

SSE Phase 1 – IBHS Experiments

NIST WUI Fire Days 2022

Agenda items

2.4: SSE Phase 1 – IBHS Outdoor No Wind Experiments

2.5: Update on SSE Phase 1 – IBHS Cold Flow Measurements



IBHS Research Center

Introduction

Experimental
Design

Methodology

Experiments

Measurement
Results

Summary

Implications/
Implementation



© Insurance Institute for Business & Home Safety

Shed Burns, No Wind

Structure Separation Experiments (SSE) Phase 1 – IBHS Outdoor No Wind Experiments

The primary objective was to estimate heat release rates of larger sheds that could not be tested under the 10 MW calorimeter at the NFRL.

These outdoor shed burn experiments measuring mass loss rate were performed in the absence of artificially generated wind field.

Heat flux from the source structure (shed) was measured at heights, orientations, and distances representative of components of a target structure (single-family residence).

Shed Burns, No Wind

Weighing Platform

Introduction

Experimental Design

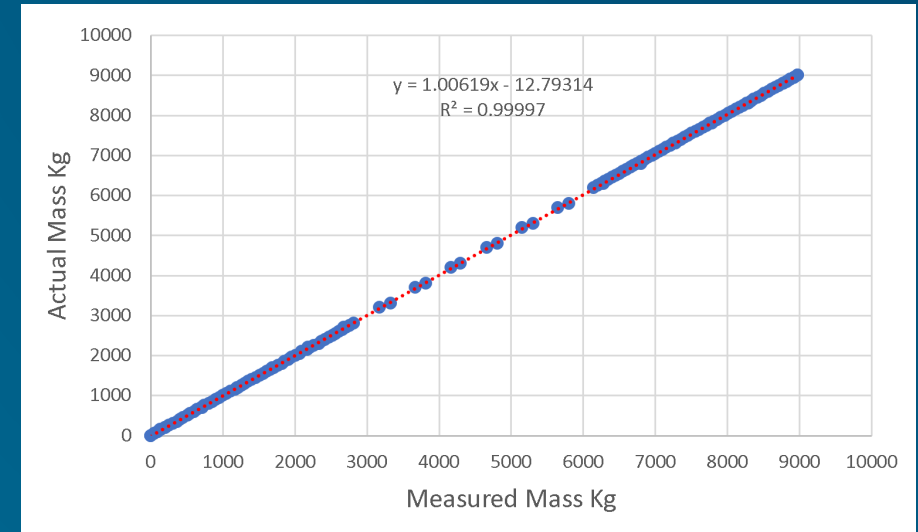
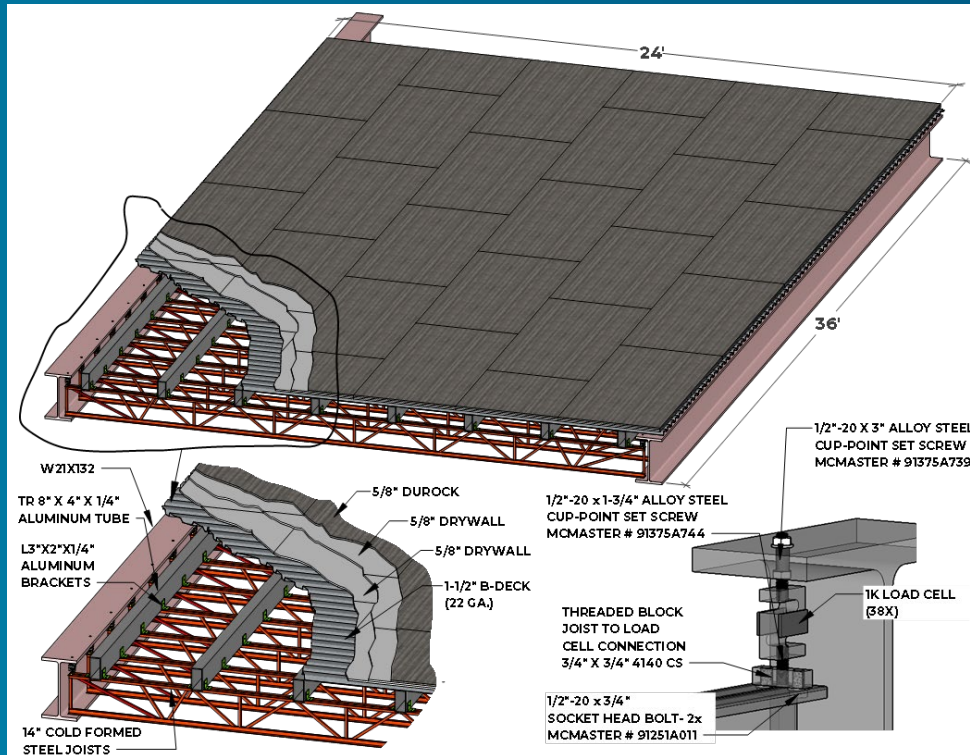
Methodology

Experiments

Measurement Results

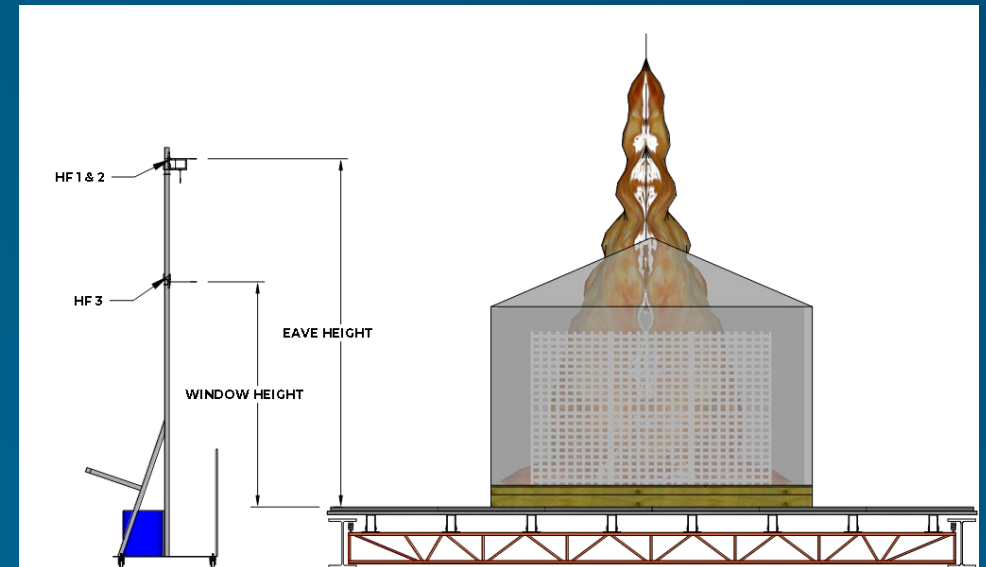
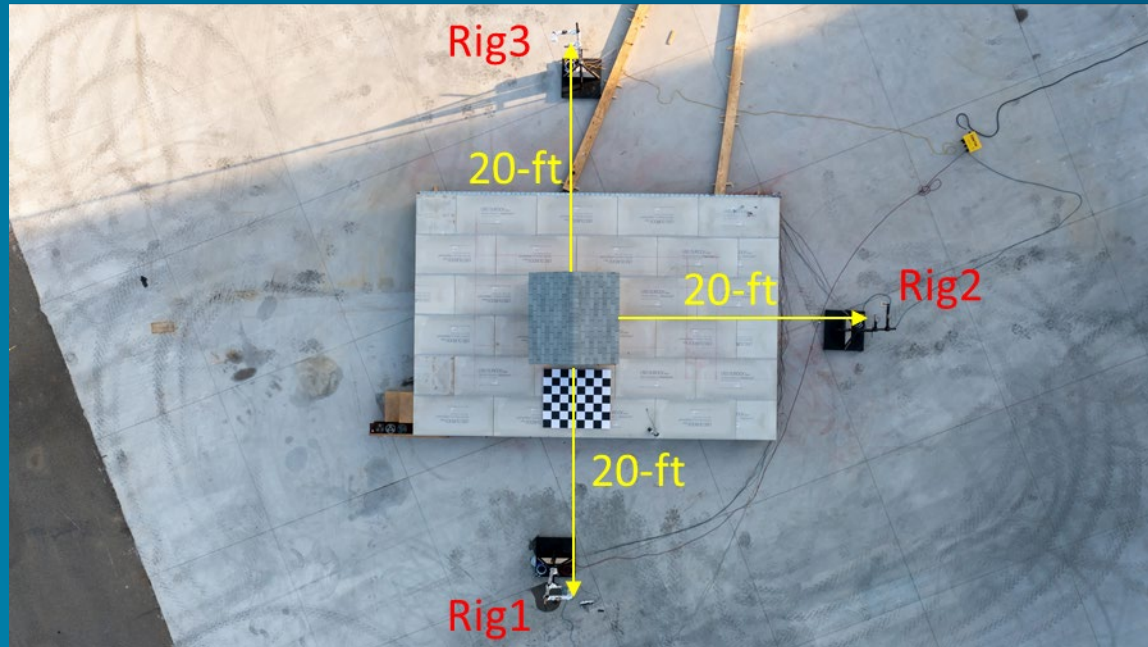
Summary

Implications/Implementation



Shed Burns, No Wind

Heat flux rigs



Shed Burns, No Wind

Introduction

Experimental
Design

Methodology

Experiments

Measurement
Results

Summary

Implications/
Implementation

| Serial number | Test ID | Shed Size | Material | Fuel loading, (number of 6-A cribs) | Mass, Kg | | |
|---------------|------------|------------|----------|-------------------------------------|----------|-------|-------------------|
| | | | | | Shed | Cribs | Total combustible |
| 1 | 1B-WMh0 | Medium | Wood | High (4) | 595 | 546 | 1141 |
| | 1B-WMh0-R1 | Medium | Wood | High (4) | 620 | 515 | 1135 |
| 2 | 1B-SLh0 | Large | Steel | High (6) | 133 | 855 | 1010 ¹ |
| 3 | 1B-PLh0 | Large | Plastic | High (6) | 127 | 870 | 1147 ² |
| 4 | 1B-SVLh0 | Very Large | Steel | High (15) | 346 | 2138 | 2920 ³ |
| 5 | 1B-WVLh0 | Very Large | Wood | High (15) | 1839 | 2193 | 4032 |

1. A 185 kg wood floor was added.

2. A 127 kg wood floor was added. The mass of the shed was 127 kg which included some noncombustible metal framing

3. A 782 kg wood floor was added.

Shed Burns, No Wind

Fuel loading

Wood Medium



Wood Very Large



Steel Large



Plastic Large



Steel Very Large



Shed Burns, No Wind

Introduction

Experimental Design

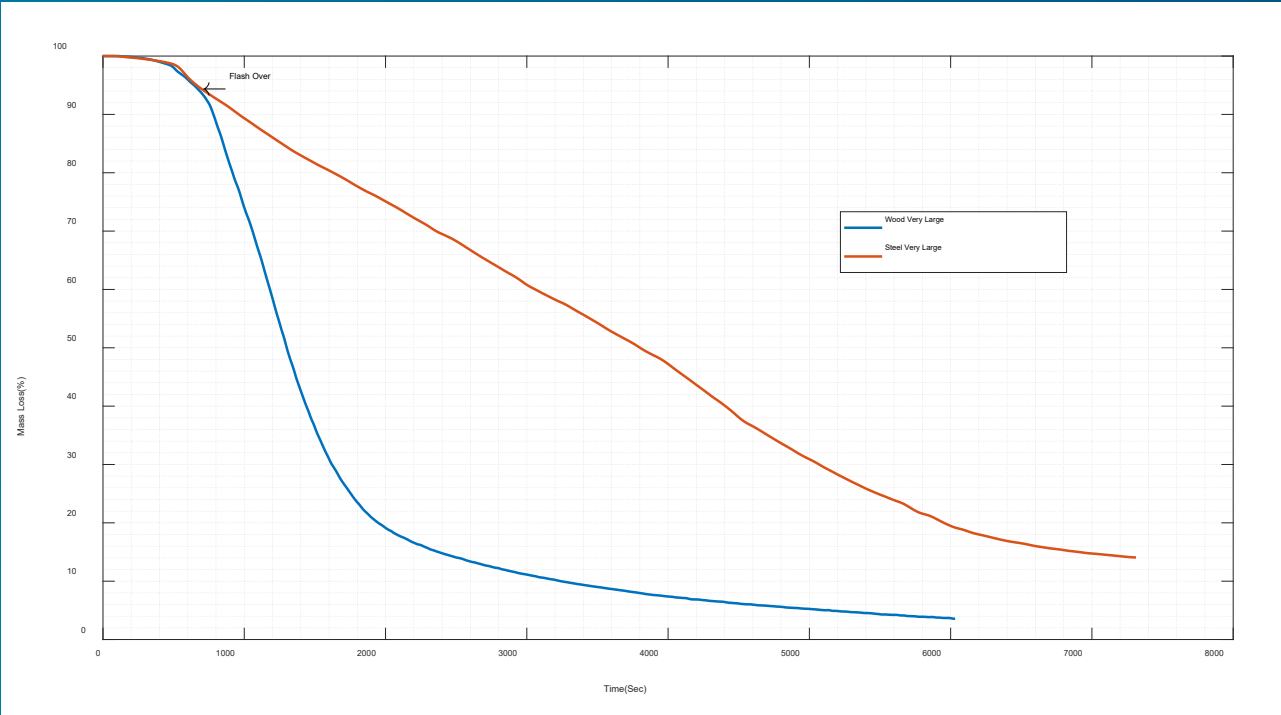
Methodology

Experiments

Measurement Results

Summary

Implications/ Implementation



Wood Very Large



Steel Very Large



Shed Burns, No Wind

Introduction

Experimental
Design

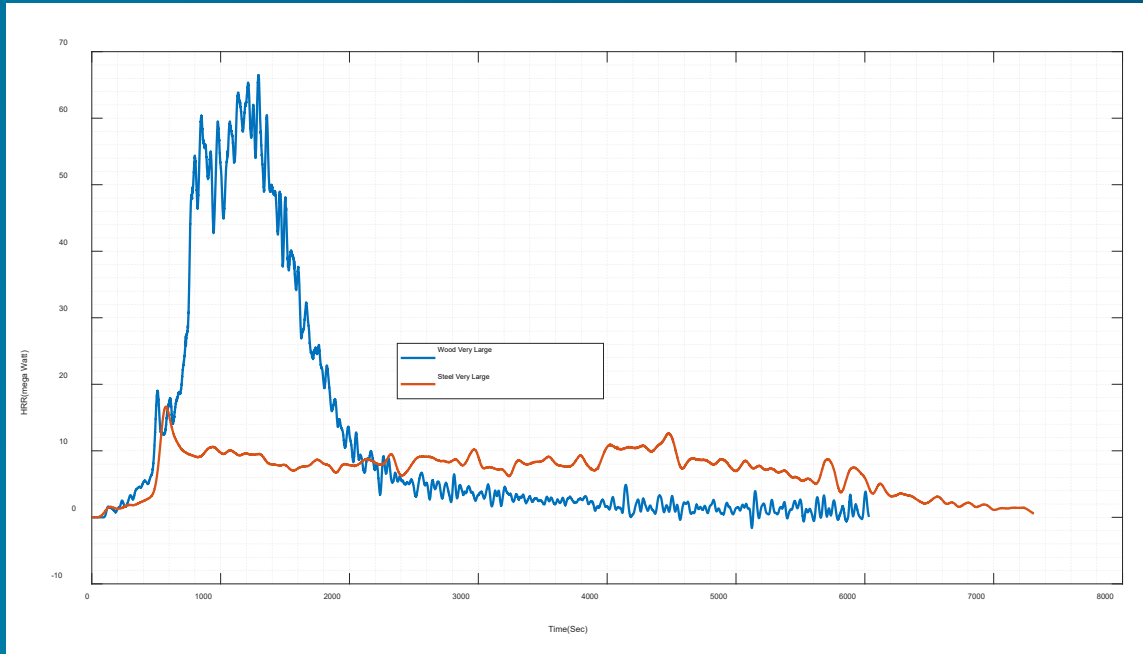
Methodology

Experiments

Measurement
Results

Summary

Implications/
Implementation



Wood Very Large



Steel Very Large



Shed Burns, No Wind

Introduction

Experimental
Design

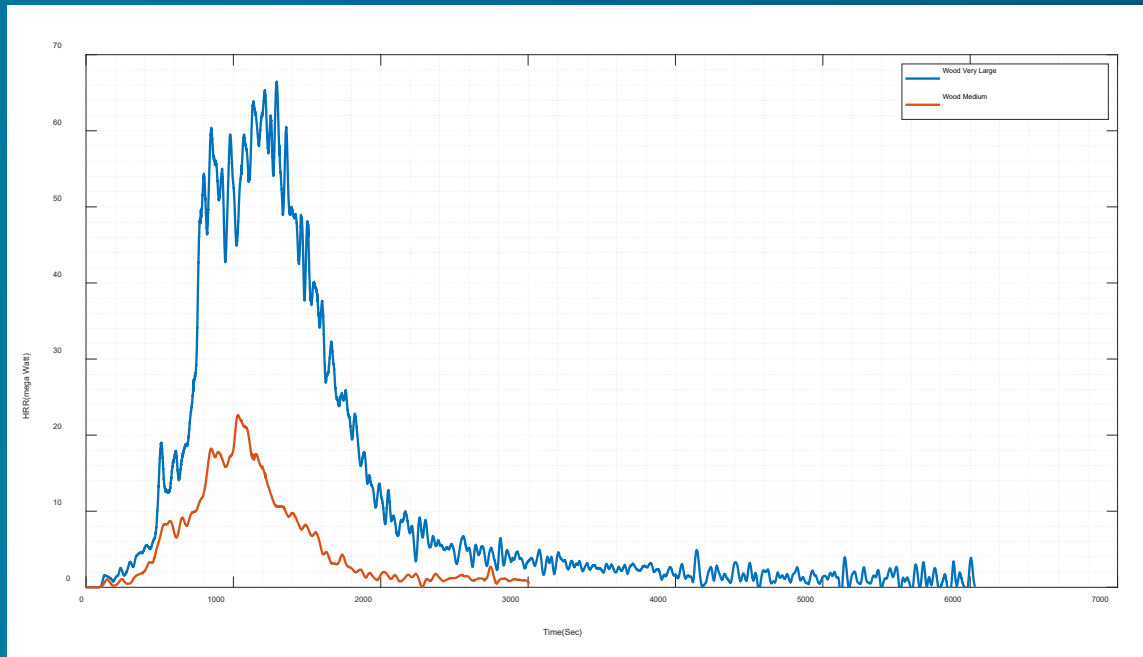
Methodology

Experiments

Measurement
Results

Summary

Implications/
Implementation



Wood Very Large



Wood Medium



Shed Burns, No Wind

Introduction

Experimental
Design

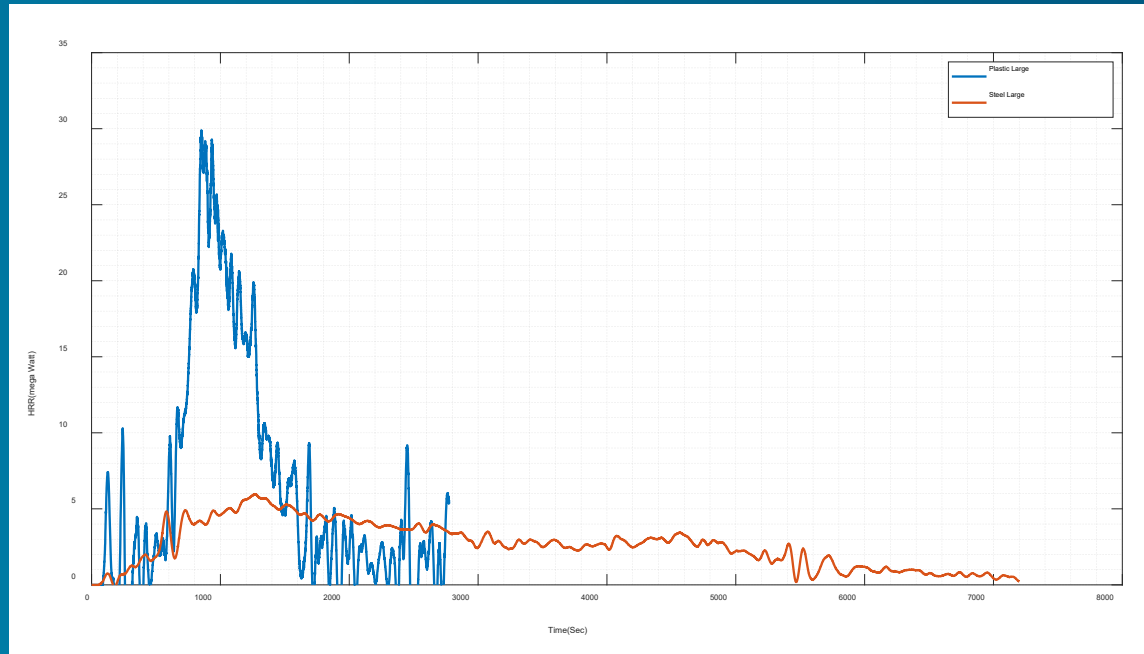
Methodology

Experiments

Measurement
Results

Summary

Implications/
Implementation



Plastic Large

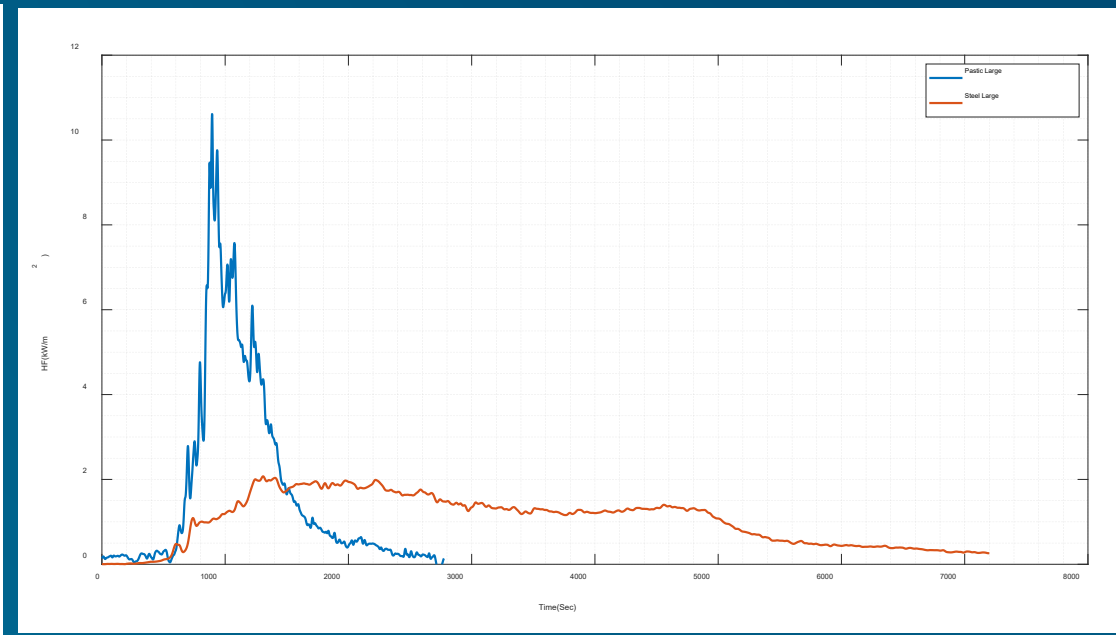
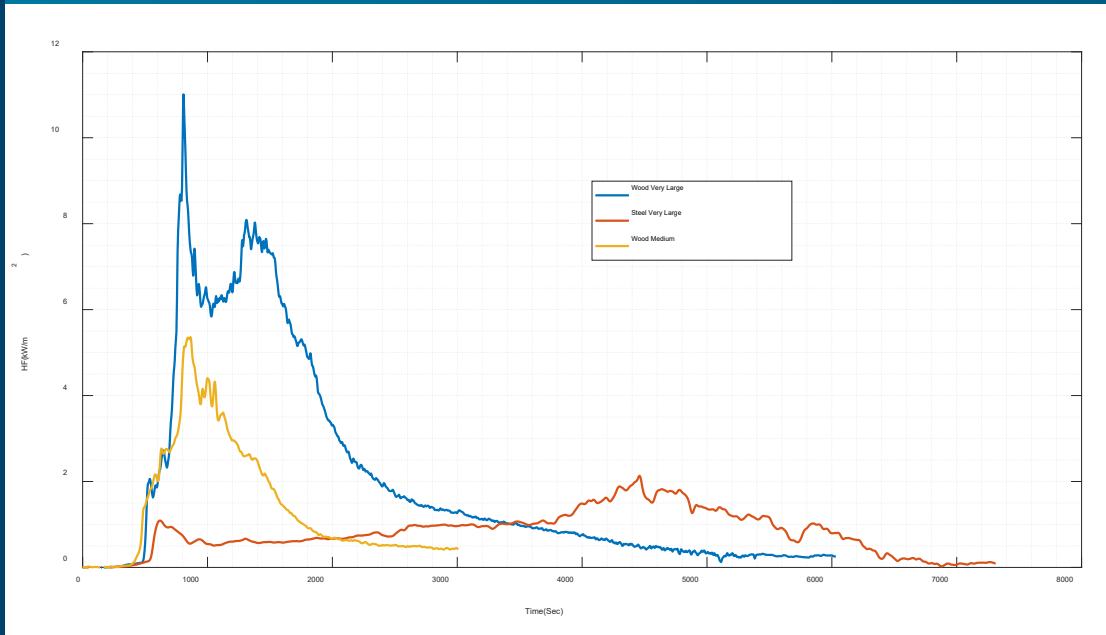


Steel Large



Shed Burns, No Wind

Heat flux measurements



Introduction

Experimental Design

Methodology

Experiments

Measurement Results

Summary

Implications/ Implementation

Shed Burns, No Wind

Introduction

Experimental
Design

Methodology

Experiments

Measurement
Results

Summary

Implications/
Implementation

| Serial number | Test ID | Test Duration (min) | Total combustible mass, kg | Derived parameters | | | Peak heat flux, kW/m ² | | | | | | | | |
|---------------|------------|---------------------|----------------------------|--------------------|---------------|-------------|-----------------------------------|-----|-----|-------|-----|-----|-------|-----|-----|
| | | | | PHRR, (MW) | TTPHRR, (min) | MLR, (kg/s) | Rig 1 | | | Rig 2 | | | Rig 3 | | |
| | | | | | | | HF1 | HF2 | HF3 | HF1 | HF2 | HF3 | HF1 | HF2 | HF3 |
| 1 | 1B-WMh0 | 50 | 1124 | 22.6 | 17 | 1.3 | 7 | 3 | 7 | 5 | 2 | 5 | 2 | 6 | 5 |
| 2 | 1B-WMh0-R1 | 50 | 1207 | 17.9 | 19 | 1.0 | 7 | 2 | 6 | 5.8 | 2.5 | 6.8 | 4 | 1.3 | 4 |
| 3 | 1B-SLh0 | 120 | 855 | 5.97 | 21 | 0.3 | 3 | 1 | 2 | 0.8 | 0.5 | 1 | 1 | 0.5 | 1 |
| 4 | 1B-PLh0 | 47 | 1133 | 29.8 | 14 | 1.7 | 11 | 5 | 11 | 4 | 2 | 4 | 5 | 2 | 5 |
| 5 | 1B-SVLh0 | 123 | 3038 | 16.6 | 10 | 0.9 | 3 | 1 | 2 | 2 | 2 | 3 | 4 | 2 | 4 |
| 6 | 1B-WVLh0 | 100 | 4027 | 66.5 | 22 | 3.7 | 14 | 3 | 11 | 7 | 3 | 8 | 29 | 18 | 22 |

Successfully measured mass loss and calculated derived Heat Release Rate (HRR) for Medium (M), Large (L), and Very Large (VL) sheds.

Successfully measured heat flux from burning sheds in the absence of artificially generated wind field.

Cold Flow Measurements

Introduction

Experimental Design

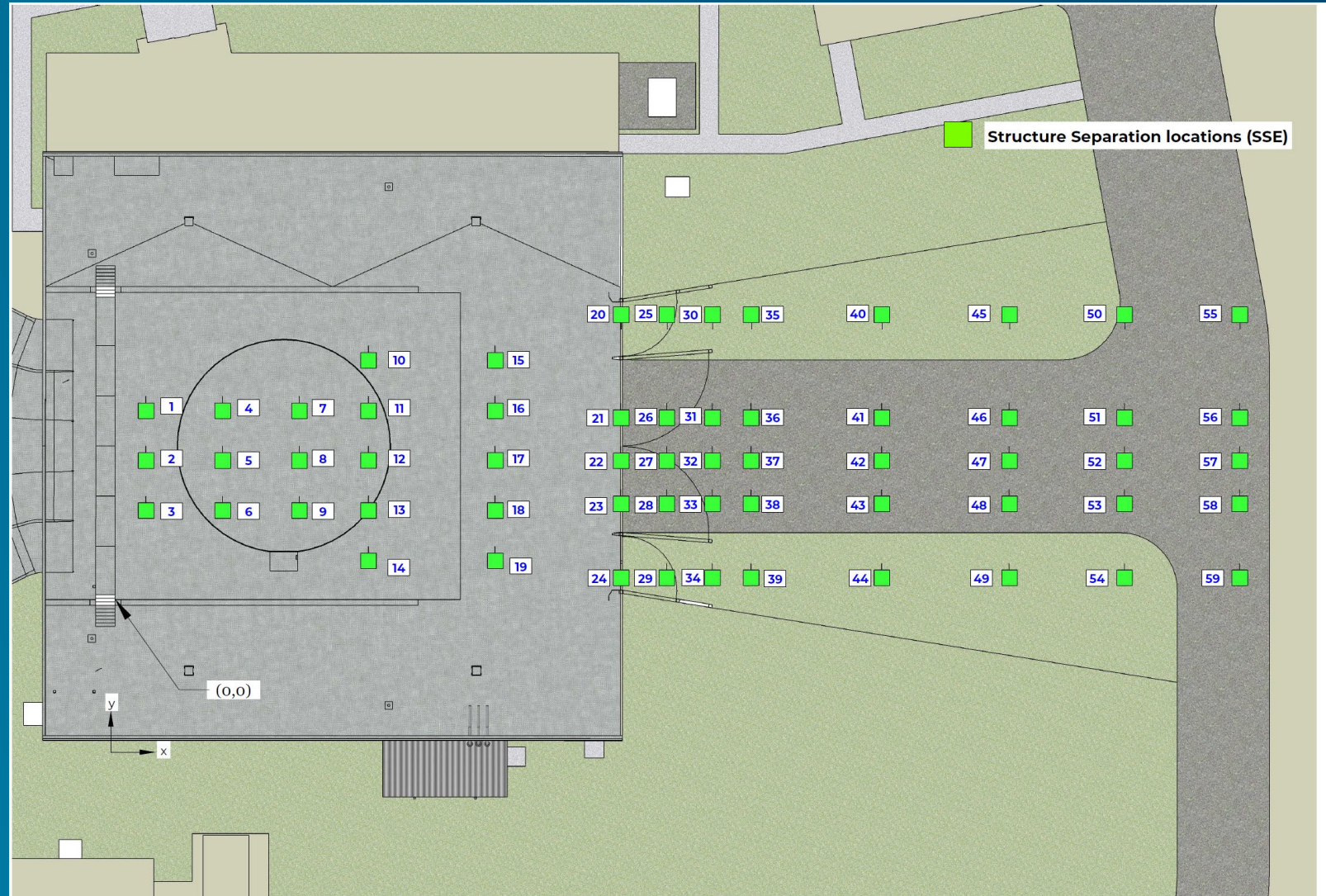
Methodology

Experiments

Measurement Results

Summary

Implications/ Implementation



Cold Flow Measurements

Introduction

Experimental
Design

Methodology

Experiments

Measurement
Results

Summary

Implications/
Implementation



Cold Flow Measurements

Introduction

Experimental
Design

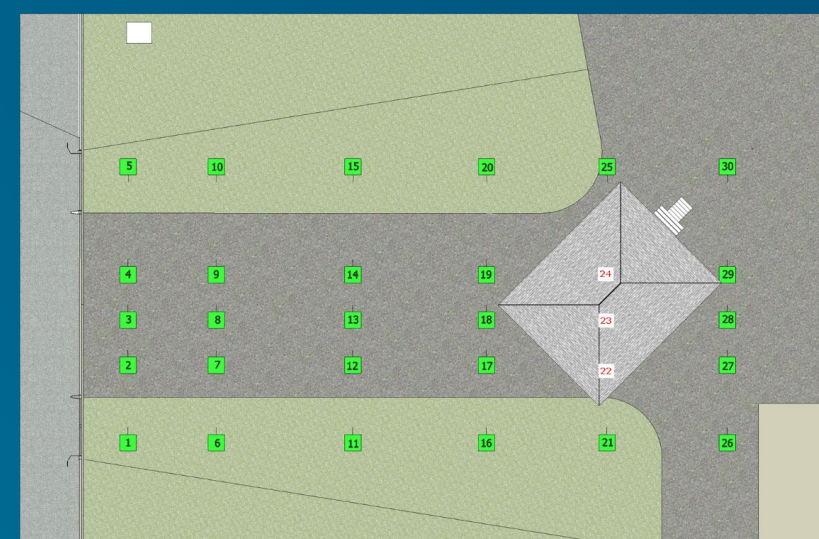
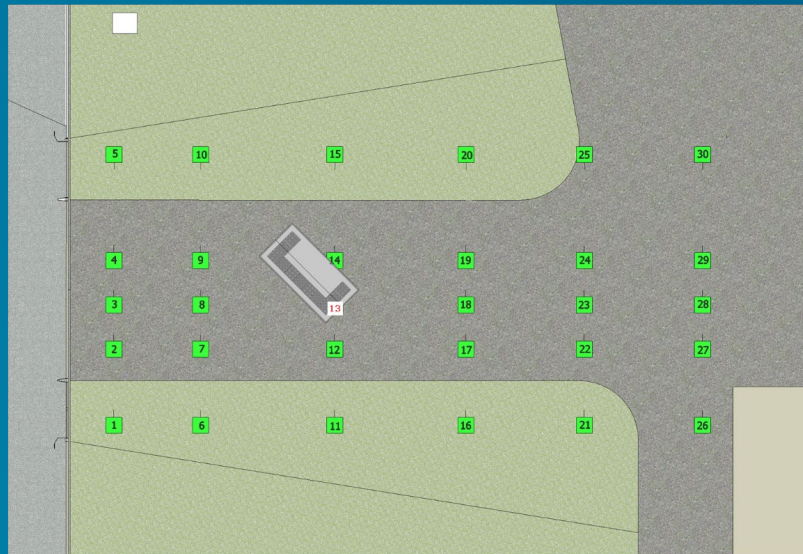
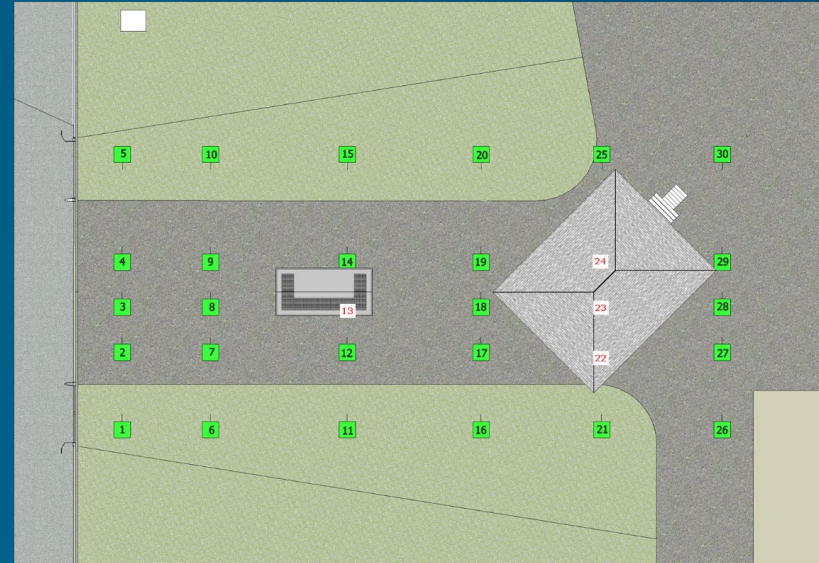
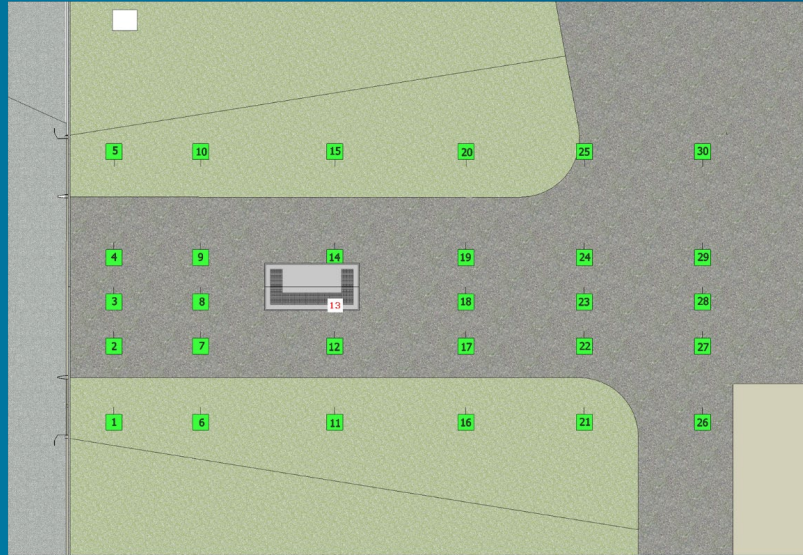
Methodology

Experiments

Measurement
Results

Summary

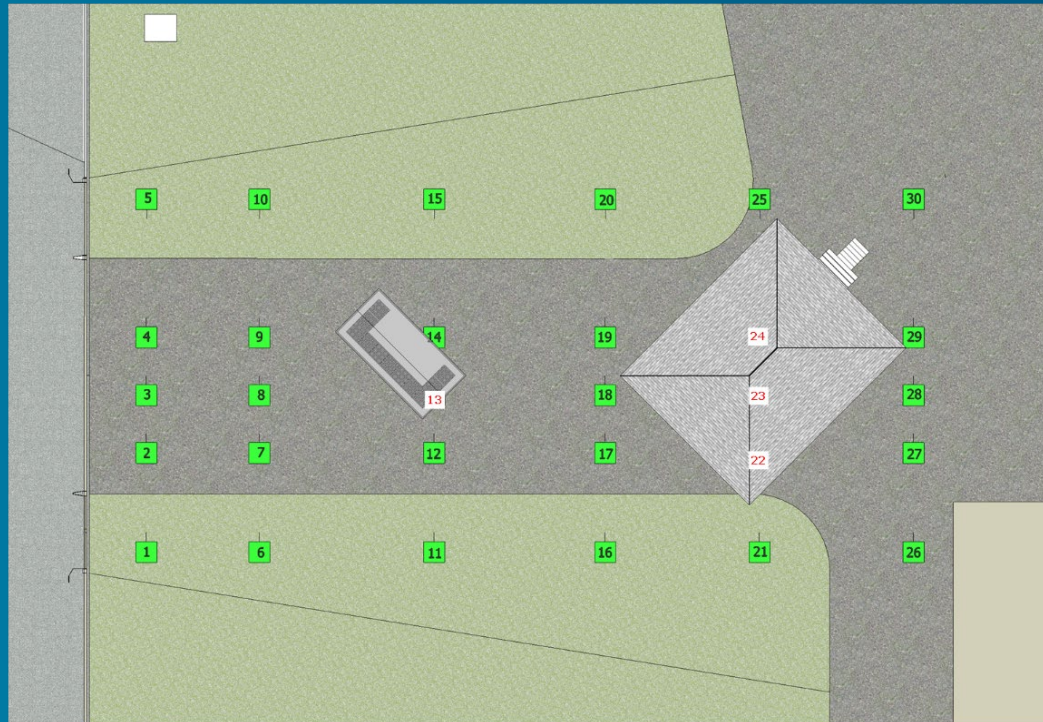
Implications/
Implementation



Cold Flow Measurements

Introduction

Experimental
Design



Methodology

Experiments

Measurement
Results

Summary

Implications/
Implementation



Cold Flow Measurements

Introduction

Experimental Design

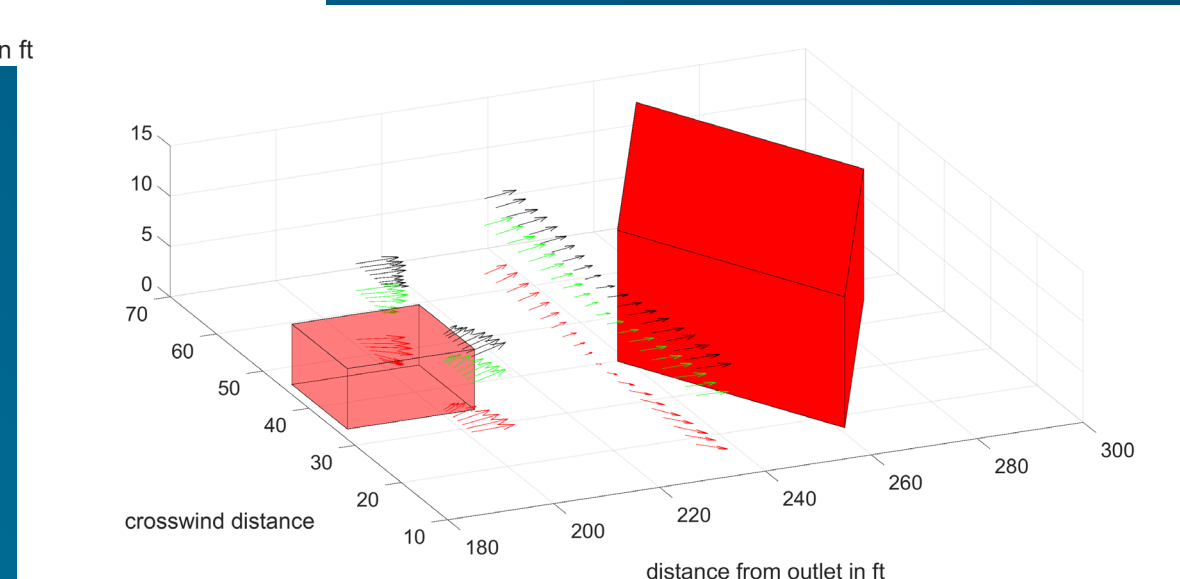
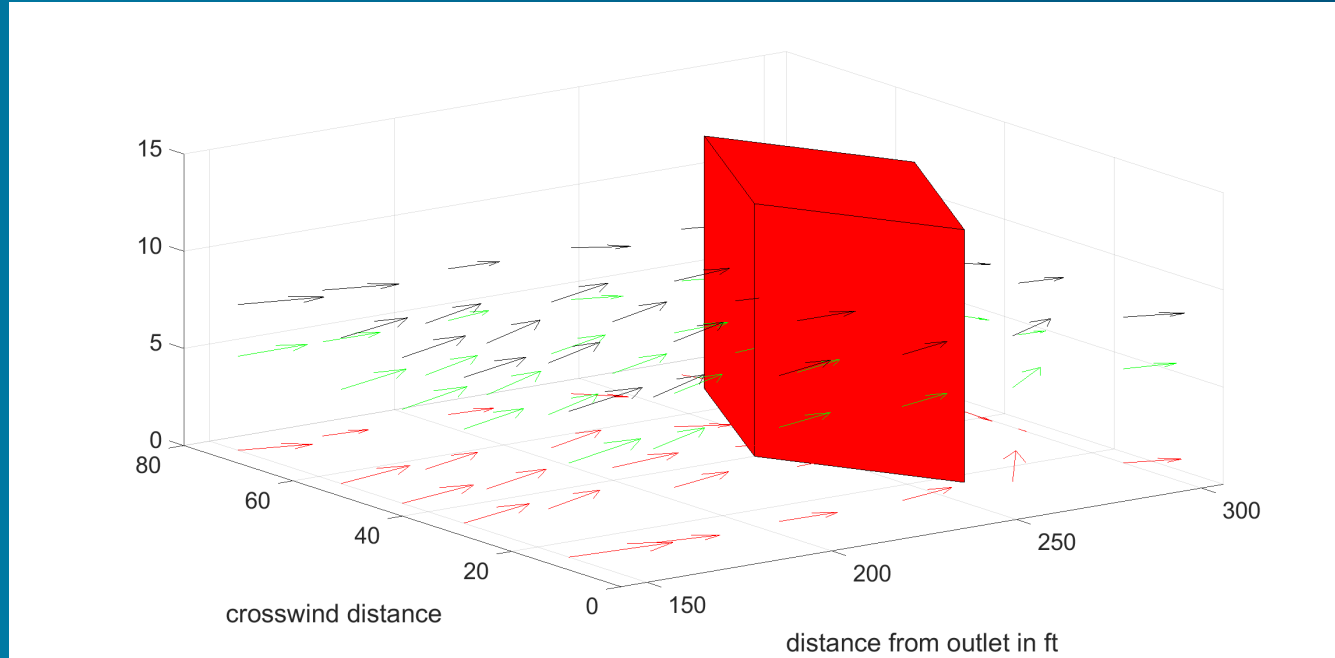
Methodology

Experiments

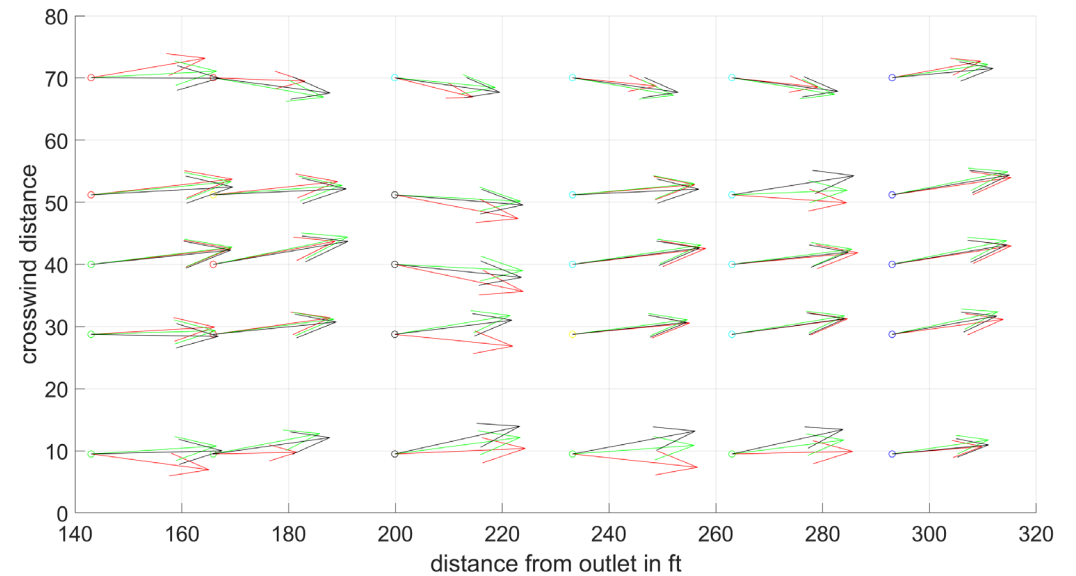
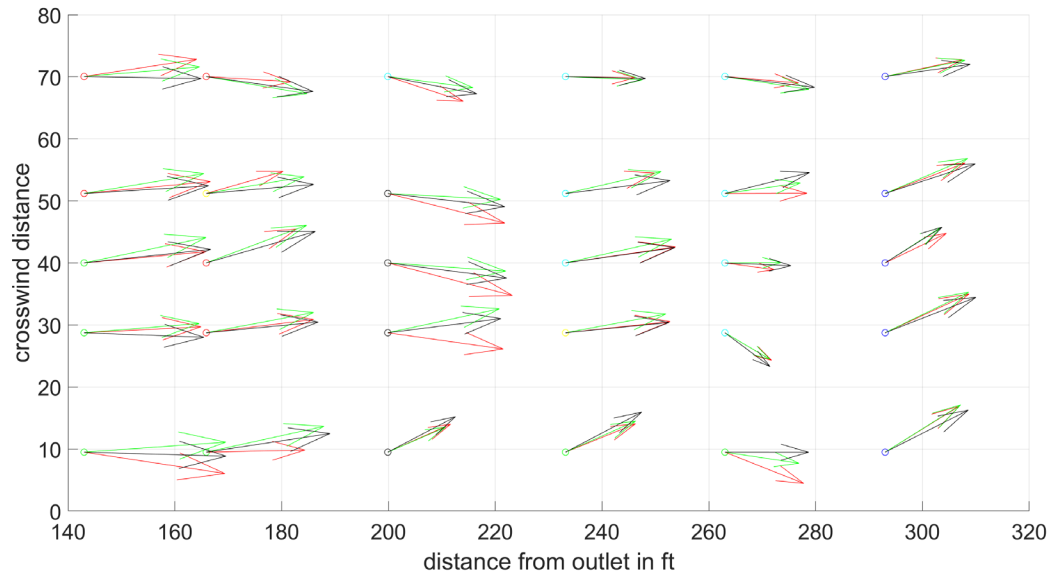
Measurement Results

Summary

Implications/ Implementation



Cold Flow Measurements



Introduction

Experimental
Design

Methodology

Experiments

Measurement
Results

Summary

Implications/
Implementation

Cold Flow Measurements

Introduction

Experimental
Design

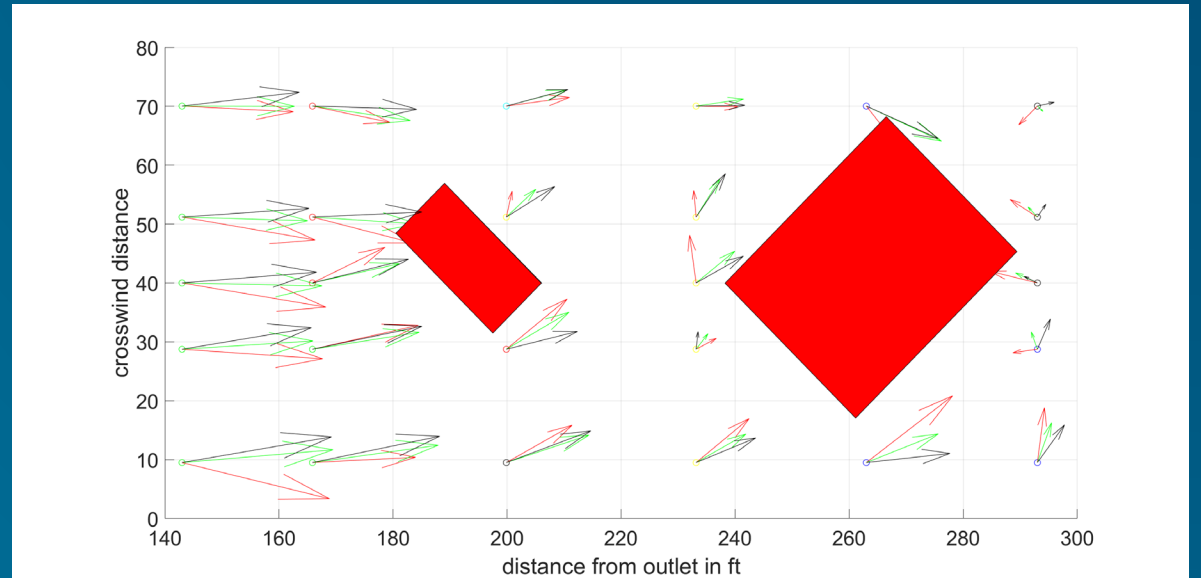
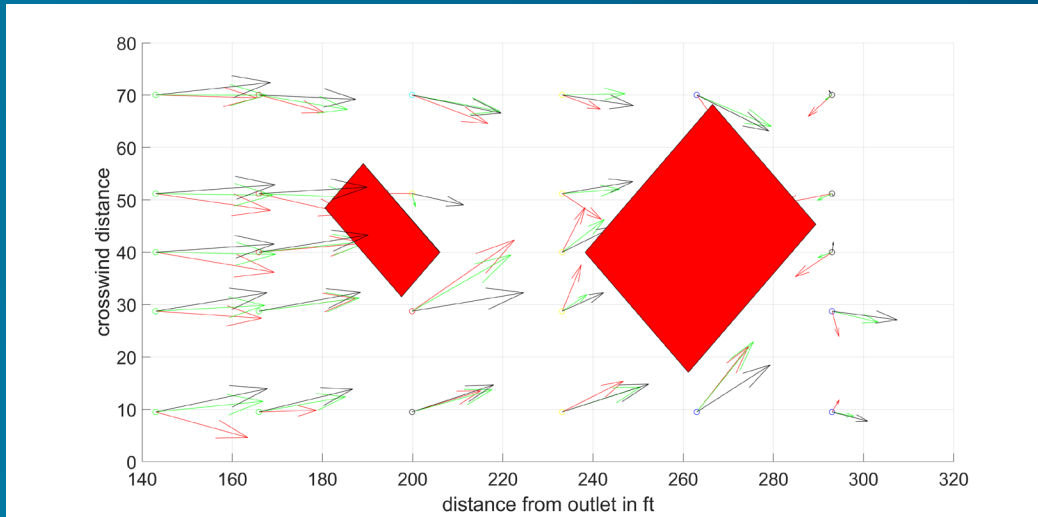
Methodology

Experiments

Measurement
Results

Summary

Implications/
Implementation



Cold Flow Measurements

Introduction

Experimental
Design

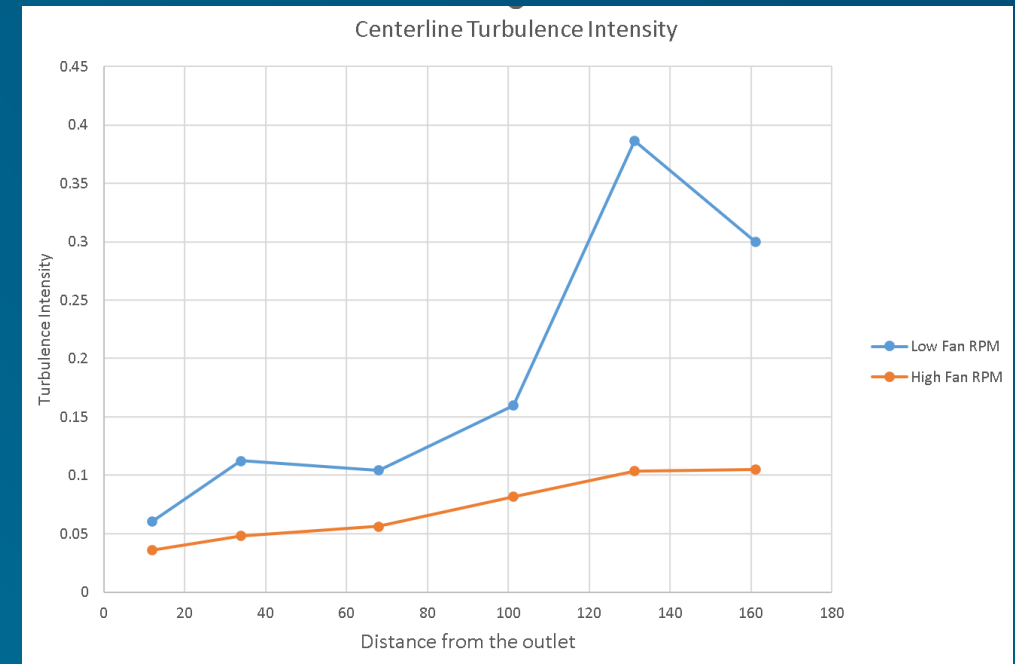
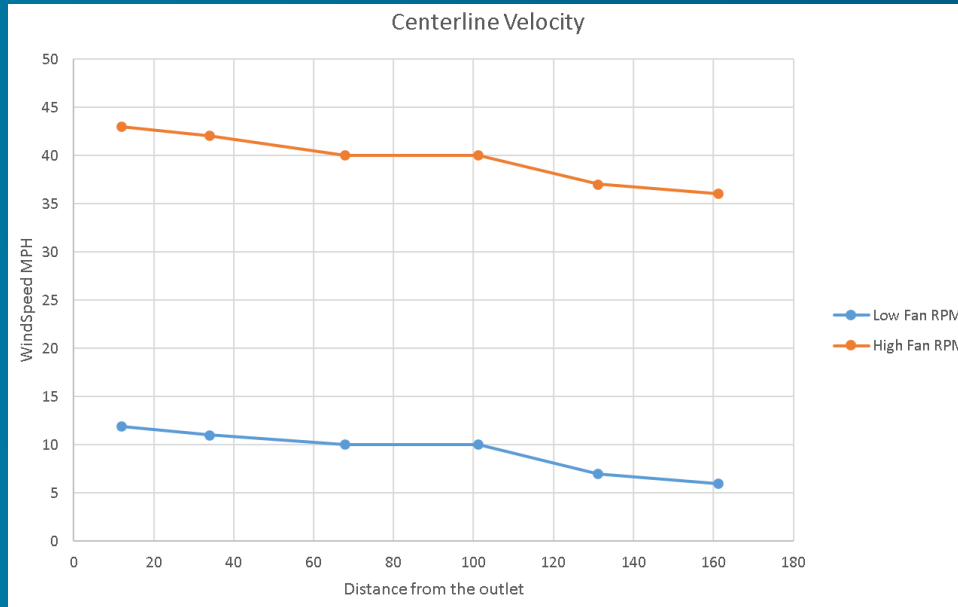
Methodology

Experiments

Measurement
Results

Summary

Implications/
Implementation



Acknowledgments

IBHS Operations:

Christopher Flynn
Shawn Macomber
Ross Maiden
David Trull
David McClain
Lee Ferrell
Will Dunn
Donald Chestnut
Justin Privette
Dave Welliver

IBHS Instrumentation:

Rick Baker
Conrad Estes
Lucas Faulkner
Ja'Juan Battles

IBHS Research:

Murray Morrison
Ian Giammanco
Christopher Gay

IBHS Media:

Amanda West
Christina Gropp
Courtney Schultz
Laurin Wilson
Sarah Dillingham
Aubrey Marcinko

Richburg Fire Department

Rossville Fire Department

Great Falls Fire Department

Questions?

Contact information:

Faraz Hedayati

fhedayati@ibhs.org

Daniel Gorham

dgorham@ibhs.org