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Trenchless Manhole Rehabilitation - Ensuring Project Success

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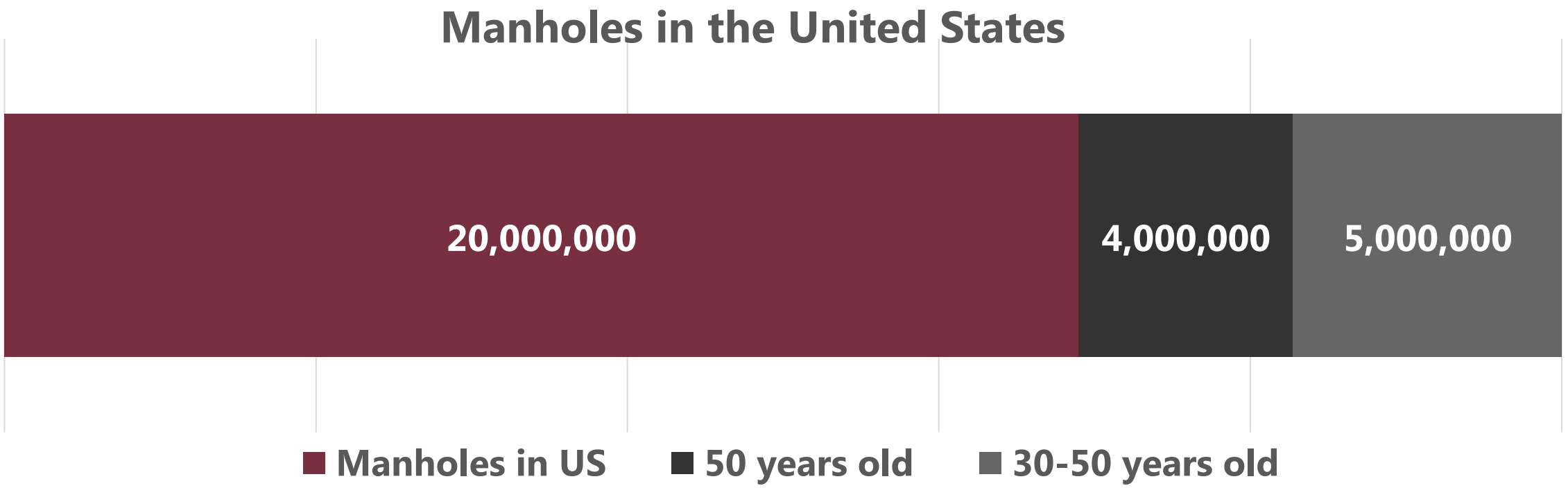
UCT 25YEARS

An estimated 3.5 million manholes are likely in very poor condition and in need of immediate attention in the US



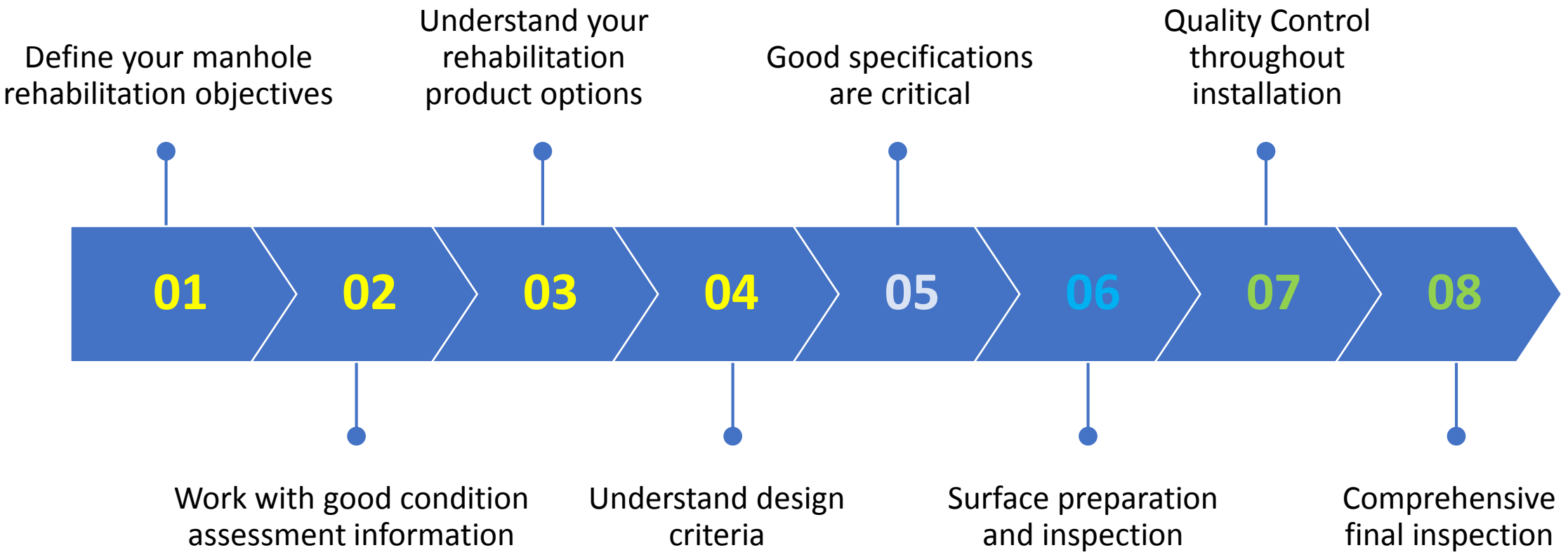
EPA estimates that there are at least **23,000 - 75,000 Sanitary Sewer Overflows** per year

A significant number of SSO's can be attributed to manholes that are in poor condition

What can be done to remediate the manholes?

- Replacement
- Rehabilitation

Pathway to success – a methodical approach addresses manhole rehabilitation needs and ensures quality



Defining rehabilitation objectives

Identifying problems in your manholes & wastewater system

- Corrosion?
- Inflow and infiltration?
- Structural issues?
- Industrial waste issues?
- Poor construction?

Evaluate risk and consequence of failure

Understanding the problems will help guide rehabilitation approach

Utilizing quality condition assessment information allows for informed decisions & reduces risk

Surface inspection

Manned entry

Manhole pole cameras

Automated inspection systems

Work with high quality inspection information

- ✓Detailed inspections identify & quantify condition
- ✓Entry inspections by qualified inspectors will provide most accurate info – safety is key
- ✓Systematic & detailed documentation, including photos, top to bottom within manhole

CERTIFIED INSPECTORS

NASSCO · MANHOLE ASSESSMENT CERTIFICATION PROGRAM · MACP

SSPC.org

NACE INTERNATIONAL

Unknowns can significantly impact the cost & approach of rehabilitation

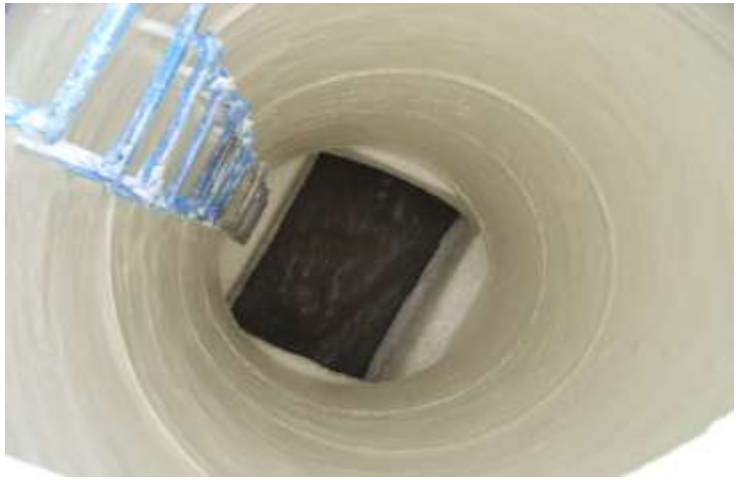
Extent of corrosion?

Extent of infiltration?

Structural condition?

Understanding different rehabilitation product options

- Resin-based coatings/ linings
- Cementitious & geopolymers
- Prefabricated structural inserts
- I&I Elimination and Grouting



All products have unique strengths and limitations

Understanding Manhole Rehabilitation Design

Significant differences exist between structural, semi-structural & non-structural rehabilitation methods

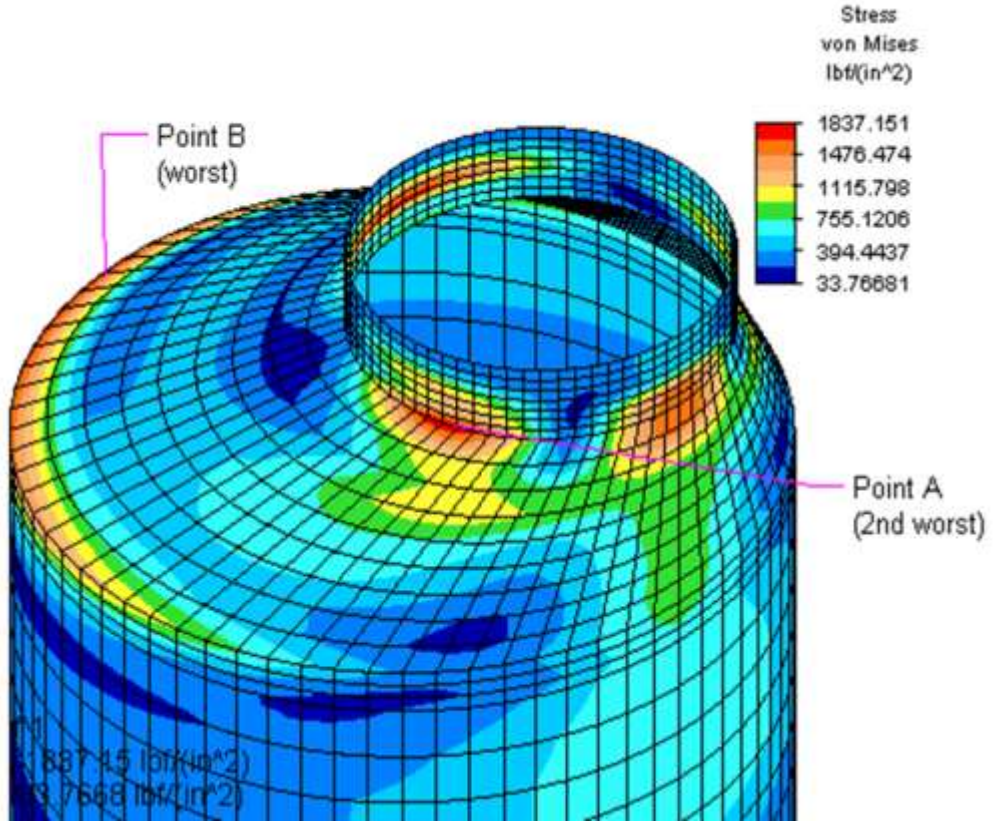
Coatings & linings:

- ✓ Semi-structural for high build applications
- ✓ Non-structural for thin DFT applications

Structural rehabilitation solutions:

- ✓ H-20 load rated composite inserts
- ✓ Polymer manholes
- ✓ New concrete manholes
- ✓ Other systems where design can be proven by FEA

Chemical grout & seals are non-structural



Design considerations for manhole rehabilitation

- "Fully structural" means it can stand completely on its own and resist loading both vertically and horizontally
- Strength of "semi-structural" linings is dependent on individual product material properties and bond to substrate to create an interactive system
- "Semi-structural" will need to rely on some degree of stru integrity of the host manhole- interactive
- Product & system compatibility is critical
- No uniform design standards exist

Well-written specifications are critical!

- Develop specifications for the unique circumstances of the project
- Specs need to be fair to both owner and contractor
- Clear & concise, performance-based specs preferred
- Measurement & payment needs to be well-defined & consistent
- Reference applicable design criteria, appropriate standards (ASTM, NACE ICRI), QA/QC requirements
- Beware of cut & paste specifications and specifications “borrowed” from other municipalities

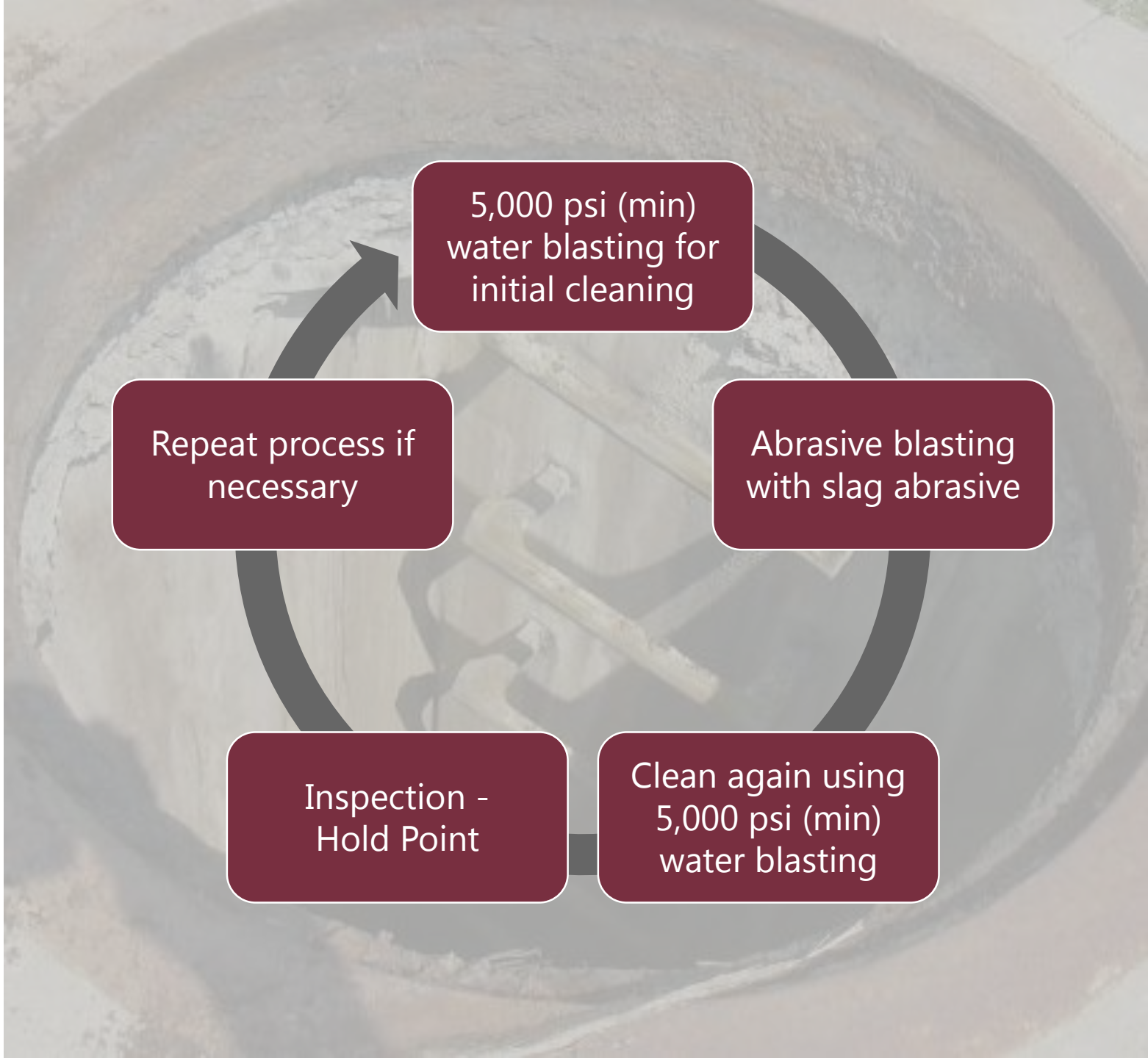
Unit price contracts help define quantities & control costs

- Performance based specs & unit-price contracts account for unknowns
  - ✓Chemical grout for infiltration control (per gallon basis)
  - ✓Substrate build-back material (per kit or per bag basis)
- Be specific with unit price measurement & payment items
- Estimated quantities will provide a basis for contractor bids
- Quantities tracked and rectified at end of project

Owner gets what they pay for, contractor gets paid for what they install

Surface preparation is key to ensure proper bonding

Approximately 95% of coating and lining failures can be attributed to poor surface preparation



The Importance of Surface Preparation

- Removal of soft, corroded concrete, contamination, debris down to clean and sound substrate
- Define surface profile requirements
- NACE No. 6/ SSPC SP-13, ICRI No. 310.2R-2013
- Infiltration control
- Consistency is key!

Abrasive blasting should be specified & required

Establishing hold points allows inspector to confirm quality and specifications are being met

- ✓Surface preparation hold point
- ✓Application hold point
- ✓Final inspection

- Inspector should have authority to stop project if there are issues
- Review process in pre-construction meeting
- Communication is key to procedural conformity

Surface Preparation QA/QC Considerations

- Visual inspection of surface preparation prior to coating/lining installation (ICRI 310.2R-2013)
  - Has specified surface profile been established?
  - Has infiltration been stopped?
  - Is surface clean?

It is recommended that SSPC-SP 13/ NACE No. 6 standards be followed

ICRI CSP surface profile comparators are useful tools for surface preparation inspection (ICRI No. 310.2R-2013)

Product Application QA/QC Inspection Considerations

- Ensure proper thickness is being applied
  - ✓ Specify and use wet mil thickness gauges (ASTM D4414)
  - ✓ Typical thicknesses for resurfacing material = ½"
  - ✓ Typical thickness for coating/lining top coat = 125 mils
- Make sure all active infiltration is stopped
- Line the manhole inverts!
- Make sure environment is appropriate for application

Final Inspection QA/QC Considerations

For resin-based polymer coatings & linings:

- Once cured, perform holiday (spark) test on all lined surfaces (NACE SP0188)
- Adhesion testing to verify bond (ASTM D7234)
- Comprehensive visual inspection

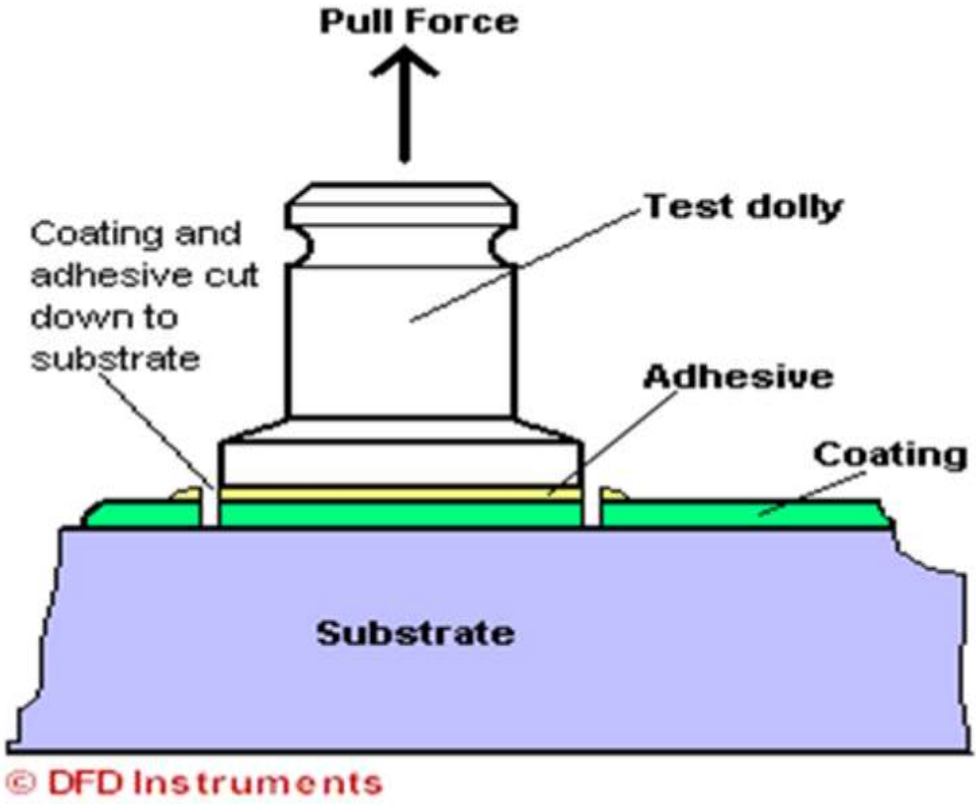
Provide written verification of inspection process

QC & Inspection Procedures Commonly Specified:

Holiday (spark) test on all coated/lined surfaces

(NACE SP0188) at 100 volts/mil

QC & Inspection Procedures Commonly Specified:



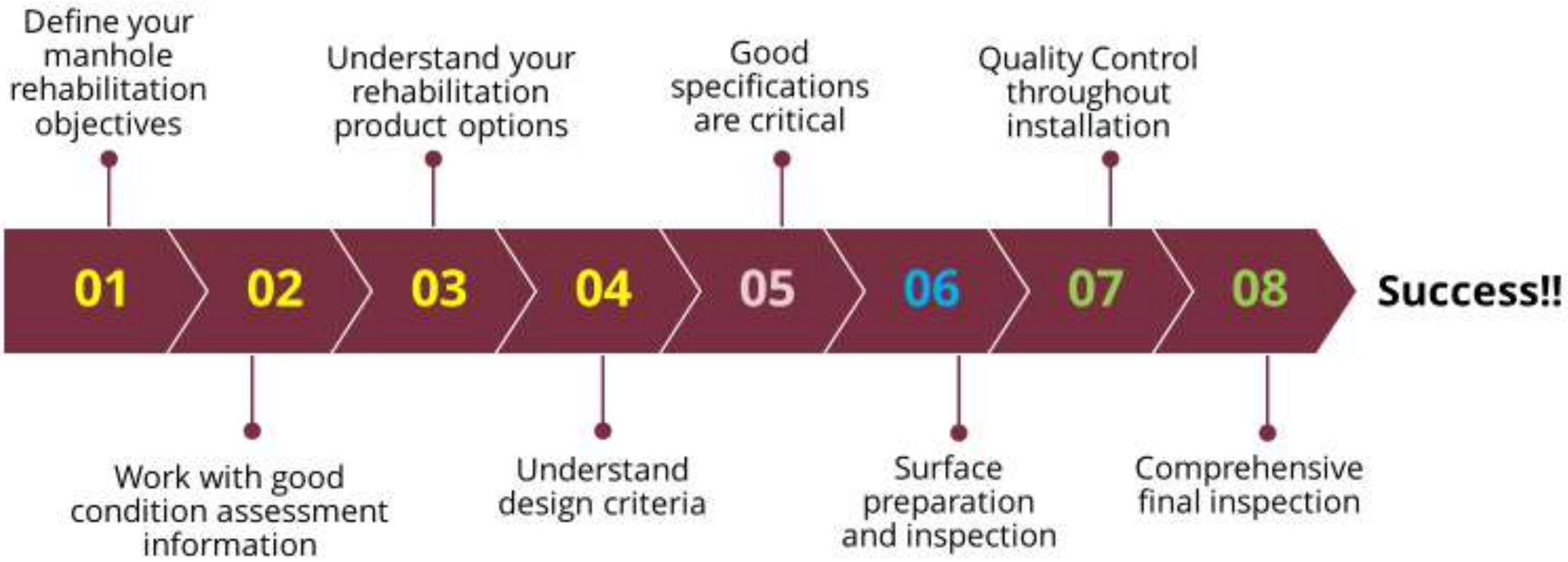
Adhesion testing to verify bond strength (ASTM D7234)

So when things are done correctly…

Before

After

Understanding and applying key considerations for manhole rehabilitation delivers successful results



Thank You!

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