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# SCIENCE-FICTION SUBWAY

The Gotthard railway tunnel was one of the engineering wonders of the 19th century. Now Switzerland is working on a project which could become a technological showpiece of the 21st century. In what at first sounds like something from a science-fiction novel, studies are being carried out on a trans-Swiss underground railway which would eventually run between Geneva and St Gall and between Basle and Bellinzona. Working on a vacuum-tube system, the so-called "Swissmetro" would be able to operate at speeds in excess of 300 mph.

Federal Councillor Adolf Ogi, Switzerland's Transport Minister, compares this remarkable development with "the pneumatic post or a subterranean aeroplane".

It is, he says, visionary. But at the same time, its planners believe it is quite practicable - and not even astronomically expensive.

## RAILWAY TRADITION

Switzerland has always been at the leading edge of railborne transport. A hundred years ago much of the country's dense railway network had already been created. Apart from the marvel of the Gotthard tunnel and the numerous high-gradient mountain lines, Swiss operators were among the first to carry out comprehensive electrification. At the same time, Swiss companies carved out an important place on the world market in the field of rolling stock and railway equipment. As far as upgrading the domestic network is concerned, the ambitious "Bahn 2000" programme is in the course of realisation while preparations continue in connection with the future trans-Alpine link (Alp Transit).

The idea for the Swissmetro goes back to the 'seventies'. It was the brain-child of Rodolphe Nieth, who during the service with Swiss Federal Railways (SBB) had been responsible of the extension of the main line to Geneva Airport and is currently City Engineer of the City of Lausanne. Working on the project in his free time, he received support from a group of professors at Lausanne's Federal Institute of Technology (EPFL): One of these, Marcel Jufer, is currently head of the Swissmetro programme. In 1989 a formal request was made for a Federal subsidy. The Transport Ministry agreed and a system was worked out in which the Confederation assumed half of the cost, the EPFL a quarter and private donors the remaining quarter.

## SPECIAL NEEDS

As Jufer recently pointed out, high-speed surface transport typified by France's TGV line or similar concepts in Germany and Italy is unsuitable for Switzerland, a country with difficult topographical conditions and a concentration of population in the habitable areas. This is a major reason for the decision to go underground. It does not, as Ogi stresses, mean the replacement of existing transport services but it would be a very valuable contribution to building up capacity in intercity traffic.

Such an ambitious programme naturally calls for a wide range of studies on a wide range of subjects. An initial feasibility study due for completion this year looks at the development of traffic demand and the integration of Swissmetro into the existing transport system, taking into account the impact on the economy, the environment and energy consumption. Due by the end of 1992 is a further report concentrating on the technical topics of infrastructure, electro-mechanical technology, aerodynamics and operational safety.

## MODERN TECHNOLOGY

Propulsion will be based on the modern technique of linear electric motors and

suspension on the principle of magnetic levitation, in which the train "takes off" from the track when travelling at high speeds.

Railway engineers are showing increasing interest in this: Japan hopes to have a 30-mile test service working on the line between Tokyo and Osaka by 1995, while the German authorities foresee a connection with Cologne and Dusseldorf airports. The particular feature about the Swiss application would be that the track would be something like 130 ft below the ground and in two one-way tubes of only 15 ft external diameter.

At the same time, a partial vacuum would be created in the tunnels, pressure of only 0.07 atmospheres comparing with that exerted on a plane flying at almost 50,000 ft.

This would enable speeds of up to above 300 mph to be attained. Indeed, over longer distances, speeds could be increased to those currently flown by jet planes - Rand Corporation has been looking at the possibility of a system which might permit the journey from New York to San Francisco to be made in an hour. The intervals between stations within Switzerland would not, of course, be great enough for "aircraft speeds" to be reached. But Ogi has broached the idea of a "Eurometro" linking major urban centres in Europe.

### RAPID CONSTRUCTION

Naturally, everything remains open as to whether and when the Swissmetro will come about. Word is in Berne that construction could be fairly rapid once a start was made. After a decision to go ahead with the plan - which could not, of course, be taken until after the second report is completed next year it is believed it would need about six years for further research and preparations, followed by a construction period of about ten years for the first line from Geneva to St Gall.

The plan initially foresees a west-east line running from Geneva via Lausanne, Berne and Zurich to St Gall and with stations linked to the main surface railway stations en route: Conceivably operation could begin on a first stretch between Geneva and Lausanne. Subsequently, there could be a north-south line from Basle to Bellizona via Lucerne, possibly being extended at some later date to Milan in the south and Strasbourg, Paris and/or Frankfurt in the north. The east-west line could itself be extended west towards Lyons and east towards Munich, with possible spurs off from St Gall to Chur and from Lausanne to Sion (Valais). Lucerne would be the Swiss junction of the two lines.

As far as costs are concerned, preliminary estimates put them at something like Sfr. 11,000 million for the 200-mile stretch from Geneva to St Gall.

The much smaller diameter of the tubes mean that their construction costs would be far below those for motorway tunnels or conventional railway tunnels. Also, the tunneling of the west-east stretch would largely be through "easy" molasse.

For all this, the Swissmetro is far from being a foregone conclusion. Jufer points to a number of obstacles: The fact that many German-Swiss tend to regard it is a "Latin" project; reluctance to enter into such a long-term concept; opposition from elements within the railway sector; and the tendency of a travelling public to jump to conclusions on the basis of what it sees as its own expertise.

But people were saying very much the same thing back in the 19th century about the Gotthard tunnel ...

JOHN WICKS