Monitoring of a warren truss hangar

L. Locklin¹, J. Orellana² and G. Akhras²

¹ Civil Engineering Cell Commander, 1 ESU Canadian Armed Forces, Kingston, Canada
² Center for Smart Materials and Structures, Royal Military College, Kingston, Canada

Akhras@rmc.ca

Summary

The Canadian Forces maintains 80 wooden warren truss hangars initially constructed as temporary structures during WWII. Within a few months of construction, significant shrinkage & cracking began to take place and start posing structural integrity concerns. Regular inspections are not sustained and recommended repairs are often costly and over conservative. A SHM system is applied to extend the design life and improve the safety of these structures. Various sensor types and methods of data collection are reviewed to select a suitable SHM system.

INTRODUCTION

• Quality of construction material was sacrificed for expediency leading to significant distress as shrinkage and cracking began to take place.
• Bottom chords experienced significant deflections and premature deterioration and post tensioned cables were installed years later.
• Regular inspections are not maintained and recommended repairs are costly and over conservative.
• Objective 1: Gain an understanding of long-term performance under service load and detect and identify the severity of damage.

RESULTS

Location of Strain Gauges & Long Term Behaviour

• Objective 2: Evaluation of various sensor types and methods of data collection.
• Electrical and fiber optic strain gauges with temperature sensors are coupled to control temperature effects and explore techniques for detection of localized damage with reduced number of measuring points.
• The system must be cost effective as well as easy to implement and analyze.

DISCUSSION

Simultaneous Point Load Test

Cracking during Loading

• Effect of point load

Day Before and After Point Load Test

Cracking, multiple repairs as clamps & post-tensioning cables and location of monitored trusses

CONCLUSIONS

✓ After 4 years, electrical strain gauge are still viable.
✓ Fiber Bragg Grating (FBG) provided more stable results with temperature compensation.
✓ System of sensors necessary on all trusses.