



## Build Your Own Digital Railway Student Design Brief

Have you ever been riding on a train and wondered, “What could I be doing with the time I’m sitting here?” Now is your chance to put those ideas into action. Your task, while working in a team of four, is to design a *Digital Railway* where you can carry out parts of your daily routine while you ride the train. You should be as creative as possible, but you must keep the following factors in mind while developing your railway:

**Cost** – How much will your team's railway cost the public to build?

**Location** – Where do you want your team's railway to run?

**Health and Safety Concerns** – Is your rail accessible to people with disabilities? Is it safe to ride for the general public?

**Rail Traffic** – How many people are going to ride your team's railway daily?

**City Planning** – Is your team's railway going to disrupt existing structures?

You and your team will have ten weeks to provide the following deliverables:

**Proposal** – An outline of your team's idea for the Digital Railway and how your team plans to design and construct it.

**Concept Model** – A semi-completed physical representation of your idea. This is your time to test things out and see how they look before finalizing the design.

**Design Plans from Concept Model** – A set of blueprints for your final structure.

**Final Model** – A scale model of your structure based on your final design.

**Presentation** – A final report to show off your digital railway in action and how your team has collaborated effectively.

Two of you will be finishing this project to complete the requirements for an Engineering Design Level 2 qualification, while two will be attempting to complete the Creative iMedia Level 2 qualification requirements. The entire team will need to work as a unit, each member's strengths complementing another's weaknesses. **Collaboration** and proper **Data Management** is key to a successful *Digital Railway* project!



## Student Resource Guide

Welcome to the Build Your Own Digital Railway Programme! Whether you are part of the Engineering Strand or the Creative Strand, this resource guide has been designed to get those innovative and creative parts of your brain pumping. Below you will find links to videos, case studies, and other helpful resources that may contribute to your design. These resources should be used to inspire, rather than duplicate. You are encouraged to do your own research as well and request resources from your teachers and mentors.

It's time to get started and inspire the future users of your railway!

### Video Resources

Below you will find links to direct you to exciting railway projects, along with questions to think about and answer as a team while watching the videos.

#### **The Fifteen Billion Pound Railway**

A documentary series following some of Crossrail's engineers and construction workers as they build London's new Underground system. Each episode highlights some of the challenges that Crossrail has to overcome and the considerations they have to take into account when working on this massive construction project.

**What sort of issues may arise at the start and during the execution of your project?**

**Episode One: Urban Heart Surgery -**

<https://www.youtube.com/watch?v=ITcQMjKppM>

**Episode Two: Tunnels Under the Thames**

- <https://www.youtube.com/watch?v=HewC4OpY8b8>

**Episode Three: Platforms and Plague Pits –**

<https://www.youtube.com/watch?v=DlziPDJXQbQ>

#### **Virtual QR Code Supermarket in Korean Subway – Tesco**

A short video on how Tesco created a virtual supermarket in Korean underground stations. This allowed people to save time by being able to shop during their daily commutes.

**What ideas do you have to save people time during their daily commutes? What about making things more convenient?**

<https://www.youtube.com/watch?v=xxoh4AKGE5M>



### **The New Tube for London**

A video on some of the future improvements that will be introduced to the Piccadilly line, followed by the Bakerloo, Central, and Waterloo & City lines.

**How do the future improvements affect passengers? What are some of the improvements you would like to see?**

<https://www.youtube.com/watch?v=Z3Q0FZUKHKY>

### **Bond Street Station Redevelopment for 2017**

A video with a virtual tour of what the Bond Street will look like after redevelopment to increase capacity and improve accessibility.

**Why are capacity and accessibility so important when designing a station?**

<https://www.youtube.com/watch?v=Z0T3cXyQ-o>

## **Case Studies**

Below you will find a list of case studies to continue inspiring and guide your project development as you build your digital railway!

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### **Lessons in Driving Business Sustainability**

<http://www.financeforthefuture.co.uk/Upload/PageAttachments/page233/files/FFTFA%202014%20case%20study%20Crossrail.pdf>

**Statement for analysis:** Before the construction of a project like Crossrail can commence, a number of social, political, and technical issues need to be addressed. In the following case study, Crossrail's design is examined to see how the project is socially and environmentally sustainable. This includes its legacy program, TUCA (Tunneling and Underground Construction Academy), as well as project approaches executed to make use of excavated clay and reduce carbon emissions.

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## Canary Wharf Crossrail Station

<http://www.ice.org.uk/topics/transport/Case-Studies/Canary-Wharf-Crossrail-Station>

**Statement for analysis:** Computer modelling plays an important role in the building process. The Canary Wharf station has been designed with 4D modelling in mind to complete the project.

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## Crossrail Tunnel Construction: monitoring movement

<http://www.ice.org.uk/topics/transport/Case-Studies/Crossrail--Monitoring-for-movement>

**Statement for analysis:** During the tunneling process, the ground on which city buildings stand can shift. If left unattended, this can cause structural damage to those buildings. Special measures need to be taken to mitigate the effects of ground movement. A system of lasers and prisms is used to precisely track the shifting of the ground.

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## Crossrail: Dry approach to Connaught Tunnel repair

<http://tunneltalk.com/Crossrail-Feb12-Connaught-Tunnel-refurbishment.php>

## Breathing new life into the Connaught Tunnel

<http://www.crossrail.co.uk/construction/tunnelling/breathing-new-life-into-the-connaught-tunnel/>

**Statement for analysis:** Sometimes unexpected problems turn up and need to be addressed. When attempting to refurbish the Connaught Tunnel, such a problem arose. The Connaught Tunnel is a Victorian Era tunnel that passes under the Royal Docks and is along the Crossrail train route. Due to safety and structural concerns, the water above the tunnel had to be sectioned off and drained in order for Crossrail to widen the tunnel.

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## Rail and Underground Panel: Crossrail – Moving to the Operating Railway

<https://www.tfl.gov.uk/cdn/static/cms/documents/rup-20150212-part-1-item-09-crossrail.pdf>

**Statement for analysis:** The organization tasked with building a railway is not always going to be the one in charge of running it! It is critical that a smooth transition railway constructor and railway operator takes place, so that no mistakes are made. Exploring the handoff from Crossrail to Transport for London (TfL), topics include: preparing for operation, integration into the existing TfL network, and rebranding.



## Websites

Below you will find a list of useful websites for you to explore while building your digital railway with your team. Be sure to record your site visits and the articles that have inspired you, so you can refer back to them later!

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**Crossrail** is useful for finding out more about the Crossrail project and the challenges and innovations associated with it. The website has articles, videos, key facts, and other useful resources relating to Crossrail.

<http://www.crossrail.co.uk/>

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**Transport for London** has information on the London underground and most other aspects of London's transport system. It also lists what improvements and projects are currently taking place on London's transport system, as well as future plans.

<http://www.tfl.gov.uk/travel-information/improvements-and-projects/>

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**Tomorrow's Engineers** is a one stop shop for information and resources about the amazing careers available in engineering. It also contains resources for students and young people, including engineering case studies.

<http://www.tomorrowsengineers.org.uk/>

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**National STEM Centre** houses the UK's largest collection of STEM teaching and learning resources. Teachers and students have access to a wide range of high-quality support materials.

<http://www.nationalstemcentre.org.uk/elibrary/>

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**ENGINEERING.com** offers a variety of articles, directories, videos, and other useful resources for both students and professionals.

<http://www.engineering.com/Library/tabid/78/Default.aspx>





## **OCR Resources**

The OCR website has an abundance of support materials, learning resources, and example assignments for the qualifications you may be trying to receive. Do not be alarmed by the number of resources. These websites are being offered to allow some research outside the project's main objective. Peruse these if you have free time available.

### **Creative iMedia Level 1/2 Award/Certificate/Diploma – J807, J817, J827**

<http://www.ocr.org.uk/qualifications/creative-imedia-level-1-2-award-certificate-j807-j817/>

### **Engineering Design Level 1/2 Award/Certificate – J831, J841**

<http://www.ocr.org.uk/qualifications/cambridge-nationals-engineering-design-level-1-2-award-certificate-j831-j841/>

### **Employability Skills Level 2 Certificate – 10404**

<http://www.ocr.org.uk/qualifications/vocational-qualifications-qcf-employability-skills-level-2-certificate-10404-from-2015/>