Re: Six lane underground rail lines

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From: habshi (*habshi_at_anony.com*)
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There have been major advances in tunnel−boring machines (TBMs), invented by the British engineer Marc Brunel in the 19th century. The past 20 years have seen TBMs built much tougher, more reliable, and to ever larger diameters. The availability of large TBMs is especially important for highways because they are the largest tunnels in cross section. Until the 1960s the largest TBMs were about 8m (25 foot) diameter, hence most tunnels so built only had space for two lanes of traffic. Thanks mainly to Japanese innovation, TBMs are now common at 10m (and even go to 14m as in the case of equipment used on the Trans−Tokyo Bay tunnel) providing room for three lanes of full−sized truck traffic. Once the principal challenge in tunneling was breaking up the hard rock and getting the debris out. Now with "road header" machines, relatively simple machines that deploy a large grinder on an arm and a conveyor belt, and with simple mechanical excavators and precise explosives that move the toughest rock, expensive TBMs and large shields can sometimes be dispensed with.

Another major advance in tunneling is the invention of the jet fan for ventilation. So named because they look like the jet engine of an aircraft, they are hung from the ceiling at intervals along the tunnel and simply move the dirty air along the tunnel. It can be vented out one end, taken to vertical exhaust risers, or diverted into treatment channels and reinserted cleaned into the tunnel. On all but the very longest tunnels, jet fans allow the tunnel builders to dispense with the plenum or separate longitudinal ducting above a false ceiling that has traditionally been used to ventilate tunnels. That can reduce the quantity of excavation and construction by 10 to 20 percent, and capital costs by comparable amounts. Pioneered in Europe and Japan, jet−fan ventilated tunnels were long resisted by the U.S. Federal Highway Administration on the argument that fire might disable the jet−fans. A breakthrough came in 1996 when live fire tests in an abandoned tunnel in West Virginia proved their safety, and they were belatedly allowed in the last designed section of the Central Artery project in Boston.

Q13. What soil types are drilled?
The subsoil excavated from both A86 West tunnels is typical of the

Paris Basin. It includes:

− “Fontainebleau” sands
− High−grade clays (oyster marl, green clay and supra−gypsum marl)
− Limestone and calcareous marl (Champigny and Saint Ouen limestone, marl, broken stone, rough limestone)
− Low−grade clays (false clays and plastic clays)
− ChalkQ18. How will the A86 West affect surface level traffic?
The decision to link up the A86 West by tunnel will mean shorter journey times across the western Paris area, and a 15% reduction in surface level traffic on parallel roads.
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Q1. What is the history of the A86 West link−up?
At an average distance of 6km from the Paris city ring road, the A86 constitutes a second Ile−de−France circumferential. It is intended to reduce traffic on local roads, relieve congestion on the city ring road, and facilitate travel between suburbs.

The A86 West is the missing link needed to complete this 78km−long outer ring road, 80% of which is already in service