BC07

Our challenge of designing CFRP bridge ～We'll make it possible.～

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Composite structure of the bridges

http://www.carbonfibergear.com/the-hybrid-of-bridges-and-carbon-fiber/

Hybrid bridge applied by CFRPs

http://garagerestoration.com/services_carbonfiberstrengthening.php

The bridge reinforced by CFRP

CFRP parts are applied to reinforcement of the bridges.

⇨ High tensile strength & stiffness, Light weight

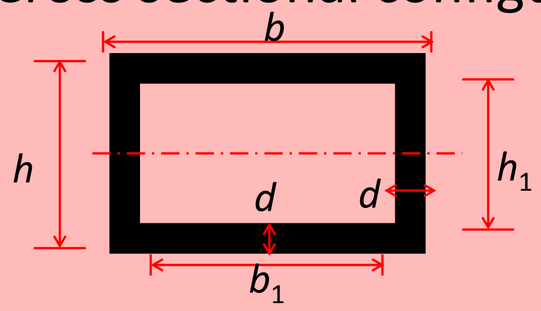
Composite structures can be molded to entire structures.

⇨
- ✓ Save parts & Weight reduction
- ✓ Improving working process
- ✓ Designable structures

It is possible to design suitable structures for the bridge applied by CFRP entirely .

Designing process of the bridge

✓ Cross sectional configuration of the bridge

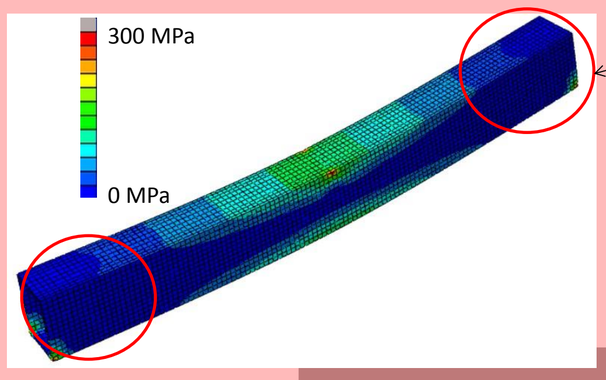


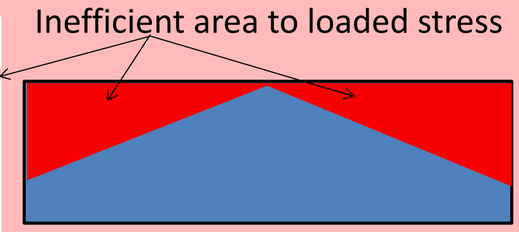
Moment of inertia of area

$$I = \frac{bh^3 - b_1 h_1^3}{12} = \frac{bh^3 - (b-2d)(h-2d)^3}{12}$$

b : Width of the bridge
h: side height of the bridge
d : Thickness of 4plies fabric

✓ Analysis of stress distribution

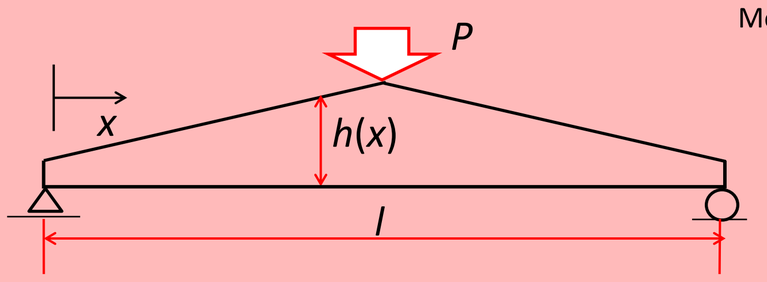




Demand to improve efficiency of the bridge

Introducing beam of uniform strength

✓ Configuration of the entire Beam

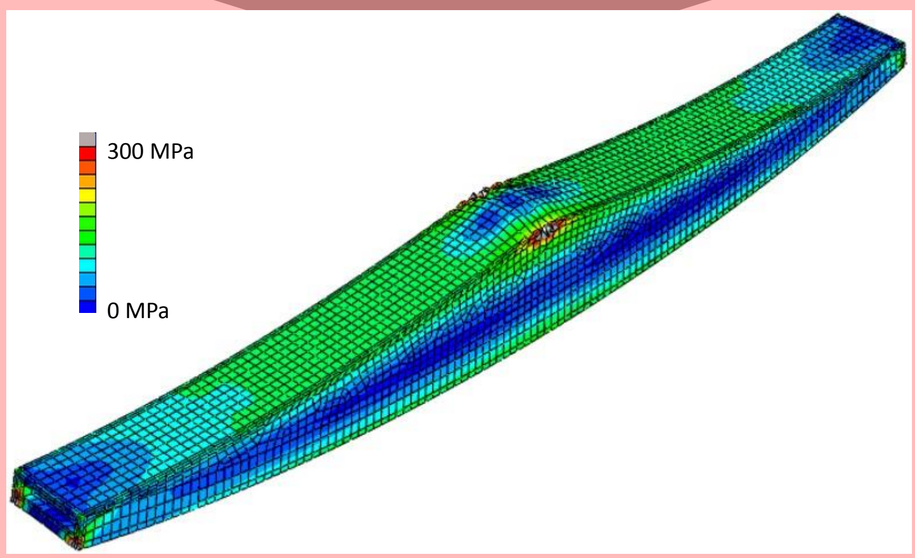


Moment of three-point bending test

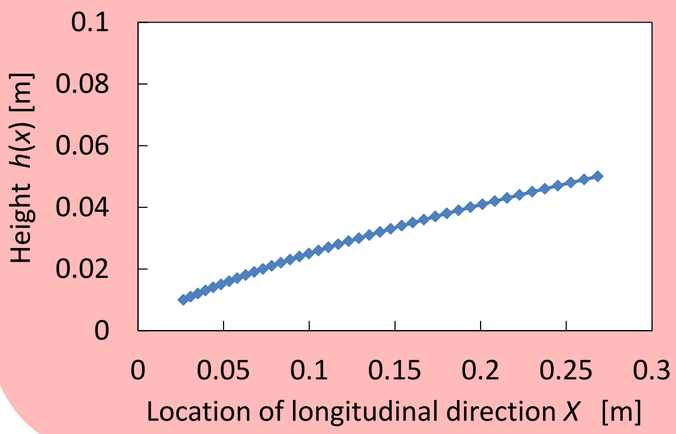
$$M = \frac{P}{2}x \qquad \left(0 \le x \le \frac{l}{2}\right)$$

$$M = \frac{P}{2}x - P\left(x - \frac{l}{2}\right) \qquad \left(\frac{l}{2} \le x \le l\right)$$

P : Load
l : length of longitudinal direction



✓ Bending stress for uniform strength



Defined the strength

P = 4500 [N]

$$\sigma = \frac{M}{I}\frac{h(x)}{2} = \frac{3Ph(x)}{bh(x)^3 - (b-2d)(h(x)-2d)^3}x$$

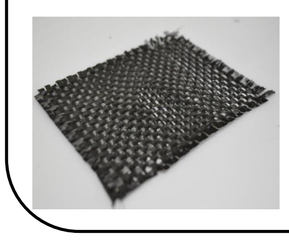
- ✓ 30 % of weight reduction
- ✓ Uniformed stress distribution

Hand-layup molding

✓ Working process

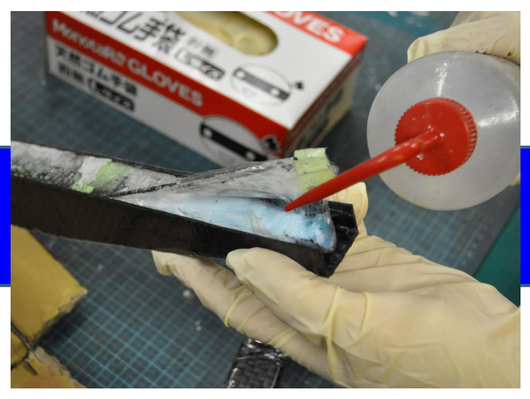
Sample material

Carbon fiber : TORAY CX6240E
Epoxy resin : SYSTEM THREE
Mold : Dowkakoh Styrofoam



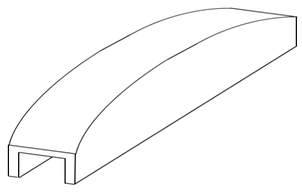
1. Fabricating shape of the mold

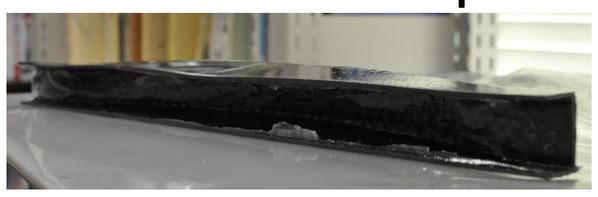
2.Stacking fabric & Applying resin



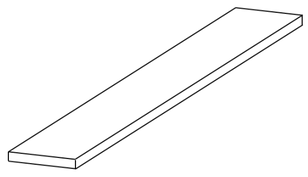
3.Releasing the mold by melting

✓ Assembly of molded CFRP parts





Upper parts



Lower parts

Trimming & Assembling composite parts

⇨

Adhesive bonding