

CASE STUDY FOR CURED IN PLACE LINING AT COWLEY BRIDGE ROAD, EXETER.

Location: Cowley Bridge Road, Exeter
Client: Devon County Council Highways Authority
Date: September 2008
Contractor: Exjet Services

Overview.

As part of a major resurfacing project undertaken by Devon County Council Highways Authority to the A377 Cowley Bridge Road from the junction of New North Road and West Garth Road, Exjet Services working in partnership with E & JW Glendenning Ltd were tasked in undertaking detailed CCTV surveys and cleansing of the existing highways drainage network in order to assess the need for below ground remediation prior to any surfacing works being carried out.

The A377 Cowley Bridge Road is a major artery providing both access to and from the outlying towns and villages to the north of the county for both domestic and commercial vehicles. Historical traffic volume records for this area showed usage to be circa 16000 vehicles per day over a typical 16 hour period. With this in mind maintaining positive traffic flow was imperative in any works that were to be undertaken in this area.

Working closely with both Devon County Council and Glendenning's a suitable traffic management plan was put into place allowing the works to precede with minimum disruption.

This included limiting the hours of work to minimise disruption during peak traffic flows and recognising that noise pollution within the residential areas was potentially problematic.

The CCTV works were successfully undertaken in June 2008.

The survey revealed that the system had become subject to major degradation through root penetration, traffic loading and in some instances damage by third party utilities contractors.

One of two options existed for remediating the damaged sewers:

- Open cut excavation and replacement
- Remediation through "no dig" techniques.

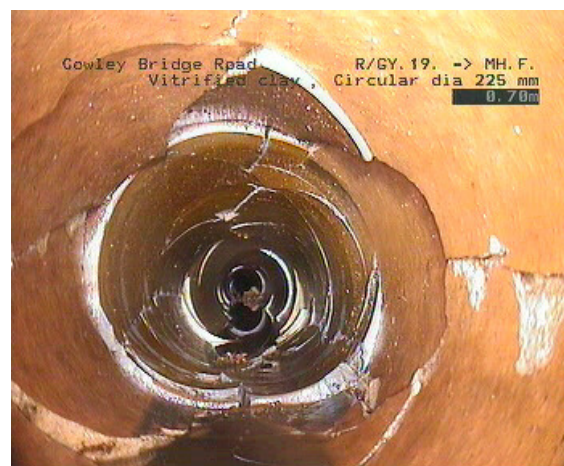
Exjet Services were tasked with analysing the compiled data and providing competitively priced solutions as an alternative to excavation.

Design Criteria.

In order for the design and implementation of cured in place lining to be successful a number of potential design problems firstly had to be overcome:

These included:

- Ensuring that the relative shallow depth of the sewers (generally below 1.0M) traffic loading and subsequent vertical ground pressure was fully considered.
- Ensuring the level of vertical deformation that was identified within the survey and subsequent loss of passive support through the loss of surrounding sub strata was taken into consideration to prevent failure through fatigue or strain corrosion.
- Devising a method of removing mass root ingress without further damaging the sewers through the over pressurization of the pipe wall during High Pressure Water Jetting operations.
- Maintaining positive traffic flows through peak traffic times by compiling a comprehensive traffic management plan and schedule of works.
- Ensuring that full consultation with the local residents that were likely to be affected by the works was undertaken and any concerns raised were dealt with quickly and efficiently.
- Compiling a flood risk assessment and action plan to deal with flows and surface flooding should adverse weather conditions prevail.
- Compiling a comprehensive works schedule that would allow the installation of a total of 489.0M of cured in place liner in the most time efficient manner



Extent of damage prior to remedial works.

Method.

Through analysing the results of the survey and taking into consideration the extent of the damage to specific areas of the sewers it was concluded that Cured in Place lining was alone not a viable option to remediate the pipelines fully. It was subsequently decided that limited excavations targeted at the most severe defects would be carried out in order to facilitate the lining process. By employing this method of works excavation and reinstatement costs were kept to a minimum as only key areas required remediation through this technique to enable the “no dig” process to proceed.

Secondly, again drawing on the information collated within the initial survey, High Pressure Water Jetting was to be carried out as a method of removing the root ingress. Monitoring by means of CCTV equipment would also be employed, again allowing the jetting operations to be targeted at specific areas where root penetration was most prevalent and ensuring that no further damage to the pipe work occurred.

Taking into consideration all the relevant factors that were identified within the initial consultation process lining design equations that prevent collapse by buckling were utilised that incorporated the following:

- Traffic loading to 45 units of HB
- External hydrostatic pressure
- Ground loading
- The sewer lengths in question were to assume a fully deteriorated pipe condition, as per the requirements of The Sewerage Rehabilitation Manual Volume (Fourth Edition), Water Industry Standard 4-34-04, American Society for Testing and Materials Standard F1216 and BS-EN 13566-PART4 2002

The design equations recommended a liner with an installed wall thickness of 9.8mm incorporating a safety factor of 2mm.

It was subsequently decided that a needled felt liner with a PU coating and filled polyester resins should be utilised for the project. This offered an installed product with a flexural e-modulus of 550N/mm² and more than covered the required structural reinforcement whilst maintaining cost efficiency over alternate epoxy or silicate resin products.

The works would be scheduled over thirteen consecutive days and incorporate the lining installation, root removal and excavation works. Time on site would be limited to a working day between 06:00 and 22:00 to ensure that disruption to the adjacent residents were kept to a minimum.

In order to limit traffic disruption, multiple lengths would be lined from a single installation point to a maximum of circa 100.0M. This reduced the length of the required traffic management and subsequently improved traffic flow through the area.



Completed liner.

The works package was subsequently approved and successfully carried out in July/ August 2008