National Science Foundation

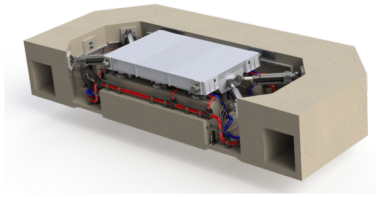
University of California at San Diego
NHERI
Natural Hazards Engineering Research Infrastructure

UC San Diego
JACOBS SCHOOL OF ENGINEERING
Structural Engineering

Modular TestBed Building (MTB^2): A Reconfigurable Shared-Use Equipment Resource for use by Researchers at LHPOST6

Tara Hutchinson, University of California San Diego

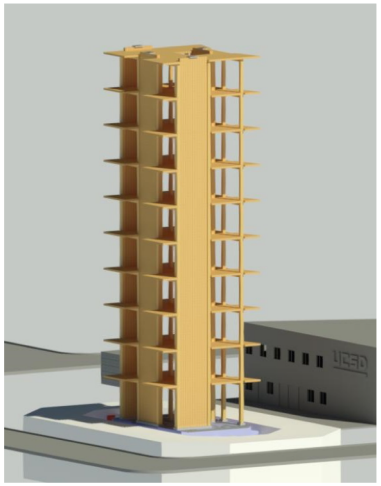
Chris Pantelides, University of Utah



NHERI@UC San Diego User Training Workshop

December 16-17, 2021
University of California, San Diego

"Don't ask what your table can do for you, but ask what you can do for your table" - C. P. Pantelides



Outline

STRUCTURAL COMPONENTS

- Configurations (BRB1 and SMF)
- BRB design and modeling
- DuraFuse design and modeling
- Instrumentation
- Calibration of BRB model
- Calibration of DuraFuse model
- Pushover Analysis for MTB^2
- Preliminary nonlinear time history analysis for MTB^2

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Configurations

BRB-1 Configuration

SMF Configuration

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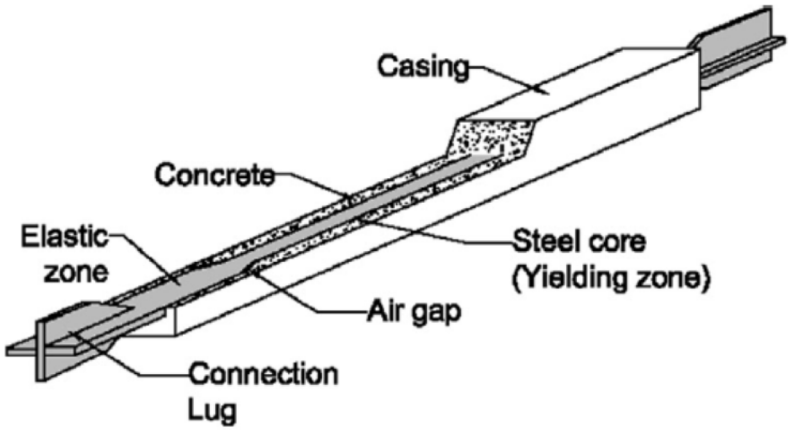
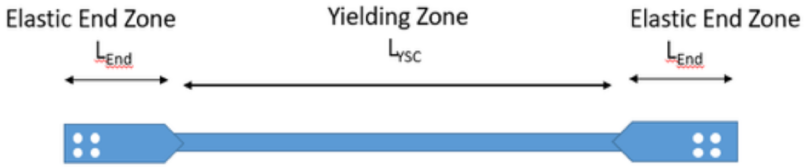
BRB design and modeling



Upadhyay et al. (2019)



Steel Core Plate

BRB design and modeling

BRB Weak Axis Buckling

BRB Strong Axis Buckling

Xu and Pantelides (2017)

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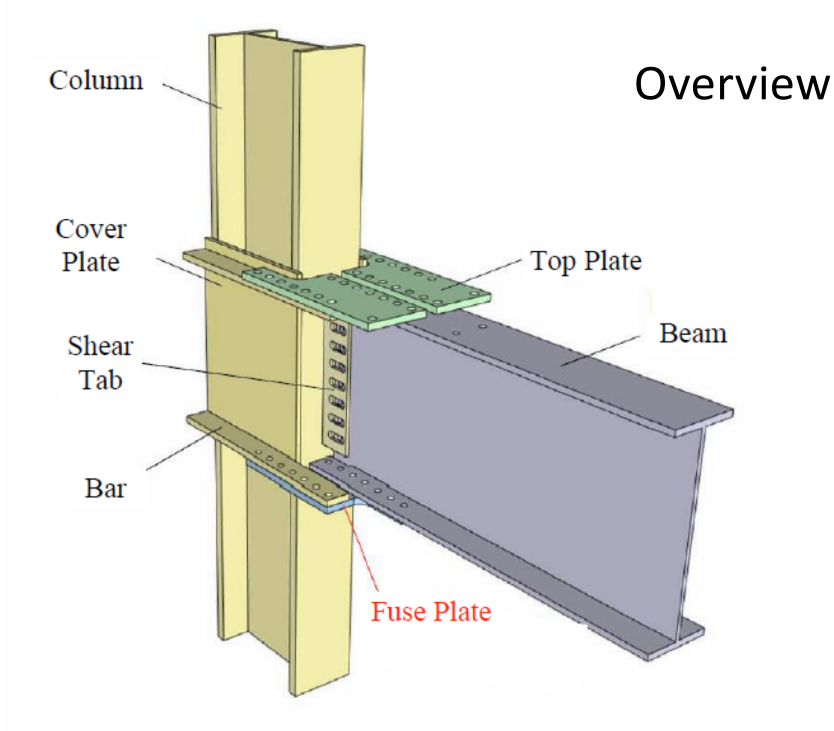
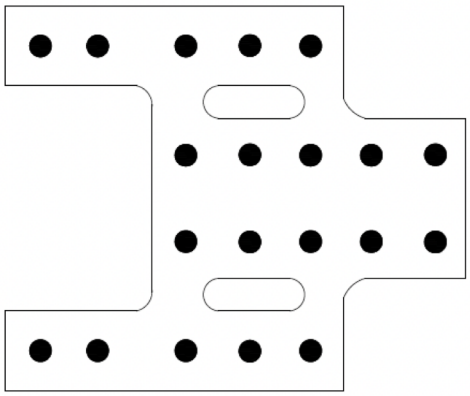


Image courtesy of *DuraFuse Frames*

Overview of DuraFrame (DF) Connection

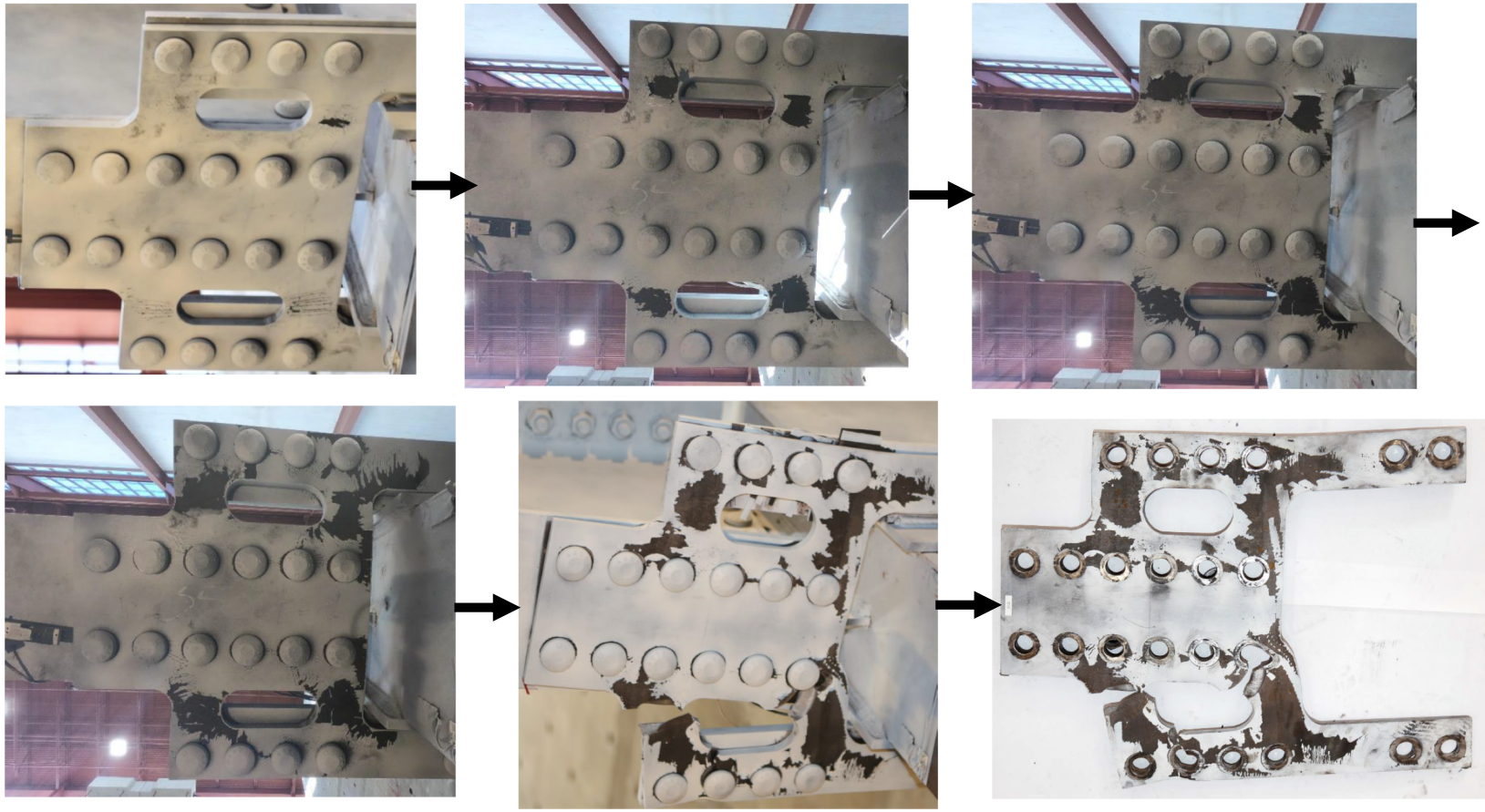


Fuse Plate

DuraFuse design and modeling

- Failure mode of DF Fuse Plates

Images courtesy of *DuraFuse Frames*



Fracture
of Fuse Plate

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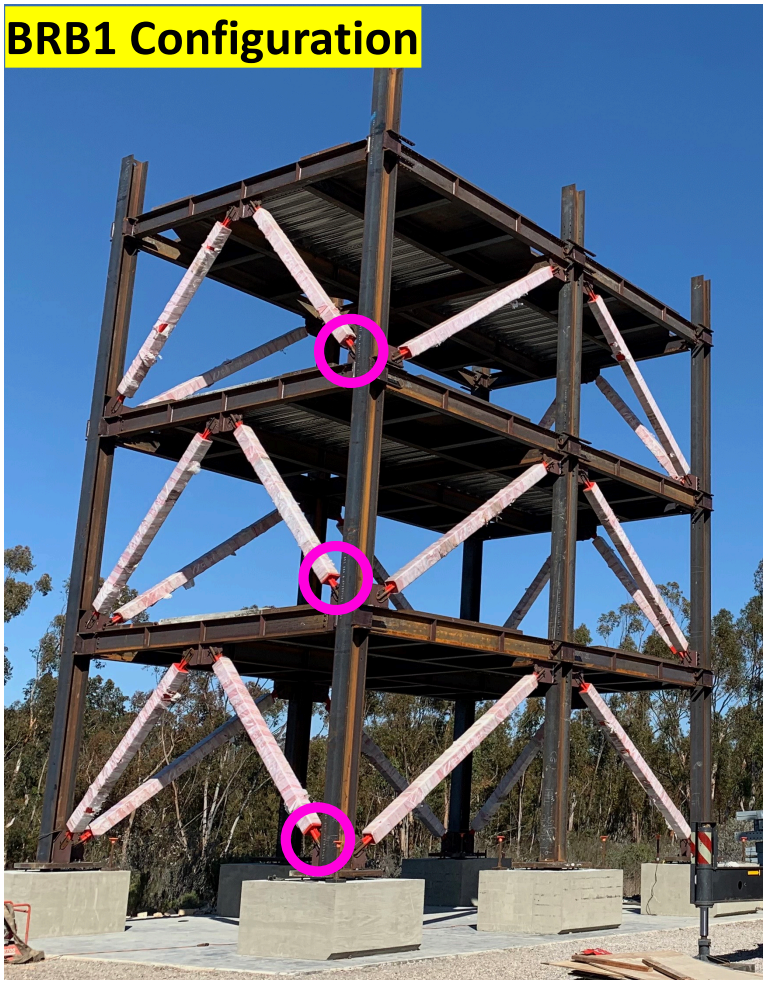
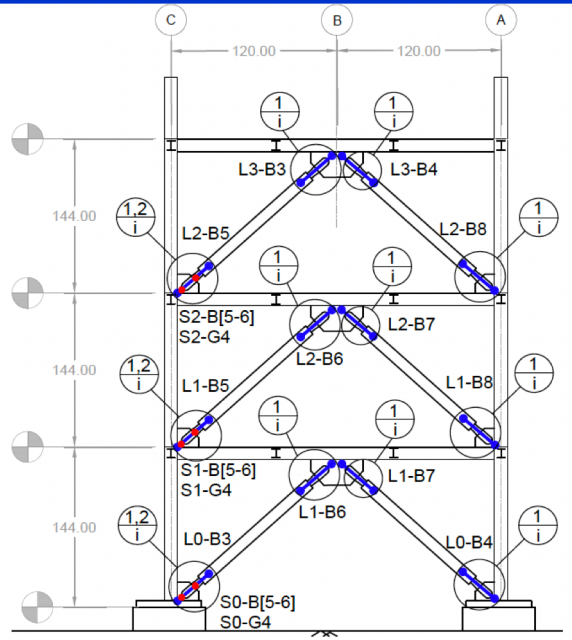
Instrumentation - Buckling Restrained Braces (BRBs)

BRB1 Configuration



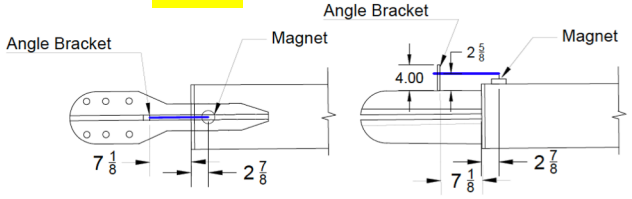
Transverse Direction

Note:
LVDT: MLS130/100
Unidirectional Strain Gage
Red arrow: SG direction



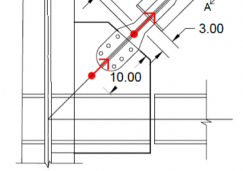
1 *Section Elevation N-S Direction*

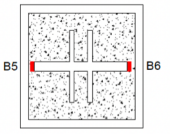
LVDTs



1/i *LT Details on BRBs*

Strain Gages





2/i *SG Details on BRBs*

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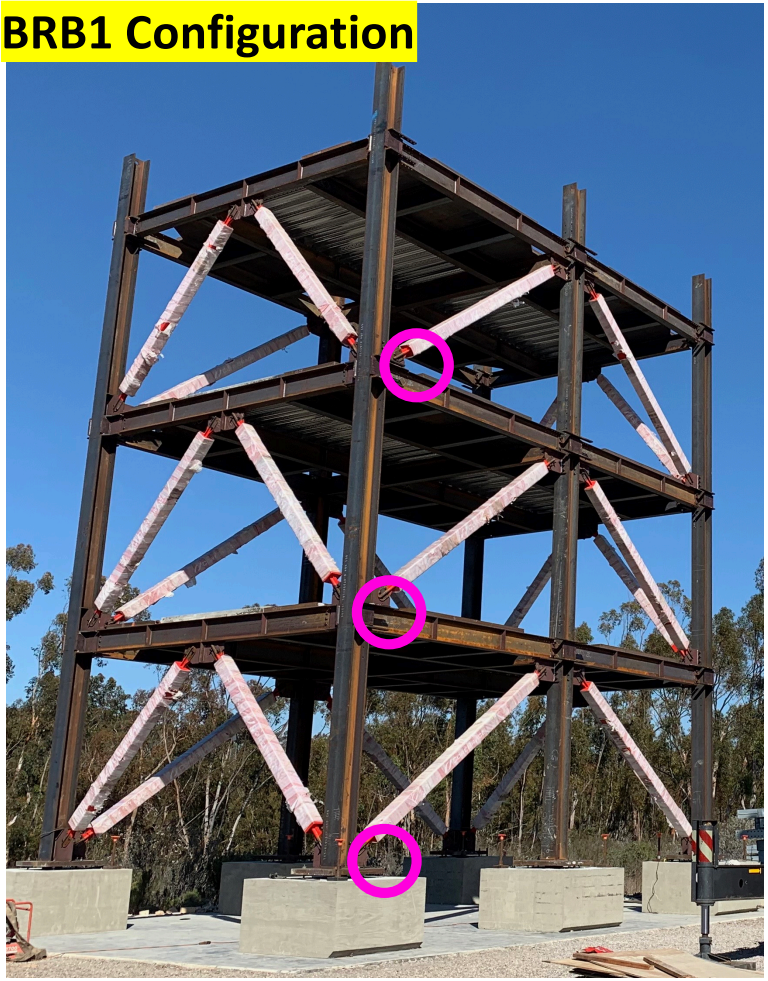
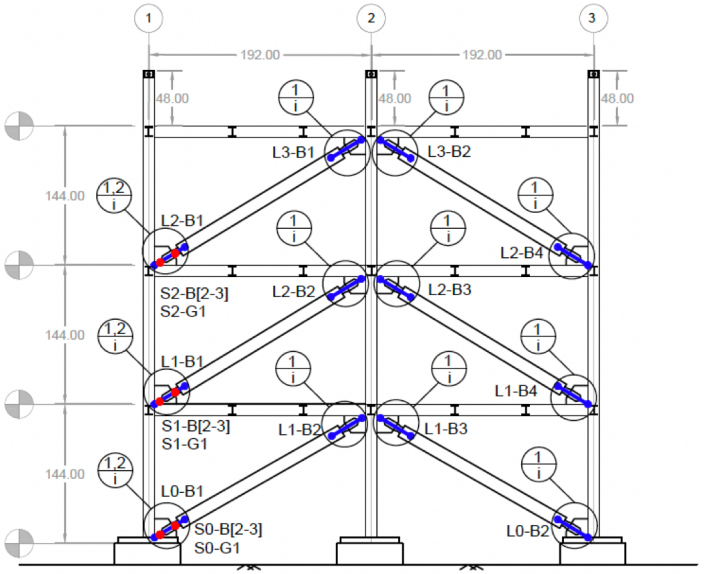
Instrumentation - Buckling Restrained Braces (BRBs)

BRB1 Configuration



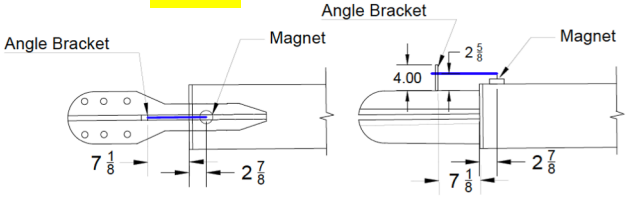
Longitudinal Direction

Note:
LVDT: MLS130/100
Unidirectional Strain Gage
Red arrow: SG direction



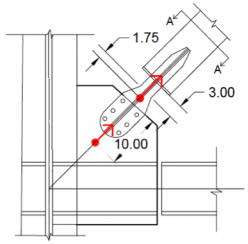
C Section Elevation
E-W Direction. BRB-1

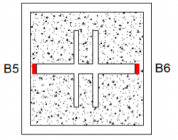
LVDTs



1/i LT Details on BRBs

Strain Gages





2/i SG Details on BRBs

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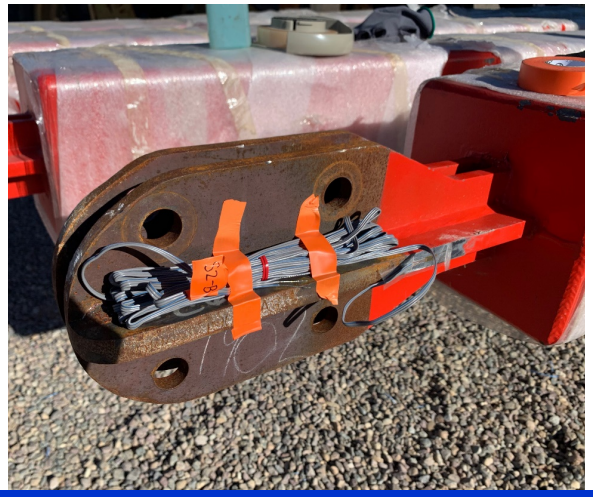
Instrumentation - Buckling Restrained Braces (BRBs)

Strain Gages & LVDTS on BRB Core and Gusset Plates



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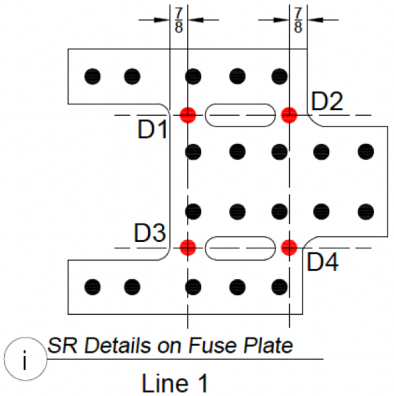
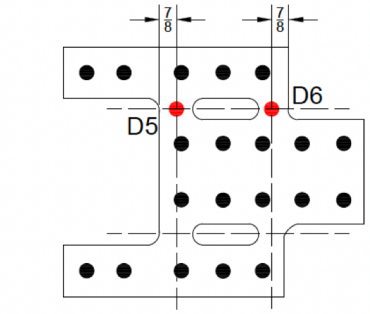
Instrumentation - Durafuse Moment Frame Joints

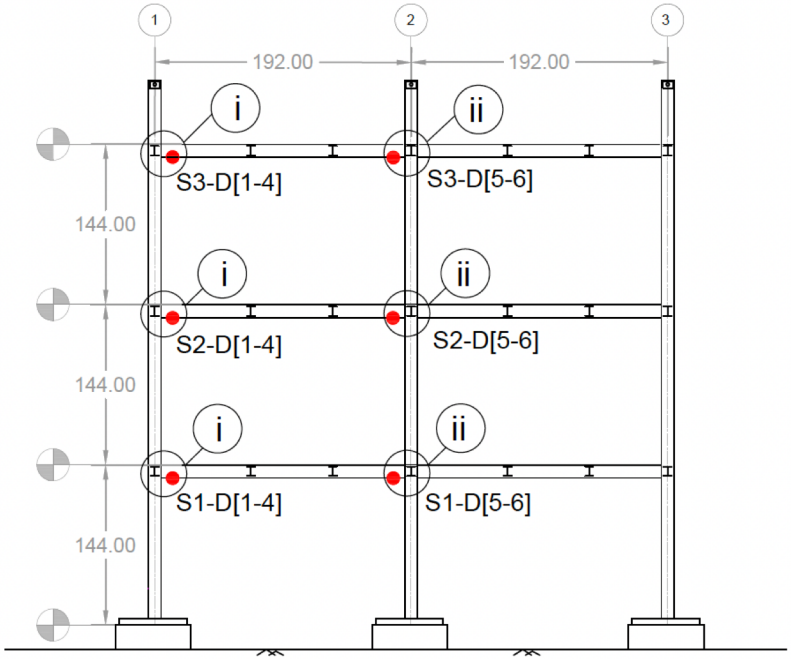
SMF Configuration



i SR Details on Fuse Plate
Line 1



ii SR Details on Fuse Plate
Line 2

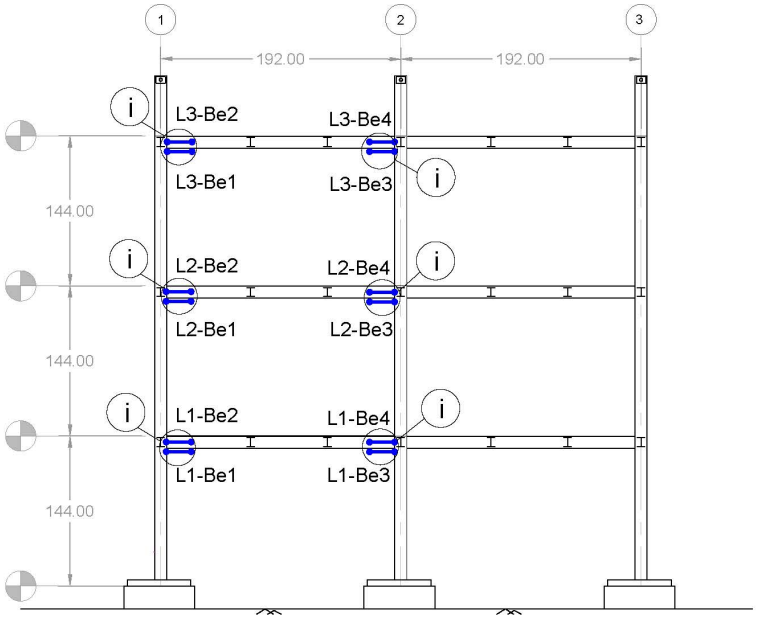


C Section Elevation
E-W Direction, SMF

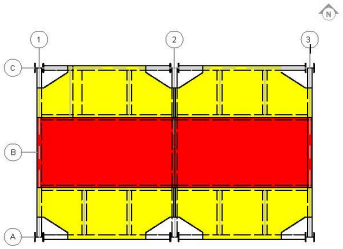
Strain Rosettes

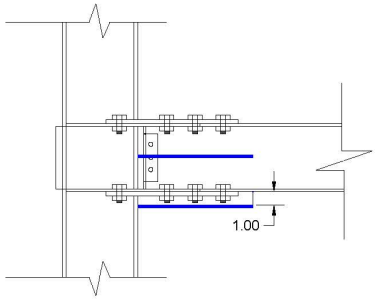
Instrumentation - Durafuse Moment Frame Joints

SMF Configuration



C *Section Elevation*
E-W Direction, SMF





i *LT Details on Beams*

Note:
LVDT :MLS 130/50

LVDTs

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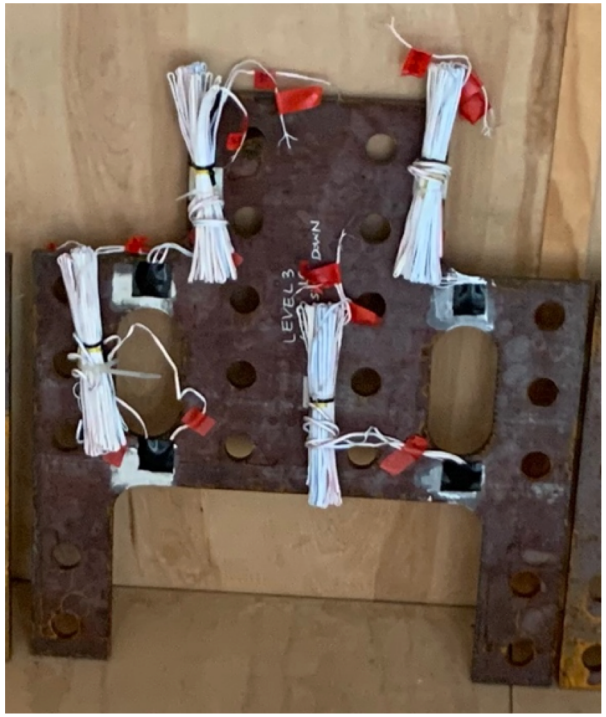
Instrumentation - DuraFuse Moment Frame Joints

Strain Rosettes on DuraFuse Plates



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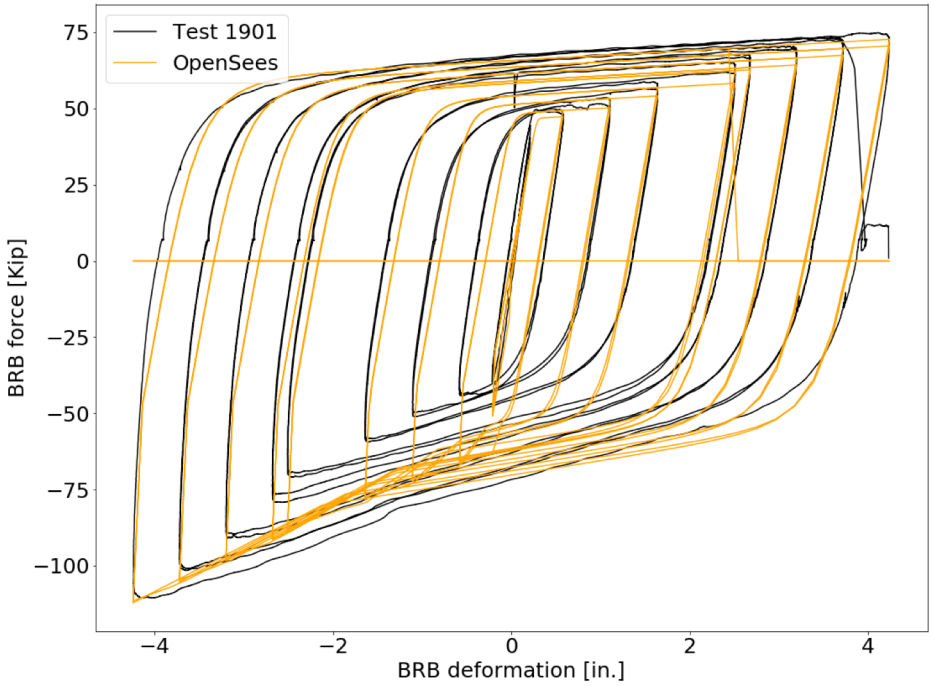
Calibration of BRB model with OpenSees



Test data CoreBrace, LLC
(Pantelides et al. 2019)

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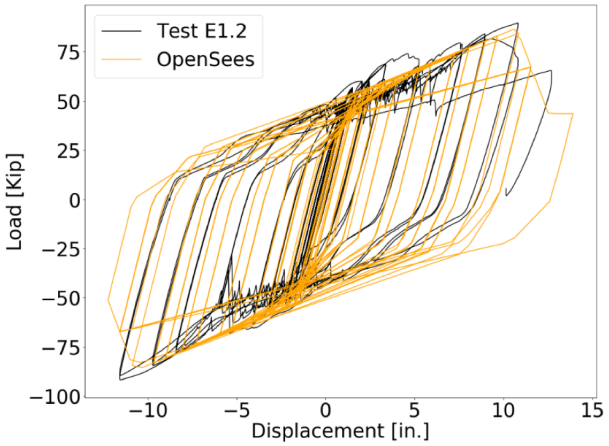
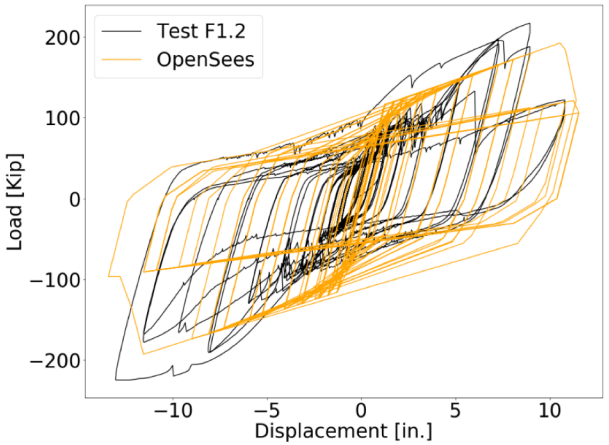
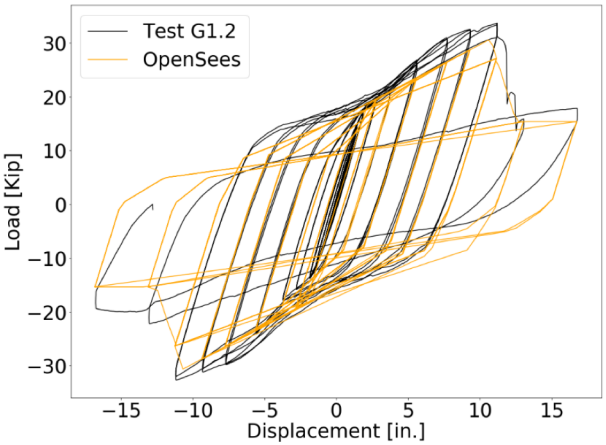
Calibration of DuraFuse model with OpenSees







Test data DuraFuse Frames

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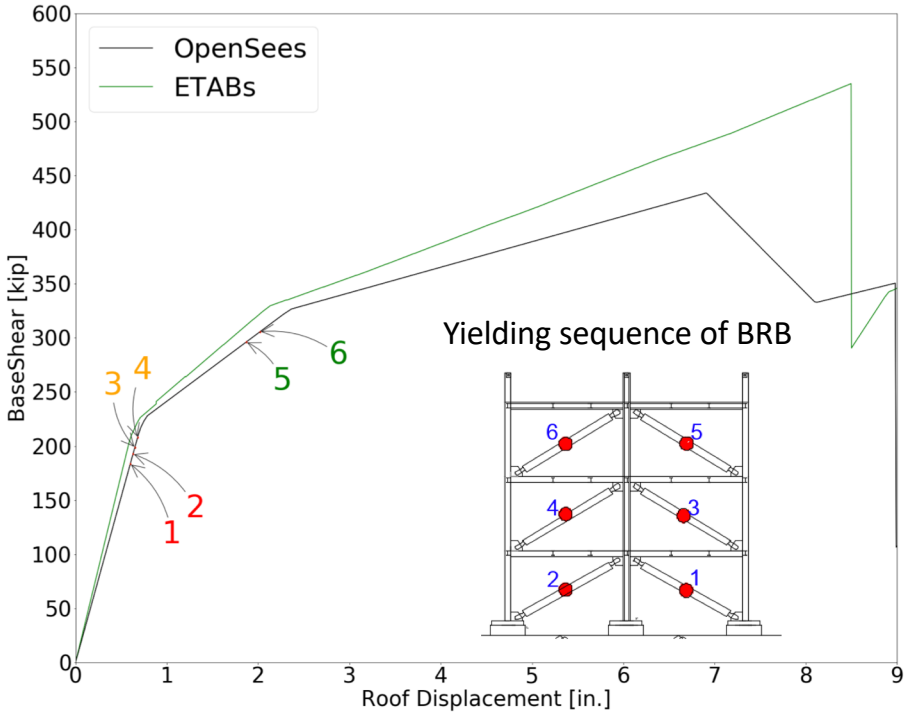
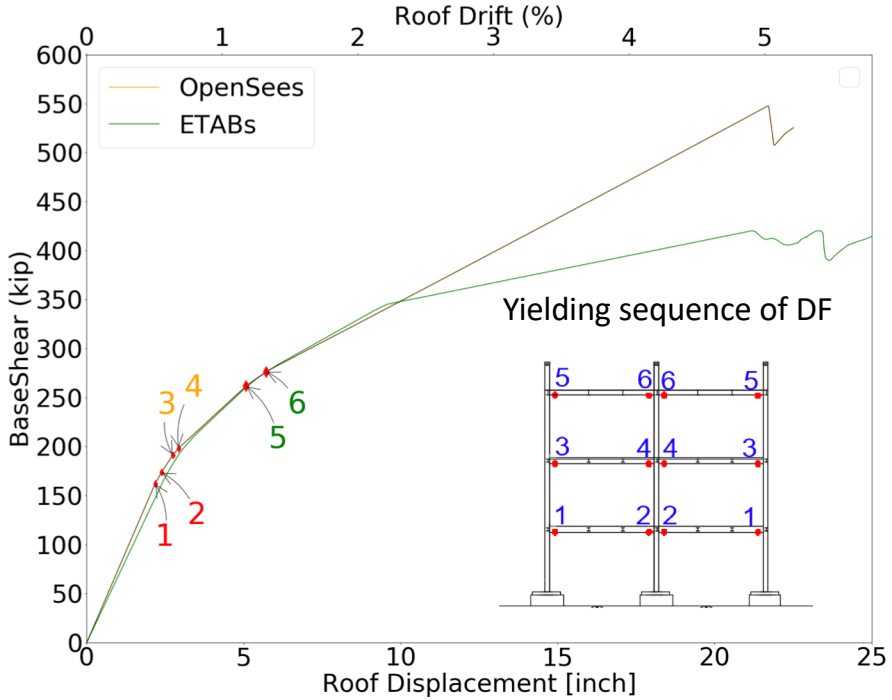
Pushover Analysis for MTB² using ETABs and OpenSees

BRB1 Configuration



SMF Configuration



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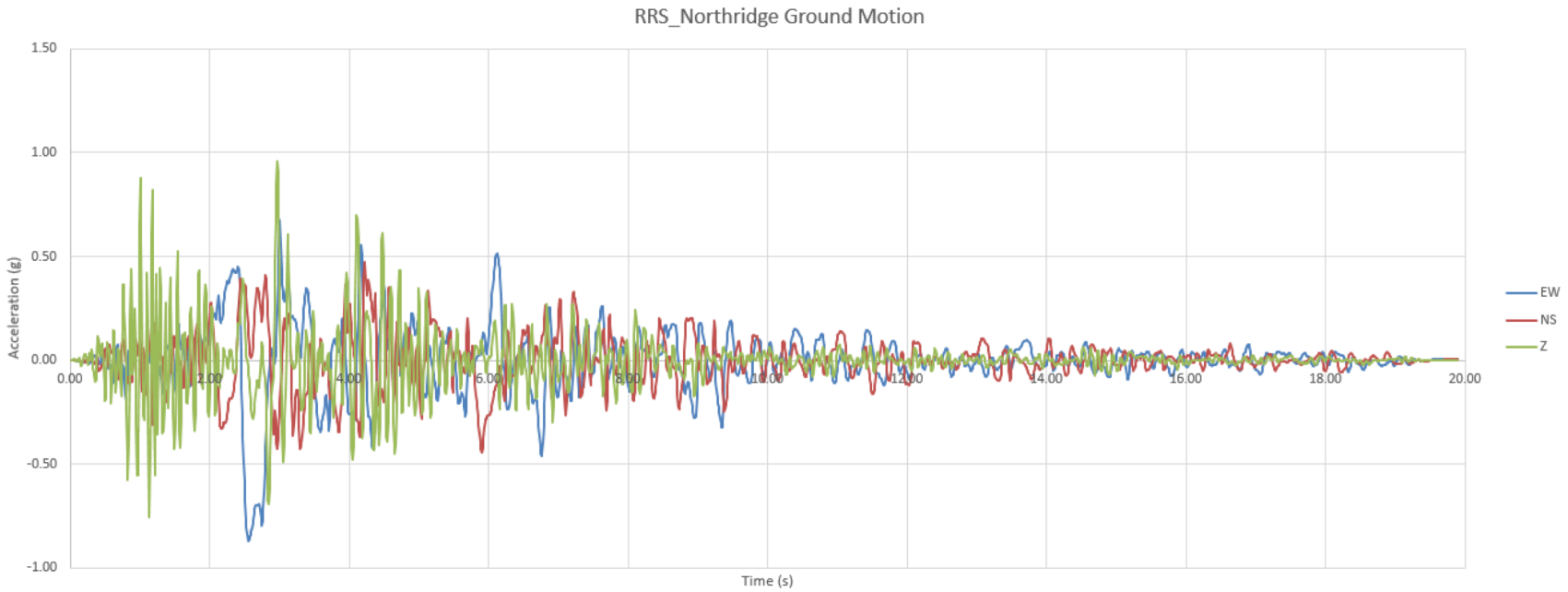
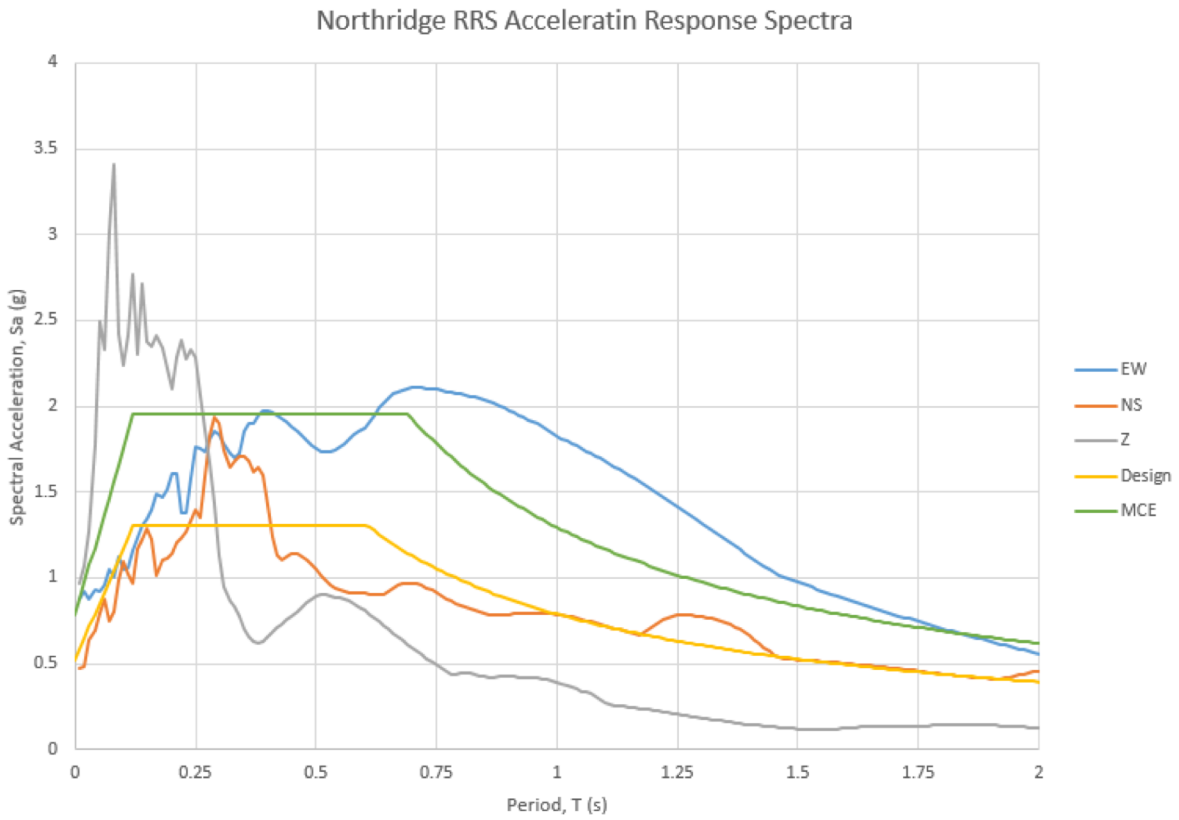
Preliminary nonlinear time history analysis with OpenSees

Dynamic Analysis for the MTB2 - *Three-directional input ground motion - Northridge-RRS Earthquake*



Preliminary nonlinear time history analysis with OpenSees

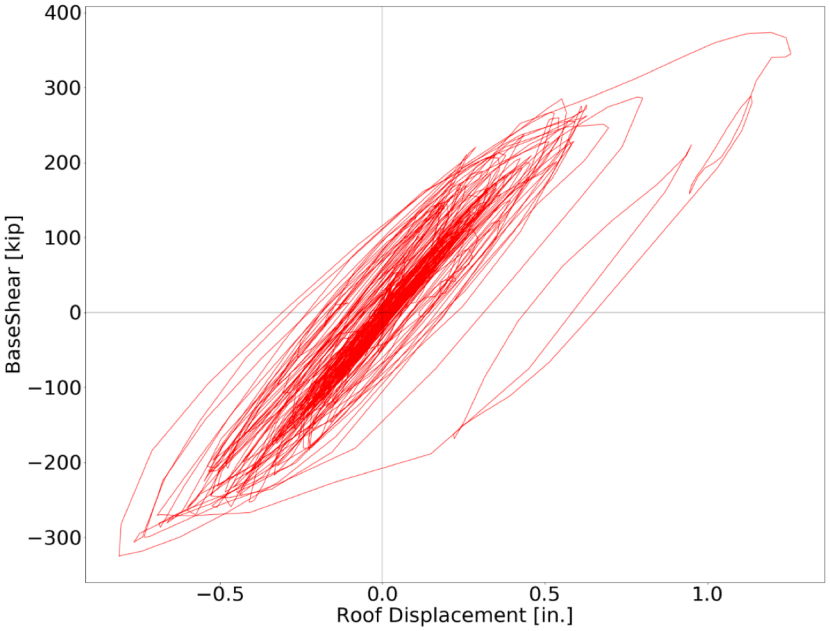
Three-directional input ground motion - Northridge-RRS Earthquake



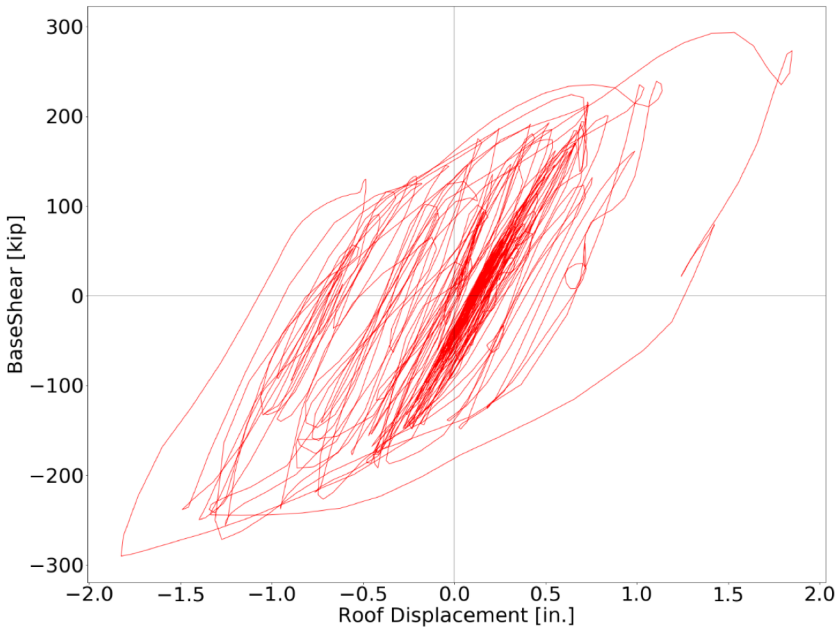
BRB1 Configuration

Base shear VS Roof displacement: Building performance prediction

Longitudinal Direction



Transverse Direction



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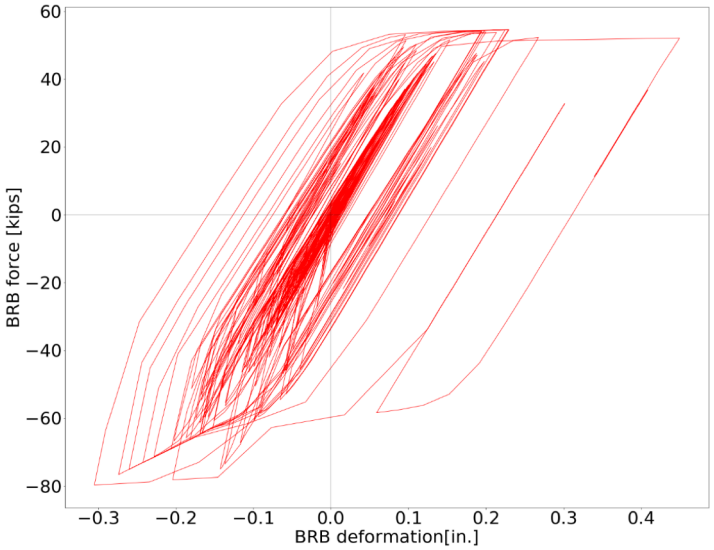
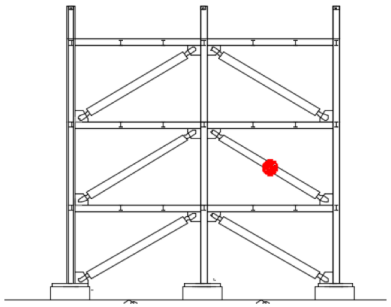
Preliminary nonlinear time history analysis with OpenSees

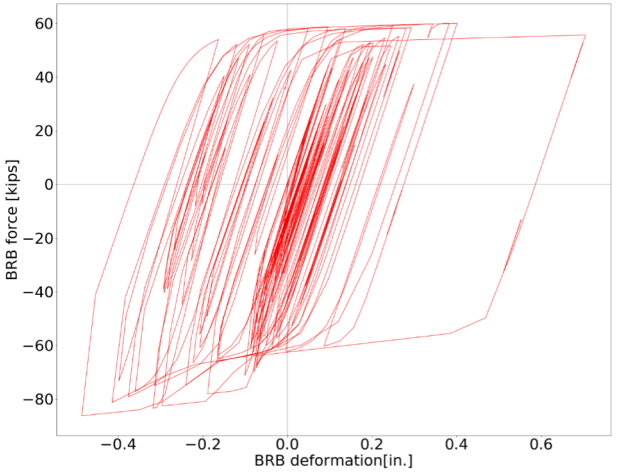
BRB1 Configuration

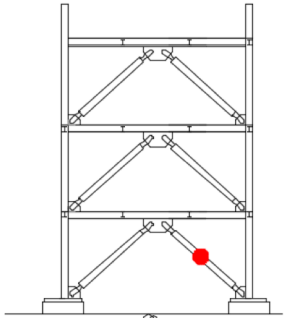
Longitudinal direction: BRB force VS BRB deformation





Transverse direction: BRB force VS BRB deformation





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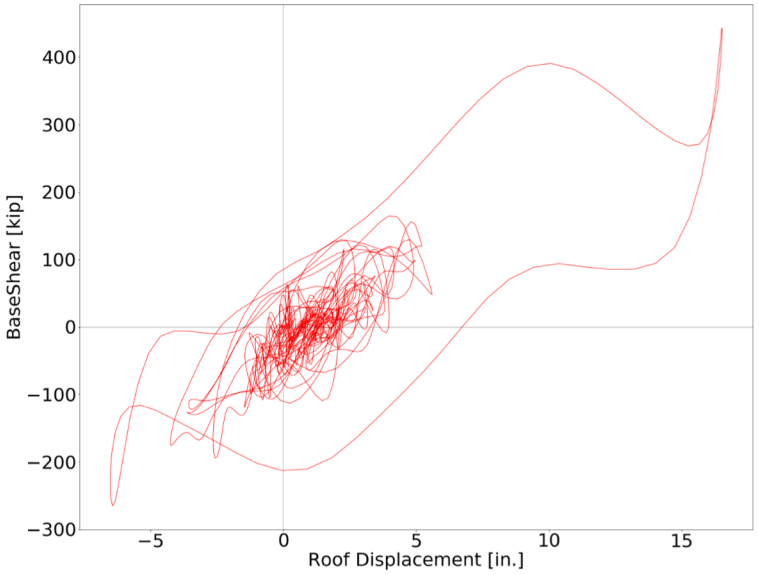
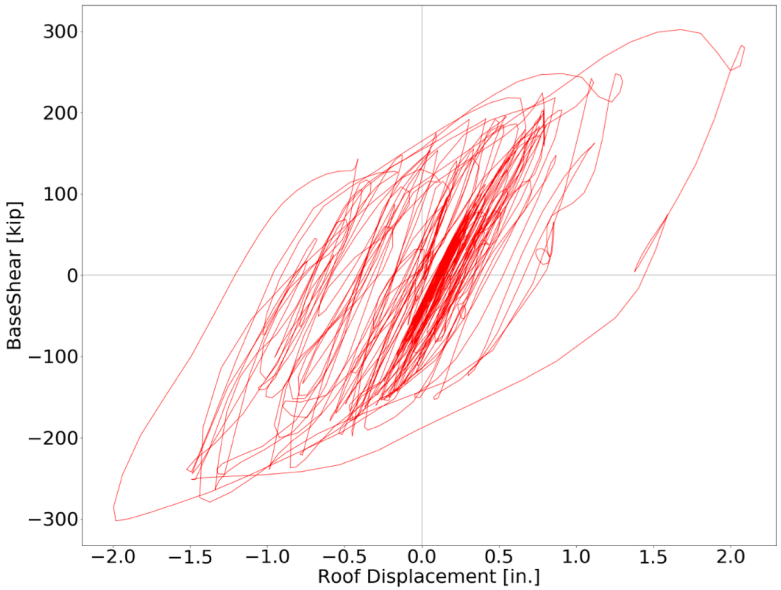
SMF Configuration

Base shear VS Roof displacement: Building performance prediction

Longitudinal Direction



Transverse Direction



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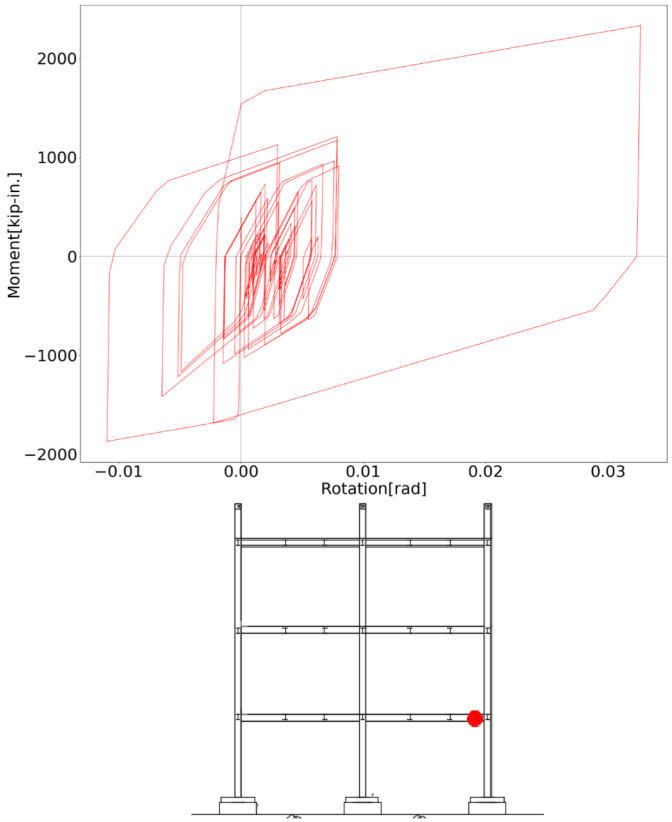
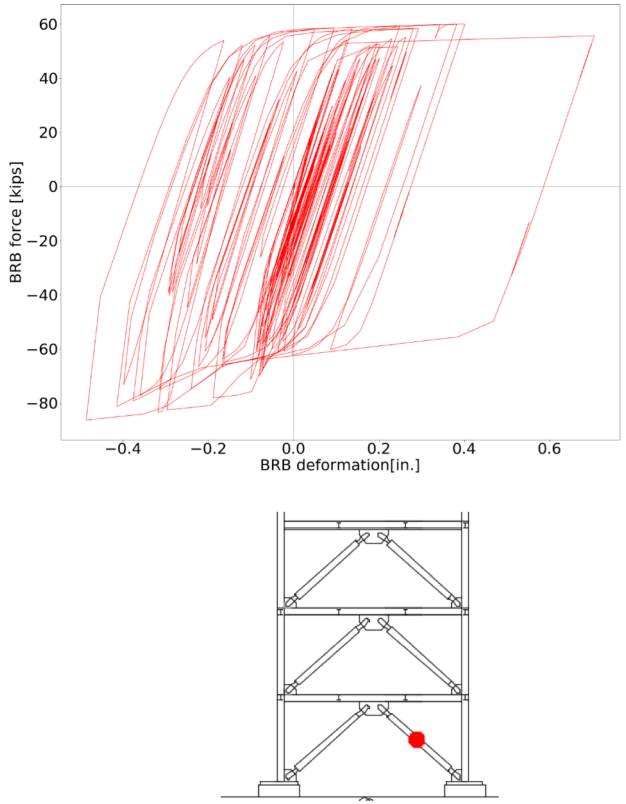
BRB1 Configuration

Longitudinal direction: DF Moment VS Rotation



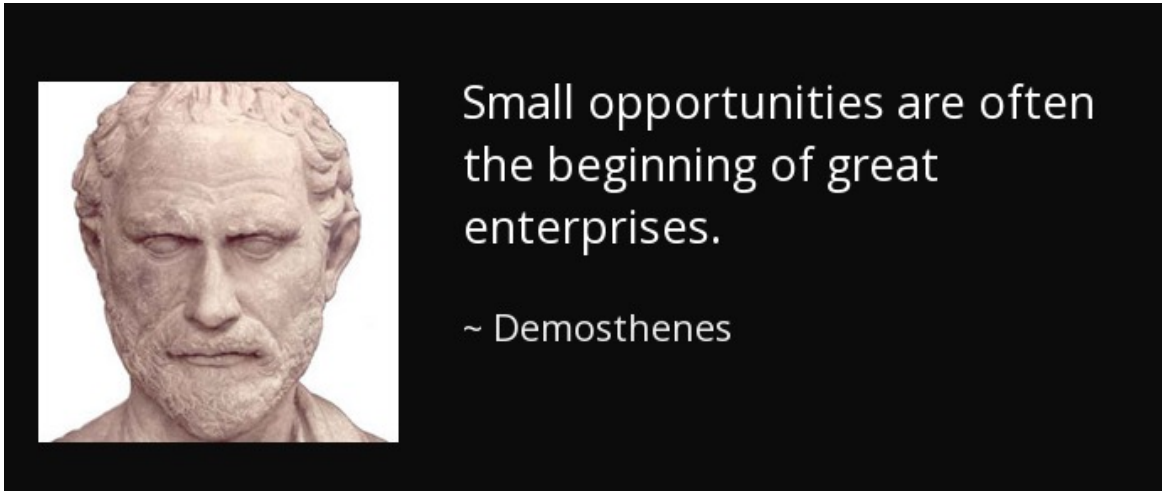
Transverse direction: BRB Force VS BRB deformation



Quote

Modular Test Bed Building (MTB^2): A Reconfigurable Shared-Use Equipment Resource for use by Researchers at LHPOST6

MTB^2 = New Era of Reconfigurable Structures



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