lengths of Cintec anchors. All anchors consisted of Cintec GB 33 stainless in either a 76mm or 110mm diameter diamond core drilled hole depending upon the length of embedment.



The existing structure was over 10m deep and 10m square with Cintec anchors arranged in both vertical and horizontal directions.

The longest anchors were the 29 vertical ones which were slightly less then 12 metres in a 110mm diameter hole.



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Project Number	1920009852
Project Name	Tideway Greenwich Chamber Strengthening
Date	17/07/2020
Revision	0
Description	Cintec Anchor Schedule

RAMBOLL

Item	Anchor Type	Location	Orientation	Size	Hole diameter	Coupler required	Spacing for dowels	no. of anchors	Length
					mm		*mm*		*mm*
	5	North/East Wall	Horizontal	GB33	76	No	300	10	2500
	5	North/East Wall	Horizontal	GB33	76	No	300	1	1490
	5	North/East Wall	Horizontal	GB33	76	No	300	1	1135
	5	North/East Wall	Horizontal	GB33	76	No	300	1	960
	5	North/East Wall	Horizontal	GB33	76	No	300	3	880
	11	Intermediate/East Wall	Horizontal	GB33	76	No	300	12	2500
	11	Intermediate/East Wall	Horizontal	GB33	76	No	300	1	1895
	11	Intermediate/East Wall	Horizontal	GB33	76	No	300	1	1355
	11	Intermediate/East Wall	Horizontal	GB33	76	No	300	1	135
	11	Intermediate/East Wall	Horizontal	GB33	76	No	300	1	1025
	11	Intermediate/East Wall	Horizontal	GB33	76	No	300	1	1000
	11	Intermediate/East Wall	Horizontal	GB33	76	No	300	1	1015
	11	Intermediate/East Wall	Horizontal	GB33	76	No	300	1	1070
	11	Intermediate/East Wall	Horizontal	GB33	76	No	300	2	1130
	4	South/East Wall	Horizontal	GB33	76	No	300	21	2500
	6	South Wall	Vertical	GB33	110	Yes	-	20	11850
	1	North Wall	Vertical	GB33	110	Yes	-	3	11300
	2	Intermediate Wall	Vertical	GB33	110	Yes	-	3	11850
	3	South Wall	Vertical	GB33	110	Yes	-	3	11850

For the site installation the long anchors were in shorter lengths to assist logistics and handling on what was a very confined site.

A crane was required to lift and position the vertical anchors which were very heavy and needed careful handling during placement.

Cintec worked closely with their installer Freysinnet to ensure the special training was provided for the unusual installation and length of anchors. There were no unforeseen issues and the site team pulled off an excellent job.