Report on the authorization and implementation of the reconstruction of Szeged Híd utca / Vár utca trolleybus junction's overhead wire and trolleybus stop

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Outline

Introduction

Szeged Transport Company (Szegedi Közlekedési Kft.) chose to join the common effort of nine project partners in order to promote and study using trolleybus, as a mean of the best solution of public transport modes in middle-size cities in terms of noise, vibration, environmental pollution and speed. This report is on the topic of the Trolleybus Intermodal Compendium, where the purpose is to show step-by-step the planning and implementing stages of a successful trolleybus investment from the infrastructure side.

This report focuses on management issues of the project implementation. We assume, that a trolleybus project had its feasibility study and proper cost-benefit analysis done in order to decide its viability in a city. In our case, since this was a pilot reconstruction of a part of an existing trolleybus network, this step was skipped, and thus it is not in our focus of discussion. Our project was based on the need of reconstruction of a 30 year old junction facility and a trolleybus stop. We highlight the modern technical solutions and requirements for designers of trolleybus overhead catenary as well as trolleybus stops, and follow through all problems, risks and solutions through the authorization and implementation process. Many textbooks overlook the intricacies of the legal environment and the usual requests of the collaborating road, park and utility operators which are a key to a successful, finished in time construction project. Our attempt is to focus on these issues, in order to prepare for them in future projects.

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The construction information table of this project

Szeged and trolleybuses

Szeged is with 169.000 inhabitants the fourth largest city in Hungary, located in the south, close to the border to Serbia and Romania. The city is a major administrative centre of the south-east region, as well as Csongrád county. It is situated on the Great Hungarian Plane, alongside the river Tisza.

The city reached its today shape after the devastating flooding of 1879, after which Szeged was reconstructed with new radial and circle boulevard system. Szeged is a national center of food industry; it is famous for its red pepper and salami production. It is a major educational center of the region, with important universities and medical facilities.

After World War I., Szeged lost its role as a major railway hub. The road to Romania and Serbia (Budapest – Bucharest and Budapest – Beograd) goes through Szeged. Szeged has only two bridges over the Tisza. A third new highway-bridge was finished in 2010 north of the city, since then both transit directions will be diverted out of the city on highways.

Szeged Transport Company (SZKT) leads back its predecessors to 1884, to the opening of the first horse-tramway service in the city, which was followed by the electric tram in 1908. The local bus service was formed in 1955, however in 1963 on Ministerial order it was handed over to the state owned regional bus company Tisza Volán, all electric transport remained by Szeged Transport Company. Ever since there are two local public transport companies in Szeged, with around 50-50 % share in passenger numbers.

The first trolleybus was introduced in 1979, and the route structure reached its today shape in 1985, serving mostly the city center and a new housing estate areas in the north-east part of the city.

In the last decade the car traffic increased significantly, together with the passenger loss of the worn down public transport. SZKT started reorganization in 2003, with concentrating its resources on the renewal of its old trolleybus and tram fleet, partly from self-labor in its existing workshops. After joining to the EU in 2004, part of national cohesion funds on the reconstruction of the electric transport in the provincial cities was granted to Szeged.

A 100 million Euro worth of investment started in 2008, including the extension of the trolleybus network and fleet, as well as reconstruction of the depots and the power supply to hopefully change the trend of the passenger loss, which most significantly occurs on the bus routes.

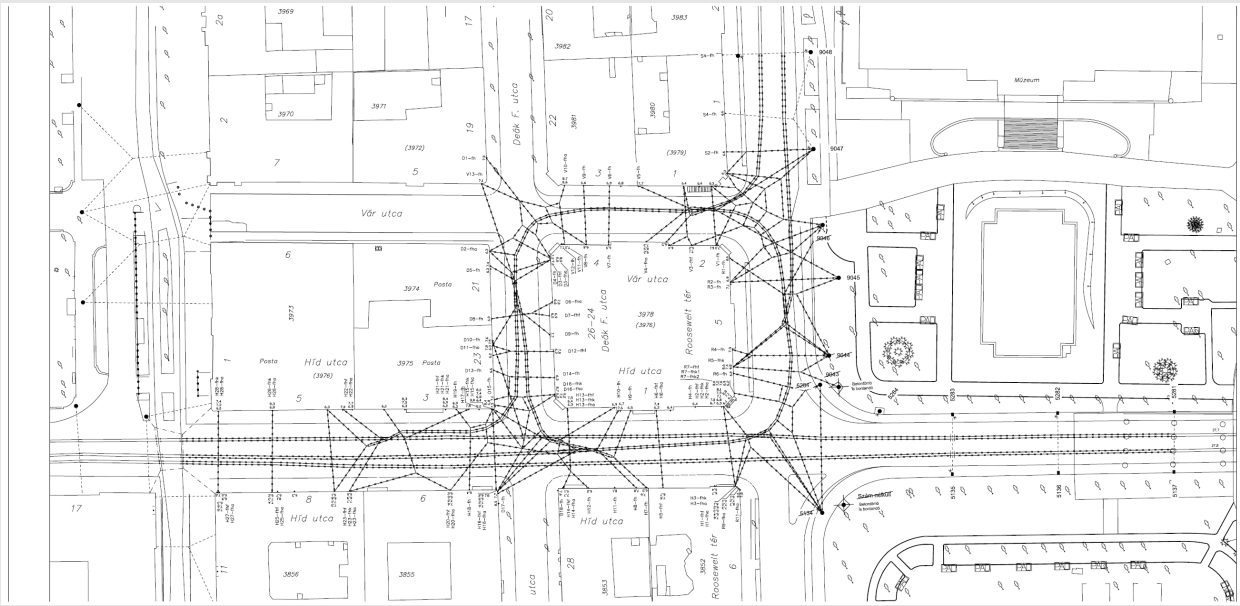
The network of trams and trolleybuses in Szeged (end of 2011)

Planning the overhead wires

The trolley catenary situation at Deák Ferenc utca and Vár utca before the project

The pre-project wire layout

In order to explain the evolution of the planning of the overhead wires, first let's explain the motivation behind the previously existing layout. On the plan below one can see the project area. The first trolleybus route 5 ran from left to right from Széchenyi tér (square) stops (left) towards the bridge (right) since 1979. On the left one can see tram crossings as well (route 1). In 1985 a second route of trolleybus was constructed (route 9) coming from the direction Széchenyi tér stops (left), and turning at the bridge head parallel to the direction of the river Tisza (up). A quasi-roundabout geometry was formed, so the route 9 trolleybuses were able to turn back here (coming from above), and both routes 5 & 9 were able to turn back coming from Széchenyi tér (left). However, there was no possibility of turning back for the route 5 coming from the bridge (right).



The wire deconstruction plan of the project area (the previous state to the project). On the left is Széchenyi tér, on the right is the bridge's ramp over the river Tisza. Trolleybus route 5 goes left-right, route 9 goes from left to the top

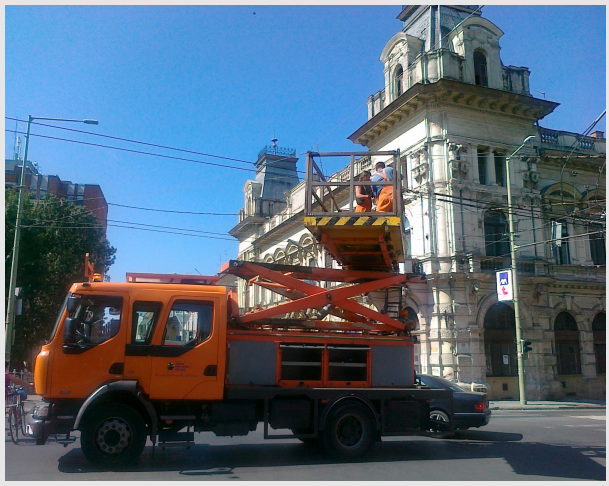
One more peculiarity to observe: from the left there are three pair of wires arriving instead of two. There is a turnout on the other end of Széchenyi tér where the routes 5 & 9 bifurcate. The reason of this layout (even if it meant to construct six tram-trolleybus crossings instead of four) was, that starting from the tram crossing there is a steady 2,1 % slope towards the bridge upwards, with streets corners, and even a traffic-light. One could have put the bifurcation of the routes 5 & 9 exactly before the bridge head. However the old version of the trolleybus turnouts were operated by the accelerating trolleybus's current consumption. On occasions of no turnout operation, the trolleybuses needed to coast without current. Since this area was uphills, and often trolleybuses started at traffic lights, the previous designer avoided this turnout to be put on the slope in order to precede the unwanted turnout operation of trolleybuses that accelerated for other reasons.

An important feature of this project was, that it required no interference with the trolleybuses power feeding system. This meant a simplification, no further electric planning, authorization and implementation was needed above the overhead wire planning.

New trolleybus technology on crossings and turnouts

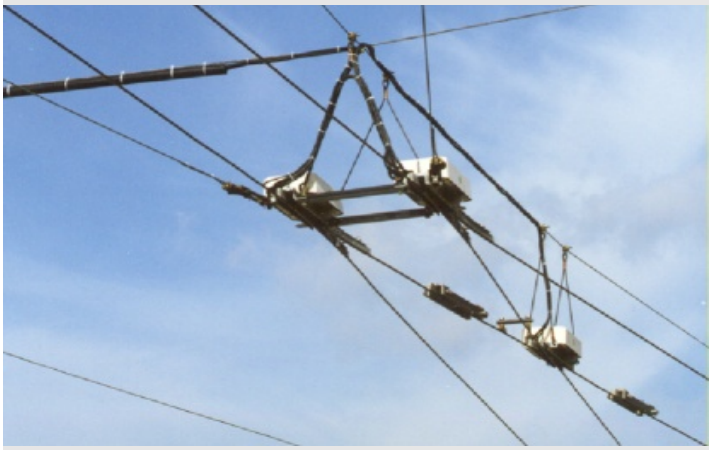
The old catenary at the bridge head with a crossing and a turnout

The project area in the previous stage contained five turnouts (two of them are bifurcations operated by the trolleybus driver) and two crossings. These were built in 1985, with Kummler-Matter system. In this system the crossings' and the turnouts' wire system are supporting a series of tubes, that actually guide the trolleybus's contact shoes. The disadvantage of this system that these tubes can get loose leading to the loss of guidance and to derailments. The tubes also cause vertical irregularities leading the increased possibility of trolleys to jump out at higher speeds. These elements mean a 10-15 km/h speed limit to the trolleybuses. This system requires constant maintenance and checking.

The old overhead elements lead often to derailments and interruption of the traffic

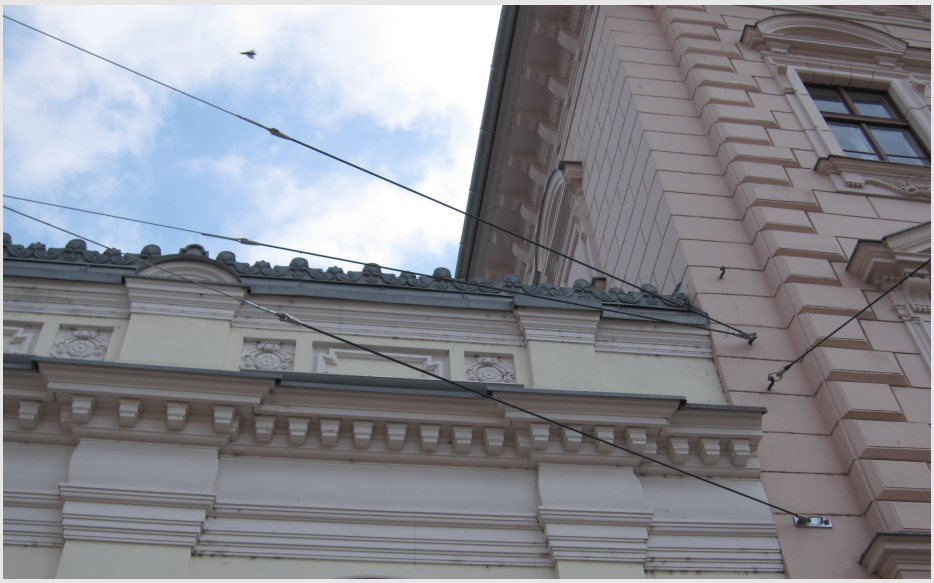
The new layout was designed with the crossing elements and turnouts from the Czech firm Elektroline's catalog. There is principal difference from the old trolleybus elements, that there are no tubes, which makes the whole system lighter, and vertically smoother by the strained wires that the trolley's contact shoes use. There are special crossing and turning point elements that has to be cut directly to their geometrical place. Elektroline offers a wide variety, but finite number of geometry for these special elements. The designer's job is to fit the most suitable element from the catalog in his layout geometry. These elements can be used up to 40 km/h speed with significantly lower risk of derailment.



Modern strained trolleybus symmetric 10° turnout

As it will be described later, we used hooks on the walls of the buildings extensively. In order to decrease the noise and vibration conducted to the walls through the wire, we used at the end of each hook a parafil element. Parafil not just insulates, but also elastic and can diminish the vibrations. These parafil inserts are also used at the “delta” type hanging that we used for straight wire sections.

As for the applicability of hooks: there was no individual static planning for each building, which would be very difficult and unnecessary. The overhead geometry designer choose to place the hooks at locations, where there is a supporting part of the building, measuring the width of the walls. Also the designer took into account, that the wires should not be in front of windows, balconies, or any other way that would disturb the residents. Before using the newly built in hook, the designer prescribed a method of testing the strength of the hook, by applying extra force for a period of hours to examine the stability.



New hooks on the wall with elastic parafil insert

The "delta" type hanging that we used on straight sections

Variations on the geometry

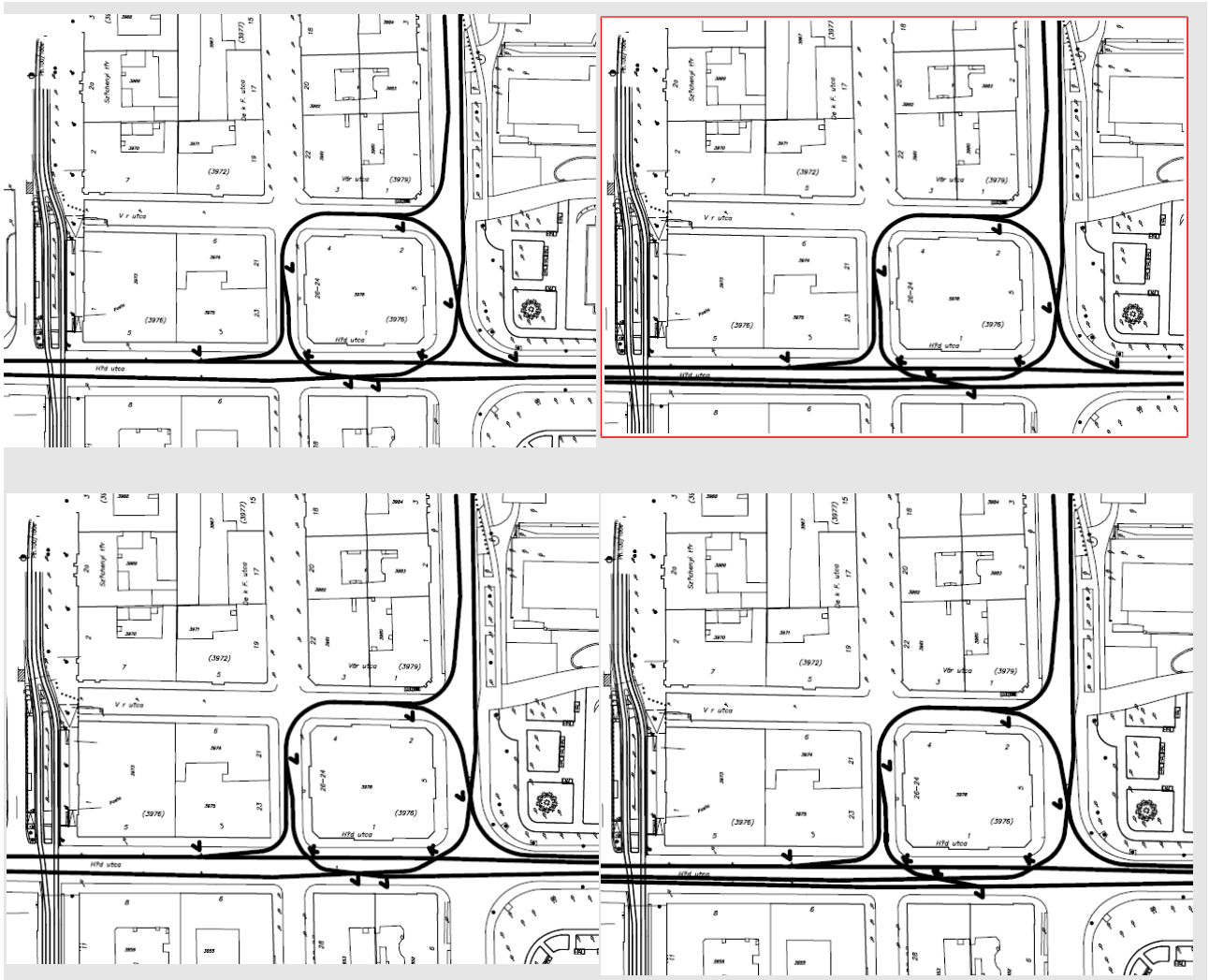
It is very important to have a good communication between the project leader and the designer in order to find the optimal layout *both* for the overhead wire and the traffic situation below. The overhead designer is not an expert in traffic geometry and does not have driving experience with trolleybuses. For this purpose, a detailed disposition needs to be given to the designer, or give him the possibility to interact with people who are going to use this trolleybus geometry (in our case the traffic operation department of the Szeged Transport Company).

For the beginning we gave the instruction to the designer that he should replicate the existing layout with modern overhead elements, with expanding the directions in order to make possible to turn

back also from the direction of the bridge.

A further direction was given to the overhead designer, to try to avoid exchanging masts which support not just trolleybus catenary, but street lights as well. These common-use masts always means autorization difficulty. The street lights in Szeged are operated by the local electric energy company DÉMÁSZ. DÉMÁSZ was in the communist era a state-owned company, but was privatized in the beginning of the 90s. Privatization of the electric industry was a controversial political issue haunting still the Hungarian decision makers, since for example the new owner of DÉMÁSZ became once again the state, only the state in question is France. DÉMÁSZ is owned by the French national electric company EDF. DÉMÁSZ acting as a profit oriented company to Szeged and always asks for the exchange of the mast with street light to exchange all the connecting cables to the neighboring streetlight as well as a condition to permit any activity on its operation area. This extra, non-trolleybus related ground digging could lead to any trolleybus project to a bunch of problems (a new electric designer's involvement is needed, further authorization by a third agency, lots of possible utility interferences) we try to avoid as much as we can.

The designer made four separate rough layout, which can be seen in the following figures.



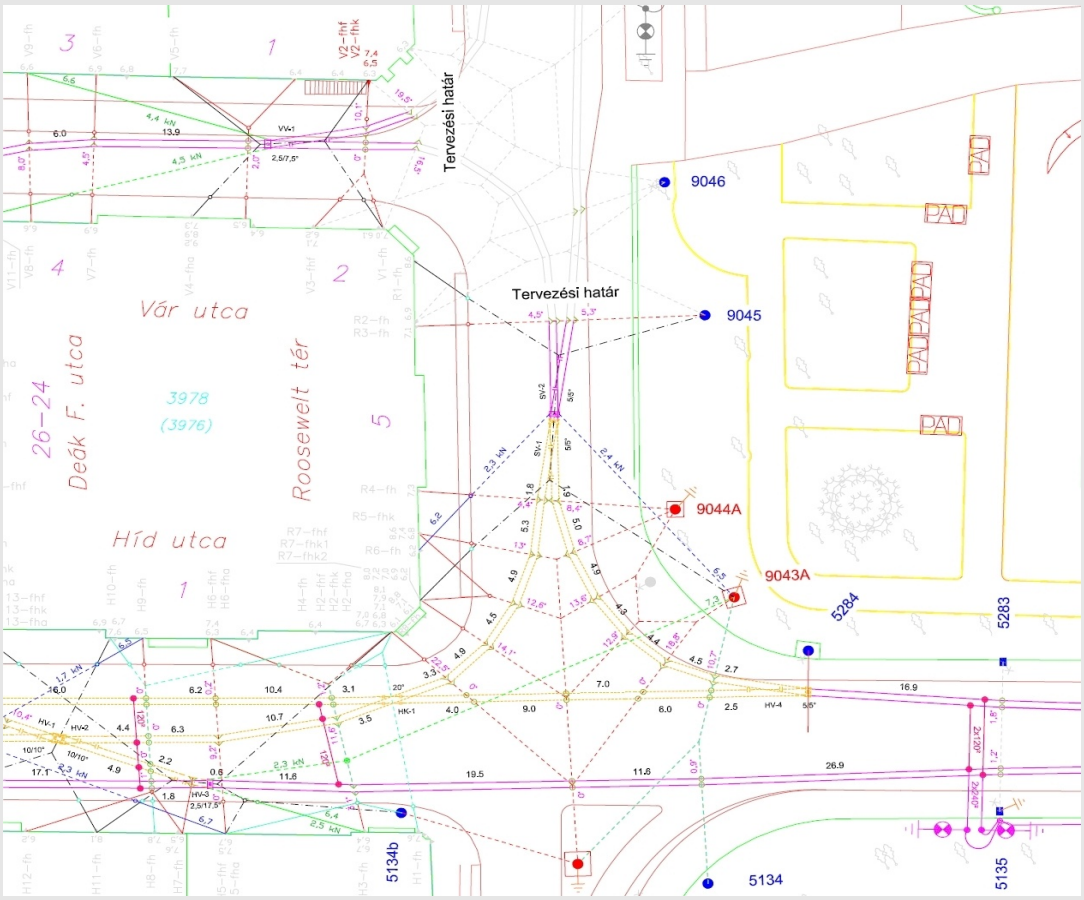
The four variations for the junction's trolleybus catenary layout. The realized one marked red

These choices pointed out solution 2. We decided to keep the bifurcation of routes 5 & 9 behind the tram crossing because of its traffic-technology advantages on the right, so still three pairs of wires

come from the left.

To explain the reason why there were options of three pairs of wires arriving also from the right we must realize, that this junction is the bridge head, and on the right the masts are already standing *on the bridge itself*. To place a turnout on the bridge is risky, so either we could put this turnout just in front of the bridge-head, or 800 meters away, to the other side of the bridge. The bridge had masts and hooks that supported trolleybus catenary, for which the static planning of the bridge was not available for the Szeged Transport Company. However, while an extra pair of wires give hardly a change in supporting forces, a turnout gives many times above the normal force on masts and hooks, and to avoid risk them overforce them, the turnout was placed according to the second solution, just in front of the bridge-head (which was not the optimal placing to the existing traffic situation). Even an extra trick was added in order not to affect the bridge masts.

The normal catenary wire not just hanged on hinges. In order to make the wire smooth, it is strain with 9 kN force by around 30 meters of hanging distances. At turnouts, two wires become four. The extra 2 x 9 kN force is lead away by anchoring wires, which end at masts or hooks. In order to save the bridge from this extra force of anchoring wires, these were not built. Instead, the arriving wires 2 x 9 kN strain is compensated with 4 x 4,5 kN strain wires. It is acceptable to strain less the wires, if the hangings are much closer than 30 meters, which is the case of the bridge head layout. Thus sections of the wire of this project-area are strained abnormally only with half force.



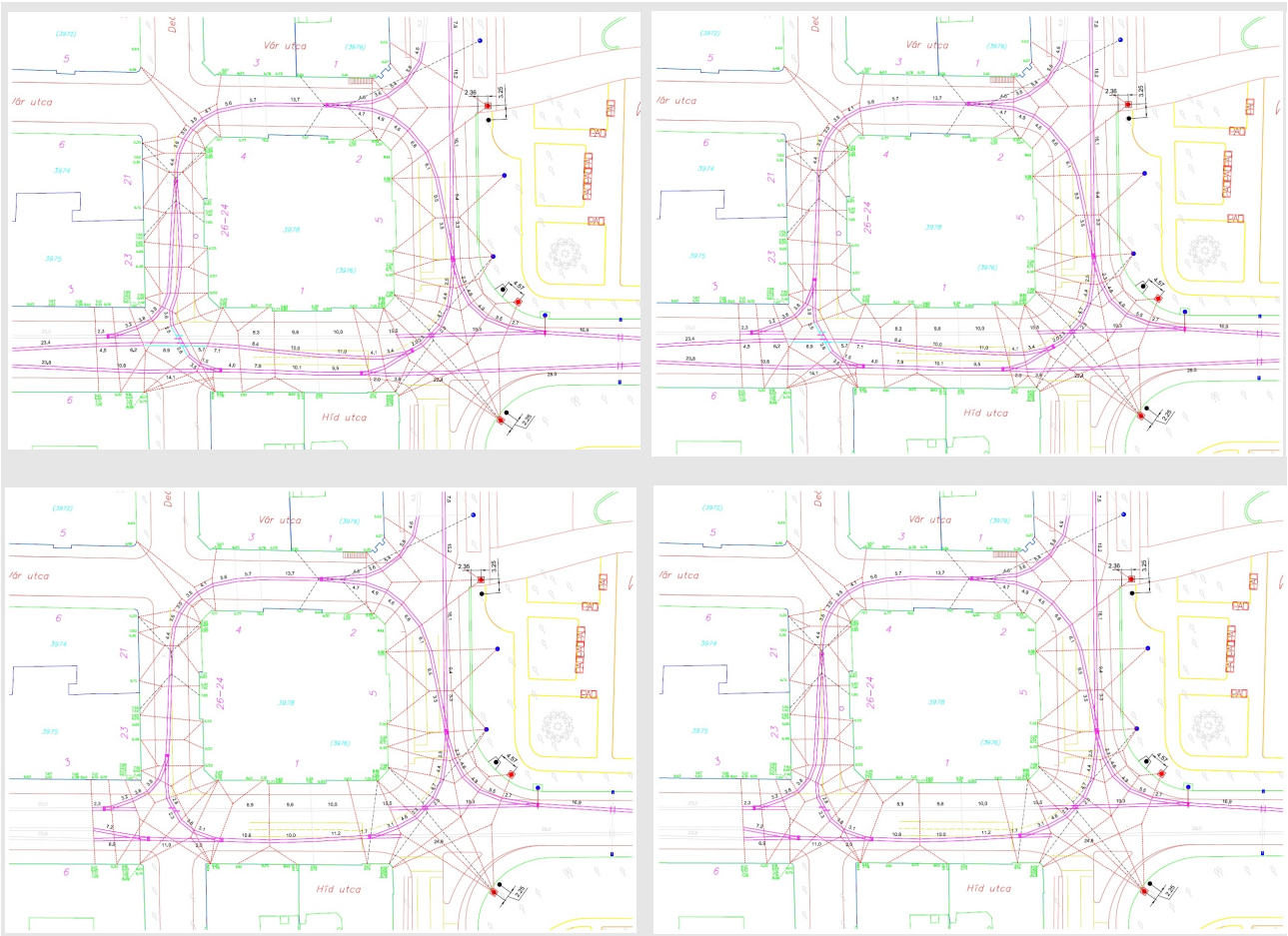
The bridge head in its almost final implementation plan version, with no anchoring for the turnout in the bridge head. Instead, the yellow wires are only strain with 4,5 kN, while the purple wires are with 9 kN

At the bridge head there were some unused masts with concrete pillar that we planned to be dismantled. These were probably built at the end of the 70s with the first trolleybus route. Since the ground level here is around 2 meters below the road surface, we designed masts built near the bridge, but longer ones than usual. For each turnout one needs an upper net to stabilize the switch elements. In the case of the bridge head turnout, we exchanged part of the upper net with a holding arm attached on the mast, which previously supported the traffic lights.

It is always advantageous by masts to use holding arms instead of spanning wires to support the catenary, although architecturally wires are usually better. Spanning wires always need to be strained, thus giving bigger force on the supporting mast which also means bigger foundation. However, naturally spanning wires are the natural choice in case of wall hooks.

The holding arm for the switch at the bridge head for the turnout, that has no anchoring. Its produces relatively small extra force on the mast, so we could use the existing mast of the traffic-lights. In the background behind the trolleybus one can already see one of the unknown type of rectangular masts that are used on the bridge

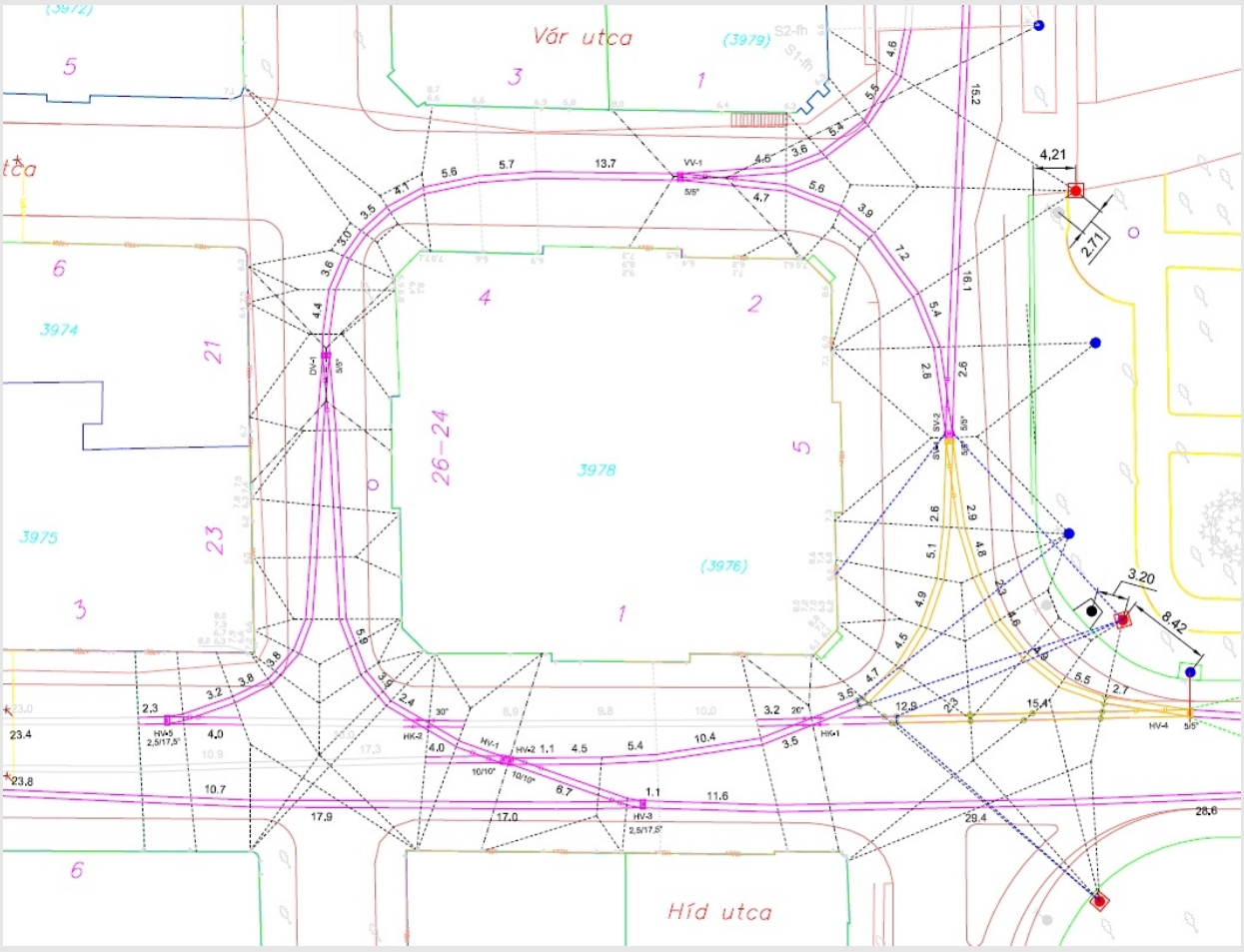
Another round of discussion through emails was conducted in order to find the best solution for the junction of Deák Ferenc utca – Híd utca. Here the priorities were to keep the original wire structure separate for the bridge heading route 5 wires from the turning route 9 wires. The bifurcation of the route 9 in Deák Ferenc utca needed to be placed in such a way, that the turnout's insulation bothers the least the trolleybuses in normal traffic situations. All trolleybus turnouts have a certain length of insulated sections (round 2 meters at high-speed 10º turnouts, round 1 meters for 20º turnouts), where the trolleybus must coast through without power. Thus it is preferred to place the insulation such a way, that the head of the trolleybus (12 meters ahead for solo cars, 18 meters ahead for articulated cars) is not at a place, where there is a junction with right-of-way dilemmas for the driver.



Four more variations in order to find the best suited to the crossing of Deák Ferenc utca and Híd utca. The optimal solution was none of the above, but the one that shown in the next figure in the next chapter

Authorization of the overhead wires

In this description we need to make a special emphasis on the authorization process of any trolleybus overhead wire. Although the term trolleybus was already known in Hungary since 1933, and in Szeged since 1979, still authorities are struggling to find correct legal frame to give out permissions to construct. Authorities can be just a plain old boring institutes putting stamps on plans, but in our case they are the "battlefields", where any policy or favor towards and against trolleybuses are translated to application of the law, and can make or brake the case of the future of the existence of this mode of transport. We will see this especially in the involvement of the Cultural Heritage Authority. Szeged naturally has a favor, since we have existing trolleybus network, but we will see in the course of this description, how at a certain point still **there was a considerable jeopardy to this project caused by the non-supportive nature of the laws on trolleybuses in Hungary, especially in the cultural heritage area**. We managed to get out of this quagmire through good management skills and a thorough knowledge of overhead wires with cooperation of our designer.



The final version of the authorization plan submitted to the National Transport Authority

Since trolleybus overhead wires are considered "railway" in Hungary, its primary law is the Law about the railways (2005. évi CLXXXIII. Törvény a vasúti közlekedésről) which defines trolleybus overhead wire and its construction as subject of this law (since 2012 however, the trolleybus vehicles themselves are not considered railway vehicles anymore). However, the rules and lesser

laws subjected to this laws don't have any more details specific to the trolleybus overhead catenary.

In October 2010 we submitted the plans for authorization to the National Transport Authority (Nemzeti Közlekedési Hatóság). The authority in this case requires the plans as well as declarations from the utility operators for agreeing or giving conditions for the building. The utility operator's (gas, water, heat, electricity, phone companies) permission was gotten by the designer of the catenary, and since it is mostly in the air, no utility operators indicated any problematic affect. Also we got the permission from the municipality.

The National Transport Authority has the right and required to consult with other authorities. In this case the following authorities were pulled in the process:

- The environmental authority (Alsó-Tisza-vidéki Környezetvédelmi, Természetvédelmi és Vízügyi Felügyelőség), who later declared, that it was by mistake to get pulled into the process, and revoked its declaration of affection;
- The Cultural Heritage Authority (Kultúrális Örökségvédelmi Hivatal), since the inner city of Szeged, and the nearness of the former castle of Szeged (which is buried under ground) makes the project area a protected cultural heritage area. In this case the Cultural Heritage Authority acts as also as an issuer of a separate building permission.

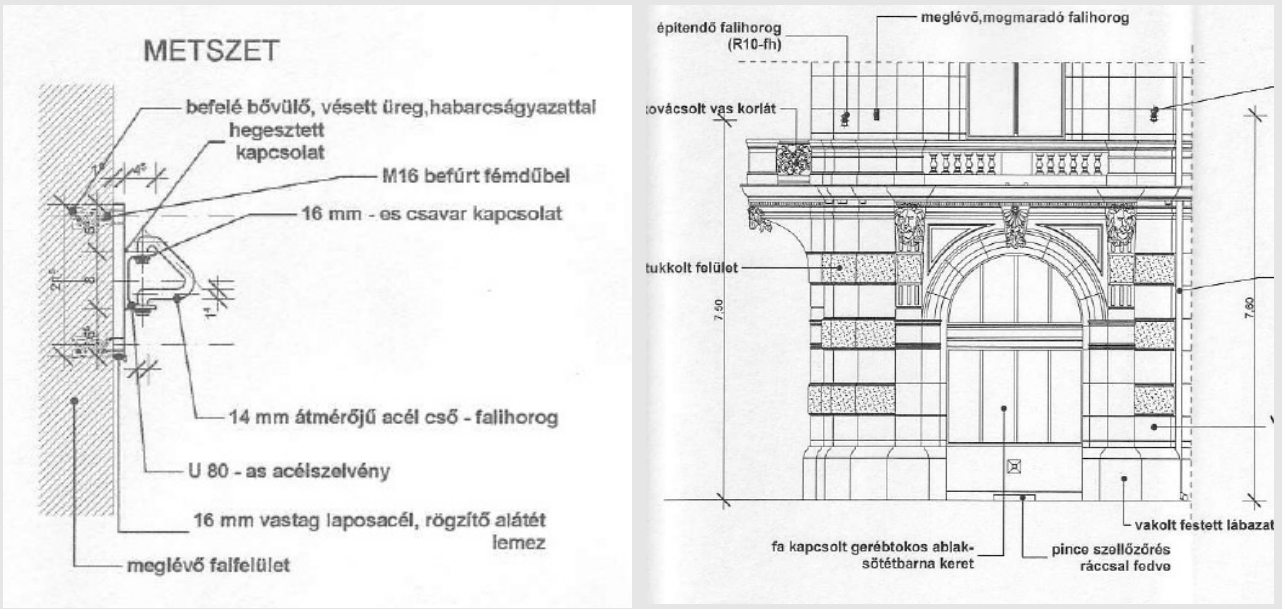
The National Transport Authority, after its site visit (February 2011) released its authorization on the Spring 2011 with conditions. The major conditions, that were affecting the further authorization of the condition of the permission of the Cultural Heritage Authority (described above), and the condition of the owners' permission for the hooks on the neighboring buildings walls. This second condition needs explanation.

Hooks

The cheapest way to construct trolleybus overhead wire in densely populated city centers is to use the walls of the neighboring buildings. In fact, it is cheaper to build the overhead on wall hooks than to erect masts, which needs clearance for foundations from utility lines, and creates opposition from architects because of their look. Often the utility situation is such, that a mast is impossible to build on the sidewalks. Almost all buildings that have the main facade over 7 m of height (i.e. has an upper floor) is suitable to carry the overhead, without concerns on their static state.

However the neighboring buildings are often belong to other owners than the municipality, since basically municipalities in Hungary sold out their building properties in the end of the 90s, often even without clearing the legal status of the existing catenary hooks. Since the new laws made after the collapse of the communist state about railways were simply not concerned catenaries in inner cities, the intent was to hand over the responsibility of catenaries to the authority, that authorize power supply lines (Hungarian Trade Licensing Office – Magyar Kereskedelmi Engedélyezési Hivatal). The problem is, that catenaries are not considered by the Trade Licensing Office as power lines, where there is a way to enforce to make the house owners to tolerate even if the power line goes through their property. Thus catenaries were thrown back to the National Transport Authority, who without any legal power **makes the project developers' duty for trams and trolleybuses to get the permission from *each* property owner for each new hook.** This proves to be almost an impossible job, even in our case of the relatively small project area, where there was trolleybus service in the project area for three decades (and a tram service since 1909), and there are more than a hundred (!) hooks. Naturally each owner is hostile to the idea, that their building would get a new hook.

Different used and unused hooks of the trolleybus catenary on a private building before the project. One can spot a historic unused one, which belonged since 1909 to the ancient tram



The planned new hooks and its placing on the above shown building (part of the architecture plan)

By the reconstruction of the overhead wires we used by far the most the existing hooks (106 pieces) and only planned 14 new due to changes of the geometry of the overhead. For these 14 new hooks the Cultural Heritage Authority prescribed, that they can be built only designed by an architect. So we hired an architect (Krizsán Katalin) to do this job.

These new hooks were made into three groups:

- new hooks on buildings, that are 100 % owned by the Municipality;
- new hooks on buildings, that are owned by a state entity, non-profit organization or a company;
- new hooks on buildings, that are partly owned by the Municipality, or entirely owned by more than one owner.

The first group was relatively easy to get a permission, since the Municipality normally supports its transport company's efforts in reconstruction. Though, since the 2010 election the political situation became such in Szeged, that since then we need two committees of locally elected politicians to get the owner's permission of the Municipality of Szeged, but it was relatively easy to get an agreement with some lobbying effort form the director of the company.

The state and non-profit entities or even private companies have the tendency to view their office buildings differently than private resident owners. Thus they normally give a permission without any qualms for a normal inquiry. This time however the result was mixed:

- The Hungarian Post Office gave permission without any major condition;
- The Hungarian Treasury however categorically denied a singe new hook on their office building although two hooks existed already. This we managed to avoid by a modification on the overhead wires once again by redistributing the strain of sections of the wire from 9 kN to 4,5 kN;

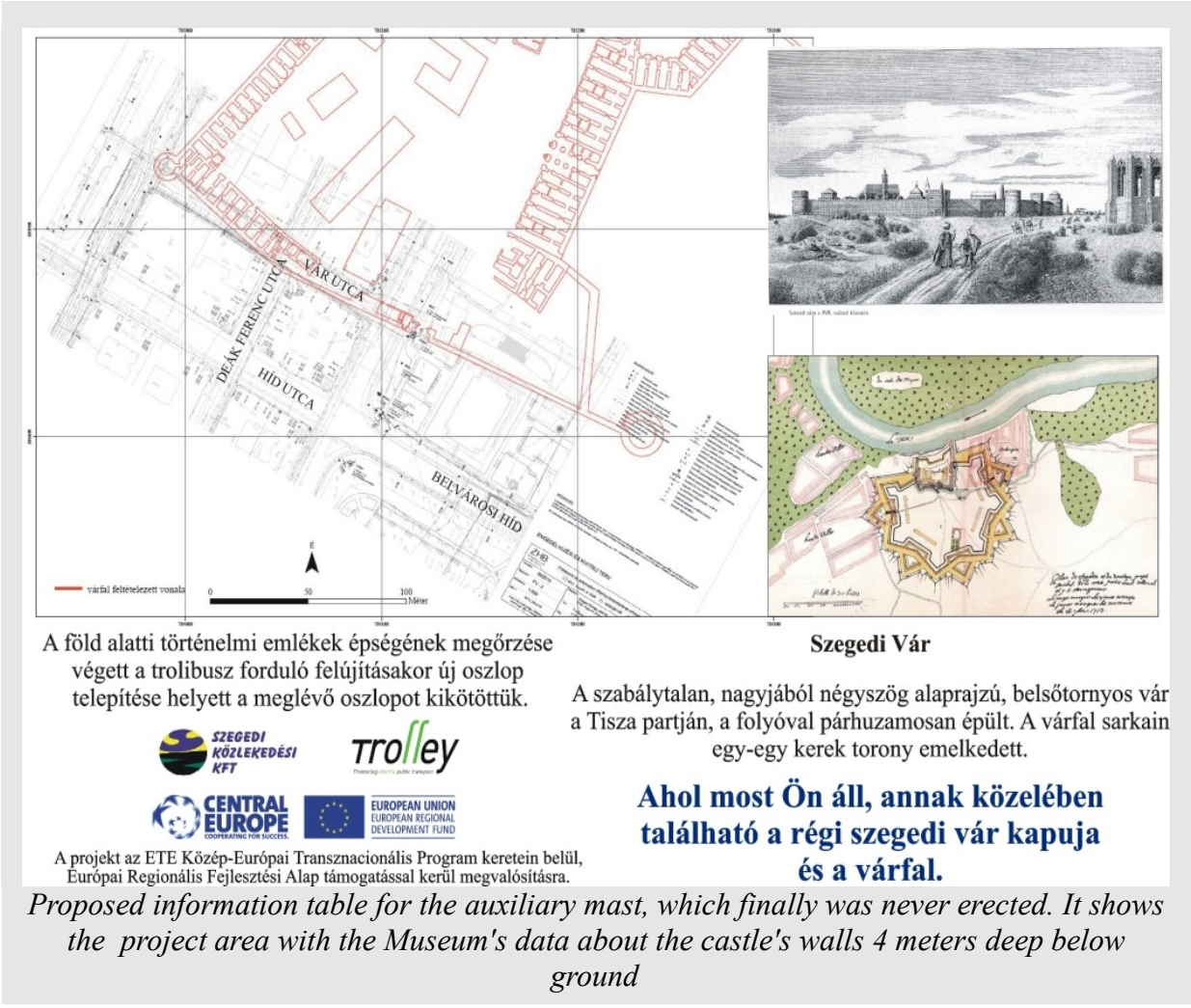
The biggest concern was the case, where the building had more than one owner. According to the Hungarian laws, in this case there should be a legal entity, which is the building itself, with community board formed by the owners. The outside facades of the buildings belong to the house, and not to any of the owners. Here we had two peculiar cases:

- The Hungarian Catholic Church was the minority owner one of the residential buildings, where even there was a dispute of the ownership between the Municipality, the Hungarian State and the Church. Thus the building did not have a community board. The Cultural Heritage Authority did not accept the majority owner's permission, they required the permission of the Church as well. First there was no agreement from the church, which meant that we needed to exchange the hook with a planned new mast. Luckily, with some lobbying from the transport company's deputy director the church changed its mind at the “last minute” in October 2011.
- Two buildings needed a new hooks each only in case the old ones are not suitable to carry the weight anymore. In each case the majority owner (Szeged Municipality) gave explicit permission for the hooks. However, the Cultural Heritage Authority demanded that each community board must decide on these permission. The operator of these buildings (also a municipality company) only agreed, if we pay compensation fee for each hook. These community board meetings were done also in the last minute (October 2011), and finally each of them gave permission with majority vote. But this was still not enough, because the Cultural Heritage Authority demanded in the end, that all owners give permission (even those, who were not attending in the community board, or did not vote for the permission). Luckily it turned out, that none of these hooks were needed to exchange, so finally we dropped the inquiry for permission. **But the moral of this story, that on a cultural heritage area in Hungary, basically one owner's disagreement is enough for forbidding hooks for trolleybus catenary, no matter how minor is the ownership.** In the case outside of cultural heritage, where only the National Transport Authority is in charge, it is sufficient that the building as an entity gives permission (i.e. the majority of owners).

Archeology

A further complication occurred concerning the cultural heritage. Although the project area supported trolleybuses for three decades, and around a dozen masts stand around, it was impossible to exchange one of the tilted masts.

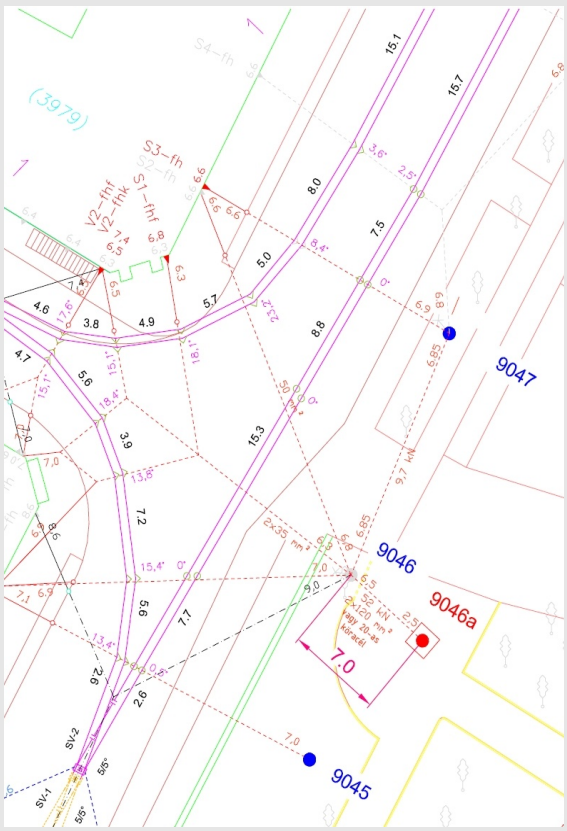
During the Authorization process, around June 2011. the Cultural Heritage Authority directed us to get permission from the local Móra Ferenc Museum as well. The Museum pointed out, that under this peculiar tilted mast in Móra park (which supported trolleybus overhead since 1985) is probably the old wall of Szeged castle 4 meters deep. The new mast was supposed to have 3,5 m deep foundation, thus the Museum decided to forbid to exchange this mast. To relocate the mast proved to be impossible due to the neighboring utility lines and and the trees (the fact of the cultural heritage area also forbids us to cut down any trees). A committee from the Museum, the Cultural Heritage Authority, the Municipal Park Service, the designer of the overhead and Szeged Transport Company on location decided to anchor this existing mast with an auxiliary mast 4 meters away, supposedly away from the wall of the castle. The museum took the opportunity, and Szeged Transport Company hired them to dig out the foundation of this auxiliary mast.

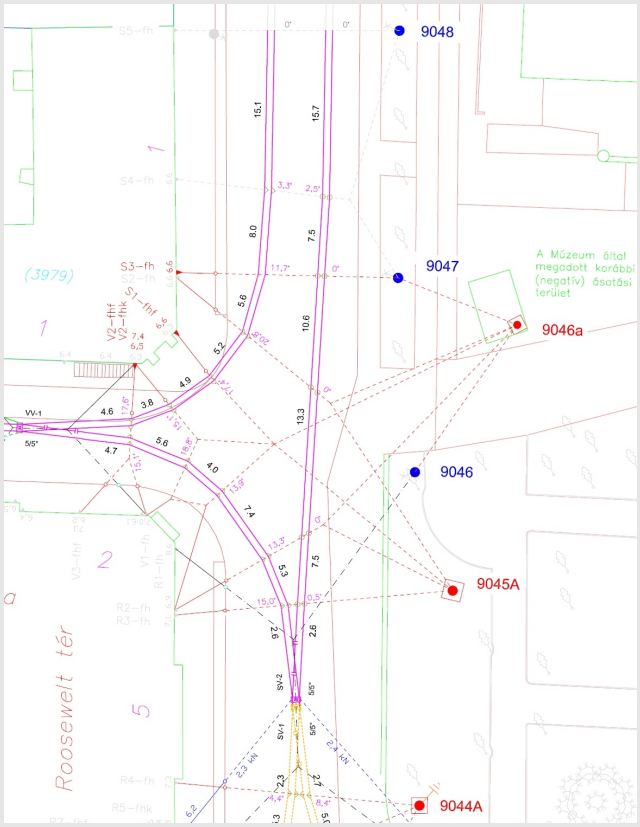


Proposed information table for the auxiliary mast, which finally was never erected. It shows the project area with the Museum's data about the castle's walls 4 meters deep below ground

The result was sensational for the Museum in July 2011, but very disheartening for the project: in this supposedly clean new location, after the Museum dug around a 6 meter deep hole, they found further parts of the wall of Szeged castle, which the archeologists later theorized belonged to one of the gates guard houses. The committee from the Museum, the Cultural Heritage Authority, the

Municipal Park Service, the designer of the overhead and Szeged Transport Company again assembled trying to find another way to support the catenary. We agreed on location, that with two more masts we can exchange the problem mast by using an Y-geometry of the supporting wires. However, although we agreed on location, in two weeks the Cultural Heritage Authority revoked its position in written form, and did not allow any new position of the masts. The 6 meter hole with the found wall was buried back.





The first figure shows the 9046a auxiliary mast to prevent the exchange of the mast 9046. The second figure is the proposed two mast exchange of the previous solution after it turned out, that the foundation of the auxiliary mast contained also an archeological wall. This second solution was refused by the Cultural Heritage Authority in the end, agreeing to it beforehand

Finally after redesigning once more, we decided not to abandon completely the tilted mast, but by changing the geometry of the overhead wires we reduced significantly the weight of the overhead on this tilted mast, by putting the weight on the neighboring mast, which was exchanged instead with the permission of the Museum. The compromise is, that sometime in the future one needs to do something with this tilted and for now not-to-be touched mast.

Archeology for the never erected auxiliary mast's foundation in Móra park, the sensational finding of Szeged castle's guard house (from the local newspaper Délmagyarország)

Implementation of the catenary reconstruction

Material purchase

Although we were far from having finished implementation plans in the end of 2010, due to project spending reasons we decided to use the authorization plan for material purchase. Our thinking was, that any change should be minimal to the authorization plan, and we will be able to use the usual spare material that are sent by an order for flexibility. (It turned out that the changes were much bigger, see the previous chapter about archeology.) We organized public procurement, and the delivery was in Spring 2011. We put the materials in storage.

Tree cutting

One of the serious considerations about project starts in Szeged is the tree cutting problem. Our project area included Móra park, where we needed to erect masts. Some wires went through the foliage of trees, and some branches were in the way. Getting a permission from the Municipality to allow to cut a branch of a tree always proves to be extremely difficult.

Tree cuttings are always values choice, and the politics are always whirling around the issue: on one hand we want to improve one aspect of the city's function, and it often affects trees and greenery. On the other hand, one wants to keep and protect the trees as much as possible. This set up leads to the continuous harassment of the municipality office which is responsible for handing out permission for tree cutting and gardening by environmentalist NGOs and green politicians.

This is the reason why the Municipality issues permission for cutting even a branch of a tree on two conditions:

- one needs to make a gardening plan;
- and the tree cutting must be done in non-vegetation time (i.e. from November to March).

Cutting tree branches in March 2011, seven months before the actual works

Both conditions proves to be a challenge. It is almost impossible to measure the positions of branches of trees, and predict which catenary wire will be hitting a branch. The Municipality normally compromises on vaguer sketches, and with on location of the overhead wire designer we manage to choose the branches to be cut. The gardening company usually use this occasion to trim the trees within their maintenance anyway. However, the tree cutting has to always be done in

Winter, outside of the normal construction time interval. Which often means, by the time of the project starts the leaves and the greenery grows back into the cleared area. A further complication was, that due to the authoritzation problems and the movement on the problem mast some tree cutting turned out to be redundant.

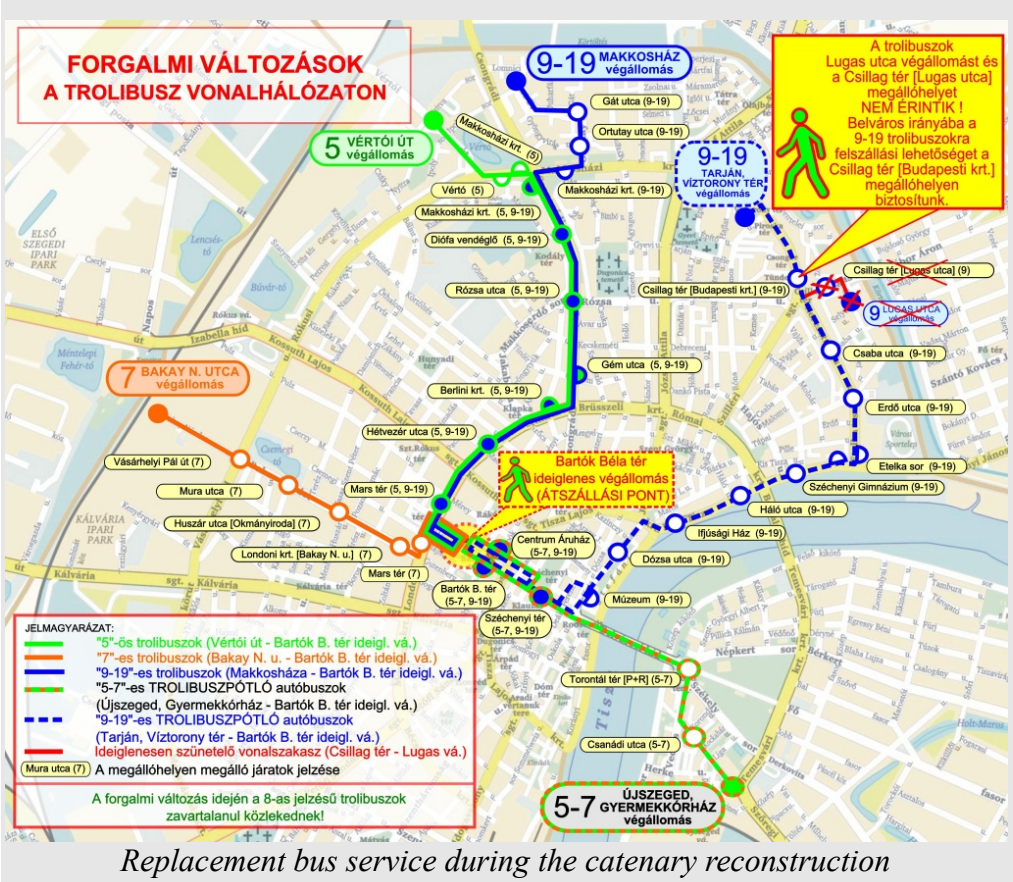
In our case, also some trees came apparent to be in the way for the new catenary at Deák Ferenc utca as well. In this case the municipality gardening company was flexible, and cut down the trees in frame of their maintenance work.

Technical inspector

We hired a required technical inspector both for the stop reconstruction and the overhead wires' reconstruction through regular procurement process. The winner was Metróber Kft., they were in charge of construction procurement's technical documentation, assembling the project-area handovers, implementation controls and assistance in case of deviations from plans.

Implementation

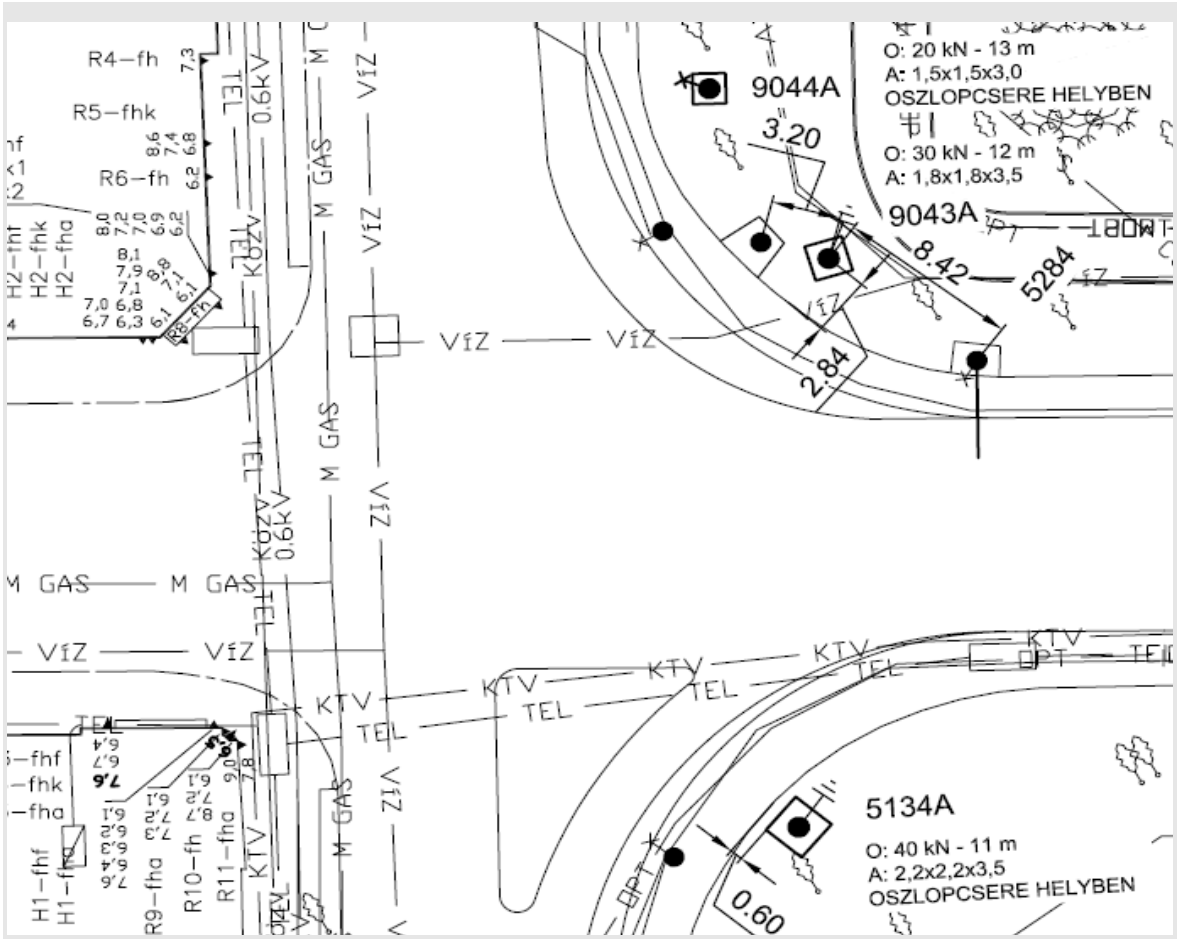
The implementation was done by the overhead repairing crew and the track maintenance crew of Szeged Transport Company, in two month. The project was implemented from November 2011 until January 2012. For three weeks no trolleybus could run in this area, and replacement buses were used. Then withing two weeks gradually we reintroduced the trolleybus service: first on route 5, than two weeks later on route 9 as well. The rest of the turning directions were finished by the end of January 2012. The works could only be carried through during the night not to disturb the normal day traffic. After the trolleybuses route 5 came back, in the evening there was an early shutdown of power, and the last evening services were carried out by buses. In January, only in the four hours of service brake was suitable for finishing works.



Replacement bus service during the catenary reconstruction

Two more problems occurred during implementation: there were non-used mast foundations and boxes of the traffic lights, that needed to be dismantled or some electric connections to be relocated. For this work we hired the traffic-light maintenance company, which is a routine work for them.

The second problem was erecting the mast 9043A, since after digging its foundation one found the large diameter water pipe connecting the two side of the river Tisza. Utility plans are unfortunately notoriously wrong in Szeged, so by each project one can expect unforeseen utilities. This time however we were lucky, by replacing the mast with 2 meters, with a slight change of the geometry of the wires we managed to erect the mast on its new location. However, we could have gotten into much bigger troubles and extra expenses for such reasons.



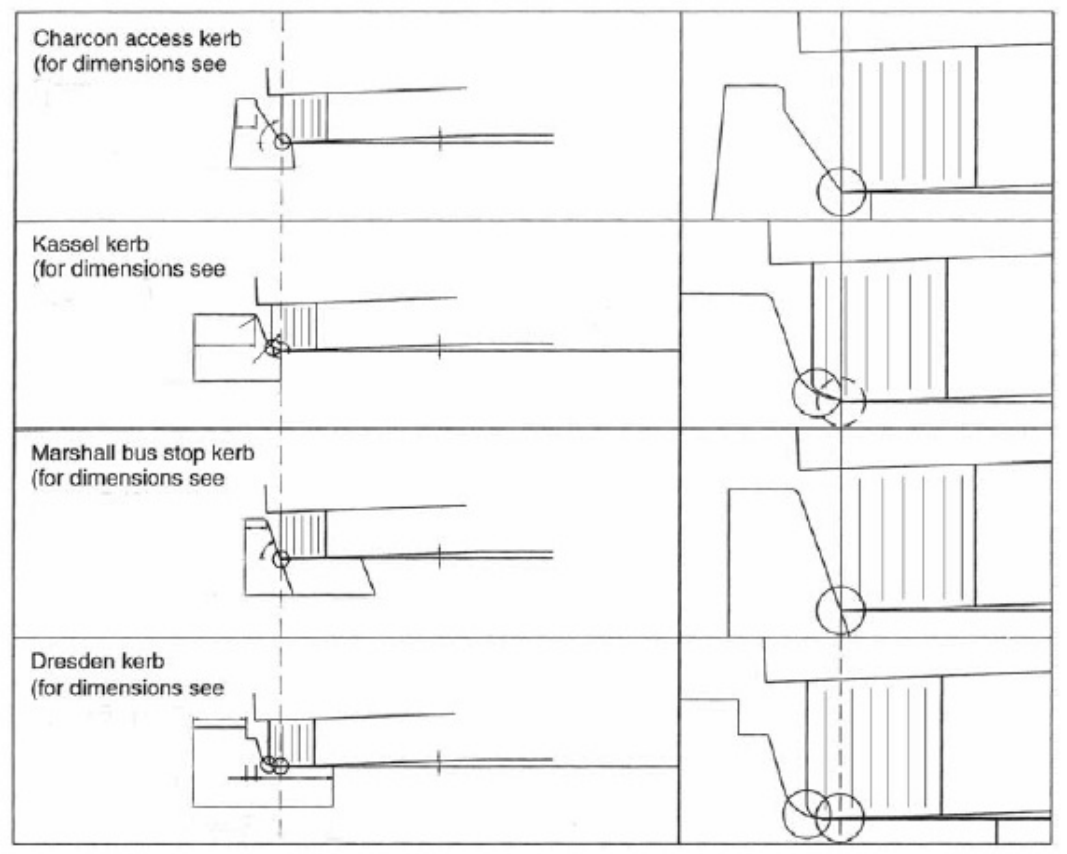
Part of the original utility plan with planned masts at the bridge head. The mast 9043A was impossible to plant, due to the water pipe which was not running according to plan. The sing VÍZ means the water pipe

Planning the stop reconstruction

The pre-project state of the stop. Notice the cracked asphalt sidewalk in front of the post-offfice building and the worn down concrete pavement of the road surface

Selection of the kerb elements and other materials

In Szeged and in Hungary general, trolleybus and regular bus stops were constructed for decades. However, the challenge of low-floor vehicles and accessibility requirements did not really translate to planning practices. The low-floor vehicles make possible for handicapped persons to travel, but at normal height (13-15 cm) of kerb elements assistance is needed for them to enter or exit the vehicle. That is why low-floor vehicles use foldable ramps and together with the kneeling ability of the air-suspension of the trolleybuses or regular buses. Assistance free accessibility is possible with trams, where we use high platforms (30 cm from the rail level) and the track guidance lets the tram to approach the kerb in the range of 5 cm.



Kerb solutions for buses

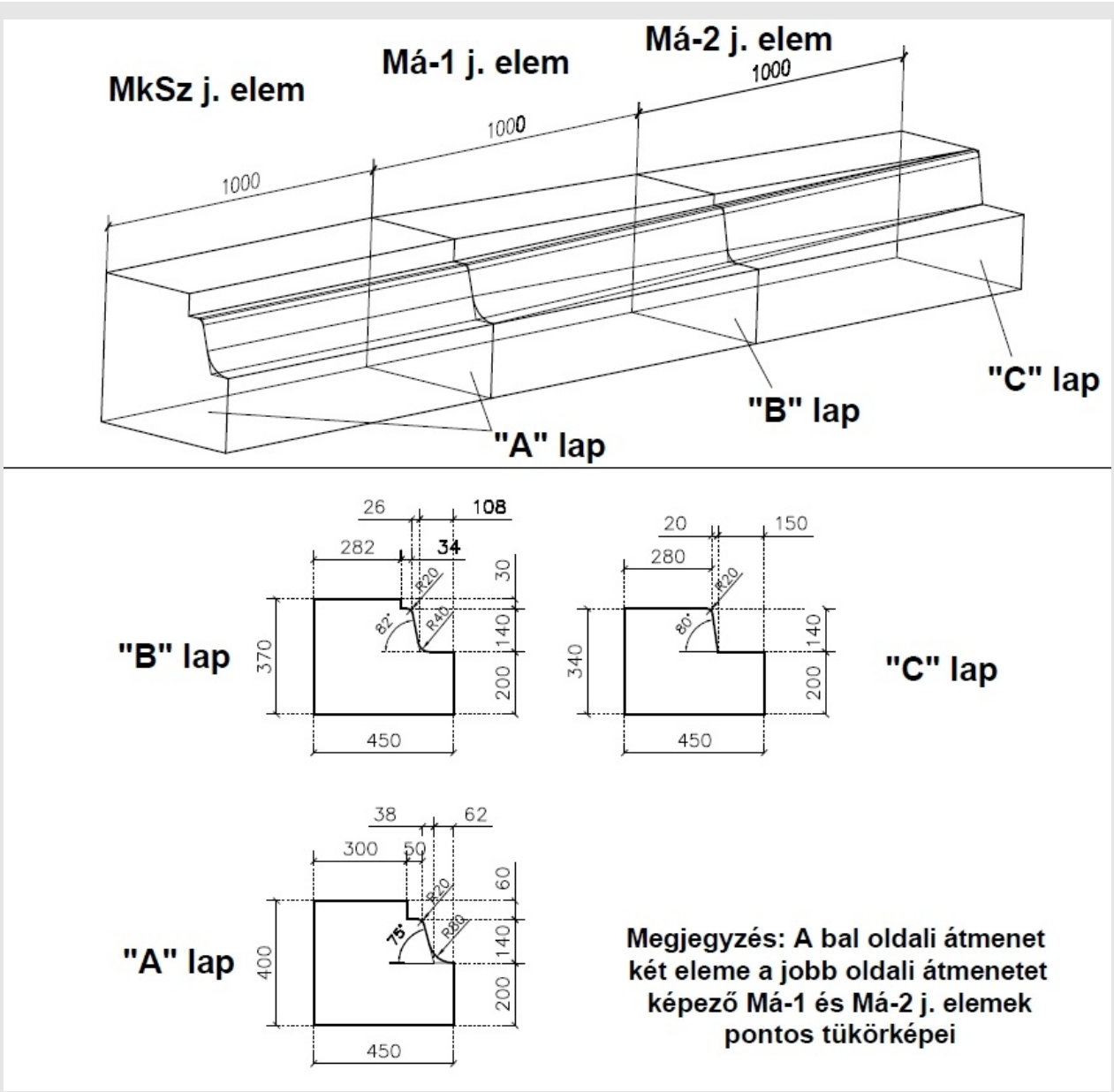
By trying to find the best approach for assistance free accessibility, we used the "Dresden kerb", where there is a guidance of the tires, and possible to drive closely parallel to the kerb, without the fear of hitting the front of the vehicle to it. By kneeling the vehicle, the 20 cm height of the kerb makes possible to have only a small gap vertically and horizontally to roll out of the interior. These kind of kerbs are not used in common tram-bus lanes, since low-floor trams usually cannot kneel.

We asked our hired road designer to plan also these kerb elements, and using this opportunity we ordered the concrete factory (Csomiép Kft.) to make these concrete patterns for their production also for future constructions.

For the materials of the stop we used concrete for the road instead of asphalt or cobblestone. In the Hungarian practice it proved that the newer buses and trolleybuses, that use smaller diameter of wheels wear down the asphalt or "viacolor" concrete or basalt cobblestones much quicker. In recent years practice almost all stops were built with concrete. This stop was also built with concrete more than three decades ago, and although cracks were allover the pavement held itself together for long over its supposed lifetime.

The pavement of the sidewalk was made of red "Klinker" bricks, which is extensively used in Szeged allover for a decade of inner city rehabilitation. Here we built in tactile stripes for the blind and ill-visioned persons leading to the first door of the trolleybuses. These elements can be purchased in the style of the "Klinker" bricks, but they are rather expensive. Unfortunately Szeged City Architect Office insisted using also red tactile stripes, which is not contrasted color enough for the ill-visioned to be able to see.

The stop is fitted with stylistic stop post for trolleybuses, which will be accommodating electronic display in the future. This is realized from an outside project. The City Architect Office did not permit rain shelter to be built near the historic post-office building.



The dimensions of the trolleybus stop's kerb

Implementation of the stop reconstruction

Authorization

Since this reconstruction did not alter the geometry of the road, we did not need permission from the National Transport Authority. The Municipality gave permission without problem.

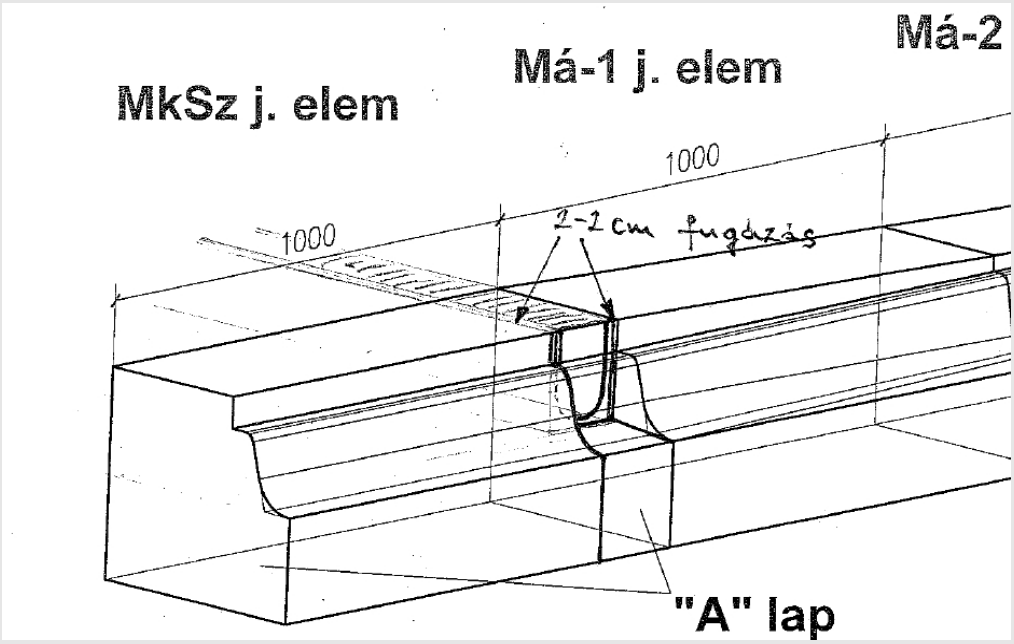
Procurement

The procurement process for the stop reconstruction was done in August-September 2011 in two rounds. The first round was declared by us unsuccessful, because the prices given by the competitors turned out to be high around 50 % higher than predicted. The reason was, that the official prices appearing on the Chamber of Building Industry were not correct (lower than the actual market values), that was obliged to be used by the road designer. After simplifying the water drain system in the stop we reran the procurement, which was successful this time. The start of the work was in middle October 2011, and it was finished by the middle of November. In order to give a proper hardening for the concrete (which was important due to the lower temperatures), we allowed one more month without usage by the trolleybuses.

Implementation

The construction company's first job was to prepare a temporary traffic layout during the construction. Since there are four lanes in this road, it seemed to be relatively straightforward to give out one lane for the construction, and one more for the machinery and for storage area. This however was not allowed by us, since the trolleybus service was not allowed to be interrupted. The catenary lays here above the two lanes, and the trolleybuses cannot infinitely get out of under the wire (4,5 meters maximum). That is why we prescribed to the construction to use the end of the site to enter, and forbade to use the neighboring lane. The construction company accepted, and rearranged its work in a way, that they mostly used the construction site for loading, unloading, and stored their material elsewhere. Thanks to the unusually relatively warm nights, the pouring of the concrete was possible to do during one night's service brake. (In case of colder weather we would have given a day of replacement of trolleybuses on one Sunday, because the pouring of the concrete was only possible to do without interruption, and could only be performed from the neighboring lane.)

Two stages of the reconstruction of the trolleybus stop. The neighboring lane were mostly kept free for traffic.



Drain outlet built on location to the kerb elements

A problem occurred on the sidewalks as well. After removing the previous, bad state asphalt cover of the pavement, it turned out, the neighboring post office buildings artificial stone footing was attached sometime after the pavement on the asphalt: meaning the footing lacked a proper foundation to the ground, and was in danger of split off. The designer changed the level of the pavement and once again modified the drainage system. The municipality road operator prescribed also in hindsight to form a drain also to connect the buildings rainwater pipes to the water siphonage system in order to protect the brick elements from washout. Since the road is in a 2,1 % slope the rainwater naturally flows away alongside the kerb elements to the water drainhole at the bottom of the slope, so we decided rearranging the drains to lead out all rainwater to the road. This meant, that on spot there was inserts to the kerb elements, with cuts to the drains; and the drains were so arranged, that they end up at the meetings of two 1 meter long kerb element. Also, the construction company took care about the water insulation at the footing of the post office building, which is necessary in case of brick surface, that can lead the rainwater down in the gaps between elements.

Results

The project finished in the beginning of 2012. The stop was in regular use after 16th December 2011, with no objection of any stakeholders. For the trolleybus overhead wire we need the approval of the final state by the National Transport Authority, which will be requested in the Spring 2012. By preliminary discussion with the Authority we expect no difficulty.

The new layout was greeted positively by the trolleybus drivers, and since then there was no derailment of the current collectors. The new configuration makes possible to turn around from each direction, which is a great advantage for the trolleybus network in case of interruption.

During the project there were reporting by the local newspapers and television about the necessity of the improvement, the residents accepted the temporary construction status without any major complaint. The project itself was recorded by a permanent information plaque for the future years.

The stop and the catenary after reconstruction, in January 2012

Sustainability

Both investments are made at the key junction of Szeged city's trolleybus network existing since 1979, which ensures long term sustainability. The city's long-term traffic-development concept (released in 2007 accepted by the local government) aims to make a “green inner city” (aim LXI.), where the preferred mode of traffic is zero-emission, electric public transport (trams, trolleybuses) as well as pedestrians, cyclists.

Transnational added value and foreseen impact and leverage

The aim of the investment of Szeged “Intermodal Corridor Pilot Action” in the framework of the Central Europe Trolley project is to show in practice the kind of overhead elements that are capable of providing a safe contact between the trolley and the wires at high speed and complicated configurations (switches, crossings). These elements are decrease the number of derailments of the trolleys as well as reduce the vibration to the walls of the neighboring houses. It is not an easy job to do the urban planning of a wire system to provide track to the clean, low-noise, low-vibration electric buses, but in our report we will give a step by step guide and a case study of possible problems and their solution.

Also we reconstruct a trolleybus stop in order to provide accessibility to the low-floor trolleybuses. The aim of the pilot to show the local and international community a best practice for trolleybus stops, where with using the kneeling capability of the trolleybuses enhance the accessibility due to the special kerb elements. We will show, that a trolleybus stop can be made emphatic while it matches the urban environment.

We expect the shown new design elements to be used further on in other construction projects, and the promotion of the clean electric public transport. Future trolleybus corridors are prepared with these overhead elements and stop arrangements.

Conclusion

In general we would like to emphasize the role of a good and a flexible management in the success of such projects. All designs must be ordered in such a way, that any change due to the unforeseen external affects during the authorization and the implementation must be possible to handle. For such purpose one can use also a general designer company, but it is more expensive, and it is difficult to contract such unknown affects in advance, which can often lead to cost increases for the general designers. In our case Szeged Transport Company was acting in the role of the general designer, thus we had no problem of our decision making process to run according to our own interests. Another way to try to foresee the possible problems is a more detailed feasibility study, however at that early stage it is not possible to the foresee the authorization problems are coming forth too late in the process. Often the stakeholders are not willing to give their conditions for the permission at that stage of the process.

We have shown in this report step-by-step how an idea of a trolleybus overhead building realized through the process of designing, authorization and implementation. We shown affect of all stakeholders in such projects, and how is it possible to get a consensus between the very different entities (politicians, residents, authorities, utility operators, neighboring institutions, etc.) in order to realize a trolleybus construction project.

External project services

- Designers:
  - overhead wires: *ZHB Erősáramú Kft, Füle Antal*
  - road: *Makadám 2000 Úttervező Mérnöki Iroda Kft., Csamangó Attila*
  - architect/hooks: *Krizsán Katalin*
  - gardening: *Hortus Bt., Fekete Zoltán*
- Procurement assistant lawyer's office: *Ollé Ügyvédi Iroda* (overhead materials), *Molnár és Tóth Ügyvédi Iroda* (road reconstruction)
- Overhead materials producer: *Elektroline A.S.*
- Technical controller (engineer): "*Metró" Közlekedésfejlesztési, Beruházási és Mérnöki Szolgáltató Kft.*
- Construction company for the road reconstruction: *Magyar Aszfalt Kft.*
  - Delivery of the concrete kerb elements: *Csomiép Kft.*
- Construction company for the overhead wires: *Szegedi Közlekedési Kft.*
- External works for the overhead reconstruction:
  - Gardening, tree cutting: *Szegedi Környezetgazdálkodási Nonprofit Kft.*
  - Archeology: *Móra Ferenc Múzeum*
  - Mast erection: *Alfa-Omega Kft.*
  - Traffic lights rearrangement: *Signalterv Kft.*
  - Information plaques: *Szimmetria Bt.*
- First level control for EU supervising: *Váti Magyar Regionális Fejlesztési és Urbanisztikai*

Nonprofit Kft.

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