Bridges and Tunnels

Bridging the Gap ...

Rivers, streams and babbling brooks; they can all be very attractive features in cities, towns and villages. But they get in the way,

That's why bridges are so important.

What you have to do

A disused building in a small village has been bought by a pub landlady - she wants to set up a new local pub. But the stream running across the front of the building restricts access. It's only a few metres wide, but she wants to run a family pub with a restaurant and a kids' play area. And even though you may be able to leap over three metres of water, an old granny or a parent with a pushchair would have a bit of trouble.

So the landlady has asked you to design a small bridge to make life easier for her customers.

She has written a description of what she would like, including the various dimensions required.

And remember, it has to be safe - you don't want anybody getting wet after their Sunday lunch!

The Rose and Crown
Little Chipmonk
Lotsapubshire

Dear Sir/Madam,

Re: Design Brief

The bridge has to span the stream, which is 300 cm wide. The river is 150 cm deep.

There may be about five people on it at any one time, so it needs to be strong enough to support them. If there is a weight limit, you'll have to provide a warning sign. It should be wide enough for three people standing side by side.

The bridge should be accessible for pushchairs and wheelchair users, so no steps please.

The surface of the bridge should be non-slip in all weather conditions. There should also be some sort of safety measure - maybe a handrail - to stop people falling into the stream.

The bridge's appearance should be in keeping with the rest of the village - no ugly monstrosities please!

Please keep costs to a minimum. You'll only need to build one bridge, but it should last for many years. Any upkeep (for example, resurfacing or painting) should be minimal and easily completed by a non-expert.

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How to set about it ...

What exactly do they want?

1. Draw a table like the one below (you may need more rows). Use the first column to list the **key design features** from the **design brief**. In the second column, "Initial thoughts", make a few notes about what you'll have to bear in mind as you begin to come up with possible solutions

Key design feature	Initial thoughts

2. You can now write your **design specification**. This should explain exactly what's required, and the implications of each design feature.

Generating ideas and shortlisting

3. Using the internet, library and/or resource centre, carry out some research into bridge construction. But remember your bridge isn't massive, so concentrate your research on smaller bridges. Here are a few places you might like to try:

   http://www.pbs.org/wgbh/buildingbig/bridge/basics.html (an American site that takes you through the different types of bridge and the forces that act on them)

   http://www.bridgesite.com/funand.htm (this site has a huge list of useful bridge links)

4. Produce a number of **design ideas** using simple freehand sketches to try to visualise them.
5. Shortlist three of your ideas, explaining the decisions behind your choices. Even at this stage you should be pretty sure your design ideas will work; scientific principles will help. For example, you should know that certain structures are able to carry heavier loads than others.

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And then there was one ...

6. You must now work out the pros and cons of your three design ideas. There are a number of ways to help you work these out. A few of them are:
   - You could carry out simple tests on scale models of particular components. In some cases you may want to test a scale model of the whole structure. For example, you may build a few bridge types and test them to see if they bear a decent load.
   - Think about costs. Which of your bridges would be most expensive to manufacture?
   - What's the rough life expectancy of your different designs? Is one much more hard-wearing than another?
7. Having weighed up the pros and cons, you've probably got a decent idea which design you think is the best. But the client is the paymaster. So, to help choose a final **design solution,** you should get feedback (comments and suggestions) from an expert who understands your client's needs.
   - Make 2D and 3D drawings and/or scale models of your three design ideas. These should be of good enough quality to allow you (and anybody else for that matter) to visualise exactly what your bridges will look like in the village.
   - Present your designs to the expert, and write down their comments and suggestions. (but if you're adamant one design is better than another, make sure you can explain why - you have to give the client what they want, but YOU are the designer!).
   - Consider the expert feedback and decide what modifications you need to make, if any, to make sure your designs meet the client's needs.
8. Choose your final design solution and summarise the reasons behind the choice, including how your **design solution** fulfils the **key design features** in your **design specification**, and how you have used expert feedback

Presenting your solution

9. Decide on a suitable engineering drawing technique to present your final solution. Make 2-D and 3-D engineering design drawings, or use computer aided design (CAD) to produce them. Make sure you stick to engineering standards and conventions.

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You've done the design job ...

10. You've successfully produced a **design solution** from a **design brief**. But what now? You've done the job of the designer, so you need to put your engineer's hat on. The design solution has to be turned into a **product specification** - giving the manufacturer the information needed to actually make the product.

    A product specification details all the materials needed to make a product; it includes its dimensions, tolerances and details of how the different components will be joined together.

    You need to decide which materials will be best to make your bridge. To decide which materials are best you should look back at the design brief and your initial research. You should also use databases and other resources to find out properties of materials.

    You might also want to try tests for materials, joints and finishes to show how these can vary and influence your choice for the product specification.

    COMPARATIVE TESTS