UTM CENTRE FOR COMPOSITE (PUSKOM)

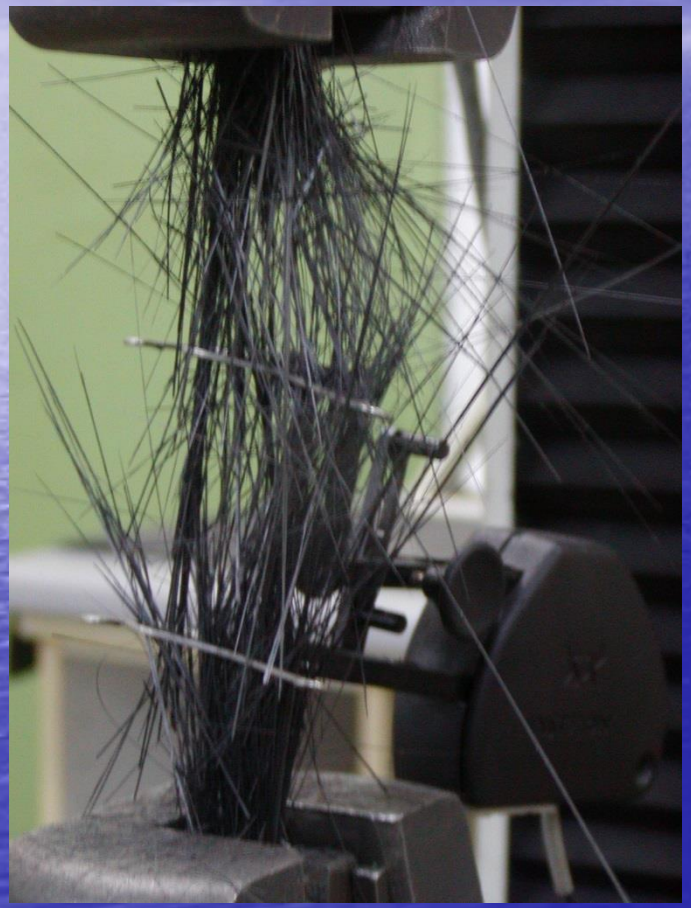
- Centre of learning and research in the field of FRP Composites in Malaysia
- To provide expertise through consultation services to local industries
- To be the link between UTM and other R&D centre around the world

List of PUSKOM Projects

Hovercraft Project

Composite Bus Project

Materials Testing Unit

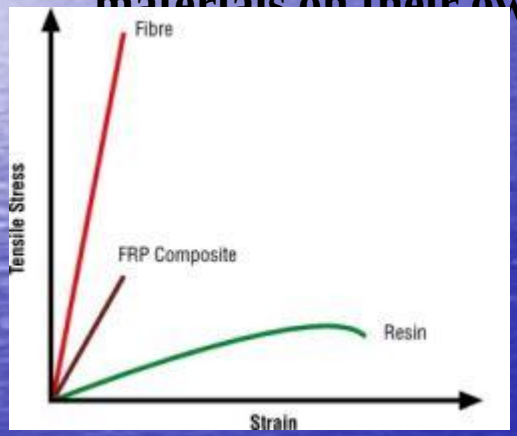


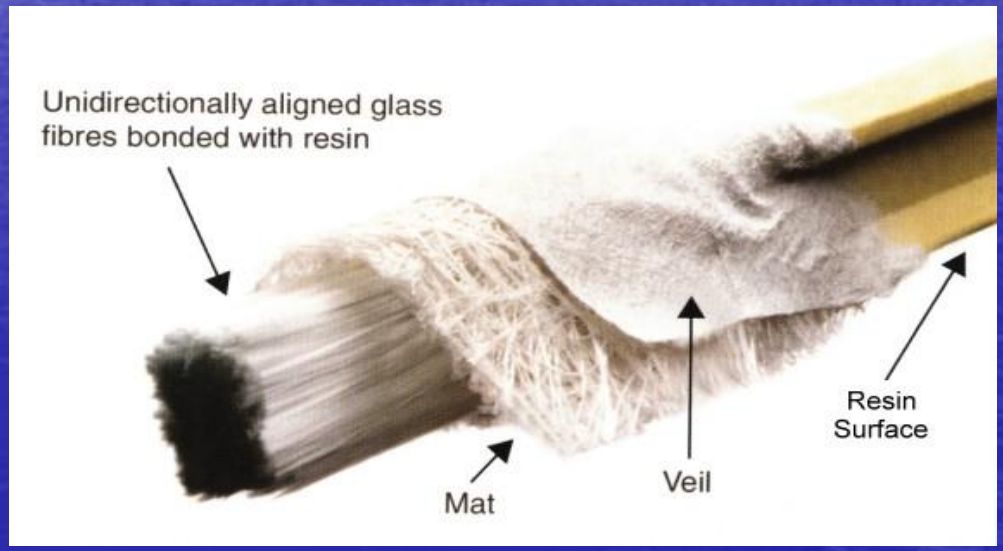
Polymer Composite Technology: Application and Future Market (FRP Composite Bridge)

DEFINITIONS

An advanced material technology that combine two or more materials of different properties and characteristics to produce a superior material properties of those

materials on their own





FIBRE (REINFORCEMENT)

GLASS FIBRE

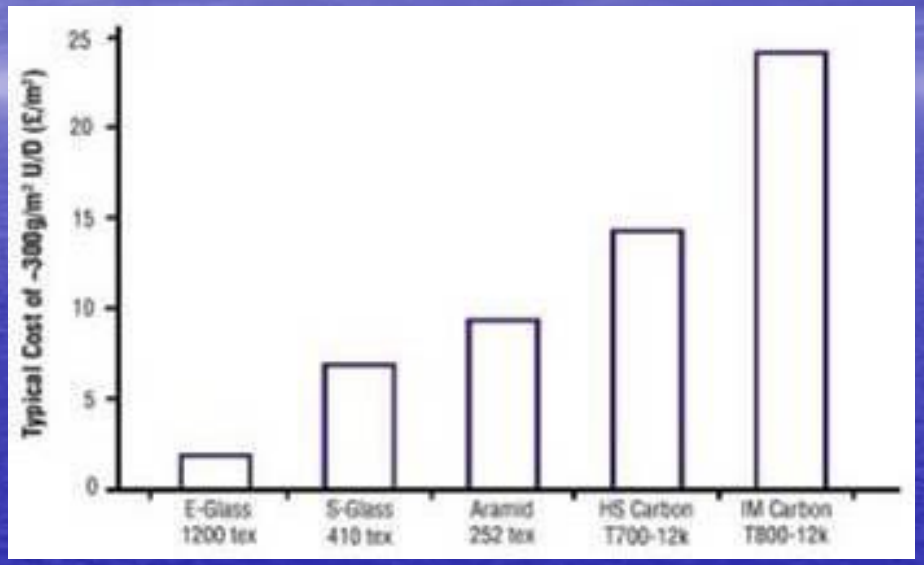
Low cost reinforcement for general application. Widely used in corrosion resistance.

ARAMID FIBRE

High end impact absorption application such as ballistic protection

CARBON FIBRE

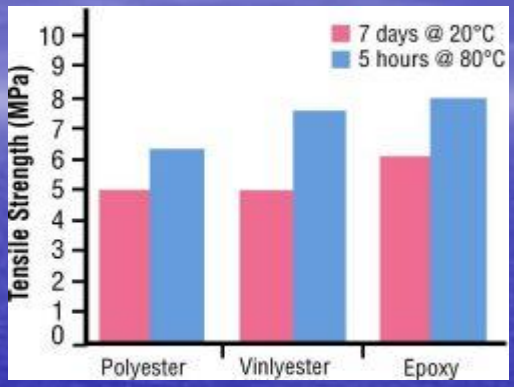
High end low weight high strength application such as structural reinforcement and aerospace parts

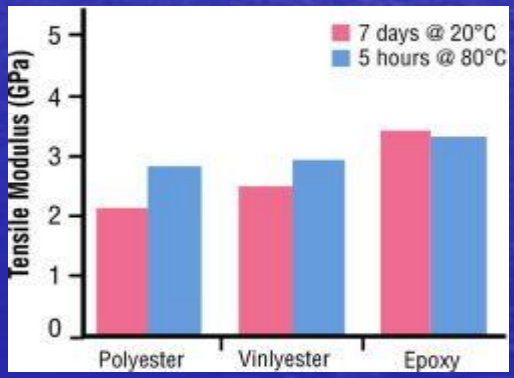


RESIN (BINDING MATRIX)

Resins is a polymer based material that bind the reinforcement i.e. fibers.

RESINS	APPLICATION
POLYESTER	General corrosion resistant application.
VINYLESTER	Heavily corrosive environment
EPOXY	High strength and fire rating performance





BENEFITS

- CORROSION RESISTANT *Unaffected by a wide range of corrosive chemicals and environments. Minimal maintenance costs.*
- HIGH STRENGTH, LIGHT WEIGHT *Density of composite is 20% of steel and 60% of aluminum. Higher performance at less weight costs.*
- MAINTENANCE FREE *Non corrosive. No repainting cost.*
- DIMENSIONAL STABILITY *Stretch-, warp-, and swell-resistant over a wide range of temperatures and physical stresses. Close tolerances*
- THERMAL INSULATION *Low thermal conductivity rating of 1/250 of aluminum; 1/60 of steel. No condensation problems*
- HIGH DIELECTRIC STRENGTH *Excellent electrical insulating properties. Non conductive.*
- DESIGN FLEXIBILITY *Many individual components can be combined into one large profile. Reduced assembly costs.*
- THEFT FREE *ZERO recycle value. Help reduce theft for public facility and infrastructure i.e. signage*

TYPICAL ENGINEERING MATERIALS PROPERTIES COMPARISON

PROPERTY	COMPOSITE PULTRUDED GRP/PE	CARBON STEEL (M1020)	STAINLESS STEEL (316)	ALUMINUM (6061-T61)	RIGID PVC	PONDEROSA PINE (WOOD)
Tensile Strength (ksi)	**30.00** (axial) **7.00** (transverse)	**60.00**	**80.00**	**45.00**	**6.20**	**0.42**
Tensile Modulus (Msi)	**2.60** (axial) **1.00** (transverse)	**30.00**	**28.00**	**10.00**	**0.39**	-
Flexural Strenght (ksi)	**30.00** (axial) **10.0** (transverse)	**60.00**	**80.00**	**45.00**	**11.00**	**15.40** (axial) **9.40** (transverse)
Flexural Modulus (Msi)	**2.20** (axial) **0.80** (transverse)	**30.00**	**28.00**	**10.00**	**0.35**	**1.00**
Izod Impact (ft-lb/in)	**25.0** (axial) **4.0** (transverse)	**N/A**	**8.5-11.0**	-	**1.6**	-
Density (lb/in2)	**0.062-0.070**	**0.284**	**0.290**	**0.092**	**0.052**	**0.019**
Thermal Conductivity (Btu/ft^2/hr/^{o}F/in)	**4.0**	**260-460**	**96-185**	**1200**	**1.3**	**0.08**
Coefficient of Linear Expansion (10^{-6} in/in/^{o}F)	**4.4**	**6-8**	**9-10**	**13.5**	**37.0**	**1.7**

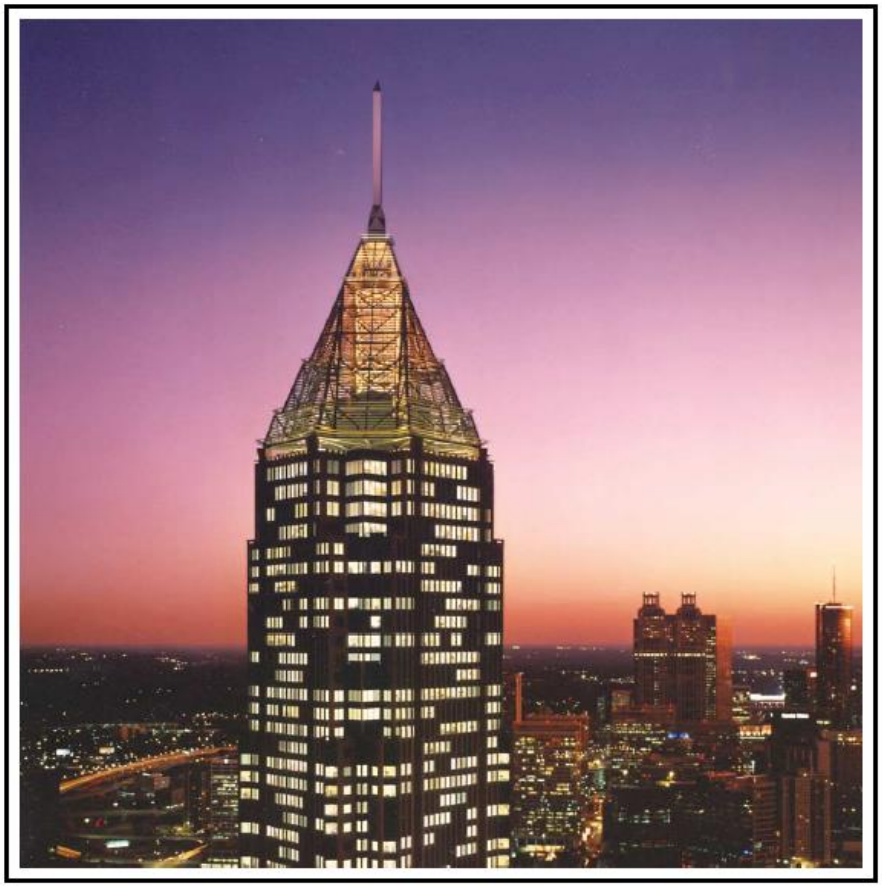
MARKET AREAS

As a material driven industry, application of composites are not only limited to certain sectors, but limited to designers imagination and capability

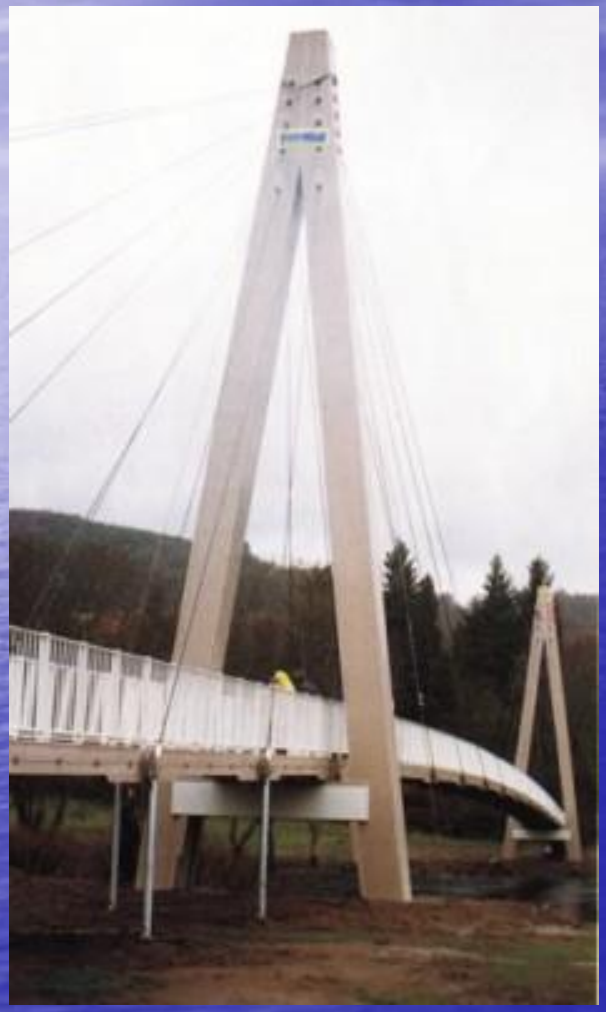
- AUTOMOTIVE *Front end, fender, doors, rocker cover, tail gate, etc.*
- MARITIME *Boat, jetty, sheet pile, etc.*
- INFRASTRUCTURE *Bridges, railing, grating, pipe, lighting poles, signage, shed, mosque dome, etc.*
- AEROSPACE *Body parts component.*
- MILITARY *Ballistic protection, missile launcher, etc.*
- CORROSION RESISTANT *Water treatment infrastructure, Jetty infrastructure, offshore platform, etc..*
- ELECTRICAL *Feeder pillar cabinets, insulation, doors, cable management system, etc.*
- OTHERS

Applications: Construction Sector

FIBERGLASS SPIRE
HIGH POINT ON
ATLANTA SKYLINE



FRP PEDESTRIAN BRIDGE



ABERFELDY, UK

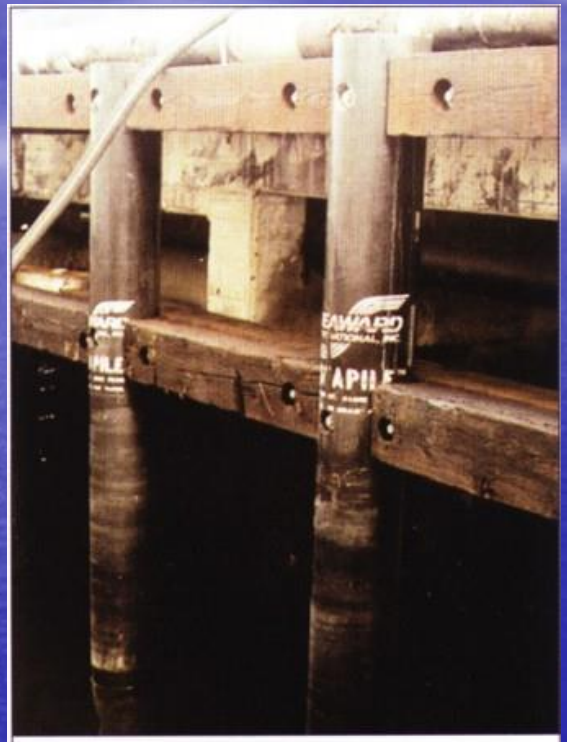
The Laroin footbridge is the very first in France to use carbon-fibre composites.

WASHINGTON NATIONAL PARK, US

GFRP VEHICHLE COMPOSITE BRIDGE

MARINE PILE & SHEET PILE

Complete composite sheetpile installation, including SuperLoc™ sheetpile and composite top cap. (Picture courtesy of Creative Pultrusions.)



Navy pier structure made using pultrusion. (Picture courtesy of Owens Corning: www.owenscorning.com.)

Composite piling being used for a dock installation in Rotterdam. (Picture courtesy of Seaward International/PC Jansen Marine Agencies.)

“ Excellent corrosion resistant properties put composites as the most preferred material choice ”

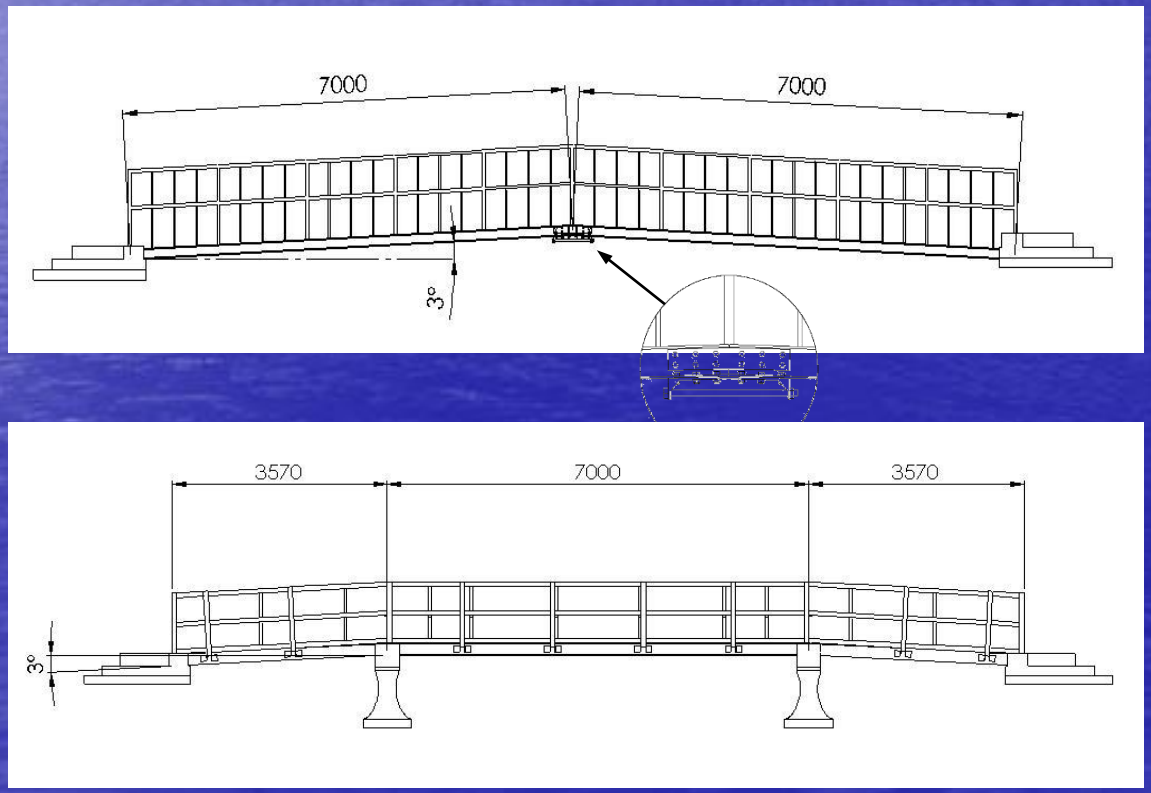
in marine applications

UTM Composite Pedestrian Bridge

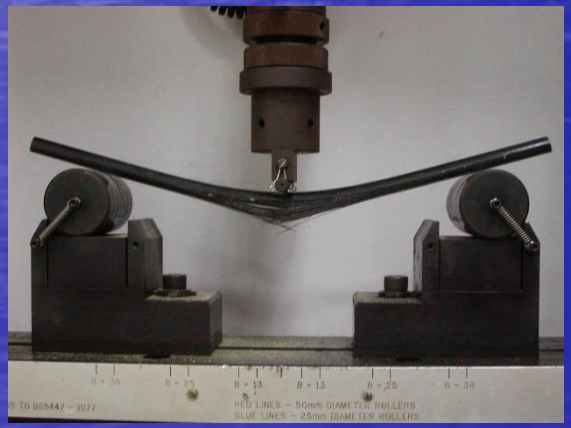
Why FRP composites?

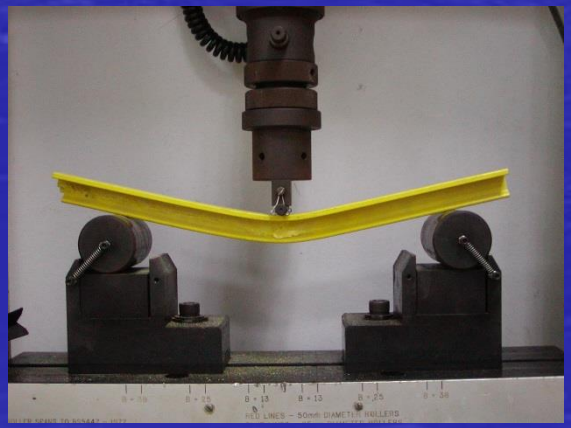
- Speed of installation – light weight (less than 2 days)
- Reduced fabrication time – fully bonded system
- Higher durability – corrosion resistance material (rate of decay very slow), coating with ultra violet protection gelcoat

The Concepts: UTM Composite Pedestrian Bridge

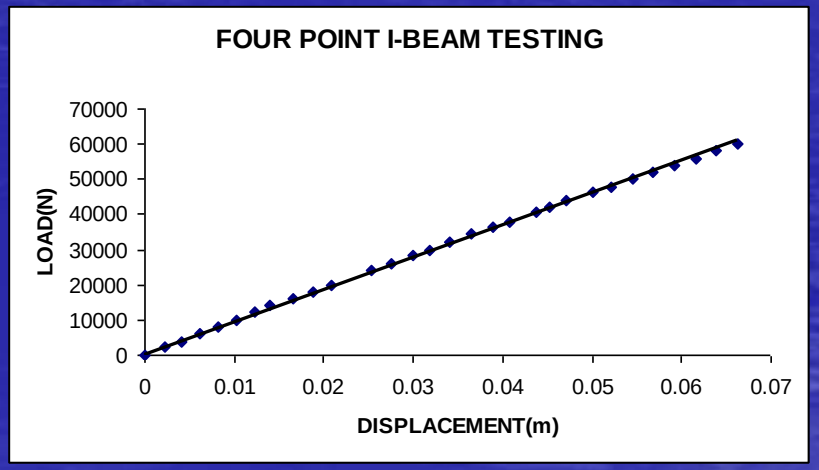


FRP Component Test



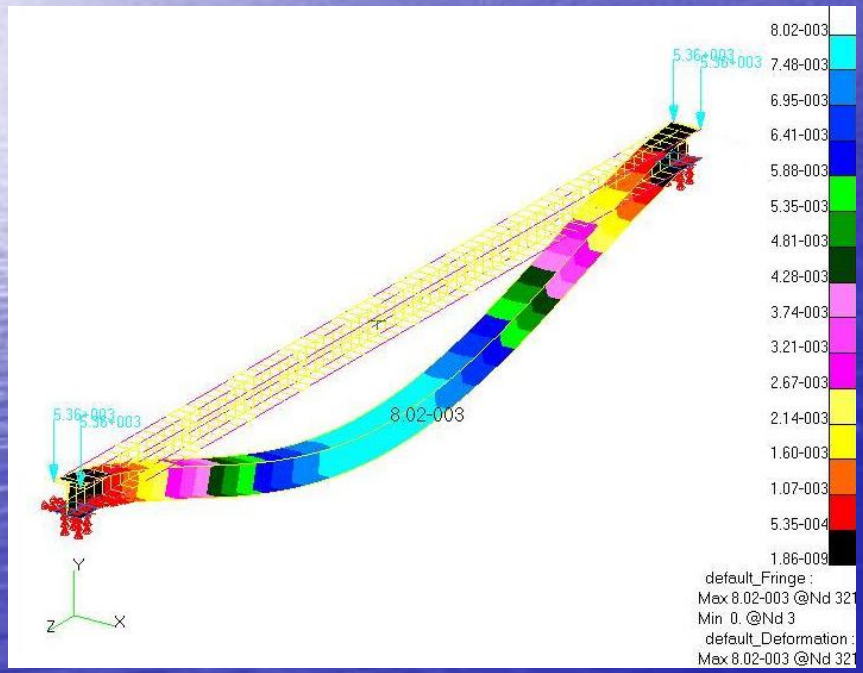


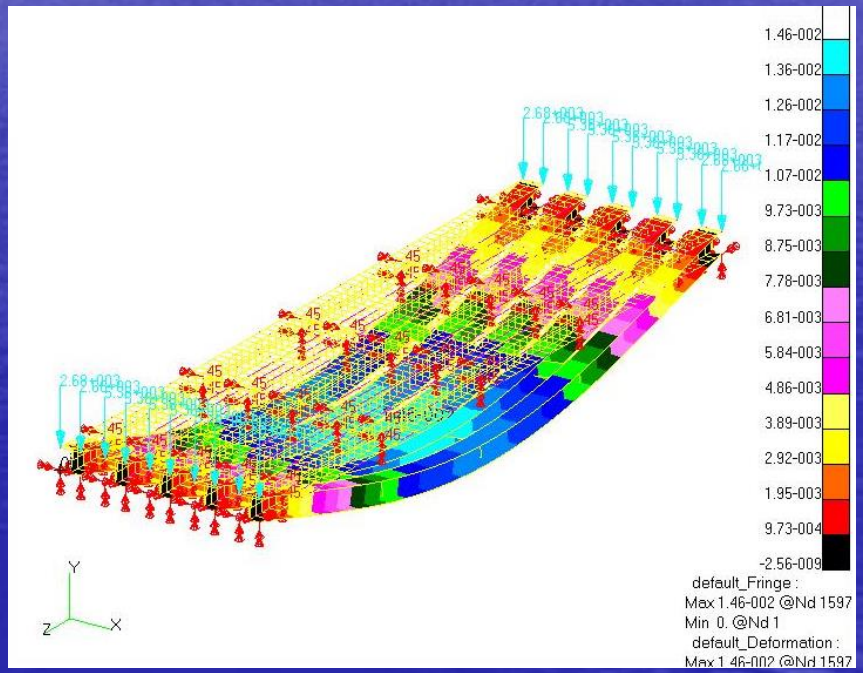
FRP Materials Testing



GFRP Grating (load test at 800 kg)

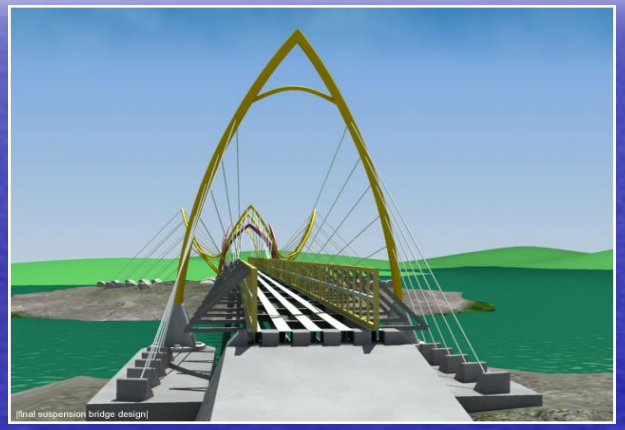
Finite Element Analysis on GFRP Main Beams





UTM FRP Bridge Erection

UTM GFRP Composite Bridge

Field Load Test

FRP Composite Bridge (UTM Future FRP Bridge)