HS2

ARE YOU EPIC?

MODULE 1: EPIC ENGINEERS STEM WORKSHOP DELIVERY GUIDE

FACILITATOR INTRODUCTION

Introduction and purpose

We have created this module to help you to deliver activities from the EPIC Engineers scheme of work as an EPIC Engineers STEM Workshop. Whether you are a classroom teacher, STEM Ambassador or facilitator, this module will provide you with the tools necessary to transform the EPIC Engineers activities into a fun and engaging STEM workshop.

For each activity, we have provided:

- an example session plan;
- an inventory of equipment;
- a training video;
- a student introduction video;
- tips and tricks for effective delivery.

We have compiled this guide with the assumption that you will be providing workshops based around a single EPIC Engineers activity, however we have also included some special considerations and materials should you wish to run a full-day workshop.

For those delivering a full-day workshop we have also provided:

- 'Day Introduction' and 'Day Reflection' plans and notes to help you to bookend the day.
- Hints and tips for running a full-day workshop.

The EPIC Engineers activities

The EPIC Engineers STEM scheme of work has been designed for Key Stage 3 students aged 11-14. It includes three workshop activities plus the 'Student Introduction' and 'Student Reflection' tasks. If you are planning a short workshop (1.5-2 hours) choose one of the activities below. The Student Introduction and Reflection should only be used in a full-day workshop accompanying more than one activity.

- **Student Introduction**
  In which students are introduced to the workshop and the Essential Skills framework.
- **Stations of the Future**
  In which students compete in teams to design the best futuristic train station.
- **Engineering Challenge: Tunnel Structures**
  In which students compete in teams to build the most efficient cut-and-cover tunnel structure.
- **Rail Rush!**
  In which students play an educational board game where they compete to build the best high-speed rail network across the UK.
- **Reflection**
  In which students reflect on their progress across the day and are rewarded for their achievement.

Single activity workshops do not include the Student Introduction or Reflection activities, as each activity has it's own shorter introduction and reflection applicable to the activity. You should however spend five minutes introducing yourself and High Speed 2 (HS2).

It is up to you to choose which activity you would like to deliver. You should consider the interests of the group you are working with and how your professional knowledge might fit with the activity.

Pre-workshop communication

If you are a STEM Ambassador or facilitator, pre-workshop communication is very important to establish yours and your host school's needs. It is also important that you leave ample time for your host to plan for your visit. Before arrival, you must request the following:

- A room that you can use during the workshop, set up with a projector, speakers and a computer.
- Seating and tables to be set up for the students, in tables of four, plus a demonstration table at the front of the room.
- A teacher per every 30 students, to be working with at all times during the workshop, plus support staff where applicable.
- The school-supplied inventory items listed in the activity guide.
- Access to the room for 30 minutes before the session starts.

You should also ask your host for the following information:

- The age range and ability of your group.
- If there will be students who require differentiated resources, such as students with Special Educational Needs and Disabilities (SEND).
- The start and end times of your session, plus the timings of any breaks.
- Whether your presentation must be sent in advance.
- Whether you must book a parking space.
- If there is anything else that you should know about the group or the school.

We have prepared the following general guidance for delivering an EPIC Engineers STEM Workshop. If you are delivering a full-day workshop, extra guidance can be found in the section 'How to Deliver a Whole Day Workshop'.

Planning

See Appendix 1: EPIC Engineers Workshop Planner (page 19) of this document to plan your workshop, along with the timings supplied in each activity section later in this guide. Make sure that you leave an extra five minutes at the beginning of the session for the students to arrive and settle themselves. Allow extra transition time for a larger group of students, as they will take more time to arrive and settle.

Use the double spaces to add in lunch time or breaks, and an additional 'Welcome' to introduce yourself and HS2.

Try to be generous with your timings. If you are doing a single activity workshop do not try to squeeze the activity into a one-hour session. Ask your host for as long as you think you will need in advance of the workshop. The students should ideally be 'off timetable'.

Preparation

Before arriving at your host school, you should be familiar with the preparation guide for each activity. You should also have with you a wireless presentation clicker, any presentations on a USB stick, enough EPIC Engineers Student Activity Booklets or activity worksheets for your group, your DBS and a photo ID such as a passport or driving licence. Bring refreshments with you as you may get thirsty during the workshop.

Arrival

You should aim to arrive at the school at least one hour before your workshop is to begin. This will allow time for your entry to be processed by the reception, for your host to collect you and for you to have 30 minutes preparation time in the learning space.

Setting up

Place four EPIC Engineers Student Activity Booklets or activity worksheets on each table, and a tablet computer if you are using them as part of Stations of The Future. Test the computer, projector, speakers, presentation and clicker are working. Unpack all equipment, and set up your demonstration table. Group the objects that you need for each activity. Check that the room is accessible and that there is enough space around the desks for the students to circulate. Store your bags in a safe area.

Find out at the beginning of the day how the school's reward system works, and use this system to award your winning teams.

Student arrival

Stand at the door to greet the students and invite them to sit four per table. Do not allow them to enter until school staff are present. As the students begin to settle, invite them to write their name and group on their booklets or worksheets. Circulate the room and give each table a team number. You will use this to refer to each table group across the workshop.

Starting off

Start the session by counting down "3, 2, 1… and quiet". Wait for silence and then praise the students for their response. Introduce yourself, your ground rules, and start the workshop. Suggested ground rules include:

- 'Please stop what you are doing and listen when I count down from 3, 2, 1.'
- 'Please do not talk when I or anyone else is talking.'
- 'If you have an answer or an idea that you would like to share, please put up your hand.'

Introduce yourself using your first name or an honorific. Try to explain your job in just one sentence. A big smile at this point goes a long way with building rapport.

Facilitating the workshop activities

Use the activity presentations and your planning sheet to navigate your session. It's up to you to present in your own style and to create the rhythm and flow of the workshop, but try to stay consistent in your approach and your application of rules across the workshop.

Helpful tips:

- Make sure that you are speaking loud enough for the size and hearing needs of the group by asking the students if everyone can hear you.
- Never speak unless there is silence. Count down "3, 2, 1…" as you established, and using a gentle "shh" for any remaining whisperers will obtain silence.
- Make sure that you have practised the instructions for each activity. Aim to never be speaking for more than five minutes at a time.
- Disruptive behaviour should be dealt with by accompanying school staff. If a student behaves unacceptably, pause and ask a staff member to intervene.
- Give specific instructions for what you would like the students to do. "Please all come to the front" should be "Starting with Table 1, please come to the front in silence bringing with you your chair, your booklet and a pen."
- Circulate the room to get to know the students during each activity. Use **Appendix 2: Workshop Scorecard** (page 20) to track progress and make sure that you have seen every group at least once per activity.
- Check regularly that students are on task. If the students are confused, stop the group and explain the activity again.
- If the students are becoming restless move on to the next part of the activity.

- Wear a watch. School clocks are not always correct.
- Do not let students switch teams or tables. If there is a problem with a team dynamic, ask a school staff member to facilitate a solution.
- Count out and in all inventory items. Double-check that you have collected all inventory items before dismissing the students at the end of the day.
- You should give the students lots of praise; to individuals, teams and the whole group. Use the Essential Skills framework to make your praise specific and meaningful.

Students with Special Educational Needs and Disabilities

You should ask your host if any students in your group will require differentiated resources or if they have SEND needs that it would be useful for you to be aware of. We have included a form to help you to do this, see **Appendix 3** (page 21). If there will be students with SEND in the group, you should send the workshop materials that you will be using in advance for their teacher or learning support assistant to differentiate and advise on.

If you have students with hearing or visual impairments, ensure that they can be sat in an appropriate place to access your delivery.

For mild or moderate learning disabilities the differentiated activities should be followed. For severe or profound learning disabilities the EPIC activities may not be appropriate. Differentiated versions of the activities can be found in the EPIC Engineers STEM Workshop for SEND Students part of this guide.

Rail Rush! may not be suitable for some students with a severe learning disability. An alternative activity could be delivered from the EPIC Engineers STEM Workshop for SEND Students part of this guide, in partnership with their support assistant.

Safeguarding

It is important to read and follow your host school's safeguarding policy and ensure that you can identify the school safeguarding officer. In addition:

- Make sure that a member of the school's staff accompanies you with students at all times.
- Only use toilets assigned to staff.
- Ensure that you do not make physical contact with students, except for a congratulatory thumbs-up.
- Do not give out your personal or work email or contact details to a student. If they want to contact you for work experience, this can be arranged through your host contact at the school and with the HS2 Education Team. The HS2 Education team can be contacted by email at skills@hs2.org.uk.

Troubleshooting

Please review **Appendix 4: Workshop Troubleshooting** (page 24) which outlines pointers for when prepping for workshop delivery.

How to deliver a full-day workshop

A whole day workshop includes the activities Stations of the Future, Engineering Challenge: Tunnel Structures and Rail Rush! as well as the Student Introduction and Reflection delivered in one full day. You should follow the same instructions from the EPIC Engineers STEM Workshop section of this document; however, the following instructions and considerations are also applicable:

Pre-workshop communication

When communicating with your host school:

- Make sure that that your learning space will be available to you all day and that it is not open or used as a student area during lunch or break time.
- Check that you will be accompanied by the correct number of teaching and learning support staff for the entirety of the day.
- As you have more equipment, ask your host for 45 minutes of set-up time in the learning space.

Planning

- Include the Student Introduction and Reflection sessions in your workshop. These include activities that bookend and add meaning to the learning in a full-day context.
- Use Appendix 1: EPIC Engineers Workshop Day Planner from this document, using the timings supplied in each activity section. Try to plan the activities around break and lunch where you can. You should use the spaces to add lunch and break times.
- Try to be generous with your timings across the day.
- Allow extra transition time for a larger group of students, as they will take more time to arrive and settle after lunch and break times.

Preparation

- Use the EPIC Engineers Student Activity Booklets, as this will save time rather than handing out worksheets for each activity.

Setting up

- When unpacking, group your equipment by activity. You will have a large inventory to manage over the day and being organised in this way will enable you to keep track.

Facilitating the workshop

- The students' energy levels will vary across the day. Try to keep the pace of the session up and if the students begin to flag, give them lots of encouragement to keep going.
- Ensure that the students leave the sessions on time for lunch, break time and at the end of the day.
- If needed, adjust your plan as the day progresses. You should be reactive to the students' needs to ensure that they have time to complete each activity to a satisfying outcome, and to respond to other losses of time.
- If you are left with forty minutes or less to complete Rail Rush!, omit the activity and divide the remaining time between the other activities.

Using the Skills Builder Universal Framework

At HS2 we have adopted the Skills Builder Universal Framework (https://www.skillsbuilder.org/) across our education and talent programs as part of our commitment to upskilling the nation. The Skills Builder Universal Framework is embedded across the EPIC Engineers STEM Workshop activities, with each activity having a specific focus on different essential skills:

- Stations of the Future (page 9): creativity, teamwork, listening, and speaking.
- Engineering Challenge (page 12): tunnel structures: teamwork, problem solving and staying positive.
- Rail Rush! (page 15): staying positive and aiming high.

How you introduce the essential skills will vary based on the format of the day. If you are delivering a full-day workshop, an extended induction to the Skills Builder Universal Framework is included in the Student Introduction where students will self-assess their essential skills as a baseline to measure their progress across the day. If you are delivering a single activity workshop you will introduce the students to the applicable essential skills as you introduce the activity, and students will use the essential skills as part of the activity reflection.

You should use the language of the essential skills framework throughout the workshop, to familiarise students with the essential skills and to help students to identify and grow the essential skills within themselves. You should also use the essential skills as a framework for praise and point out excellent examples of their application during the reflection parts of each activity and at the end of the workshop. For example, if one of your teams has recovered well from a disagreement, praise them for "excellent teamwork" and "staying positive". If a team has produced an exemplary piece of work, praise them for "aiming high". Special praise should be given for the focus essential skills of each activity.

A sense of progress is important to students, and assessing the growth of their essential skills across the day is both motivational and rewarding for them. Make sure that in the full-day workshop you allow the students enough time to self-assess at the end of each activity and to give examples of their achievement during the plenary.

For a wider explanation of each essential skill, see the full-day presentation deck (www.hs2.org.uk/education) or the Skills Builder website (https://www.skillsbuilder.org/).

Workshop Activities

Student Introduction

If you are delivering a full-day workshop you should begin with an introduction sequence. In this sequence you will introduce the wider learning objectives of the day, the HS2 project, some examples of STEM Careers and the Essential Skills. We have provided the HS2 Phase One Animation (www.hs2.org.uk/education) for use as part of this sequence.

Inventory

You will need to supply:

- EPIC Engineers STEM Workshop Full-day Presentation (www.hs2.org.uk/education)
- 30 x EPIC Engineers Student Activity Booklets (www.hs2.org.uk/education)

Sequence

Use the following sequence to plan this activity. You may wish to adjust the timings according to your own style of delivery, group and workshop length.

More detailed guidance can be found in the presenter's notes of the EPIC Engineers STEM Workshop Full-day Presentation (www.hs2.org.uk/education).

Time (min)	Sequence	Instructions	Booklet Page	Slides (Single Activity)	Slides (full-day)
5	Welcome	Introduce yourself, the HS2 Project, the learning objectives for the day and the day plan. Use the HS2 Phase One Animation. Ask students to write their name and group on the booklet cover.	1	N/A	1-6
5	STEM careers	Ask the students to complete the starter activity, STEM Careers.	2	N/A	7
5	Student answers	Ask the students to feedback answers and then reveal the word cloud of STEM careers.	2	N/A	8
5	Essential skills	Introduce the essential skills to the students. Ask the students to complete the activity Welcome to The Team.	3	N/A	9-19
5	Student answers	Ask the students to identify their best essential skill, with a show of hands, running through the list of essential skills.	3	N/A	19

Tips and tricks

- Circulate the room to check that the students are completing the activities correctly and allow them to discuss their answers as they work.
- Allow the students three minutes for each activity. This will establish a fast pace for the rest of the day. Allow them an extra two minutes to complete Welcome to the Team if they need it.
- The students do not have to write in full sentences.
- Welcome to The Team establishes each student's baseline score for their essential skills. Ask them to refer back to this across the day and to concentrate on the essential skill that they planned to improve.
- You do not have to read the detailed description of each essential skill at this point. You can return to these slides later during the appropriate activities should you want to increase the pace of this section.
- You may want to share the detailed descriptions of the relevant essential skill with any supporting teachers or volunteers so that they can comment on the different aspects of the skill when they are interacting with students.

Stations of the Future

Stations of the Future is a team-based design-and-present activity where students compete to design the best futuristic train station to be opened in the year 2050. Each team of four students will produce a plan for their station, presented as a top-down map view, drawn on an A2 piece of paper.

Each member of the team will have a different real-life job role within the team and be responsible for the associated aspects of the design. At the end of the activity students will present their designs to the rest of the group.

During the design phase of the activity you will reward each team points for demonstrating the Essential Skills of 'Creativity', 'Teamwork', 'Listening' and 'Speaking'. The team with the most points at the end of the session is the winner.

Inventory

You will need to supply:

- 1 x Workshop Scorecard (**See Appendix 2** (page 20))
- 30 x Stations of the Future Activity Sheets or EPIC Engineers Student Activity Booklets (**www.hs2.org.uk/education**)
- 8 x A2 sheets of graph paper
- 8 x tablet computers, loaded with the EPIC App. (Optional)
- EPIC Engineers STEM Workshop Full-day Presentation or Stations of the Future Presentation (**www.hs2.org.uk/education**)

You should ask your host to supply:

- 1 x class set of coloured pencils
- 1 x class set of drawing pencils
- 1 x class set of rulers
- 30 x A4 sheets of blank paper

Note: The inventory above is for use with a class of 30 students. For a group of 60, you will require 15 x A2 sheets of graph paper, and double everything else apart from the Workshop Scorecard. Optionally, you will require 15 x tablet computers.

Preparation

You will require the room to be set up with tables of four. Place some scrap paper and coloured pencils and a tablet computer (optional) on each table. Watch the Stations of the Future Training Video (**www.hs2.org.uk/education**) for additional subject knowledge and activity instructions.

Using the AR EPIC App (Optional)

- To use the AR EPIC App, you must unlock each tablet, launch the app and click 'start your journey'. Each character has a profile and an augmented reality (AR) experience. Trigger the AR experience by pointing the tablet camera at the back page of a booklet.
- Switch the tablets 'on' when you hand them out and 'off' when you collect them. Check the battery levels and charge them if needed.

Tips and tricks

- This 100-minute version of the activity includes 50 minutes for the students to create their design proposals. You can extend this up to 70 minutes.
- You should encourage the students to think about the needs of all customers who will use their station (see the Universal Design section of this document). They should also consider the environmental impact of their station, including its ecological impact and impact on the local historic environment.
- Be generous with the awarding of points. Give points for using any of the essential skills, but make a particular point about rewarding skills that are the focus of the activity.
- Count in and out all equipment to make sure that all equipment is returned. This is especially important for sharp items such as scissors and the tablet computers.
- You could also inspire the students with this video (https://www.youtube.com/watch?v=JdyLE-yznqU&feature=emb_logo&ab_channel=HS2Ltd) of a station designed by a group of students from Northampton. If you have time and the materials you could include extra time for your students to make a model, which is a great way to communicate design ideas.

Questions

Use these questions to stimulate the students' creativity during the activity:

- Should the station 'fit in' with your local area or be a futuristic statement building?
- How can the station building minimise its ecological footprint? Students could consider:
  - minimising plastic use;
  - water recycling;
  - built-in renewable energy sources;
  - using natural materials in the fabric of the building;
  - using natural light where possible;
  - heat recycling;
  - minimising energy use.
- What will the interior design be like? Students should consider what stations look, sound, and smell like, inside and outside.
- Will there be robots in the year 2050? How will they look?
- How will the station connect to other local transport services? Students should consider:
  - bicycles;
  - electric buses;
  - self-driving electric vehicles;
  - trams;
  - taxis;
  - metro trains.

Sequence

Use the following sequence to plan this activity. You may wish to adjust the timings according to your style of delivery, group and workshop length.

More detailed guidance can be found in the presenter's notes of the EPIC Engineers STEM Workshop Full-day Presentation and Stations of the Future Activity Presentation. If you are delivering this activity as part of a full-day workshop, omit the Introduction and packing away sequence.

Time (min)	Sequence	Instructions	Booklet Page	Slides (single activity)	Slides (full-day)
5	Welcome (Optional)	Introduce yourself and the HS2 Project. Use the HS2 Phase One Animation.		1-5	N/A
5	Stations of the Future	Introduce the activity learning objectives and play the Stations of the Future Introduction Video.		6-7	20-21
5	Joining the team	Introduce the learning objectives for the activity and ask the students to complete questions a and b from Challenge 1: Joining the Team. Check that each student knows what their job is by running through the list of jobs with a show of hands.	4	8-13	22-27
10	HS2 EPIC App (optional)	Ask the students to research their job role using the HS2 EPIC App. Demonstrate how to unlock their tablet, open the app and trigger the augmented reality (AR) features. Students should complete question c from Challenge 1: Joining the Team.	5	14	28
5	Activity instructions	Introduce Challenge 2: Create Your Proposal. Explain how points will be awarded and that the team that scores the highest will win.	5	15-29	29-39
50	Create your proposal	Students now have one hour to complete their proposal. You should circulate the room, handing out points and encouraging the students to complete a quality outcome.	5	15-29	29-39
5	Presentations	Students are to present their idea at their table. Two students stay to present whilst the two remaining students circulate the room, watching the presentations.	5	30	40
5	Evaluation	Students should now reflect on their performance by completing Challenge 3: Evaluate, and by evaluating their Essential Skills.	5	30	40
5	Plenary and reflection	Instigate a short Q&A about the activity. Ask the students what was difficult about the activity. Ask them how they overcame these difficulties. Ask them if they think they have improved their essential skills. Pick out good demonstrations of essential skills from across the session. Announce the winner. Play the EPIC Engineers Careers Video if you are delivering as a standalone workshop.	5	31-33	40
5	Tidy-up time	Allow 5 minutes at the end of the session for students to pack away, and for any remaining equipment to be collected.		N/A	N/A

Engineering Challenge: Tunnel Structures

In this activity students will design, construct and test a supporting structure for a cut and cover tunnel. Each team of four students will aim to build a structure that meets three tests:

- that it spans the full 400mm distance between the tunnel entrances of the testing jig;
- that the train can fit through it;
- that it can withstand the 'ground pressure' of the weighted testing bag being put on top of it.

Each team of four students will receive 40 x 400mm straws, two pairs of scissors and a roll of masking tape to complete their structure. Each structure will be weighed before testing, and the lightest structure that passes all three tests will be the winner.

Students will focus on using their essential skills of teamwork, staying positive and problem solving during this activity.

Inventory

You will need to supply:

- 1 x digital scales
- 1 x testing kit (see below)
- 1 x workshop scorecard (see Appendix 2 (page 20))
- 30 x EPIC Engineers Student Activity Booklets (www.hs2.org.uk/education) or Engineering Challenge: Tunnel Structures Activity Sheets (www.hs2.org.uk/education)
- 8 x bundles of 40 medium paper straws
- EPIC Engineers STEM Workshop Full-day Presentation or Engineering Challenge: Tunnel Structures Presentation

You should ask your host to supply:

- 8 x rolls of masking tape
- 16 x pairs of scissors
- 8 x rulers

Note: The inventory above is for use with a class of 30 students. For a group of 60, you will require 15 x rolls of masking tape, 15 x bundles of straws, 15 x rulers and 30 x pairs of scissors.

How to assemble your testing apparatus set

To complete this activity you will need to assemble your own testing apparatus. This should include:

- **Weighted bag**
  - This will be dropped onto the students' models. Create your own weighted bag by filling a cloth bag or pillowcase with 2.5kg rice and tying a knot or fixing with a cable tie.
- **Tunnel Structures testing poster**
- This printed poster shows the area over which the tunnel will be built. Students should ensure that their tunnel stretches the 400mm distance between each of the tunnel entrances. This can be found at www.hs2.org.uk/education.
- **Train**
  - This will be used to test that the height and width of the tunnel is correct. Attach a toy train to a 500mm ruler with adhesive putty.

Preparation

You will require the room to be set up with tables of four plus a demonstration table at the front of the room. Bundle the straws before commencing the workshop. Watch the Engineering Challenge: Tunnel Structures Training Video (www.hs2.org.uk/education) for additional subject knowledge and activity instructions.

Tips and tricks

- This 100-minute version of the activity includes 50 minutes for the students to design and make their structure. You should extend this up to 80 minutes for younger students.
- The students should start with the base of their structure. This should just be a rectangle of straws that is 400mm long by 100mm wide.
- Triangular prisms are the strongest shape for their tunnel.
- Students should test their model for its stability as they build but should not be given the weighted bag. This encourages self-sabotage. Students should instead gently compress their tunnels by hand to find weak points and areas needing reinforcement.
- To prevent jeering during testing announce that "the only acceptable response to success or failure is a polite round of applause".
- The learning in this activity happens during the testing. Try to point out the different design features of each model before you test it and the efficiency by which students have used their materials, as represented by the mass of the structure. Students should understand that using more materials does not necessarily contribute to the strength of the structure and a more economical use of materials is preferable.
- You will require 20 minutes to test with a group of sixty students.
- Count in and out all equipment to make sure that all equipment is returned. This is especially important for sharp items such as scissors.

Questions

Use the following questions to stimulate the students' thoughts during testing and the plenary:

- Which structures were the strongest? Why was this?
- Did your predictions become more or less accurate? Why was this?
- How would you change your design if you could design it again?
- How would you have improved your tunnel structure?
- Why is testing a structure important in real-life?
- How did you use your essential skills during this activity?

Sequence

Use the following sequence to plan this activity. You may wish to adjust the timings according to your style of delivery, group and workshop length.

More detailed guidance can be found in the presenter's notes of the EPIC Engineers STEM Workshop Full-day Presentation (www.hs2.org.uk/education) and Tunnel Structures Activity Presentation (www.hs2.org.uk/education). If you are delivering this activity as part of a full-day workshop, omit the introduction.

Time (min)	Sequence	Instructions	Booklet Page	Slides (single activity)	Slides (full-day)
5	Welcome (Optional)	Introduce yourself and the HS2 Project. Use the HS2 Phase One Animation.		1-5	N/A
5	Tunnel structures	Introduce the learning objectives for the activity and play the Tunnel Structures Introduction Video. Use the slides to explain to the students what a cut and cover tunnel is, the role of construction plant operators in tunnel building and how tunnels are built.	6	6-10	41-45
5	The challenge	Explain to the students the activity challenge, including the testing process, types of structure and the forces that their structure must resist. Also include the essential skills that are used in this activity.		11-16	46-48
5	Designing a tunnel structure	Introduce Challenge 1: Designing a Tunnel Structure. They should spend five minutes drawing out their ideas using the isometric grid in their booklet. One student from each group may come to the demonstration table to measure the activity equipment.	6	17	49
50	Making	Students now have fifty minutes to make their tunnel structure. Hand out one bundle of straws to each table.	6	18	50
5	Tidy-up time	Students must stop making and tidy up. Unused straws must be handed back for reuse. Choose volunteers to collect the scissors and tape.	N/A	19	51
15	Testing	Instruct students to find Challenge 2: Testing and Evaluation in their booklets. Invite one student from each group to bring their structure to the front of the room in turn. Weigh the model and test it by placing it into the testing jig, placing the weighted bag on top and pushing the train through. Students should make a prediction, then record the mass of the structure and whether it was a success or failure in the table.	7	20	52
5	Evaluation	Students should now evaluate their performance by completing questions a to d and self-assessing their essential skills.	7	21	53
5	Plenary & reflection	Instigate a short Q&A about the activity. Ask the students what was difficult about the activity. Ask them how they overcame these difficulties. Ask them if they think they have improved their essential skills. Pick out a good demonstration of essential skills from across the session. Announce the winner. Play the EPIC Engineers Careers Video if you are delivering as a standalone workshop.	7	21-24	53

Rail Rush!

Rail Rush! is an educational board game-like activity to encourage students to consider the environmental and community impact of high-speed rail construction. Students will compete against others on their table to construct the highest point-scoring railway network on a map of the UK.

Students will focus on the essential skills of staying positive and aiming high during this activity.

Inventory

You will need to supply:

- 30 x EPIC Engineers Student Activity Booklets or Rail Rush! Activity Sheets
- 8 x Rail Rush! boards
- 8 x sets of Cut-Out Rail Rush! Cards
- 8 x sets of Rail Rush! Cut-out Pieces Sheets
- EPIC Engineers STEM Workshop Full-day Presentation or Rail Rush! Activity Presentation

You should ask your host to supply:

- 16 x pairs of scissors

Note: The inventory above is for use with a class of 30 students. For a group of 60, you will require 15 x Rail Rush! Board, 15 x sets of Rail Rush! pieces or Rail Rush! cut-out pieces sheets.

Preparation

You will require the room to be set up with tables of four. Place a pair of scissors, the Rail Rush! board, one of each cut-out sheet and four Student Activity Booklets or activity sheets on each table. Watch the Rail Rush! Training Video (**www.hs2.org.uk/education**) for additional subject knowledge and activity instructions.

Sequence

Use the following sequence to plan this activity. You may wish to adjust the timings according to your style of delivery, group and workshop length.

More detailed guidance can be found in the presenter's notes of the EPIC Engineers STEM Workshop Full-day Presentation (**www.hs2.org.uk/education**) and Rail Rush! Activity Presentation (**www.hs2.org.uk/education**). If you are delivering this activity as part of a full-day workshop, omit the introduction.

Time (min)	Sequence	Instructions	Booklet Page	Slides (single activity)	Slides (full-day)
5	Welcome (Optional)	Introduce yourself and the HS2 Project. Use the HS2 Phase One Animation.		1-5	N/A
10	Cut-out game pieces	Students should be instructed to cut-out their fifteen tracks and six stations each using the scissors and cut-out pieces sheet.	8	6	54
5	Rail Rush! introduction	Introduce the Rail Rush! Activity very briefly using the presentation and Rail Rush! Student Introduction video. Introduce the relevant essential skills. Ask students to set up their boards and to decide who will go first.	8	6-11	54-55
5	The rules	Explain the rules of the game.	8	12-17	56-62
40	Rail Rush!	Ask the students if they have any questions. The students may start. Announce a five-minute warning from the end of the session to give students a chance to work out the winner.	8	17	63
5	Tidy-up time	Ask students to put all cut-up pieces into the middle of the board. Choose a volunteer to collect scissors.	6	18	64
5	Plenary and reflection	In your closing remarks, ask the students what they learned from the game. Ask students about their individual strategies for winning. Ask for a show of hands of those who won, and ask for a round of applause for the winners. Play the EPIC Engineers Careers Video if you are delivering as a standalone workshop.	7	19-21	64

How to Play

- For full rules of the game, see the EPIC Engineers Student Activity Booklets (www.hs2.org.uk/education) or Rail Rush! Activity Sheets (www.hs2.org.uk/education).
- Overview of the rules:
  - To start the game, take it in turns to place two stations and two tracks anywhere you like on the board.
  - Then, in turn take any two cards and follow the instructions on the cards.
  - If the card instructs you to build a station or track, build it.
  - If it says that you have won points, add them to your scorecard.
  - Each track is also worth one point. The person with the most points is the winner.

Questions

Use the following questions to test that the students understand the rules:

- How do you win?
- Who is winning at the moment?

Use the following questions during the plenary to stimulate the students learning:

- Was it best to have the longest track or the most points?
- Why is it important to think about communities, the environment and the rail service?
- Which places are important to connect into your network?
- Which areas need special consideration?

Tips and tricks

- The idea of this game is to demonstrate that railways are more than just the tracks and stations. Winning the game is not just about building the longest track; it's about connecting places together and considering the impact on the environment and local communities.
- This 75-minute version of the activity includes 40 minutes for the students to play Rail Rush!. You could extend this for up to 50 minutes.
- As students begin the game circulate the room to check that they correctly understand the rules. Ask them "How do you win?" to gauge if they understand the points system of the game.
- When printing the game cards, print them double-sided and on white card. Print the game pieces single-sided on white card also.
- You may wish to use commercially purchased pieces. Please follow all packaging instructions and age recommendations and ensure that all pieces are collected.
- Count in and out all equipment to make sure that all equipment is returned. This is especially important for sharp items such as scissors.

NB: Rail Rush! is for pedagogical use only and is not a toy. Its use should always be under the supervision of an adult instructor.

Reflection

If you are delivering a full-day workshop you should finish the day with the end-of-day reflection. This is final plenary for the day and a chance for students to reflect on their progress and achievements.

The students will do a final re-assessment of the essential skills and answer some questions about STEM Careers.

We have also created the EPIC Engineers Careers Video to help the students to connect their learning from the day with a future education and career path.

Inventory

You will need to supply:

- EPIC Engineers STEM Workshop Full-day Presentation (www.hs2.org.uk/education)
- 30 x EPIC Engineers Student Activity Booklets (www.hs2.org.uk/education)

Tips and tricks

- Make sure that you leave adequate time for this part of the day. A calm, unrushed end to the workshop makes for a quality finish.
- Double check your timings for the day finish with your host contact as there may be a final registration or line-up to be completed.
- Make sure that you have all equipment returned.
- Make sure that the students leave on time.

Sequence

Use the following sequence to plan this activity. You may wish to adjust the timings according to your style of delivery, group and workshop length.

More detailed guidance can be found in the presenter's notes of the EPIC Engineers STEM Workshop Full day Presentation (www.hs2.org.uk/education).

Time (min)	Sequence	Instructions	Booklet Page	Slides (full-day)
5	Reflection	Students are to complete Challenge 1 of the reflection.	11	66
5	Student answers & final plenary.	Ask students for a show of hands reflecting how much they have improved their essential skills. Ask students 'how' they improved, and what they did differently. Announce the winners of each activity.	11	66-67
5	EPIC Engineers Careers Video	Play the EPIC Engineers Careers Video (www.hs2.org.uk/education), and point students to the links at the end of the booklet should they want to find out more.	11	68
5	Final words	Thank the students and praise their work and behaviour over the day.	11	69
5	Evaluation	Use the HS2 Workshop Evaluation Sheets (www.hs2.org.uk/education) to find out what the students thought about the day.	N/A	69
5	Dismissal	Check that the room is tidy and that all equipment is returned. Ask your host to dismiss the students.	11	69

Appendix 1: EPIC Engineering STEM Workshop Planning Sheet

Day Plan: ..... **Day Start Time:** ..... **Day End Time:** .....

Time	Activity	Duration
	Arrival	
	Student Introduction	
	Welcome	5
	STEM careers	5
	Student answers	5
	Essential skills	5
	Student answers	5
	Stations of The Future	
	Stations of the Future	5
	Joining the team	5
	HS2 EPIC App (Optional)	
	Activity instructions	5
	Create your proposal	50
	Presentations	5
	Evaluation	5
	Plenary and reflection	5
	Tidy-up time	5
	Engineering Challenge: Tunnel Structures	
	Tunnel structures	5
	The challenge	5

Time	Activity	Duration
	Designing a tunnel structure	5
	Making	50
	Tidy-up time	5
	Testing	15
	Evaluation	5
	Plenary and reflection	5
	Rail Rush!	
	Introduction	5
	Cut-out game pieces	10
	Rail Rush! introduction	5
	The Rules	5
	Rail Rush!	40
	Tidy-up time	5
	Plenary and reflection	5
	Reflection	
	EPIC Engineers Careers Video	5
	Final words	5
	Evaluation	5
	Dismissal	5

Appendix 2: HS2 Workshop Scorecard

School ..... **Region** ..... **Date** .....

	Stations of the Future									Engineering Challenge: Tunnel Structures			
Team	Listening	Speaking	Problem Solving	Creativity	Staying positive	Aiming High	Leadership	Teamwork	Total	Structure Mass	Structure Success	Total	Rank
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													

APPENDIX 3: SEND Questionnaire

We require the following information to help our facilitators to plan for the specific needs of your group. Please answer in general terms about the group and do not share the student names or any other personally identifiable or sensitive data about an individual in this questionnaire.

School Name
Date of Workshop:
If you are an SEND or alternative provision school, please provide a brief overview of your school.
What is the general make-up of the group?
How many students will be attending the activity? **(Only complete when a specific activity has been arranged)**
What year group(s) is/are taking part?

What is the age of the students?
What is the group's level of ability? MLD, SLD, PMLD
How many students in the group have English as an additional language?
Do any students have any allergies? (If so, what?)
Will any of your students be supported by additional support staff. If so, how many?
How do your students learn best? E.g. Power Point, visual aids, objects of reference, writing, drawing, working in a team, working on their own, listening etc. Please add any other additional ways.
Do any of the students taking part in the workshop have mobility issues? If so, what support will they require?
Are any special adaptations needed?

Are there any specific things that I need to consider? If so, what?
Are there any special techniques or strategies I should consider?
Any other important information?

In accordance with data protection rules, when completing this form please only include general information about the needs of the group. Personal information, such as names, that could identify individual students must **not** be included.

APPENDIX 4: Workshop Troubleshooting

Pointers for troubleshooting when prepping for the workshop delivery:

- You cannot access the room until the start of the workshop.
  - You should ask that the start of the workshop be delayed until you can set up and then you should re-plan your timings.
- Your host tells you that due to a staff shortage you will be accompanied by support staff or sixth formers instead of teachers.
  - You are to cancel the workshop and offer to reschedule when there are teachers available.
- The group have challenging behavioural needs that are not being met by the staff assigned.
  - You should speak to the host at the earliest opportunity and if you are not confident that the problem will be adequately resolved, end the workshop early at an appropriate juncture such as break time or lunch.
- The projector or speakers do not work.
  - If the speakers do not work you can continue without using the video content, adjusting your delivery accordingly. If the projector is not working from the beginning of the day you can continue as we have designed the booklet to be used stand-alone should the presentation fail.
- The room has been set with tables that seat eight students.
  - Ask for the room to be set up as requested as groups of eight students will not work.
- You have been assigned a room that is too small, hot or poorly ventilated.
  - You should request to change rooms or to reduce the number of students. Uncomfortable students will not enjoy the workshop and behavioural issues may occur.
- You have been assigned a room that is also used as a lunchroom during your workshop.
  - If no alternative room can be found, ask your host to procure for you a photocopying box for every table. This will enable the students to easily store their work and equipment during lunch and quickly retrieve it afterwards.
- You have a safeguarding concern at your host school.
  - You should follow the school's safeguarding policy, which you should ask for on entry to the building.
- A student or adult at the workshop has a specific query or personal complaint about HS2.
  - You should refer them to the HS2 helpdesk so that their enquiry can be logged and responded to.

APPENDIX 5: Extension Activities

There are two extension activities included in the EPIC Engineers STEM Workshop Booklet, Future You (www.hs2.org.uk/education) and EPIC Careers Skills (www.hs2.org.uk/education). These can be used to fill extra time in a workshop, or can be set as homework activities.

In EPIC Careers Skills, students respond to interview-type questions, related to a chosen role from the workshop. Students could work in pairs, recording each other's answers, or answer the questions independently as homework.

In Future You, students take the Future You Quiz (www.hs2.org.uk/future-you-quiz), and then create a careers profile. Students will require access to the Internet to complete this activity. You could develop this activity into a longer session, or set it as homework.

These activities are also included as standalone worksheets and can be downloaded here (www.hs2.org.uk/education).