

An Engineering Odyssey

MATSUE College of Technology

Good morning

I am going to take you on a journey

An excursion through the design and construction process

So we need to start with a project

The project was to design and construct a concrete canoe

Why a concrete canoe?

To see if we could.

Most modern canoes are made from fiber glass - but a concrete canoe could be much cheaper. Also it could be made from recycled materials.

But it would present special challenges - not least of which would be the weight - the biggest challenge was going to be a vessel that wouldn't sink. Clearly, this was going to take good design, special techniques and technical know how.

A project needs a project team

Takahiro, Megumi, Saori, Saki and me

So we have a project and a project team – the next step should be identifying any special objectives and constraints

The canoe was to be made from recycled materials – the materials chosen were reinforcing steel and roof tiles from old buildings.

The materials were going to have a big impact. So we developed a concrete mix and tested it - at the same time as we were working on the design.

This is a great example of design as an interactive and iterative process. You have to keep going back and checking against the design criteria.

We tried various combinations to get the concrete mix right. The problem was to make concrete to spread on a curved frame. And it had to be strong enough.

Did the materials' test results have much impact on the design?

Oh yes. – buoyancy was a big issue. We had to factor things like weight, dimensions and profile into the design. It was quite complex.

We kept asking how low it would sit in the water

If you've ever wondered how you can make concrete out of old roof tiles – now is your chance to find out! The secret is – you have to add some extra ingredients!

After we thought we had the design almost right – we made a model of the frame out of plywood. We used lasers.

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So now the team moved on to the next stop on our odyssey - construction. It took them two weeks to bend the frame into shape – of course doing it by hand didn't help.

I heard you ran into some logistical problems during the next stage – mixing enough concrete?

Yes – that's true.

They needed a huge number of PET bottles for the concrete – and they just didn't have enough. Rumor was that the team were roaming Matsue by night scavenging PET bottles back out of recycle bins.

It was a strange experience but eventually we had enough PET bottles. We made the concrete and coated the inside of the canoe. A week later it was dry enough to apply the outside coating.

And a week after that came the next landmark on the journey – field testing. A moment of truth for any project – will the design work?

So on to the first trial! On the gold fish pond!

Any innovative project can expect some hiccups – and this wasn't an exception.

The first problem was how much it weighed! Six of us weren't really strong enough to carry it. And then we discovered the concrete coating was porous – it let water in.

Our project team was not to be beaten – next lesson in the engineering Odyssey - when it doesn't work – think of a solution.

We coated the outside of the canoe with epoxy. That did the trick.

As an electrical engineering student I could stand by and admire their efforts. But I wouldn't have wanted to join in. However the next phase was promising to be exciting!

I agree – we information engineering students like cleaner design and construct activities than this – but I couldn't wait to see what would happen when they put the canoe in the river!

Well we took it down in a truck – luckily we had plenty of labor to carry it the last few meters. We put in on the water.

And it floated perfectly – what's more- it worked like a dream with people in it. – it was easy to maneuver and we had a great time

Even though they worked so hard – it looks like they really enjoyed themselves.

Proving that it is possible to make a super-cheap canoe out of recycled materials.

And that brings us to the end of our odyssey – we hope you enjoyed the journey.

THANK YOU