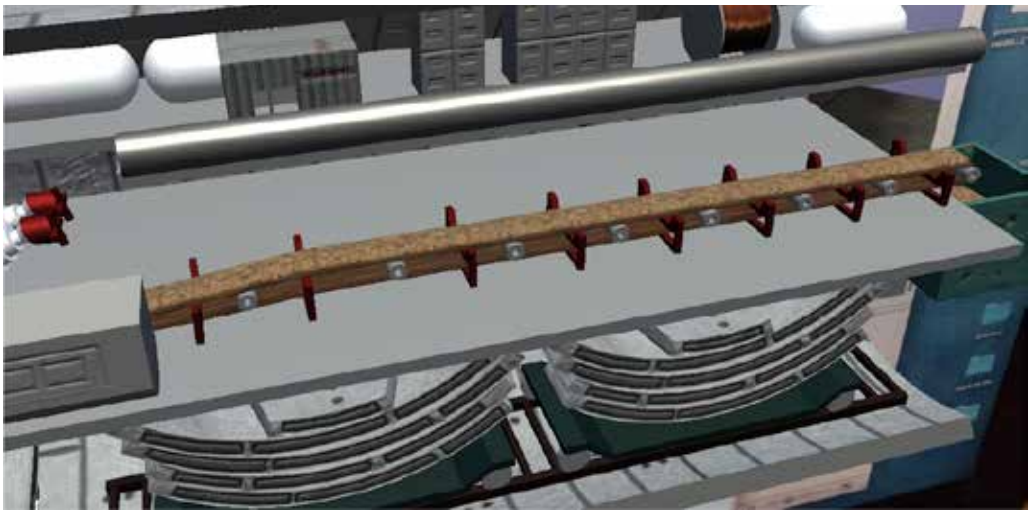
TUNNELWORKS AR APP
KS4 DESIGN & TECHNOLOGY
THE BELT CONVEYOR, AUTOMATION & SOCIETY

Specification
A key component of the tunnel boring machine is the belt conveyor, which carries excavated material away from the tunnel face and out of the tunnel. You will have seen a belt conveyor in use at your local supermarket at the checkout or you will have travelled on one if you have been on a travelator.

In this lesson, you will learn to:
- describe the functioning of a belt conveyor
- calculate the length of a belt between two pulleys
- understand the societal impacts of automation.

Explore the Tunnelworks AR app or use your teacher's guidance to help complete the challenges below. You may also need to use your wider research skills.

Challenge 1: The TBM Belt Conveyor



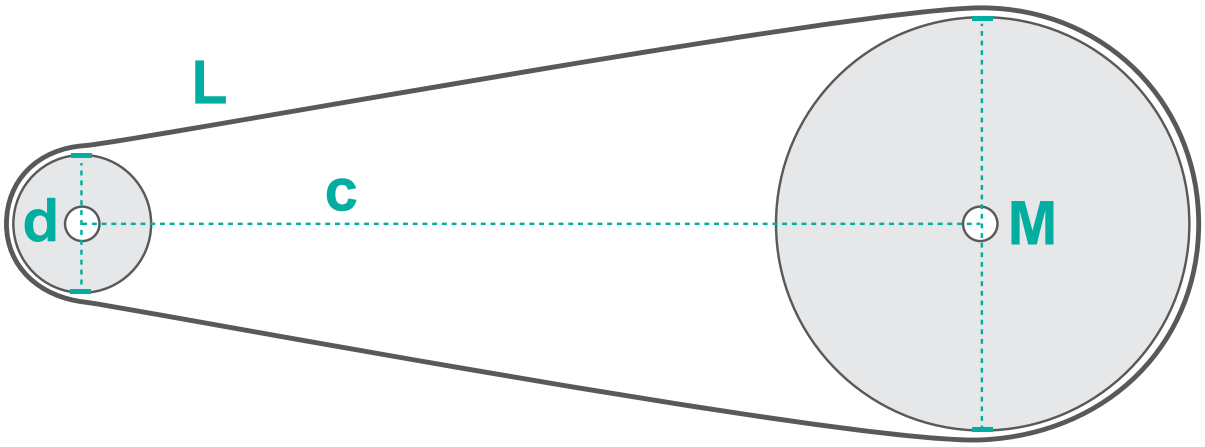
Using the *Tunnelworks* AR App, explain the function of the belt conveyor system in the context of its use in a tunnel boring machine.

Challenge 2: Designing Belt Conveyor Systems

Belt conveyor systems are designed by Mechanical Engineers, who design, develop and manufacture mechanical systems. There are three considerations Mechanical Engineers when designing belt conveyors:

- The diameter of the driver pulley
- The diameter of the driven pulley
- The distance between the centres of the driver and driven pulleys
- The length of the belt.

Mechanical Engineers use the following equation to work out the length of belt required for any two pulleys at a fixed distance:



$$L = (d\,\pi / 2) + (D\pi / 2) + (2c) + ((D - d)2 / 4c)$$

Where

L = length of belt (mm)

d = driver pulley diameter (mm)

D = driven pulley diameter (mm)

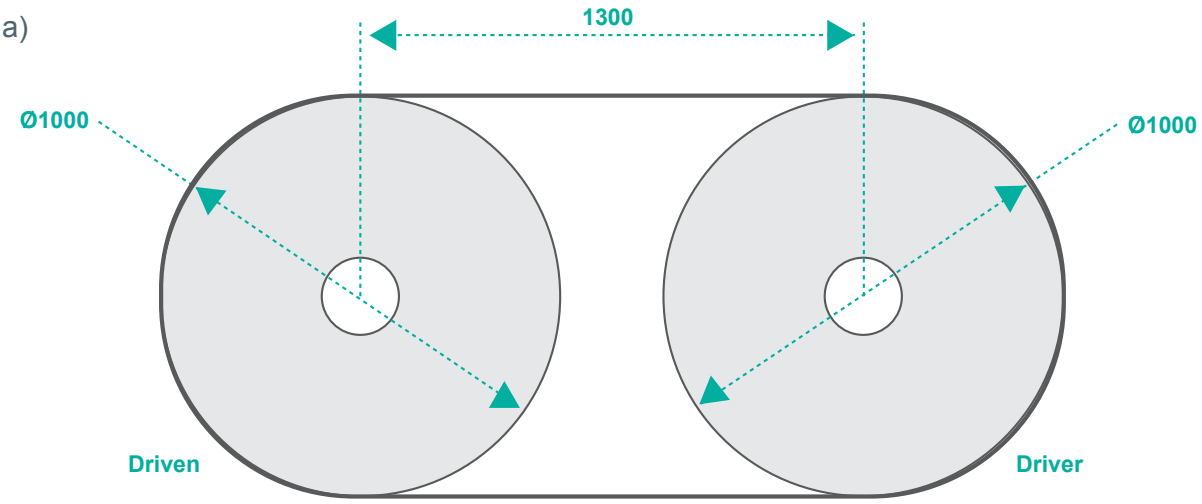
π = 3.14

c = centre to centre distance of driven and driver pulleys (mm)

The same equation can be used for any belt and pulley system, whether it is a belt conveyor or drive transmission pulley.

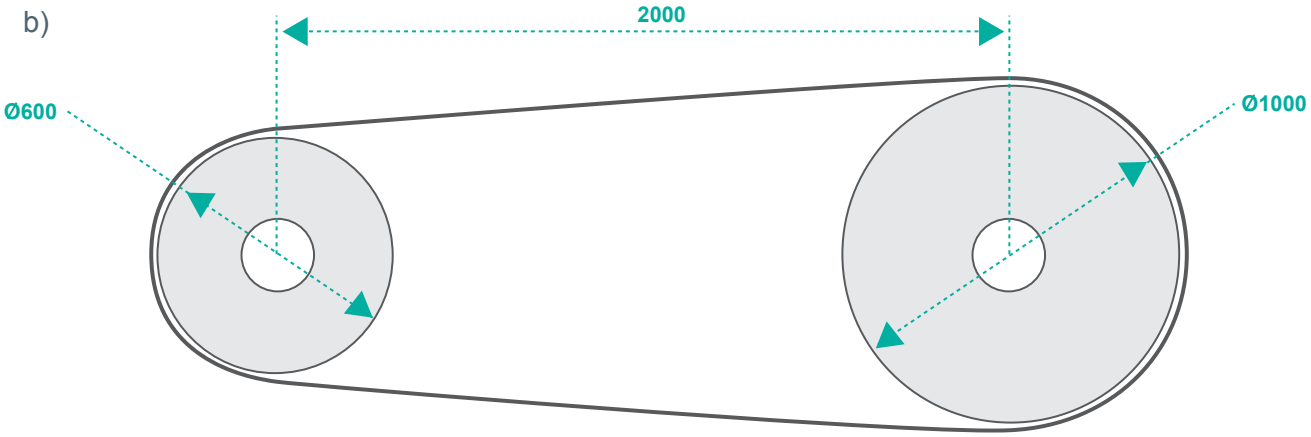
Use the equation on the previous page to calculate the belt length on the following pulley belt systems:

a)



Answer

b)



Answer

Challenge 3: Automation & Society

Belt conveyors are sometimes used in sushi restaurants. Instead of employing waiters and waitresses, sushi restaurants deliver food straight from the kitchen to the diner via a belt conveyor, with the diners seated around it. Diners can choose different dishes as they are moved past.

Answer the following questions:

a) What are the cost implications for the owner of the restaurant in using this method of food delivery?

b) What could be the advantages or disadvantages for the diner?

ii) What could be the advantages or disadvantages for the waiting staff?

c) Some sushi restaurants have begun to put use pods instead of plates in their restaurants such as those shown above. Why might they have done this?

d) Suggest three design specifications for sushi serving pods.

1.

2.

3.

e) Suggest a suitable material for the lid of the pod.

f) Mechanical Engineers must consider health and safety when designing. Suggest two health and safety considerations for a sushi conveyor.

1. _____

2. _____

g) Replacing waiting staff with belt conveyors is an example of 'automation', where people are replaced by machines in the workplace. Suggest two social impacts of automation.

1. _____

_____

2. _____

_____

EXTENSION:

Mechanical Engineering career profile

Specification:

Mechanical engineers are becoming increasingly needed in our ever more mechanised world. From tunnel boring machines to cars and robots, Mechanical Engineers have the skills and expertise to make things move. In this activity you will use your wider research skills to build a careers profile of a Mechanical Engineer.

In this extension, you will learn to:

- understand what it takes to become a mechanical engineer
- discover the application of mechanical engineering projects in the wider world.

Explore the Tunnelworks AR app or use your teacher's guidance to help complete the challenges below. You may also need to use your wider research skills.

Challenge 1: Career Profile
Using your wider research skills, fill out the following table to discover more about mechanical Engineer is and how to become one.

Career profile: Mechanical Engineer
What is the job description of a Mechanical Engineer?
Where do Mechanical Engineers work?
How much does a Mechanical Engineer earn?
How do you become a Mechanical Engineer?
Which are the top five universities for studying mechanical engineering?
Which subjects should I choose to apply for a degree in mechanical engineering?
What kinds of skills and qualities should a Mechanical Engineer have?