

Simulated Global Climate Testing

Lawrence Tech is enhancing its reputation for cutting-edge research by building an Environmental Test Chamber for testing vehicle components for military and other uses. This latest addition to CIMR will include an actuator capable of delivering impact blows with up to 150,000 pounds of force on components being tested. The environmental/loading chamber will replicate the impact of both repeated and static loads in simulated climatic conditions ranging from Iraq to Antarctica.

The Environmental Test Chamber will:

- Significantly advance U.S. Army materiel design, testing, evaluation, and durability, and result in the deployment of new high-strength, lower-weight vehicle armor to protect troops and save lives.



Nabil Grace

Work with the Best

Since his arrival at Lawrence Tech from the private sector in 1988, Dr. Nabil F. Grace, distinguished professor, chair of the Department of Civil Engineering, and CIMR director, has won more than 20 grants and contracts totaling more than \$13 million to advance innovative materials research.

With more than 25 years of practical experience with carbon fiber technology,

greater service life, resulting in outstanding sustainability. He is one of only two academic researchers on the Federal Highway Administration's Fiber Reinforced Polymer Composite Bridge Technology Virtual Team.

CIMR Can Help

The Center for Innovative Materials Research at Lawrence Tech can help you develop new and innovative products that make a positive difference in people's lives and solve important and challenging problems.

- What product development problems are you working to solve?
- What new materials are you developing?
- What material characteristics are you seeking to achieve?
- How long do you want them to last?

CIMR's facilities and experienced university research team can get you the answers you need!

Contact Us Today

Mark Brucki
Director of Technology Partnerships
Lawrence Technological University
248.204.2310
mbrucki@ltu.edu

Nabil Grace, PhD, PE
Director, Center for Innovative Materials Research
Lawrence Technological University
248.204.2556
nabil@ltu.edu



CIMR director Nabil Grace discusses CIMR's research capabilities with visiting engineers.



- Meet standards for full- and partial-scale vehicle and composite armor testing under harsh conditions, including salt spray, salt water, solar/UV light, relative humidity, and sand in addition to freezing, thawing, and dry heat.

No other facility in the United States can provide full-scale environmental condition testing and evaluation to meet Military 310 Global Climatic Data for Developing Military Product for an entire vehicle.

Dr. Grace is an international expert in bridges and transportation infrastructure. He has authored over 100 technical papers in national and international conferences, journals, and magazines. He also holds three patents related to carbon fiber structures for transportation infrastructure and lightweight armor.

Dr. Grace is widely sought after as a state, national, and international expert on innovative carbon fiber-reinforced concrete designs that have much lower life-cycle costs and

"The center is a prime example of the intersection of high technology and homeland defense. Building the center will help create jobs today, putting the technology the center develops to work will create jobs tomorrow, and all of it will help protect America's troops. This is a win for our economy today and a win for its future."

– Michigan Governor Jennifer Granholm



Lawrence Technological University | College of Engineering

Center for Innovative Materials Research | 21000 West Ten Mile Road, Southfield, MI 48075-1058 | 800.CALL.LTU | ltu.edu



The Michigan Department of Transportation has designated the Center for Innovative Materials Research an MDOT Center of Excellence for Sustainable Infrastructure and Testing.



Partnering for Your Success

Innovation is the key word at the Center for Innovative Materials Research (CIMR) at Lawrence Technological University. CIMR researchers are working on innovative material and structural solutions for defense, homeland security, transportation infrastructure, construction, and automotive applications, to:

- save lives
- reduce injuries
- cut life-cycle costs

Make it stronger, lighter, and cheaper. Boost fuel efficiency, and build it to last. Lawrence Tech can help you deliver product excellence.

Use expert CIMR researchers and facilities to explore:

- New military vehicles that require armor weighing less than 100 pounds per square foot
- Carbon fiber wind turbine blades that can withstand harsh changes in weather or climate
- Advanced materials for commercial vehicles that reduce weight and improve fuel economy
- New generation of long-lasting highway bridges
- Components that incorporate high-performance materials

Accent on Advanced Materials On the battlefield . . .

Innovative and advanced carbon fiber materials are being developed at CIMR that can help reduce military vehicle and body armor weight while providing greater protection and durability for our troops.

On the home front . . .

Lawrence Tech's CIMR team is developing and testing materials that strengthen and prolong the life of critical facilities such as office and commercial buildings, bridges, military complexes, airports, and highways.

Get the answers you need to challenging questions about

- Product costs
- Strength and stiffness
- Durability
- Expected life
- Design measures

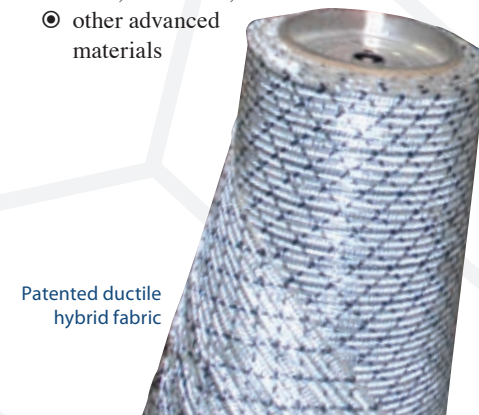
Discover how CIMR can be your one-stop resource for large-scale life-cycle durability testing research, development, and commercial deployment.



The Center for Innovative Materials Research

Let Lawrence Tech help you understand the performance characteristics of

- high-strength, lightweight carbon fiber composites
- steel, aluminum, ceramics
- other advanced materials



Patented ductile hybrid fabric

CIMR: Where Research = Results

CIMR researchers are collaborating with the U.S. Army Research Laboratory and the U.S. Army Tank Automotive Research, Development and Engineering Center to significantly advance materiel design, testing, evaluation, and durability of military vehicle armor.

Result: Deployment of new high-strength, lower-weight vehicle armor to protect troops and save lives.

CIMR researchers are working with the U.S. Department of Transportation and the Michigan Department of Transportation (MDOT) to develop highway bridges that can last 100 years – twice the normal life span – by using innovative materials during construction.

Result: Lower life-cycle repair and maintenance costs, fewer detours and traffic disruptions, and substantially safer travel for motorists.

Bridges to the Future

Sobering statistics. . . More than 72,000 highway bridges across the United States are structurally deficient and more than 81,000 are functionally obsolete.

Lawrence Tech is playing a lead role in the research, development, and deployment of innovative, high-strength bridge technology designed to replace those structures . . . and avoid such tragedies as the 2007 bridge collapse in Minneapolis that claimed 13 lives.

Work at CIMR is advancing the industry's current best practices for bridges and infrastructure to include the design of new non-corrosive carbon fiber reinforced polymers (CFRP) for building and reinforcing concrete bridges. Lawrence Tech also is conducting durability tests using this technology in I-beam and box-beam bridge construction.

In 2001, Lawrence Tech, in collaboration with the City of Southfield, Federal Highway Administration, HRC Consulting, and MDOT, built the nation's first highway bridge using CFRP rather than steel. The pioneering Bridge Street Bridge project led to CIMR being awarded a \$900,000 grant from the Michigan Economic Development Corporation 21st Century Jobs Fund in 2007 to deploy the CFRP technology on three new bridges in 2010 in partnership with MDOT.

"Research is happening right here in Michigan at Lawrence Technological University that isn't happening anywhere else in the country. Lawrence Tech's Center for Innovative Materials Research is doing research on carbon reinforcement and testing that ultimately will result in bridge structures that will last longer than ever before. The Michigan Department of Transportation has named CIMR as a Center for Excellence in recognition of this important work. We are proud to partner with Lawrence Tech as CIMR develops innovative technologies that will benefit current and future generations by improving the nation's infrastructure."

– Kirk T. Steudle, director, Michigan Department of Transportation



Government/University partnerships (L-R, top, bottom): Congressman Joseph Knollenberg, Michigan Governor Jennifer Granholm, Congressman Sander Levin, and Senator Carl Levin, tour CIMR.



The Bridge Street Bridge project team earned the Precast/Prestressed Concrete Institute's prestigious Harry H. Edwards Industry Advancement Award. The engineering design and research team also was awarded the Eminent Conceptor Award – the highest award for engineering excellence for outstanding achievement for an engineering or surveying project – from the American Consulting Engineers Council of Michigan and the Michigan Society of Professional Engineers.

Inside CIMR's Testing Facilities Fired Up To Help You

Each year catastrophic fires in the United States claim thousands of lives and cause billions of dollars in property damage. Lawrence Tech is meeting the challenge by examining how structural materials respond to very high temperatures.

CIMR houses a state-of-the-art Fire Chamber that enables researchers to conduct large-scale testing of structural components at temperatures of up to 2,300 degrees Fahrenheit and simulate conditions of the 9/11 tragedy at the World Trade Center. Large enough to fit a full-sized military HMMWV, the Fire Chamber also lets researchers conduct tests on various components of military vehicles, especially those subjected to blasts and fire on the battlefield.



CIMR Fire Chamber

Let the Force Be With You

Lawrence Tech's Center for Innovative Materials Research has three separate structural testing areas to accommodate multiple projects, handling structures up to 100 feet long with both static and repeated loads up to one million pounds of force.

CIMR can help you achieve:

- Improved material characterization
- Advanced prototype evaluation
- Long-lasting, reliable products



The Penobscot Narrows Bridge, Maine's first cable-stayed long-span highway bridge, opened in December 2006. In June 2007, Lawrence Tech collaborated with the Maine Department of Transportation, the Federal Highway Administration, and Figg Bridge Engineers to replace six strands with carbon fiber composite cables – a first in the United States. These strands are being monitored in order to evaluate this material for future use in bridge designs.



Lawrence Tech students prepare a prestressed concrete bridge beam for a research project sponsored by the National Science Foundation.