

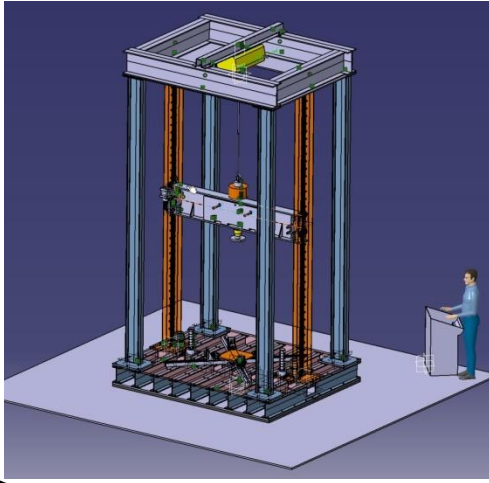
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MODIFICATION

- ◆ Develop cost effective generic high energy drop tower system for testing of panels, fastener assemblies and other structures including:
 - ◆ Large flat panels with adjustable x-y-positioning
 - ◆ Three point bend fixtures
 - ◆ Direct impact fixtures
 - ◆ Mobile fixtures (prior to field testing) and vehicle structures
- ◆ Impact node must be generic enough to accommodate large area impactor (blast) FSP type as well as custom nodes
- ◆ Base support must be rigid but allow for wide range of fixture assemblies

CUSTOM BUILT HIGH ENERGY DROP TOWER

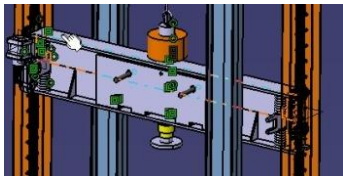


NEEDS

- ◆ ARL: Damage Tolerance Studies
- ◆ Studies for novel energy absorption methods and quasi static studies
- ◆ Mine Blast Fastener Design
- ◆ UD-Civil Engineering: Blast Damage of Bridge Structures
- ◆ CCM: Crash Testing of Filament wound cylinders for automobile industry
- ◆ Added capability for novel experiments, research and thesis work

CROSS BEAM DETAILS

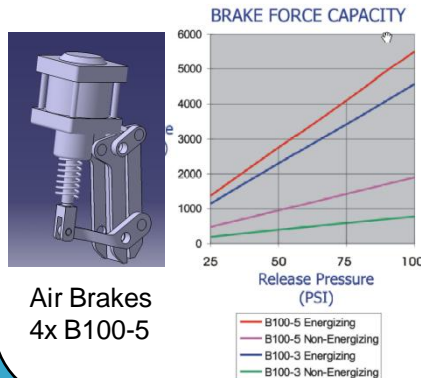
Weighted Plates
(100lb Increments)



Linear Bearings
SNNC76
Precision rail

Load Node
Instron Load
Cell

BRAKING SYSTEM



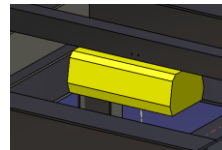
3IN BORE SHOCK ABSORBERS

- ◆ **CASE 1)** 1,000 lbs to 3,000 lbs
Free fall from 18ft: =>30 g's
- ◆ Stopping Force = 47,000 lbs. per shock absorber for the 3,000 lb. weight, 16,000 lbs. per shock absorber for a 1,000 lb. weight.
- ◆ **CASE 2)** Empty Weight 500 lbs
free fall from 6 ft. => 19 g's.
Stopping Force = 5,000 lbs. per shock absorber for the 500 lb. weight.



LIFT/DROP MECHANISMS

- ◆ COFFING 2
Ton Hoist –
EC4024-20
Electric Chain
Lift
- ◆ CER -12
4000lb Lift
Capacity
Circular
Electric Lift
Magnets



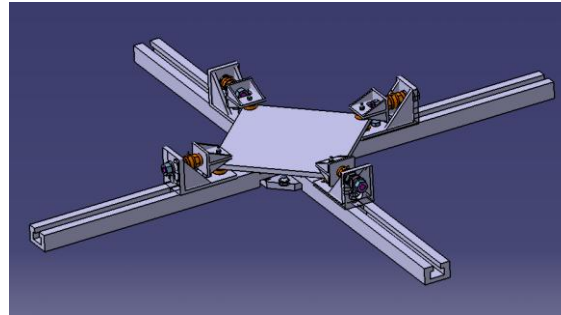
DEVELOPMENT OF HIGH ENERGY DROP TOWER CAPABILITY AT CCM

(Continued)

GENERIC IMPACT FIXTURE

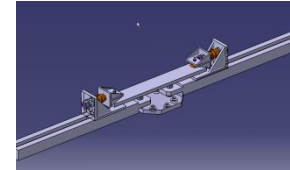
- ◆ Generic fixture designed to ensure the following parameters are achieved:
- ◆ Ability to accurately measure tension, compression and shear in the fastener during loading
- ◆ Evaluation of various fastener concepts
- ◆ Consider variation in panel size and shape
- ◆ Ability to control boundary conditions
- ◆ Ability to use fixtures for other tests including three point bending of beams

GENERIC IMPACT FIXTURE

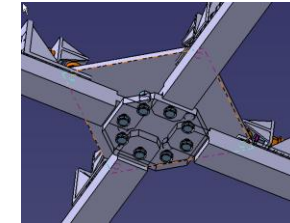


- ◆ Fixture slides along T-Slot for accurate placement with respect to fastener hole Location

3-POINT BEND TESTING



- ◆ Fixture easily modified for three point bend testing



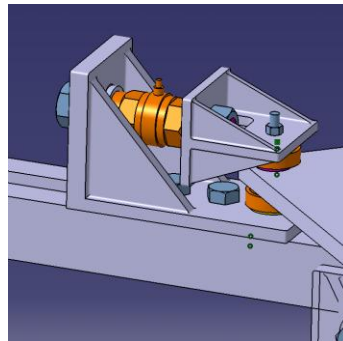
- ◆ Fixture easily accommodates different panel dimensions

COMPRESSION-TENSION SENSORS

- ◆ PCB Compression and Tension Rings
- ◆ Used to measure initial Compression and Reaction Loading
- ◆ Addition of spherical ring for simply supported boundary condition



SLIDE TITLE



LINK SENSORS

PCB Link Sensor Bearings

- ◆ Used to Measure Shear Loading
- ◆ Removal of this connection results in simply supported condition
- ◆ Adjustable in vertical and horizontal direction

SUMMARY

- ◆ High energy drop tower will be invaluable for truly understanding impact behavior for multilayered systems
- ◆ Also aid in better understanding fixture requirements

ACKNOWLEDGEMENTS

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