

# **PROCEDURE FOR TECHNICIAN AND LABORATORY FACILITIES REQUESTS**

Department of Civil and Environmental Engineering  
University of Michigan

December 5, 2018

## **Introduction**

The technical staff, fabrication facilities, and testing laboratories (structural engineering laboratory, mechanical testing laboratory, and concrete mixing laboratory) provide an indispensable resource for the Department of Civil and Environmental Engineering supporting its research and teaching programs in natural environments and built infrastructure. In order to benefit from the technical staff and facilities to the fullest extent possible, procedures are necessary to ensure that research and experiential teaching can be supported in an efficient, cost-effective, and safe manner. These outcomes can only occur when the expertise of the technical staff is harnessed early when students, post-docs and faculty are considering equipment/supply acquisition, test setups, and testing procedures. Likewise, the physical resources that are available are instrumental in conducting high quality research, but they must be coordinated to ensure that they are available for all who desire to use them. This document provides a procedure for coordination with the department's technical staff to assist in planning experimental research and teaching demonstrations using the technical staff and the laboratories. The primary aim of the procedure is to encourage a more collaborative approach to delivering technical services within the department. The benefits of improved collaboration between the technical staff and student/faculty teams are enormous including improved technical guidance at the outset of projects, shifting of technical burden from students to staff, and more cost-efficient project delivery. Formalizing a procedure also ensures that all faculty, post-docs and students within the Department are treated in a consistent and even manner.

## Technician Staff

### *Jan Pantolin – Technical Services Supervisor*



- GGB facilities or building issues
- Safety questions and training
- Chemical waste pickup
- Room and laboratory design
- Moving offices and equipment
- Property disposition
- Experiment design & field work
- Equipment maintenance and operation

### *Tom Yavaraski – Laboratory Services Supervisor*



- Core Analytical Facility in EWRE
- Lab instrumentation
- Lab training
- Lab safety
- Troubleshooting equipment issues
- Equipment installation and repair
- Reporting incidents
- EWRE facility or building issues

### *Justin Roelofs– Engineering Technician*



- GG Brown building needs
- GG Brown housekeeping needs
- Lab needs (both wet & dry sides)
- Lab training and safety
- Structures lab, mechanical testing lab, concrete mixing lab
- Fabrication of wood and plastic-based material items
- Hydraulic systems

### *Steve Donajkowski – Mechanical Technician*



- Fabrication
- Loaning out of measuring tools
- Design advice
- Outside vendor resources
- Room access
- General help with moving
- General help in the labs

***Ethan Kennedy – Electronics Technician***



- Fabrication of instrumentation and control equipment
- Troubleshooting mechanical & electrical equipment
- Ordering materials
- Safe operating procedures
- Data acquisition
- Maintain and repair lab and field instrumentation
- Assist in upgrading legacy devices

## Laboratory Facilities

***Structural Engineering Laboratory*** – The structural engineering laboratory provides the ability to perform large-scale testing of structural elements and sub-assemblies under monotonic and quasi-static cyclic loads. It consists of an L-shaped strong wall that is 20 ft. high and an approximately 40 ft. by 36 ft. strong floor. The laboratory is equipped with a hydraulic pump that can run a variety of servo-controlled actuators. The structural laboratory also is available for non-structural testing that requires large footprints, tall ceiling heights, or the need of the 10 ton crane upon coordination with the Technician Staff and Structures Laboratory Director.

***Mechanical Testing Laboratory*** – The mechanical testing laboratory is equipped with a number of hydraulic uniaxial load frames ranging in capacity from 22 kips up to 1000 kips. The Forney compression testing machine has been recently upgraded with enhanced controls and a touch screen for more precision load-controlled testing.

***Concrete Mixing Laboratory*** - The concrete mixing laboratory has basic equipment for mixing mortar, paste and concrete. Equipment includes: two coarse aggregate sieving machines, small to large mixers, a supply of plastic cylinder molds and a large wash out pit in the middle of the lab. Equipment for sulfur capping of concrete cylinders is inside a standard size fume hood. An oven also is available for drying out soils and a 10 inch diamond wet block saw for cutting larger concrete specimens.

***Data Acquisition*** – The laboratory facilities are equipped with a number of linear variable differential transformers (LVDTs), strain potentiometers and inclinometers. This instrumentation equipment and strain gages can be used in conjunction with the National Instruments SCXI-1001 data acquisition system which includes 7 modules providing 88 available channels for collecting data. The laboratory also is equipped with the NDI Optotrak Certus optical displacement tracking system. Two cameras, one close position sensor camera and one far position sensor camera, are available for use individually or paired.

***Fabrication Facilities*** – A small shop area is available adjacent to the Structural Engineering Laboratory and Mechanical Testing Laboratory that contains a table saw, drill press, mill, lathe and miter saw. This equipment is generally used by the laboratory staff, but with proper training can be used by faculty, post-docs and students during normal working hours.

## Step 1: Request and Scheduling

All work to be performed using department technical resources begins with a formal request for assistance. The request is the starting point for establishing *collaborative* relationships between researchers and technical staff members. It also allows for projects to be appropriately scheduled. Scheduling is an essential element of coordinating the resources required to support all of the department research and teaching projects. It ensures accuracy in predicting delivery times of project deliverables while providing guaranteed access to laboratory facilities. All scheduling of fabrication needs, laboratory use and technician time will be done through the *Work, Test and Lab Time Request Form* available online. Technical service customers will need to be logged into their UM Google accounts to use the form and to access the technical services calendar and spreadsheet. Upon receipt of requests, the Technical Services Supervisor will assess the request and schedule a time to meet with the primary contact for the project and appropriate technical staff.

***Work, Test and Lab Time Request Form*** –The Technician Staff has put together this form to be used for any request associated with fabrication, electronics assistance, equipment repair, equipment reservations, laboratory use, laboratory testing and need of technician time. This form will be used by the Technical Services Supervisor to setup a pre-planning meeting as well as to prioritize and schedule technical work and testing. Please use this form to initiate work you want done by the Technical Staff including staff time for research support and testing times with equipment reservations. It is imperative to start this process early, as a pre-planning meeting will be required. The link below provides access to the form:

- *Work, Test and Lab Time Request Form:*  
[https://docs.google.com/forms/d/e/1FAIpQLScDqUCi\\_fQSsvhadF4pAMPtPpY-c3c4RGyM44IXgBzXIOkfJA/viewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLScDqUCi_fQSsvhadF4pAMPtPpY-c3c4RGyM44IXgBzXIOkfJA/viewform?usp=sf_link)

***Work Requests Spreadsheet & Lab Usage and Planning Calendar*** – Once the aforementioned *Work, Test and Lab Time Request Form* is submitted and a pre-planning meeting has been completed, work requests will be added to the *Work Requests Spreadsheet* and testing/equipment requests will be added to the *Lab Usage and Planning Calendar*. The spreadsheet and calendar are displayed on the monitors in the Structures Lab for user convenience. You can also view the spreadsheet and calendar using the links below:

- *Google Work Requests Spreadsheet:*  
[https://docs.google.com/spreadsheets/d/1D1T7g314b\\_0cdTJu4w-5eVlplUjTWUCuEYTr4pHE4JY/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1D1T7g314b_0cdTJu4w-5eVlplUjTWUCuEYTr4pHE4JY/edit?usp=sharing)
- *Lab Usage and Planning Google Calendar:*  
<https://calendar.google.com/calendar?cid=dW1pY2guZWR1X3ExcGo1aTdoNTJpZGRnNDQyMHVnYzJwY28wQGdyb3VwLmNhbGVuZGFyLmdvb2dsZS5jb20>

## Step 2: Pre-Project Planning

### **Pre-Project Planning Meeting: Collaboration between Faculty, Student, and Staff**

To effectively work with the technical staff and utilize the Department's laboratory facilities, it is important to engage the technical staff as early in a project as possible. Engaging the technical staff at the planning stage allows for their expertise and experience to help save project cost and time. It also allows the technical staff to plan accordingly for upcoming projects so that they can work as efficiently as possible. To promote this early interaction, *a pre-project planning meeting is required for every project that requires fabrication, use of laboratory space, use of laboratory equipment and use of technician time*. Do not hesitate to setup a pre-planning meeting even during the conceptual phase of project planning.

The first step in the process of requesting departmental laboratory services is to fill out the *Work and Test Request Form*. On this form, a suggested pre-project planning meeting date and time is requested. The Technical Services Supervisor will confirm availability for a meeting and notify the customer within 2 business days of receiving the request. It is recommended to wait to purchase or fabricate any items for a project until after the pre-planning meeting; it is quite common for new ideas to emerge from these meetings such that previously purchased elements or fabricated items may no longer be needed.

The pre-planning meeting is used to identify all of the important elements of the request and to establish a timeline based on the project's needs and technician's availability. Customers should be prepared with as much detail as possible and have a list of specifications including numbers, units, materials, drawings, etc. For controlled systems with microcontrollers, provide the different states of operation and any future possible inputs/outputs and operation states; plan for future expansion if applicable.

More complicated and involved devices or systems, as well as test setups, require more planning and design work. These efforts take more time in the beginning, but will ultimately save the project teams time later, reduce the number of design iterations and get teams what they need quicker. Devices and systems can be designed many different ways; the technical staff have a lot of experience and have a sense of what works and what does not. Hence, the technical staff can help you consider the best design options that meet the project needs. The appropriate technical staff should be involved *throughout* the design process of larger projects as a member of the research team to facilitate coordination and to maximize their contributions to the project.

### **Purchase versus Fabricate**

When looking for an item or complete system, sometimes it is more efficient to just purchase it than spend hours of time trying to fabricate it. Sometimes someone else has gone through all the engineering issues and has a final operating product that may work better than anything that could be designed and fabricated by the technical staff. Ask the technical staff for input before you make a final decision to purchase an item or complete system. They can often provide an idea of whether fabricating an item is reasonable and feasible.

With that said, it is also recognized that purchased items, equipment and systems may have their issues. Cheaper, less robust items may not work well for the application or may fail early and break. The technical staff have seen purchased systems that are poorly engineered, are unsafe and

do not operate as expected. It is imperative you do your homework. Websites with good documentation of specifications and pictures can help you make better decisions. A company that can give you a demonstration and backs up their product with a warranty is better. The technical staff can ensure you purchase from a reputable business and will assist teams in selecting an appropriate vendor. Consulting with the staff will help save time and money in the long run.

### **Step 3: Technician and Laboratory Use Procedures**

There are three categories that the majority of interactions with the technical staff and laboratory facilities fall into: (1) fabrication, (2) laboratory use and testing, and (3) technician time. A description of the procedure for initiating and conducting work in these three categories is found below.

#### **Fabrication**

Standard mechanical fabrication can be a single piece of material cut to size with holes in it, while more complicated mechanical fabrication can involve several units put together in an assembly with moving pieces driven by a motor or other sources. Electrical fabrication can be as simple as wiring a light to plug into a standard electrical outlet to a PC or microcontroller turning valves and motors on and off and collecting data. Combined systems may need to allow for mechanical and electrical systems to work together. These types of fabrication efforts are within the purview of the laboratory technical staff.

To start the fabrication process, as previously described, use the *Work, Test and Lab Time Request Form*. Fill out as much information as you know and schedule the Pre-Project Planning meeting. The technical staff will get back to you within *2 business days* to setup up a Pre-Project Planning meeting suitable for all involved. The Technical Services Supervisor will ensure that the proper technical staff are present.

The Pre-Project Planning meeting will be used to establish all the requirements for the elements to be fabricated. It is not necessary to have a fully worked out design at this stage, but it is best to know the functional parameters of the elements to be fabricated. During the meeting, the technical staff will work with you to refine the design and suggest what needs to be purchased. Follow-up meetings may be necessary prior to the start of fabrication to ensure that the design meets the needs of the project while still being able to be fabricated. Simpler projects will have a shorter meeting and may be able to be assigned to a technical staff member immediately after the Pre-Project Planning meeting, while more complicated projects may require multiple meetings. After the last meeting, the work will be immediately assigned to the appropriate technical staff. To be conservative, from your first submission of the project form and taking the process through one or more iterations with the staff, anticipate the process to last about 1 week. Fabrication can take two weeks or more depending on its complexity and other on-going projects. As a result, please anticipate this time frame and start the process early.

Work will be assigned to the technician that is best suited for the task. The Technical Services Supervisor will coordinate and plan the work assignment and overall work flow once assigned. In general, do not assume one technical staff member will be assigned over another; it is at the discretion of the Technical Services Supervisor to optimally allocate technical staff time.

Students and post-docs wanting to do their own basic fabrication is possible. Required laboratory safety training must be completed prior to any equipment specific training (see training requirements in the Laboratory Use and Testing Section). Equipment specific training must be arranged by the Technical Services Supervisor with the appropriate technical staff member prior to starting any fabrication work. Verbal instructions and hands-on demonstration of the tool use



are part of the training. The student must be deemed competent with the equipment and its use is only allowed during the normal business hours of the Structural Engineering Laboratory. Arrangement of student training should be done during the Pre-Project Planning meeting.

### **Laboratory Use and Testing**

Laboratory use and testing generally covers activities on the structural engineering laboratory floor and in the mechanical testing laboratory, fabrication facilities, concrete mixing laboratory and sand pit. Some testing equipment requires only a pre-configured load frame, while the strong floor often requires larger, custom configurations. The concrete mixing laboratory is used for mixing concrete materials, but also has a large wet concrete saw and wash out facilities.

To request use of the laboratory facilities, reserve equipment or arrange for experimental tests, use the *Work, Test and Lab Time Request Form*. Fill out as much information as you know and schedule the Pre-Project Planning meeting. The technical staff will get back to you within 2 *business days* to setup up a Pre-Project Planning meeting suitable for all involved. The Technical Services Supervisor will ensure that the proper technical staff are present.

The Pre-Project Planning meeting will be used to establish what is required for using the facilities and conducting the test. Any other needs, such as the development of fixtures and test setups will be discussed and a timeline established. The Pre-Project Planning meeting will also be used to ensure that proper training has been conducted for all participants. Scheduling will be determined based on existing reservations and other testing being conducted during the expected time frame of use. Typical laboratory usage and reservations of small load frames may only require a short meeting or email exchange in lieu of the Pre-Project Planning meeting for coordination purposes (at the discretion of the Technical Services Supervisor), while larger tests planned for the structural engineering laboratory floor may require follow-up meetings. Simple material testing that has all of its fixtures available and has been conducted in the past requires 24 hour notice. More complicated and larger tests require 5 *business days*' notice provided all fixtures, testing protocols and standard operating procedures are in place.

After the Pre-Project Planning meeting and confirmation that all required resources needed for use of the laboratory are available, laboratory and equipment usage will be scheduled. The reservation will not be made until all required training (general laboratory and specific equipment) is completed. Equipment specific training can be offered to new users by currently trained students, faculty or technicians. System/equipment standard operating procedures (SOP) should be used as a training guide. Any variations from the SOP will require another version that is approved by faculty or technical staff prior to running tests. SOP's should include equipment name, fixtures, test setup, step-by-step instructions, template/procedure/program files used, and pictures. SOPs should be written in MS Word for sharing and editing when creating new SOPs and be provided to the Technical Services Supervisor for review and electronic storage.

Safety is the number one priority when conducting experimental work.

### ***Required training prior to working or testing in the Structures and Mixing Lab includes:***

1. UM EHS General Lab Safety Training Course BLS025W. It is an online course that can be accessed through MyLinc at : <http://ehs.umich.edu/education/ehs-training-login/>

It takes a few hours to go through the presentation and take the test. Print out a copy of the completion certificate and give it to the Laboratory Technician so the Department has it on file.

2. Schedule Lab Specific Safety Training for structural engineering laboratory, mechanical testing laboratory and concrete mixing laboratory with the Laboratory Technician. This training is provided the first Friday of each month at 10 am. This will take about one hour to complete.
3. Working in other laboratories not covered in this document requires training from that lab's PI or designated safety officer.

***After Hours Use:*** There are times that use of the structures laboratory or mixing laboratory facilities is required after hours (after 5 pm on Monday through Friday and weekends). However, due to safety concerns after hours use should be avoided at all cost. If after hours use is the only alternative, a meeting must be setup between the faculty member and personnel involved in the after hours work and the technical staff to ensure proper safety procedures are followed and an adequate safety plan is in place.

The UM-Chemical Hygiene Plan states that it is not prudent to work alone in a laboratory with hazardous materials or procedures. The American Chemical Society states that one should, “never work alone in the laboratory” (ACS, 2003). The MIOSHA Hazardous Work in Laboratories Standard states “Avoid working alone in a building; do not work alone in a laboratory if the procedures being conducted are hazardous.” Accidents are unexpected by definition and if a person is working alone when one occurs, his or her ability to respond appropriately could be severely impaired, which could result in personal injury or death. Thus, the Department has a policy that when working in the laboratory, others are actively aware (e.g., being present, checking in frequently, etc.) of your activities to ensure your safety.

The equipment in the structural engineering laboratory, mechanical testing laboratory and concrete mixing laboratory has physical hazards that can cause severe bodily injury or death. Therefore, after hours use will require a faculty member or another student be *physically present* at all times when mixing or testing is in progress, unless previously arranged with the Technical Services Supervisor and Laboratory Director. This “buddy” will also need the EHS General Lab Safety Training, Lab Specific Training and must be familiar with test equipment operation and emergency shut down of equipment. After hours testing will need to be scheduled through the *Work, Test and Lab Time Request Form*.

Safe lab practices and the buddy system will be monitored.

### **Technician Time**

Technician time is time needed for a technician to assist with a project, excluding fabrication time. This type of request is submitted through the *Work, Test and Lab Time Request Form* and will need at least 5 business days' notice along with information about what is involved, date and time. The Technical Services Supervisor will assess the request and first determine if the staff have the qualifications to perform the work requested (e.g., move large and heavy equipment) prior to a Pre-Project Planning Meeting. After a request is submitted, a Pre-Project Planning meeting is

required to review and schedule the time request. Off campus work must be within regular business hours and the expectations should not be that the technical staff use their personal vehicles. Because off-campus time limits the availability of the travelling staff to work on other projects, off-campus work must be approved by the Department Chair prior to staff being assigned the task. The Technical Services Supervisor will make the request to the Department Chair.

## Step 4: Survey

When the technical staff have completed the work associated with the request, the Technical Services Supervisor will send within *5 business days* a survey to the main contact for the project to assess the quality, timeliness and professionalism of the technical staff members who assisted in the effort. This form must be filled out by one member of the project team. A survey will also be sent to the technical staff working on the project to get their feedback in regards to the working with the project team, the project team's responsiveness to requests and potential areas of improvement. The results of these forms will be reviewed by the 1) Technical Services Supervisor, 2) Director of the structural engineering laboratory, 3) Chair of the Facilities and Research Committee, 4) Department Administrator, and 5) Department Chair on a monthly basis in order to ensure that the faculty, post-doc and student's needs along with the technical staff's needs are being adequately met.

*Google Project Evaluation Form:*

[https://docs.google.com/forms/d/e/1FAIpQLSctjJ-2easoAcYErn\\_e0RuHaCr2IPx-3wz3Sqetgwqh69s1dQ/viewform](https://docs.google.com/forms/d/e/1FAIpQLSctjJ-2easoAcYErn_e0RuHaCr2IPx-3wz3Sqetgwqh69s1dQ/viewform)

## **Last Minute Requests**

The policies and procedures stated above must be followed in order to use the technical staff, fabrication facilities, structural engineering laboratory, mechanical testing laboratory, and concrete mixing laboratory. By maintaining these policies, everyone has fair and equitable access to the expertise of the department's technical staff and laboratory facilities. However, there are times when last minute requests are unavoidable due to constraints put on PIs by funding agencies or due to unexpected breakdown of equipment. In these cases, the *Work, Test and Lab Time Request Form* must be filled out stating clearly what needs to be completed, the required time line and the reason for the last minute request. A Pre-Project Planning meeting will be setup between the technical staff and the relevant faculty member(s), post-docs and students as soon as possible to discuss the logistics of the last minute request. The Technical Services Supervisor will make every effort to accommodate the request. To do so, the faculty member may be asked to contact any other faculty member that this last minute request affects to obtain agreement that their project can be put on hold to complete the last minute request.

# Procedure Flow Chart

