The ground beneath our feet

If you are fascinated by rocks and our planet and can spend hours digging, maybe you've got a geologist inside you trying to get out!

Think like a geologist

Key Learning:

To investigate the role of a geologist on the A9 Dualling project.

Experiences and Outcomes: Second Level

I am investigating different careers/occupations, ways of working, and learning and training paths. I am gaining experience that helps me recognise the relevance of my learning, skills and interest to my future life.

HWB 2-20a/HWB 3-20a/HWB 4-20a

Having explored the substances that make up Earth's surface, I can compare some of their characteristics and uses. *SCN 2-17a*

Through exploring non-renewable energy sources, I can describe how they are used in Scotland today and express an informed view on the implications for their future use. *SCN 2-04b*

I can consider the advantages and disadvantages of a proposed land use development and discuss the impact this may have on the community *SOC 2-08b*

When listening and talking with others for different purposes, I can:

- share information, experiences and opinions
- explain processes and ideas
- identify issues raised and summarise main points or findings
- clarify points by asking questions or by asking others to say more *LIT 2-09a*

I am developing confidence when engaging with others within and beyond my place of learning. I can communicate in a clear, expressive way and I am learning to select and organise resources independently. *LIT 2-10a / LIT 3-10a*

Learning Intentions

- I am learning about the type of work a Geologist does
- I am learning about the geology of Scotland (what lies underneath the ground) and the importance of cost and efficiency in the road building process

Success Criteria

- I can explain the type of work a Geologist carries out
- I can investigate natural materials through sight and touch and describe their properties
- I can explain the place that cost and efficiency plays in the road building process
- I can work in a team and listen to other people's point of view

The Activity

To work with a geologist from the A9 dualling project to discuss what lies beneath our feet and how this affects building a road and bridges.

NB This activity forms part of the 'Roadshow' that will be delivered into schools. It will be led by a geologist from one of the three design consultancies dualling the A9 and will take approximately 40 minutes.

Notes for teachers

- The A9 corridor has a number of different rock types along its route. **Geologists** know this from their existing knowledge about rock types found in Scotland, as well as carrying out ground investigations.
- The **geologists** use the results of these investigations to help decide what route the A9 can take.
- In the activity, **black** text is general information, **blue** text is pupil activities and **green** text is answers/additional information for teachers.
- An additional 'Resource images and optional worksheet' has been provided on p10.

The ground beneath our feet: geology challenge for the primary roadshow – for 6 pupils

Required by school: Provide name badge for each pupil.

Key Learning: To investigate the role of a geologist on the A9 Dualling project.

Key Vocabulary: Geologist, constraints, percussive, rotary, sustainability, investigation.

ELO Checklist

Required by ELO – 6 geologist lanyards;

- ✓ one timer;
- ✓ 3x boxes of samples;
- ✓ A length of plastic pipe to demonstrate the motion and sampling of the drilling rig
- ✓ 1x rock core;
- ✓ 3 x support blocks (yellow, orange and blue);
- ✓ 6 x disposable gloves (size small latex free),
- ✓ disposable plastic table sheet;
- ✓ laminated pictures of - drilling rigs; (enough to share between 2 pupils) main street, mountainside; Geological map of Scotland and optional worksheet;
- ✓ small nail brush to clean blocks at the end;
- ✓ wet wipes to tidy any mess in the class room;
- ✓ bin bag for gloves.

After each session:

- ✓ Please clean up sample boxes and store in a cool, dry, dark place between sessions. If the plaster box is still damp, store with the lid off.
- ✓ Clean the coloured blocks with the scrubbing brash and dry thoroughly before storage

Re-order gloves and any other required materials for the next session.

Part 1: What is a geologist?

Introduce yourself to the pupils (name, job title).

Today I am here to help you understand what a geologist does on the A9 Dualling project. You are going to be geologists with me and take part in some of the activities I do every day. Hand out a geologist lanyard to each pupil.

Geologists find out about what is beneath our feet in many different ways. We can all look around us for clues. Show the photo of the main street. Sometimes there are not many clues there. This ground is all covered up by tarmac and pavements. Show the photo of the hillside. When you move outside of the towns, patches of rock poke through the surface and give us clues as to what lies beneath our feet.

Part 2 How we investigate

Before a project like the A9 Dualling begins **I need to go on site to where the new road may be built. I help engineers decide where the new road and bridges may go. If I can't see the rock at the surface, I do this by investigating what materials are under the ground and think how they may affect the design of a road or bridge.** How do you think I would carry out a ground investigation?

I have brought 2 photographs to show you how we do it using drilling rigs.

Have 2 A5 labelled photographs of the rigs on one piece of A4 paper. Share these between 2 pupils (or have some footage of the rigs working.)

Let's look at the Light Cable Percussive rig. Have you seen this one along the A9? Does anybody know what the word percussive means? This rig winds a cable around a drum (show kitchen roll tube and a piece of string) and then lets it go. The drum falls onto the ground and sinks in. A sample gets caught inside the drum and is brought back to the surface.

Let's look at the Rotary rig. Have you seen this one along the A9? Does anybody know what the word rotary means? It is like a very big version of the electric drill you might have at home. A cylinder with diamond on the edge rotates very quickly and cuts through the ground. The rig can send up little samples to the surface or it can cut a core sample for me to examine.

Collect the photographs if used.

Part 3 Materials

I need to examine the samples from the rigs when they come back to the surface. Can you guess what materials the samples may contain? Tell the pupils sand/gravel, clay and rock are found.

Let's look at those materials the rigs can bring up. You will need to put on your plastic gloves. Have 3 plastic tubs. Give each pair 1 plastic tub. I want you to feel the samples and be thinking of words to describe each of them. Give pupils allocated time to investigate and then rotate the tubs to allow each pair to see the sand/gravel, clay and rock. On the final rotation, can you give me a word to describe the sample you have? Ask pupils to remove their gloves.

Which rig do you think would bring up the sand and gravel/clay/rock?

The rotary rigs get the samples of the hard rock under the sand, gravel and clay. Here is a sample of rock for you to examine. Give pupils allocated time to examine. How would you describe the rock sample?

Part 4 Bridge Structures

When the rigs have shown me what is underground, I can advise the engineer's designing the new road or bridge on the ground conditions. We are going to imagine we are advising the engineers building a bridge and are working together as a team to work out which material would be best to build a bridge on. I am giving you 3 coloured supports for a bridge, with different volumes and different stabilities.

Stand up and we are going to imagine we are carrying a heavy weight on our head.

- balance on one leg – you are the blue pillar and quite weak
- stand two feet together arms by your side – you are the orange pillar and getting stronger
- stand two feet apart and arms bent but away from your body – you are now the yellow pillar and very strong. Sit down.

I need you to try each support in the material you have and decide which would be the most stable support for a bridge to rest on.

Give out the supports and provide allocated time for this.

My rock experts, can you tell me which support could be best for the bridge?

(All 3 supports would be stable – physically push down the supports to emphasise)

My sand and gravel experts, can you tell me which support would be best for the bridge? (Both orange and yellow because they have a wide foot base)

My clay specialists, can you tell me which support would be best for the bridge? (Yellow would be best as it has the widest base)

From the answers we have heard, which ground material would be the **best** to build a bridge on? Rock

When a bridge needs to be built, we don't get to choose the best, stable material to build on, we need to build on the materials that we find in that place: clay, rock or sand and gravel. As you have found out the materials we find will make us use different supports for our bridge. We need our bridge to be strong, safe and hard wearing **but** we also need to look after our environment when we design it. What do you think our bridge supports could be made out of to make them very strong? (Concrete) Unfortunately making concrete is not environmentally friendly and engineers only like to use the smallest amounts of it and no more than is really needed.

I want you to think carefully about the bridge supports and chose one that you would advise an engineer to use to build a bridge that is stable yet uses the least amount of concrete.

My rock experts what would you advise? (blue - has a low volume and does not take much concrete to make, better for the environment but not very stable, needs a solid base)

My sand and gravel experts what would you advise? (orange – has a medium volume and needs more concrete to make, but is more stable)

My clay experts what would you advise? (yellow - has a large volume and takes a large amount of concrete to make but is very stable)

The last 2 activities can be repeated so all pupils try all samples if time allows.

Conclusion

That concludes your time as a geologist. I hope you have learned a little about my job on the A9 dualling. As you pass me your lanyard, tell me one thing a geologist does? Would any of you like to be a geologist? Have you any questions? **Don't forget to wash your hands.**

Ask questions to ascertain learning in line with the Success Criteria.

Resource images and optional worksheet

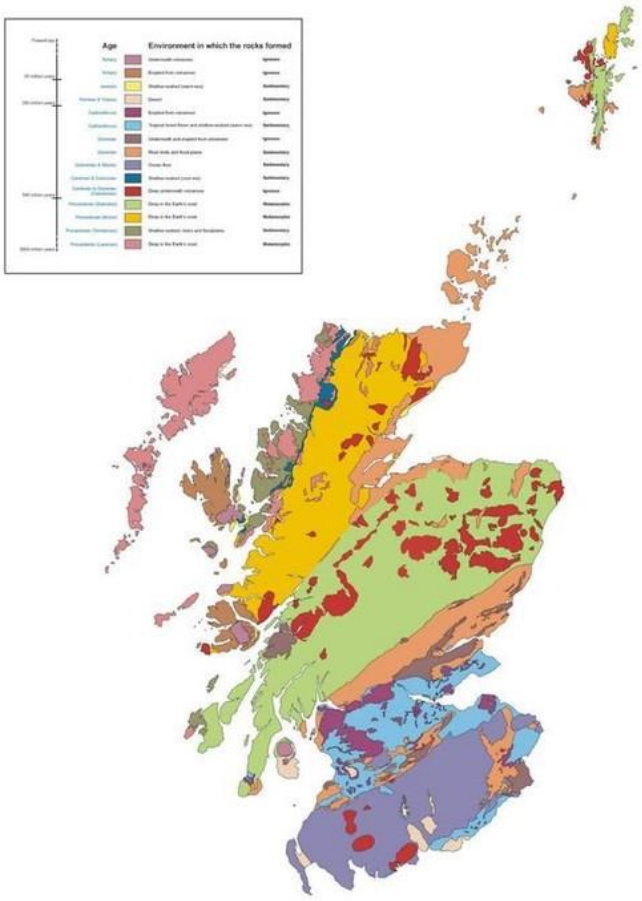
Pitlochry

Ben Vrackie


Light cable percussive rig


Rotary rig (1)

Rotary rig (2)



The geological map of Scotland

The Challenge!

Remember! You need to READ the notes and instructions very carefully to complete this challenge!

Sometimes you will be asked to READ, to DO or to WRITE

READ: Three tubs have been provided with different materials in each:

- Soft clay – similar to the type of material you might find on the flood plain or estuary of a slow moving river, or deposited by a melting glacier 10,000 years ago
- Sand and gravel – from the river deposits near to the river Tay. The gravel is quite angular because the drilling rig broke up the larger pieces as it progressed through the ground.
- Solid rock – in the tub you have an artificial representation of rock in layers to help you visualise what you might see under the ground.

DO: Remember! Health and Safety first! Put on your disposable gloves before you begin.

DO: Investigate each of the 3 materials (*move each around and feel them between your fingers)*.

DO: Discuss what they feel like with your partner.

WRITE: THREE good describing words for each material on your worksheet.

READ: You have three support shapes for the investigation. Imagine they are made of concrete.

DO: Discuss the different shapes in terms of their volume in relation to the materials used to make each of them.

<u>WRITE:</u> On your worksheet write which shape you think has:

a) the LEAST volume

b) the MOST volume

<u>READ</u>: the information below to see if you are correct!

- <u>Blue pole</u> –This has a low volume and therefore doesn't use as much raw material to make it. It might represent one of a number of circular concrete columns supporting a bridge. Better for the environment but not very stable.

- <u>Orange square column</u> –This has a moderate volume. It would probably need more concrete to make it and would use more raw materials than the pole. This would represent a pair of thick concrete columns supporting a bridge. It is more stable as its foot area is greater.

- <u>Yellow rectangular column</u> –This uses a large volume of concrete to give it shape. It might represent a thick concrete abutment (solid block of concrete at the end of a bridge) supporting the end of a bridge. Very carbon intensive, but also very stable.

<u>DO:</u> Investigate how each shape stands up on the materials in each of the tubs?

<u>Write:</u> On your worksheet write down how well each shape stood up in the different tubs.

Worksheet

Name:

Write THREE good describing words for each material.

Clay	
Sand & Gravel	
Rock	

1. In your OWN WORDS write down why engineers try to minimise the amount of concrete required when making support shapes during the building process.

_____

_____

_____

Write your answers on the line

a) The shape with the LEAST volume is: _____

b) The shape with the MOST volume is: _____

Write how well each shape stood up in each of the tubs?

	Sand and Gravel	Clay	Rock
Blue Pole			
Orange Pillar			
Yellow Block			