User Policies & Guidelines

NEES equipment site at the University of Texas at Austin (nees@UTexas)

- nees@UTexas Project Management Team, March 28, 2005
- This handbook describes the George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) user policies and guidelines for the University of Texas at Austin Equipment Site (nees@UTexas).

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1. INTRODUCTION

The NEES equipment site at the University of Texas at Austin (nees@UTexas) is an equipment site that is aimed at advancing the state-of-the-art in in-situ dynamic material property characterization and field testing of geotechnical deposits and soil-structure systems. The nees@UTexas equipment includes: (1) three mobile shakers that have diverse force and frequency capabilities, (2) a tractor-trailer rig to move the two largest shakers around the United States, (3) an instrumentation van that houses state-of-the-art data acquisition systems and a satellite link-up, and (4) a large collection of field instrumentation that includes wired and wireless sensors that measure vibrational motions and dynamic pore-water pressures. The primary goal of nees@UTexas is to load real geotechnical and structural systems dynamically in their actual settings.

The three mobile shakers are called: (1) T-Rex (Figure 1), (2) Liquidator (Figure 2), and (3) Thumper (Figure 3). T-Rex is capable of generating large dynamic forces in any of three directions (X, Y, or Z directions). The shaking system is placed on an off-road vehicle so that it can be operated in difficult geologic environments. Liquidator is a lower-frequency shaker than T-Rex. It is also carried on an off-road vehicle. The shaking system is shop orientable in either the vertical or horizontal direction. Liquidator's shaking system is specially designed to give a maximum dynamic output in the low frequency range, defined as 0.5 to 4.0 Hz. Thumper is the smallest shaker which has the lowest output but operates at the highest frequencies. Thumper is ideal for urban usage.

A field instrumentation van (Figure 4) houses the control systems and instrumentation for the mobile shaking equipment. The van carries data acquisition systems, waveform processing equipment, computer workstations, sensors, and teleparticipation equipment. There are two state-of-the-art data acquisition systems installed in the instrumentation van. These systems are: (1) a Sercel 408XL System which is capable of collecting up to 2000 channels of data (wired or wireless), (2) a VXI Technology System which is a 48-channel dynamic signal analyzer. Sensors include 3-D, 1-Hz geophones, additional smaller geophones, accelerometers, and pore-water pressure transducers. The mobile field shakers and instrumentation van are connected to the NEESgrid via a satellite modem. Telepresence allows remote researchers to interact with field personnel and view results from field testing "on the fly".

An inventory list of the nees@UTexas equipment is provided in Appendix A. Performance specifications and additional details of the equipment are available at http://nees.utexas.edu.

Projects involving the nees@UTexas Site can be categorized as either: a) NEES shared-use projects or b) non-NEES project. These two types of projects are defined as following.

Figure 1 T-Rex

Figure 2 Liquidator

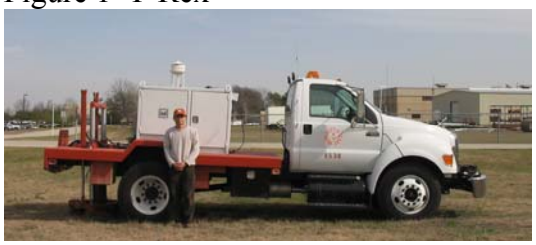

Figure 3 Thumper

Figure 4 Instrumentation Van

a. NEES shared-use projects:

Projects that are founded by the Division of Civil and Mechanical Systems (CMS) of National Science Foundation (NSF) through the NEES Consortium, Inc. (NEESinc) are defined as NEES shared-use projects. A Project funded by other organizations can also be qualified as a NEES shared-use project, if a written approval for the project is granted from the NSF NEES Program Director. (Final decisions regarding the classification of NEES shared-use project status for research projects rested with the NEES Board of Directors in consultation with NSF NEES Program Director.)

There are no user fees associated with the baseline level of service for the operation and maintenance of nees@UTexas facilities for the NEES shared-use projects. However, the users are responsible for fuel and hydraulic oil needed for the field work. Please refer to Section 4 for user cost. Additional levels of service beyond the baseline will be subject to user fees as specified in Appendixes B and C.

b. Non-NEES projects:

Projects which are not qualified as a NEES share-use projects are non-NEES projects. These projects are subject to user fees for all project activities involving the nees@UTexas facilities. Procedures of a non-NEES project are discussed in Section 5. All costs will be determined based on the fee for non-NEES projects listed in Appendixes B and C.

2. SAFETY AND SECURITY

The nees@UTexas Site is committed to the safety, health and well being of its students, faculty, staff and visitors. Faculties and staffs have the responsibility to promote health and safety in their environments and operations. All users of the nees@UTexas Site are expected to support this commitment.

2.1 Safety

Everyone participated in the field work are responsible for the safety of his own and those of the people who work around him. Wear proper cloth, and do not do or ask anyone else to do anything that is not safe. Under the guidelines of the University of Texas general vehicle safety and driver certification, **NEES vehicles must be operated by UT employees.** Safety preparations and safety concerns during the field tests are discussed below.

2.1.1 Safety Preparation before Field Tests

The Principal Investigator of the user team needs to perform a site survey on the proposed test site to identify all potential hazards of the site and the potential hazards that may be caused by the shaker before field tests, and provides the nees@UTexas Project Management Team (PMT) with a description of planned experiments one month before testing commences. The nees@UTexas PMT will review the planned experiments to assess hazards that may compromise the safety of the nees@UTexas personnel and equipment, and may give suggestions accordingly. However, the responsibility for the design of the experiment with regards to safety of the environment rests on the user, and **the Principal Investigator of the user team is responsible for obtaining permits for site access and the site liability insurance.**

Before starting any field test, the project principal investigator of the user team should prepare a **project-specific disaster-preparedness-kit** as specified in the nees@UTexas Safety Handbook. This disaster preparedness kit should contain maps and information specific to the project site emergency contacts, nearby hospitals, and evacuation routes. This disaster preparedness kit must be located on the project site at all times during the field operation.

2.1.2 Safety in the Field

All project participants should understand the nees@UTexas Safety Handbook and to complete the safety certification as needed. Failure to comply with any of the nees@UTexas safety policies may result in the termination of the project. A complete listing of the safety rules and guidelines can be found in the nees@UTexas Safety Handbook.

In general, each field experiment will have two leaders, a Chief Engineer, and a Chief Scientist. The Chief Engineer will be a member of the nees@UTexas team, and the Chief Scientist is one of the users, who may be the project Principal Investigator of the user team or a person whom is authorized by the project Principal Investigator of the user team to make decisions concerning the experiments to be performed on site. The roles and responsibilities of the Chief Scientist and the Chief Engineer in the field are described below.

The roles and responsibilities of the **Chief Scientist** are:

1. **performing a through survey on the proposed test site with the Principal Investigator of the user team to identify all potential hazards of the site and the potential hazards that may be caused by the shaker before field tests;**

2. **ensuring a way of communication (e.g. cellular phone or satellite phone) for emergency contact at all time;**
3. responding to disasters according to the disaster preparedness kit prepared by the Principal Investigator of the user team.
4. the safety of the non-nees@UTexas personnel and equipment;
5. providing "Acknowledgement of General Field Hazards and Policies" and maintain a signed statement to/from non-nees@UTexas members participated in a field experiment;
6. maintaining an on-site log of insurance information and emergency contacts for non-nees@UTexas members;
7. ensuring that everyone works within 100 ft radius of the shaker has been trained;
8. avoiding overtime or operating in the dark

The roles and responsibilities of the **Chief Engineer** are:

1. **an authority on the operation of all nees@UTexas vehicles and equipment;**
2. the safety of the nees@UTexas personnel and equipment, and has final authority concerning operation of any nees@UTexas equipment;
3. providing "Acknowledgement of General Field Hazards and Policies" and maintain a signed statement to/from nees@UTexas members participated in a field experiment;
4. maintaining an on-site log of insurance information and emergency contacts for nees@UTexas members;
5. providing on-site safety training for non-nees@UTexas members who will be working with 100 ft radius of the hydraulic shakers;
6. maintaining a signed copy of the "On-Site Shakers Safety Training Statement" from non-nees@UTexas members who will be working with 100 ft radius of the hydraulic shakers.

Both Chief Scientist and Chief Engineer have the responsibility and authority of asking anyone who does not follow the nees@UTexas Safety Handbook to leave the test site immediately.

2.2 SECURITY

The principal investigator of the user team is responsible for ensuring the security of nees@UTexas equipment at the project site, and developing a risk management plan. Security concerns at a field site include theft, vandalism, fire, rain, hail, etc. In certain situations, the Principal Investigator may be required to hire security personnel to guard the nees@UTexas equipment.

3. Scheduling Guidelines and Policies

a. The nees@UTexas Site is operated on a first come, first served basis. However, the nees@UTexas Project Management Team (PMT) may adjust the test schedules to reduce conflicts and operation costs accordingly.
b. A standard nees@UTexas work day consists of 8 hours of operation, generally between 8:00 am to 5:00 pm local time. These hours include time incurred traveling to and from the project site and time required for vehicle safety maintenance and

refueling the shaker (~ 1 hour a day). Exceptions to this policy must be made in writing in advance and agreed upon by the nees@UTexas PMT. In most of cases, a shaker vibrates about 6 hours each day.

c. It is strongly discouraged to operate shakers more than 6 hours a day in the field. Mental fatigue of the shaker operator can reduce his/her ability to react to incidents, which can raise safety concerns.
d. Field work should not operate after dark without proper lighting.
e. Users are responsible for overtime hours pay incurred by nees@UTexas personnel during extended hours of operation.
f. T-Rex and Liquidator are operated at a pressure as high as 3,000 psi with a force output as high as 60,000 lb and 20,000 lb, respectively. Components are subjected to high pressure and high acceleration for a long period of time. Equipment break-down happens from time to time. The recovering time can take from one hour to one month, depending on the severity of the break-down and the readiness of the spare parts. Approximately 20% of the time in the field should be dedicated to maintenance. User(s) should plan for this and should cover the time and cost of these maintenance operations. In the other words, a total of 6 working days should be planned for a project that requires 5 experiment days. In addition, a 25% mark-up of the traveling cost (equipment shipment, personnel travel, and per-diem) need to be added on each project as a reserve fund. This fund will be used for projects that experience unexpected equipment break-down.
g. If a project extends through a weekend, users are responsible for either (1) costs for nees@UTexas personnel to travel home or (2) lodging, per diem and rental car for the personnel to stay at the project location. nees@UTexas personnel will not work through weekend. A written approval from the nees@UTexas PMT is required for weekend operation.
h. All safety guidelines detailed in the nees@UTexas Safety Handbook must be strictly followed.

4. NEES Shared-Use Projects

The nees@UTexas site will provide a baseline level of service to all NEES shared use projects at no cost. This includes providing equipment and facilities, IT infrastructure for NEES connectivity, training, and research assistance throughout the ten-year operational period from 2004 to 2014. However, the costs of fuel, hydraulic oil, and travel expenses are site dependent, so are not covered in the baseline level of service. Equipment and facilities, IT infrastructure, and research assistance the nees@UTexas site can provide for the NEES shared-use projects are discussed below.

4.1 EQUIPMENT & FACILITIES

NEES researchers will have access to all nees@UTexas equipment purchased through the George E. Brown, Jr. Network for Earthquake Engineering Program. Field testing will include one mobile shaker (Thumper, T-REX, or Liquidator), the instrumentation van, and at least three University of Texas field personnel. Only University of Texas personnel may operate the field equipment. If more than one mobile shaker is required, additional UT field personnel may be required. NEES users will be required to pay for transportation/mobilization costs for the equipment and field

personnel, per diem costs for the field personnel, and a rental car for the field personnel. (Please see Appendixes B and C for details.)

If more than one mobile shaker is required, transportation/mobilization costs may be higher than listed below because there is only one NEES transportation tractor-trailer (Big-Rig). Tractor-trailer transportation only is required for T-REX and Liquidator. Please note that **Big-Rig loaded with T-Rex or Liquidator will be an overweight vehicle**. The dimensions of the Big-Rig are 13.5 ft tall, 72 ft long, 8.5 wide. The weights of the Big-Rig loaded with T-Rex or Liquidator are 106,000 lb or 112,000 lb, respectively. It is an overweight vehicle and requires special permits for all states. Due to the weight and length of the loaded Big-Rig, some locations are beyond the reach of the T-Rex and Liquidator. The costs for overweight permits are site dependent and are beyond the baseline level of service to all NEES shared use projects.

The nees@UTexas teams will be responsible for maintaining all equipment at full function, operating the equipment, and reconfiguring (not modifying) the equipment for specific experiments, repairing or replacing failed equipment, and providing basic training for selected equipment. However, the **Principal Investigator of the user team are responsible for repairing or replacing failed equipment damaged or lost in the field tests caused by the user team.**

Visiting researchers can request to have office space allocated on a temporary basis on the University of Texas at Austin campus for NEES project related activities. Visiting researchers will be authorized by the Operations Manager to perform limited activities using the nees@UTexas equipment (e.g. laying out sensors and cables) upon successful completion of training. Visiting researchers will be provided access to utilities and ancillary services (e.g., libraries, shuttle buses, and on campus internet access) at the University of Texas at Austin. At field project sites, the Principal Investigator of the user team and his/her team will be responsible for providing ancillary equipment (e.g., forklift, crane, etc.) and utilities (fuel or additional generators beyond what exists at nees@UTexas).

4.2 IT INFRASTRUCTURE

The nees@UTexas Site has unique networking requirements given that it is a field testing site without hard-wired connectivity to the NEESgrid[1] during an experiment. Consequently, the nees@UTexas Site has developed a two component solution consisting of a campus and field network.

The campus network contains a central NEESpop system and telepresence server for collaboration and real-time telepresence. The NEESpop server connects to the global NEESgrid network through the Internet via a gigabit backbone, and serves as the central system to monitor relevant services, authenticate users, perform resource discovery, provide computational capabilities, cache data, browse data, and host the local NEES data repository through the life of the project. This system functions as the primary point of contact with NEESgrid since it is directly connected to the campus gigabit backbone.

The field network is deployed at the remote site and transparently connects to the NEESpop through an encrypted satellite up-link. The field network enables the streaming of video, uploads of data to the campus NEESpop, and provides local streaming video and temporary data, video and metadata storage in the field. In addition to the satellite up-link, the field network includes a high performance wired (Gigabit) and wireless (54Mbps) network in the field for on-site researchers.

The nees@UTexas staff will provide training for visiting researchers on both the NEESgrid system and the field systems in addition to assisting in data transfer to the NEES data repository.

Note: 1. NEESgrid is a networked infrastructure that facilitates integration of diverse systems such as instrumentation (including huge shake tables, centrifuges and tsunami wave tanks), computational resources and collaborative environments. Please visit the NEESinc web site, http://nees.org, for more information.

4.3 RESEARCH ASSISTANCE

The nees@UTexas Site will assist researchers with post-award planning and design and experiment execution as discussed below.

4.3.1 Pre-award planning and design

Pre- award planning includes **discussions** with researchers planning to submit NEES proposals:

- estimating experiment costs beyond the baseline level of service in using nees@UTexas equipment;
- nees@UTexas equipment specifications;
- scheduling tasks.

4.3.2 Post-award planning and design

Post-award planning includes **assisting** NEES researchers in:

- estimating experiment costs beyond the baseline level of service in using nees@UTexas equipment;
- obtaining overweight permits for Big-Rig;
- scheduling tasks;
- developing a disaster-preparedness kit;
- assessing project safety;
- developing a risk management plan;
- clarifying equipment performance capabilities and configuration;
- reviewing instrumentation plan and configuration;
- providing trainings.

4.3.3 Experiment execution

The nees@UTexas baseline level of service includes:

- ensuring that all nees@UTexas equipment are functioning properly, and repairing or replacing failed equipment (which are not caused by the users).
- operating nees@UTexas shakers at locations specified by the Chief Scientist.

- operating the nees@UTexas data acquisition systems.
- installing, configuring, and operating the field nees@UTexas IT network including the satellite uplink.

The following services are considered beyond the baseline level service of nees@UTexas. If agreed in advance, some service can be supplied if time permits. **Costs for these services as determined using the rate schedule in Appendixes B and C will be directly reimbursed by the individual research projects without involving the NEES Consortium funds**.

- Modifying equipment, instrumentation or facilities to meet specific experiment needs.
- Coordinating nees@UTexas equipment shipping from the UT campus to the field project site.
- Travel costs associated with performing NEES research off-campus.
- Shipping costs associated with deploying equipment. This includes fuel costs for mobilizing the shakers and instrumentation van.
- Providing fuel* and hydraulic oil for field operations.
- Costs associated with securing the equipment at the project site.
- Costs associated with leasing the project site.
- Costs associated with obtaining site permits.
- Costs associated with obtaining overweight permits and toll fee.

Note: *For field work longer than 2 days, users are responsible of refueling (diesel) T-Rex and Liquidator. **A field-fuel-supply-truck** is the preferred fueling method. In cases where a fuel truck can not be arranged, diesel fuel tanks may be used. However, caution is required to prevent dust and dirt from the diesel fuel, and an enclosed transportation vehicle is required for the fuel transportation. Both T-Rex and Liquidator need about 10 gallon of diesel fuel for each hour of operation.

5. Non-NEES Projects

Projects which are not qualified as NEES share-use projects are non-NEES projects. Project initiation and cost assessments for a non-NEES project are discussed below. At least one of the nees@UTexas Principal Investigator or Co- Principal Investigators should participate in the research of any non-NEES project.

5.1 PROJECT INITIATION

Investigators of non-NEES projects desiring to utilize the nees@UTexas facility are requested to first contact the nees@UTexas Principal Investigator to discuss the nature and scope of the project. Following this discussion, potential users are requested to submit a 1-page project summary which describes the project objectives, test site, planned test series, requested nees@UTexas equipment and tentative project schedule.

The nees@UTexas Project Management Team will review the non-NEES project requests and make a final determination based on scheduling, safety and other considerations. If the nees@UTexas Principal Investigator authorizes the project, the

Operations Manager will work with the user to develop a cost estimate and project schedule.

5.2 COST ASSESSMENTS

Project testing costs will be determined using the fee schedule provided in Appendixes B and C. Non-NEES users are responsible for all project costs related to:

- Design, setup, installation, execution and removal of the experiment.
- Modification of equipment, instrumentation or facilities to meet specific experiment needs.
- Travel costs for nees@UTexas personnel associated with performing NEES research off-campus.
- Shipping costs associated with deploying equipment. This includes fuel costs for mobilizing the mobile command center and/or the cone penetration testing truck.
- Providing fuel* and hydraulic oil for field operations.
- Costs associated with securing the equipment at the project site.
- Costs associated with leasing the project site.
- Costs associated with obtaining permits.

In turn, the nees@UTexas Site will be responsible for maintaining all equipment at full function and will bear costs related to repairing or replacing the equipment due to failure not caused by the user. However, the nees@UTexas Site will not be responsible for extra per diem, travel, or lease costs incurred by the user team that arise from equipment malfunction.

Note: *For field work longer than 2 days, users are responsible of refueling (diesel) T-Rex and Liquidator. **A field-fuel-supply-truck** is the preferred fueling method. In cases where a fuel truck can not be arranged, diesel fuel tanks may be used. However, caution is required to prevent the dust from the diesel fuel, and an enclosed transportation vehicle is required for the fuel transportation. Both T-Rex and Liquidator need about 10 gallon for each hour of vibration.

Appendix A – Equipment Portfolio

Equipment	Quantity	Description
Shakers		
T-Rex	1	3-axises shaker
Liquidator	1	Lower frequency shaker
Thumper	1	Urban shaker
Other Vehicles		
Big-Rig (Tractor-Trailer)	1	Highway transportation for T-Rex and Liquidator
Instrumentation Van	1	Equipped with DAQ and internet connection
Dirty Trailer	1	Air-conditioned and can be towed by Instrumentation Van or Thumper
Data Acquisition Systems		
Sercel DAQ System	1	With Wired or wireless sensors
VXI 72-Ch Analyzer	1	With Data Physics software
Agilent 4-Ch Analyzer	1	Self contained 4-ch analyzer
Sensors		
1-Hz Geophone	12	3 component
1-Hz Geophone	16	1 component (vertical only)
Liquefaction Sensors*	8	Will make plans available so researcher can build. One or two sensors can be obtained on short term loan.

Notes: * If a liquefaction sensor is damaged or not retrieved, the estimated replacement cost for the NEES user is about $2,500

Appendix B – Recharge Rates[1,2]

	non-NEES projects	NEES shared-use projects
EQUIPMENT (Labor not included)		
T-Rex	$140.00/hr	$30.00/hr[3]
Liquidator	$125.00/hr	$30.00/hr[3]
Thumper	$50.00/hr	$17.50/hr[4]
	$1.25/mile	$0.30/mile[5]
Big-Rig	$2.40/mile	$0.35/mile[5, 6, 7]
Instrumentation Van		
Highway	$0.81/mile	$0.25/mile[5]
Recording Equipment	$16.00/hr	$2.00/hr[5]
Satellite Equipment	$280/hour	$280/hour[8]
Trailer	$500/project	$500/project
LABOR		
Programmer Analyst	$300/day + $56/hr Overtime	$0 + $56/hr Overtime
Big-Rig Operator	$300/day + $56/hr Overtime	$0 + $56/hr Overtime
Shaker Operator	$300/day + $56/hr Overtime	$0 + $56/hr Overtime

Note:
1. The nees@UTexas Site is a non-profitable organization and does not compete with any private company. The recharging rates of using the nees@UTexas Site is a direct reflection of the site operation costs. These costs may be adjusted according the actual costs of the operations.
2. **University 50% overhead is not included, and must be added.**
3. Including $25.00/hr for diesel fuel and $5.00/hr for hydraulic oil refill.
4. Including $12.50/hr for diesel fuel and $5.00/hr for hydraulic oil refill.
5. Fuel charge.
6. Overweight permits or toll fee are not included. The over weight permit is estimated to be about $1.00/mile.
7. There is only one Big-Rig at nees@UTexas. If both T-Rex and Liquidator are used in the project, a private transportation provider may be needed.
8. This rate accounts for the maximum data (400MB/hr) that can be transferred by the satellite equipment. In most of the case, one video camera will take about 40MB/hr. The project will be charged by the amount of data transferred using the satellite equipment.

Appendix C – Travel Fees and Policies

1. Users are responsible for all travel costs associated with their project. This includes lodging, per diem, airline fares, rental cars, toll fee, over weight permits, mileage reimbursement and parking for nees@UTexas staff.
2. If a project extends through a weekend, users are responsible for either (1) costs for nees@UTexas personnel to travel home or (2) lodging, per diem and rental car for the personnel to stay at the project location. nees@UTexas personnel will not work through weekend.
3. Per diem rates may vary from region to region. However, a rate of $150/person/day can be used in most cases to estimate lodging and per diem costs.