Sanitary Sewer Overflow (SSO) Control and Wastewater Facilities Program

Sewer Rehabilitation Design Requirements

City of Baton Rouge/Parish of East Baton Rouge Department of Public Works

Submitted by

CH2MHILL

Prepared by: Matthew Johnson
Reviewed by: Holly Morgan and Robert Cook
Approved by: Jennifer Baldwin

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1. Introduction

This document provides requirements for the design of sewer rehabilitation projects associated with the City of Baton Rouge/Parish of East Baton Rouge (C-P) Sanitary Sewer Overflow (SSO) Control and Wastewater Facilities Program. It is intended to serve as a tool for Engineers involved in sanitary sewer rehabilitation design projects. The design guidelines are applicable to gravity collector and trunk sewers. Professional engineering judgment shall be exercised on all design components for a given project. All local, state, and federal rules and regulations shall be followed.

The Engineer is encouraged to use initiative, professional engineering judgment, and professional experience for each design project. The Engineer shall follow all recommended methods and materials stated in the Program's Standard Specifications. Deviations from the criteria contained within this document and standard specifications require the approval of the Program Manager (PM).

Sewer rehabilitation methods are utilized to restore aging or failing sewer systems. If implemented properly, rehabilitation methods have the potential to restore sewer systems to operate for decades beyond their intended lifespan. However, rehabilitation methods may not be applicable under certain circumstances and replacement may be necessary. Therefore, proper assessment and design measures shall be utilized when rehabilitating or replacing gravity sewer systems.

2. Cured In Place Pipe (CIPP)

The criteria below are intended to guide the Engineer with the implementation of Cured In Place Pipe (CIPP) in sanitary sewer systems. CIPP is intended to restore the overall pipe condition by eliminating infiltration, exfiltration, root intrusions, etc.

2.1 Cured In Place Pipe (CIPP) Implementation Criteria

CIPP shall not be used if major infiltration/inflow is observed in the pipe.

CIPP shall be considered when there is only light infiltration (seepage) into the pipe.

CIPP shall be considered where offset pipe joints are generally 1 inch or less.

CIPP shall be considered where longitudinal or circumferential cracking in the pipe has caused minimal structural deformation.

CIPP shall only be used where light to medium roots exist through the pipe joints and can be removed by interior cutting.

CIPP shall be used where sags in the pipe are less than 60% percent of the pipe diameter. When considering sags within the range between 30% and 60%, the sag shall be repaired if it is in the proximity of a recorded overflow or significantly impacting the overall capacity of the sewer system and is deemed by the Engineer to be contributing to the overflow.

CIPP shall be used only where debris can be removed from the pipe.

CIPP shall not be used where holes in the pipe have visible voids (i.e., no soil visible outside the hole). Larger holes allow CIPP liners to deform and weaken near the edges of the hole.

CIPP shall be used only where all protruding service laterals have been properly repaired prior to CIPP installation.

CIPP shall not be used on non-porous pipe materials such as PVC and HDPE.

CIPP shall be used only where existing point repairs are in good condition with minimum settlement, flow restriction, offsets, and structural deformations.

CIPP shall not be used when multiple point repairs are necessary prior to installation. Replacement shall be considered when the spacing between repairs and/or lateral reinstatements is less than 60 feet. Refer to the Point Repair Implementation Criteria in Section 2.2.1.

CIPP shall be used when the host pipe has severely exposed surface aggregate.

All laterals shall receive a top hat CIPP lateral lining when the mainline is CIPP lined, unless the lateral is to be replaced due to a required repair. Laterals which have a diameter change within the first 3 feet from the connection to the mainline or offset joint shall be replaced before a top hat can be installed.

2.2 Pipe Reconstruction

The following criteria are intended to aid the Engineer in determining when pipe replacement using open cut methods is necessary. Reconstruction shall be divided into two types: point repair or remove and replace. Sewer point repairs are defined as the actual length of pipe replaced, up to and including 20 feet in length. Any repair beyond the 20 foot sewer point repair limit shall be considered Sewer Remove and Replace. In addition to these guidelines, Engineer shall also refer to the Program *Conveyance Design Guidelines*.

2.2.1 Point Repair Implementation Criteria

The Engineer shall carefully consider all point repair recommendations. Point repairs are subject to future settlement and infiltration migration (i.e., migration to an adjacent defect[s]). Therefore, careful engineering judgment is necessary when recommending point repairs.

A point repair shall be considered where existing point repairs have offsets greater than 1 inch, sealing rings protrude more than 1 inch, or there are structural deformations, restrictions of flow, settlement, or collapses.

All necessary point repairs shall be completed prior to CIPP installations.

All necessary point repairs for sags shall be completed prior to pipe burst installation (see Pipe Bursting Implementation Criteria in Section 2.2.3).

If a point repair is conducted at a lateral connection, the lower lateral shall be replaced to the property line. A cleanout shall also be installed at the property line on all laterals being replaced.

2.2.2 Pipe Replacement Criteria (Open Cut Method)

Pipe replacement shall be considered when the spacing between point repairs and/or lateral reinstatements is less than 60 feet.

Pipe replacement shall be considered where the length of a point repair is greater than 40% of the total pipe length.

Pipe replacement shall be considered for multiple offset joints greater than 1-inch or if sealing rings protrude more than 1 inch unless a point repair is appropriate (see Section 2.2.1).

Pipe replacement shall be considered where a portion of the existing pipe is collapsed unless a point repair is appropriate (see Section 2.2.1).

Pipe replacement shall be required where the pipe is structurally deformed and the profile of the pipe is lost unless a point repair is appropriate (see Section 2.2.1).

Pipe replacement shall be considered where heavy roots through pipe joints cannot be removed by interior cutting or by a point repair (see Section 2.2.1).

Replacement shall also be considered where heavy roots have compromised the structural integrity of the pipe.

Pipe replacement shall be considered where sags are greater than 60% percent of the pipe diameter. When considering sags within the range between 30% and 60%, the sag shall be

repaired if it is in the proximity of a recorded overflow or significantly impacting the overall capacity of the sewer system and is deemed by the Engineer to be contributing to the overflow.

Replacement shall be considered where existing point repairs have offsets greater than 1 inch, or if there are structural deformations, restrictions of flow, settlement, or collapses, unless a point repair is appropriate (see Section 2.2.1).

Pipe replacement shall be considered where sinkholes are above or within close proximity of the pipe.

Pipe replacement shall be considered where holes with visible voids (i.e., no soil visible outside the hole) exist unless a point repair is appropriate (see Section 2.2.1).

Pipe replacement shall be required where a storm sewer is connected directly to the sewer system unless a point repair is appropriate (see Section 2.2.1).

Where a pipe segment is replaced, lower laterals shall also be replaced up to the property line. A cleanout shall also be installed at the property line on all laterals being replaced.

Pipe replacement shall be considered when the pipe material is truss pipe.

2.2.3 Pipe Bursting Implementation Criteria

Pipe bursting may be implemented when extenuating circumstances limits pipe replacement (open cut) as a viable alternative (i.e., heavily traveled roadways, narrow servitudes, etc.).

Soil borings shall be drilled during the design phase to determine the feasibility of pipe bursting. Standard penetration tests, unconfined compression tests, moisture content tests, and groundwater readings after drilling and again no sooner than 24 hours after drilling shall be performed. Pipe bursting is most feasible in clay soil with unconfined compression strengths less than 2 tons per square foot and above the groundwater table. Pipe bursting is less feasible in rock trenches.

Pipe bursting shall not be implemented under railroads, buildings, or structures.

Pipe bursting is routinely used for pipe sizes less than or equal to 12-inches in diameter, up to 12 feet in depth, burst lengths up to 350 feet, and for one pipe diameter up-size. Sewer depths up to 18 feet, pipe sizes up to 18-inches in diameter, greater than one pipe diameter up-size, or up to 450 feet in burst length can cause moderate difficulty. Pipe bursting is generally not allowed for sewers deeper than 18 feet, more than 24-inches in diameter, more than two pipe diameter up-sizes, and burst lengths greater than 450 feet. Special attention shall be paid to pipe diameter when replacement pipe is HDPE.

Pipe bursting shall not be used when the existing pipe has sags greater than 20% or has sags that continue in length for more than 8 feet. Sags create the potential for ground heaving and increase the potential for utility damage.

Pipe bursting is commonly used on clay, non-reinforced concrete, PVC, cast iron, and asbestos-cement pipe. Plastic, steel, and ductile iron pipes require cutting blades. Inter-seam process shall not be allowed.

Pipe bursting replacement pipe shall be high-density polyethylene (HDPE) or fusible polyvinyl chloride (FPVC). Pipe joints shall be fused and cooled prior to bursting. Clay pipe or DIP can also be used for pipe bursting when space is limited.

Minimum cover of the new pipe shall be:

- 10 times the burst displacement
- 3 times the new pipe diameter
- 4 feet below the ground surface
- 3 feet clear from the nearest utility

Pipe bursting shall be used only where it is economically feasible and/or limits the impact of the project on the public. The location and size of the pit(s) shall also be considered.

If pipe bursting is a consideration, the location of potentially "conflicting" waterlines shall be investigated diligently. This may require test pitting to verify clearances between sewer and "conflicting" waterlines.

"Conflicting" natural gas or petro-chemical lines shall be avoided using pipe bursting. A minimum 3 foot clearance shall be required.

Wastewater services shall be excavated, plugged, and pumped prior to pipe bursting and continuously pumped until the services are reconnected.

Pipe bursting lubricants shall always be used to reduce friction and relaxation shortening.

Pipes encased in concrete shall not be burst. If the encasement has a limited length, excavating and demolishing the encasement and then using the excavation as a launching pit may be considered.

The minimum relaxation period shall be 24 hours. As sewer depth, pipe size, degree of pipe up-sizing and burst lengths increase, the relaxation period shall increase.

Open cut replacement shall be considered when a line to be pipe bursted has 4 laterals every 200 feet.

2.2.4 Slip Lining Implementation Criteria

Slip lining shall be used only in special situations with the approval of the PM.

Slip lining shall only be used on pipe sizes greater than or equal to 24-inches in diameter.

Slip lining shall not cause a capacity reduction in the sewer, unless specifically approved by the PM.

3. Manhole Rehabilitation and Repair

3.1 Manhole Rehabilitation (with Cementitious Lining)

The following criteria are intended to guide the Engineer with the implementation of manhole rehabilitation methods in existing sanitary sewer manholes. Manhole rehabilitation shall restore the overall manhole condition by eliminating infiltration, exfiltration, root intrusions, and minor defects. Manholes with solely minor defects and no evidence of infiltration beyond normal seepage shall be left as is. In general, the following criteria shall be met when rehabilitating sanitary sewer manholes.

3.1.1 Brick / Masonry Manholes

Manhole is in good structural condition.

Manhole is relatively shallow (depths generally less than 10 to15 feet).

Manhole is a minimum of 4-feet in diameter.

Manhole has a well defined bench with positive grade.

Manhole does not have active infiltration (seepage only).

Manhole only has minor defects relating to light infiltration (seepage only) and/or slight to moderate defects such as deterioration of bricks and mortar and minor cracks.

All existing steps shall be cut off, flush, and removed. Steps shall not be replaced.

An internal chimney sealant shall be used in all manholes located in streets.

Pneumatic spray applied cementitious lining shall be used when rehabilitation is necessary.

3.1.2 Concrete Manholes

Manhole is in good structural condition.

Manhole does not have any offset joints greater than 1 inch.

Manhole is a minimum of 4 feet in diameter.

Manhole has a well defined bench with positive grade.

Manhole does not have active infiltration (seepage only).

Manhole only has minor defects relating to light infiltration (seepage only) and/or slight to moderate defects relating to the deterioration of the concrete sidewalls and joints, and cracks and offset joints.

All existing steps shall be cut off, flush, and removed. Steps shall not be replaced.

An internal chimney sealant shall be used in all manholes located in streets.

Pneumatic spray applied cementitious lining shall be used when rehabilitation is necessary. Membrane linings shall not be used to repair existing concrete manholes.

In existing concrete manholes with brick cones, the brick cones shall be replaced with pre-cast concrete cone sections, if replacement is required.

3.1.3 Concrete Manholes with Brick/Masonry Cones

This type of manhole shall be evaluated per the Concrete Manhole Criteria above.

3.1.4 Manholes with Interior Drops

If a manhole to be rehabbed has an interior drop, the interior drop shall be removed prior to rehab and then replaced back within the manhole after it is rehabbed. The interior drop pipe supports shall remain in place during rehabilitation.

3.2 Manhole Rehabilitation (with Epoxy Lining)

Epoxy linings shall be considered where corrosive environments exist. Corrosive environments may be detected during the manhole inspection phase by the detection of hydrogen sulfide gas. Severely deteriorated concrete sidewalls, brick sidewalls, manhole frames, manhole covers, and manhole steps are indicators of a corrosive environment. The same evaluation criteria used for cementitious lining above shall be used for epoxy liners also. Epoxy liners shall be used, at a minimum, in the two manholes downstream and upstream of the manhole with the forcemain discharge or in corrosive environments.

3.3 Manhole Rehabilitation (Patching)

If a manhole has a localized area(s) requiring repair but the majority of the manhole is in good condition, the area(s) of defect may be patched. However, the Engineer shall consider the condition of the entire manhole when considering patching in lieu of complete manhole rehabilitation.

A trough shall be built or repaired for manholes which do not have a trough or have a defective trough.

3.4 Manhole Cleaning

Manhole cleaning shall only be recommended to remove large debris, such as large rocks, concrete, construction debris, other heavy/bulky debris, etc. Cleaning shall not be recommended for manholes with minor dirt/debris on the bench or in the trough.

4. Manhole Replacement

4.1 Manhole Replacement

The following criteria are intended to aid the Engineer in determining when manhole replacement is necessary. Replacement shall be required when rehabilitation methods are not applicable due to the overall condition of the manhole or if sewers are replaced.

4.1.1 Brick / Masonry Manholes

Manhole has structural failure or in generally poor condition.

Manhole is relatively deep (depths generally greater than 10 to 15 feet).

Manhole is less than 4 feet in diameter.

Manhole has undefined bench or has a negative grade.

Manhole has moderate to severe infiltration (more than seepage).

Manhole is located in a drainage path or subject to high groundwater conditions.

Manhole has previously been rehabilitated and the rehabilitation has failed.

Manhole has service laterals requiring repair or replacement.

Manhole has a connecting mainline requiring replacement.

Manhole has tap or heavy roots.

4.1.2 Concrete Manholes

Manhole has structural failure or in generally poor condition.

Manhole is less than 4 feet in diameter.

Manhole has undefined bench or has a negative grade.

Manhole has moderate to severe infiltration (more than seepage).

Manhole has previously been rehabilitated and the rehabilitation has failed.

Manhole is located in the drainage path and has evidence of moderate to severe infiltration.

Manhole has a connecting mainline requiring replacement unless a suitable and proper boot connection can made between the manhole and pipe.

Manhole has tap or heavy roots.

4.1.3 Concrete Manholes with Brick / Masonry Cones/Risers

This type of manhole shall be evaluated per the aforementioned Concrete Manhole Criteria. Brick cones or risers shall be replaced under the following conditions:

- Brick cone or riser has active infiltration.
- Manhole is located in a drainage path.
- Brick cone or riser has structural failure.

5. Lateral Rehabilitation/Replacement

5.1 Lateral Rehabilitation/Replacement

The following criteria are intended to aid the Engineer in determining when lateral rehabilitation or replacement is necessary. This section describes other design considerations as they relate to cleanouts and service lines tied into services line.

5.1.1 Lateral Replacement

Laterals shall be replaced to the property line if any of the conditions described in Section 2.2.2 are present.

A pipe shall be upsized to 8 inches and a new manhole installed at the upstream end of a 6-inch line which has other services tied into it.

5.1.2 Lateral Rehabilitation

Lateral lining or pipe bursting may be considered if conditions exist which prevent open cut installation. The appropriate criteria in Sections 2.1 and 2.2.3 shall be met if either of these installation methods are chosen.

The service connection shall be recut for services tied to mainlines which have been lined with CIPP and the previous service was incomplete.

5.1.3 Cleanouts

A manhole shall be installed at the end of a line which is 8 inches in diameter or greater and has a cleanout at the end of the line.

A cleanout shall be installed on a 6-inch line if there is no cleanout at the end of the line.