National Brick Research Center
The National Brick Research Center, located off the main Clemson Campus near Anderson South Carolina, is an industrially funded organization providing research, education, and service to producers and users of clay bricks and other ceramic materials (tile, mortar, and ceramics). Entities join the Center by paying annual dues according to a schedule set by the Center’s Industrial Board of Directors. The Center seeks to augment the educational process of University students and be an important contributor to the University’s mission in research and public service.

Major activities include research in manufacturing, environmental compliance, wall cladding systems, and masonry performance, testing services related to masonry, education including short courses, technical reports, magazines, and the annual forum for brick manufacturers, sustainability and restoration evaluations and publication of the brickyard road magazine.

Bishop Laboratory

The National Brick Research Center’s (NBRC) Bishop Ceramic Laboratory, owned by the Clemson University Research Foundation, is an industrially funded facility which also allows students and employees to conduct research and perform tests that meet the mission of the Center. The Bishop Laboratory is owned by the Clemson University Research Foundation. The building and equipment in the Bishop Laboratory was purchased with private funds with one exception – a Scintag X-ray diffraction apparatus (owned by the School of MS&E and upgraded by the NBRC). Additional equipment includes a multipurpose bay pilot plant with major pilot scale ceramic processing equipment, LabVIEW virtual instrumentation (VI) software to control, monitor and record data display and design control systems. Other equipment of the Brick Research Center is housed in four different laboratories listed below.

Harrop Thermal Analysis Laboratory (Lab 105)

The Harrop Thermal Analysis Laboratory has the following instrumentation:

- Netzsch 402 D Dilatometer with an operating range of 160 C to 1600 C.
- Netzsch STA 449C Jupiter STA/DSC FTIR used for differential scanning calorimetry, simultaneous thermal analysis, thermo gravimetric analysis, and simultaneous off gas analysis with FTIR.
SWINDELL DRESSLER Environmental Laboratory (Lab 106)
The Swindell Dressler Environmental Laboratory has the following instrumentation:

- Orton 1600D Dilatometer with an operating temperature range from room temperature to 1600 C.
- Orton XSA 1 Crystalline Silica analyzer for analysis of materials for crystalline silica content.
- Thermo Noran X-ray Fluorescence Spectrometer for chemical assays.
- Scintag PAD V X-ray diffractometer for identification of compounds and minerals (owned by the School of MS&E and upgraded by the NBRC)
- LECO SC144DR Carbon/Sulfur Determinator for analysis materials for sulfur and carbon content

Pyrohydrolysis Laboratory
The Pyrohydrolysis Laboratory contains the following instrumentation.

- Micromeritics Autopore 9320 Mercury Porosimeter for analysis of the pore structure of materials.
- Micromeritics Gemini 2360 BET Surface Area Analyzer for the analysis of materials to determine total surface area.
- Micromeritics Accupyc 1330 Helium Pycnometer for determining density and volume.
- Micromeritics 5250 Sedigraph for particle size analysis.
- Dionex ICS 1500 Ion Chromatograph for analysis of solutions for Cations.

Harold Moore Laboratory:
The Pyrohydrolysis Laboratory contains the following instrumentation.

- Experimental Freeze/Thaw cabinet with Labview instrumentation for proving new ASTM testing methods.
- Fully automated, PC controlled Freeze/Thaw capability for use with National Instruments Labview software.
- ASTM Freeze/Thaw testing cabinet for subjecting brick specimens to ASTM C67 Freeze/Thaw testing.
Steele Laboratory

The Steele Laboratory contains the following instrumentation.

- Orton GTF-MD Thermal Gradient Furnace with an operating range at room temperature to 1300 C. Used to study reactions of materials as a function of temperature.
- Lindburg Blue M Electric Box Furnace with an operating Range at Room Temperature to 1100 C. Used for loss-on ignition tests.
- Laboratory Ovens for the preparation of materials for testing.
- Lancaster/Kercher High Intensity K-lab mixer for the preparation of materials for testing, pelletizing raw materials and mixing raw materials for extrusion.
- Reymond Machine Laboratory Extruder for the extrusion of test mixes for evaluation.
- Satec/Instron 400Rd Prism Compression Testing Machine with an operating range of 0 to 400,000 lbs, for strength testing of materials.
- J.W. Lemmons Grindosonic for the non-destructive sonic testing of materials.

Pilot Plant

The Pilot Plant contains the furnaces and kilns for various experiments conducted within the research center.

- CM Furnaces 2900 BL Bottom Loading Electric Furnace with an operating range from room temperature to 2900F for high temperature firing of materials.
- Harrop GF – BG 2300 Gas Fired Lab Furnace with an operating range from room temperature to 2300F for firing of materials.
- Harrop GF – BG 3000 Gas Fired Lab Furnace with an operating range from room temperature to 3000F for firing of materials.
- Swindell Dressler Laboratory Shuttle Kiln with an operating range from room temperature to 2200F for large capacity firing of materials.
- Stohl SE-10 Laboratory Extruder for the extrusion of full size test brick units
- Eirich R08W High Intensity Mixer for the preparation of materials for testing and for pelletizing granular materials
- Midwestern Screening System with a large capacity material screening capability for the preparation and sizing of raw materials
• SITI 20 Meter Roller Hearth Kiln with an operating range from room temperature to 2300F (~2 hour cycle time) for firing low profile materials (tile, thin brick etc.)

• Forney 500 FDX Compression Testing Machine with an operating range of 0-500,000 for the strength testing of materials

• Lingl Experiment Dryer with fully automated drying capability for use with National Instruments Labview Software, and operating temperature range between 0-200 F, and a humidity range from 0 to 100%. The Lingl Dryer, used for materials evaluation, can control both temperature and humidity throughout experiments, has 2 load cells (0-2000 lbs, 0-10 lbs) for tracking weight loss, multiple thermocouples to track temperature throughout sample, and 2 LVDT’s to track linear shrinkage of sample specimens.

**NBRC Office Facilities**
The Nontechnical Facilities of the National Brick Center encompass an office area, a conference room, a lecture room, and a self contained kitchen area.

- **Office Area** - 504 Sq. Ft. Small conference table with seating for 4 people is located in the Office Lobby.
- **Conference Room** - 276 Sq. Ft Seating is available for 12 people.
- **Lecture (Seminar) Room** - 1,295 Sq. Ft. - Seating capacity: 100 seats in theater style and 60 seats in class room style.
- **Kitchen/Food Service Area** – equipped with stove, full-sized refrigerator, sink, microwave, and cabinet space.