



A Project Approach to Delivery Transport for London Rail Challenge



Transport for London (TfL) is a local government body responsible for the transport systems in Greater London (see <http://tfl.gov.uk/corporate/about-tfl/culture-and-heritage/londons-transport-a-history>)

TfL has responsibility for London's network of principal road routes, for various rail networks including the [London Underground](#), [London Overground](#), [Docklands Light Railway](#) and [TfL Rail](#), for London's trams, buses and taxis, for cycling provision, and for river services.

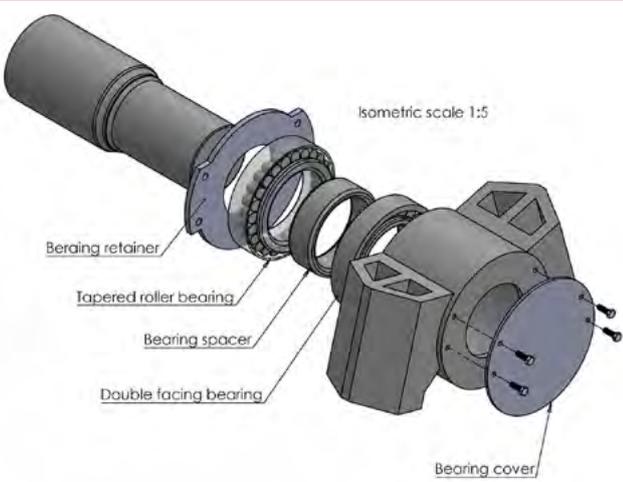
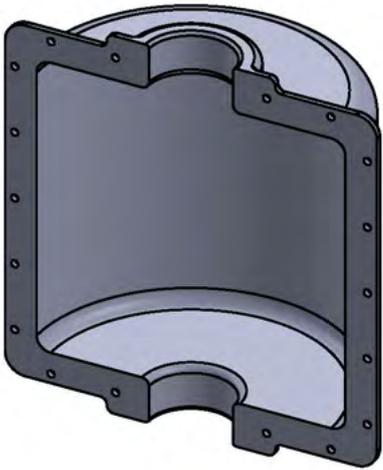
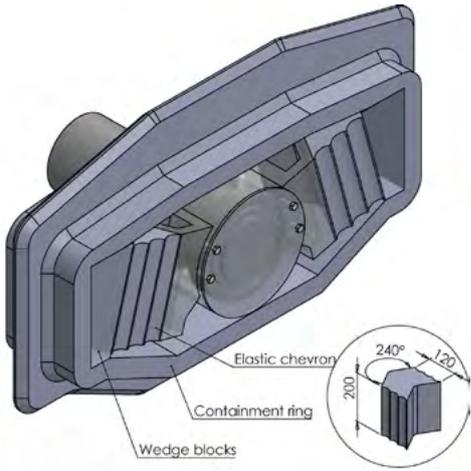
TfL has released a railway design challenge for a new design of railway carriage for its overground rail network. The railway carriage needs to be fit for purpose for the 21st century.

The following criteria are considered important:

- Traction.
- Ride comfort.
- Noise.
- Energy storage and recovery.
- Maintainability.



TfL has selected four key mechanical features of the carriage design consisting of mechanical components and assemblies which relate to the key criteria identified above. Typical design ideas are shown below:

Mechanical feature and description	
 <p style="text-align: center;">Axle bearing and encasement</p>	<p>The axle bearing encasement contains the axle bearings. The bearings constrain the motion of the axle whilst reducing friction between the moving parts. Efficient rotation of the axle is vital for maintaining traction between the wheels and the track. The bearing housing must be designed to provide maintainability of the bearings it contains, which should be easy to change if worn or damaged.</p> <p>Refer to drawing file DWG_1_Axle_bearing_and_encasement which shows the axle bearing and encasement in more detail.</p>
 <p style="text-align: center;">Energy recovery flywheel housing</p>	<p>TfL have experimented with the use of a rotating flywheel to store and recover energy. The flywheel requires a safe and secure housing. The drawing shows half of a two-part housing design.</p> <p>Refer to drawing file DWG_2_Energy_recovery_flywheel_housing which shows the energy recovery flywheel housing in more detail.</p>
 <p style="text-align: center;">Primary axle suspension unit</p>	<p>The primary axle suspension unit provides containment of the axle bearing encasement. Rubber chevron wedge blocks provide suspension of the axle bearing encasement. The suspension unit is vital for providing noise isolation and ride comfort.</p> <p>Refer to drawing file DWG_3_Primary_axle_suspension which shows the primary axle suspension unit in more detail.</p>

Mechanical feature and description



Seating design

Seating design is important for passenger ride comfort and safety. The cantilever design shown also provides under seat access for storage and cleaning.

Refer to drawing file DWG_4_Seat_design which shows the seating design in more detail.

By selecting one or more of the mechanical features (shown above) to design/re-design your tasks are to:

- produce and communicate designs for the selected feature or features
- select appropriate materials and manufacturing processes
- optimise designs
- produce Computer Aided Design (CAD) models
- investigate how simulation tools can be used in the design process.

In order to do this, you will need to:

- use graphical and engineering drawing techniques to communicate design solutions
- select appropriate engineering materials to achieve the design solutions
- design components that can be successfully manufactured

- optimise designs to improve performance
- use CAD to produce 3D models of components and assemblies
- use CAD to produce 2D drawings to appropriate standards
- investigate how simulation tools may be used within CAD systems.

You can also select alternative mechanical components, assemblies and design features of the railway carriage so long as they relate to: traction, ride comfort, noise, energy storage and recover or maintainability.

The design challenge could be extended to other units through the manufacture of a scale prototype of components and assemblies that have been designed.

This work can be undertaken as an individual or within a team. If working within a team learners are expected to contribute to each of the areas (and be able to evidence this contribution) in order to gain the experience and knowledge required to successfully complete the Cambridge Technicals in Engineering Level 3 (Mechanical Engineering and Design pathway).