MINUTES OF ORAL EVIDENCE

taken before the

HIGH SPEED RAIL BILL COMMITTEE

on the

HIGH SPEED RAIL (CREWE – MANCHESTER) BILL

Tuesday, 21 February 2023 (Afternoon)

In Committee Room 8

Evidence available here
Watch the proceedings here

PRESENT:

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Dr Lisa Cameron
Antony Higginbotham
Grahame Morris
Holly Mumby-Croft
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FOR THE PROMOTER:

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Tim Smart, Phase Two Managing Director, HS2 Ltd

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IN PUBLIC SESSION

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(At 2.19 p.m.)

1. THE CHAIR: Good afternoon. Welcome to today's Committee where we will be receiving technical briefings on tunnelling and on traffic and transport. Same rules as yesterday, or same advice, rather. If it is on the screen, we can obviously read it, so we don't need to talk to every word on the slides, but obviously we're in your hands in terms of how you proceed. So I'll hand over to you, Mr Strachan.

2. MR STRACHAN KC (DfT): Thank you very much. I'm going to ask Mr Smart to take you through the tunnelling presentation first and you've got some slides, as you've already indicated, and obviously you've met Mr Smart before.

3. THE CHAIR: A number of times now.

4. MR STRACHAN KC (DfT): Indeed, and I'm going to ask him to start, if we go to slide 2, just to explain what you're going to hear about.

5. THE CHAIR: Thank you. Same as yesterday; fairly relaxed. Perhaps if Members just want to jump in if they have any questions.

Evidence of Mr Smart

6. MR SMART: Good afternoon, Sir; good afternoon, Committee. I'm very conscious of what you said about not going through what are fairly obvious things on the slides, so what I'll try and do is pick out the more salient points that might not be obvious as we go through them. This first one here gives you an outline of the presentation. I'll go through some of the construction aspects of tunnelling, then the operational aspects, and then finally some of the cost implications.

7. So, if we go to the next slide, why tunnel? First off, I should mention that if you've got a fully enclosed railway that's over 100 metres, you have a tunnel. So a tunnel could be 100 metres, but you don't have to do a lot with 100 metres. But why tunnel? Well, the key things are terrain. The alignment has to be within certain parameters for the train to be stable and give passengers that right ride comfort. So if you've got hilly terrain, you've got to potentially tunnel. Surface disruption is particularly important. If you create so much of a problem putting in a surface railway, you might consider tunnelling. And then there's a connectivity element as well; that's

pretty pertinent when you're going through some of the smaller communities where, if you're on the surface, you might sever them.

8. I can give you an example. Our Chilterns tunnel on Phase One would be a terrain issue, and the Northolt tunnel going out from Euston towards to Ruislip, and indeed the tunnels we've got on Phase Two through Manchester, are more a combination of surface disruption and connectivity.

9. If we go to the next slide, the Committee will be familiar with the Crewe tunnel, a 4.2-mile tunnel with two vent shafts. We visited pretty much all the places of relevance when we were out on the route tour, so I don't think I need to dwell too much on that. I think you will be fairly familiar and I also went through that in the overview.

10. To be visited at a point in time, we've got our Manchester tunnel, which is an 8-mile tunnel with four vent shafts, and that's pretty much the route as we come out of the surface route just north of Manchester Airport station until we just get quite close to the existing Manchester Piccadilly site, but you'll be looking at that later.

11. THE CHAIR: You explained to us on the HS1 trip, for those colleagues who weren't there, why a twin-bore tunnel for safety is the new standard.

12. MR SMART: Yes.

13. THE CHAIR: Which I thought was quite interesting compared with in HS1, where it was all single bore.

14. MR SMART: So the tunnel that you saw on the site visit was the North Downs tunnel, and the risk assessment at the time of that tunnel was that it could be safe under a single bore, because there were certain requirements set under the European technical standards for interoperability, which have been enshrined now in UK legislation, that would mean that would be quite difficult to do. The other thing is the climate in that particular location was such that the vent arrangements were satisfactory because it isn't just what happens in the tunnel; it's what happens around the portals of the tunnel. So that was quite a unique tunnel to be able to have one bore and, also, particularly relevant is that we were going through an escarpment and we weren't starting pretty much at the surface and going down and up again. So there were some construction constraints

around that tunnel as well, and perhaps that will come out a bit later on when I'm talking about the –

15. THE CHAIR: Sure, but everything we're dealing with is twin-bore tunnel for this route, isn't it?

16. MR SMART: It's pretty much twin. All our tunnels I'm going to be talking about on this section of the route are twin-bore tunnel and, in fact, every tunnel on HS2 is twin-bore. If it's not, if it's cut and cover, it still has a separation, but that is less relevant here. So that's the Manchester tunnel.

17. Then we come on to the tunnelling techniques, and pretty much all the tunnelling we're going to have on the Crewe to Manchester section will be bored tunnels. That is where we use a TBM, a tunnel boring machine, to create the tunnel opening and then we build precast segment rings, which I'll come on to later, behind the tunnel which form the opening, and we will have twin-bore tunnels, as you have noted, Sir.

18. Commonly, tunnel boring machines are used when you've got longer tunnels because obviously – the setup costs etc of the machine – you get better utilisation on longer tunnels and also, as I said, it's when you've got more soft ground and you're going down and up again.

19. THE CHAIR: On the long tunnel, is it bored from one end all the way –

20. MR SMART: No, not necessarily, because it depends on programme. So on a Manchester tunnel we're going to go from the north and the south and meet in the middle at what's called Palatine Road shaft.

21. THE CHAIR: Fingers crossed.

22. MR SMART: That's pretty much driven by programme, yes, to achieve the best programme.

23. THE CHAIR: Yes, sure.

24. MR SMART: Cut and cover tunnels are less relevant on the Crewe to Manchester section, but it is where I think I went through on the route overview that we create – basically we dig a hole, create a tunnel, create the opening by precast or casting a box,

and then covering it over again. So the only place where this is relevant – there are a couple of places on the passive provision but the most obvious place where we'd have a box and then cover it would be Hoo Green junction, which is the connection of where the Golborne link was going to be, which, again, you saw when we were out on the route tour.

25. And then there's also another technique, which is spray concrete lining, where you create a hole by excavating by mechanical means with what could be a back actor but usually is what's known as a roadheader and then you spray the concrete lining. Now, on our tunnels – I'll come on to it – that will be relevant to the cross passages, which are a key safety element and, in fact, that was the construction methodology used on the single-bore tunnel that you saw on HS1.

26. THE CHAIR: Right.

27. MR SMART: If I go to the next slide, this is what is known as an earth pressure balance tunnel boring machine and I'll try to just briefly point out some of this. You have the cutterhead, which obviously forms the tunnel, and behind that you have an excavation chamber. Now, what happens in the excavation chamber is that the material that's mined out through the cutterhead, because that has bits and it has openings to pull material through, is then worked in the excavation chamber, which is sealed, and you sometimes have to put an additive in because if it's clay, which is viscous and thick, you need to get that workable and you then move the excavated material up the screw conveyer, which you can see, which is the red screw conveyer, which is actually an Archimedes screw principle, and then that comes out pretty much as earth in some ways, on to a conveyor, and then you can take the tunnel arisings out via the conveyor or, indeed, sometimes you can use rubber tyre vehicles if it's in some sized tunnels. But the point is that you create the pressure on the material that you're tunnelling through so that it doesn't cave in, if I can use that term, by that excavation chamber.

28. An earth pressure balance machine would be used more where there is a good stand-up time of the material that you're tunnelling. I mean, you've probably all dug a hole in your garden and if it's clay, you can probably dig the hole and it will stand there very happily for some period of time, but if you try doing that on sand or silt, it's not going to. So this is the sort of machine you would use where you've got more

competent tunnelling material. Most obviously in the UK it's London clay, because London clay is a good tunnelling material. It has some issues in places where you've got inclusions and what's known as greasy backs, which is old slips, and therefore you can often go in open face mode. So, in other words, you can virtually close that excavation chamber and just mine out the clay and you can move quite quickly on a tunnelling rate. But if you get into slightly more difficult ground, you've got to have that excavation chamber and it slows down the rate of the machine's progress, but what it does do is it controls settlement and that's the key point here.

29. I will move on to what we call a slurry machine. This machine would be used where you've got high water pressures, so you're resisting the pressure of the water coming down on to the face of the machine, and also where the material is what I would call less competent and not so viscous – in other words it's not thick; it's more liquid – and the chamber behind the cutterhead is maintained not by mixing the material and by the screw, but by injecting slurry into that chamber. So you hold back what is less competent silty, sandy and water material by the pressure of the slurry.

30. What I should have pointed out on the last slide, but I can do on this one, is you can see there the concrete segments. I think you'll recall Mr Mould showed you, and I've got it in the presentation, a segment yard, which we've got currently on Phase One. That's where you precast those segments and you erect them via the segment erector.

31. So the sequence is: erect the segments; then the machine shoves forward off those segments and is rotating and then cutting the ground as it goes; and, in this particular case, all the excavated material is pumped back via the pipes, which you can see as the 'slurry pipe'; and that goes back to a recycling plant, which is situated wherever the entrance to the tunnel might be; and it is treated via a number of different processes and then pumped back again to be used again. So it is a closed circuit. You have to top it up; it's a closed circuit. So that is the slurry machine. As I say, for less competent ground and especially where you've got higher water pressures.

32. If we go to the next slide, this is actually our machine that has now completed the first bore on our Long Itchington tunnel on Phase One, and you can see that is just before it goes into the escarpment under Long Itchington Wood and that is actually a slurry machine. In fact, it's a special type of slurry machine. It's what's known as a

variable density slurry machine because you can have different thicknesses of slurry, depending on whether there's a risk of the slurry going into discontinuities or voids in the ground.

33. If we go over to the next slide, this is our Chilterns tunnel. You can see the portal. I think the Committee is due to pay a visit to our Chilterns tunnel site at some point in the future and you can just see the twin-bores there, again going into the hillside, into an escarpment. So we're able to launch both these two machines – so this tunnel has two machines. Because of the programme, the previous slide for Long Itchington was one machine and the tunnel isn't so long. So we go through, re-erect the machine and come back. One machine does two bores, but because of the length of the Chiltern tunnel and the time, and because we can only tunnel, due to environmental requirements, from one end, we've got two machines going. So that's the portal.

34. THE CHAIR: How long is that tunnel, by the way? The Chiltern one, sorry.

35. MR SMART: So it's just off the M25 around Denham. That's where we go in and it then comes out at – well, it's south of Wendover.

36. MR STRACHAN KC (DfT): South Heath.

37. MR SMART: South Heath, yes.

38. THE CHAIR: How long is it? Is that the longest tunnel on the whole route?

39. MR SMART: Yes, it is. It's just over 16 kilometres long.

40. THE CHAIR: How long?

41. MR SMART: Sixteen kilometres, which in miles is going to be –

42. THE CHAIR: Ten miles.

43. MR SMART: Ten miles, yes.

44. THE CHAIR: So, it's not too dissimilar to the Manchester tunnel in size then, although it's two miles' difference, so that's quite significant, but they're similar tunnels then.

45. MR SMART: The Manchester bore tunnel after this one will be our longest tunnel, yes. It will.

46. THE CHAIR: How long will that take to bore? It's not completed, presumably, yet then. This is the entrance to it, you said.

47. MR SMART: Yes. So we're probably about just over halfway in and so the progress of the tunnelling averages 80 metres a week. The machine will go faster, but when you take account of downtime, maintenance, launching the machine and taking the machine out, by the time you've finished, you're looking at a progress rate of somewhere between 80 to 120 metres a week, on average. But, of course, once the machine is going, you might well achieve more than that on a week to week basis, but on average it tends to be that order.

48. Going on to the next slide, I think the Committee saw this before when Mr Mould gave his presentation.

49. MR STRACHAN KC (DfT): That's the same site.

50. MR SMART: That is the same site, yes.

51. MR STRACHAN KC (DfT): But just zoomed out if you can now see the other parts of the site.

52. MR SMART: In the background there, you can see the entrance to the tunnel, the launch pipe that was on the previous slide, and on the right-hand side you've got the concrete batching plant under cover. In the centre, you can see all the segments. That is the segment production yard. The segments have to be taken in by vehicles and then fed into the back of the machine. Over on the left is the recycling plant. So that's where the slurry comes back.

53. THE CHAIR: Can I just ask a question?

54. MR SMART: Yes.

55. THE CHAIR: I'm intrigued on this. So you add the segments as you go.

56. MR SMART: Yes.

57. THE CHAIR: So how do you get the other segments, given they're the same size as the segments you've just backfilled with?

58. MR SMART: So the ring is made up of, depending on the configuration that you want to do, about eight rings.

59. THE CHAIR: Right.

60. MR SMART: So you just feed them – yes, you can see them there. And then the erector puts them up, and you form the ring and bolt the rings together.

61. THE CHAIR: In the tunnel?

62. MR SMART: Within the excavation. And you grout – this is important – between those rings and the outer part of the machine to ensure you get a tight fit, if you like.

63. THE CHAIR: Seal.

64. MR SMART: Seal between the tunnel extrados and the ground, and that is important in minimising settlement as well. That's the tail skin of the machine. So the rings just fit within the skin of the machine and, as you move forward, you build another ring.

65. MR STRACHAN KC (DfT): I think on slide 18, later on, you can see the individual segments. I don't know if we can just –

66. THE CHAIR: I'm jumping ahead, you see. I'm too visionary; that's why.

67. MR SMART: The elegant part of the tunnel ring is a good for stress distribution, so in water you can sometimes use what you call wedge block where you literally just wedge them in. We don't use that in our technique.

68. THE CHAIR: I see, right, okay.

69. MR SMART: Mr Strachan has jumped to a slide that comes later in the presentation. You can see there the segments and then you've got the bolt holes and that's actually a cross passage, but we'll come on to that later. But what I think it does give you is a view of the configuration of the segment.

70. I think we're on the portal construction. The point to make here is, if you're not going into an escarpment like you saw at Long Itchington and the Chilterns, you have to create a launch point within the ground for the launch of a tunnel machine. So, for example, at Manchester, when we're coming from the north to south, and then we're also going south-north, this is the sort of technique we would use. So we would construct a retaining wall. We would excavate down and create a launch chamber for where we start to build the machine out, and then move it forward and, indeed, that is West Ruislip vent shaft I think you can see on the right-hand side, and that is the cutterhead of the machine with the HS2 logo on it.

71. That is the cutterhead of the machine, which will be taken across to – you can see the excavation in the background and it will be lowered into place and then behind that, what's known as a back shunt needs to be sufficient space to build the machine and move it forward and launch it. So that's when you're not in an escarpment and you've got to start from a low point, from existing ground level. So that's more like the technique we will use when we're in Manchester. It's a common technique.

72. So to the next slide. Also you mentioned it so, on the right-hand side, that is North Downs tunnel on HS1 and I think you recall we –

73. THE CHAIR: That's where we stood, isn't it?

74. MR SMART: That's where we stood and you will see that's the – and it's going into effectively the Downs escarpment there so we wouldn't have needed the technology of the previous slide. And on the left-hand side is a visualisation – you can see there, you have a tunnel portal building outside, which is where a lot of the electrical, mechanical equipment is to deal with lighting, fire mains, high and low voltage and all the equipment that you need for fire life safety and maintenance in the tunnel, and you also have the portal. I think I explained on the route overview that going into a tunnel at high speed creates issues with microwaves, which are waves that oscillate up and down the tunnel and can result in some audible noise at the end of a tunnel as the train pushes air through the tunnel. To mitigate that, you basically have a slatted structure. So as the train comes in, it dissipates the air before it – it's not pushing it all ahead of itself.

75. If we then go on to the next slide, it is important to note that the rate of tunnelling is dependent on the ground conditions and also in minimising settlement, because if

you're in what I call closed mode in the machine, where you're keeping a lot of pressure on the face because you need to, to minimise settlement, there will be slower progress. But in order to keep within acceptable limits, we have a 1% volume loss criteria. We often achieve better than that. That is basically the ratio of settlement to the tunnel diameter. Our tunnel's diameter is about 8.89 metres, and it's just a way that tunnellers express the likely ground movement, and there's also information on our approach to that in information paper C14, which I think is available to the Committee.

76. THE CHAIR: So at surface level, do you see any settlement then?

77. MR SMART: Yes, we do.

78. THE CHAIR: Right.

79. MR SMART: And I'll come on to how we deal with that.

80. THE CHAIR: When you're going under houses, presumably, that –

81. MR SMART: But the settlement is often minimal, such that you wouldn't necessarily notice the fact that you've had some settlement, but it's not necessarily the case. So we use tried and trusted methods to predict the settlement contours, what's going to happen, and then everything within the 1 millimetre contour is assessed for whether the settlement will cause any distress to any property, and we have a three-stage process really. We do a greenfield evaluation and if we are confident that no building is going to achieve more than 10 millimetres' settlement or a 1:500 slope, we wouldn't really do another assessment. We would monitor as we do the tunnelling to make sure we fit within our criteria, but we wouldn't really do that much more. We might on a heritage structure. Potentially a heritage structure, if it's vulnerable, because it's an old building, we might do more.

82. THE CHAIR: You're not seeing the sort of levels of settlement that you have in mining, for example. It's on the edge of my patch where people's houses have literally cracked.

83. MR SMART: No. Well, because in mining, on a longwall face, you take out the coal and basically, behind, it just collapses. So the point of the tunnelling machine is it controls the settlement ahead as you tunnel and then the ring, and the grouting then

holds that and minimises that settlement. You will get some settlement. I mean, it's impossible to not have the ground relax slightly. But the point is, it's got to be within controllable limits and you control that by the machine in the first place.

84. THE CHAIR: If I'm a homeowner living above where you're tunnelling, do I notice anything?

85. MR SMART: We have a settlement deed and you're entitled to a deed if you're within 30 metres of effectively the tunnel. And, as I say, if on a greenfield assessment you're not going to get more than 10 millimetres or 500, we wouldn't do too much. We'd just make sure we actually monitor the tunnel settlement to make sure that it remains in our parameters, if you like, and there might be trigger levels, if it gets more, on how we would intervene.

86. If a property is going to suffer more than that 10 millimetres or 1:500, we would do an assessment, and then Professor Burland established some criteria for the effects of settlement on buildings and it goes through a hierarchy of moderate and slight and various criteria of damage. So if you fall within the slight criteria, if you're a houseowner within the slight criteria, which means that you wouldn't experience any cracks more than 1 to 5 millimetres, the best way of dealing with that is literally to go in and fill the cracks and redecorate. So that's what we would do. If it was going to be above the moderate category, we would have to look at how we would take more special measures. It might be grouting, we might employ jacks, or we might have to do other methods to ensure that the building doesn't go into any more than the moderate category.

87. THE CHAIR: This may not be a question for you, but just thinking about yesterday, where we obviously heard of the various different routes for people to be able to access compensation – the not-so-express express option and all this lot – what about for people who are above? Because if my house suddenly starts developing cracks, am I not blighted in the same way that somebody who is next to the track, within a few yards of the track, is blighted?

88. MR SMART: Well, that would be where the settlement deed comes in because that's going to happen quite close to the tunnel.

89. THE CHAIR: A settlement deal?

90. MR SMART: Deed, which is actually part of our settlement plan that we have. So you've got some contractual mechanism to protect yourself if you're within certain parameters. But if you look at Crossrail and the Jubilee line extension project, there's quite a lot of houses and properties that have been affected on both those projects but you can achieve the tunnels, especially at the depths, when you're down at the deeper part, and we're 40 metres on the Manchester tunnels, where the settlement is quite minimal at the surface and any disruption is very fixable, and that would be done if there are buildings that crack, etc.

91. MR STRACHAN KC (DfT): Just if it helps, information paper C14, which is what's referred to on ground settlement, both sets out that policy approach to deal with settlement where it occurs and the severity or cracks etc., and also sets out the availability of a settlement deed for those properties that are within that distance. And then – sorry.

92. THE CHAIR: No, sorry, I thought you'd finished.

93. MR STRACHAN KC (DfT): And also the mechanisms for – you were talking about compensation, but compensation is a slightly different term in that respect. This is to address, if damage were to occur, how it's remedied and also precautionary measures to monitor.

94. THE CHAIR: I suppose, if the Committee will indulge my thinking aloud in terms of how I would feel for my residents, my concern would be that, even if there is action taken to rectify the settlement issue, in the local area, if it is known that these properties have been affected in that way, I would potentially suffer a sort of blight and loss of value, in terms of, "Why would you buy a house above that tunnel when they had to have all that work done?" So, while I understand you might put it right, it's potentially going to affect the house value, isn't it, in the longer term, if people sniff that there has been work done and it's dodgy? Holly?

95. MS MUMBY-CROFT: Again, it's probably not the right moment, but I don't know how much of that kind of work you can have done before it starts to affect your insurance and how much your renewal is.

96. THE CHAIR: Yes. I mean I'm just intrigued to know. I get they're putting the work right and we've had subsidence issues in my area in the round, and obviously people avoid properties in certain places.

97. MR SMART: Well, I think sometimes the difficulty with mining areas is that you've gone ongoing creep and ongoing movement. The point about this is that the movement happens –

98. THE CHAIR: And then it's finished.

99. MR SMART: Yes.

100. THE CHAIR: I get that, but people might not understand that and might think, "Those houses in that street suffered this settlement issue and HS2 came and had to do all this work. Why would I buy a house there? What if it happens again?" Because that's how people think, right? So I'm just intrigued to know whether there's any evidence from Crossrail or whatever of effect on house prices and if there's a compensation scheme for that.

101. MR STRACHAN KC (DfT): We can certainly find out. I'm not aware of that as creating a separate compensation issue. The purpose of the settlement deed, in part, is to provide that reassurance for house prices, etc. The issue, if it ever arises, is covered by specific deed, hence effectively some contractual provisions that mean that, if damage were to occur, it's addressed and remedied. So I appreciate the point that you're making that that may still give rise to some degree of uncertainty.

102. THE CHAIR: Longer-term impact on house prices.

103. MR STRACHAN KC (DfT): Yes.

104. THE CHAIR: I mean, I may be completely incorrect on that, but obviously the natural conclusion of this is that you can see a point where properties in an area that have been affected, potentially, could be blighted in terms of value. But, anyway, I labour the point.

105. MR STRACHAN KC (DfT): We can see if we can find out any other information about other schemes, of course, where lots of tunnelling has occurred in very dense

urban areas and to see if there's any information that would give you some help on that.

106. THE CHAIR: And obviously I appreciate tunnelling is different to the mining issues that we've had up in my patch.

107. MR SMART: Well, it's a tried and trusted method.

108. THE CHAIR: And, I mean, once it's done it's effectively resolved.

109. MR SMART: Yes. I think we did it first on the Jubilee line, a settlement deed approach. So I think that is there to mitigate the sort of things you're highlighting, Sir.

110. THE CHAIR: Okay, alright, thank you.

111. MR SMART: So, yes, just to be clear, slight damage is the 1 to 5 millimetre cracks, which we would go in and completely repair, and I think that would be – you could arguably say that some of the places that I've seen on the Jubilee line were better off than when we'd finished than when we started, but that's just my opinion.

112. I'm not going to go into construction noise on tunnelling because I think that's going to be covered at another presentation that you're going to have, so I don't think we need to go through that here.

113. So next I am going to come on to some of the safety arrangements around tunnelling. As you're aware, we do have vent shafts and the vent shafts fulfil the functions that you can see there. I am not going to read you through it, because you can see, but I think as we discussed when we were out on the tour, the idea of the vent shaft is not for passengers to escape, okay? In extreme circumstances, if you did have passengers at the bottom of a vent shaft, you might consider taking them up, but actually this is more about the emergency services getting in. But the important part of this really is the fans, which provide smoke vent control and cooling, and I'll explain that a little bit more as we come on to the next slide, because if you've got smoke in a tunnel, that could be typically hot smoke at 450° C and that moves fast, so the fans have got to be able to push or suck to overcome that.

114. If I go on to the next slide, this is a schematic of a cross passage. Cross passages are typically about 3.5 metres in diameter. They are – actually they're not always,

because sometimes on bigger tunnels you can use a small boring machine –in our case, because of the constraints of the tunnel, pretty much hand dug by the miners. Well, they use mechanical plant, but it's not a machine in terms of a tunnel boring machine. This is where we might use a spray-shot concrete lining. You might need to use compressed air in bad ground to form a cross passage, or you can ground freeze, because if the ground starts to come in on you, like I was explaining on the tunnel boring machines, you might have to resist that by putting positive pressure in. Now, compressed air is not great for miners to work in, so it's a bit of a last resort, or you can ground freeze and they did use ground freezing on Crossrail. But what happens –

115. THE CHAIR: What is ground freeze, just out of interest?

116. MR SMART: You put pipes in the ground and literally freeze it. It's the water you're dealing with and then of course it forms like an ice cube, which you can pretty much tunnel through. So the cross passages are a maximum of about 500 metres. Now, they might be less because it depends on a lot of factors in the risk assessment of getting people out of the tunnel safely. So what happens if I was just to assume that the left-hand tunnel was the incident tunnel and you had a fire. Everything would stop running in that tunnel. With the rescue tunnel, which would be the right-hand side, everything would stop running there. If you recall, I showed you the portal building on a previous slide. So the next available in-service train would stop outside the tunnel and any passengers on it would be discharged to the safe area at the tunnel portal, and the train would then proceed through and the passengers that have come off the train where the fire incident is would go through the cross passage, on to the walkway and on to the rescue train.

117. When you open the cross passage, if you don't pressurise the rescue tunnel, the smoke will come in. So what the fans are doing is pressurising the rescue tunnel to make sure that the smoke doesn't come through with the passengers. At the same time, the fans in the incident tunnel would be either sucking or blowing, depending on where the train is and where the fire is, to make sure that the passengers evacuating don't get exposed to smoke while they're doing that. So that's why we need the cross passages and obviously the doors seal that.

118. And then if we go to the next slide, you can see that is actually an HS1 tunnel.

That hasn't got the doors on, but that's the opening, if you like, that the passengers would come in on the walkway, and through that and into the rescue tunnel.

119. I'll just go through some of the safety arrangements, which are on the next slide. So I think the first thing to say is a fire in a tunnel is a bit like 30 February. It will never happen, but it might. So the first thing that would happen is that the train would drive out. Rolling stock that we have must be capable of travelling for 20 minutes, if a train's on fire, at 50 miles an hour. So that's going to get you about 20 kilometres. So you're going to drive out, okay? In the event that you had a really, really long tunnel and you couldn't achieve that, you might have to have what is known as an intervention point, but we haven't got them on HS2, so I won't explain them.

120. But what we do have is the fire intervention points, which are the shafts, and one of the reasons for the spacing of the 3.3 kilometres is that beyond that point, any firefighters or rescue authorities find it difficult to fight a fire, because if they have to go down a shaft and then move for 3.3 kilometres, by the time they get to the fire, they haven't got time with their breathing apparatus and the rest of it to actually really do much. You can help by putting trolleys and things so they've got more breathing apparatus, so they can swap, but that's about the limit that you can go on fighting a fire effectively. And, of course, you do have other things such as the water supply capable of delivering 800 litres a minute for two hours and, as I've said, we've already got the cross passages. So this is the way that we ensure fire life safety in the twin-bore tunnels and the key thing is you drive out. The only circumstances, of course, where you wouldn't be able to drive out is if you've got a power failure and you've got a train on fire. That is the circumstances where you'd have to start the rescue via the twin tunnels and the cross passages.

121. So I'm going to move on now to the cost of tunnelling. Clearly, certainly when you're dealing certainly with bored tunnels – it's a bit different perhaps on some other forms of tunnelling, but bored tunnels with a tunnelling machine – there are a lot of costs in the fixed costs, which is actually the tunnel boring machine itself; all the backup logistics you need to take rings and segments in and take the excavated material out, whether it be by conveyer or whether it be by slurry pipe; the power supply, because the tunnelling machines are quite power hungry, so you've got to have a temporary power supply to power the machine; and electrical and mechanical plant, because you've got to

force ventilate the tunnels for the safety of the miners, as we call them – the tunnel operatives who are actually working the machine. That is pretty much fixed.

122. But then you do have linear costs because the further you go, the longer you need your labour for; the more materials you have for linings; the more segments you have; the more excavated material you've got to deal with; the more ground monitoring you've got to deal with; and the more ground treatment and basic tunnel logistics of running electrical cables, running vent pipes and the like you have. But then the linear costs suddenly leap up with another incremental cost because as soon as you go another 2.1 miles or 3.3 kilometres, you need another vent shaft and, of course, you need more cross passages.

123. So that means you've now got the cost of an additional vent shaft plus all the pressurised lifts that the fire brigade use. They've actually got to be pressurised for them to go down in the event of a fire to keep any smoke out of the vent shaft as they go down. You've got the cost of the fans that you now need, plus switchgear plus – and, and, and – so you suddenly leap up. So if I go to the next slide, I guess, and if you look at it linearly, there's a lost of cost at the setup and they increase linearly due to the things I've highlighted on the linear cost, but then as soon as you go beyond 2.1 miles, you then need a vent shaft, so you've then got an increase in cost. You then continue linearly again until you've gone past another 2.1 miles when you need another vent shaft. So that's kind of how the cost profile will build up.

124. Of course, it's right that in a way it's counterintuitive because you'd think, if you'd paid all the money for the machine, the more you tunnel, the cheaper it would be, but it doesn't quite work that way because of all these other costs and, in fact, you get to 20 kilometres and then you've got some really serious costs. And notwithstanding that, the serious consideration with bore tunnels is making sure you have got fire life safety completely under control and the longer the tunnels are, the more of a problem that might be, because you've got to stop trains, get trains in and you can only have one train between each vent shaft section, otherwise you couldn't control the smoke properly. So there are operational constraints on that, which mean that the view that, "Well, if you've just got a tunnel machine, why don't you keep tunnelling?", doesn't quite hold true.

125. And I think that's the only thing I need to present. I don't know whether there are

any more questions on any of it.

126. THE CHAIR: No, thank you. I mean, that last point was interesting because you would assume that once you're in the tunnel, the more you can keep going, the cheaper it would be as opposed to it actually becoming more expensive the more miles you go.

127. Colleagues, any questions on tunnelling? No? I think that was very interesting and will be useful for us moving forwards, so thank you for that. I think we're back to you again, though, aren't we now?

128. MR STRACHAN KC (DfT): We are straight into traffic and transport.

129. MR SMART: I'm afraid it's all me.

130. THE CHAIR: If you can work your way through this one as you did the last one, we'll be very appreciative.

131. MR STRACHAN KC (DfT): I should just say, in answer to one of your questions, that the Chiltern tunnel is due to be completed – the boring – I think, in mid to late 2024.

132. THE CHAIR: Right, and it started when? Sorry, I keep asking more questions.

133. MR STRACHAN KC (DfT): No, that's fine. 2021.

134. THE CHAIR: Right.

135. MR STRACHAN KC (DfT): So it's something like nearly three years.

136. THE CHAIR: Right, so we're now moving on to traffic and transport.

137. MR SMART: Well, I think you probably know that it is me, I'm afraid. But if you go to the first slide, as I said at the beginning, Sir, you can read this, so I'm going to try and bring out some of the more salient points as we skip through. But really the point of this presentation, I think, is to, firstly, explain our modelling procedures and what we model and why, and then also to give you a taster or a bit of an overview of some of the exhibits, because a lot of the petitions are going to have traffic and transport in and we portray our information on that in a certain way. I think this will familiarise you – or hopefully it will anyway – with what you're going to be looking at when we

get into some of these exhibits.

138. If we go to the next slide, the outline of the presentation, that is where we are. With the next slide, I think all I am really going to pull out, because you can read it, is that the transport assessment is a core part of the overall environmental assessment and there is a wealth of information in the existing documentation. For me to try and cover all that in this presentation would simply not be possible, but I would commend you to look at any relevant part within the transport assessment. We will go through with some of the highlights of that.

139. So we're looking at traffic and transport in construction and this is, if you like, roadgoing vehicles that are connected with construction. If you recall, on the route overview, I talked about having dump trucks etc., which operate on the trace, which is the width of the railway when we're constructing it, and we try and use that as much as possible to move material on the trace to keep them off the existing road network. But this is about where we are on the roads and I think it's worth pointing out that an HGV is defined as anything over 3.5 tonnes but that, of course, would include vans because a large van could weigh that. But when we get into the term HGV, heavy goods vehicle, for us, that is something in the order of a 7.5 tonne vehicle. So it's more like the wheeled construction muck-away material handling wagons that you've seen around London dealing with construction sites.

140. Basically, in our assessment, we're attempting to model traffic behaviour, so it includes diversionary routes, and it's fair to say that we do get some abnormal loads. For example, on the slide in the tunnelling, you saw that cutterhead being taken to the site at West Ruislip. That would be an abnormal load, so that comes with all sorts of special measures and flashing lights, and we tend to do that at night. But this sort of traffic and transport assessment is more around the routine construction and outside the abnormal loads.

141. MR STRACHAN KC (DfT): Just before you leave that, Mr Smart, when we refer to diversions or diversionary traffic, there are two types of diversion can occur in this: the first is where we are actually realigning a road; the second is where people act differently as a result of construction activity, so they divert on to another route. That is captured on the second bullet point and the two sub-bullet points, I think, Mr Smart.

142. MR SMART: Yes, that's a good point.

143. THE CHAIR: Thank you.

144. MR SMART: The next slide brings out here that we use strategic models, so we use existing models that are maintained by the traffic authorities. I think we've got about five models that we need to look at in the Greater Manchester section and they are strategic traffic models. And the first thing we do is look at the existing situation and then the next thing we do is, if you like, up-rev that to what it's actually going to be like when we're actually doing construction, because there will be a natural organic growth in traffic, which we then do for the future session. We then look at the HS2-related traffic forecasts and we calculate the peak traffic volumes that are forecast to be generated. And that's peak–the peak number, not necessarily in the peak, which is typically 8.00 to 9.00. So we look at the peak construction activity and look at what that is going to do to the roads. I'll come on to what that means in terms of an assessment, and our working hours are 8.00 to 6.00.

145. And we then look at the future situation when HS2 is in operation, because we will have moved roads, there will be cars that want to access stations and we will have changed road configurations, so we look at what does that mean when HS2 is in its operational case, and we look at that for both 2038 and 2051.

146. Moving on, I won't read the slide, but I think it's fair to say that, under the scope of the assessment, we look at all likely traffic effects that are generated by the things you can see here: severance; stopping up roads temporarily; or diverting. We then focus on the assessments during the weekday peaks, because that is normally when we're going to have the most significant road effects. It might not be so we always look wider than that if there's specific activities that might generate things outside of those hours. But, generally, because of the existing traffic situation, the worst situation is going to be with the morning and evening peaks. And we do this in consultation with the relevant highway authorities and, of course, National Highways, when we're on the strategic road network.

147. So we come on to the next slide. So we've used the term here "reasonable worst case", and the reason I say that is because we look at the peak, and the peak activity might be for a couple of months or weeks out of a whole construction activity of maybe

years. We tend to predict the worst, and there are things which will happen which will mean that's not likely to occur, but we assess on that to make sure we've got a robust response. And some of the reasons why it is a reasonable worst case are, first off, that it is peak levels of construction traffic, and that might be for relatively short periods of time compared to the whole construction schedule.

148. In rural and suburban areas, we look at ways of mitigating. We assume that workers are in cars, but the contractors, as they are on Phase One, look at using their own works buses and the like, and you can read the words there. And, again, 50% of the workforce is assumed to travel in the peak hours of 8.00 until 9.00, and 5.00 until 6.00, but actually our construction hours are 8.00 until 6.00, so our construction workers tend to be on site before 8.00 and they tend to be not leaving until after 6.00. So there are some things around that, which mean that we would call this a reasonable worst case of what is going to happen.

149. And then with the next slide, I think you're aware of the community areas that we're talking about, and we talked about that on my route overview, so we can move on from that very quickly. This is the section now in which I'm going to explain how our exhibits work and what you will see in various petitions where traffic and transport is an issue.

150. I think the Committee has been given some A3 sheets. Yes, excellent. First of all, we've got our overview of the construction traffic routes. Then we have our construction route maps. So this is where we are looking more at the HGV flows, which tend to be the more important or some of the more issues with local people around while it's HGVs. We also have our traffic flow maps, which present the background and then HS2, and then we look at what we're going to do in mitigation, which I'll come on to. And then we have our construction traffic histograms and I'm going to go through these in a bit more detail over the next few slides but, basically, it's getting more granular as we go down the information in terms of what all this means.

151. I should also point out that obviously when we get into the northern part of the route towards Manchester then there'll be a different set of stand exhibits. You've got the stand exhibits for the community areas that we're talking about in the first section of the Committee hearing.

152. So the next slide shows –

153. MR STRACHAN KC (DfT): It's probably self-explanatory, that slide.

154. MR SMART: I think it is, isn't it? Basically, it just shows what the strategic roads and what the community areas are that we will be affecting, and I haven't got the big picture one so I'm looking at the small one but, anyway, I think it's self-explanatory. I don't think I need to say much, do I? So we move to the next slide.

155. So the next slide is our construction traffic route, which is effectively where we will have HGVs on the roads.

156. MR STRACHAN KC (DfT): So this is where you might need the larger version because some of the numbers don't appear very clearly.

157. MR SMART: So the example – you can see on the map there is a node point. I can't quite see it on my example here, but it's blown up into the peak daily flows and I'll explain that. Okay, so you will see there are various points on the roads where we show on the section of road what the construction traffic is. So if we go to the box, which you can see, the 224 means there's 224 HGV movements on that road and that's two-way movements. So what that means is 112 going one way and coming back out again, another 112. Added together, that's the 224. And the duration of the time that that is going to be experienced, which I'll come on to explain. It is written, but it's perhaps clearer on another slide, that there will be three months of busy period and three months of peak period, and we assess the peak period at 70% of the overall construction HGV traffic and we assess busy at 50%, and I'll explain that a bit more. But it's also worth noting that if HGV movements are 20 – that's 10 each way – we do not, it's in note 2. You might be able to see note 2 on your bigger exhibit, but we don't – that's a de minimis, so we wouldn't do an assessment in that because that's one an hour and so it's really only when we get above one an hour that the assessment kicks in looking at our HGV movements. I don't think I need to –

158. MR STRACHAN KC (DfT): No, unless you've got any particular questions on that. And on the bigger map, you should be able to see that these boxes point to specific road points, so you can correlate them with the road.

159. MR SMART: Yes.

160. THE CHAIR: Given all the numbers aren't even, how are some numbers of vehicles going in different to numbers that are coming back? Are they going through different routes or –

161. MR SMART: There are some different routes or sometimes it's – that's basically the point, yes. It's different routes.

162. THE CHAIR: Or the vehicles remain there.

163. MR SMART: Yes. So it is slightly counterintuitive and you think, "Well, how does that work that way?" But you are looking at a section of the road.

164. THE CHAIR: Surely if they're going in, they've got to come out somewhere.

165. MR SMART: Yes, well that's accounted for in the two-way movements, really. This is where it gets slightly more complicated, but the next slide, which is, I think, exhibit 12, yes, we colloquially call this our alphabet map and you can probably see why, looking at the right-hand side of this. But this is where I've explained that we look at the baseline as it is, based on traffic surveys that we've done. We project that forward to take account of the natural organic traffic growth that will happen without HS2. We then look at our construction traffic and then we put that on to, if you like, the updated traffic figures and then – this is where the magic happens – the traffic models predict what that means going forward, because you will get these diversionary issues happening where people will not use a certain road because they know it's a construction route, so they use another road.

166. MR STRACHAN KC (DfT): If you move on to the next slide, we've just extracted some of the information so you can see that in practice for two of –

167. MR SMART: Before we do that –

168. MR STRACHAN KC (DfT): Sorry, yes.

169. MR SMART: You can see, if we just go back one slide, you can see node point A and that is on the old –

170. THE CHAIR: Chester Road.

171. MR SMART: Chester Road, yes.

172. THE CHAIR: And Plumley Moor Road and Northwich.

173. MR SMART: So you went along part of that route. We turned off and went towards B, so I think you might – I don't know whether you recall it but we did travel that. But, anyway, there's node point A, which you can see there, and to make it a bit easier, and certainly easier for me, the way my eyesight's going, if we go to the next slide, which Mr Strachan is about to go to, we can try and explain it a little bit better. So at node point A, which is the road, which is the A556 Chester Road between Plumley Moor Road and the A503 Northwich Road, this is a construction route. So this is where our HGVs will be travelling. So you can see that under the up-revved but existing traffic – I'll call it that because it's not existing now, but this is the prediction of the existing when we actually do the construction.

174. MR STRACHAN KC (DfT): Which is 2030, which is considered to be what's called the future baseline.

175. MR SMART: Yes, when we will be, if you like, at peak construction period.

176. THE CHAIR: And this is daily numbers or weekly.

177. MR STRACHAN KC (DfT): These are daily numbers.

178. THE CHAIR: Right.

179. MR SMART: So what you see is that the total traffic volume northbound – that's NB – is nearly 20,500, of which 873 vehicles fall into the HGV category, okay? And that means that 4% of the traffic is HGVs. We then look at what we do and our construction traffic will generate 650 vehicles, of which 75 are HGVs.

180. THE CHAIR: And that includes the vehicles of people coming to work.

181. MR SMART: No. So it is HGVs.

182. THE CHAIR: That's just HGVs.

183. MR SMART: Yes, yes.

184. THE CHAIR: Right. So your vehicle figure is – the 650 of all vehicles includes the workforce.

185. MR SMART: Yes, so that is workforce and, potentially, any vehicles that are servicing sites or whatever – vans etc. – which don't fall into the above 7.5 tonnes HGV category.

186. So we now have what our impacts are and then if you move to the right, what that actually means is, when we are in the construction, the traffic is increased now by 1,400. So we've now got 21,840 vehicles on the road, of which 968 are HGVs, which means that the actual percentage of HGVs to traffic in this particular case has not increased because it's still 4% of the overall traffic volume. And the reason it doesn't quite read across is that, although we know our HGVs are 75 per day, we know, and this is the magic of the modelling, that other HGVs will use routes to, if you like, circumnavigate our construction routes and that will generate HGVs elsewhere, and that is constrained in the 968 figure, but it still means that the mix in this particular case – it's not always like this, but it does mean that the mix of HGVs to normal traffic hasn't actually increased in this particular case.

187. THE CHAIR: Right, so that difference of the plus 1,410 of which only 725 are your vehicles, the HS2 vehicles, is the effects of other drivers using these routes.

188. MR SMART: It's our effect but, of course, the effects of other drivers altering their normal course, by taking action to go elsewhere, could cause a traffic impact and that is taken account of by the model.

189. THE CHAIR: Right.

190. MR SMART: So if HGV drivers said, "I'm not going to go down that route because I know there's a lot of HS2 construction vehicles down there; I'm going to go down this one," the strategic model would predict that and it might not be our HGVs but it could be other HGVs.

191. THE CHAIR: Sure, because your total HS2 traffic is 725 but the total net change is 1,410.

192. MR SMART: Yes, that's right.

193. THE CHAIR: So it's double the impact as a result of the works, compared to your vehicles.

194. MR SMART: That's right.

195. MR STRACHAN KC (DfT): And you can also see that there's a differential between the northbound effect and the southbound effect because that's taking account of what's going on in other parts.

196. THE CHAIR: Other places.

197. MR SMART: And you can see under K, this is where we look at construction traffic, which is not our construction route traffic. So this would be vehicles that are generated by HS2 but they don't fall into the heavy goods vehicle category. So this would be the element where there are roads that workers might use going to site or, indeed, vans servicing sites that are not in the HGV category. So we look at not just our construction routes, which is where the heavier wagons tend to be, but what other effects we might have with workers and the like. And that gives you a point of time so that you can see, for any particular stretch of a road, what the impacts of movement might be on that road.

198. THE CHAIR: And this is all shared with the local authorities, highways authorities and residents when you do your public engagement.

199. MR SMART: Yes, it's all in the ES, and certainly all this has to be done with consultation with the local authority. In a minute I'll come on to what it means about interventions, because clearly they own the strategic models that sit behind this, which we have to use to predict some of what is going to happen.

200. THE CHAIR: Thank you.

201. MR STRACHAN KC (DfT): Just to be clear, this form of information we produce for the purposes of exhibits for the Committee and petitioners. These maps and this presentation doesn't occur in that way in the engagement process that follows. All of this data is there, but we present it in this way to try and assist everyone, focus on –

202. THE CHAIR: In response to the petitions?

203. MR STRACHAN KC (DfT): The petitions in particular.

204. MR SMART: Sorry, I should have made that clear.

205. THE CHAIR: It's not presented in this format when the data is shared with local authorities, for example.

206. MR STRACHAN KC (DfT): Normally the local authorities are interested in the data itself that comes from the traffic models. They get all the data but they won't have it shown –

207. THE CHAIR: Right. How they present it is irrelevant. It's the fact that they get this data for their management.

208. MR STRACHAN KC (DfT): They have the data.

209. MR SMART: Yes. You can arguably say, although it might not seem it, that this is slightly simplifying it compared to the local authority, which has traffic experts that understand the models and what sits behind it, effectively. It all has to be done in consultation with the highway authorities because they have the powers to –

210. MR STRACHAN KC (DfT): Just one other subtlety in case it helps you in the future. The 'k' is shown in lower case and the 'A', 'B' and 'C', they're in upper case. That's distinguishing between construction traffic routes with HGVs and the lower case is showing effects on roads but which are not construction traffic routes but where there are changes in traffic flows.

211. THE CHAIR: I get on the construction traffic route. Maybe I've got this wrong, but if I'm somebody who works on one of these sites, you can't control which roads I use to access your site. So how do you know I'm not driving down that road to get to work? I mean, am I missing something here?

212. MR SMART: Well, yes, I think this is a valid point. So if you're a construction worker and you're coming to a site, you might use the best route there, which might not coincide with the construction route because, with the local authority, we haven't agreed the construction routes, which is where the heavy vehicles are. So you would use –

213. THE CHAIR: If it gets me there quicker.

214. MR SMART: For want of a better term, a rat run, if you like, to avoid it. But the model would then predict that's what happens. So we'd then say, "Well, actually if we assume 50% of our workers are going to move on the road," we would load that, and that's why it should be a credible worst case, because, one, they might well be on public transport and using local buses, but it's predicting that very behaviour to make sure that's captured in the assessment. We've got the effects of what our HGVs are doing but there's all this other construction-related traffic, potentially cars and the like, that we haven't captured to make sure we've done the right assessment on what the impacts might be. And that's where strategic models use that.

215. THE CHAIR: Thank you.

216. MR STRACHAN KC (DFT): And just to be clear – I think this is maybe what you were saying in your question – the HGV routes and construction traffic routes are controlled through –

217. THE CHAIR: No, I understand that. I'm thinking in terms of your vehicles which includes these people coming to site in their car. If you live on the rat run and suddenly you've got 100 cars coming past every day, you might not be on the construction route but you're certainly impacted, aren't you?

218. MR SMART: Yes, exactly, and the model does predict that, and that's the lower case that Mr Strachan was saying. So if we go to the next slide, it might help a bit, I think, in terms of understanding what this means. So we have histograms as part of our exhibit. What this shows in this particular, which is on the Pickmere Lane, MAO3, is that the highest predicted construction activity occurs in July 2029 and the assessment is 500. So it's 500 vehicles. So we would assess on 500 to look at the impact on things such as queuing time and effectiveness of junctions and roundabouts and the like. As the Committee can see, that 500 only occurs for one month over the predicted construction period where this road's going to be affected.

219. So, for example, if that assessment showed that we should, for example, put in a new roundabout or put in traffic control measures, like traffic lights, that would signalise a roundabout, would you really do that for one month of construction activity? And

actually, that might even be a worst case anyway.

220. MR STRACHAN KC (DFT): Can you just explain why it might be? Maybe it's obvious, but sometimes the queuing can be worse than the –

221. MR SMART: I was going to come onto that.

222. THE CHAIR: We've all had interventions in our constituencies where the traffic management model and system that were put in place had made the situation worse.

223. MR SMART: Yes. As Mr Strachan says, and as I was going to come onto, if you have to do things like put in a new roundabout, you can cause more disruption putting in a new roundabout for a month's worth of problem than you would actually get by just living with it, for want of a better of term.

224. So what we would do is say, "Well, look that is the one month and we'll assess at 500." That might suggest that we should be doing an expensive intervention but, as I say, would you really do that for one month when the intervention might cause more problems in itself?

225. So we then look at what we call the peak period and on this particular slide, that's shown by the green line. So we'd say, "Well actually, we've got an assessment – 70% is the sort of peak period," so we would look at, "Well, if that's for five months, would we on a sort of cost-benefit analysis want to do an intervention, when really it's only going to happen for five months?" And it's part of the assessment of, "Well, would we do something which might be more of an intervention, which could be expensive for taxpayers and could be disruptive, and would we do that for five months?" There's a balance to be struck, I think.

226. THE CHAIR: And those interventions would be traffic management.

227. MR SMART: Yes, widening junctions and potentially putting in a roundabout.

228. THE CHAIR: Temporary traffic lights.

229. MR SMART: Temporary traffic lights. Temporary traffic lights are probably less of a problem, but it might even be that the highways authority would want us to permanently signal a roundabout, and you'd say that's quite an expensive proposition

and would you do that for five months, when actually the queues are not that bad and you're only adding, maybe, X amount of queue time to a junction? Is that a credible thing?

230. But, of course, that is for what we call the peak, which is 70% of the 500, in this case. But if, actually, you had a busy period, where you had 50% of that 500, but for a much longer time, potentially the disruption might be something that would push them into doing that intervention because it actually mitigates over a longer period of time, and it has more beneficial effects. And then the cost of it, and the disruption of it, might be more worthwhile, depending on the circumstances.

231. And it's that busy period we tend to liaise with the traffic authorities about. That's the one they're more concerned with. So I think, probably, when you hear petitions, you might hear about this busy period, and that's sort of like 50% of the loading, and what we might do to mitigate that should it cause some effects that are more significant. So we look at it at sort of three levels. We assess on the high level, because that really can be a very small period of time, and then look at the peak and assess whether is it still worth doing the intervention, and then we look at the busy period, so we've kind of got a really good assessment about whether we need to make these interventions, or not, based on the cost-benefit analysis.

232. That's probably the most complicated part of the presentation, just getting your mind around all these predicted figures, etc. There are three slides remaining in the presentation which I can quickly run through, but I think you've already heard me talk about the mass haul and how we move material on the train.

233. THE CHAIR: Borrow pits.

234. MR SMART: We've talked about the use of borrow pits and how we use excavated material. We've talked about rail heads, where we want to use it. Provision of overnight accommodation can mitigate workers, and we've got Hoo Green junction as an example of where we might want to be doing that to mitigate things. The specific temporary highway improvements – I think the Committee can read all that.

235. If we go onto the next slide, obviously our main construction routes have to be submitted to the local traffic authorities for approval and we prioritise routes. We have

construction management and transport measures contained within the construction code of practice, which the Committee has access to, which explains how we mitigate that. And there are local traffic management plans that are dependent on, you know, the peculiarities of the local area. And there might be obviously provision for cyclists. Schools are an important point. We might not be putting traffic down during – or reducing it –times when residents are picking up children from school, and things like that.

236. THE CHAIR: Given the construction time is 8.00 until 6.00, I presume some of the petitions we'll be receiving will be around the construction hours and the impact on traffic at peak times. You've come to arrangements previously to work different hours, presumably.

237. MR SMART: So, under the Control of Pollution Act, if you want to extend those hours, you have to get approval of the local authority.

238. THE CHAIR: No, I mean, I'm thinking: have you come to any agreements anywhere to reduce those hours, particularly if you're going past schools during –

239. MR SMART: Yes, we might say we might not have construction traffic during the hours where residents are picking up or dropping off kids; we would do that. So that would be something that would be enshrined in the local transport plan. Obviously that's particular to the schools and the hours they work. But, yes, most certainly, we do that.

240. MR STRACHAN KC (DFT): I think it's fair to say that those sorts of arrangements tend to be specific to a locality, rather than changing the operational hours of working at a site, so one can limit the traffic passing –

241. THE CHAIR: Yes, that's what I meant. You would say, "We'll have no construction traffic passing St Giles Primary School between the hours of blah, blah and blah." I mean, that's fairly normal when there's a big development going on. We all have that in our own patches. But that would be something you'd agree with the local authority, presumably. I don't know how many petitions, if any, relate to issues such as that.

242. MR SMART: Some do. Sometimes people fear that we might be cutting off access, and there's no access for emergency vehicles and things like that. But all that has to be agreed and there's a plan for, if we do, how we make sure that emergency vehicles can get through and the like. We also monitor, so we can remotely monitor via number plate registration where construction vehicles are going, to make sure that they are behaving themselves, as far as possible. And that's one of the things we've got listed.

243. THE CHAIR: Yes, that was going to be one of my questions. I live in a community which HGVs are banned from, but a lot of them seem to come past. So you have monitoring in place then. So presumably your drivers are provided with construction route maps.

244. MR SMART: They are.

245. THC CHAIR: And then there is some enforcement of that.

246. MR SMART: There is.

247. MR STRACHAN KC (DFT): And you heard mention of the local traffic management plans, which are intended to be the more specific, local control of traffic, specific to areas of the type and facilities that you're talking about.

248. THE CHAIR: But I mean a significant proportion of the petitions, I'm assuming, relate to transport and traffic issues, don't they?

249. MR STRACHAN KC (DFT): I think that's fair to say, yes.

250. THE CHAIR: And these are people who haven't been resolved by their local authority arrangements, or local arrangements, rather.

251. MR SMART: Sometimes the petitioners don't like what the local authority's agreed.

252. MR STRACHAN KC (DFT): To be clear, the local transport management plans come later, so in a sense they're a measure that will be –

253. THE CHAIR: The detail that you won't have yet facilitated.

254. MR STRACHAN KC (DFT): Exactly. So the petitioners won't necessarily be aware of what detail would be agreed by the local authority.

255. THE CHAIR: But that would be something you could give an undertaking on.

256. MR STRACHAN KC (DFT): The requirement to have local transport management plans is already there.

257. THE CHAIR: No, I mean in relation to some of the specific concerns raised by petitioners, you may give an undertaking with regards to traffic hours or routes now.

258. MR STRACHAN KC (DFT): It's possible to do that in an appropriate case. But generally speaking – I say generally speaking –the provisions we've already got in place, with the code of construction practice, the local transport management plans, and the need for the local authority and the highways authority to be engaged in ultimately settling how construction takes place once more is known, is the best place to do that, rather than giving assurances or undertakings now before there's the maturity of knowing how the construction –

259. THE CHAIR: I understand that. It's just that if – people, please nod if this is true – a large number of the petitioners are raising transport and traffic concerns, they're going to be looking for a resolution now, as opposed to waiting for construction to actually commence, or a local authority to begin that work, which could be years hence.

260. MR STRACHAN KC (DFT): That can certainly be the case. And where there is a rationale and a sense of trying to give assurances about what will or will not happen now, we would certainly look at that. It's just that sometimes that can actually have a counter-effect which may not actually be beneficial in terms of what's going to happen.

261. THE CHAIR: No, of course.

262. MR STRACHAN KC (DFT): So it could have an impact elsewhere. But certainly we have in the past looked at assurances where people are concerned about traffic going down the road and there's no intention for that to happen. It may be possible to give some greater comfort to them in those circumstances. Mr Mould reminds me that that has happened in particular in relation to schools in the past.

263. THE CHAIR: Sorry, Mr Smart?

264. MR SMART: I hope it's obvious from what I said but, obviously these interventions, where we do agree we're going to do things, happen before the construction. We do that as part of the early work before we start getting heavy construction going down.

265. And I think, if that's reasonably clear to the Committee, I'll go to the last slide, which is where we have these local arrangements in place. And I think we've got some examples of our particular traffic and transport plans that the contractors put in place to manage the traffic in their construction areas. And I suppose it's just worth saying that, if you are contractor, you don't really want your construction vehicles standing in long queues, etc. So it's in their self-interest actually to mitigate the impact on the queuing time at junctions, etc. Otherwise, there is a cost to them.

266. THE CHAIR: Excellent.

267. MR STRACHAN KC (DFT): That's it.

268. THE CHAIR: Excellent, thank you. Well that's our favourite briefing yet. We'd enjoyed all the others, but we particularly enjoyed rattling through this one, because these things are important, but transport and traffic particularly are the sorts of things that Members are used to dealing with in their constituencies whenever there's a big construction project. So we're well aware of the view that residents take on this and the concerns that are normal to big projects, and also, obviously, the role of local authorities in trying to manage that, and how there can sometimes be a divergence between the two, which is why we're very keen for you to resolve those that do relate to that as appropriately as possible.

So Mr Strachan, Mr Smart, thank you very much, and we will look forward to seeing you again. We've no other business so, on that basis, I'll call the meeting to a close.