

New transport technologies and territorial planning in Switzerland: is not time to consider ultra-fast speed passenger transport systems in vacuum tunnels?

After reviewing the “Transportation Plan 2050” (“Teilprogramm Sachplan Verkehr von Mobilität und Raum 2050”) recently published by the Swiss Federal Department for Transports, Energy and Communication (DATEC) and after my further researches on the relevant subject matter I tried to give an overview of what has been done in Switzerland in the past and what is currently being done, also politically, in the research and development of new technologies for ultra-fast passenger transport in underground vacuum tunnels analogue to Swissmetro resp. SwissMetro-NG, Hyperloop and similar projects.

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Fig. 1.1 SWISSMETRO - Variantes d'études

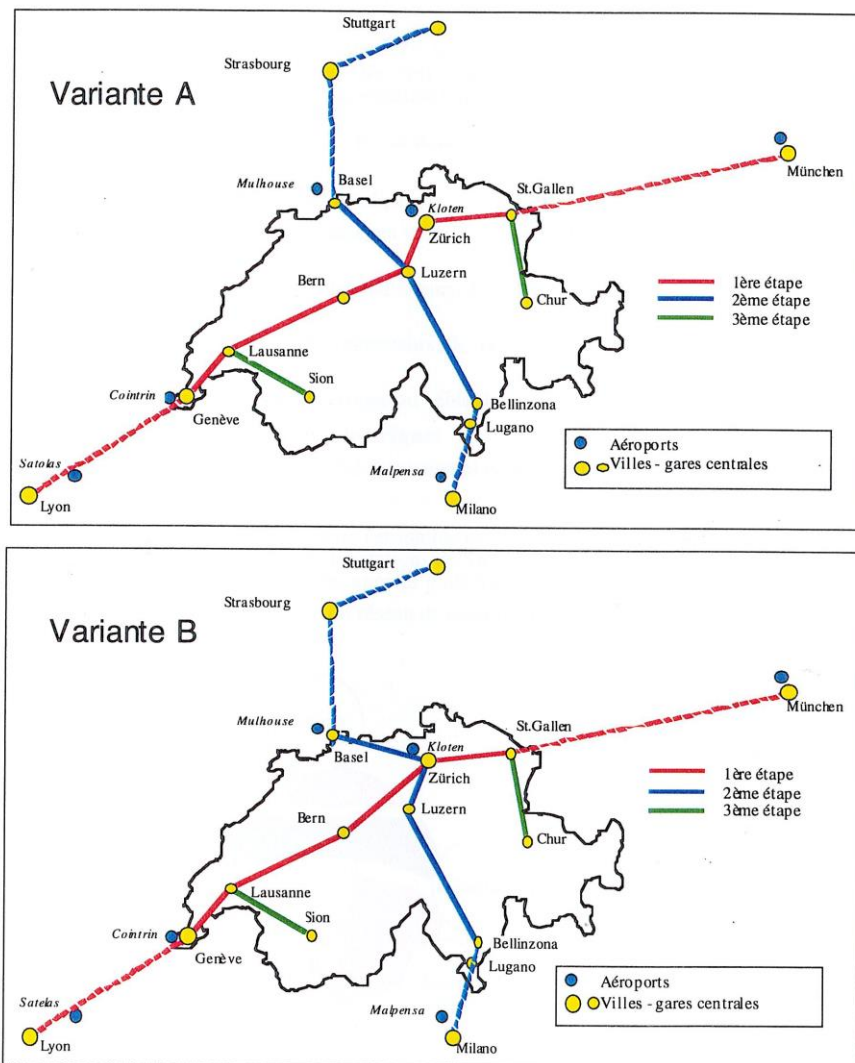


Figure: One page abstract from the Final Report of the Swissmetro Principal Project 1994 – 1998, of 31 May 1999 - Cahier B4 – Electromechanics (by Swissmetro SA)

1) Foreword

The transport sector plan - programmatic part of April 26, 2006:

The previous Swiss transportation sector plan programmatic part was published on 26th April 2006.

This document represents the basis for the assessment of the tasks of the Confederation in terms of territorial impact. Based on Art. 13 of the Federal Act on Territorial Planning (LPT), the federal government develops the basis for fulfilling its Territorial planning tasks and defines the necessary concepts and sectoral plans and coordinates them with each other.

In this transport plan, the confederation set the following as a very high priority: ensuring the functionality of the motorway network, ensuring the functionality of the rail network and the connection to the European high-speed rail network.

2) The strategic plan for transport and the Swiss territory up to 2050 of 20th October 2021

On 20th October 2021, the Federal Council adopted the planning text "*Switzerland and Territorial development 2050: transport planning part*", which was developed under the leadership of the ARE in close cooperation with the DETEC offices (FOCA, FOEN, FOT and FEDRO). The Federal Office for Territorial Development published the "*Mobility and Territorial Planning 2050: Transport Sector Plan, Programmatic Part*" (hereinafter "*Programmatic Part*").

Parallel to this, the Federal Council published an explanatory report outlining the individual impulses that resulted from the consultation process (hereinafter referred to as the "*Explanatory Report*").

<https://www.are.admin.ch/are/it/home/media-e-pubblicazioni/comunicati-stampa/medienmitteilungen-im-dienst.msg-id-85502.html>

The programmatic part of the transport sector plan, has the ambition to provide the framework for "*the long-term development of the overall transport system in Switzerland and its coordination with the territory and the environment.*"

The "*Mobility and Territory 2050*" document focuses on the long-term development of the overall transportation system in Switzerland coordinated with territorial development and focuses primarily on coordinating territorial and transportation planning while seeking to limit their environmental impacts as much as possible.

This planning document forms the basis for the coordination of territorial development, the environment and transport infrastructure of **national importance**. Part of its contents are **binding** for the **authorities**.

The sectoral concepts and plans in accordance with Art. 13 of the Territorial Planning Act of 22nd June 1979 (SR 700) are the main planning instruments of the Confederation. These instruments enable the Confederation to meet the legal requirements, to plan and **coordinate** its territorial **planning** tasks and to adequately resolve the increasingly complex problems associated with the implementation of **projects of national interest**.

According to the sectoral plan, an efficiently structured overall transport system promotes the **optimal combination** of the various transport carriers, guarantees an adequate level of accessibility in all parts of the country, and supports **sustainable territorial development**. By **minimizing environmental impacts** and considering the quality of settlements and landscape, it also contributes to the **preservation** of living space and quality of life.

The aim of transport infrastructure planning is to find the right **balance** between the transport needs of the population and the economy on the one hand, and the need to **minimize Territorial and ecological impacts** on the other, without neglecting criteria such as **technical feasibility** and **economic efficiency**.

The federal government plans transport infrastructures in a transparent manner, using mainly technical, operational and, if necessary, incentive measures. Where these measures are insufficient, they are supplemented by infrastructure expansions where appropriate. The transport sector plan - programmatic part illustrates the principles to be taken into consideration.

The transport infrastructure is planned in consultation with the **cantons, cities, municipalities**, and **other interested partners**. To ensure this collaboration, it is essential to identify synergies and conflicts of objectives at an early stage to jointly seek sustainable solutions. (cf. Programmatic part p. 6).

The strategic vision represents the desired scenario for 2050 in territorial and mobility planning. It serves as the basis for federal planning and as a complement to the Territorial strategies drawn up by the cantons as a result of the Federal Law on the Territorial planification. (cf. programmatic part p. 20).

In point 4.2 of the Policy section of the ***Guarantee of an effective global transport system*** (p. 37 ff.), the Federal Council states the following principles:

- V1 - The various means in passenger transport (including pedestrian and bicycle traffic) are effectively **combined** according to their respective strengths.
- V2 - The various modes of transport for goods are combined according to their respective **strengths** and in an **efficient and sustainable** manner.
- V3 - The global transportation system ensures **safety, reliability, availability, and ease of access**.
- V5 - The Swiss overall transport system is optimally **integrated** into the international context (including the **Trans-European Networks - TEN corridors**), which facilitates the achievement of the goal of transferring transalpine traffic through appropriate measures. The **interoperability of networks and services** - such as night and high-speed rail links - and the cross-border use of new technologies (e.g. autonomous driving and drones, but also harmonized data, norms and standards, etc.) as well as long-distance lines (overland, air, water) for both **passengers** and **freight** will be ensured.
 - The Confederation creates the framework conditions for the implementation of **international interoperability** and supports measures and **pilot projects** where necessary.
 - The Confederation undertakes to implement the measures defined in **international treaties** and to achieve the jointly agreed objectives.

- In **cross-border agglomerations**, mobility is the subject of **comprehensive planning**. Within the framework of **agglomeration programmes**, the Confederation promotes and monitors **cross-border cooperation** and continues to **finance projects in foreign parts** of agglomerations, if they have a **substantial impact** on the part of the agglomeration located on Swiss territory.
- Cross-border networks and services are coordinated accordingly. The Confederation ensures that the national networks are planned and developed in a mutually coordinated manner and that rail services in passenger transport are promoted in a manner that is commensurate with needs. The Confederation and the cantons work together with the relevant foreign authorities to achieve **efficient cross-border** mobility solutions both within and outside the agglomerations.
- Air and land transport are optimally **combined**.

Regarding **current trends in freight transport**, the Federal Council states the following:

"The demand for freight transport services will continue to grow: by 2040 an overall growth rate of 45 % is expected. The future development of the just-in-time model, which is leading to an increase in production on demand, and the growth of online commerce will require, for example, the creation of more flexible freight transport chains and the transport of smaller lots. The Territorial arrangement of companies generating large volumes of traffic follows these trends, but overlaps with the scarcity of suitable surfaces and the resulting competition for their use. To remedy this situation, plans are underway for underground freight transportation, which could partially supplement existing freight transportation chains." (Programmatic part, p. 12)

Regarding **technological advances**, the Federal Council indicates the following:

"Technological advances Technological innovations can increase the efficiency of the overall transportation system and promote the development of a decentralized settlement structure. They can also increase the capacity of transport carriers for different travel purposes, e.g. by making possible better traffic management, the use of renewable energy sources and efficient and sustainable traction technologies and greater use of small vehicles (bicycles, small electric vehicles, but also drones etc.), as well as paving the way for automated vehicles, sharing systems and more flexible and mobile work and education options. In the future, new types of offerings based on technological innovations could blur the current distinction between traditional PT (Public Transportation) and IMT (Individual Motorized Traffic) offerings, as well as pedestrian and bicycle traffic. The focus should be on increasing the degree of vehicle occupancy/utilization and ensuring efficient and uniform use of transportation networks throughout the day. The implementation of new technologies in this field must be accompanied by an appropriate regulatory framework and corresponding measures to achieve the desired objectives, i.e. greater efficiency combined with a decongestion of the network.

In the field of freight transport, efficiency will be improved by automation processes in rail (as example, the widespread use of digital automatic coupling) and road transport as well

as by the development of underground freight transport. Increased efficiency in all transport carriers can increase the overall efficiency of logistics chains. Digitization techniques, in particular, enable the intelligent linking of different transport carriers, which also benefits freight transport. The boundaries between transportation carriers within logistics chains thus become less clear-cut." (Programmatic part, p. 12)

Regarding the **rail network**, the Federal Council indicates the following:

"The rail network currently covers 5196 km and connects about 1730 stops. Over the past few decades, the introduction of the cadastral timetable and express network systems has led to a significant adjustment of the service offering. More recently, the rail network has been significantly expanded with the high-speed lines between Olten and Bern and the Lötschberg and Gotthard lines through their respective base tunnels. The rail network is now characterized by a very dense timetable and, consequently, by high loads in terms of infrastructure and rolling stock." (Programmatic part, p. 184)

Regarding **capacity problems**, the Federal Council indicates the following:

"Due to the increasing capacity problems affecting roads the IMT, freight and road PT end up hindering each other. However, in the medium to long term, capacity problems in rail freight transport arise at the level of loading operations between road and rail as well as at loading facilities for combined transport or other loading and unloading facilities. The safety and attractiveness of pedestrian and bicycle traffic in urban areas are affected by the high volume of traffic concentrated in a small space. In the centers and agglomeration belts there are capacity problems on all types of roads at peak times, while among the metropolitan areas the sections of motorways crossing the Central Plateau are particularly affected. As far as TIM is concerned, the degree of vehicle occupancy is low. As far as rail transport is concerned, capacities at peak times are sometimes exhausted. Demand cannot therefore be met everywhere in the long-distance traffic network nor in the fast networks of metropolitan areas or in rail freight transport. In order to address these capacity problems and the expected overload situations, in June 2019 Parliament approved a phase of rail infrastructure expansion with the PROSSIF FA 2035 program. In planning, rail freight has the same importance as passenger transport. However, it must be taken into consideration that the exact need for train paths is not easy to plan for the long term, because orders are often placed at short notice based on demand. The federal government takes this requirement into account with its network utilisation programme, which reserves certain capacities in the form of train paths for all types of transport. Regional traffic, on the other hand, has to contend with low utilisation rates and reduced self-financing in peripheral areas. The Confederation and the cantons are responsible for the uncovered costs of regional passenger services.

The provision and operation of an underground freight system would create freight capacity on the Plateau axes characterized by heavily congested road and rail infrastructure.

Currently, the largest growth in percentage terms is being experienced by air traffic. In spite of the strong growth in demand, due to the limited space available and noise emissions, both the new construction of airports and the expansion of existing ones are

faced with significant, and in fact insurmountable, obstacles. The main challenge lies in the capacity problems of national airports that may be foreseeable in the long term."
 (Programmatic part, p. 12)

Regarding the **Swissmetro-NG project**, in the context of freight and underground transport projects, when asked to consider "SwissMetro-NG" as an option for Intercity public transport, the Federal Council has decided not to accept the request, since "*no specific projects are mentioned*" (p. 12 of the Explanatory Report).

Regarding **new technologies**, the Federal Council responded to the question of attaching greater importance to certain means and modes of transport, for example vacuum transport or motorised individual transport supported by new modes of propulsion, which was also formulated by Eurotube, that the request is partially accepted. The planning of charging infrastructures for new drive modes has been integrated into the development strategies (Chapter 4) (p. 16 of the Explanatory Report).

On page 16 of the Programmatic part, the Federal Council indicated that:

"In order to achieve the goals of Swiss energy and climate policy (climate neutrality by 2050), vehicles will have to be equipped with efficient, fossil-fuel-free drive systems. These systems will likely involve adapting charging and refueling infrastructure as new needs emerge, which will need to be taken into account in territorial planning."

While on page 37 of the Programmatic part, the Federal Council stated that:

"In their respective areas of responsibility, the federal government, cantons and municipalities shall allow the provision of charging and refueling infrastructure with renewable energy."

Regarding the proposals formulated (also) by the **Eurotube Foundation** of Collombey (VS), the Federal Council had the opportunity to note the following in its Explanatory Report:

- On the proposal to question the paradigm of mobility growth, considering that it could also be limited by the following measures: behavioral changes, promotion of mobile work, reduction of traffic peaks, promotion of jobs in rural peripheral regions, promotion of decentralized mobility offers, the Federal Council accepted it, strengthening these proposals in the context of the transport sector plan. (p. 23)
- On the proposal to optimize the collaboration between the institutional levels in the territorial planning of transport as well as the coordination with neighboring countries in the European institutions and in view of the progressive decrease in land use and the negative impact of transport on the environment and climate, the request was partially accepted by the Federal council, with integration of the contents in the programmatic part (p. 35).
- The proposal that transport infrastructures should be integrated into settlements and the landscape in the best possible way has been accepted by the Federal council with the principle that transport infrastructures, after consideration of the

feasibility of the costs involved, should be integrated into settlements and the open landscape wherever possible (p. 39).

- The proposal that the principle that, in the context of infrastructure expansions, the increase in capacity takes precedence over measures to reduce journey times has been partially accepted by the Federal Council, insofar as it states that any expansions must be aimed at increasing capacity and not speed (p. 41).

About the project of **Cargo sous terrain AG**, Basel-Stadt (hereinafter also referred to as **CST**), the Federal Council indirectly points out in its explanatory report the following about the guarantee of **efficient and functional logistics chains** in the context of **freight transport: transshipment platforms for connecting and bundling**:

*"From a Territorial planning perspective, this development and the intelligent connection between the various road and rail transport carriers and the **underground** freight transport system presuppose first and foremost the consolidation of intermodal transshipment platforms located close to centers, similar to passenger transport platforms. Intermodal transshipment platforms enable the movement of goods between individual transport carriers and the division of large batches of goods into smaller batches for capillary distribution or supply/disposal (and vice versa). Ideally, additional logistics services, primarily warehousing and order picking, can also be offered at transshipment platforms."* (Programmatic part, p. 33).

In the explanatory report, the demands of *Cargo sous terrain*:

- To pay more attention to underground **freight** transport, in the context of **underground** freight transport, was accepted by the Federal Council by making the relevant additions (p. 12).
- Mention of underground freight transport in the sections on trends in freight transport and technological progress has been accepted with additions (p. 26).
- To explain with sufficient clarity the term of **transport platforms** and related **links**, also requested by Eurotube, has been accepted by providing some basic indications on the location of logistics sites also for CST with reference to the concept of freight transport (p. 43).
- In the context of the development strategy, the request regarding the transport of **underground** goods and the reconciliation of the various interests at stake in the elaboration of the coordination sheets was not accepted as it does not fall within the scope of the transport sector plan programmatic part (p. 61).
- to take more account of his project, was rejected by the Federal Council, stating that not all specific projects are mentioned in the programmatic part and that these, if anything, can be taken into account in the part of the infrastructure concerned (p. 63).
- for further clarification concerning the modalities of adjustment in relation to specific issues was rejected by the Federal Council, stating that the modalities defined in the programmatic part must be able to be applied without distinction for each part of the infrastructure. (p. 65).

It is not only in the context of the territorial planning of transport in perspective 2050 that the federal government has not considered the technology of ultra-fast public transport in

atmospheric vacuum conditions: neither does it mention it in the document published on 28 January 2021 entitled "*Long-term climate strategy 2050*", a policy aimed at reducing greenhouse gas emissions based on the Paris Agreement.

<https://www.bafu.admin.ch/bafu/en/home/topics/climate/info-specialists/emission-reduction/reduction-targets/2050-target/climate-strategy-2050.html>

3) Some innovative projects concerned with vacuum or underground ultra-fast speed transport in Switzerland, and analogous others:

a) The *Swissmetro SA* project

The *Swissmetro SA* Project was initiated by Eng. Rodolphe Nieth of Lausanne, together with other enthusiastic engineers, politicians and entrepreneurs, in Geneva in Lausanne, in the two Federal Institutes of Technology in both Lausanne and Zurich and throughout Switzerland.

In the context of new ultra-high-speed transport technologies, the Federal Council and the SBB had supported from 1995 until the early 2000s the *Swissmetro AG* project based in Bern. This company, at its peak in 2002 with over CHF 6 million in capitalization, had the following purpose:

"Promoting the advertising and development of the Swissmetro transport system; acquiring the concession for the construction and operation of the Swissmetro; financing advertising and publicity measures and raising funds with a view to the realization of the Swissmetro; may acquire interests in other companies and acquire real estate." (Translated from French)

In 1997 *Swissmetro SA* filed to the Federal Council an application for a Franchise for the development and building a first section of magnetic levitation train in a partial vacuum underground tunnel between Geneva and Lausanne.

The project was conceived around the Swiss cross-shaped network, whose main section Geneva - Lausanne was to be the first one, which would be followed by studies on the connections Basel - Zurich, Geneva - Lyon, and others, with a view to quickly connecting the respective airports.

Several countries were interested in the *Swissmetro* project including Russia (St. Petersburg - Moscow) and Saudi Arabia with the aim to connect to Mecca. Considering that the company was born in 1974 and was established in 1992 as a spark of Swiss enthusiasm and at the dawn of the development of the internet and information technology, his development has been formidable.

Approximately hundred entrepreneurs -also foreigner- believed in the project and invested directly or indirectly more than 9.5 million CHF in research and development to obtain the concession for the first section between Geneva and Lausanne. A further investment of CHF 5.5 million was also provided by the federal government in the form of research and development services.

The decision taken by the Federal Council to follow only the route of the railway renovation project called "Rail 2000" in order to cover its costs, induced the Federal Council not to

continue, even on an experimental basis, the Swissmetro project. This put a freeze on any further private interest in investing in the project, also because no major infrastructure investment in this futuristic technology was conceivable in the foreseeable future.

The publication of the 2006 ETH Zurich study "**Report: European market study for the Swissmetro system phase I**", further contributed to breaking both the political and financial support of the federal government for the project.

<https://www.research-collection.ethz.ch/bitstream/handle/20.500.11850/23503/sr134.pdf?sequence=273&isAllowed=y>

In chapter 10.5 of its conclusions, the ETH study noted the following:

- The Swissmetro System in the (then) configuration was about 2,770 people per hour and direction, which would be insufficient and to absorb the demands of the current European high-speed corridors.
- Comparing the travel times with currently competing long-distance transport systems, the market segment for Swissmetro is in the 500 to 1000 km range.
- In relation to the trans-European network Ten-V with investments of more than 600 billion Euro for interoperable transport routes, the formation of alternative systems in relation to Europeans here is not a strategic objective.
- In Western and Central Europe there is a strong demand for high-speed corridors and it is not conceivable for Europe to invest in line infrastructure that competes with existing high-speed lines.
- The crucial investments from an underground structure would cost two to eight times more than the European high-speed lines, due to the high costs and the underground construction the development of the Swissmetro network would be very slow and could therefore develop its effect on the market only during a limited period. (Thanks to today's new technical developments, costs can be reduced to a similar extent as for railways).
- The revenues from the operation of a Swissmetro line would not be sufficient to refinance the infrastructure and the means of transport even in the most optimistic forecast; therefore, the Swissmetro system would not be profitable.

In the light of these results, the report considered the market potential for the use of the Swissmetro system in its then configuration in European long-distance transport and thus the relevance of the system for Europe as not given.

Thus, in Switzerland, the Swissmetro project has been at a political standstill ever since.

In December 2009, Swissmetro AG was put into liquidation, which ended in 2011 with the deletion of the company from the commercial register.

In 2012, Elon Musk launched the Hyperloop project with his text "*Hyperloop Alpha*". Simulations with Pods (vehicles for about twenty people) moving at ultra-fast speed in low-pressure tubes mainly placed above the ground have been and are being conducted in collaborative and open-source mode.

https://www.tesla.com/sites/default/files/blog_images/hyperloop-alpha.pdf

Richard Branson is also working on the project with "Virgin Hyperloop", the American "Hyperloop Transportation Technologies HTT" and the Canadian "Transpod", among others.

In Switzerland at present, without wanting to be exhaustive, we have at present several groups active in different ways in the field of ultra-fast speed passenger and freight transport.

These, in different ways, refer to the historical Swissmetro project.

b) The **Association group of interest (Interessengemeinschaft) SwissMetro-NG** founded in January 2018, based in Klingnau (AG), has as its purpose:

"The interest group SwissMetroNG is a non-profit organization. Its purpose is to promote a high-speed transport system in Switzerland based on the technologies developed by Swissmetro (Eng. Rodolphe Nieth, EPFL and ETHZ) and VacTrain (Swiss Transportation Research Institute). The SwissMetro-NG interest group maintains the necessary contacts with the federal government, cantons and municipalities, as well as with other institutions, individuals and investors interested in a Swiss high-speed project. The goal is also to find interested parties for the foundation of a joint stock company for the planning, construction and operation of such a system in Switzerland. In this context, the SwissMetro-NG community of interest serves to prepare the groundwork for such a foundation. The interest group can establish branches and subsidiaries in Switzerland and abroad and participate in companies in Switzerland and abroad as well as conduct all business directly or indirectly related to its purpose. The community of interests may purchase, encumber, sell and manage real estate in Switzerland and abroad. It may also undertake financing for its own account or for the account of third parties and conclude guarantees and surety bonds for subsidiaries and third parties." (Translated from German).

Inspired on the original Swissmetro project, The project consists of a form of transition from the train car to a magnetically levitated, underground "fuselage" having the characteristics of a space capsule, i.e., an underground sub-mesospheric pressure tube for the very-fast transportation of human beings in magnetically levitated pressurized capsules".

A sort of "translation" of "space navigation" technology, underground.

The speed inside these underground structures under vacuum with magnetic levitation, if with Swissmetro with partial vacuum could be assumed in 500 km/h, increasing the vacuum in the sliding tube, -theoretically- it can be assumed to exceed even the speed of sound (1'235 km/h), even if the average operating speeds would probably be subsonic (under 960 km/h) or even trans-sonic.

c) The project **Swisspod Technologies SA** founded in March 2019 and headquartered in Monthey (VS) is oriented to Hyperloop technology and indicates as different partners the Swiss Federal Institute of Technology in Lausanne (EPFL), the European Commission, the University of St. Gallen, and Cargo sous terrain. As its purpose it indicates:

"Provision of services, development and sale of solutions, products and software in particular in the field of technology and transport, especially in the field of atmospheric and low-pressure transport." (Translated from French)

Recently at the EPFL, a track consisting of a 40-meter-diameter toroidal ring was inaugurated to test Hyperloop high-speed transport on a 1:6 scale. EPFL Prof. Marcel Jufer, former co-founder of Swissmetro, is also part of the advisory board.

d) The Project followed by **Eurotube Foundation**, founded in May 2019, and based in Collombey (VS), (municipality next to Monthey), with research institute in Zurich, has as its purpose:

"To promote the sustainable development of high-speed transport systems by fostering research and development with the construction of non-profit infrastructures; to financially support research projects aimed at building technical prototypes in the field of high-speed vacuum transport and efficient transport systems in general; to enable the construction and operation of non-profit infrastructures for publicly accessible research and development in these fields" (translated from French)

Its website shows that the Eurotube Foundation is part of the Hyperloop development program and is benefiting from an investment of 6 million francs for the construction of a 3-kilometer experimental track at Colombey-Muraz in Valais, through the Federal Department of Education, Research, and Innovation. Prof. Günther Detlef, vice-president of research and corporate relations at the Swiss Federal Institute of Technology Zurich (ETHZ) since 2015, has also been a member of the Foundation Board since June 2020. Among those who collaborate with the foundation from the site reports the Swiss Federal Railways (SBB), the ETHZ, the Paul Scherrer Institut (PSI) in Villingen (AG), the High School of Applied Sciences of Western Switzerland (HES-SO in Lausanne VD) and the Canton of Valais, among others.

When asked if Eurotube is similar to Swissmetro, they write no, as the project was initially presented by Eng. Rodolphe Nieth and started in 1998 after being submitted to the Federal Council but was then interrupted due to lack of political and financial support. They add that Eurotube is a research foundation and a technological incubator directly supported by the State Secretariat of Education, Research and Innovation (SERI), and that the idea behind Swissmetro and Eurotube is the same, advanced as technological development.

e) According to a different methodology, but still focused on non-high speed underground transport, the project in advanced development **Cargo sous terrain AG** should certainly be mentioned

Cargo sous terrain AG, initially established in 2015 as an interest group association, was transformed in March 2017 into a limited company based in Basel, which has as its purpose:

"The purpose of the company is the planning, authorization, construction and operation of a total underground and ground logistics service with other combined means of transport, as well as logistics and forwarding services in Switzerland and abroad. The company may

open branches in Switzerland and abroad and enter into all transactions and contracts that may be suitable to promote the purpose of the company or that are directly or indirectly related to it and may also undertake financing on its own behalf or on behalf of third parties, enter into guarantees and warranties for subsidiaries and third parties, purchase, manage and dispose of real estate. The Company may acquire, encumber and manage copyrights, patents and licenses of all kinds.” (Translated from German)

"Cargo sous terrain" is a futuristic project aimed at creating a new logistics system to be developed initially on the Swiss Plateau by integrating the existing systems (road and rail). It is designed primarily to meet the future needs of the retail trade and parcel logistics industry (primarily online commerce) by enabling a continuous flow of delivery in contrast to current systems. Through autonomous and disturbance-free operation (in a tunnel) and an innovative retail distribution system (city logistics with new distribution systems based on the use of automated and emission-free vehicles), CST will enable a substantial improvement in efficiency and reliability.

The structure of the system is intermodal and modular and consists of a main route (subway metro) connected with individual transshipment stations ("hubs") and a retail distribution system (integrated city logistics). At the transshipment stations, palletized goods reach the surface for distribution to end customers. A first stage (by 2030) plans the construction of a tunnel about 65 km long between Niederbipp/Härkingen and the city of Zurich. The completion of the work (at the horizon 2050) plans to extend the route between St. Gallen and Geneva with branches to Basel, Lucerne, and Thun.

The promoting association CST has elaborated several bases in a feasibility study (POC II, 2016) and had concluded that such a project, in addition to relieving the current freight transport system, is technically feasible and economically manageable and can be financed by private means.

After examining the possibility of regulating the specific legal requirements for the implementation of the CST project in a special law, DETEC carried out an independent study to analyze the effects of the CST on public interests (transport, economy, environment and Territorial planning) and formulated the requirements for future implementation in a legislative message that was subsequently formulated by the Federal Council in 2020. (Abstract taken from the Summary Economic aspects and impacts of the Cargo sous terrain (CST) project of the Federal Office of Transport of 23rd September 2016).

In fact, in 2020, the Federal Council published the message of the **Underground freight transportation facilities Act** and the corresponding draft law. This is toward the end of parliamentary deliberations, expected soon.

<https://www.bav.admin.ch/bav/it/home/pubblicazioni/comunicati-stampa.msg-id-80871.html#downloads>

https://www.parlament.ch/de/services/news/Seiten/2021/20210930172348844194158159038_bsd215.aspx

This law will form the basis for inter-cantonal planning of underground freight transport routes. The Federal Council and Parliament have given clear signals of willingness for such projects to develop, considering however that these must be private, not public.

It should be noted that in the context of this federal opening, any possibility of underground transport of **passengers** is implicitly excluded. The federal opening is limited to **freight**. On the other hand, the proposed law is silent on the speed of underground freight transport, nor on the technology adopted. It does not seem that this law explicitly excludes the application of ultra-fast speed transport technology of goods in underground tunnels in a vacuum.

In this law the federal government provides the possibility for the promoters to proceed with expropriations of land properties based on the federal law on railways, it establishes procedures for inter-cantonal planning coordination, and that -basically- such projects must be private.

The law does not prevent a public institution from participating in a private limited company whose objective is to build such an underground freight transportation facility in a certain canton or in certain municipalities. The corresponding regional and cantonal political debate is already underway.

In addition, there are several other companies or projects revolving around the topic of building underground infrastructure operating under low pressure that are gradually emerging, also in Switzerland.

In Europe there are also several companies that revolve around the Hyperloop open base project that carry out research development, also with the collaboration of the strong European research funding, including massively in Spain and Holland, among others.

The non-signing of the institutional agreement with the European Union by Switzerland during this summer, has determined, for our country, the loss of the possibility of being able to participate as well as receive substantial European funding in the context of new disruptive technologies in the field of rail and public transport.

The same can be said of the United States. Having recently launched a 1.2 trillion-dollar infrastructure relaunch plan, including in the public transport sector and, therefore, trains. It is therefore very likely that massive investments will take place in the context of research and development of new ultrafast transport technologies in a rarefied air environment.

It is also of this summer the news of the first Maglev train in Quindao, Shandong province in the People's Republic of China, able to reach 600 km/h, in ordinary atmospheric conditions. If this is the imaginable speed using the magnetic suspension technology, it cannot be excluded that the same in conditions of strong reduction of pressure therefore air resistance, can greatly exceed this speed as even supersonic speeds are hypothesized.

4) Evaluations

In the programmatic part of the transport and territorial planning 2050 the Federal Council does not mention any type of project for the transport of passengers at ultra-fast speed in vacuum tunnels, neither like Swissmetro-NG, nor like Eurotube or others.

The proposal made by Eurotube that the principle that, in the context of infrastructure expansions, capacity increases take precedence over measures to reduce travel times,

was partially accepted by the Federal Council, which indicated that the indication was somewhat relativized by referring to travel times and operational aspects. (See Explanatory Report p. 41).

It is not clear whether this -relative- indication enshrines the principle that it is preferable to expand the capacity of existing facilities rather than to increase their speed and thus reduce travel time.

Nor is it clear whether this approach means that, in principle, existing systems should be expanded rather than new, faster ones built.

Finally, it is not clear whether the skepticism regarding the improvement of travel time is dictated by an a priori consideration of environmental and economic unsustainability of ultra-fast speed infrastructures.

The only openness on the part of the Federal Council to underground freight transport techniques is when it mentions "*projects for underground freight transport, which could partially supplement existing freight transport chains*". Various formulations proposed in this regard by *Cargo sous terrain* have been considered by the Federal Council.

It appears, therefore, that the system of underground freight logistics proposed by *Cargo sous terrain* enjoys the political support of the Federal Council, while the same cannot be said - for the moment - for similar systems of ultra-fast speed passenger transport in low-pressure tunnels, whether outside or underground.

It should be remembered that the document "*Mobility and Territorial Development 2050: Transport Sector Plan, Programmatic Section*" published on 20th October 2021 forms the basis for the coordination of territorial development, the environment and transport infrastructure of national importance. Part of its contents are binding for the authorities.

The document published by the Federal Council thus synchronically represents the objectives of territorial development and transport in the acquired state based on the current situation of consolidated federal and cantonal projects, under construction or planned, in the perspective of the federal executive power, for the next 30 years.

Its contents are binding not only on the federal executive authorities, but also on the cantonal, city and municipal authorities, which are in principle required to consider the federal projects in their own cantonal master plans and municipal master plans.

Although the cantons and/or cities and/or municipalities, on the basis of their residual autonomy, have room for manoeuvre that does not conflict with projects of federal interest, they can also develop projects that they consider to be of cantonal or municipal public interest.

Since ultra-fast speed transport projects consist in infrastructures that are often trans-regional, cantonal and international, the absence of a supra-structural regulation, such as the federal one, which establishes the rules, leaves many questions open, which could economically and legally sink any project from the beginning.

It is therefore unimaginable that a canton could itself create the regulatory basis to allow the construction of an ultra-fast speed underground transport infrastructure on its territory.

The federal government should determine whether the technology of very high-speed passenger transport under vacuum can be considered a "*public work*" in the interest of the

federal government according to Art. 81 of the Federal Constitution and whether a magnetic levitation transport system running at ultra-fast speed through such a vacuum tunnel is comparable to a “*railway*” in accordance with Art. 87 of the Federal Constitution and, therefore, falls within the exclusive federal jurisdiction.

This, regardless of the possible disruptive force that such a new transportation system could partially have towards the actual success of FFS/SBB, owned by the Confederation itself. Switzerland cannot afford to wait and watch what happens abroad.

In view of what has been decided about the *Cargo sous terrain* project, it is likely that the federal legislative competence is given also in case of underground structures of ultra-fast speed passengers transportation in vacuum tunnels.

The federal competence should be applied with a certain urgency so that the rules are clear for all entrepreneurs who want to launch themselves in this new ultra-technological sector of public transport.

In any case, it is up to the federal parliament, and - casually - to the cantonal and municipal parliaments to determine the trends and developments in the relationship between traffic patterns and territorial planning. Also, if necessary, in opposition to the government.

The Federal Parliament, regardless of the planning described by the Federal Council, has not only the power but also the duty to modify the planning, before 2050, if it decides to change the excessively cautious approach of the Federal Council.

In fact, as noted in the planning section, the implementation of new technologies must be accompanied by an appropriate regulatory framework and corresponding measures to achieve the desired goals of increased efficiency combined with a decongestion of the overall transportation network.

The long lead times for the cascading adaptation of planning instruments in our federal structure make it even more necessary for the Federal Council and the Federal Parliament to act proactively.

In our rule of law State, we do not have the ability to impose new transportation technology projects without possibility of judicial recourse against them. Therefore, the timeframe before the start of the operational implementation, already from a legislative and judicial point of view, risks to be very -excessively- long. Time that, if excessive, could prove fatal to the economic stability of the project's financing.

It is curious, to say the least, that the Federal Council, in the context of the *Cargo sous terrain* project, relied on a feasibility study prepared by the association *Cargo sous terrain* itself, to initiate their study. Why was the study not immediately developed by the federal government experts?

After the constitutional basis on the federal railways in 1848 and the corresponding law of 1872, it was precisely the legal basis that gave rise to various private initiatives that allowed the construction and operation of various rail networks, including the one to which Alfred Escher's group belonged, which was politically active both in the canton of Zurich, in the Federal Parliament, in the Federal Institute of Technology (in its inception phase), as well as in the commission of experts called by the Federal Council to formulate the proposal for the Railways Act, later adopted by the Federal Parliament.

It is difficult to understand why the Federal Council has not appointed a commission of legal and technical experts (including EPFL and ETHZ) to outline a proper framework for new innovative transportation technologies, analogue with what has been done in the 19th and 20th Centuries for the Swiss Railways. This is careless when considering the prospect of the development of such revolutionary passenger transport systems and the possible benefits incl. the worldwide export and the global CO₂ Impact.

Regardless of the real will of the Confederation to launch itself into these enterprises, if such systems will develop in Europe, China, the United States or Canada and if Switzerland will then want to integrate, in “tow”, into such innovative networks, it will have to have a regulatory framework apt to allow the territorial access and integration of such ultra-fast speed infrastructures from neighboring States. Switzerland, as European historical and geographical crossroad, also has the moral duty to forecast and integrate these new disruptive transportation developments trends.

The federal parliament has in the past, after the experience with Swissmetro SA, not forgotten the project. In fact, on 3rd April 2017, the Senator from the canton Uri, Josef Dittli, had submitted a postulate entitled "*Federal Mobility Cross and Railway Network Concept*".

<https://www.parlament.ch/fr/ratsbetrieb/amtliches-bulletin/amtliches-bulletin-die-verhandlungen?SubjectId=40577>

He asked the Federal Council to develop, through the preparation of a master plan, a rail network concept. He also asked that in an additional chapter the executive should consider other **visionary ideas**, such as Swissmetro (new generation) or Rail 2000 plus, which should be examined from the point of view of opportunity and feasibility.

Also, the Senators Claude Janiak (BL) and Konrad Graber (LU), among other Swiss politicians, also proposed similar efforts.

Although the postulate was accepted by Parliament, the Federal Council has never reconsidered the possibility of creating a formal legal basis so that this new type of passenger transport could be the subject of research, development, and implementation, nor has it ever taken an official position on the subject. Silence confirmed even in the recent Strategic "*Transportation Plan 2050*".

Ultra-fast passenger transport systems such as Swissmetro, SwissMetro-NG and Hyperloop were not even mentioned in the "*Transportation Plan 2050*", despite parliamentary decisions 17.3262, 18.087 and others and despite the fact that this is a Swiss Invention by EPFL Engineer Rodolphe Nieth, which preceded Hyperloop by about three decades and which is technologically still ahead, even despite this long delay. There is also no mention of passenger transport in the *Underground freight transportation facilities Act*, enacted to permit the development of the *Cargo sous terrain* territorial project planning. It can thus be assumed that the federal government is presently not considering the public interest in ultra-fast underground transportation systems for passengers.

As in the case of *railways* in the twentieth century, the time is ripe for the Federal Council to appoint a commission of experts to evaluate and prepare the legal basis for the development of ultra-fast speed passenger transport systems in underground tunnels.

The G20 meetings in Rome and COP 26 in Glasgow, but also the events in preceding years (Paris 2015, etc.) should have alerted the Federal Council. Switzerland has the capacity for the relevant research and development within the Federal Institutes of

Technology, Applied Sciences universities and Swiss Engineering and Industrial companies. Also has and can still adopt proactive strategies aimed at reducing the impact of intercity and transcontinental transportation on the climate in our country and on a global scale, without having to wait for private individuals to propose solutions to better manage the future of public transportation in Switzerland and abroad.

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