

Performance Assessment of GFRP Rebars Used in an Existing Bridge

Ali F. Al-Khafaji (Graduate Research Assistant), Prof. John J. Myers (Advisor)

Department of Civil, Architectural, and Environmental Engineering, Missouri University of Science and Technology

Introduction

There are approximately 583,000 bridges in the U.S. 235,000 are made from conventional reinforced concrete. About 15% of them are considered structurally deficient due to the corrosion of steel reinforcement. Per NACE, annual direct cost estimates total \$8.3 billion.

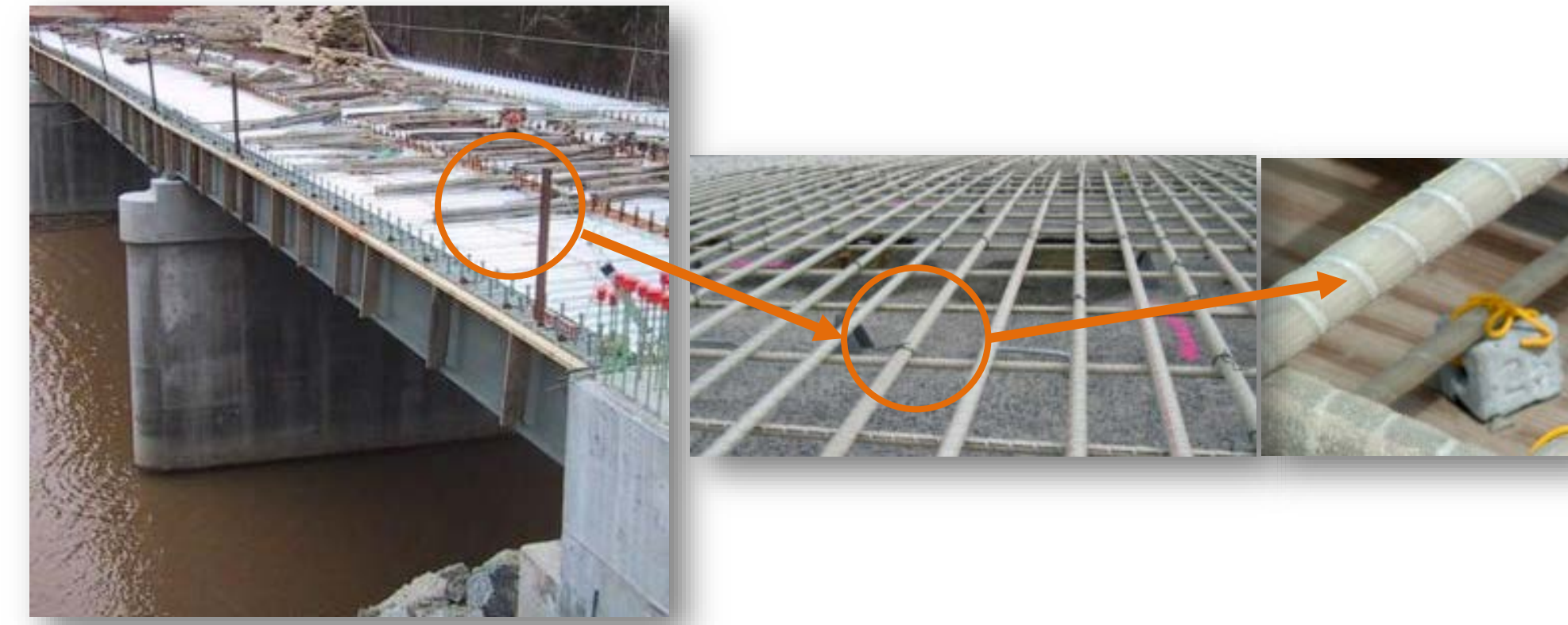
Since replacing and maintaining bridges from corrosion issues are very costly, other alternatives needed to be considered to at least mitigate these costs if not avoid them completely



Thus, GFRP rebars have been introduced as a main reinforcement and great replacement for the ordinary steel reinforcement. GFRP is an excellent corrosion resistant. But, unfortunately, there are very scarce information about its performance and durability issues.

Objectives

- Investigating the performance and long-term durability of GFRP rebars in aggressive environments

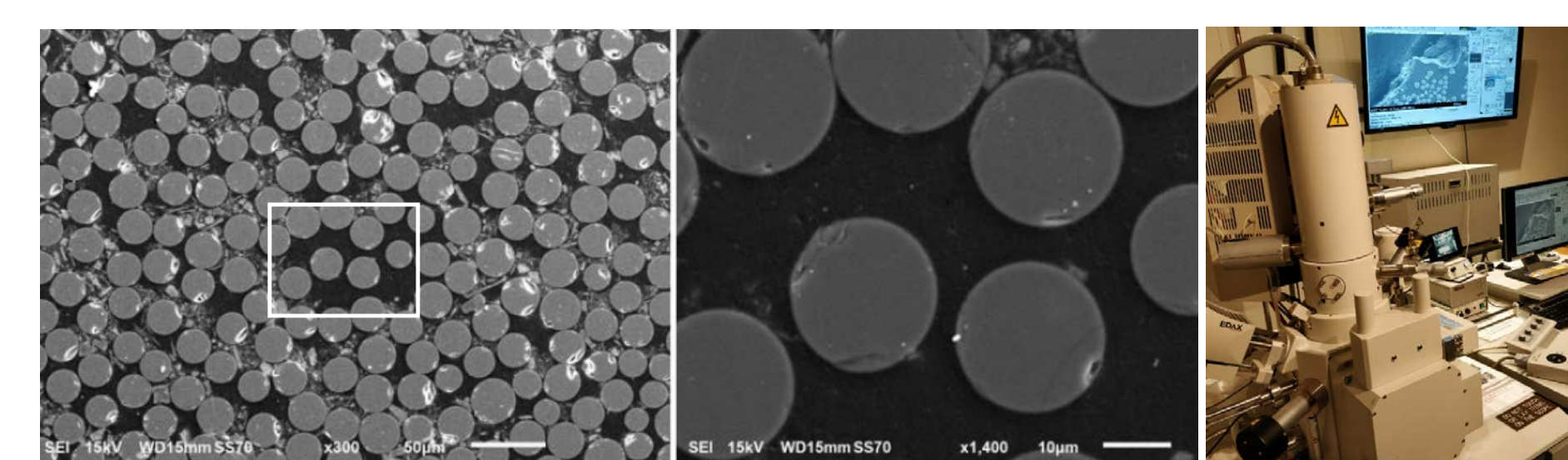


GFRP Rebars Extraction



Extraction of the concrete core from the Bridge, then Extraction of the GFRP rebars pieces from the concrete core

GFRP Durability Tests

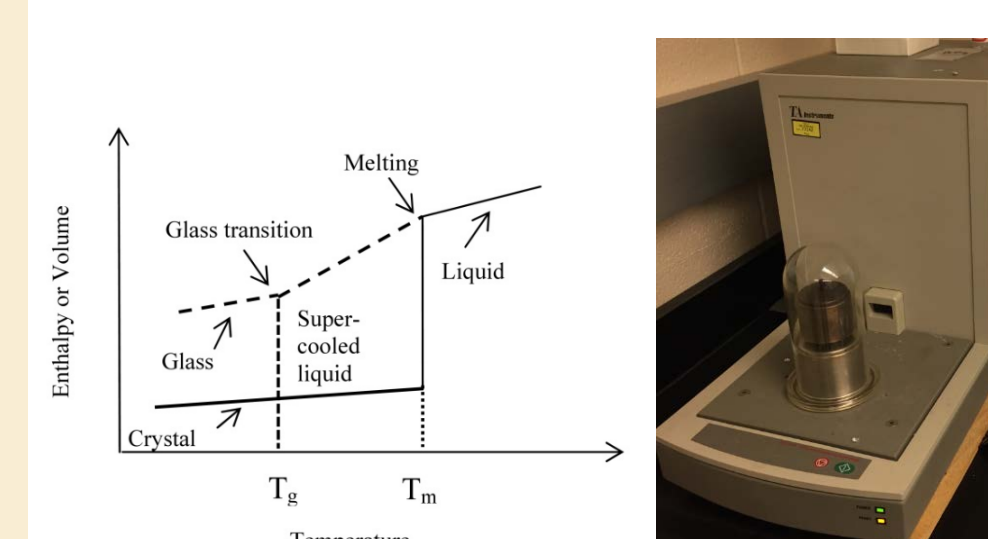


Scanning Electron Microscopy (SEM)



Burn-Off

Short Bar Shear (SBS)



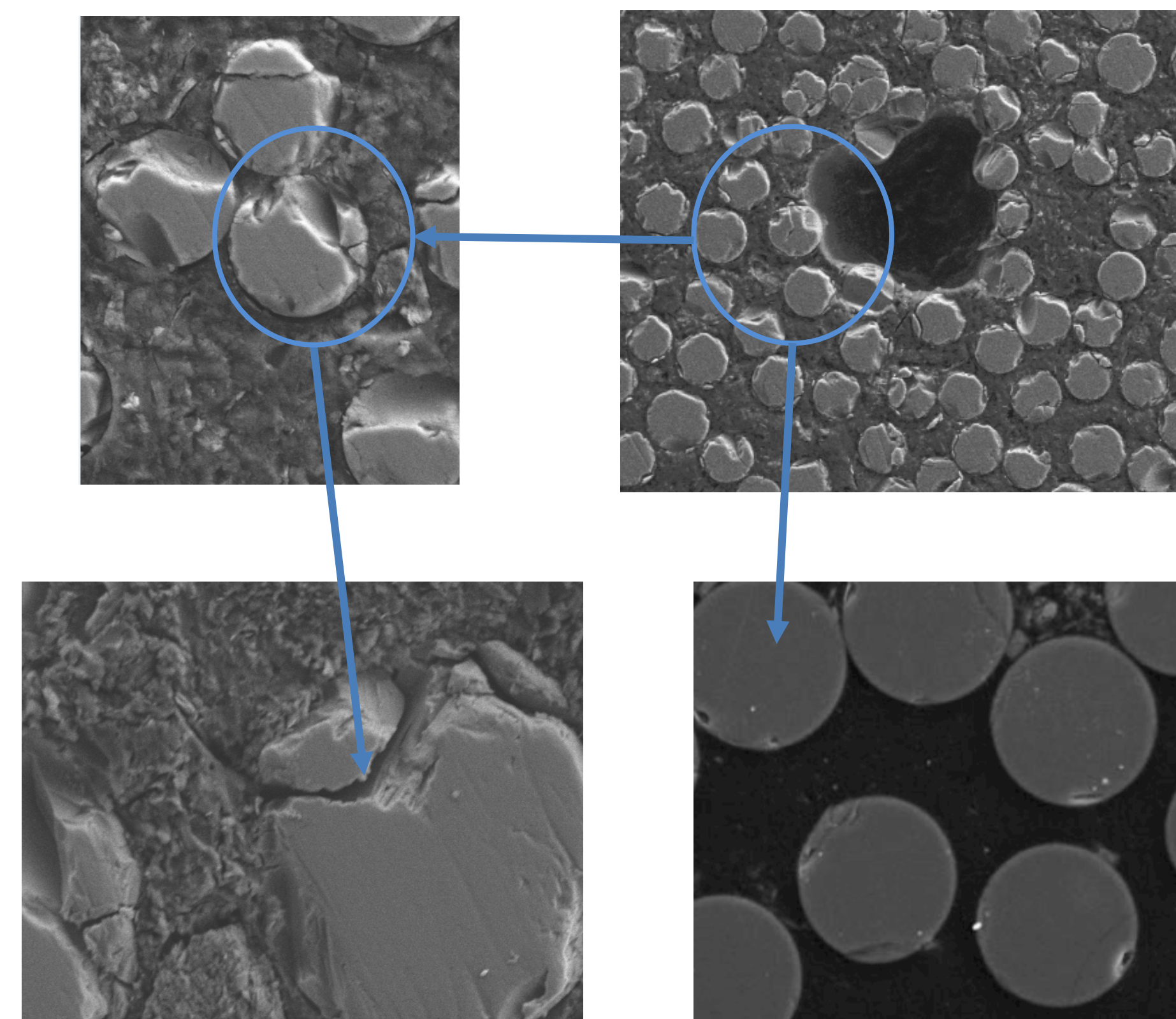
Glass Transition Temperature (Tg)



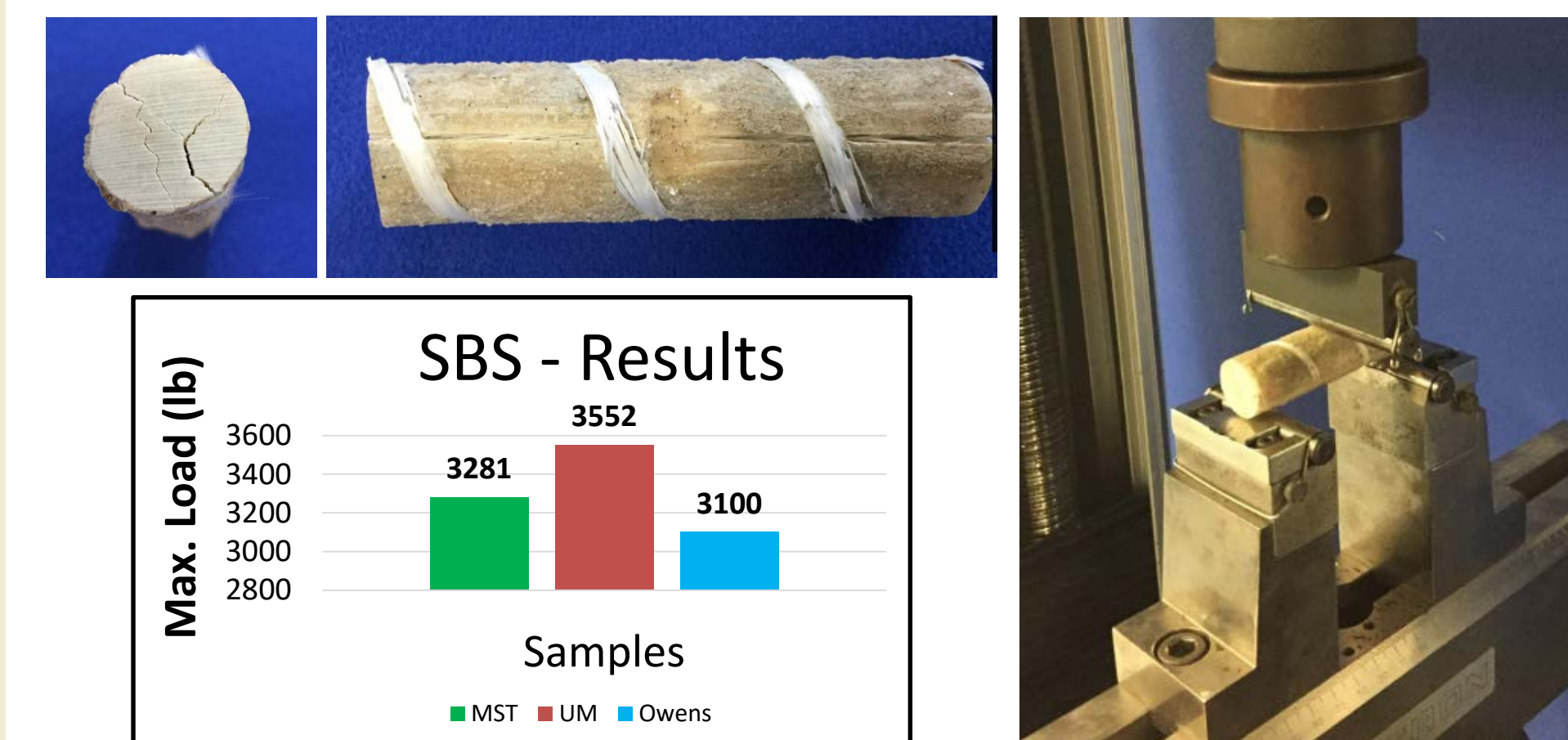
Water Absorption

Results

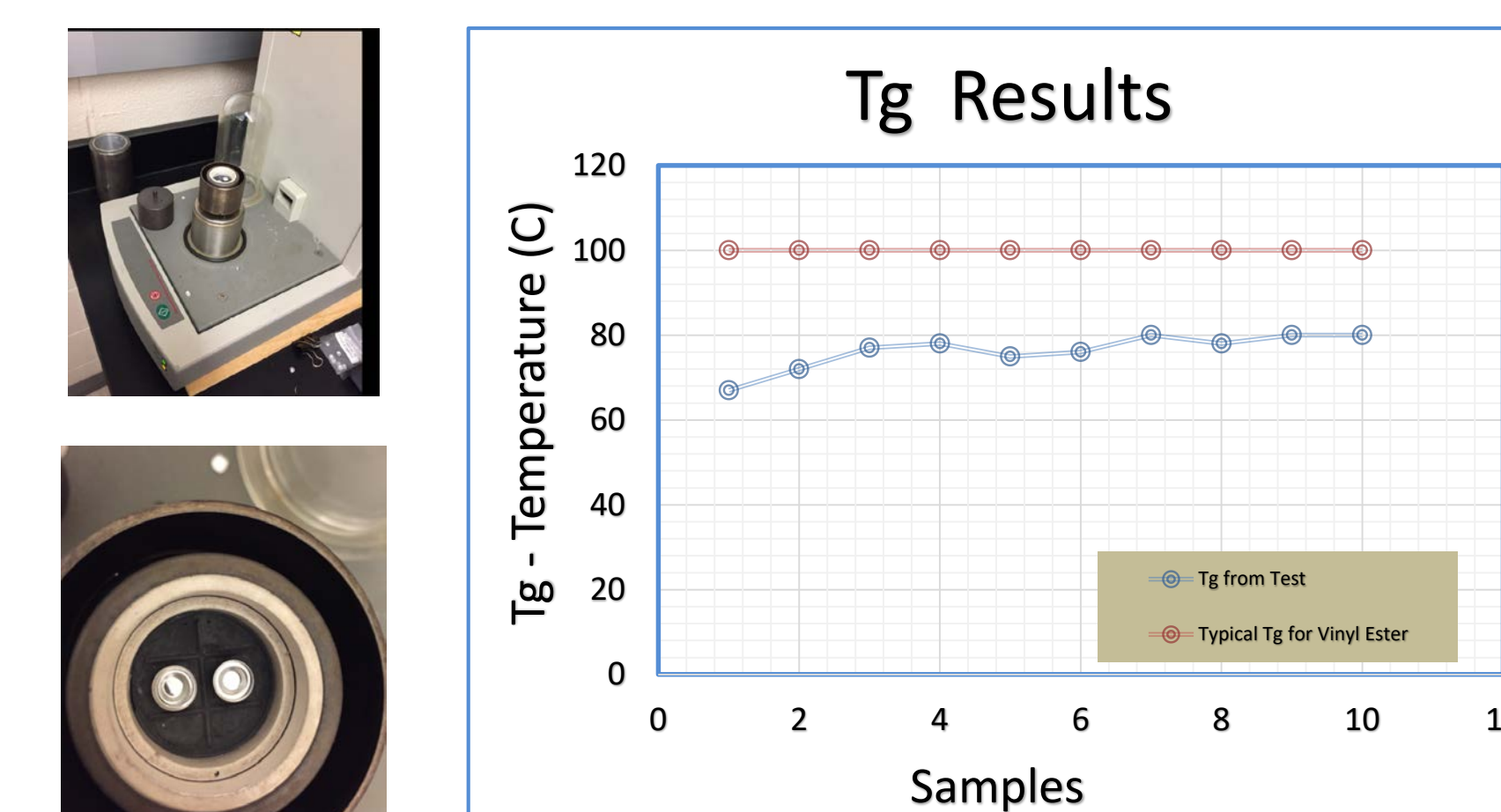
Scanning Electron Microscopy (SEM)



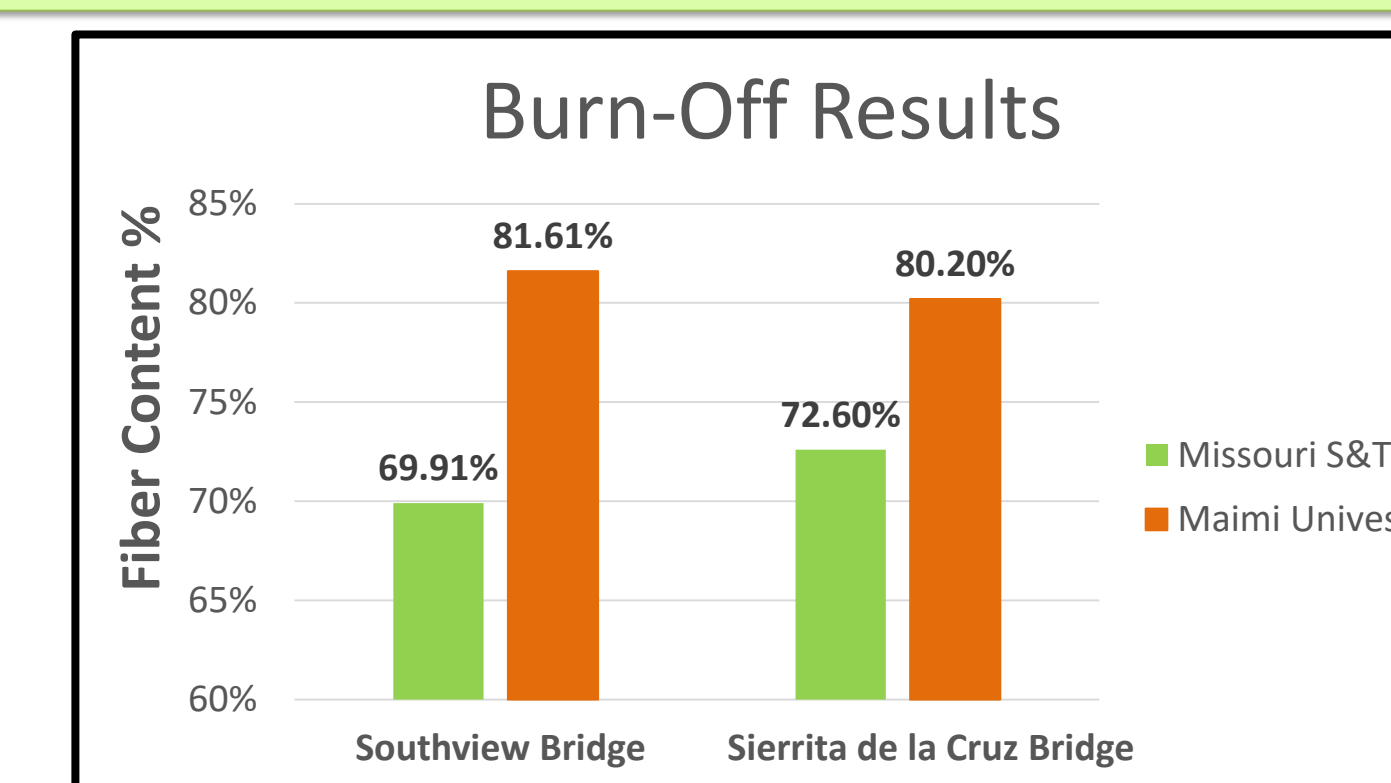
Short Bar Shear (SBS)



Glass Transition Temperature (Tg)



Burn-Off



Conclusions

- SEM analysis showed some microstructural degradation.
- There was no loss in any cross-sectional area of the bar.
- SBS test results were a little higher than the results of Owens, need more specimen for justification.
- Tg results showed a significant reduction in temp (about 20 C less)
- Burn-Off test results showed that fiber content in the tested samples were close to the ones tested at UM

Recommendations

- More samples are needed to validate the current results.
- More bridges are needed for GFRP monitoring performance.
- Other technique for the same test maybe useful for verifications



Acknowledgements

- Owens Corning Infrastructure
- The technical support staff in the Civil Department, Material Lab, and SEM labs