National Science Foundation

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

UC San Diego
JACOBS SCHOOL OF ENGINEERING
Structural Engineering

Preparing an NSF Proposal to Utilize NHERI@UC San Diego LHPOST6

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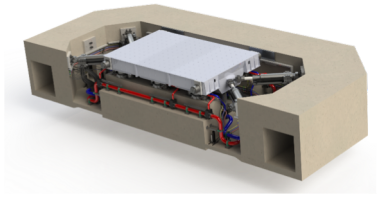
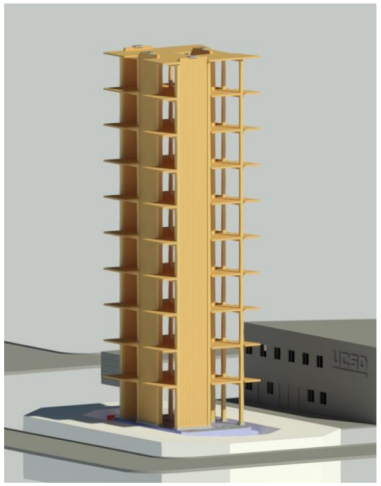
University of California San Diego



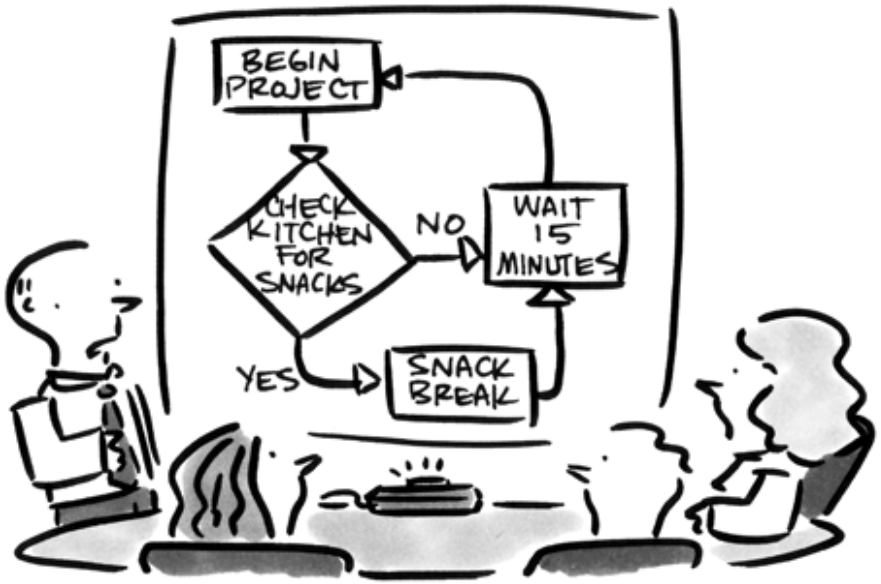
NHERI@UC San Diego User Training Workshop

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



Key Steps

1) Define project vision
   a. Test purpose, impact
   b. Modeling component, impact
   c. Technology transfer
2) Selecting your team
3) Developing your schedule
4) Estimating your budget



"I think I found what's slowing us down..."

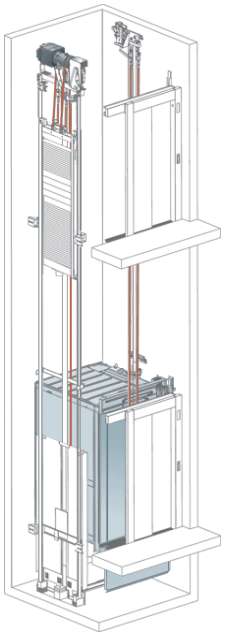
In this discussion, we will focus on test planning in the context of 1-4

1) Vision, Test Purpose, Impact

- Outline the Project Vision
  - These tests are LARGE, COSTLY, and LARGE
  - They will take immense time and resources
  - By their nature, they are landmark and completely unique & support broad *visions to solve grand challenge research problems*
- Clearly define the Tests Program Purpose
  - Identify the purpose of the test program
  - Focus on clarifying the mechanisms that will dominate the response; this will help you sell your vision, and know what to measure
  - What are the key gaps in knowledge?
    - Past related research
    - Limitations in design codes/methods/standards of practice
- Incorporate modeling/simulation/design standards, for:
  - Validation of existing, advancement of new, extending test scenario conditions, etc.

Test Program Overview (NEESR-BNCS)

- Three-phased full-scale test program conducted on a 5-story building-NCS system
- Vision (short): understand total building system seismic response



Summary of Major NCSs:

- Egress systems:
  - Operable Elevator
  - Stairs
- Facades:
  - Concrete cladding
  - Balloon framing
- Hospital equipment
- Roof mounted equipment
- Sprinkler and riser systems
- Ceilings
- Interior partition walls

HVAC

Facades

Hospital Floor

Project Vision (verbose)

- To make breakthrough advances in the understanding of total building systems performance (structural *and* nonstructural systems) under moderate and extreme seismic conditions through full-scale testing.

- Obtain data, which are sorely needed to characterize the earthquake performance of structural and nonstructural building systems, including nonstructural systems with protective measures.

- Use this data to validate nonlinear simulation tools, which in turn can be used for higher-performance code design and performance-based seismic design of nonstructural and building systems.

- Infuse findings into seismic design guidelines and codes
  - Validate current code assumptions
  - Advance current code guidelines

Identify your hopeful impact!

- State your impact in the context of NSF Merit Review Criteria
  - Identify the **intellectual impacts**: "..potential to advance knowledge…"
  - Identify the **broader impacts**: "…potential to benefit society and contribute to the achievement of specific desired societal outcomes"

  - **Tip:** review NSF criteria (PAPPG – NSF 22001) & write your intellectual & broader impacts verbosely within the body of your proposal

2) Choose your project team

- Complex, large test programs can require input and support from large teams:
  - Academics (PIs, graduate students, undergraduate students)
  - Industry partners (design engineers, manufacturers, code experts)
  - Staff (your home University, NHERI@UCSD, DesignSafe-CI)

15 members of the “CFS-Midrise Building” test program (2016), three PIs (UCSD, WPI), two grad students, eight industry partners (four companies), two staff

Plan for your Project Leaders

- Researcher(s) on-site @ UCSD = project leaders
- Manage project resources to achieve deliverable (timeline)
  - Supplies, contractors, equipment
  - Work closely with NHERI staff
- Before coming to UCSD
  - Scheduling
  - CAD drawings (construction, instrumentation)
  - Pre-test analysis
    - Motion selection
    - Instrumentation layout
  - Prepare mathcad/matlab sheets
- At UCSD
  - Instrumentation, cameras
  - Tooling, labeling, oversight/participate in construction

Industry Partners (BNCS)

Also on your team: on-site technical staff@UCSD

Dr. Koorosh Lotfizadeh
Project Scientist,
NHERI Operations Manager

Alex Sherman
Site Foreman
Construction/de-erection, instrumentation

Robert Beckley
IT Manager and Network Administrator
Cameras, data storage

Jeremy Fitcher
Development Technician
Construction/de-erection, instrumentation

Abdullah Hamid
R&D Engineer
Shake table operation, instrumentation/planning

Roxy & friends
(construction supervisor)

3) Develop your schedule (major items)

- **@Proposal level**
  - *Test planning*
    - Construction drawings, pre-test modeling, instrumentation planning, material & construction procurement
  - *On-site test efforts*
    - Construction: duration varies significantly based on test scope (BNCS > 1yr, CFS ~ 5 weeks)
    - Instrumentation: can vary, 2-4 weeks is common, some can occur during construction
    - Test Execution: can vary, 2-4 weeks is common, but depends on how many motions, how much in between (different phases/model configurations, retrofit/repair, inspection down-time, etc)
    - Demolition: don't forget this in your schedule & budget! Can take 2-4 weeks depending on the complexity of specimen!
  - *Post-test data processing*
  - *Post-test modeling*
  - *Technology transfer – disseminate the outcomes of your research project (K-grey)*

3) Develop your schedule (on-site efforts)

- **@Start of project**
  - Notification of award, rough planning (approximate YrQrt)
  - Prior year (narrow in on the quarter)
  - ~3 months before *(when is highly dependent on complexity)*
    - Specimen drawings
    - Test protocol
    - Motion selection, iteration (bare table)
    - Instrumentation plans
  - Present to NHERI staff *(when is highly dependent on complexity)*
    - Solicit input on planning
      - Specimen preparation phases: Specimen construction, attachment to table, mass assembly/attachment, instrumentation
      - Test execution phases: motion selection, scaling, ordering, inspection (& repair or specimen modification?) protocol
      - Test completion: planning for de-erection and disposal of specimen
    - Assure safety protocols are in place

Schedule e.g. (on-site efforts, CFS-HUD)

- Start of construction: (layout, tie-downs); major construction items [4-5weeks]:
  - Structural framing erector (4/18-4/28); mass installation with floors
  - Doors (framing, finish) (5/8-5/13)
  - Interior work (sheetrock, mud/tape) (5/2-5/13)
- Instrumentation (5/9-5/27) [3weeks]
- Seismic tests (5/30-6/3) [1week]
- Remove seismic sensors (6/6-6/10) [1week]
- Fire tests (6/13-7/1) [2weeks]

- 12 weeks total on-site (construction, testing)
- 1 week rapid, modular de-erection

Construction Duration Varies Greatly!

Deconstruction Duration Varies Greatly!

Schedule e.g. (on-site efforts, superstructure construction, BNCS)

ROOF SLAB:
September 21st,2011

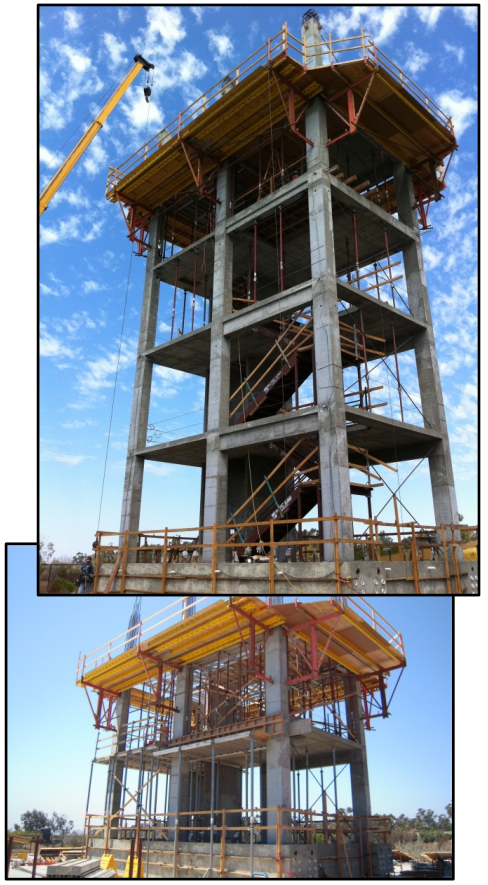
FIFTH FLOOR SLAB:
September 6th,2011

FOURTH FLOOR SLAB:
August 19th,2011

THIRD FLOOR SLAB:
August 3rd,2011

SECOND FLOOR SLAB:
July 15th,2011

FOUNDATION:
June 27th,2011



Research Activities (during construction)

- During construction, research team needed to multi-task
  - Conduct pre-test simulations (guide motion selection, instrumentation layout)
  - Watch, document, & take part in (as feasible) construction
  - Create instrumentation drawings
  - Watch, document, & take part in (as feasible) construction
    - We created a weekly construction log documenting all key construction activities digitally & disseminating them during a weekly team meeting

An actual schedule (major items, e.g. BNCS)

Elan: Aug 8, 2007

Temus: March 31, 2011

2007 | 2008 | 2009 | 2010 | 2011 | 2 | 2013+

- Pre-proposal workshop
- NEESR Funding & Kick-off meeting
- Construction (~9m)
- Seismic Testing Phases (~1m)
- Live Fire Testing (~0.5m)

4) Estimating your budget (Big Picture)

- Research staff (PI, students)
  - Carrying out tests, modeling, project, etc.
  - How many and for how long (designate PI/students to major items)
- Tests
  - Physical test costs
  - Secure donations (complement research funds)
  - Can vary dramatically, some ideas next slide….
- Travel, workshops
  - Supporting your research planning and dissemination
  - How much, how many, purpose, etc.

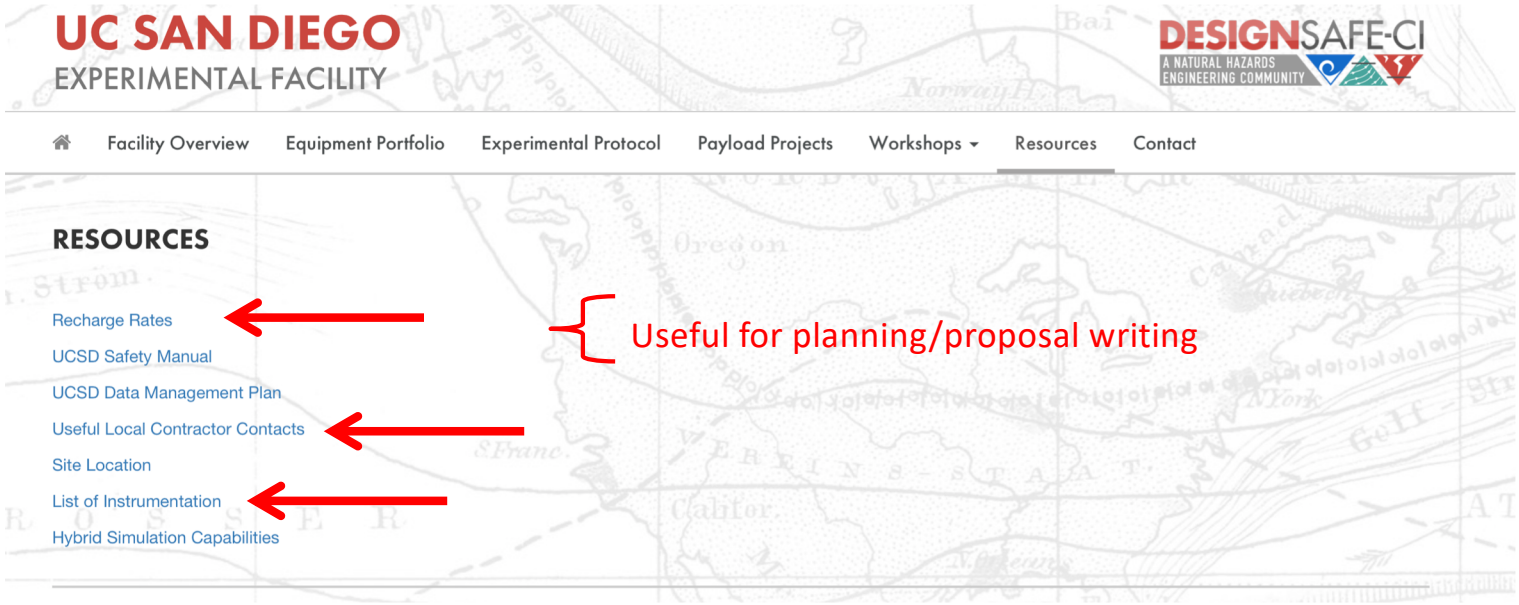
Overall budget heavily linked to duration, scope of tests, and additional support (outside of NSF resources)

4) Estimating your budget (Physical Test Costs)

- Site will support operations during construction and de-erection
  - Guidance regarding test planning
  - Over-sight during construction and de-erection; execution of tests
- Site is not able to support construction and de-erection costs – you will need a separate budget for these costs
  - Select several contractors, request estimates; understand their heavy equipment needs (during construction they will need to either rent the sites equipment or obtain rental outside of site)
  - For initial planning/budgeting, select UCSD-vendor contractors
- Site will provide and support placement of all major sensors
  - Analog sensors, camera system – check our inventory against your needs, if there are specialty sensors you will need to budget for them
- Site will not support cost of expendables associated with sensors – you will need a separate budget for these costs
  - Strain gages, cabling, labels, unique support brackets for sensors or cameras, damaged sensors and cables (include SOME allowance in your NSF or other complementary funding)

Additional Resources (via DesignSafe)

- https://ucsd.designsafe-ci.org/resources/



4) Budget: Expect the Unexpected!

Testing Scope & Project Resources (BNCS)

- Three Test Phases
  1. Base isolated building-nonstructural system
  2. Fixed base building-nonstructural system
  3. Controlled live fire tests
- ~5M US$, multi-organizational 4 year project (2010-2014)
  - NSF-NEES core research project - $1.2M
  - Englekirk Advisory Board - $1.5M (est)
    - Construction, de-construction & demolition
  - Charles Pankow Foundation - $250k
    - Design guidelines for precast concrete facades
  - California Seismic Safety Commission - $360k
    - Seismic performance of hospitals
  - Industry consortium - remainder $ resources, materials, equipment, technical expertise, etc.

Other considerations when planning your NSF research program: ECO

- Education & community outreach (ECO) is a key element in NSF merit review (broader impacts)
- Experience of NHERI@UCSD Team:
  - Technology transfer (webinars, project videos, laboratory tours, etc)
  - Media relations [Jacobs School of Engineering Media Team (available to help)]: https://jacobsschool.ucsd.edu/news/media-contacts
  - Educating future engineers
    - Seismic outreach ambassador program (eg. NHERI4kids)
    - NSF NHERI REU
    - Graduate student training

Please contact Prof Lelli van den Einde @UCSD for these and many more ideas (see her earlier talk for more ideas!)

Last Remarks

- NHERI@UC San Diego staff and PI/Co-PIs/SP are available resources to help with your proposal planning and project execution
- We recommend discussions during proposal preparation to help develop scope & budget
- All conversations are kept confidential
  - We want to help you succeed! (your success is our success)
  - The actual level of early interactions during project planning with NHERI@UC San Diego is up to you - but again, we want you to succeed!

Please reach out – we are here to help you prepare/plan the advancement of your your unique ideas using NHERI@UC San Diego