CJ293 Percy Road – Bournemouth Coastal Interceptor Sewer Structural Repairs, December 2016-February 2018

Scheme Summary

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Overview

The Bournemouth Coastal Interceptor Sewer tunnel (CIS) runs between central Bournemouth and Holdenhurst Sewage Treatment Works and is the main trunk sewer serving a population of up to 180,000. The CIS was constructed in the late 1960’s with the purpose to divert all flows away from historic sea outfalls to Bournemouth Bay to the newly constructed Holdenhurst STW on the town outskirts. Minimum flows are in the region of 300l/s in dry weather and in storm conditions the CIS provides attenuation and regularly surcharges significantly above crown levels. Flows into Holdenhurst STW from the CIS can exceed 2500l/s in storm conditions.

The CIS is 11km in length, is 1.8m in diameter and is located at approximately 15-16m to tunnel crown below ground level. Access to the tunnel is very restricted and is via deep shafts located at 500m intervals along its length. The route of the CIS is generally aligned below urban roads through the densely populated residential areas of Bournemouth town centre, Boscombe and Southbourne.

In September 2016 settlement was observed above the CIS at Percy Road resulting in this busy route being closed by Bournemouth Borough Council to allow investigative works to be carried out to determine the cause.

Enabling Works

It was quickly determined that settlement was due to structural issues in the CIS and that urgent structural repairs were required to maintain the integrity of the tunnel and prevent further deterioration and settlement occurring. The consequences of sewer collapse potentially included loss of this vital asset and the ability to transfer sewage flows from central Bournemouth to treatment at Holdenhurst STW, significant structural damage to adjacent buildings and serious environmental impact.

A key constraint imposed on the work following consultation with the EA and Bournemouth Borough Council was that any works of repair had to be undertaken outside of the important tourism season and the CIS had to be fully operational in advance of the start of the bathing water season on 1 May 2017 and ideally prior to Easter weekend starting on 1 April 2017.

Immediate action was taken by Wessex Water to develop and implement a plan for securing the CIS.

The plan included making safe the area by diverting and capping of services including water mains and a high-pressure gas main in the area of surface settlement.

In order to carry out the repairs inside the tunnel it was quickly determined that it would be necessary to install an over pumping system to deal with all flows. This would ensure that the repair works could be carried out as safely and quickly as possible. In addition, the quality of repairs could be guaranteed and the risk of environmental incident minimised.

Design parameters for the overpumping system were set to match the dry weather flows at approx. 300l/s, distance between suction and discharge 2.8km, max static head 19m, operating pressure limited to 6bar. Consideration was made for pipeline restraint, pipeline priming, flushing and isolation in the event of pipeline failure.

The over pumping comprised the establishment of a major temporary pumping station within a temporary access shaft constructed on to the tunnel and an over pumping pipeline to divert all flows from the CIS above ground a distance of 2.8km bypassing the 80m section of tunnel requiring repair. The system was integrated with the Wessex Water control and monitoring network and also remotely monitored via the Pump Supplies web host. The pipe route was via public gardens (Boscombe Chine...
Gardens, Boscombe Italianate Ornamental Gardens and Bournemouth Overcliff) and public highways and open spaces. The over pumping system was designed and the route agreed with all stakeholders within 4 weeks and the physical installation completed in 2 weeks prior to Christmas 2016 providing an emergency facility for managing flows over the Christmas period and allowing the works in the CIS to proceed early in January 2017.

Time was of the essence for the repair works because of the potential catastrophic impact of complete failure of the CIS. It would not have been possible to complete the repair works without the installation of the temporary pump system.

**Tunnel Repair Methodology**

Analysis of the failure mechanism indicated that a full structural repair system was required and that the design should not rely on any residual support provided by the existing tunnel lining. A design based on tunnel ribs to provide temporary support during construction and a fully reinforced and grouted lining was developed. Specialist geotechnical, design and construction input ensured that the design could be constructed safely within the constraints which included access and working within a hazardous environment and managing live foul flows.

**Outcome**

Settlement was observed in Percy Road above the CIS in late September 2016. By the end of November failure analysis, remedial structural lining design and over pumping design were complete. Installation of the temporary over pumping station and 2.8km of pipeline commenced on 6 December and was ready for use on 23 December 2016. Following the Christmas break access for repair works in the CIS was made and the overpumping system fully commissioned and tested by 16 January. Repair works then commenced and were complete on 16 March 2017, a period of 10 weeks. The over pumping system was removed and sites fully reinstated by 7 April 2017.

Following completion of the tunnel repair works Percy Road remained closed to allow monitoring of residual settlement to be undertaken. A contingency plan to carry out ground treatment using compaction grouting was developed to address any consolidation settlement following repairs. This was not required and Percy Road was fully opened on 9 February 2018.

Monitoring of the CIS, sub surface and surface settlement and structures movements will continue for a minimum period of 2 years to confirm ongoing stability.

**Project Team**

The key project delivery partners were:

- **Project Management and Construction:** Wessex Water, YTL Engineering and Construction
- **Overpumping System:** Pump Supplies Ltd
- **Tunnel Repair:** Matt Durbin Associates

The full project team is shown below.
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Incident response and Planning – CIS Failure Mode

Overpumping
Tunnel Repair