www.norcalpug.com

The Northern California Pipe User's Group
29th Annual Sharing Technologies Seminar

VIRTUAL EVENT
February 18, 2021

SEWER LATERALS – REHABILITATION PLANNING, DESIGN, AND LESSONS LEARNED.

Peter Lyons[1]

[1] Woodard & Curran, Canton, MA

ABSTRACT: The Town of Hull, MA completed rehabilitation of over 100 sewer laterals as part of a state funded sewer rehabilitation project between the Spring of 2019 and Fall of 2020. Although the project's original intent was to utilize lateral cured-in-place pipe technology to complete the work, various field conditions were found during construction which limited the use of the technology. In order to meet the design intent to rehabilitate all sewer laterals in the project area, various alternative lateral rehabilitation technologies were implemented during construction.

The paper provides an evaluation of the sewer lateral rehabilitation process from design to construction. An overview of design considerations, on-the-market technologies, impacts to residents, and constructability lessons will be summarized. The paper discusses the technology limitations, benefits, and disadvantages of various lateral rehabilitation technologies and how best to use these methods to solve sewer lateral infrastructure challenges.

1. INTRODUCTION

A municipality's continuous balancing act between planning capital improvement budgets, providing a high level of service to their customers, and rehabilitating aging collection systems is sure to continue well into the future. Much of the sewer collection systems in northern California have or are beginning to reach the end of their design life, which will continue to spur the cyle mentioned above. However, when municpalities are considering improvements to their collection system they may not always consider one of their most critical assets – sewer laterals. This paper discusses why sewer laterals are a key factor in providing a high level of service to customers and why rehabilitation of these assets should be considered during the budgeting and rehabilitation phases of a capital improvement project. After making the case for why sewer laterals should not be forgotten by municpalities, a discussion on the various rehabilitation methodologies available on-the-market is presented.

2. MAKING THE CASE FOR SEWER LATERALS

Sewer laterals comprise a signifcant portion of municipal infrastructure ownership and operational efforts. Sewer laterals are prone to defects that can contibute excessive flows infiltration, root intrusion, sanitary sewer overflows, and roadway sinkholes. Sewer laterals that lack an appropriate access point (e.g. cleanout on the property line) provide limited to no options for sewer operators to clean and maintain these systems.

Compounding the operational challenges of this critical asset class is that construction oversight during initial installation historically lacked the oversight of its counterparts. This leads to a lack of record keeping and varying levels of satisfactory construction technques compared to modern construction methods. For

example, it is not uncommon for neighborhoods to have record drawings of their sewer mains and connections, but no records of the layout, bends, size, cleanouts, and/or materials of the sewer lateral. Similarly, it is uncommon for modern day GIS databases to include sewer laterals.

The final challenge for municipalities is likely the most basic – which portion of the lateral (if any) do they own and what types of maintenance and rehabilitation should they be performing? It is common for municpalities to own at least some portion of the sewer lateral and therefore likely has responsibility for maintenance and renewal. One of the most common operational duties for collection system operators is to respond to "basement backups", where their routine is to check the mainline flow, check the lateral flow, and make an assessment of whether the backup was due to munipcal ownership or private ownership. Typically, if municipal infrastructure is to blame this leads to regulatory reporting and fines.

Statistics compiled from municipalities in New England highlight the importance and the confusion surrounding how and when to rehabilitate sewer laterals.

- 60% of resident calls to the sewer department were attributed to defective sewer service laterals .
- 27-43% of the municipal sewer infrastructure by length are sewer laterals (see Figure 1).
- Ownership of sewer laterals vary between munipality to municpality (see Figure 2).
- A survey of one New England municpality showed that only 25% of properties had record drawings for sewer lateral installation (commonly referred to as "tie cards"). Munipcal record keeping for sewer laterals is typically incomplete.
- Sewer lateral construction varies neighborhood to neighborood in size, material, and fittings due to ground conditions, installation age, and contractor preference.

For the reasons described above, many municpalities and sewer agencies may struggle with the maintenance and renewal of their sewer laterals. Fortunately, there are multiple technologies in place that can rehabilitate sewer laterals. The sections below describe planning and design considerations, a discussion of available technology, and lessons learned.

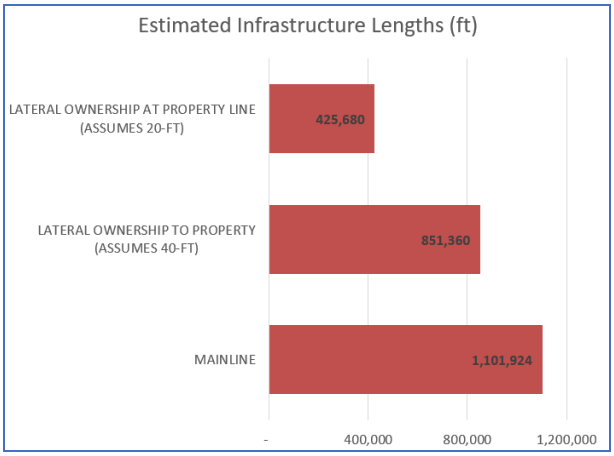

Figure 1. Estimated Sewer Main and Lateral Lengths in one densely populated New England City.

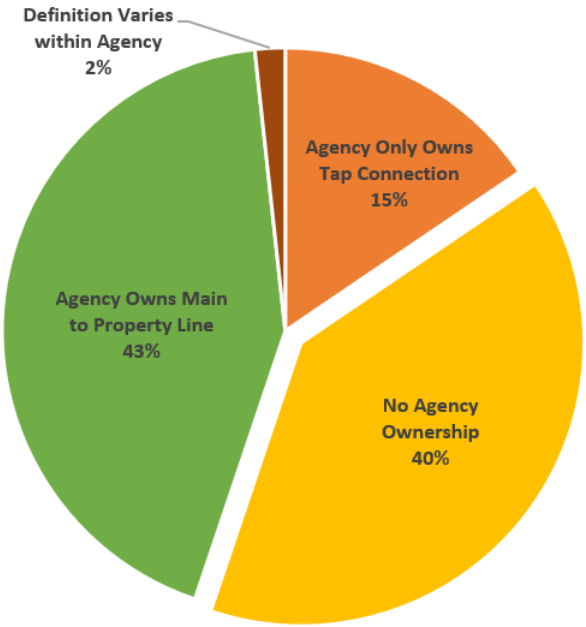

Figure 2. Varying Ownership of Sewer Laterals[1,2]

2. PLANNING AND DESIGN CONSIDERATIONS

It is in each municpalitie's best interest to consider sewer lateral rehabilitaion as part of their sewer capital improvement projects or prior to roadway/sidwalk paving and improvments. For municpalities that do not own any portion of the sewer laterals, the path to rehabilitation is even more convoluted (i.e., sewer laterals will fail at some point in the future regardless of ownership). The following discussion assumes that the municpality has the sewer regulations and ownership in place to perform work on sewer laterals.

Reasons a municpality should consider sewer lateral rehabilitation:

1. Sewer lateral rehabilitation is a key factor to infiltration removal success. Rehabilitating only the mainline can push groundwater upwards to the sewer laterals. Sewer laterals are also prone to rain-induced infiltration.
2. Absence of cleanouts make lateral maintenance not feasible or excessively expensive.
3. Sewer laterals pose significant maintenance challenges due to roots entering pipe defects.
4. Economies of scale – Contractors may be more willing to provide a favorable price should the project scope involve additional work in the same mobilization.
5. Minimize resident disturbance by completing rehabilitation of all sewer work within neighborhoods rather than piece-mealing projects.
6. Roadway paving or sidewalk improvements are planned in the area and the municpality wants to reduce the risk of sinkhole or excavation of pavement within designated moratoriums.

Should the agency begin the planning of a lateral rehabilitation project the following considerations should be made during the scoping and design phase:

1. Ownership Extents

It is vitally important for the municpality to understand it's ownership in order to make the best use of available funds. The example of spending available funds to repair infrastcuture not owned by the utility may result in political scandal.

2. *Access to Existing Cleanouts*

When considering rehabilitation options (see sections below), many technologies rely on the presence of a cleanout outside of the building (e.g., on the property line). This allows for future ease of maintenance and also for reduced rehabilitation costs. It is suggested that cleanouts be installed should during or prior to a laterl rehabilitation project.

3. *Lateral CCTV Inspection During Design OR During Construction?*

In order to effectively rehabilitate the sewer lateral, inspection of the lateral is required to assess the condition of the lateral (e.g., broken sections of pipe), geometry of the lateral (bends that may limit ability to perform trenchless rehabilitation), and connectivity and status of the lateral (is it active and to which building is it connected).

The challenge for these inspections are both financial and due to the available technology. Lateral inspections can cost between $200-$1,000/lateral which is a signifcant upfront cost for municipalities during design and is typically the main driver behind not completing lateral rehabilitation as part of a larger sewer main rehabilitation project. The benefit of inspection during design is that it alllows the municpality to reduce change orders and scheduling challenges during construction. Lateral inspections completed during construction can open municpalities to Contractor ingenuity that may or may not match the design intent leading to delay and additional construction costs.

4. *Availability of Records*

It is not uncommon to have little to no record of the installation of the sewer lateral. This can lead to unexpected buried conditions encountered during construction. Without records to document exact locations of sewer laterals it is a significant task during construction to select which laterals are active/not-active and which laterals can or cannot be repaired trenchlessly.

5. *Presence of "Common Laterals"*

It is suggested that areas where "common laterals" (i.e., laterals with multiple buildings on a single lateral without cleanouts) to install dedicated laterals via excavation. This leads to ease of future maintenance and residential ownership challenges.

6. *Expectations of Future Buildout*

It is suggested that when considering a sewer mainline rehabilitation project, that the area be reviewed for future buildout of empty parcels. It is best practice to install a new connection and stub to the property line prior to sewer main lining so that cutting of the recently installed CIPP is not necessary.

7. *Significant Water/Sewer Users*

Large residential buildings, industrial facilities, or businsses may require special provisions to ensure that sewer use is maintained throughout the construction project. For example, a coffee shop requires use of their water and sewer system throughout the entire business day and temporary sewer lateral bypass may be required for regular business to be maintained.

8. *Community Engagement and Education*

It is important for the sewer users to understand the design intent of the project, how they will be affected (e.g., noise, sewer use, odors, etc.) so that complaints and confusion can be mitigated. It is best practice to utilize 7-day and 24-hour notices prior to completing work that will affect the user.

3. AVAILABLE LATERAL REHABILITATION TECHNOLOGY

There are five primary lateral rehabilitation technologies that are commonly used to rehabilitate sewer laterals. These technologies are continually developing and each have their own advantages and limitations as well as cost requirements. Below is a discussion of the most common technologies.

1. *Dig and Replace:* A tried and true method utilizing excavation to remove and replace the existing sewer lateral with a new sewer lateral.

Advantages:

- When trenchless rehabilitation is not feasible, excavation can be completed to renew the lateral or prepare the lateral for future trenchless rehabilitation.
- Installation of cleanouts can be completed.
- Seperation of common sewer laterals can be completed.
- Can repair laterals that have settled over time and do not have the proper slope.
- Repairs the pipe structurally
- Reduces I/I from main connection to end of installation.

Limitations:

- Requires surface restoration
- Can encroach upon private property which can lead to unexpected costs and disputes.
- Utility conflicts during excavation can cause unexpected delay and costs.

General Cost and Production Rate

- Typically more expensive than trenchless rehabilitation
- Cost varies by depth, length, and surface restoration required.
- A typical installation crew can install 1-4 sewer services per day.

2. *Main to House Sewer Lateral Lining (CIPP):* Rehabilitate sewer laterals and connections from the mainline using a combination of a heat source (steam or ambient cure) and pressure (inversion method or bladder method) to insert a new pipe within a pipe (fiberglass mesh with cured epoxy).

   Advantages:

   - Can rehabilitate up to 200-ft of sewer laterals without surface restoration
   - Minimal resident disturbance
   - Repairs the pipe structurally
   - Reduces I/I from main connection to end of installation.
   - Does not need a cleanout for installation

   Limitations:

   - It is common for the existing lateral construction or defects to make this method not feasible. The presence of pipe size changes, 90-bends, sharp edges, significant offsets, wye connections within the lateral limits the installation effecitveness and can lead to neccesity of excavation or reducing the length of the lateral liner.
   - Can lead to odors within buildings if sewer traps are not properly plumbed or are dry.
   - Can lead to sewer basement backups from steam inversions (higher risk without outside cleanouts).
   - Temporary sewer bypass is sometimes required.

   General Cost and Production Rate

   - Typically less expensive than dig and replace
   - Cost varies by depth and length of installation
   - A typical installation crew can install 1-4 sewer liners a day.

3. *House to Main Sewer Lateral Lining (CIPP)*: Rehabilitate sewer laterals from an access point outside of the mainline (e.g., cleanout inside or ourside of the house) using the materials and technology similar to Main to House Sewer Lateral Lining.

   Advantages:

   - Can line up to 200-ft of sewer laterals without surface restoration.
   - Repairs the pipe structurally
   - Reduces I/I within the lateral section, but does not typically seal the connection at the main. Note that the connection at the main is the most likely point of infiltration.

- Has the ability to navigate 90-bends, size changes, offset joints, and some sharp edges that are not possible via the Main to House technologies.

Limitations:
- Requires access to a cleanout
- May require significant building owner coordination
- Cannot reinstate wye connections within the lateral.
- Additional work is required to seal the connection at the main (grouting or lateral connection repair).

General Cost and Production Rate:
- Typically less expensive than Main to House Lining
- Cost varies by depth and length of installation
- A typical installation crew can install 3-6 services per day.

4. *Full Wrap Lateral Connection to Main Repair*: A method where the lateral connection is repaired from the mainline utilizing a full circumference ambient-cured fiberglass/epoxy wrap.

Advantages:
- Can line up from 1-10-ft up the lateral
- Can be used for chimney connections
- No surface restoration
- Minimal resident distrubance
- Reduces I/I at the mainline connection

Limitations:
- Some systems can only extend 3-ft up the lateral
- Cannot navigate conditions that would make Main to House lining not feasible.

General Cost and Production Rate:
- Similar cost to Main to House Lining, but may be less expensive if installation length and duration is significantly less.
- Cost varies by depth and size of the gravity mainline.
- Typical instllation crews can install 2-4 services per day.

5. *Lateral Grouting from the Mainline:* A method where hydrohpillic grout is injected into the voids around the lateral connection to fill the annular space and prevent infiltration. Typically used in conjuction with mainline CIPP.

Advantges:
- Can be completed in most mainline/lateral configurations.
- Can be used for chimney connections
- No surface restoration
- Minimal resident distrurbance
- Reduces I/I
- The simplest and most straight-forward form of lateral rehabilitation.

Limitations:
- Does not structurally repair the sewer lateral.
- Doest not mitigate infiltration originating from up the lateral.
- Manned entry typicaly required for 24” pipe and larger.

General Cost and Production Rate:

- Cost is least expensive lateral rehabilitation method.
- Typical installation crews can grout many service connections per day
- Cost varies by pipe diameter and volume of grout injected.

Figure 3 : Sewer Lateral Excavation

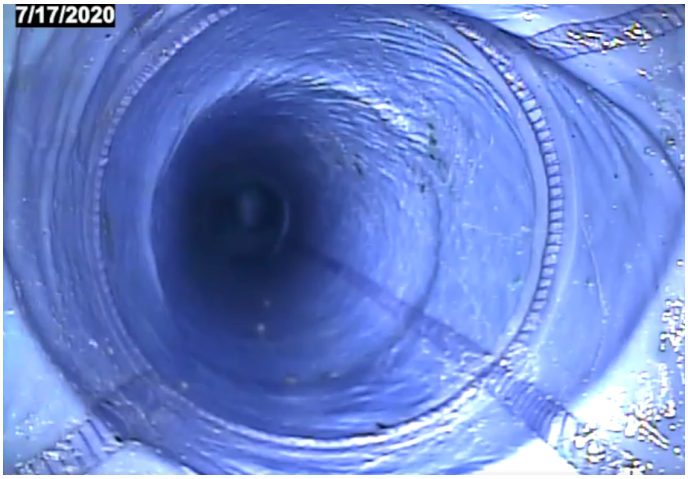

Figure 4 : Before and After of Main to House Lateral Lining

Figure 5 : House to Main Installation

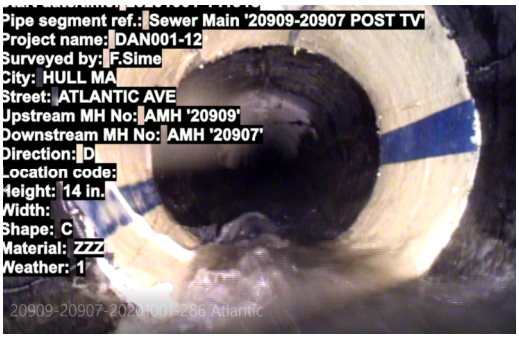

Figure 6: Lateral Connection Repair (Mainline Wrap and 2-ft Chimney Lateral Repair)

Figure 7: Lateral Grouting Equipment (Small Diameter and Large Diameter)

4. SUMMARY AND CLOSING THOUGHTS

Municipalities are required to operate and maintain a significant amount of sewer infrastructure that consumes available budgets and resources. Sewer laterals represent a significant investment to maintain adequate operation, mitigate infiltration and exfiltration, reduce roadway sinkholes, and ultimately eliminate sanitary sewer overflows. However, due to large upfront costs of inspection and the lack of adequate record keeping, sewer lateral condition is usually not well understood by municipalities. In addition, the trenchless rehabilitation of sewer laterals can be a significant design and construction challenge and can lead to project delay and costly change orders.

5. REFERENCES

1. Das, Susan (2016). Excavation of Cured-In-Place Pipe Lining Installations, University of Alberta
2. Sterling, R. L. (2010). No-Dig Techniques and Challenges, Journal of GeoEngineering, 5(3), 63-67