

## History Never Looked So Good: How Proper Application Stands the Test of Time

### *Raven's Manhole Rehabilitation is 'Proven, True & Blue!'*

An industry leader is not born or made on popularity. Industry leaders become champions by proven successful practices. A reputation in the coatings and linings industry takes time, energy, and history to build upon. This history of success with premium products does not rest with the products alone. It is illustrated through the techniques of assessing the environmental conditions to which a structure will be exposed; developing a protective coating and/or rehabilitation solution which meets the needs of the situation; conducting the proper application as per manufacturers' recommendations; and finally, conducting the proper quality control testing to assure that the linings meet the performance specifications.

Norman E. "Ed" Kampbell, Rehabilitation Resource Solutions, LLC, best describes this process in the white paper titled "Manhole Rehabilitation: Delivering on the Design with Proper Installation Practices and Related Quality Assurance Testing." Kampbell states: "With recognized quality assurance comes a better understanding of what is required to ensure that the renewal efforts truly are 50-year improvements and not just a hollow promise." <sup>1</sup>

Through an exclusive network of highly trained certified applicators, Raven Lining Systems' "Proven, True & Blue" methodology has embraced this philosophy for nearly three decades by providing the highest level engineering coating solutions for the water and wastewater industry. It takes real people with innovative techniques and commitment to create an environment which ensures the longevity of the product itself. The techniques and the products employed have led to a high level of performance that ensures a niche in the cornerstone of industry best practices.

Kampbell begins his analysis by placing the importance on designing a rehabilitating solution that solves the unique environmental challenges of each structure. The engineer starts with an analysis

to determine the current condition of the wall structure and soil surrounding the manhole. Signs of corrosion and/or erosion caused by traffic loading, stress from groundwater cycle loading, cracks caused by shifting and expanding soil, leaking manhole rings, infiltration through precast joints and loose or cracked mortar, and leaks at pipe penetrations are noted. Any resulting issues are addressed and corrected before moving to the rehabilitation step suggested by Kampbell.

Once the engineer has an understanding of the environmental conditions in which the coating and lining must perform, solutions that do not meet the long-term environmental and performance requirements (e.g., corrosion resistance, infiltration/inflow reduction or elimination, or any structural enhancements) can be eliminated. The remaining available solutions can be evaluated as to the cost of the design and service life of the solution.<sup>2</sup>

Kampbell's next step requires specifying the solution which evolved from the design exploration results. "The goal of manhole rehabilitation is to cost effectively restore the structure to meet the design requirements," he states.<sup>3</sup> Raven provides proven, monolithic bonded liner systems designed to outlast environmental conditions and exceed structural requirements. Once active leaks have been stopped, the coating and linings are applied to prevent future inflow and infiltration (I&I) while rebuilding the existing structure and protecting against corrosion.

Kampbell notes the importance of following the manufacturers' application guidelines to achieve a well-bonded monolithic protective liner. These applications employ the ability of the material to interact with various environmental elements of the candidate structures (i.e., temperature, pH levels before cleaning and level of dampness).

For complete and proper adhesion, the surface must first be meticulously prepared, which involves cleaning and ensuring the wall surfaces have the required surface profile for the lining to both chemically and mechanically adhere. Application success can also be assured by utilizing a proven and

well-trained manufacturers' certified installer to make sure that the job will be done correctly. Kampbell states that most coating and lining failures are the result of poor applications. Raven Lining Systems partners with an exclusive network of highly-trained and supported certified applicators with a proven track record of success.

Lastly, Kampbell stresses the role of Quality Assurance in verifying the manhole rehabilitation meets the design requirements. Inspection should be conducted throughout the rehabilitation process to ensure the surface is properly prepared and the lining was applied as per the manufacturers' recommendations. During the application, a film gauge is used to confirm that the liner is applied at the proper thickness. Once the job is complete, a visual inspection should be conducted within the structure to confirm a monolithic lining was achieved. Further holiday testing is conducted to identify any voids or pinholes to be repaired. Lastly, adhesion testing is conducted to assure that a strong, lasting bond has been achieved. Completing these quality checks allows the owner to confirm that the coating and linings were correctly applied in order to provide long-term protection. Any and all Quality Assurance issues discovered are addressed and resolved per manufacturers' guidelines by Raven before the job is considered complete.

In order to talk the talk, a leader needs to be able to walk the walk. Raven's history stands the test of time and has illustrated the vital protection to infrastructure with proven products for over 25 years. For example, in Tulsa, Oklahoma, 1990, the call for a project was awarded to a contractor. With the proper inspection, preparation, and application the project ran without error. Twenty-five years later upon inspection, the three manholes were in relatively good shape with a strong bonded liner, confirmed by average adhesion pulls greater than 360 psi. While some repairs had occurred and there were two leaks, "the coating was still intact and will be able to withstand the existing harsh conditions for many years," stated Ryan Bauman, Raven Field Technical Service.

A manhole in Lago Vista, Texas was inspected in 2015, 16 years post-application. It was coated in 1999 with Raven 405, a high-performance epoxy. The site of the manhole was in a commercial area with little flow and high levels of hydrogen sulfide. The coating showed no visual defects or leaks and still had a very strong bond (+500 psi average adhesion). The only issue rested with a rusted ring where the coating lost adhesion. Rather than completely neglect this issue, it was recommended that the City of Lago Vista use a flexible chimney seal, such as Raven 581, to secure the seal between the ring and the chimney.

To supplement this, two other manhole projects were inspected in 2015, both in Cedar Park, Texas. These manholes were coated with Raven 405, the first in 1999 and the second in 2004. They exhibited strong adhesion bonds greater than 500 psi average with no defects or leaks.

Manholes are not the only structures that need protecting within the industry. Infrastructure like clarifiers, digesters, and basins are essential to keeping systems operating efficiently. They are in danger of corrosion's effects and can be applied with coatings and linings as well. At the Hanahan Water Treatment plant, twenty filter basins were in need of rehabilitation in 2000. The facility produces potable water and required a coating that was NSF ANSI 61 certified safe for drinking water. Raven's AquataPoxy A6 was applied in 2000 and was still structurally sound 15 years later. The inspection, which was also during an upgrade at the plant, showed some impact damage from the construction of new troughs and an area that was repaired cosmetically from a missed recoat window due to holiday repairs. Even with these slight issues, the A6 was still providing confident protection to the structure, saving the facility from costly infrastructure overhauls.

Becoming a leader is not based on a brand's popularity or what it has done with previous industries. It is based on how the products, people and businesses affect the industry long-term. Raven's history has illustrated the longevity of our products with its continual protection of the nation's

infrastructure. When those products are paired with people who are expertly trained and skillful in application and quality assurance, the champions at Raven Lining Systems are set apart from the everyday winners.

REFERENCES:

<sup>1-3</sup>Kampbell, N. (2016) – Manhole Rehabilitation: Delivering on the Design with Proper Installation Practices and Related Quality Assurance Testing, North American Society for Trenchless Technology (NASTT), No-Dig Conference and Exposition, Conference Paper TM2-T3-03, USA

All historical case studies can be found on Raven’s website: <http://www.ravenlining.com/news-events/case-histories/>

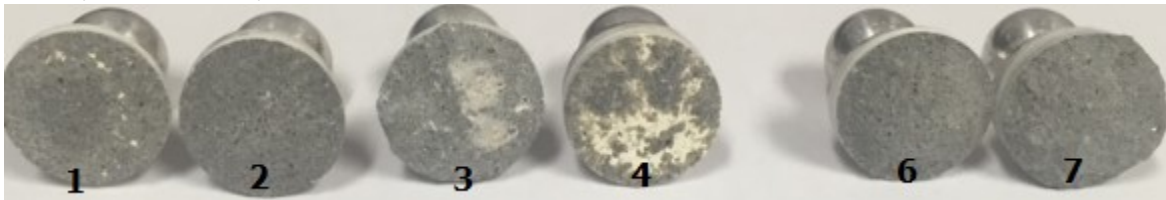


Figure 1 Charleston adhesion pulls

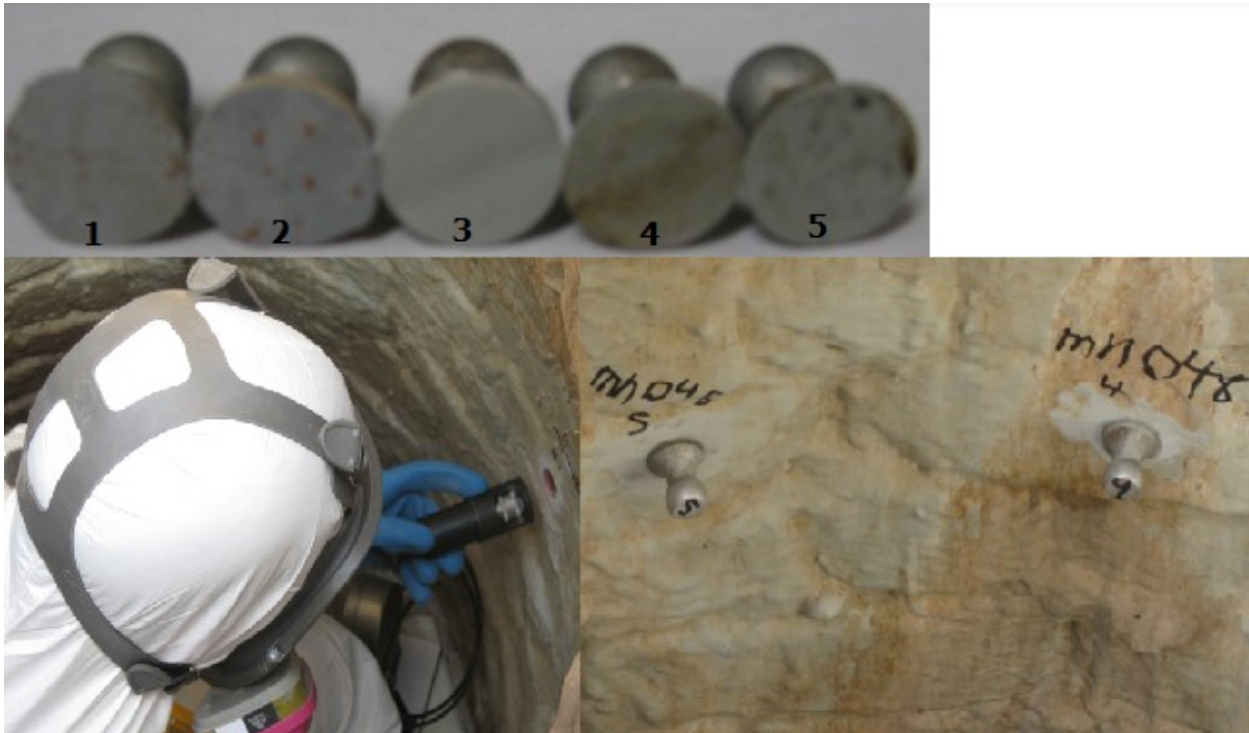


Figure 2 Bartlesville pulls



Figure 3 Tulsa