Comparison of Composite Repair performance on Drilled and Eroded Defects

U.S. Department of Transportation
Pipeline and Hazardous Materials
Safety Administration

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Main Objective

The goal of this project is to understand the performance of composite repairs when there are applied to through wall defects with significant diffuse wall damage. This project compares the expected performance of repairs with the current design approach in which the flaw is simulated with a drilled hole.

Figure 1. Drilled defect

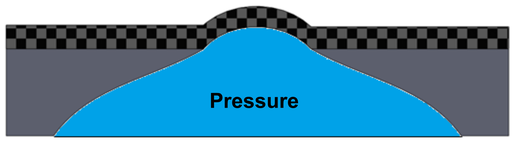

Figure 2. Eroded defect

Project Approach/Scope

To test the performance of diffuse defects, dry gas erosion was used to generate a through wall defect inside a straight pipe specimen and elbow specimen. An example of this damage is shown in figure 3. The size of the diameter of the eroded area was, on average, five times larger than the through wall defect as shown in figure 4. Repaired specimens were pressure tested until failure in the test facility shown in figure 5. At the same time, Digital Image Correlation was performed in order to obtain displacements and strains for the repair during testing.

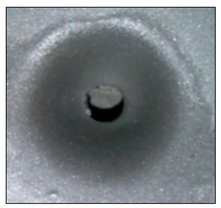

Figure 3. Eroded defect inside the pipe

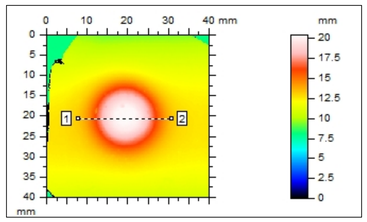

Figure 4. Defect Characterization

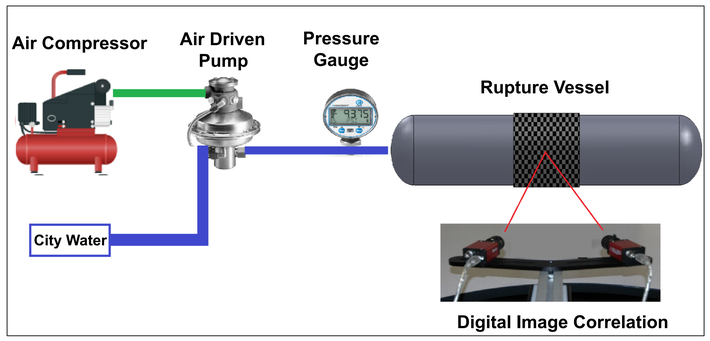

Figure 5. Test Facility

Results

In the case of straight pipes, there was no significant variation in failure pressure from drilled to eroded defects. This indicates that the substrate deformation is not important in the repair performance. Figure 7 shows the failure pressure for elbows where the eroded specimens failed at lower pressures than the drilled specimens. Figure 8 shows an example of the DIC strain measurement on elbow specimens along with an extraction line for the data in Figure 9. As expected eroded specimens had higher strain levels. Straight specimens with elongated damage also failed at lower pressures when compared to specimens with circular damage, indicating that damage shape is important for repair performance.

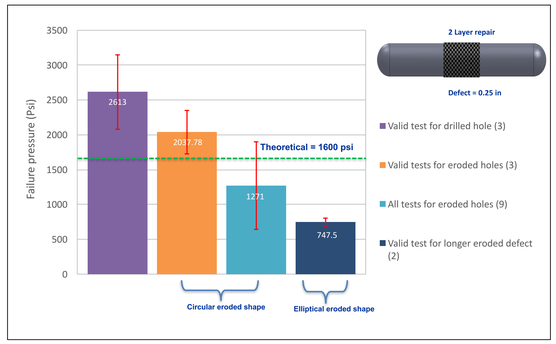

Figure 6. Failure pressure for straight specimens

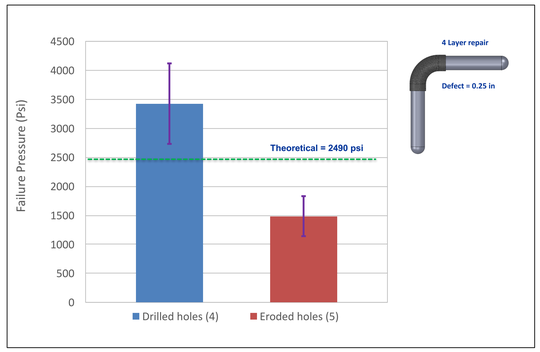

Figure 7. Failure pressure for elbow specimens

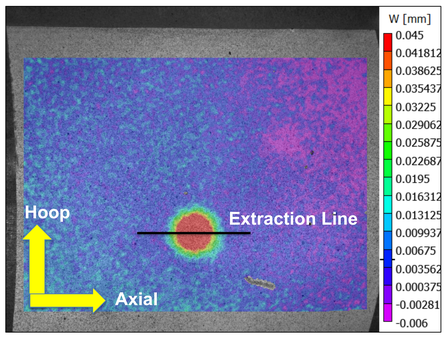

Figure 8. DIC measurement

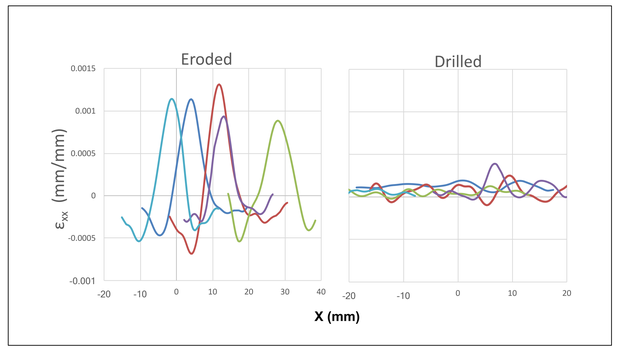

Figure 9. Axial Strains for elbow specimens

Acknowledgments

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Public Project Page

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