A 100-mile maglev rail tunnel under the Alps in five years

by Alexander Hartmann

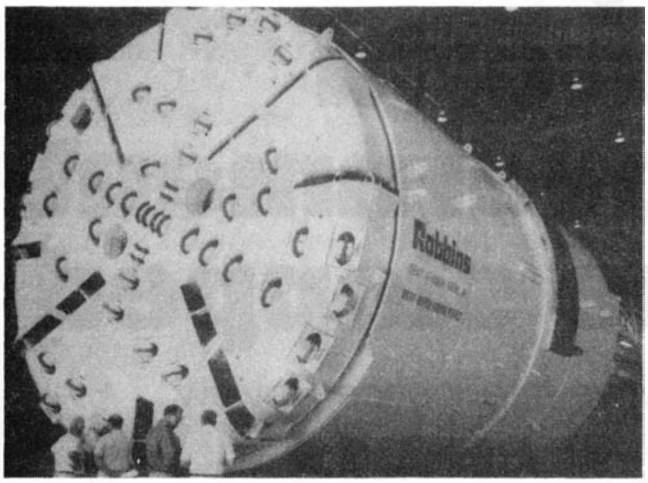
If the plans of the Austrian company Tunnel Tirol AG work out, within this century, goods will be sent from Germany to Italy (and vice versa), through a tunnel beneath Austria. The company wants to complete construction of this connection within five years, which would have the capacity to transport half of the current volume of goods traffic over the Brenner Pass. The fully automated magnetically levitated (maglev) technology could serve as a model for efficient goods transport on rail in general.

Tunnel Tirol AG has created a joint venture with five other engineering companies, the International Planning Group (IPG), which has carried out a detailed study and presented several different options for such a connection:

1) a tunnel connecting Raubling, Bavaria (30 miles southeast of Munich) with the Pusteria (Puster) Valley in South Tyrol, which would link up to the German and Italian national rail and highway grids. This tunnel would be 112 kilometers (70 miles) long;

2) variants of this tunnel would extend the tunnel to the south by 17 km (10.5 miles) to the Isarco (Eisack) Valley, or by 50 km (30.8 miles) to Bolzano;

3) a tunnel connecting Reutte in Austria and Bolzano, which would mainly serve to pick up goods transported by trucks via the national highway A7.



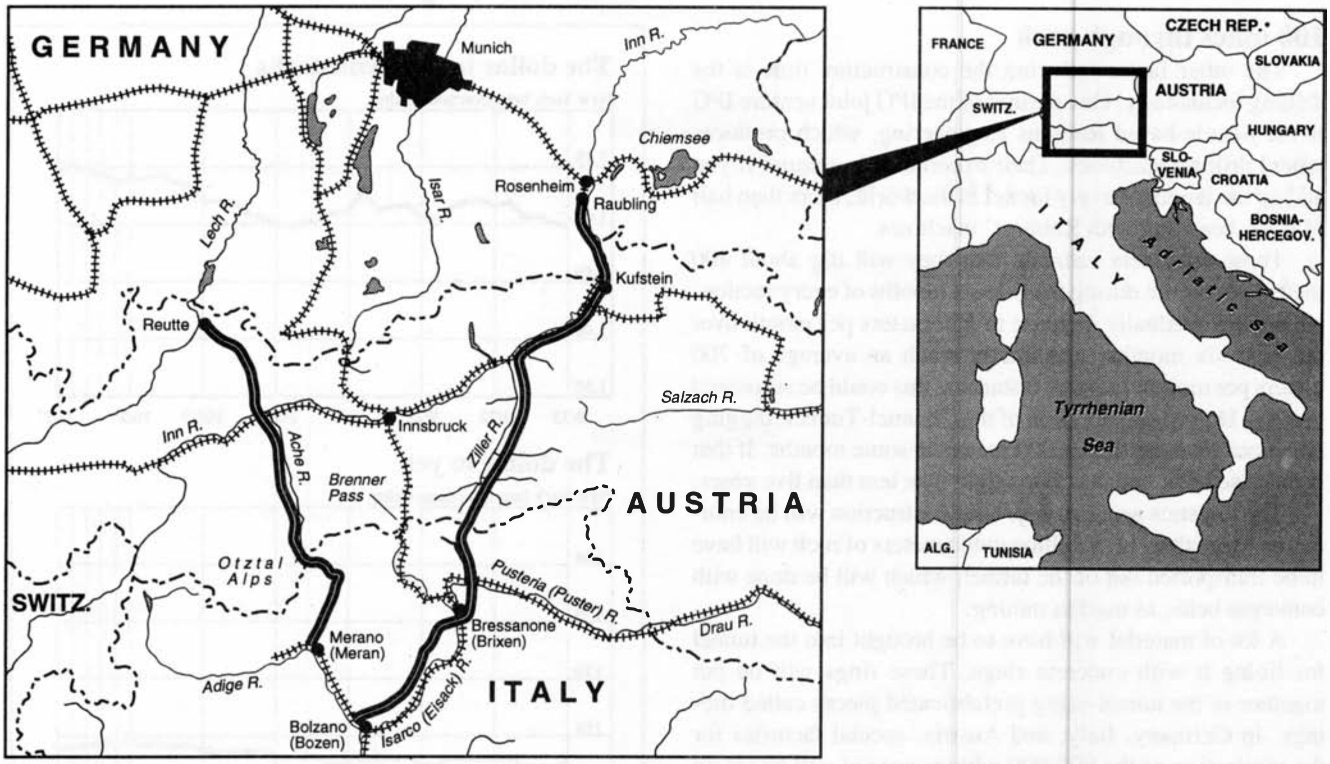
A tunnel drilling machine, manufactured by Robbins Engineering, one of the partners in the joint venture to build a tunnel linking Raubling, Germany, with Bolzano, Italy.

These tunnels would be built as two tubes, which would be interconnected at regular intervals. This means that in the extreme case of connecting Raubling and Bolzano, 324 km (200 miles) of tunnels would have to be dug. Compare this with the Channel-Tunnel connecting France and Britain, which will be opened next spring, itself one of the greatest projects ever built. Its three tubes combined are, by comparison, 148 km (91 miles) in length.

The fact that the companies involved want to dig these 200 miles of tunnel in only five years is just as astounding. This is just a little more than half the time necessary to construct the tunnel at the Semmering, which will be 22 km (13.6 miles) long, and estimated to need a construction time of nine years.

The shorter construction time is possible because of the drilling technology used to dig out the tunnel. But even more important for the reduction of the construction time is the use of maglev technology, which will later be used to transport the goods through the tunnel. This technology affects the time needed to build the tunnel in two ways. First, while rail traffic has to follow a more or less even path and avoid steep ascents and descents, maglev transport is much more flexible. If you look at a map of the Alps, you see that there are a number of valleys following the east-west axis of the alps, whose floors are at different altitudes. Since maglev trains can "climb" much more easily than conventional rail, the tunnel can be projected to come close to the floors of some of these valleys, which means that up to seven sections of the tunnel can be built at the same time, starting in each of these valleys. These sections will each have a length of 14 miles at most, thus saving years of construction work.

Routes under discussion for tunnels underneath the Alps



Fully automated operation

Second, maglev transport in the tunnel can operate in a fully automated fashion. Under normal operating conditions, there will be no personnel in the tunnel, except for maintenance and repair. Therefore, many installations usually mandated to protect people on the trains are not necessary.

The operation of the tunnel will work as follows: At the northern and southern entrances of the tunnel, two goods terminals each will be built, one for rail and one for truck cargo. Trucks and containers will be put on special cars that will run on rails like regular rail cars, using European standard rails of 1,435 millimeters in width. Up to four of these transport units (TUs) will be combined into short trains. Rail cars will be used as TUs just as they are.

These trains will follow each other through the tunnel at intervals of as short as 70 seconds at a speed of 60 km per hour (37 mph), passing through the tunnel in 2-2.5 hours. They will not have a locomotive. Between the two rails there will be a third rail, a linear engine, which creates a magnetic field moving along the rail. The TUs will have magnets at their bottom, which will be pulled by the wandering magnetic fields, and thus the cars will be pulled through the tunnel. Regular rail cars will be hooked to magnetically levitated devices moving along the rail.

The whole length of the tunnel will be divided into segments of 22-30 miles, depending on the incline at that point. Thus, every train will be passing over several such segments at any time. Every segment is connected to a steering unit installed right next to the rail in the tunnel. These steering units control the speed of the train. Any irregularity will be signaled to a supervisory center, which will react immediately, and stop all traffic in the tunnel, if necessary.

At the other end of the tunnel the trains will be combined to make up regular freight trains again, and trucks and containers will be unloaded. The TUs will be sent back with one of the next trains. They will pass the tunnel four times per day in both directions.

This procedure is very flexible. Depending on traffic density, the number of TUs per train and/or the time interval between two trains can be changed. The upper limit is 200 TUs per hour and direction, or 8,000 TUs per day.

This method of operation is revolutionary in two respects. First, it operates fully automatically (except for loading or unloading trucks and containers at the terminals), which should be a model for goods transport on rails in general. Imagine if you could load your goods at your company on a rail car, and have everything else taken care of by computer, until the goods arrive at their destination. Second, traffic experts have demanded a separation of transport systems for goods and passengers, which will be done in this case. The railway climbing up over the Brenner Pass will be free for passenger trains, if this tunnel is built.

100 miles through rock

The other factor reducing the construction time is the drilling technology. One partner of the IPG joint venture IPG is the Seattle-based Robbins Engineering, which produces tunnel drilling machines. Their experience is unique. If you add up the length of every tunnel in the world, more than half of it has been dug with Robbins' machines.

These engineers estimate that they will dig about 400 meters per month during the first six months of every section, which will gradually increase to 550 meters per month over the next six months, and finally reach an average of 700 meters per month. In some instances, this could be surpassed greatly. During construction of the Channel-Tunnel, digging advanced by more than 1,000 meters in some months. If that is the case here, construction might take less than five years.

The logistics necessary for the construction will be enormous. More than 12.5 million cubic meters of rock will have to be transported out of the tunnel, which will be done with conveyor belts, as used in mining.

A lot of material will have to be brought into the tunnel for lining it with concrete rings. These rings will be put together in the tunnel using prefabricated pieces called tubings. In Germany, Italy, and Austria, special factories for the production of the 900,000 tubings needed will be set up for the duration of the construction. Six of these tubings will form a ring 1.5 meters broad. Special concrete will be necessary to carry the weight of the mountain. In principle, these tubings will just be stuck together, which will save a lot of time during construction. The tubings and other construction materials will be brought into the tunnel on the rail tracks, which will be installed right behind the drilling machine. It will be the same tracks used later for goods transport. The material for the rails themselves, and the steering units for the operation of the maglev transport, will also be transported into the tunnel on these rails.

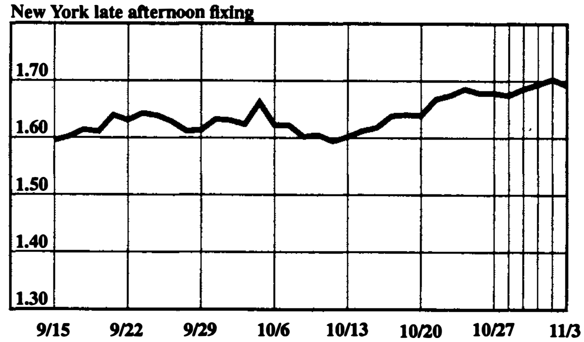
Tunnel Tirol estimates that digging the tunnel itself will cost 21 billion Austrian shillings (ATS), about $2 billion. Other expenses, such as the construction of rails, power supply, disposal of carved-out rock, preparation, planning, and supervision, will bring the bill up to ATS 45 billion ($4.3 billion). Building the other 50 km of tunnel to Bolzano would add ATS 9.2 billion ($900 million). The route from Reutte to Bolzano would cost ATS 23.9 billion ($2.3 billion).

In and of itself, the tunnel is a very sound project, and is long overdue, given the deteriorating infrastructure linking Germany and Italy. Another question is whether to build a second tunnel for passenger traffic right next to it, either for high-speed maglev trains alone, or for high-speed traffic of both maglev and rail trains, like the German ICE. At present, 4,300 trucks, 32,000 cars, and 130 trains pass through the Brenner Pass every day.

Currency Rates

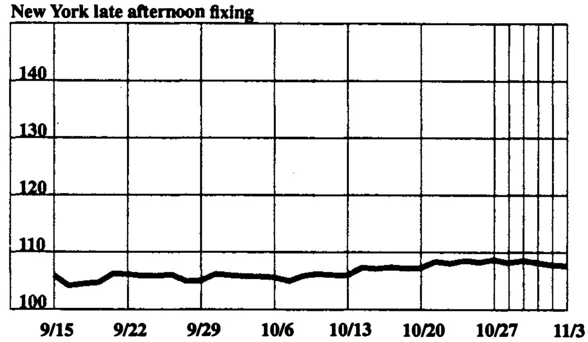
The dollar in deutschemarks

New York late afternoon fixing



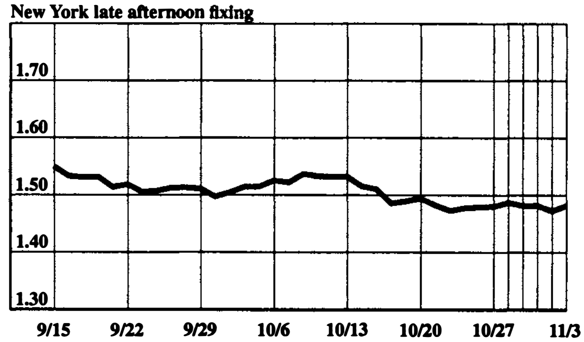
The dollar in yen

New York late afternoon fixing



The British pound in dollars

New York late afternoon fixing



The dollar in Swiss francs

New York late afternoon fixing