

MODULE 1 - ENGINEERING CHALLENGE: TUNNEL STRUCTURES

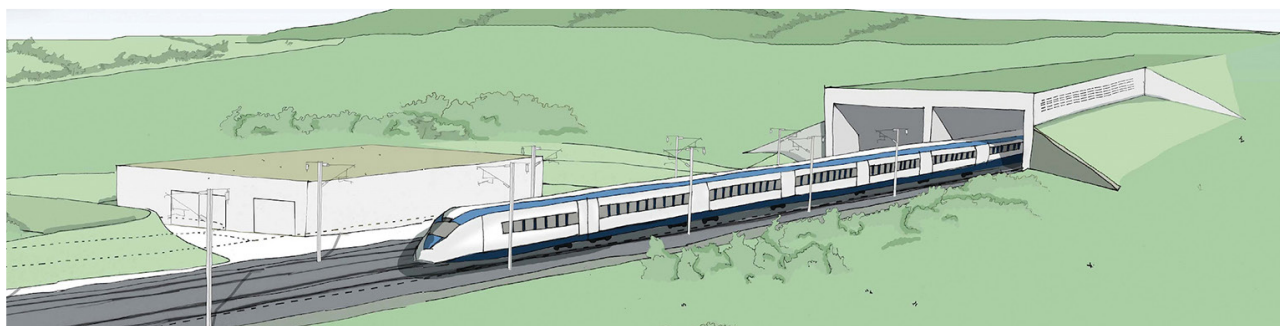
Building railways would be impossible without tunnels. Tunnels allow trains to travel through hills rather than over them, reducing disturbance to houses and woodlands by going under them.

There are three ways of building tunnels. They are either **excavated** using tunnel boring machines, **mined** by diggers, or built using a technique called '**cut and cover**'.

Cut and cover tunnels

When building cut and cover tunnels, the land above the tunnel route is removed, the tunnel is constructed and the land is replaced over the top. The tunnel structure is built of reinforced concrete, to help resist the forces acting upon the tunnel and to prevent collapse.

Today, you will build a tunnel structure for a cut and cover tunnel.



Challenge 1: Designing a tunnel structure

Together with your team, you must design a prototype tunnel structure to span 400mm through a testing jig. Your tunnel structure should be strong and lightweight, using as few materials as possible to resist the earth pressure acting upon it.

Sketch your design below. We have included an isometric grid to help you.



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Challenge 2: Testing & evaluation

For each group's tunnel structure, let's record its weight and whether you think it will collapse under or withstand the forces acting upon it.

Group	Mass (g)	Prediction (✓ or X)	Result of test (✓ or X)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Next, evaluate your own tunnel structure using the questions below.

a) What would you improve about your tunnel structure?

b) What were the challenges you faced when designing and building your tunnel structure?

c) How did you use your essential skills during this session?

d) Self-assess your use of essential skills during this session.

Essential skill	Low						High
Teamwork							
Staying Positive							
Problem Solving							