NHERI Experimental Facility, NSF Award 1519679

Oregon State University

Natural Hazards Engineering Research Infrastructure

Coastal Wave/Surge and Tsunami Experimental Facility

NHERI-CWST-EF

O.H. Hinsdale Wave Research Laboratory

Large Wave Flume and Directional Wave Basin

NHERI Experimental Facility, NSF Award 1519679

O.H. Hinsdale Wave Research Laboratory

Example Applications of Natural Hazards Research

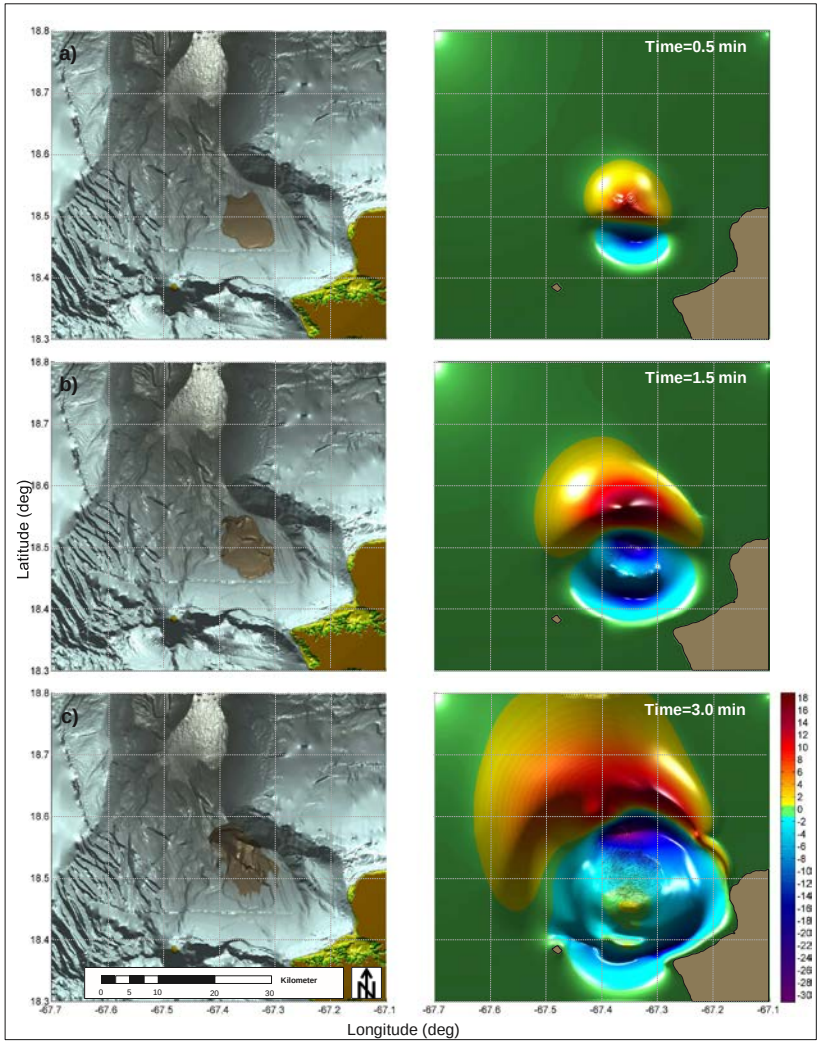
Tsunami Generation by Landslides

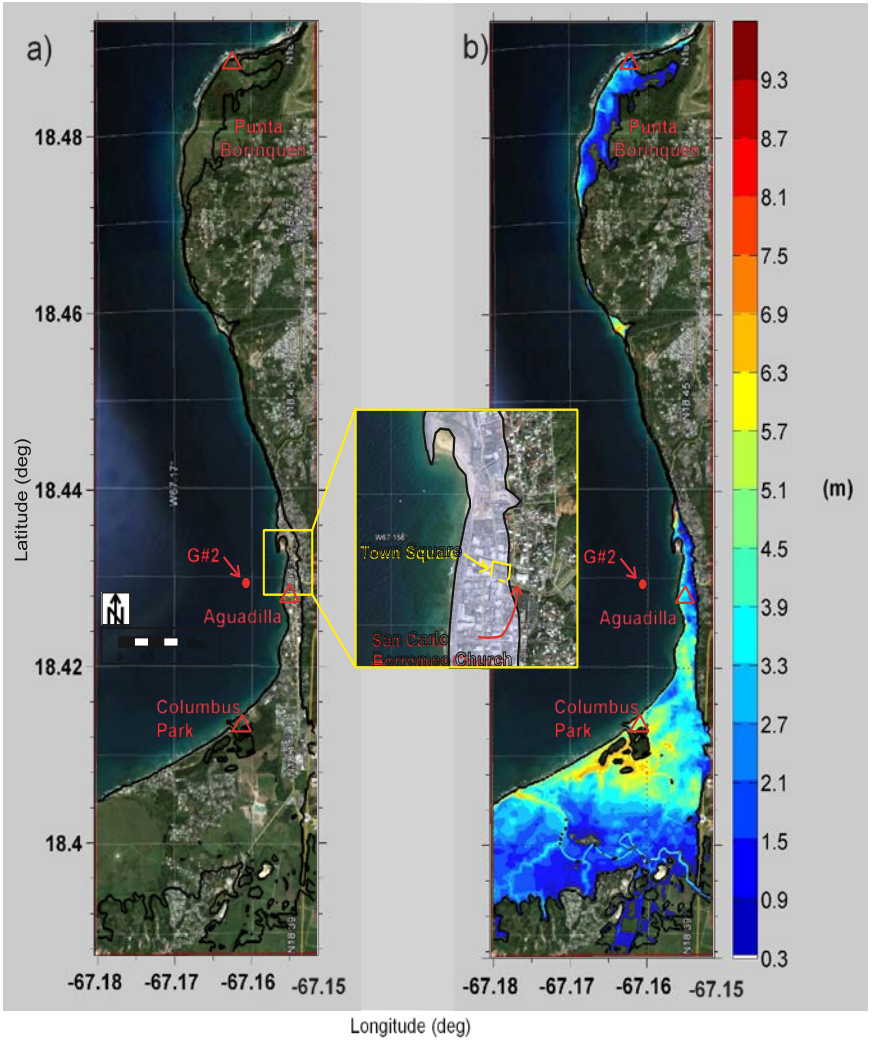
Key features:

Directional Wave Basin
Special machine to generate tsunamis by landslides
Optical measurement of the surface elevation
Interaction with coastal structures
Numerical simulation and validation

Example Applications for ENH Research

Tsunami Generation by Landslides. Georgia Institute of Technology, Texas A&M

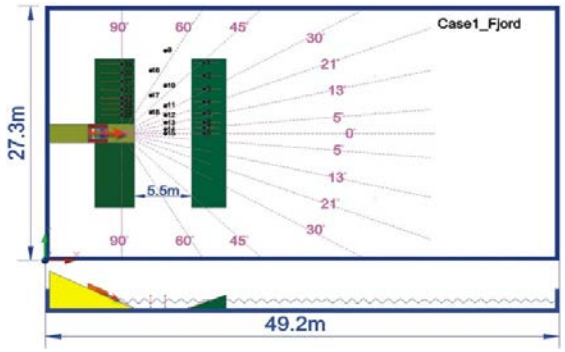




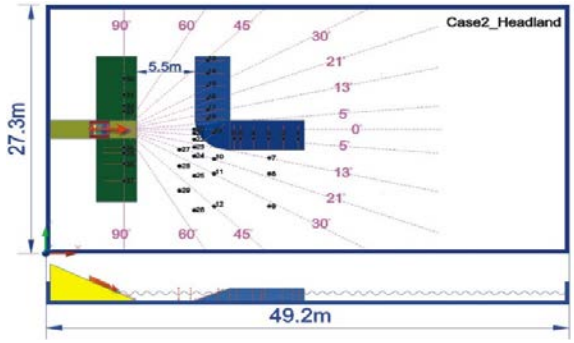
Example Applications for ENH Research

Tsunami Generation by Landslides. Georgia Institute of Technology, Texas A&M

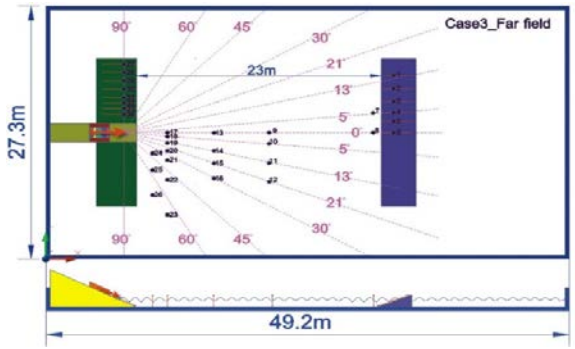
Fjord Experiment

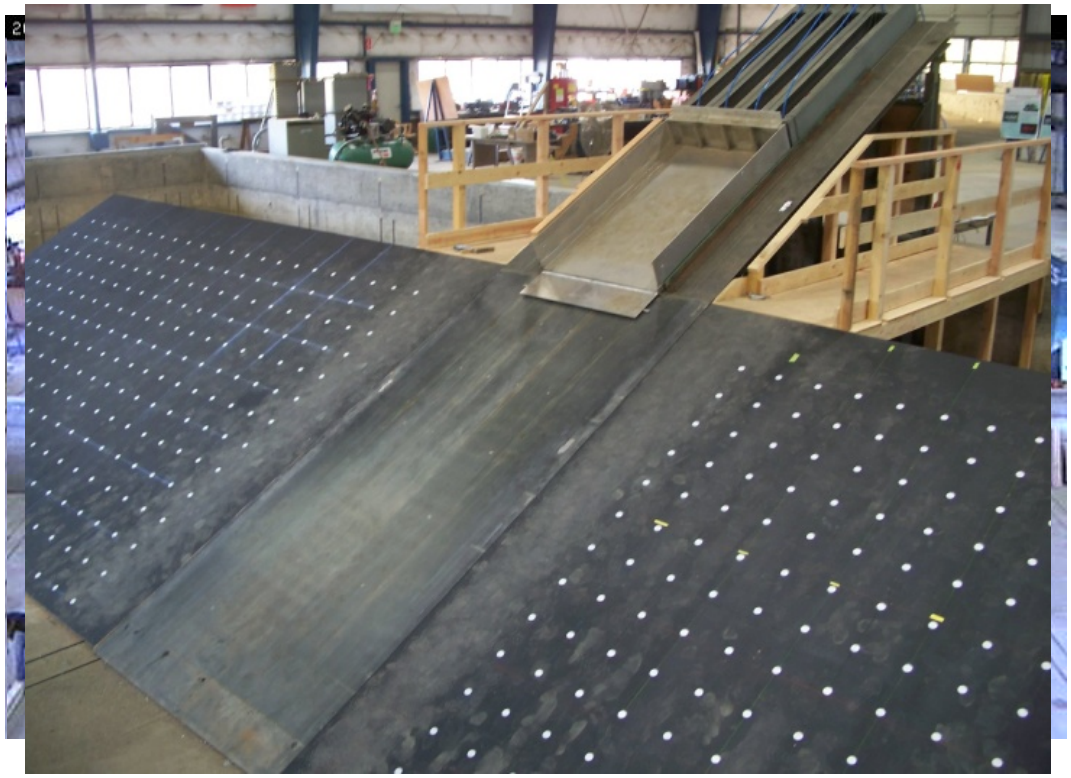


Headland Experiment



Far Field Experiment

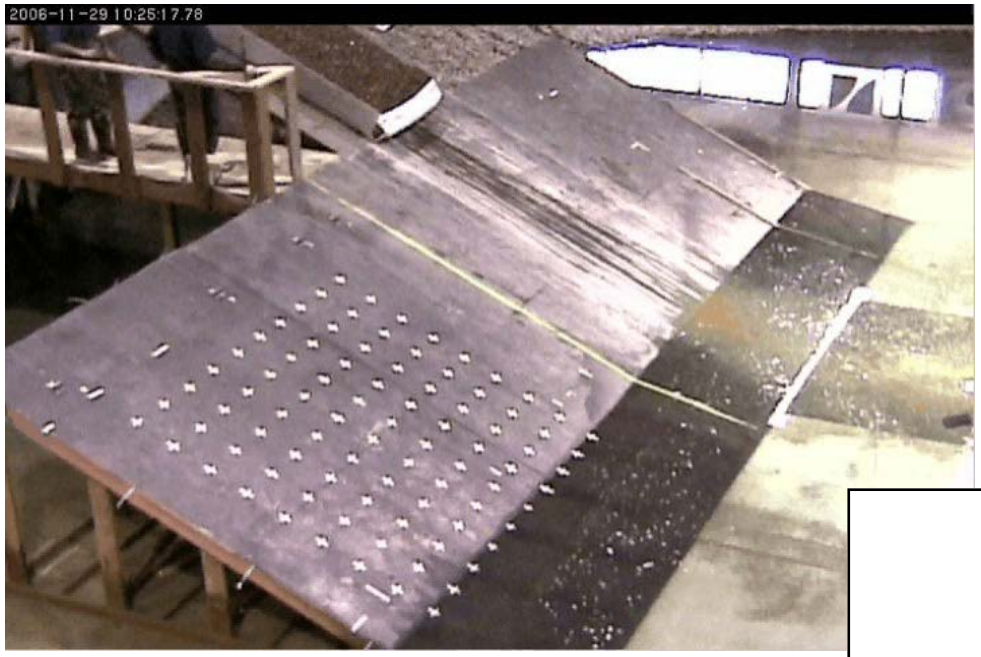




Bathymetry: idealized, fixed
Hydrodynamic conditions: landslide tsunami
Instrumentation: wave gauges (surface elevation), still and video cameras
Model: pneumatic piston tsunami generator, rigid slopes as boundaries

Example Applications for ENH Research

Tsunami Generation by Landslides. Georgia Institute of Technology, Texas A&M



O.H. Hinsdale Wave Research Laboratory

Example Applications of Natural Hazards Research

Wave and current interactions with coastal structures

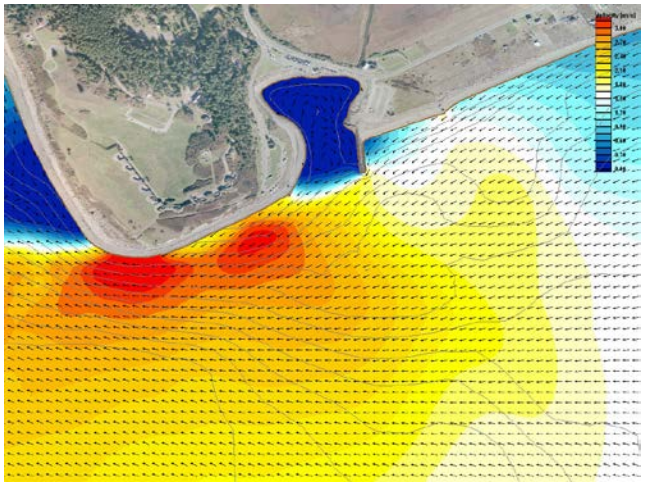
Key features

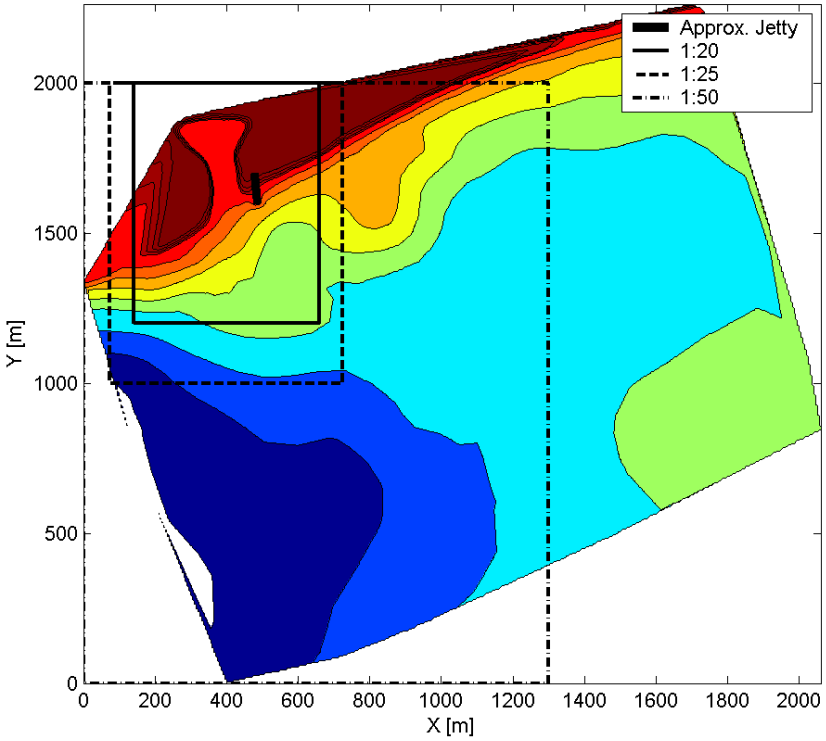
Directional Wave Basin
Construction of a real bathymetry
In-situ wave conditions
Tidal (ebb) current conditions
Nearshore sediment transport (mobile bed)
Laser scanner (LIDAR) survey
Numerical model validation

Example Applications for ENH Research

Wave and current interactions with coastal structures

Physical model study





Facility: Directional Wave Basin

Model design:

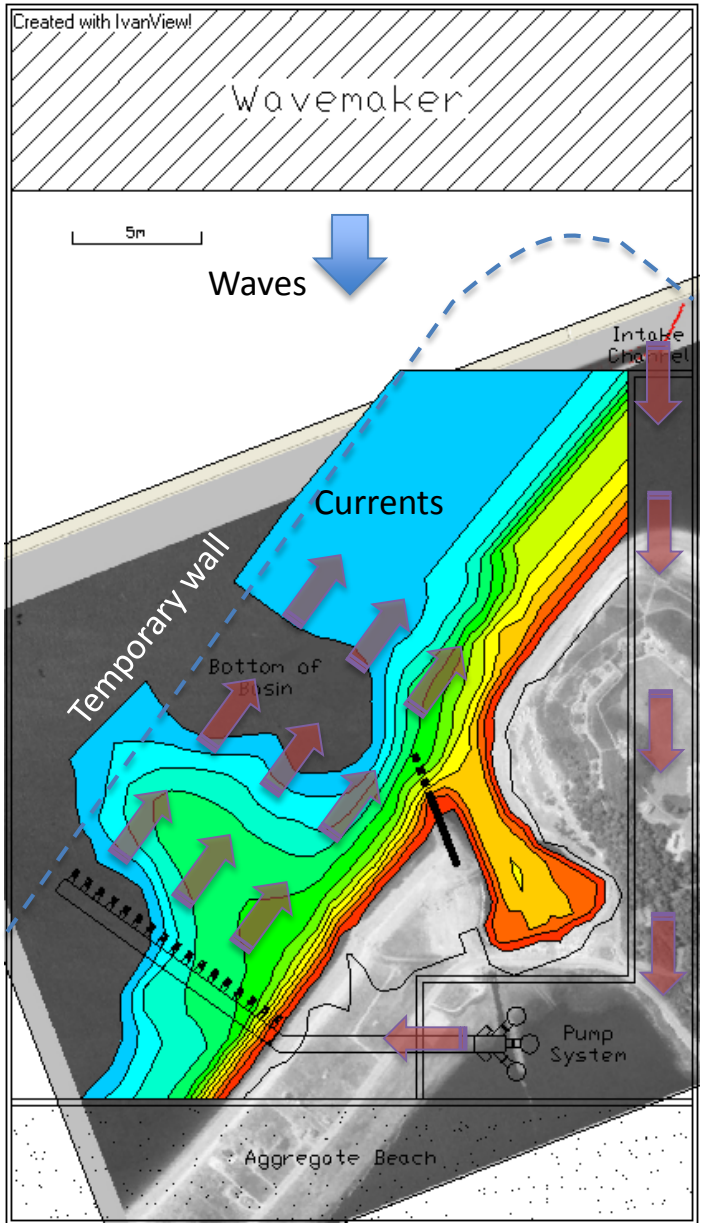
- Scaling selection
- Wave conditions
- Current conditions
- Bathymetry construction (fixed bed)
- Sediment transport (mobile bed)

Example Applications for ENH Research

Wave and current interactions with coastal structures

Scale 1:40
Max depth 25 m
Uniform alongshore (ebb)
Orientation for “worst case” wave conditions
Range of sediments from sand to cobble

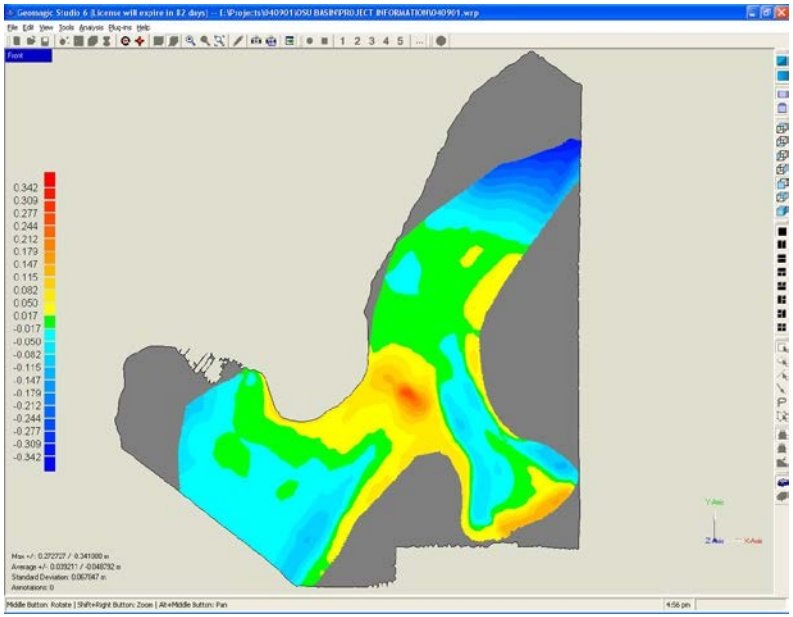
Bathymetry construction

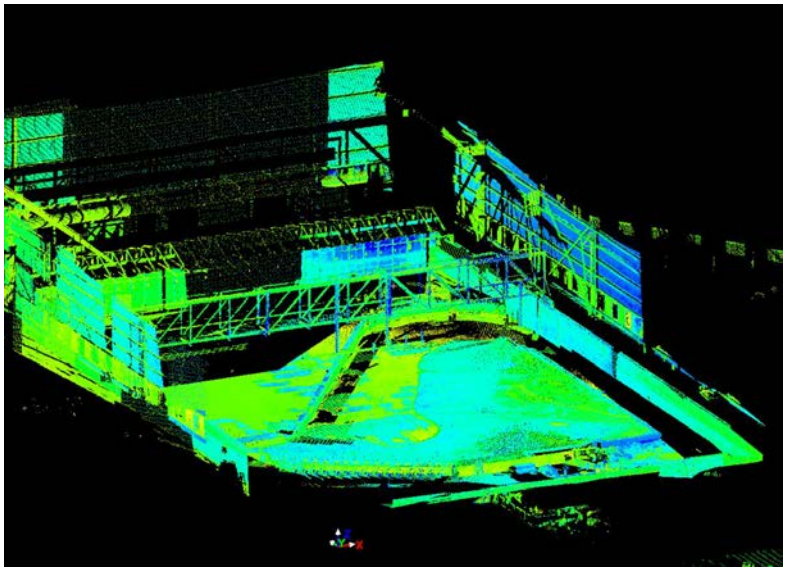


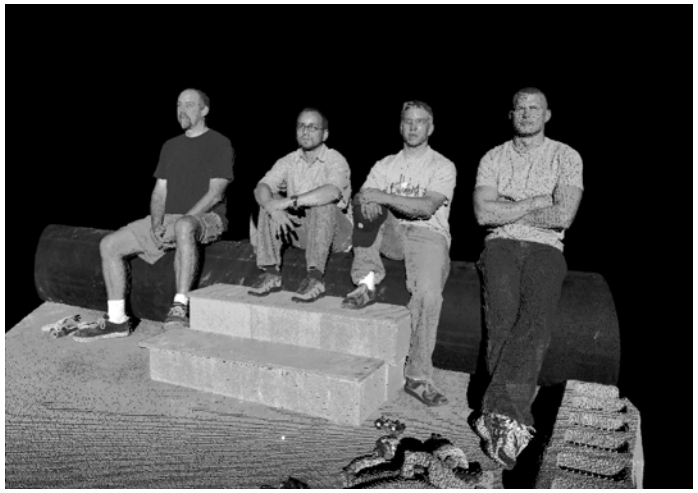
Example Applications for ENH Research

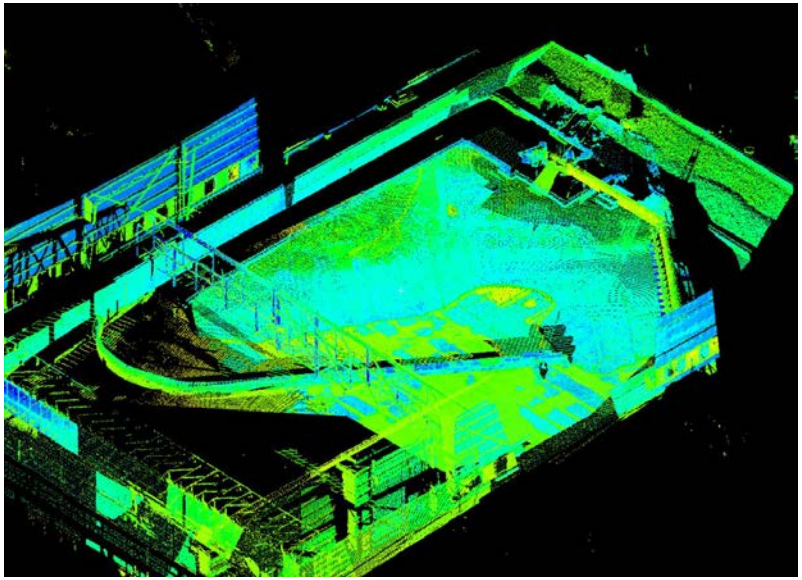
Wave and current interactions with coastal structures

Model construction verification survey (LIDAR)









Example Applications for ENH Research

Wave and current interactions with coastal structures

Wave study and its effect on sediment transport

Example Applications for ENH Research

Wave and current interactions with coastal structures

Current study and its effect on navigation for different alternatives

O.H. Hinsdale Wave Research Laboratory

Example Applications of Natural Hazards Research

Tsunami runup and withdrawal dynamics on a sloping beach with discontinuous macro-roughness

Key features

Directional Wave Basin
Use of existing modular bathymetry
Full-stroke tsunami generation (user defined)
Modular patches
Resistive wave gauges, acoustic probes and ADV's
Pilot, payload and full project phases

Example Applications for ENH Research

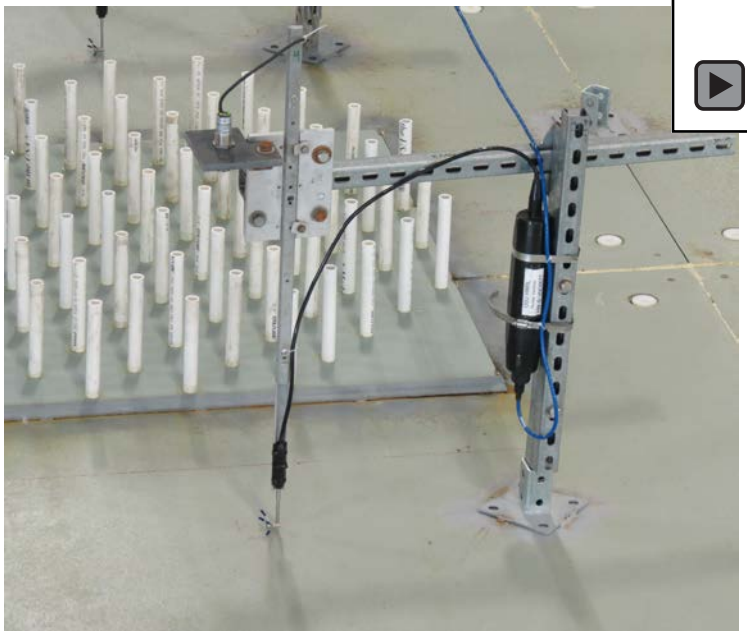
Tsunami runup and withdrawal dynamics on a sloping beach with discontinuous macro-roughness.
Virginia Tech

Example Applications for ENH Research

Tsunami runup and withdrawal dynamics on a sloping beach with discontinuous macro-roughness. Virginia Tech

Multi-phase project:

- Pilot and payload project
- Wave calibration
- Full project



Bathymetry: idealized, fixed

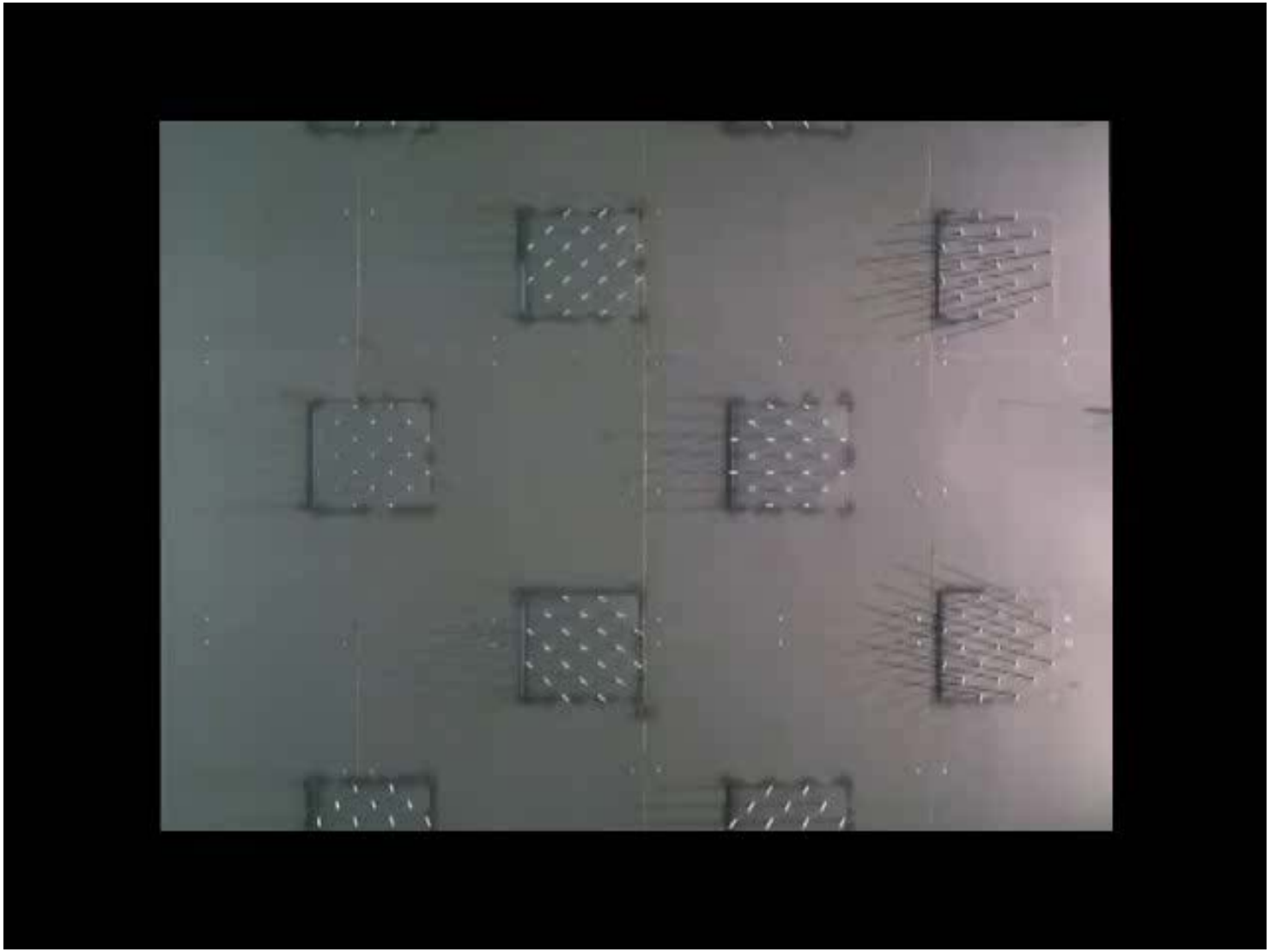
Hydrodynamic conditions: Full-stroke tsunami

Instrumentation: wave gauges (surface elevation), acoustic probes (run-up), ADV (3D velocity), still and video cameras

Model: patches of vertical cylinders

Example Applications for ENH Research

Tsunami runup and withdrawal dynamics on a sloping beach with discontinuous macro-roughness.
Virginia Tech



O.H. Hinsdale Wave Research Laboratory

Example Applications of Natural Hazards Research

Tsunami impact forces on bridges

Key features

Large Wave Flume
Modular, variable slope beach profile
Two 1:5 bridge specimens (steel girders and concrete slab)
Tsunami and (storm) wave impact forces
Hydrodynamics and structure response
Numerical validation

Example Applications for ENH Research

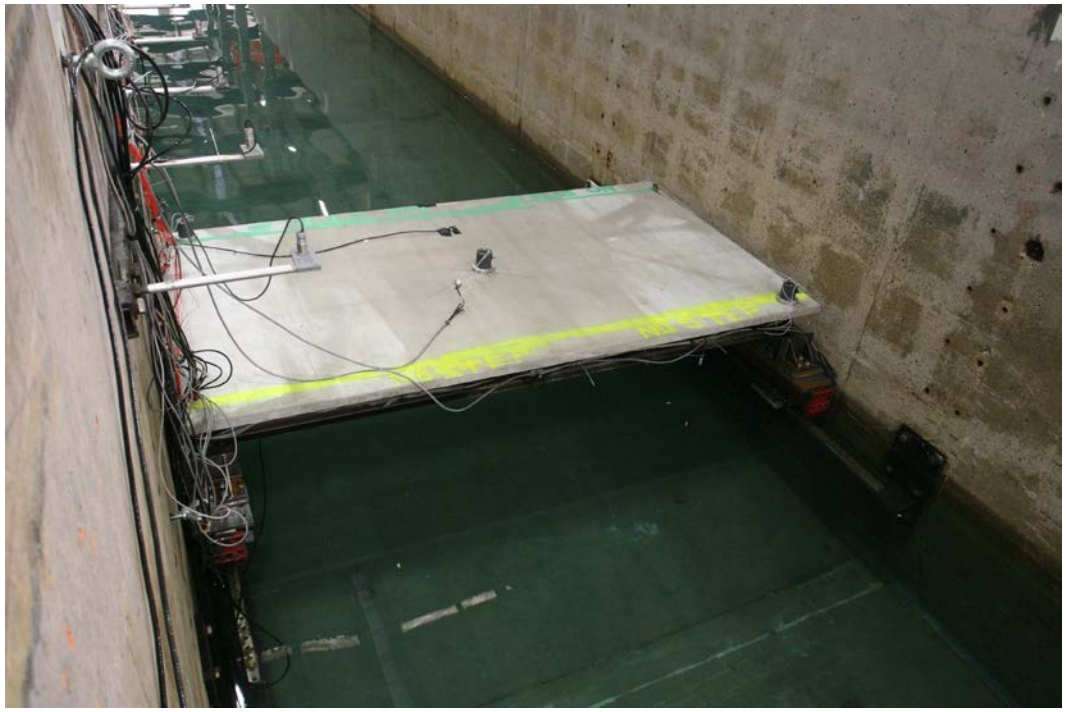
Tsunami impact forces on bridges. University of Nevada - Reno

Preliminary tests: Tsunami generation and bore formation

Example Applications for ENH Research

Tsunami impact forces on bridges. University of Nevada - Reno

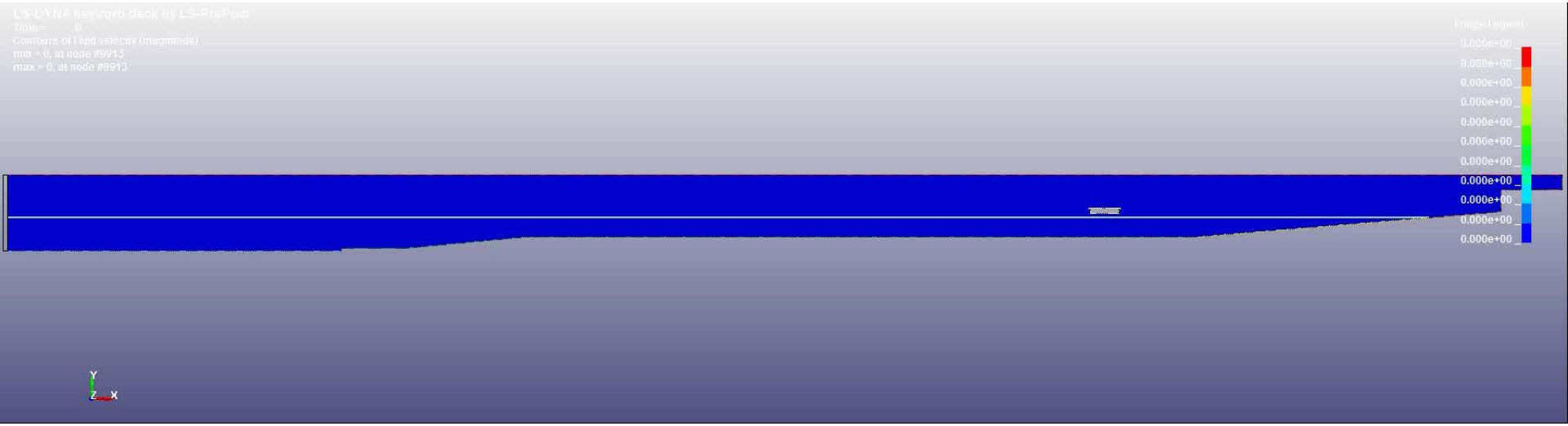
Model construction and installation



Example Applications for ENH Research

Tsunami impact forces on bridges. University of Nevada - Reno

- Bathymetry: idealized, fixed, adapted configuration
- Hydrodynamic conditions: Solitary-waves and storm waves, variable depth
- Instrumentation: wave gauges (surface elevation), acoustic probes (overtopping), ADV (3D velocity), pressure gauges, load cells, strain gauges, accelerometers, position transducers, still and video (underwater) cameras
- Models: 1:5 steel girder and concrete slab bridge



O.H. Hinsdale Wave Research Laboratory

Example Applications of Natural Hazards Research

Levee overtopping

Key features

Large Wave Flume
Full-scale levee with natural grass
Overtopping measurement and recirculation system

Example Applications for ENH Research

Levee overtopping. Jackson State University

Bathymetry: idealized, semi-fixed, adapted configuration

Hydrodynamic conditions: Storm waves and overtopping discharge

Instrumentation: wave gauges (surface elevation), ADV (3D velocity), still and video (underwater) cameras

Model: prototype levee with natural turf and grass

Example Applications for ENH Research

Levee overtopping. Jackson State University

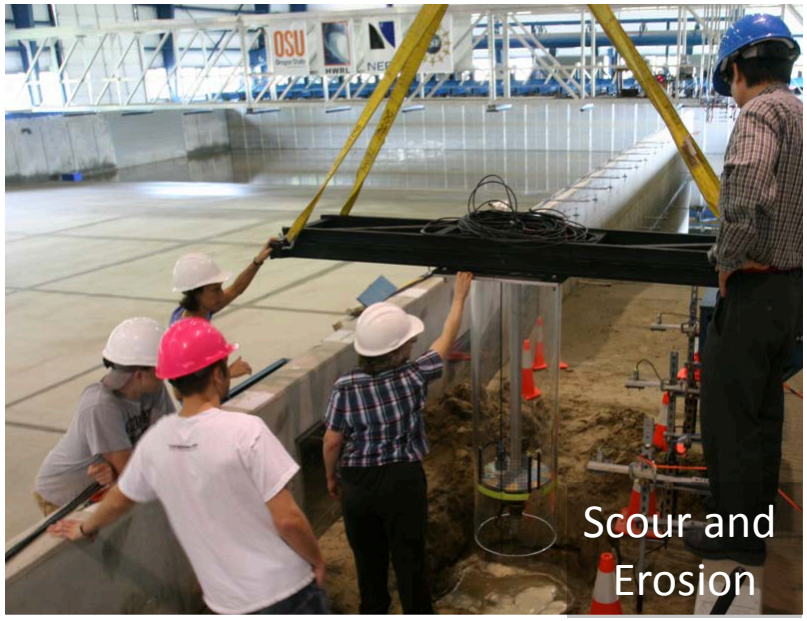
O.H. Hinsdale Wave Research Laboratory

Example Applications of Natural Hazards Research

Other examples:

Hurricane waves and surge impact forces on bridges
Sheltering and debris impact forces in Tsunami events
Scour and erosion in coastal structures

Additional Example Applications for ENH Research



LWF and DWB can accommodate both seismic (tsunami) and wind (wave/surge) hazards