Conflagration in Communities; Full Scale Experiments and Field Investigations

Faraz Hedayati

Lead Research Engineer

Insurance Institute for Business & Home Safety

Table 2. Contributing Factors

Natural Environment	The Built Environment	Humans
Topography	Structure density	Preparedness and mitigation
Climatology	Building materials	Ignition sources
Local Weather	Connective fuels	Fire service intervention
Wildland Fuels	Infrastructure	

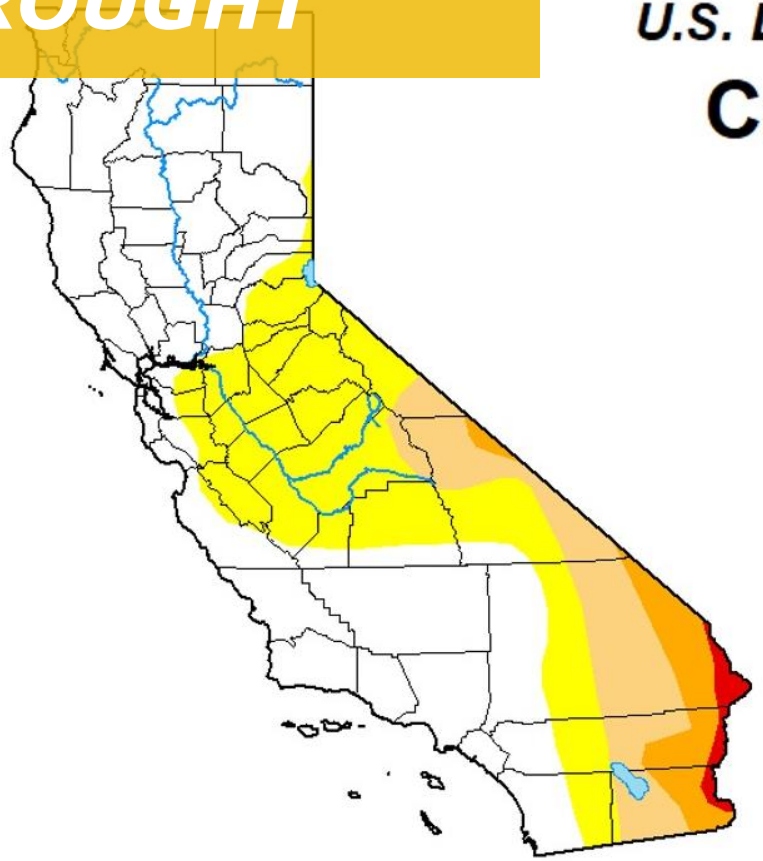
THE RETURN OF CONFLAGRATION IN OUR BUILT ENVIRONMENT

IBHS WILDFIRE RESEARCH REPORT
September 2023

Ian M. Giammanco, PhD
Faraz Hedayati, PhD
Steve R. Hawks
Xareni Sanchez Monroy, PhD
Evan Sluder

Insurance Institute for Business & Home Safety®

DROUGHT



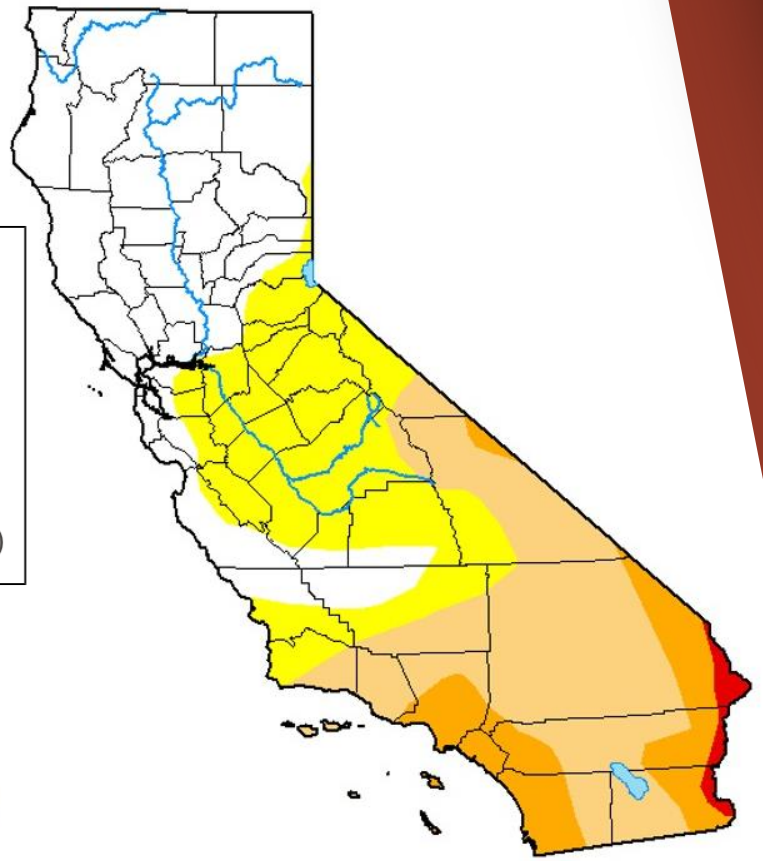
December 3, 2024
(Released Thursday, Dec. 5, 2024)
Valid 7 a.m. EST

U.S. Drought Monitor
California

- None
- **D0** (Abnormally Dry)
- **D1** (Moderate Drought)
- **D2** (Severe Drought)
- **D3** (Extreme Drought)
- **D4** (Exceptional Drought)

Author:
David Simeral
Western Regional Climate Center

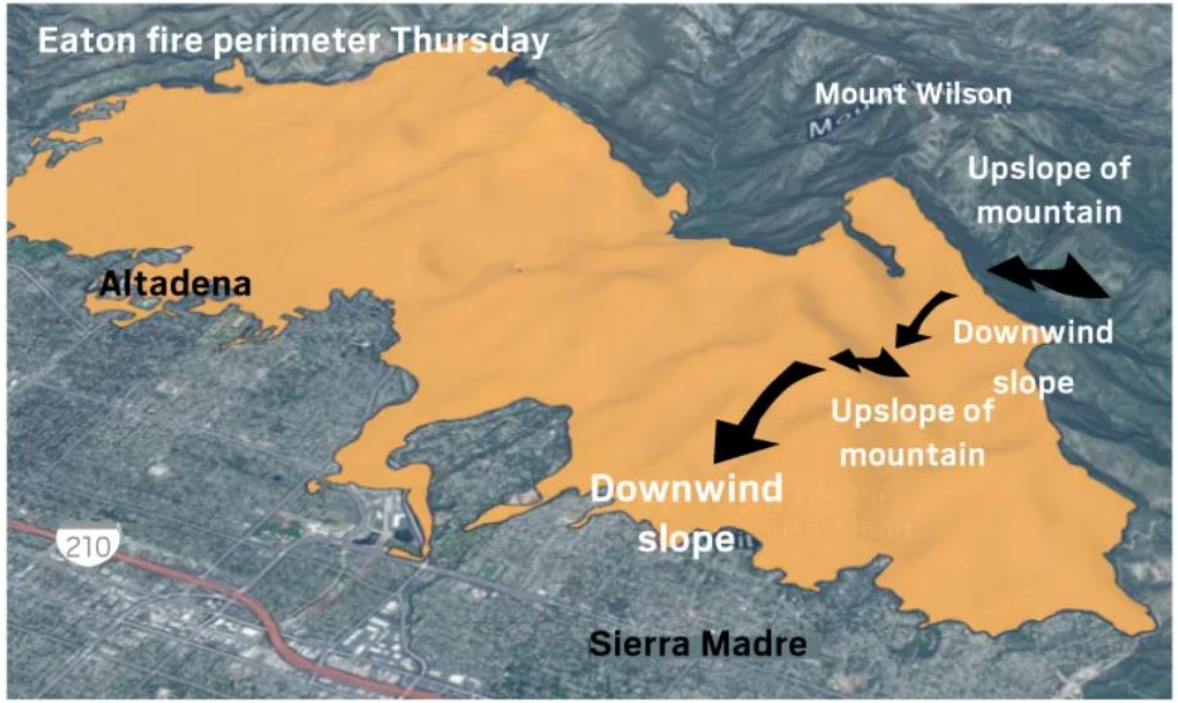
droughtmonitor.unl.edu



January 7, 2025
(Released Thursday, Jan. 9, 2025)
Valid 7 a.m. EST

By January 7, 2025, more than
5.8 million people
were living in areas classified as severe drought in LA County.

DOWNSLOPING WIND



COURTESY OF CAL FIRE

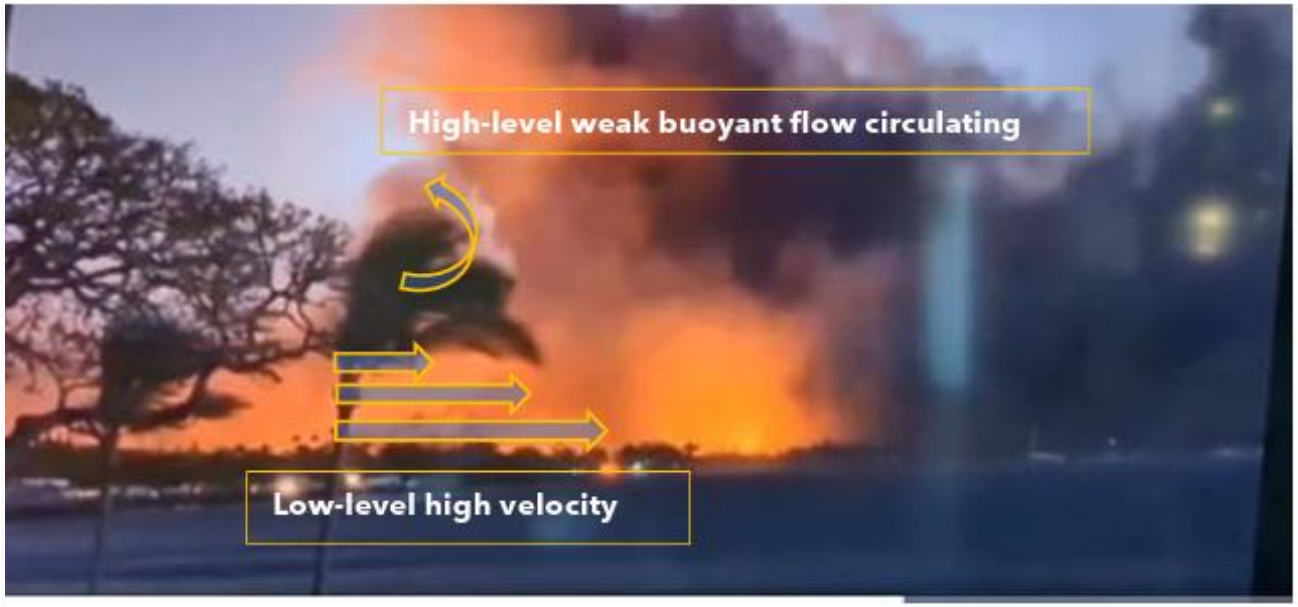


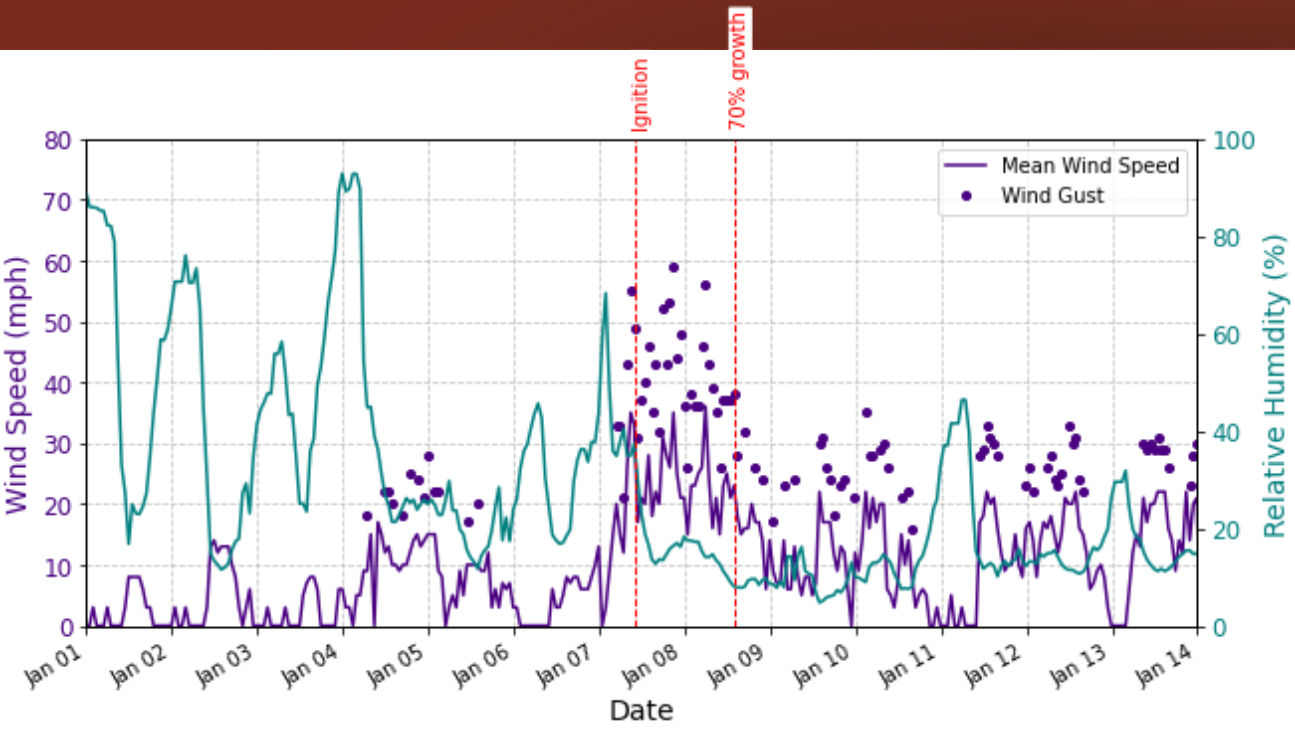
Figure 39. Frame from a publicly available video of the Lahaina Fire shows the impact of downsloping winds with annotations describing the wind flow added (Lareau, 2023).

EATON FIRE

LAHAINA FIRE

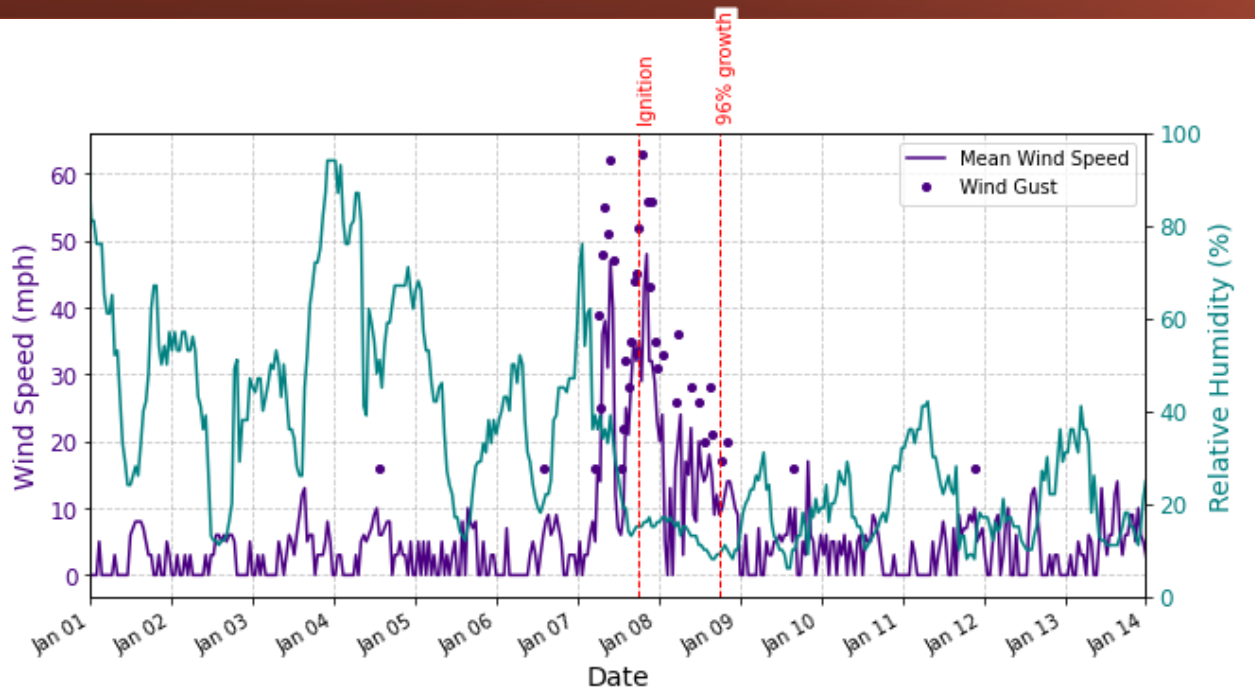
WIND

14 hours



PALISADES
Peak Gust: 75 mph

24 hours



EATON
Peak Gust: 65 mph

Table 2. Contributing Factors

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NO DAMAGE

COSMETIC DAMAGE

ENVELOPE DAMAGE

TOTAL LOSS

NO DAMAGE

COSMETIC DAMAGE

ENVELOPE DAMAGE

TOTAL LOSS

07/26/2022 AM 05:34:26

NO DAMAGE
COSMETIC DAMAGE
ENVELOPE DAMAGE
TOTAL LOSS
08/08/2022 AM

NO DAMAGE

COSMETIC DAMAGE

ENVELOPE DAMAGE

TOTAL LOSS

NO DAMAGE

COSMETIC DAMAGE

ENVELOPE DAMAGE

TOTAL LOSS

NO DAMAGE

COSMETIC DAMAGE

ENVELOPE DAMAGE

TOTAL LOSS

09/20/2022 AM 07:24:58

Extreme Wind Conditions

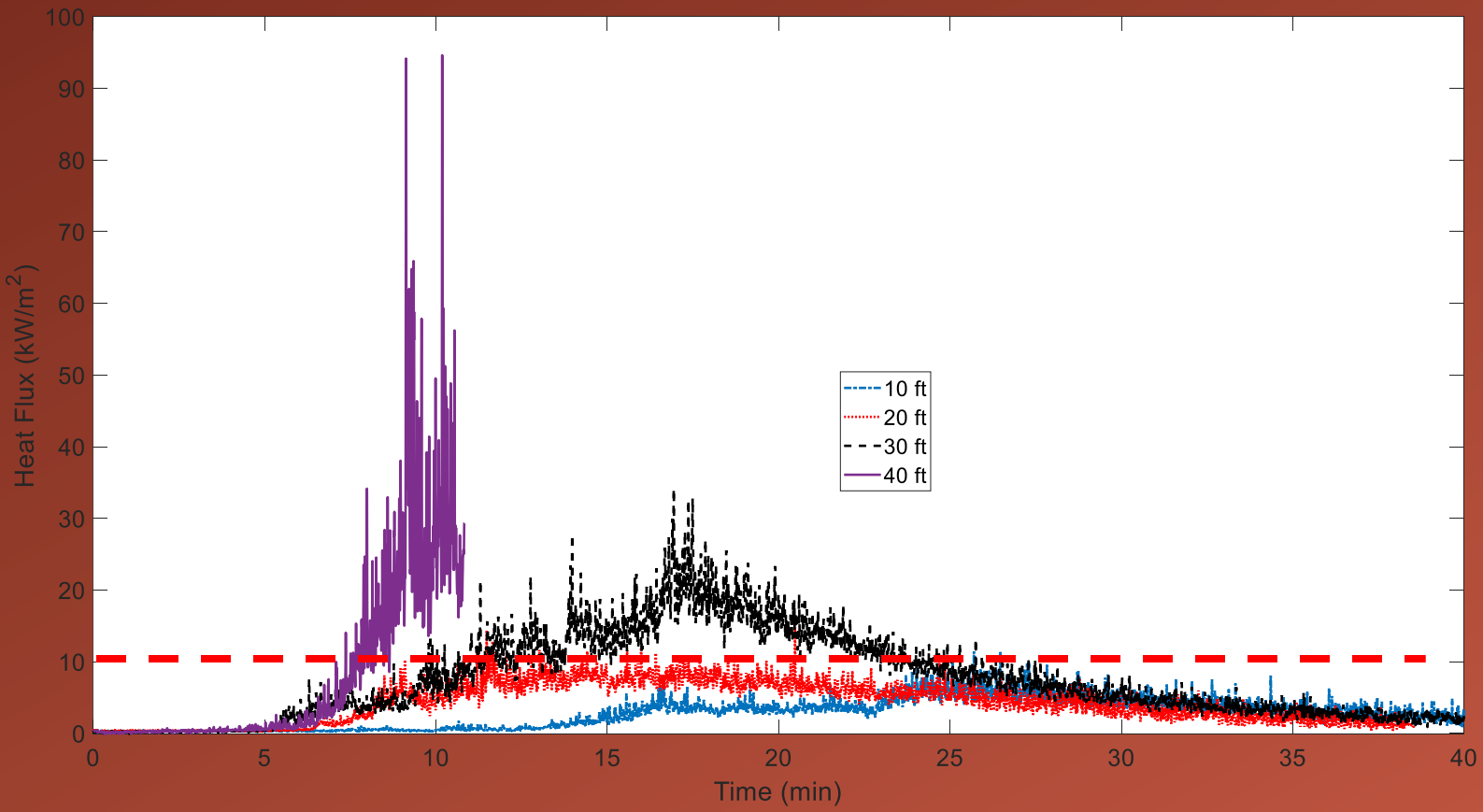
NO DAMAGE

COSMETIC DAMAGE

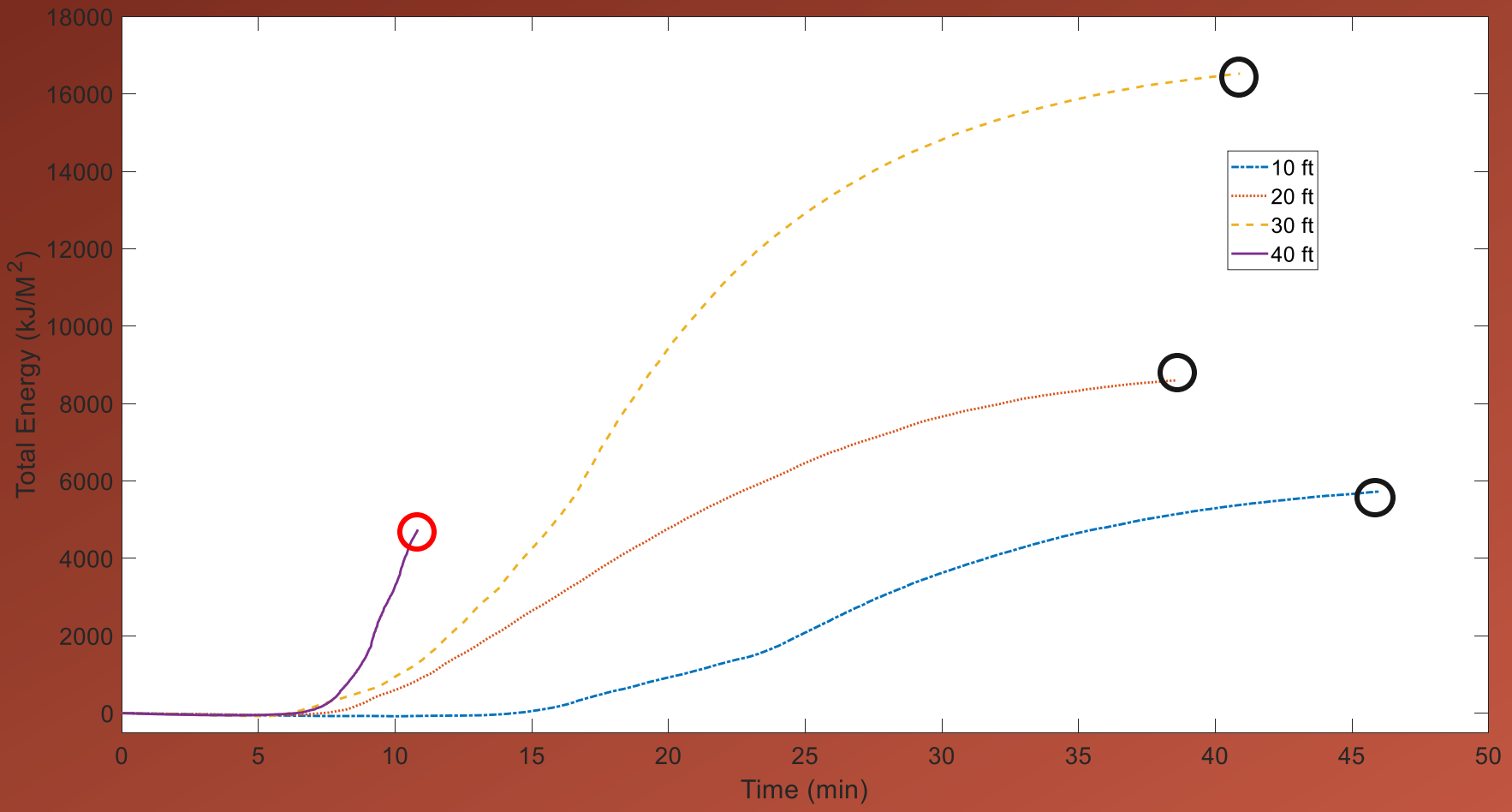
ENVELOPE DAMAGE

TOTAL LOSS

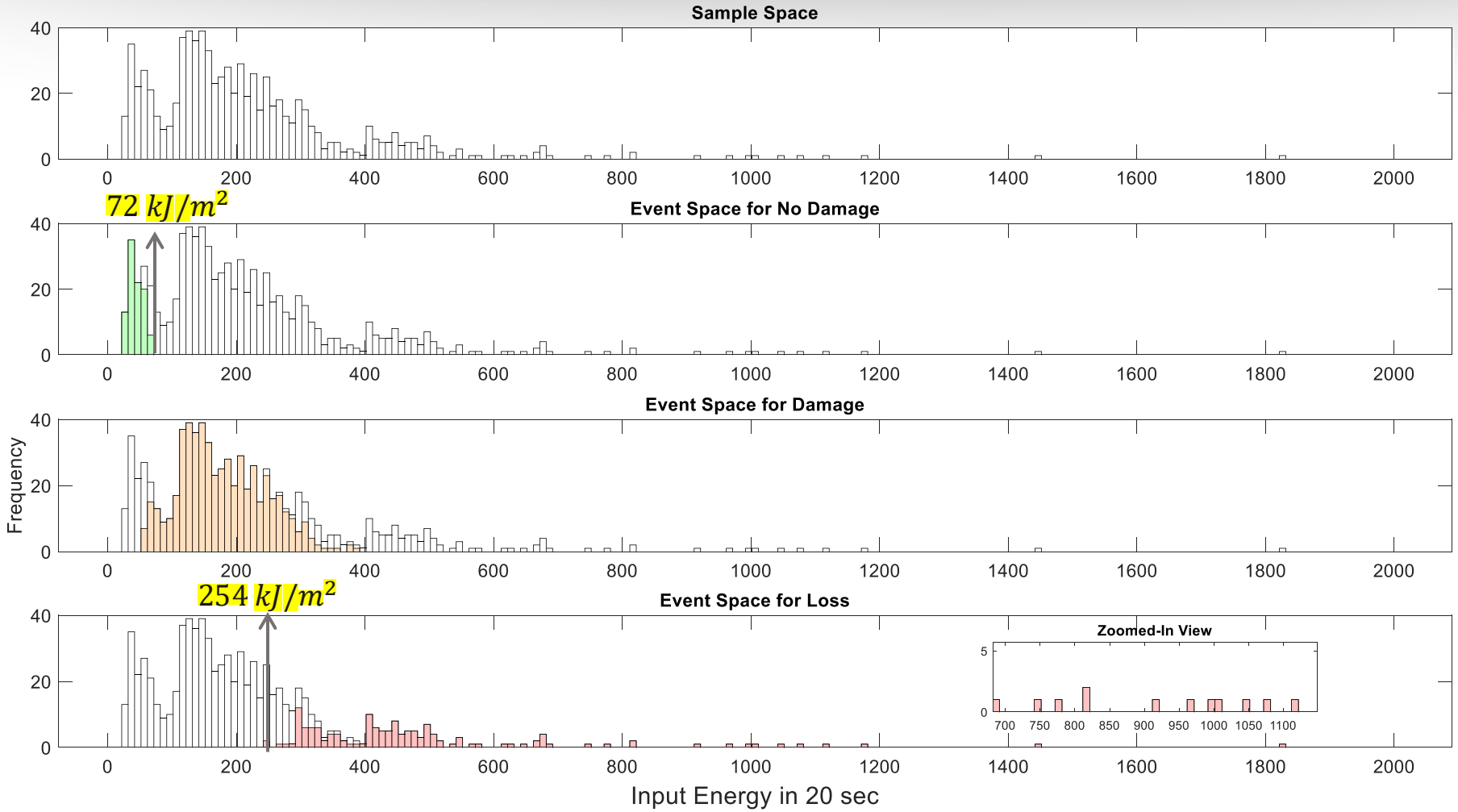
Choosing the Right Variable



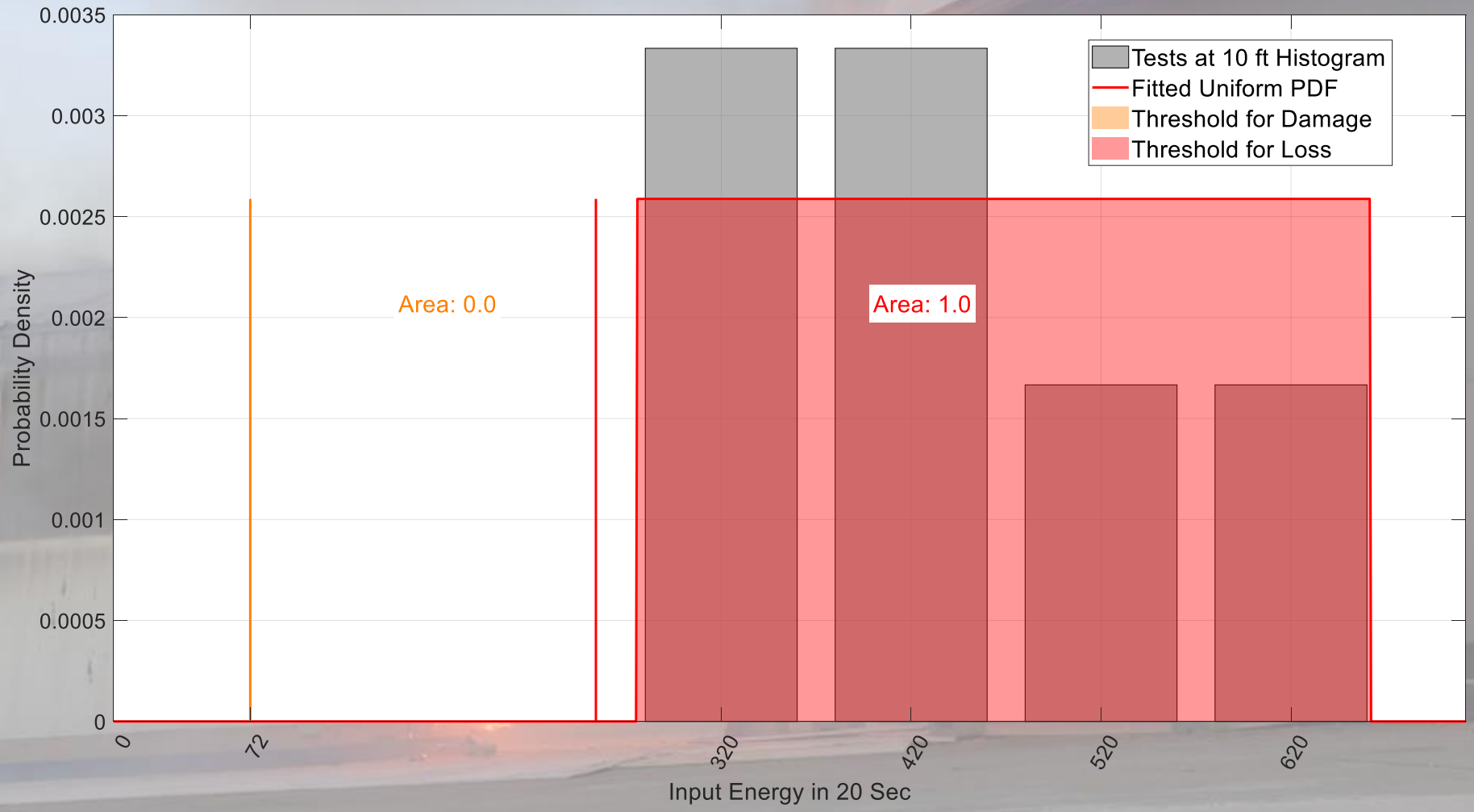
Choosing the Right Variable



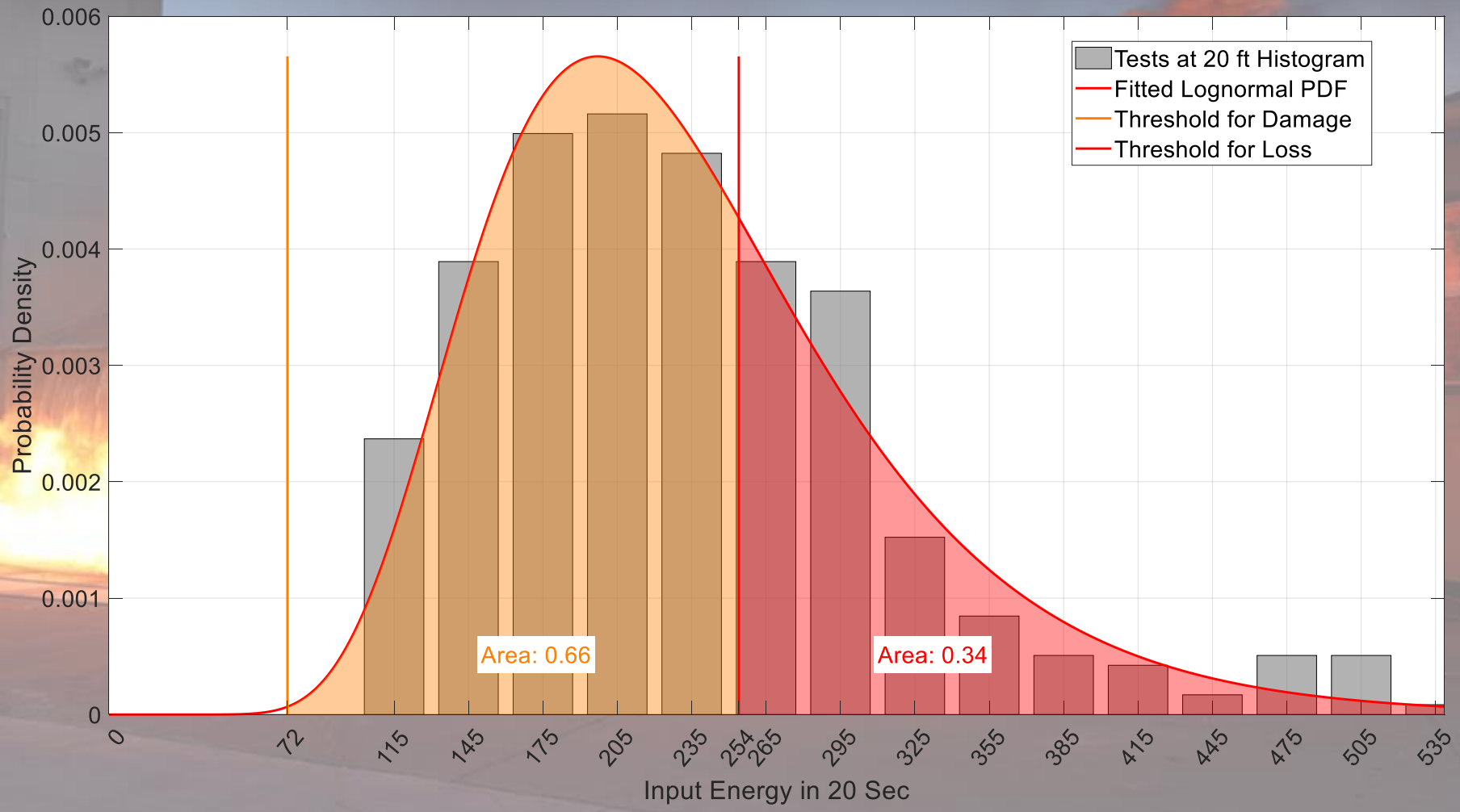
Sample and event spaces



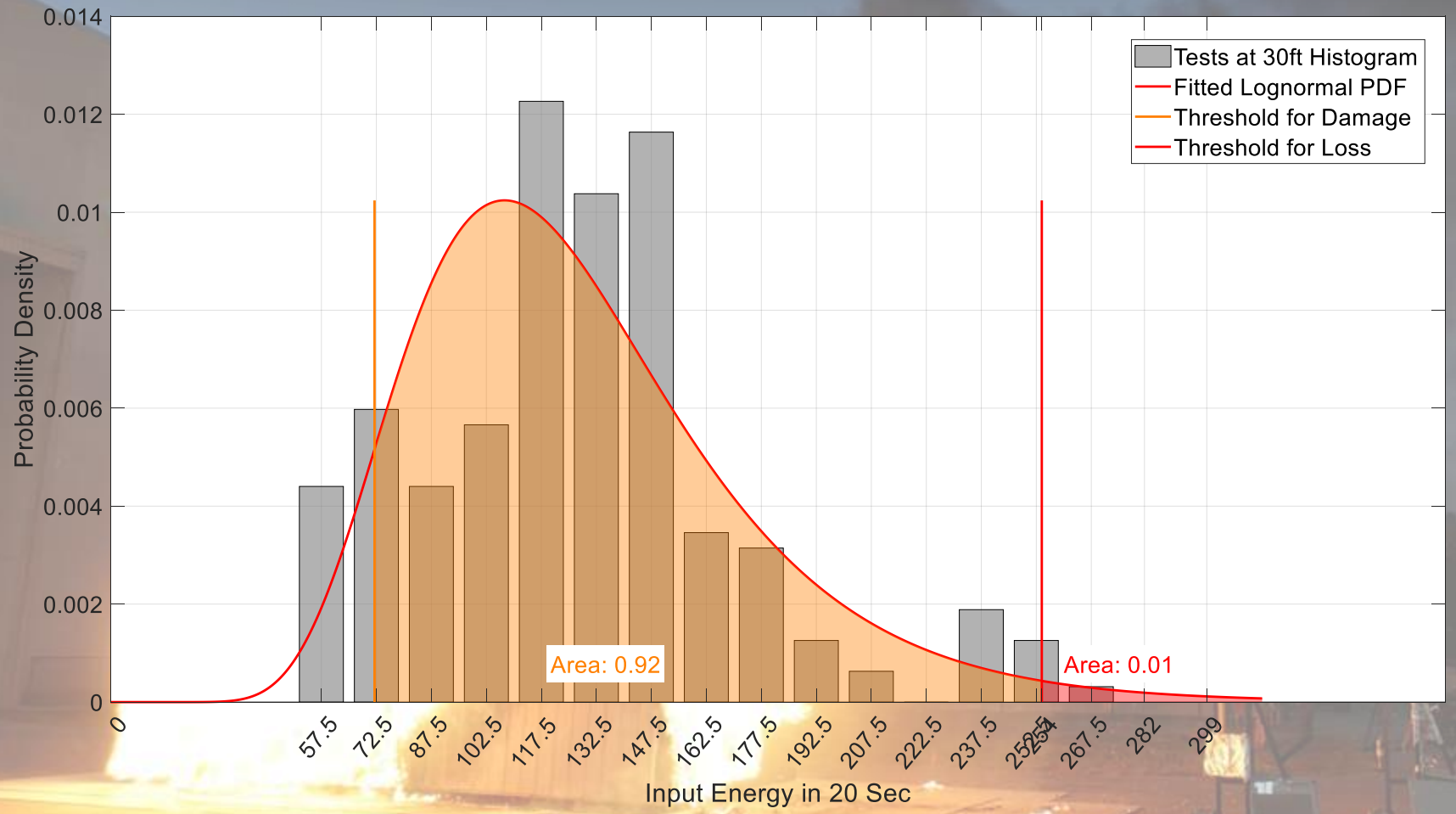
10 ft Separation



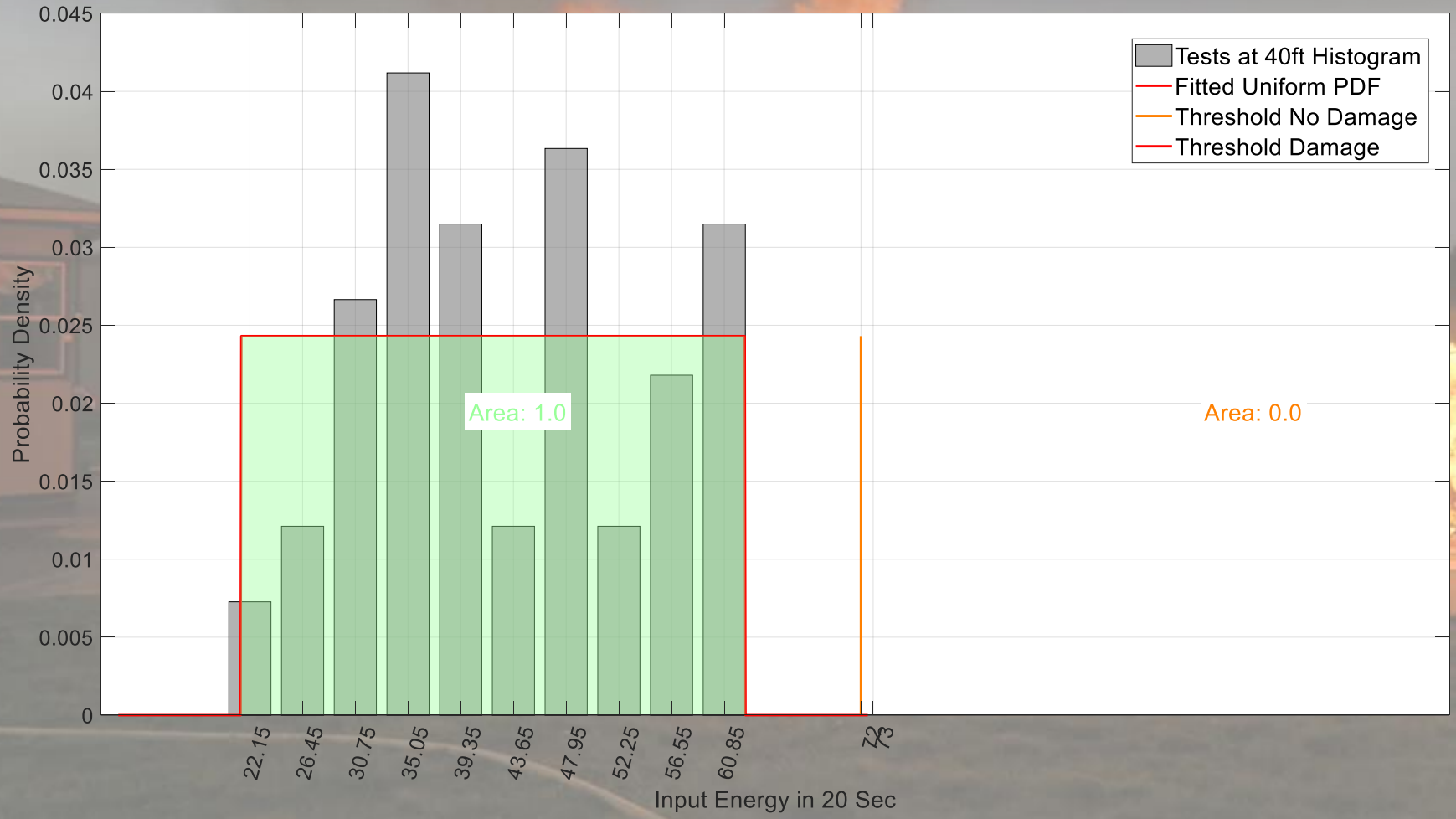
20 ft Separation



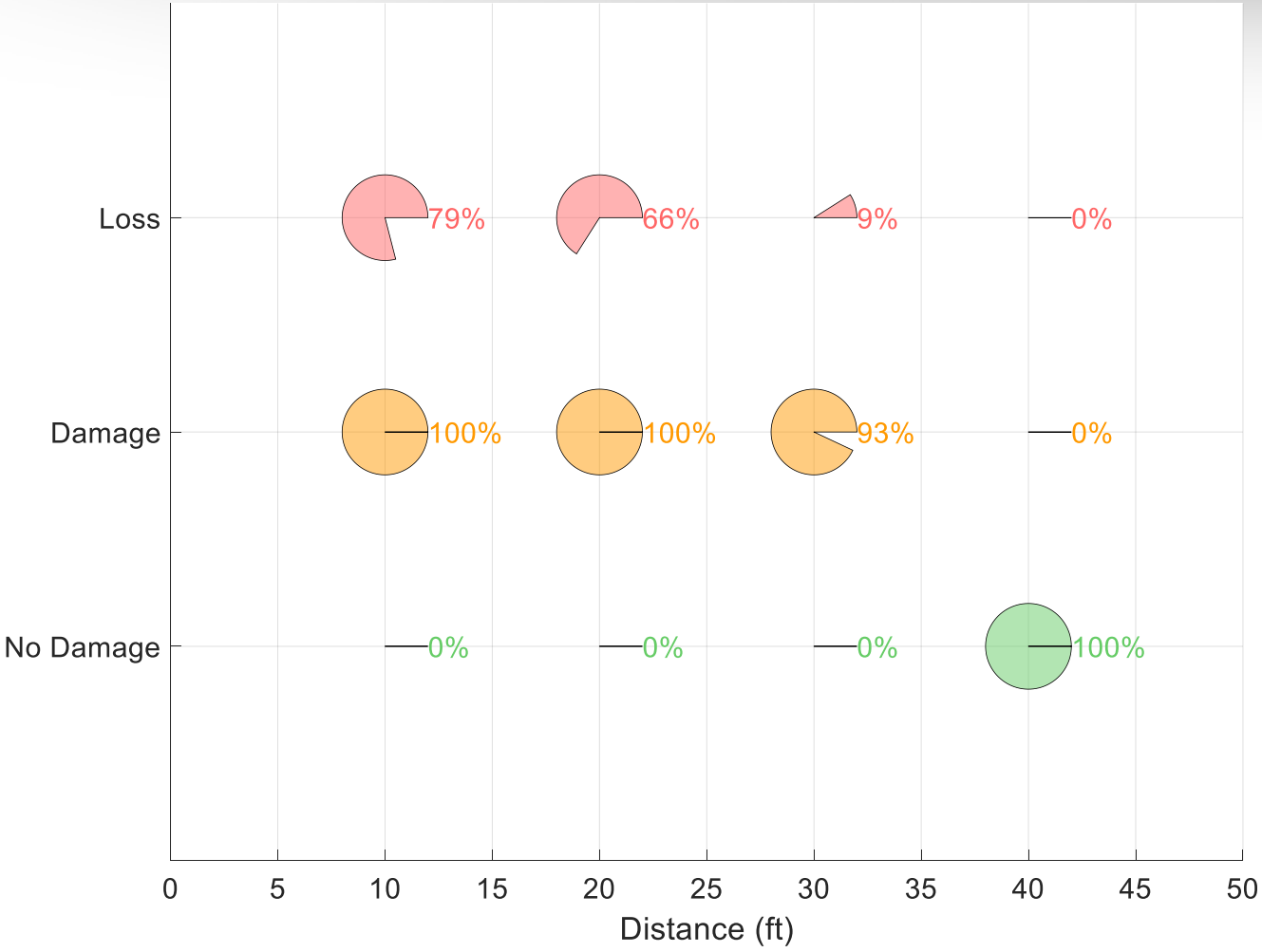
30 ft Separation



40 ft Separation



Likley Damage Modes at Varying Distances



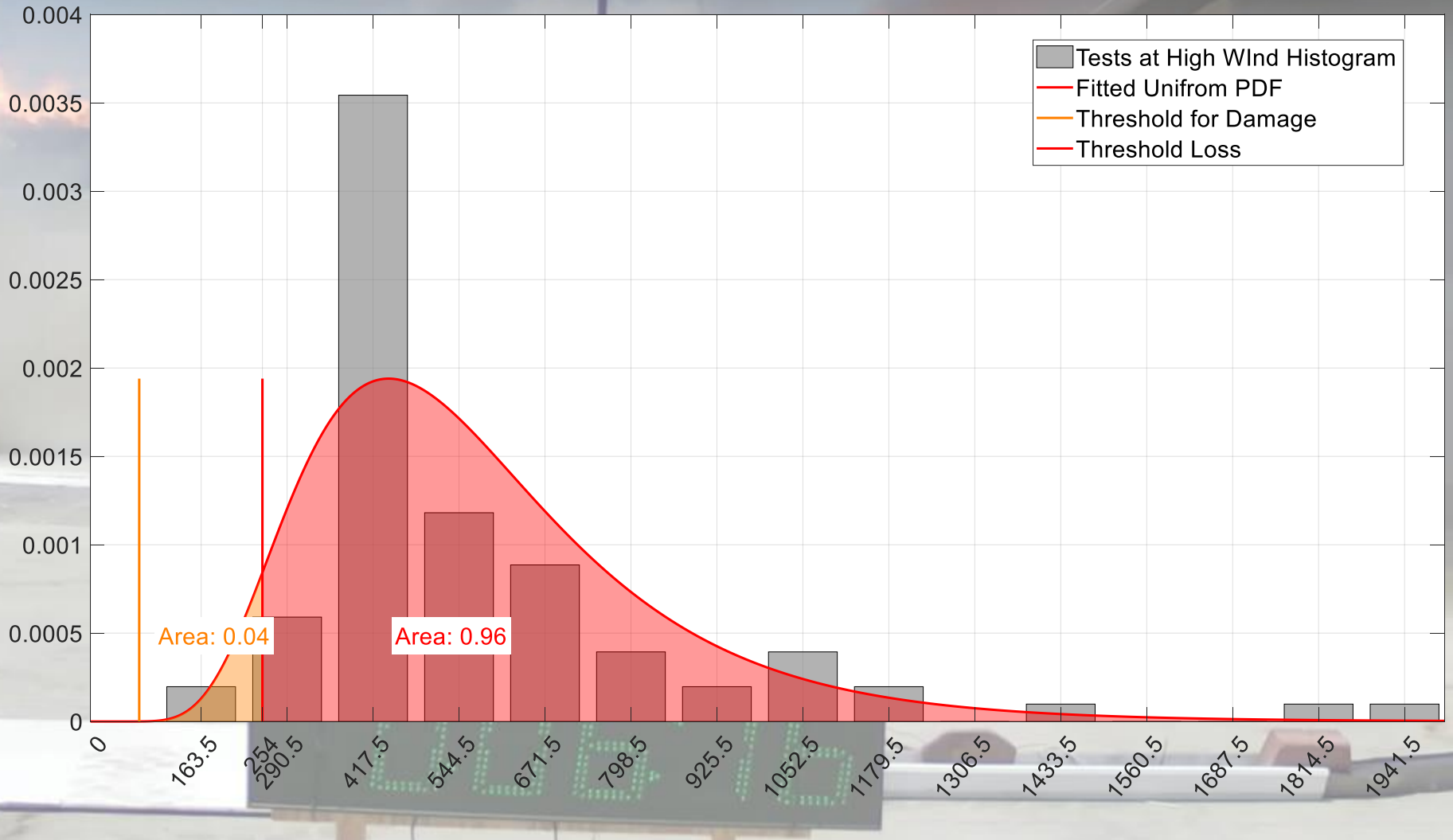
For fire intensities like a shed

For building materials like the target building

No connective fuels

Continuous downwind heating

High Wind Tests

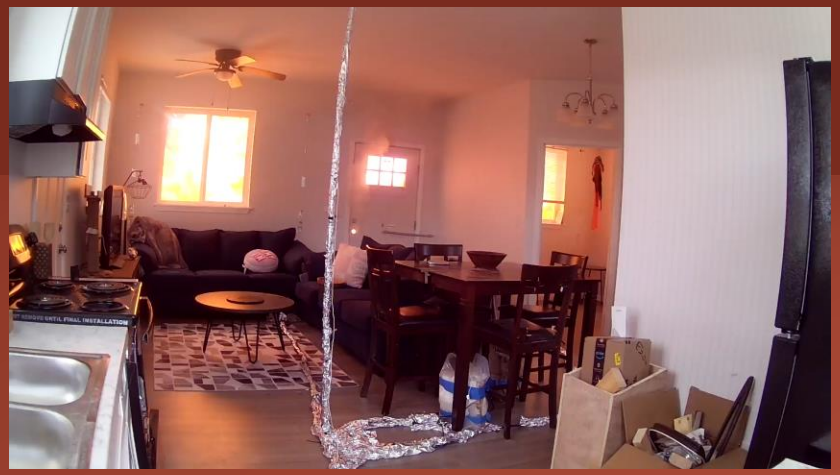


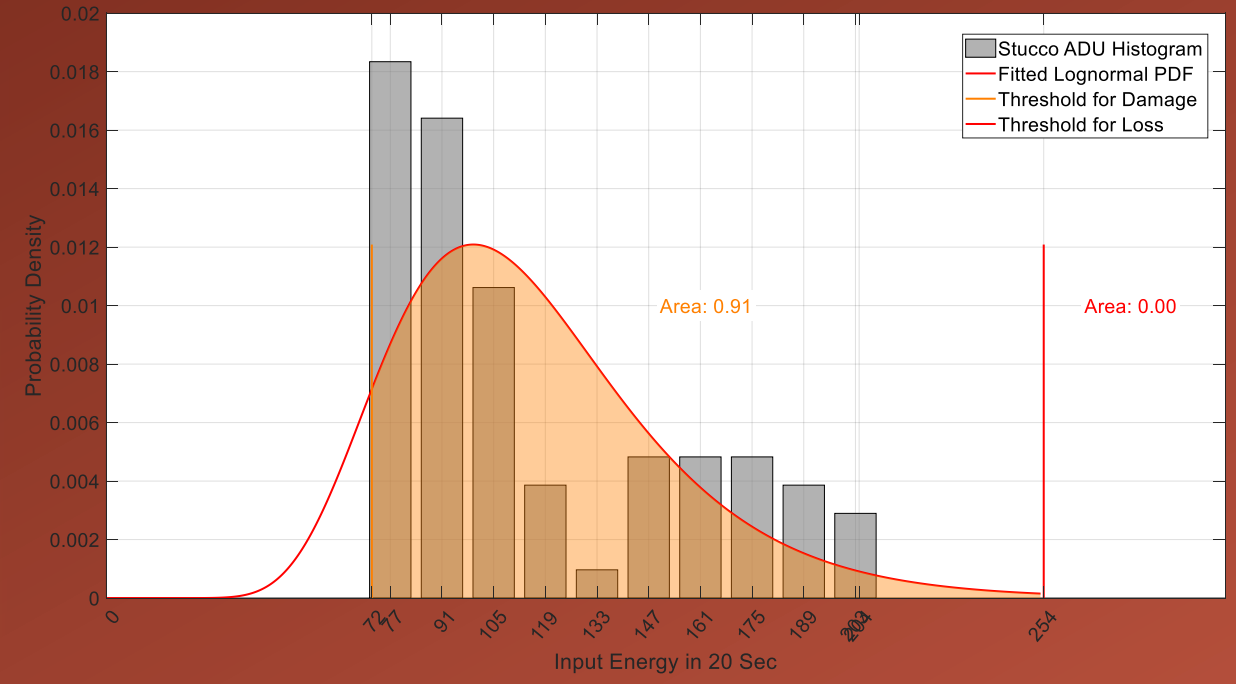
Point of Least Resistance

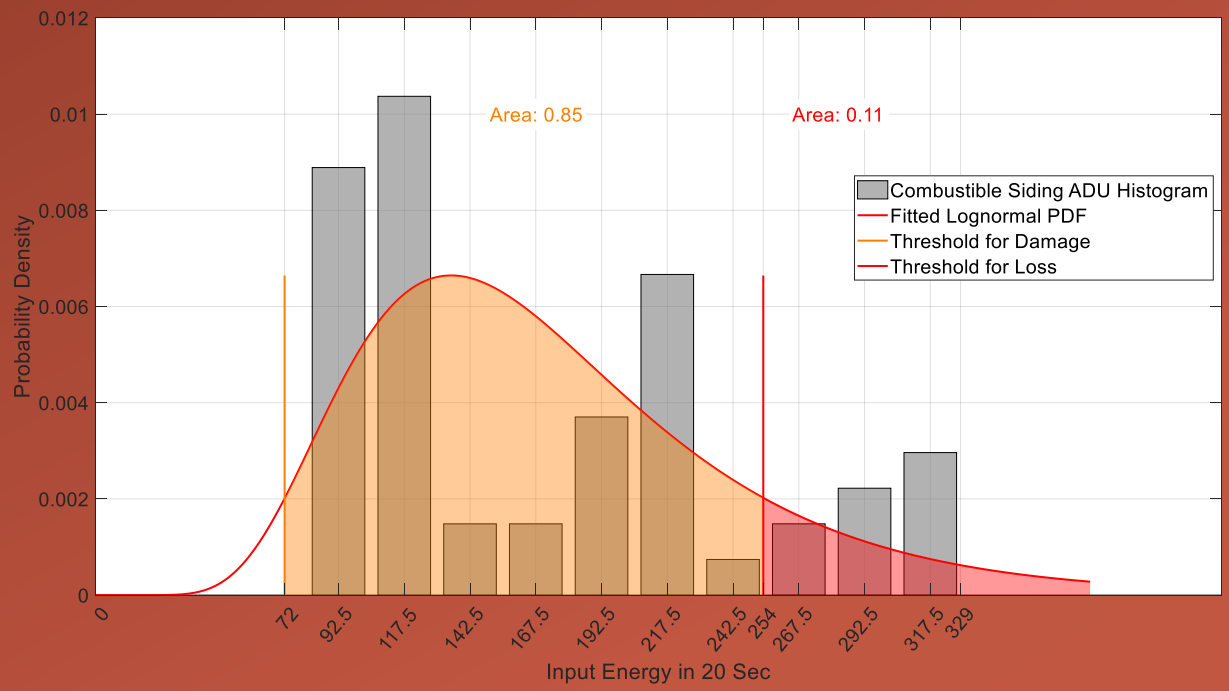
WOOD

FIBER CEMENT

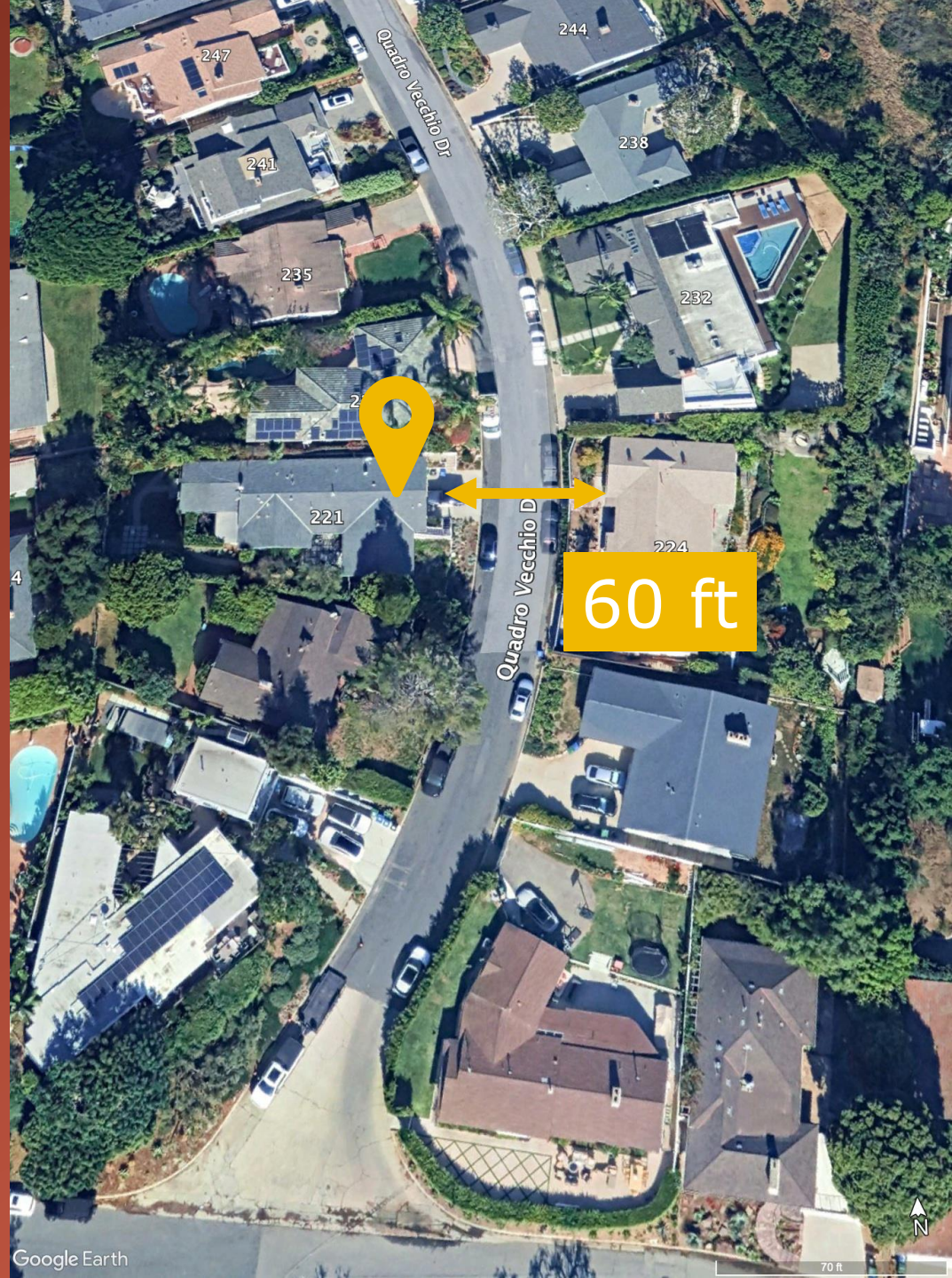
STUCCO




Stucco ADU Histogram
Fitted Lognormal PDF
Threshold for Damage
Threshold for Loss
Area: 0.91
Area: 0.00
Probability Density
Input Energy in 20 Sec
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
0
72
77
91
105
119
133
147
161
175
189
254

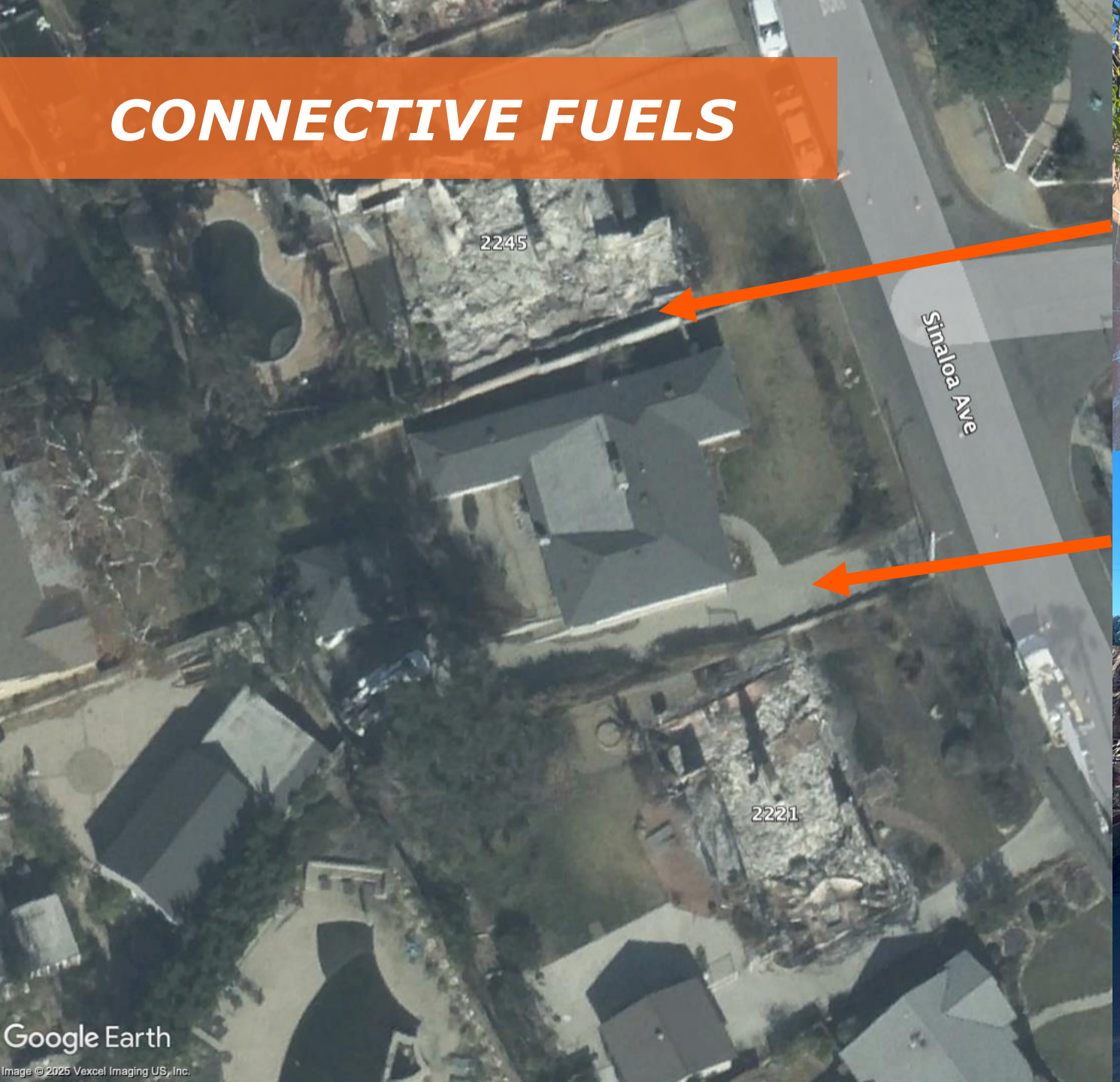

Combustible Siding ADU Histogram
Fitted Lognormal PDF
Threshold for Damage
Threshold for Loss
Area: 0.85
Area: 0.11
Probability Density
Input Energy in 20 Sec
0.012
0.01
0.008
0.006
0.004
0.002
0
0
72
92.5
117.5
142.5
167.5
192.5
217.5
242.5
254
267.5
292.5
317.5
329

STRUCTURE SEPARATION



CONNECTIVE FUELS

CONNECTIVE FUELS

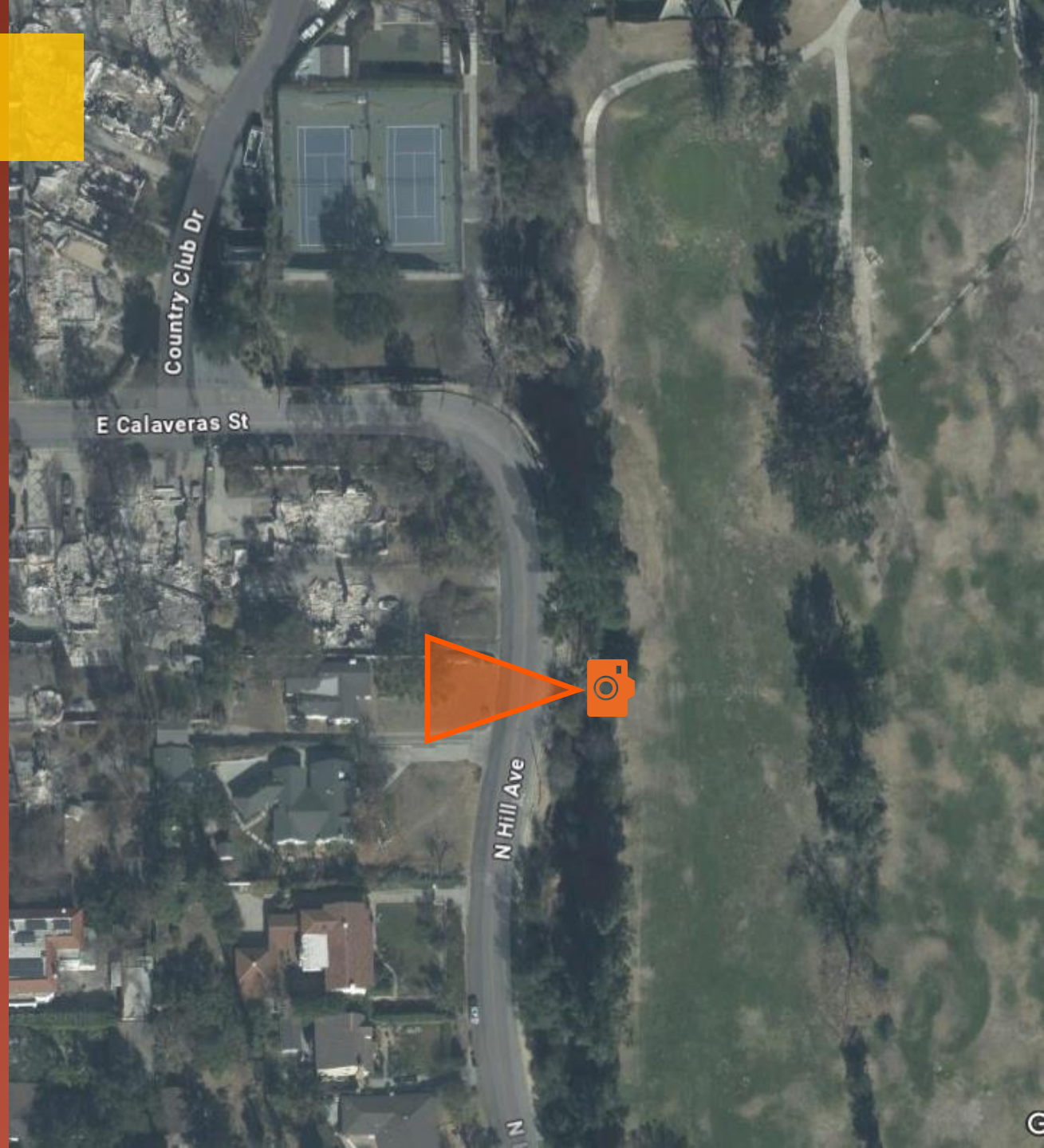


CONNECTIVE FUELS: *TRASH CANS*

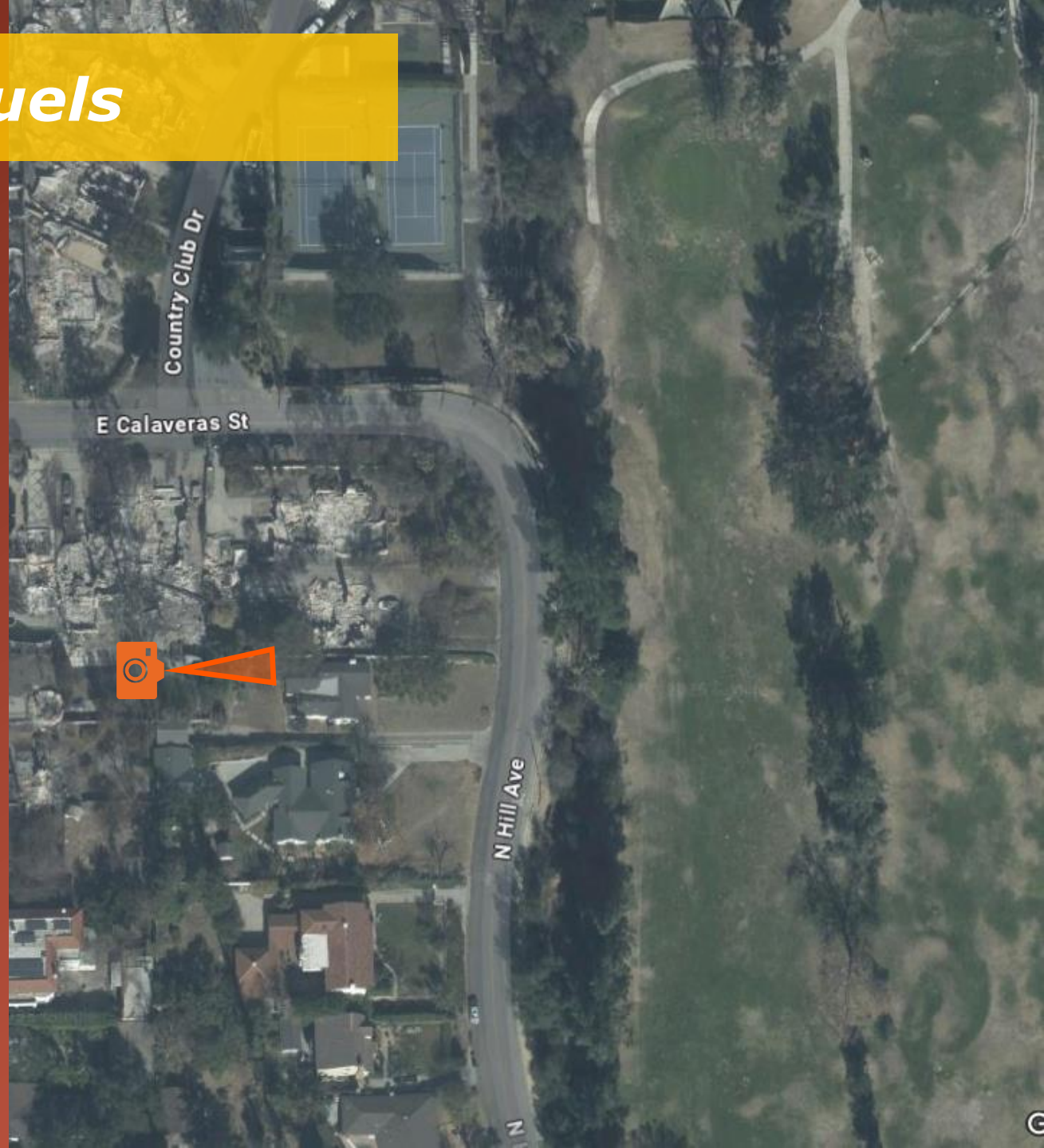
CONNECTIVE FUELS: *HOT TUBS*

CONNECTIVE FUELS: *Zone 0*

Case Study: *Eaton Fire*

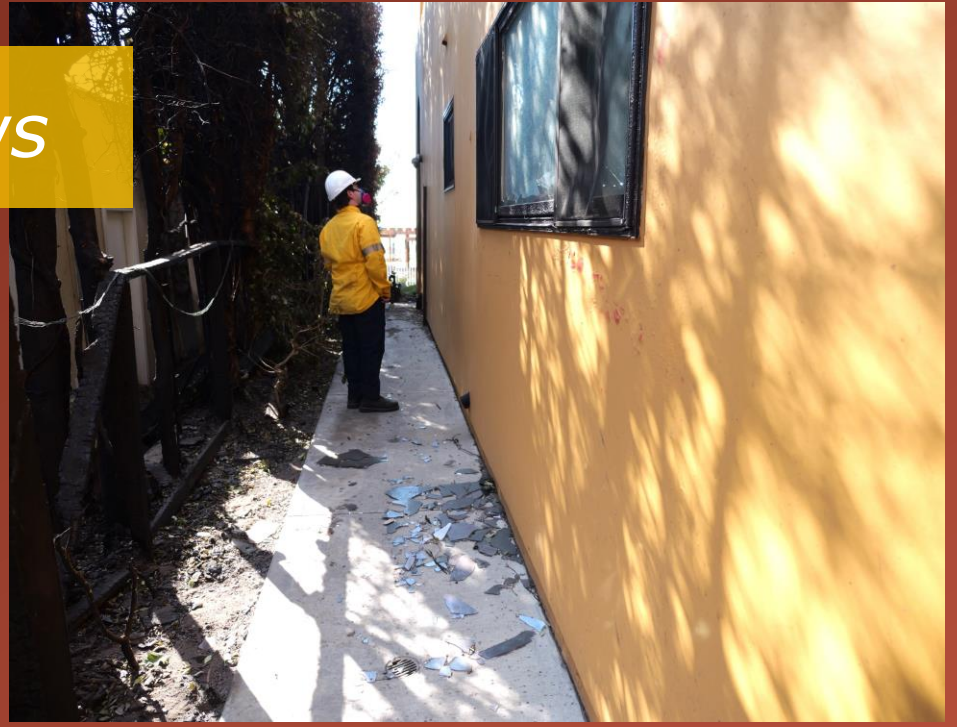


Case Study: Connective Fuels



BUILDING MATERIALS: *6-Inch Vertical Clearance*

BUILDING MATERIALS: *Windows*



TUESDAY, AUGUST 8, 2023

6:37 AM: Brush Fire reported

3:54 PM: Rekindle

Waikuli Terrace Park
Kahoma Stream
Mala Ocean Tavern
Temporarily closed
Safeway
Kihei Caffe Lahaina
Maui Chocolate Tour
Keawe St Ext
Lāhainā Bypass
Keawe St
Westside Foreign Auto Repair
Banyan Tree Divers Maui
Lāhainā Jodo Mission
Lahaina
Launiupoko Ditch
Princess Nāhi'ena'ena Elementary School
Lāhainā Intermediate School
P13
Lahainaluna Mission Cemetery
Play court
Kanaha Stream
Kanaha Stream
Paupau Ditch
Piilani Ditch
Pilani Ditch
Lahainaluna Ditch
Ku'ia Agricu
Education Center
Outlets of Maui
Temporarily closed
808 Grindz Cafe
Kimo's Maui
Temporarily closed
Maria Lanakila Catholic Church
Fleetwood's on Front St
Temporarily closed
Down the Hatch Maui
Temporarily closed
Hale Pa'ahao Prison
Lahaina Harbor
Kamehameha Iki Park
Maui Ku'ia Estate Cacao Farm
3000
Google
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TUESDAY, AUGUST 8, 2023

7:30 PM: Ember-Driven Ignitions

6:37 AM: Brush Fire reported

4:51 PM: Homes burning on Front St.

3:54 PM: Rekindle

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Ainakea Rd
Malolo Pl
Kahoma St
Kahoma St
Google Earth
N
40 ft
~9:30pm

Ainakea Rd
Malolo Pl
Kahoma St
Hiki Pl
Ainakea Rd
Ainakea Rd
RS carpet cleaning
Nahale St
~10 pm

Ainakea Rd
Malolo Pl
Kahoma St
Hiki Pl
Ainakea Rd
Ainakea Rd
RS carpet cleaning
Nahale St
~11 pm

Ainakea Rd
Malolo Pl
Kahoma St
Kahoma St
Hiki Pl
Ainakea Rd
Ainakea Rd
RS carpet cleaning
Nahale St
Structural Embers
~12:00am
2023-08-09 03:05:01

Ainakea Rd
Malolo Pl
Kahoma St
Hiki Pl
Kahoma St
Ainakea Rd
Ainakea Rd
RS carpet cleaning
Nahale St

Ainakea Rd
Malolo Pl
Kahoma St
Hiki Pl
Ainakea Rd
Kahoma St
Ainakea Rd
Nahale St
~12:30 am

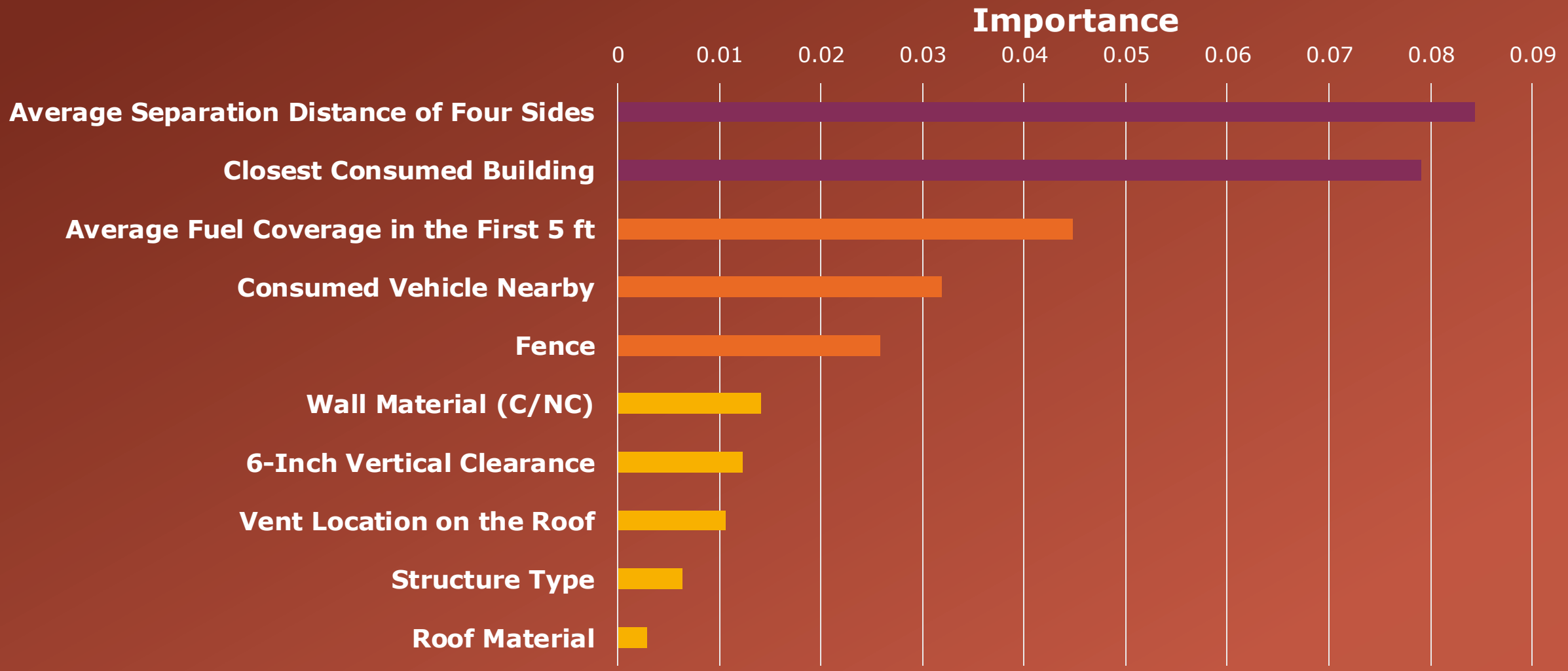
Ainakea Rd
Malolo Pl
Kahoma St
Hiki Pl
Ainakea Rd
Ainakea Rd
Kahoma St
Nahale St
SPEED BUMP
~3 am

LAHAINA:
CONFLAGRATION FACTORS

Structure Density

Connective Fuels

Building Materials



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Lead Research Engineer

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