The limits of new tram network in Geneva

Vincent Kaufmann, LaSUR - EPFL
Marc Antoine Messer, CEAT - EPFL
Ander Audikana, LaSUR – EPFL

Conference paper STRC 2014

STRC

14th Swiss Transport Research Conference
Monte Verità / Ascona, May 14-16,2014

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Vincent Kaufmann
LaSUR - EPFL
Lausanne

Phone: +41216933232
Fax: +41216933840
email:
vincent.kaufmann@epfl.ch

Marc Antoine Messer
CEAT - EPFL
Lausanne

Phone: +41216933232
Fax: +41216933840
email:marc.messer@epfl.ch

Ander Audikana
LaSUR - EPFL
Lausanne

Phone: +41216933232
Fax: +41216933840
email:ander.audikana@epfl.ch

Abstract

On 11 December 2011, Geneva Public Transport (TPG) conducted a complete overhaul of their network, in particular changing the operating system with trams passing from an axial operating system to an individual line operating system. This important change has resulted in a reduction of more than half the number of tram lines from 7 to 3, and caused the elimination of direct connections. The implementation of the new network generated a strong user resistance (evidenced by numerous letters from readers, positions on social networks and parliamentary interventions in the municipalities concerned).

Based on a mandate from the City of Geneva, this paper offers a critical analysis of the change in the network operating Geneva tram system and proposes technical and institutional recommendations, in the short and medium terms, to improve the attractiveness and management of the Geneva tram network:

(1) The Geneva tram network seems marked by what could be called the tyranny of small decisions. Lack of long term vision seems to dictate the way trams run in Geneva. Both lack a clear definition of the role of the tram in the mobility of the urban area, but also will enhance it both as a tool for territorial development and urban transformation, as well as for clear guidance on technical choices guidelines to operate.

(2) The network of public transport in Geneva today seems to be at the limit of what can be done in terms of regulation. Network capacity to develop seems particularly compromised by the difficulty in regulating vehicles. Commercial speed of trams in Geneva is very low, which limits the attractiveness of the network. The lack of a real public transport priority in traffic and the massive presence of automobile traffic in the downtown area explain these difficulties.

(3) The lack of comfort, difficulty in orientation and safety issues are key characteristics of the tram network's Transfer points, a situation which existed before the change of the operating system and is not directly related thereto. The removal of some direct connections and increased flow of users in these poles made the design problems more acute, especially since they are often crossed by major traffic flows.

Keywords

Mobility – Urban Public Transport – Tram Network – Geneva

Objective and methodology

The objective of this paper is to present a critical analysis of the reorganization of the tram network in Geneva in 2011.

The study is divided into three main parts.

- Review of the arguments. To begin, we thoroughly examined the arguments cited in favor of changing the operating system. This systematic research was done using open access documents (master plans, other planning documents, reports and legislative works including minutes of the High Council and its Transportation Commission), as well as press articles, information brochures and the official communications from the Canton and TPG (Transports Publics Genève). To assess the comprehensiveness and pertinence of the arguments, a complete list was submitted to TGP's general management. Unfortunately, we were not able to do the same with the Canton.

- Analysis of the transfers and their impact on the attractiveness of public transportation. An analysis of the flows in the Geneva network before the change and the lessons that can potentially be learned was done as part of the second phase of the study. The data from the investigation was then analyzed to determine the effects of the transfers on the attractiveness of public transportation in Geneva.

- Critical analysis of the arguments. The third part aimed to serve as a general critique of the current functioning of the tram network in Geneva, as well as the decision and application of the change in operating systems. The critical analysis of arguments in favor of the change is based on lessons learned from the second phase of the study and hearings with Geneva interest groups, including representatives from environmental associations and municipalities.

This paper is divided into three points: 1) a presentation of the history of decisions and the reasoning cited by the authorities, 2) an analysis based on origin-destination flows (O-D) and a secondary analysis of investigation data on the relationship between modal practices and line changes in Geneva, and 3) a presentation of the main findings of the analysis.

Towards a change of operating systems: history and arguments

We will begin by examining the history of and justifications for the change of operating systems of the tram network in Geneva.

Legal context of the change of operating systems

The March 17, 1988 Cantonal law on public transportation networks is not explicit with regard to the tram network's operating system. In accordance with the provisions specified in the law, the State Council planned the development and functioning of the network in a public transportation master plan (PDTC) for the duration of the standing parliament. While the adoption of the PDTC is the responsibility of the State Council, the latter must present it to the High Council, which issues recommendations by way of resolution following its adoption. The 2007-2010 PDTC, adopted in April 2006, does not mention the change. It is only in the objectives and priorities for the development of the public transportation offering in the 2011-2014 PDTC that the need to reorganize the network's operating system is mentioned for the first time.

Adopted by the State Council on October 7, 2009, the new version of the public transportation master plan was submitted to the High Council. Concerns about the operation of the future network and what were deemed unsatisfactory responses of the TPG and the Mobility Department fueled a strong debate in the Transportation Commission. The consensus proposed by the commission was not accepted in the plenary of the High Council, against the backdrop of a left-right debate, and the project was remanded to the Commission. The Commission then prepared a resolution requiring the reversibility of the change of operating systems. It was with this requirement that the High Council finally adopted resolution n.609. Bearing in mind this request, the State Council made corrections to the submitted project and adopted the final version on June 23, 2010. On the basis of this master plan, the State Council drafted and signed a service contract with TPG for the 2011-2014 period. Pursuant to Article 36 of the law on TPGs, the service contract was then submitted to the High Council. After debate thereon, the High Council accepted the service contract on December 2, 2010, nonetheless amending the fare increase provided for in the contract by pushing back the change from 2010, as originally planned, to 2011. Annex 5 of the service contract mentions the change of operating systems and the decrease to three tram lines in December 2011.

It should be noted that the decision to change operating systems was thus made in conformity with the cantonal legal framework. The State Council - by adopting the public transportation master plan - and the High Council - by approving the service contract - both clearly validated

the change of operating systems and its introduction starting in 2011. While this important change generated strong opposition during the High Council discussions on the PDTC, this was no longer the case less than a year later, when it had to adopt the service contract.

Arguments in favor of a single line operating system

The change of operating systems in Geneva's tram network was therefore part of a multi-year vision, and was implemented with cantonal planning tools. Arguments in favor of this change can be identified and divided into three different types. In planning documents like the 2011-2014 PDTC, emphasis is placed on technical arguments in particular, (i.e. referring to the network's management and operation). These most notably include the network's compliance with regard to increased needs in the middle term, and the separating of lines to avoid chain-type disturbances by domino effect. The arguments of comfort, improved readability of the plans and increased service frequency, while mentioned as early on in the planning documents, are especially highlighted during public communications to inform users starting in autumn of 2011. These were the arguments most often cited in press conferences and articles following the implementation of the change in operating systems. Finally, a third type of argument runs through this debate: namely the creation of a "Greater Geneva" and of strengthening this metropolitan hub within the network of European cities, most notably with the issue of the tram network running like a subway.

Adaptation to future developments

The main argument for the reform, strongly emphasized in the 2011-2014 PDTC, is the network's adaptability to future developments in the public transportation supply. The change of operating systems would thereby help develop strong routes to join up with trolleybus and regional bus networks, to cover the entire city. In a small double-sided information pamphlet entitled "*Genève grandit, son réseau tpg aussi*" (October 28, 2011), Ms. Künzler, the State Councilor for the Department of the Interior, Mobility and the Environment, mentions the decrease to three tramway lines as "the best way to supply the territory," particularly given the planned extension of future lines to France and connections to the new RER stations planned by the CEVA for 2016-2017.

At the hearing before the High Council's Transportation Commission in 2010, TPG representatives estimated that the current meshed operating system stunted the network's development. In its presentation before the Commission, General Management for Mobility (DGM) stated that the arrival of the new TCOB (Cornavin-Onex-Bernex tram) was likewise a "sure opportunity" to implement the new individual-line network.

The separating of lines and the struggle against the domino effect

There is a second argument with regard to the operation of the tram network: that of the possibility of partitioning the lines. This offers two advantages. Firstly, it would help combat the domino effect, whereby a disruption on one part of the network has repercussions on all of the lines. Secondly, it would make it possible to develop and modify the service frequency on one line without impacting the whole time table.

The domino effect argument was particularly used in TPG communication following the new network's launch and the numerous incidents that marred operations in December 2011. This argument was also cited as one of the three benefits of the new network in the "*Genève grandit, son réseau tpg aussi"* brochure. The new network would be more stable than the old one, and thus more reliable.

On its first day of operation, these arguments would be directly tested in the field. Effectively, on Monday, 12 December, several accidents occurred, including a collision between a car and a tram in Chancy. Mr. Anhorn, the TPG communications officer, said in an interview with the *Tribune de Genève* the following day that the organization of replacement shuttles had been facilitated by the new network. Further to the problems on Monday of the first week, the network encountered major problems for the entire month of December. On December 21, the *Tribune de Genève* said that, despite the partitioning of the lines, the network had seen "an abnormal series" of problems. However, it is difficult to determine what impact these incidents would have had on the old system.

The partitioning was also intended to give the lines freedom to develop independently, as the 2011-2014 public transportation master plan highlights, thus making it possible to adapt the supply to actual needs without modifying the entire timetable.

Increased frequency

Increased frequency and TPG services in general are often used as arguments for changing operating systems. In an interview with the *Tribune de Geneve* on February 8, 2012, Ms. Künzler said the new network had led to a 25% increase in service. The increased frequency argument is also very much linked to issues of line partitioning (making it possible to increase frequency on a given line according to its specific needs without upsetting the entire schedule) and simplified management of the network for TPG. The latter rightly argues that, with a nine-line network, it is much more difficult to increase frequency on a single line at a given stop.

Logically, the increase in frequency is the main advantage cited in the "*Genève grandit, son réseau tpg aussi*" brochure and, naturally, the one that appeals most to the user. With the new

system, frequency could be increased to one tram every 3 ½ minutes (or 16/passengers/hour) during peak times. The 2011-2014 PDTC's explanations and TPG communication are ambiguous with regard to the question of increased frequency. The PDTC cites need-based service frequency and the fact that the lines "can develop independently" as advantages of the new system.

The increase in service frequency should first and foremost be understood as an adjusting of supply to demand on certain lines, and the possibility of decreasing frequency on others in order to balance the schedule. TPG clearly saw it as a significant increase in supply. In an interview with the *Tribune de Genève* on December 24, Mr. Bonzon, the general director, said that TPG could respond to the increase in the demand either by making the vehicles longer or increasing service frequency. In a later interview (March 1, 2012), he stated that he considered that maintaining the meshed network and increasing the supply were not compatible, and that TPG had therefore chosen a "massive increase in supply for the entire network," knowing that this would entail eliminating the Carouge/Rive – Cornavin connections. The rhetoric surrounding the argument for increased service frequency should therefore be seen as a quantitative increase (the number of passing vehicles per hour at a given stop), and not as a qualitative improvement (more destinations at a given stop without transfers).

Simplification

The simplification argument is two-fold. Firstly, it relates to simplifying the management of a network that only has three lines. Secondly, it refers to facilitating the network's use for riders. With the individual-line operating system, each stop (with the exception of hubs) is only served by one tram line. In their statement, TPG considers that, with the introduction of the TCOB tram to Bernex, the meshed operating system would have created the need for nine lines (the 2011-2014 PDTC estimated eight). A three-line system would be easier for them to run, and undoubtedly facilitate the creation of an overall schedule. Mrs. Künzler also stated the argument of easier use for passengers in her statement, noting that, from that point on, commuters would no longer mistakenly get on the wrong tram. Thus, both getting on the right tram and reading the network map would be easier as there would be fewer lines. Users could therefore get on any tram that arrived at their stop without thinking, as in a meshed system.

Cost reduction

A financial argument for changing operating systems was also made. This particular argument was mainly present in the planning documents and parliamentary debates, but was largely absent from communication to the public. The 2011-2014 PDTC mentions the savings the new system would generate, both in terms of investments and operating costs, estimating that it would be possible to bring operating costs down by 12%, compared to a meshed system. On February 13, 2012, the *Tribune de Genève* estimated an annual savings of roughly 17 million CHF. These savings would largely result from more effective management of service frequency, according to Mrs. Künzler's testimony before the High Council's Transportation Commission, which the *Tribune de Genève* took to mean also reducing the number of drivers and, hence, potential savings.

Before the same commission, DGM (Direction générale de la mobilité) representatives estimated that a "more targeted" adjustment of the supply to the demand would reduce costs by roughly 10%. Finally, the new system would provide savings in terms of investments. During their hearing before the Commission, TPG representatives estimated that savings could be made on the TCOB project if the new operating system were to be adopted. Indeed, several items in the building permit request were removed, such as a P + R Bernex loop allowing mono-directional trains to go back the other way, and a dual carriageway at Stand. The investment savings for not building a dual carriageway was estimated at 3 million CHF. Mrs. Künzler also mentioned the initial infrastructure savings estimated for the TCOB during her hearing.

Geneva becomes a metropolis

Finally, an additional argument can be found more or less explicitly in the planning documents, hearings and communication to the general public: seeing the change of operating systems as a symbol of Geneva's move towards taking a more prominent place on the European stage. Mrs. Künzler summarizes it well in "*Genève grandit, son réseau tpg aussi*," stating that "this resizing (from 7 to 3 tram lines) symbolizes the metropolis Geneva has become." This assertion seems to follow the same logic as the reference to the subway in this same brochure, as well as press statements, but is totally absent from the planning documents. The new tram system with its individual-line operating system, similar to that of the subway, would logically put Geneva on par with major European cities whose collective mobility was originally conceived of in terms of the subway. This "replacing" of a tram system by a tram system that functions like a subway also serves to distinguish Geneva from other Swiss cities where (with the notable exception of a single line in Lausanne) the subway has never won against the tram.

While it is difficult to imagine to what type of audience this argument would appeal, we might be able to compare it to the recent initiative which led to renaming the Franco-Valdo-Geneva

agglomeration project "Greater Geneva." The project would make the Geneva agglomeration more like French-style agglomerations (and Lyon specifically), thus distinguishing it from other Swiss agglomerations. Hence the argument is not to improve the system for technical reasons or use comfort, but for the image the network was intended to reflect of Greater Geneva and its development. This third type of argument - that of the birth of a Geneva metropolis - is clearly aimed at actors involved in the city's economic promotion or image-conscious local politicians, and has little to do with changing operating systems.

Other arguments

Other, less detailed arguments are mentioned in planning documents and communications to the public. One such argument is the increase in commercial speed, which is included in the objectives linking the TPGs between 2011 and 2014, in the service contract signed with the State of Geneva. In Annex No. 6, the TPG agree to increasing the overall commercial speed of their vehicles by 0.25 km/hr. in 2011, 0.5 km/hr. in 2012, 0.75 km/hr. in 2013 and finally +1 km/hr. in 2014. In their hearing before the Transportation Commission, TPG representatives cited the increase in commercial speed as an argument for the new operating system. The matter of increased commercial speed is mentioned in several press articles (for example, a feature article in the *Tribune de Genève*, February 13, 2012). However, it is impossible to determine how the three-line operating system technically facilitates increasing transport speed of trams.

Analysis of transfers and their impact on the attractiveness of public transportation

To analyze the impact of transfers on the attractiveness of public transportation, two further investigations were conducted: an analysis of origin-destination flows, an analysis of the effects of transfers on the attractiveness of public transportation in Geneva based on research results.

Analysis of origin-destination flows

An analysis of users' origin-destination flows on the tram network, based on the origin-destination study done by Test SA in 2008, allowed us to make the following observations on the tram network: line 12 had the highest traffic volume, with 19,900 people between 4 and 9 p.m., the second busiest being the former line 13, with 11,000 users between 4 and 9 p.m.

Roughly one third of trips on the TPG network had at least one connection. The vast majority (92%) involved only one transfer, while 8% of trips involved two or, less frequently, three changes. This distribution indicates that line changes are particularly penalizing for public transportation use in Geneva (for trips requiring more than one line change, there are virtually no users), which we will come back to in point 3.2.

Besides the fact that line 13 syphoned off a large number of passengers, two useful lessons can be learned from this analysis.

- Quantitatively, Cornavin Station is by far the network's most important exchange hub, with more than twice as many ascents and descents as Rive or Bel-Air. This is largely due to the fact that train use has increased considerably in recent years in the Geneva region. Connecting this exchange hub is therefore of particular importance.
- For passengers boarding at Cornavin, the stop where most people exit between 4 and 7 p.m. is Moillesulaz, the terminus of the old line 16. This means there is a steady demand between the station and the Annemasse region, demonstrating the need for a direct connection on this line.

The impact of transfers on the attractiveness of public transportation

Line changes are one of the most difficult issues for public transportation networks and tend to be their Achilles' heel, insofar as they adversely affect how they are perceived, their performance and their attractiveness as compared to the automobile.

The investigations and research we have done since the mid-90s have allowed us to identify a set of possible levers for improving public transportation use and, more specifically, the importance and impact of transfers.

Speed is essential in modal choice, but the perception of this speed is detrimental to the image of public transportation. Thus, comparative research on the possibility of generating a modal shift in Bern, Geneva, Grenoble and Lausanne (Kaufmann and Guidez 1998, Kaufmann 2000, Munafo & al. 2011) illustrates that people tend to use their car when the car is actually faster than public transportation (in Bern this trend is less clear). However, when public transportation is faster, it is used only 50% of the time in Geneva, Grenoble and Lausanne, while 80% of respondents in Bern said they used it.

The relationship between travel time and modal practices is strong, and thus is a means of impacting modal practices. Its operational efficiency, however, is mitigated by the fact that travel time is seen in a biased manner and in many cases where public transportation is actually faster than the car, this fact is not perceived by users.

Several studies we have conducted in recent years show that perception of the quality of time and the "speed" at which it passes (its duration) are linked (Kaufmann 2000, Joly et al. 2007, Wallemacq 1991). When travel time allows for or involves an activity (driving, reading, making phone calls, etc.) it is perceived as "free," and hence passes quickly (sometimes even too fast!). When travel time does not allow for partaking in for such activities, it is simply perceived as a long wait and passes slowly. This time, which is often the privilege of public transportation, is always perceived as too long, even if it lasts only a few minutes. Surveys on this topic highlight important differences between urban public transportation and the train in terms of the comfort of travel time.

For urban public transportation, if one considers the perceptual biases of travel time as indicators of the past experiences, surveys attest to the existence of different social frames of perception for the car and public transportation (O'Farrel and Markham 1974, Fichelet 1979, Kaufmann 2000, Flamm 2004):

- Travel time by car is highly underestimated, a perception that does not vary according to frequency of use or socio-professional category.

- Conversely, travel time in public transportation is highly overestimated, particularly as the number of transfers is high.

The perception of travel time on public transportation is clearly linked to the number of transfers. The greater the number of line transfers, the greater the overestimation of travel time, thus confirming the link between the spatio-temporal constraints linked to the use of public transportation and travel time.

In Geneva, studies show that not only is perception bias of travel time great, but that it is also linked to the number of line changes. Generally speaking, the attractiveness of public transportation greatly decreases with the first line change, which has to do with the long distances between stopping points in exchange hubs (which, moreover, have greatly increased in recent years, especially at Cornavin), high traffic flows at major transfer points, slow speeds (which further hinder the acceptability of transfers) and insufficient furniture at stops, and shelters in particular.

Biased perception of travel time and the negative impact of transfers on public transportation's modal share are closely linked to the intrinsic characteristics of car mobility and other individual modes (scooters, bikes, etc.) - which allow for continual movement - versus urban public transportation which, by definition, is discontinuous (Gotz 2007, Tertoolen 1996).

General Lessons

The following four points can be considered as general lessons.

The tram network is a victim of the tyranny of small decisions

Geneva's tram network seems to be marked by what could be described as the tyranny of small decisions, and a lack of long-term vision appears to dictate the tram's functioning. A clear definition of the tram's role in the agglomeration's mobility, the desire to promote it as a tool for regional development and urban transformation, and clear guidance on technical choices are all absent. From these deficiencies stem a wide range of implications, including: 1) lack of genuine public transportation priority in traffic routes, 2) line routes that do not seem to target a modal shift and 3) technical choices that are periodically called into question. Above all, the lack of a long-term vision makes the network extremely vulnerable to decisions taken individually, without considering and assessing them in regard to the overall context.

Before reaching what could be seen as a point-of-no-return, the Geneva network, as mentioned above, suffered from isolated decisions with long-term implications that were grossly underestimated. Among these, the maintaining of the metric gauge during the 1980s, when the tracks of the only existing line were entirely changed. The decision was fraught with consequences. For one, it did not allow for the integrating of the Eaux-Vives-Annemasse line with the tram network whereby - like the Bordeaux, Strasbourg and Lyon networks - it would have been possible to run a high-speed tram on this line. While this decision might have seemed crucial at the time, other decisions were likewise made at a time that might have seemed less restrictive for the future. For example, during the Bernex tram (TCMC) development project, the decision was made to design stops with central platforms, even though the TPG fleet, until that time, had consisted of mono-directional trams. This choice complicated the network's management, as it then became necessary to manage two different fleets on two different groups of lines. The elimination of certain routes, like the Bernex P + R, was decided later, making the use of the new Cornavin-Bernex section impossible for mono-directional trams. The decision to not put a second rail on the Rue de Stand, though authorized by the Federal Transportation Agency, which had been abandonned for the time being, and, until reconsideration, the possibility of once again meshing the network, even though the operation's reversibility had been required by the High Council in resolution 609.

Difficulty regulating the network

Today, Geneva's public transportation network seems to be at the limit of what can be done in terms of regulation. The network's ability to develop seems especially compromised by the

difficulty of regulating its vehicles. Difficulties keeping on schedule, poor transfers and problems due to increased service frequency already exist here, but could become worse. In order to improve and develop the network, it is crucial to act on its flow. This means improving the speed of the vehicles, decreasing individual motorized traffic, creating bus lanes and developing radial lines. The speed of Geneva's tram network overall is slower than those of the networks we compared it with.

Geneva, with its high density, has a good argument for a modal shift to soft modes. Moreover, as we saw earlier, a clear policy of restriction as regards parking spaces downtown has an important impact on modal shift. At present, Geneva still has an extremely high rate of car ownership for a city of its density. In order to improve the public transportation network, comprehensive reflection on mobility and parking seems indispensable. A reduction in car traffic would also have beneficial effects on the safety and speed of commuter flows in transfer areas on the tram network. Maintaining the status quo ultimately does not seem to be the best solution for any mode of transportation, soft of collective.

The simplifying of the tram network is extreme

A reconfiguring of the tram network's operating system prior to December 11, 2011 was difficult to avoid, considering the various constraints and for the reasons we have mentioned. However, the options chosen by the planning authority, in our opinion, are debatable, particularly the proposed alternative. It is indeed difficult to explain why the authority played on extreme alternatives, by systematically comparing the old, fully-meshed system to a three-line system, and neglecting to take into account viable intermediate solutions.

The issue was not that of one concept versus another. Yet, it was this direction that was adopted. In terms of quality for users, the concept of an operating system has very little impact on the quality of travel. For us, the fact that it now functions more like a subway cannot be seen as an improvement. The planning authority should have proposed some improvements and made compromises. Some lines could have been eliminated to facilitate the network's management without necessarily affecting a certain degree of meshing.

Transfer hubs are uncomfortable

Lack of comfort, difficulty orienting oneself and safety issues are key characteristics of the tram network's transfer hubs – a situation which existed before the change of operating systems and is not directly related thereto. The elimination of certain direct connections has, however, increased the flows of users in these hubs and accentuated their design problems.

The Stand station appears to us to raise safety issues for users, especially at peak hours. Users get on and off line 15 trams only to find themselves in the middle of four lanes of traffic, where, despite stop lights, cars still go fast. Moreover, it seems to us that certain incivilities – such as not respecting red lights – worsen this situation. The Bel-Air hub also must deal with the problem of mixed flows (pedestrians, buses, trams and private vehicles). Signage there is barely visible, and users who do not know their way between lines 12 and 14 have little chance of figuring it out intuitively. The lack of signage is also a problem at Cornavin, where mixed flows again makes travel more complicated for public transportation users. Users who transfer at Plainpalais must also cross a steady stream of cars but, in our opinion, in relatively safer conditions.

Communication lacked dialogue and transparency

A dialogue that more closely resembled information, communication colored by arrogance and a lack of transparency seem to have made it more difficult to accept the change of operating systems and search for facilities to respond to the problems that emerged.

Concerning prior consultation, it would have been advisable for municipalities and users to be more actively involved in the decision-making process. For example, the purchase of bi-directional trams a decade ago, whose doors open alternately on one side and then the other, poses problems for disabled persons or families with strollers. The issue should have been put to users. The procedure used, while it followed the legal framework, was not called into question. However, the search for a consensus among the municipalities that were to be deprived of direct links to Cornavin could have been more actively pursued. It is even more unfortunate that no consultative mechanism was provided for users. In their hearing before the Transportation Committee, TPG representatives do not deny not having communicated beforehand or not having included users in the reflection. When asked by a commissioner who wanted to know if users had validated the three-line tram concept, the TPG representative answered “TPG’s marketing, sales and promotion department knows the expectations and habits of its clients, and therefore may decide in their names.”

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