Fact Sheet, Constructing the 1.5 kilometre Cut and Cover Tunnel

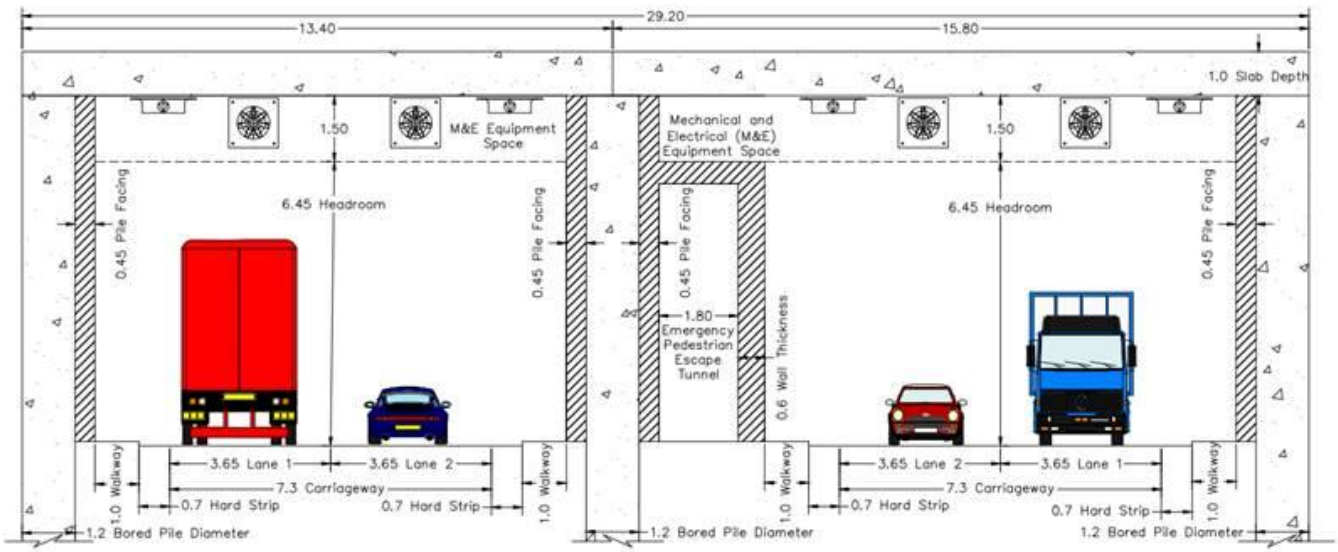
The purpose of this Fact Sheet is to provide a summary of the scoping work carried out on how the 1.5 kilometre cut and cover tunnel that forms part of the Community's Option would be constructed and operated. We appreciate the display boards contain a significant volume of information on this key issue and so this Fact Sheet can be taken away to allow you to fully consider the outcome of this scoping work.

General Information on Tunnels

- The design of tunnels in the United Kingdom is in accordance with the Design Manual for Roads and Bridges (DMRB) (Volume 2, Section 2, Part 9, BD 78/99: Design of Road Tunnels).
- For safety reasons, pedestrians, cyclists, motorbikes (with engines less than 50cc), animals and animal drawn vehicles are not permitted to use a tunnel.
- The provision of safety facilities in tunnels is related to predicted traffic flows. Based on the estimated A9 flows, the tunnel will be a Category AA, which is the highest category of tunnel. The category dictates the level of communication and alarm equipment, fire extinguishing equipment, signs and rescue equipment and other general equipment that is required.
- Tunnels have significant higher capital costs compared to open roads. They also have significantly higher operation and maintenance costs as a result of ventilation, lighting and maintenance of the tunnel structure itself.

1.5 kilometre Cut and Cover Tunnel

- The cut and cover tunnel has a number of advantages. It presents an opportunity to improve accessibility to Dunkeld & Birnam Station and the Category A Listed station building by re-connecting to Station Road and creating a replacement car park on top of the tunnel.
- The option also reduces noise levels and visual impacts and may provide an opportunity to establish new planting or possibly amenity space on top of the tunnel, which would benefit the local community.
- Geometric design parameters within the tunnel restricts the speed limit to 50mph for safety. This reduced speed limit increases journey time by up to 30 seconds longer than the existing A9, affecting approximately 24,500 vehicles per day in year of opening.
- The proposed tunnel cross-section is shown below. Dimensions are in metres.



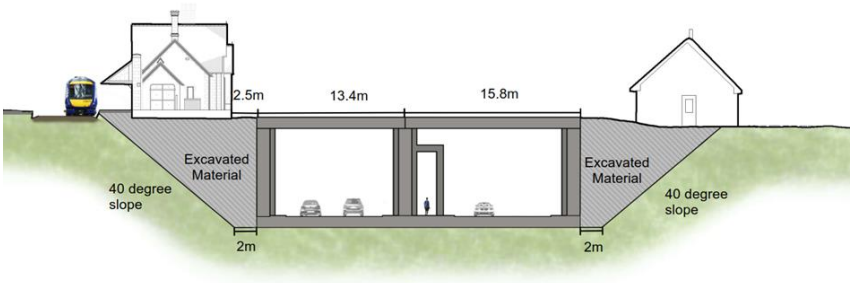
- The tunnel cross-section will be wider than a standard dual carriageway due to the need to incorporate a segregated emergency pedestrian escape tunnel, accessed from both carriageways, to allow the tunnel to be evacuated in the event of an emergency.
- A 24-hour manned control room will be required to monitor the tunnel. It is assumed that this control room would be positioned on top of the tunnel, at the southern end.
- A ventilation system is required to provide fresh air to all parts of the tunnel. Jet fans in the ceiling of the tunnel, along with vehicle induced air flow, would provide ventilation.
- Tunnel equipment, including fire safety apparatus and ventilation equipment will need to be checked and maintained regularly, which would require to be done under closures. For example, if the northbound carriageway is closed for maintenance, then the southbound carriageway would accommodate single 2-way flow to keep the A9 open. It is anticipated each side of the tunnel will be closed to traffic once a month.

Construction

- Tunnels can be formed using a bottom-up construction technique, using open excavations, or a top-down technique, using retaining walls. Given the space constraints, with the Highland Main Line railway to the south-west and residential properties to the north-east, bottom-up construction is not considered a practicable method. Top-down construction, using retaining walls is therefore the likely preferred construction method, formed with large 1.2 metre diameter bored piles.

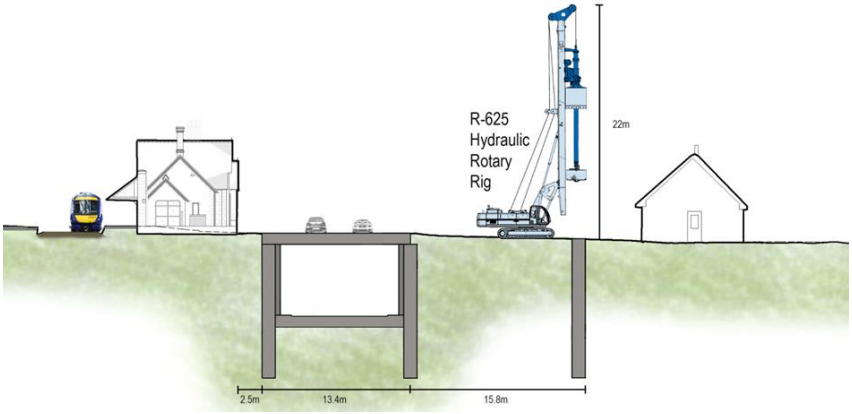
  - <u>Bottom-up construction, open excavation</u>

    Involves the construction of a structural box, formed in a temporary excavation. The tunnel box structure is constructed in the excavation and then backfilled. This form of construction would encroach into the Highland Main Line railway on the south-west side and residential properties on the north-east side. It is not considered likely that this technique would be used by a contractor.



  - <u>Top-down construction, retaining walls</u>

    Where construction space is constrained, retaining walls can be installed to form the tunnel walls. Once retaining walls are complete, material is excavated between the walls to form the tunnel. This is likely to be a contractor's preferred technique.



- Bored piles, where soil is excavated to form a hole for reinforced concrete, are proposed rather than driven piles, which involve prefabricated concrete columns being driven into the ground by percussion, pressing or vibration.
- Construction of the Community's Option, including the 1.5 kilometre tunnel, is expected to take 4 ½ to 5 years, based on a 6-day working week, with works undertaken between 7am to 7pm Monday to Friday and 8am to 1pm on Saturdays. Construction duration would be lengthened to 5 ½ to 6 years, for a 5-day working week. Perth and Kinross Council (Environmental Health) will ultimately decide the working hours and days per week, however, we are keen to hear the community's views on this.
- Ground Investigation (GI) undertaken in the locality of the existing A9 suggests dense granular deposits are present with significant boulder obstructions. Owing to the granular ground conditions, it would be necessary to temporarily support the pile bore during construction. A polymer mud solution would be used to support the excavation until the steel reinforced cage and concrete (pumped in from the bottom of the excavation, displacing the polymer mud) are put in place.
- Approximately 3,700 bored piles, with a large 1.2 metre diameter, to a depth of 15 metres, are required to form the three tunnel walls. As a result of the ground conditions, the anticipated rate of progress is estimated to be 2 piles by each piling rig per day.
- It is anticipated that piling works would take approximately 18 months to complete, based on 6 piling rigs on site and a 6-day working week. This duration would increase if fewer piling rigs are used and whether working day restrictions are imposed.
- In total, approximately 180,000 cubic metres (430,000 tonnes) of concrete is required to form the tunnel. This equates to approximately 45,000 lorry journeys to transport concrete. During peak periods 200 cubic metres (approximately 500 tonnes) of concrete would be produced each day, resulting in approximately 50 lorry journeys each day.
- A concrete batching plant would be required for the duration of the works to satisfy concrete production demand, along with an on-site mud plant. This would require larger construction compounds than is normal in close proximity to the works and would be included in the land-take that is compulsorily acquired to construct the scheme. Construction compounds would also be used for material storage and construction of reinforcement and other key elements of construction.
- Excavation and removal of approximately 535,000 cubic metres (approximately 1,020,000 tonnes) of material would be required to form the tunnel. This results in approximately 90,000 lorry journeys to dispose of excess material, which equates to around 250 lorry journeys per day.
- Inchewan Burn would require to be lowered by approximately 8 metres to divert the burn below the tunnel. This requires a vertical drop structure and a box culvert to be built, which would adversely impact the natural characteristics of the burn.
- Initial assessment suggests that construction works would generate noise in excess of 85dB $L_{Aeq,T}$, which is broadly equivalent to the sound of a lawnmower, within approximately 10 to 15 metres of the receptor. It should be noted however, that Perth & Kinross Council (Environmental Health) would set noise and vibration limits for construction and appropriate mitigation would be employed where necessary.
- Maintaining access to Dunkeld & Birnam Station during construction will be complex, with piling works being undertaken approximately 2.5 metres from the Category A Listed station building. Options to maintain access, such as a temporary relocated station or a pedestrian bridge, are being investigated and, whilst a temporary solution may be possible, it is likely to have engineering and cost implications.
- Traffic Management will be employed during construction to maintain two-way traffic flows on the A9, with reduced speed limits and narrow lanes widths in operation. It is anticipated that traffic will remain on the A9 during construction, however short duration closures may be required in exceptional circumstances.