



Aberdeen Western Peripheral Route

Milltimber Brae Cut and Cover Tunnel Assessment Report

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1 Introduction

1.1 Overview

Consideration has been requested for incorporation of a cut and cover tunnel at Milltimber as part of the scheme proposals.

1.2 Current Scheme Proposals

The current AWPR scheme proposals comprise a dual carriageway with two lanes in each direction. The route crosses the River Dee and crosses the floodplain to the north of the river on embankment approximately 5m high. The route passes below the Old Deeside Line Walk in cutting and continues north in cutting approximately 10m deep as it approaches the A93. An overbridge is required to the north of Old Deeside Line Walk to maintain access to Milltimber Brae. The route passes below the A93 and continues north in cutting between 7m – 9m deep until it reaches Milltimber Junction. Milltimber Junction is located to the north of Kippie Lodge.

1.3 Review

DMRB Volume 2 Section 2 Part 9 BD78/99 Design of Road Tunnels describes the procedures required for the design of new tunnels on trunk roads. The issues associated with a cut and cover tunnel at Milltimber have been reviewed based on BD78/99 and including reference to any changes that would be required to the current scheme proposals to accommodate a tunnel. This paper presents the findings from a review considering the following:

- Tunnel extents and category
- Technical issues
- Environmental issues
- Cost

2 Tunnel Extents and Category

2.1 Extents of Tunnel

The maximum potential length of the tunnel is considered to be approximately 600m, extending from Chainage 102950 in the south to Chainage 103550 in the north.

The southern location is determined by the depth of cutting at which sufficient headroom can be achieved to enable a tunnel to be formed. The northern location is determined by the requirement to provide a vehicle cross-over facility in advance of the tunnel while enabling traffic using that facility to continue to use Milltimber Junction. This requirement is imposed by paragraph 3.18 of BD78/99 which states that vehicle cross-overs are required in advance of the tunnel entrances.

The tunnel location and extent is shown in Figure 1 in Appendix A.

2.2 Tunnel Category

Paragraph 3.10 of BD78/99 states that tunnel category depends on the length of the tunnel and traffic volume, and that this dictates the requirement for standard and optional safety and fire prevention equipment. Significant cost items can result depending on the class of tunnel including the requirement for an emergency stopping lane and ventilation for smoke control. The question of whether a central reserve safety passage is also significant depending on tunnel class.

The cut and cover tunnel at Milltimber would be Category A, which means that significant cost items, including emergency stopping lanes, emergency walkways and ventilation for smoke control, would be required. Mechanical ventilation is also required for all tunnels greater than 200m in length.

3 Review of Cut and Cover Tunnel

3.1 Technical Issues

A range of technical issues arise when considering a tunnel at this location. These are described below.

Clearance, Vertical Alignment and Ground Conditions

The current scheme design does not have sufficient headroom for a tunnel at the A93 and the route would require to be lowered at this location. The route would have to be lowered in this area by 2m – 3m to enable the tunnel to extend south of the A93. Some raising of existing ground levels would also be required to the north and south of the A93.

The excavation for the tunnel would be anticipated to encounter rock at depths below approximately 5m deep; however it should be noted there is limited ground investigation information available for this area. The additional depths of excavation required for the tunnel compared to the conventional road proposal would result in additional cost.

The current main line gradient is above that recommended for a tunnel. Lowering this gradient will increase costs by taking the excavation further into rock, and will have other impacts, such as either increasing the depth of diversion formed for the two major aqueducts in this area or requiring the tunnel itself to be sufficiently lowered to retain these in-situ. In addition, the lowering of the main carriageway would require an associated lowering of the slip roads, which would significantly increase the impact on Kippie Lodge golf course that has effectively been designed out of the current scheme proposals.

Slab and Wall Design

It is assumed that the tunnel slab is intended to enable landscape treatments to be placed above the tunnel. Should it be proposed that the tunnel support development of overlying land then the tunnel slab, walls and potentially foundations would require significant increases to accommodate the proposed loadings. This would increase the cost of the tunnel.

Tunnel Design and Safety Group

The methodology for developing tunnel proposals entails formation of a Tunnel Design and Safety Group, including representatives of the Overseeing Organisation, Design Organisation, Police, Maintaining Agent and Emergency Services. This group are required to liaise on the development of proposals for a tunnel. While it is clearly possible to form such a group for this proposal, it is not certain what timescale that group would be able to work within to agree the details for such a tunnel.

3.2 Environmental Issues

It is understood that the tunnel is considered to provide an effective means of mitigating the impacts associated with the scheme. Specific comments on relevant environmental issues are given below:

- As the proposed tunnel is to be formed using cut and cover techniques it is not considered to offer any construction advantage, as all demolition and earthworks will still have to take place. In fact it may be considered to increase construction impacts, as the length of time to complete the works in this area will increase considerably due to the additional structural works required, and the overall scale of the works will increase due to additional excavation being required associated with lowering of the main line alignment.
- While the tunnel would be expected to give some improvement to residual noise levels, it should be noted that as the road would in any case be in a significant cutting, the additional benefits of further noise mitigation would be limited.
- Again, while the tunnel would be expected to give some improvement to residual air quality levels, it should be noted that these are not expected to be at a level in any case where there would be concerns over air quality, and therefore any improvement provides no real benefit. There are also some concerns about degraded air quality in tunnel portal areas, and further assessment would be required as to whether this would be of specific concern at the southern portal which would be close to a residential area.
- The main advantage that the tunnel would provide is the opportunity to landscape the area above the tunnel and significantly reduce the visual impact of the scheme. This would also create the opportunity to use the area above the tunnel for habitat recreation, potentially offering some ecological benefit.

3.3 Cost

Given the limited nature of the ground investigation and the outline nature of the tunnel proposals the cost estimate prepared at this time should be considered in terms of an order of magnitude for the proposals considered.

The basic cost of forming the tunnel is estimated as £85m per kilometre, before consideration of contingencies. Given the level of uncertainty, contingencies have been applied at 50%, which results in an overall construction cost of £125m per kilometre. This compares with the construction cost of £135m per kilometre used for the AGA East proposal, which is considered reasonable given the more complex ground conditions that were expected under that proposal.

For a tunnel 600m in length the rate of £125m per kilometre would equate to a construction cost of £75m. Offset against this cost would be a reduction in the scheme for works that were incorporated within that cost, such as excavation works and provision of a bridge for the A93 over the AWPR. These offset works are estimated at some £10m, giving an overall construction cost for a 600m long tunnel of £65m. When preparation,

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inflation and other costs are added the scheme cost estimate for a 600m long tunnel is £85m. As noted above, this cost should be considered as an order of magnitude, within a range extending from £60m to £110m.

In addition to construction costs, the tunnel would also entail significant additional whole-life costs associated with tunnel operation eg ventilation and lighting.

Appendix A: Location Plan



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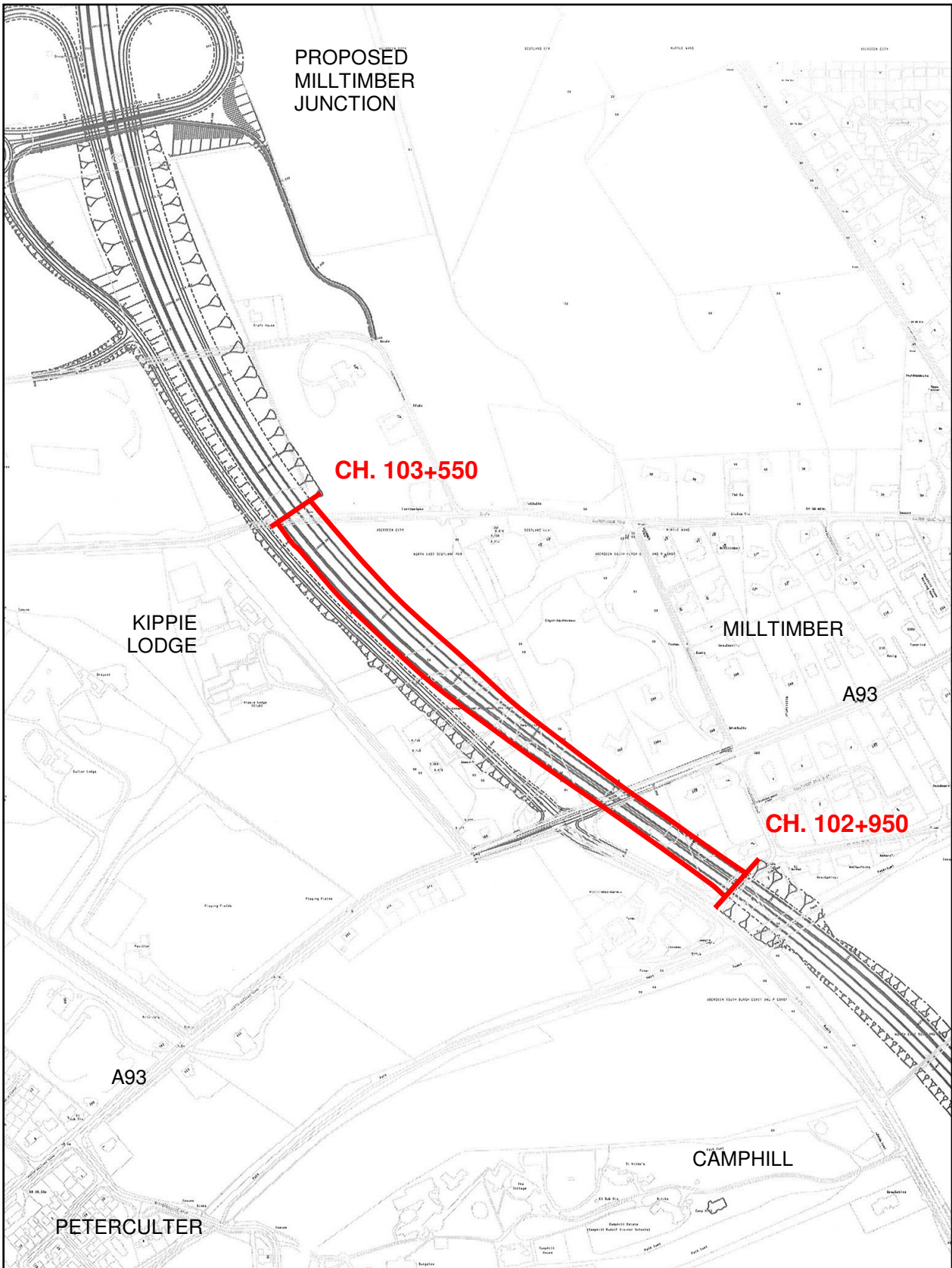


FIGURE 1
MILLTIMBER CUT AND COVER TUNNEL LOCATION