A Brief Report on CARE supported research facilities at the Structural Engineering Laboratory

Name of the CARE Facility: Enhancement of the Cyclic Testing Facility 2000-2001
Servo-Hydraulic Actuators for Load Application 2005-2006

Location: Structural Engineering Laboratory (Workshop – II)
Total cost of equipment/facility: Approx. Rs. 156.0 Lakh
Support provided by CARE: Rs. 46.0 Lakh (Rest from sponsored projects and Laboratory funds)
Names of Principal Investigators: C.V.R. Murty (cvrm@iitk.ac.in; 7267)
Durgesh C. Rai (dcrai@iitk.ac.in, 7717)
Participating departments: Civil and Mechanical Engineering

Brief description and capability of CARE facility:

Three servo-hydraulic actuators (Make: MTS Systems Corp., USA) have been acquired to enhance the load application capability of the existing Cyclic Testing Facility. One 500kN (Model: 243.45T) was purchased during 2000-01 and two 100kN (Model 244.22) were acquired during 2005-06. These actuators can apply loads in both displacement- and load-controlled mode to simulate various structural loading environment. These are essential loading equipment for simulating loading environment typical for earthquakes; however, they can be used for gravity loads simulation as well.

Technical Specifications:
Force Capacity: +/- 500 kN and +/- 100 kN; Stroke : +/- 125 mm. Swivel Base and Swivel Head. Controller for actuators are capable of applying programmable loading cycles under load, stroke and strain control mode apart from standard sine, ramp, triangle, etc. function for cyclic tests. The actuators are being operated using Hydraulic Power Supply available in the laboratory having the flow capacity of 237lpm at 2.1 MPa.

Utilization of the facility:
a) PI's : have extensively used the actuators to perform cyclic tests on different types of sub-assemblages like reinforced concrete beam-column joint, moment resisting frames with and without masonry in-fills, confined masonry walls, steel beam-column joints, aluminum shear links etc.
b) Others: *Prof. Prashant Kumar and Ram Kumar, Mechanical Engineering:* Cyclic Tests on wooden partition walls reinforced with unidirectional glass fabric-epoxy composite, unidirectional glass/epoxy composite connection for steel beam-column joints. *Prof. S K Chakrabarti of Civil Engineering:* Steel bracket connections to reinforced concrete members under multi-axis loading involving up to two actuators simultaneously. *Prof. Sudhir K Jain of Civil Engineering:* Shear test on pre-cast slab system, Cyclic tests on pre-cast reinforced concrete beam-column connections, moment resisting frames with brick in-fills.

Mechanism of time sharing: Operation of **s**ervo-hydraulic actuators requires use of sophisticated controller for high pressure hydraulics for which trained manpower is available. However, in general a test involves a support structure for the test specimen and reaction frame for the actuators. These are usually unique to a test program and need to be fabricated by the user. Further, the user need to bring all the sensors like LVDT's, strain gauges, etc. to measure the response. The actual test run is usually a few hours, however, fabrication of the test rig and specimen may require several weeks to months, therefore, it is very important to plan ahead to get on the activity list of the lab early on.

Charging Mechanism: Rs. 3,000.00 per experiment (proposed) to cover the high maintenance charges.

Any difficulties, that you faced in running CARE facility: Though we are able to provide the actuators to users, it is not possible for the lab to provide for the test rig and reaction fixture to individual users. Depending on the test program, these can be quite expensive both in terms of material as well as labour.

Link to the website for the CARE facility: http://www.iitk.ac.in/civil/strgrp/intro.html (is under revision)