Welcome to my “I could be a Civil Engineer” challenge badge.

Answers pack

…and some waffley bits.

I have added in some explanations and extra information to some of the topics. If you would like any more information, please do email me and I will reply. I will then update this document to share the key questions and answers (anonymously).

Photos are attributed to their authors at the end of this document.

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The answers and the waffley bit!

1. **Build a tower out of newspaper that is taller than you**
   Generally the tighter rolled newspapers will be stronger and less likely to bend.
   The flat strips of newspaper will work if the joints to the other pieces are not too far apart.

2. **Build a structure using spaghetti & marshmallows**
   Extra sticks of spaghetti will add strength between the marshmallows, or you could try cocktail sticks. Pieces of spaghetti across the diagonal, brace the structure and stops it from twisting.

3. **Investigate famous bridges**
   Longest: Danyang–Kunshan Grand Bridge - Beijing–Shanghai High-Speed Railway - China
   http://en.wikipedia.org/wiki/List_of_longest_bridges_in_the_world
   Tallest: Millau Viaduct - France
   http://en.wikipedia.org/wiki/List_of_tallest_bridges_in_the_world
   Highest: Sidu River Bridge - China
   http://en.wikipedia.org/wiki/List_of_highest_bridges_in_the_world

   As part of your discussion think about the following:
   What does that bridge do? Why is it there? What would happen if it was not there?
   As well as move people/ transport/ trains etc what else can it do? (Bridges can also carry services, such as water or gas pipes, in or under the deck.)

4. **Make Rocky Road bars.**
   By changing the components of the concrete mix, the hardened concrete will have different properties and ultimately different strength, some are even waterproof. There continues to be innovation in concrete adapting to the changes in available materials for use.

5. **Name the skyscrapers.**
   1g, 2d, 3a, 4c, 5h, 6b, 7e, 8f

6. **Make sandcastles**
   You should find that sandcastles made from dried sand do not hold their shape, also too much water will cause the sandcastle to deform. So similar to concrete the correct amount of water must be used for success.

7. **Sand holes**
   The Leaning Tower of Pisa leans because the ground is different on each side.

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8. **The flour game**

9. **Design a marble run**

10. **Design a water run**

    It is really important that our water supply pipes do not leak and so the connections between pipes sections must be completely sealed.

11. **Tunnels game**

12. **Travel on a train**

    Currently, there is a lot of discussion in the industry about HS2 (High speed 2) about whether it is required and the benefits it provides. In London we are building Crossrail, a brand new railway that runs roughly east west and is being built directly under some of the major business districts, and already there is talk of Crossrail 2 to connect the north and south.

13. **Keep your "train" on the tracks**

14. **Motorways route plan**

    Edinburgh
    Glasgow
    Ingleton
    Ilkeston
    Ely
    Ipswich
    Vange, nr Basildon
    Leatherhead
    Reading
    Compton, Berks
    Newbury
    Newport, Wales
    Exeter

    This route would be 847miles, and would take about 16hours if there are no traffic jams!

15. **Make a windmill**

16. **Play "The Atom Game"**

17. **Solar car trail**

    Solar energy is now readily available for individuals. You have probably seen some houses around you which have solar panels on the roof of a house near you.

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18. **Make a lava lamp**

    There has been considerable research and development to build equipment which can collect energy from the tidal movement of the water.

19. **Make a levelling tool**

    It is very important that everything is built in the right place and at the correct level. Even the Egyptians used water levels when building the pyramids.
    Levelling tools have improved and developed during the years that I have been an engineer. From dumpy levels to laser levels, and now we are taking positional information from 3D virtual images available via a web browser.

20. **Build it**

    Communication is key, so that everyone knows exactly what information is required and who is going to do each task. Communication is also key when delivering the safety briefings at the beginning of each shift.

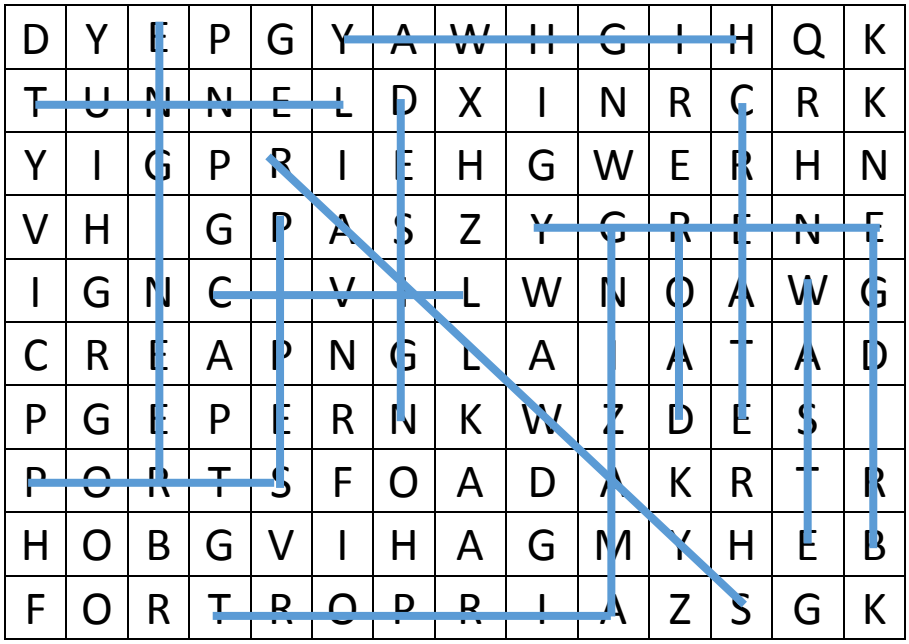
21. **Lego evening**

22. **Watch "what is a civil engineer" video**

    http://www.ice.org.uk/Get-involved/Working-with-young-people/Learning-Resources
    There is lots of information at this web site, in particular I like this video – "Are you ready to build a better world (Part 2)"

23. **Visit a building site**

24. **Wordsearch**



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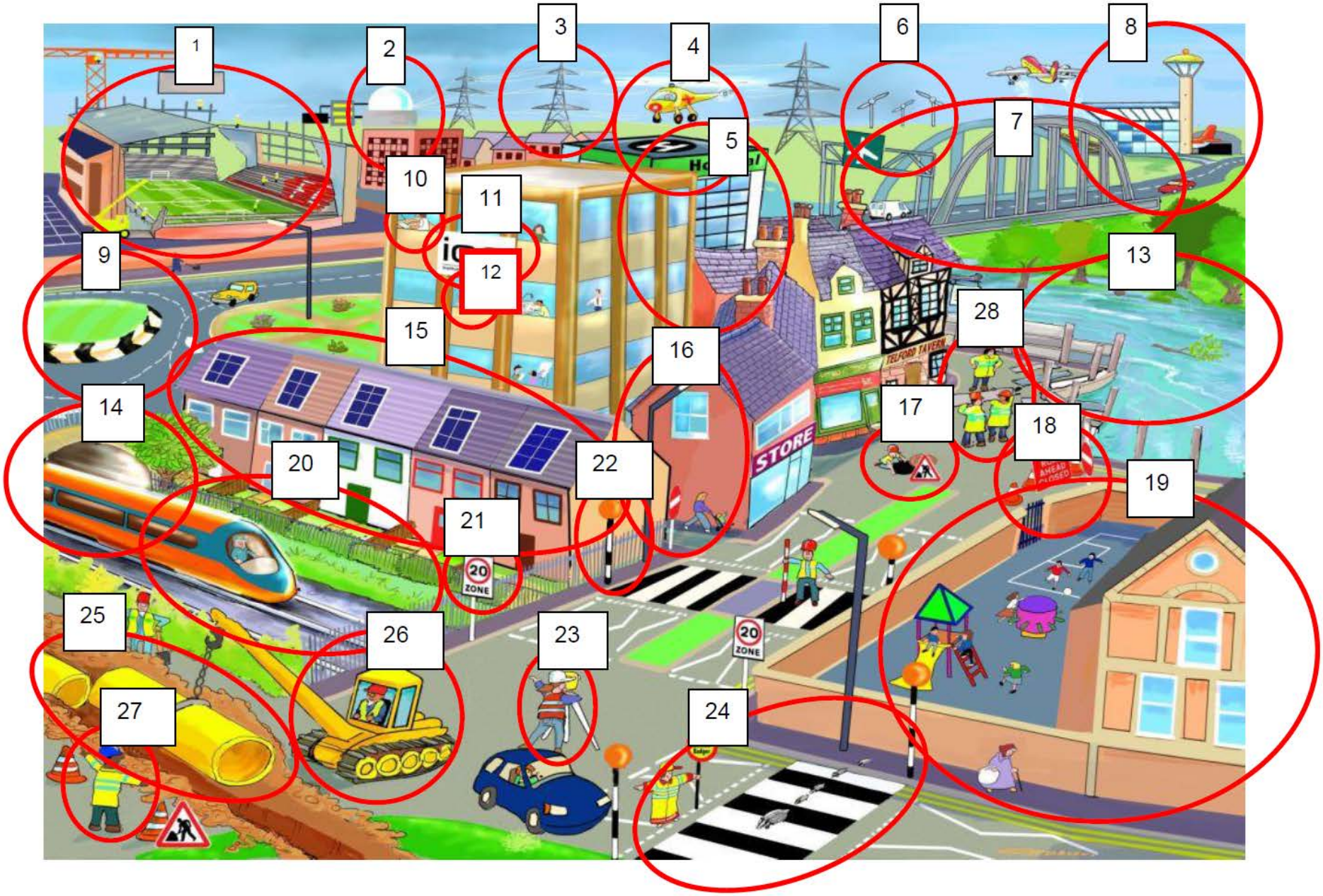
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ZONE

Continued..

Number	Civil engineering description
1	Stadium
2	Power station
3	Electricity pylons
4	Helipad
5	Hospital
6	Renewable energy
7	Bridges
8	Airports and runways
9	Roads
10	Office-based civil engineer working on paper designs
11	The Institution of Civil Engineers, the professional membership body for civil engineers
12	Office-based civil engineers working on computer designs
13	Flood defence and management, also known also coastal engineering
14	Tunnel engineering or geotechnical engineering
15	Housing and associated infrastructure
16	Lighting
17	Sewerage transport and treatment
18	Health and Safety
19	School
20	Railway system
21	Road system
22	Road furniture
23	Civil engineer working outside and investigating a site
24	Civil engineers must consider the impact of their work on the environment, animals and plant life
25	Infrastructure that distributes energy and water services to the community
26	Civil engineer building infrastructure
27	Civil engineer directing and managing a project
28	Civil engineers working in a team

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26. What's under your feet?

A: Telecoms

B: gas (local supply)

C: electrical (LV)

D: electrical (HV)

E: water (local supply)

F: gas (distribution main)

G: combined sewer

H: water (trunk main)

a) Gas pipe – the yellow one

b) BT ducts – the grey ones

c) Another telecoms supplier – the green ones

d) And another telecoms supplier - the black ones (although black ducts are often electric cables, so we had to be careful when identifying the ducts.)

e) Data cable ducts – the white ones

f) LV electric cable - the loose cable

g) Really old clay ducts – the brown ones. (Clay ducts broke really easily and so several repairs were required.)

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Photos and their origins

1. Photo by Pippa Higgins – taken 13-Aug 2014
   My eldest son and his newspaper tower, without the support of my family, this would not have been possible.

2. Photo by Pippa Higgins – taken 23-Aug 2014



3. This image is from the Geograph project collection. See this photograph's page on the Geograph website for the photographer's contact details. The copyright on this image is owned by **David P Howard** and is licensed for reuse under the Creative Commons Attribution-ShareAlike 2.0 license.

3. This image is from
   http://www.ila-chateau.com/caze/Millau-Viaduct.htm

3. This image was contributed by Maarten_Scheurwater to MiMoa website
   http://www.mimoa.eu/projects/Sweden/Malm%F6/%D8resund%20bridge

3. This image is from
   http://www.ikbrunel.org.uk/clifton-suspension-bridge

4. This image is from
   http://www.bbc.co.uk/food/recipes/rockyroadcrunchbars_87104

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5. The skyscapers.

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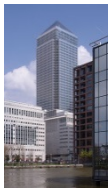

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"Burj Al Arab, Dubai, by Joi Ito Dec2007". Via Wikipedia - http://en.wikipedia.org/wiki/File:Burj_Al_Arab,_Dubai,_by_Joi_Ito_Dec2007.jpg#mediaviewer/File:Burj_Al_Arab,_Dubai,_by_Joi_Ito_Dec2007.jpg

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8. This image is from http://scribbit.blogspot.co.uk/2008/07/flour-game.html

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26. Photo by Pippa Higgins – taken 25 Nov 2010

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Project photo – author unknown - 2008

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