Influences of Utility Networks on Measuring

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ABSTRACT: The measuring of any quantities is always encumbered with inaccuracy. To attain the best results it is necessary to restrict these errors. The exactness of measuring depends on the quality of the measuring equipment, the lay-out of the equipment, and on external influences. The goal of this paper is to draw attention to those external influences that are rare or are not supposed to be present.

KEY WORDS: Circuit, frequency, line, cable.

1 THE TEXT

Utility networks placed underground and in the air are used for the comfort of mankind. In cities and towns, these include, above all, water mains, sewerage systems, gas mains, and electricity mains, as well as the supply of railway applications for public transport. Utility networks placed in the air are used for connections and radio and television broadcasting. This paper deals with the influences of radio relay communication and the contact lines in Brno – Veveří.

1.1 Radio relay links

České Radiokomunikace are one of the radio relay links operators. A wireless connection is operated on frequencies from 1.5 to 40MHz. For operation on the above mentioned frequencies direct visibility between a transmitter and a receiver is necessary. To ensure a quality transmission the operator requires corridor lengthwise ideal beam axis. If a certain part of the energy of the beam is outside the corridor; its level is not suitable for quality reception, on top of which it can be a source of interference for other equipment. See the line in Figure 1.

1.2 Traction equipment

Public transport in Brno comprises both of tracked and untracked lines. In the case of tracked lines, the system of rail connected plus pole is used. Tractions are fed from rectifier substations, where alternating current is transformed to direct current. Trams and trolleybuses accept electrical current from contact line routes and rails that are connected by cables with rectifier substations. Tracks are fed in segments; these segments are electrically divided and fed by means of independent cables. Rectifier substations supply tracks in certain areas around the rectifier substation; it is for this reason that feed cables are placed in streets without transport. The feeding system is subject to continuous development. Formerly, trams were only fed by cables to the section of contact line routes.

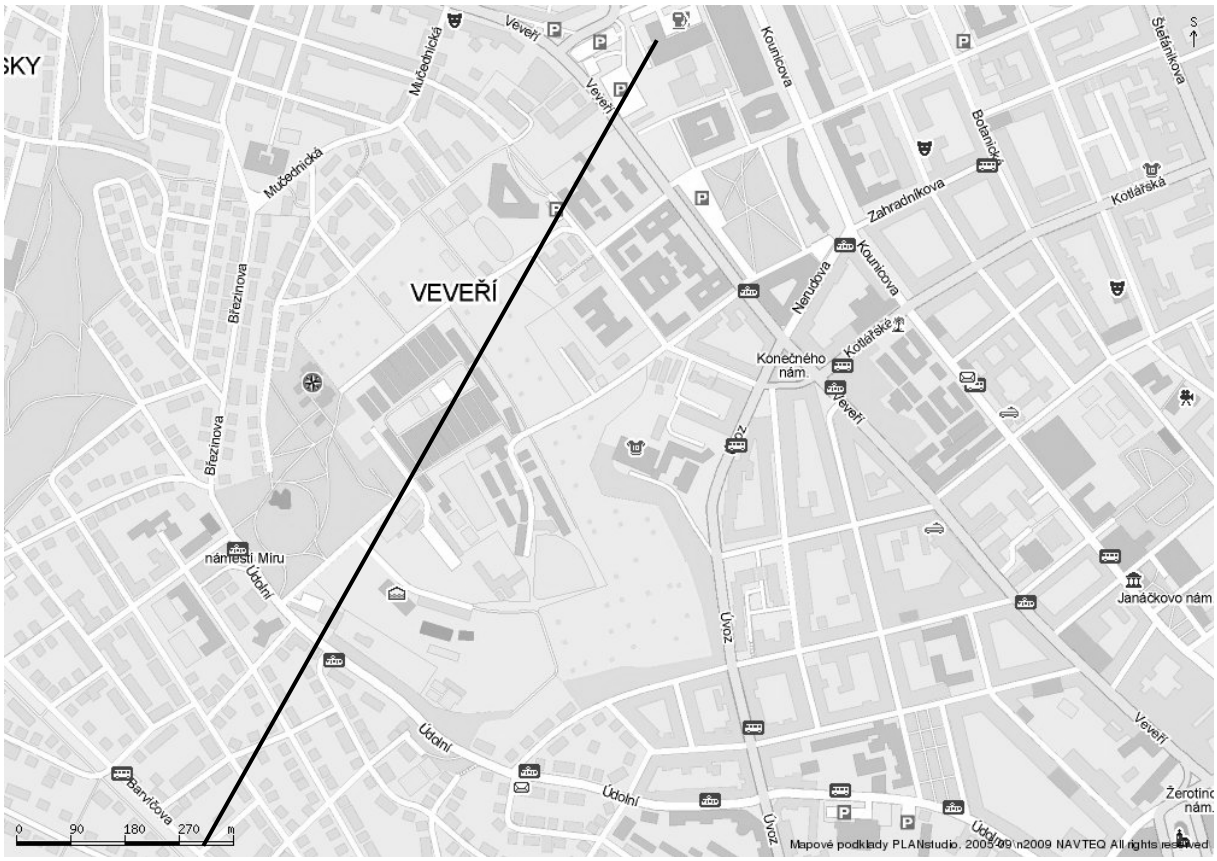

Figure 1: Radio-relay line Barvičova – Šumavská, Brno.

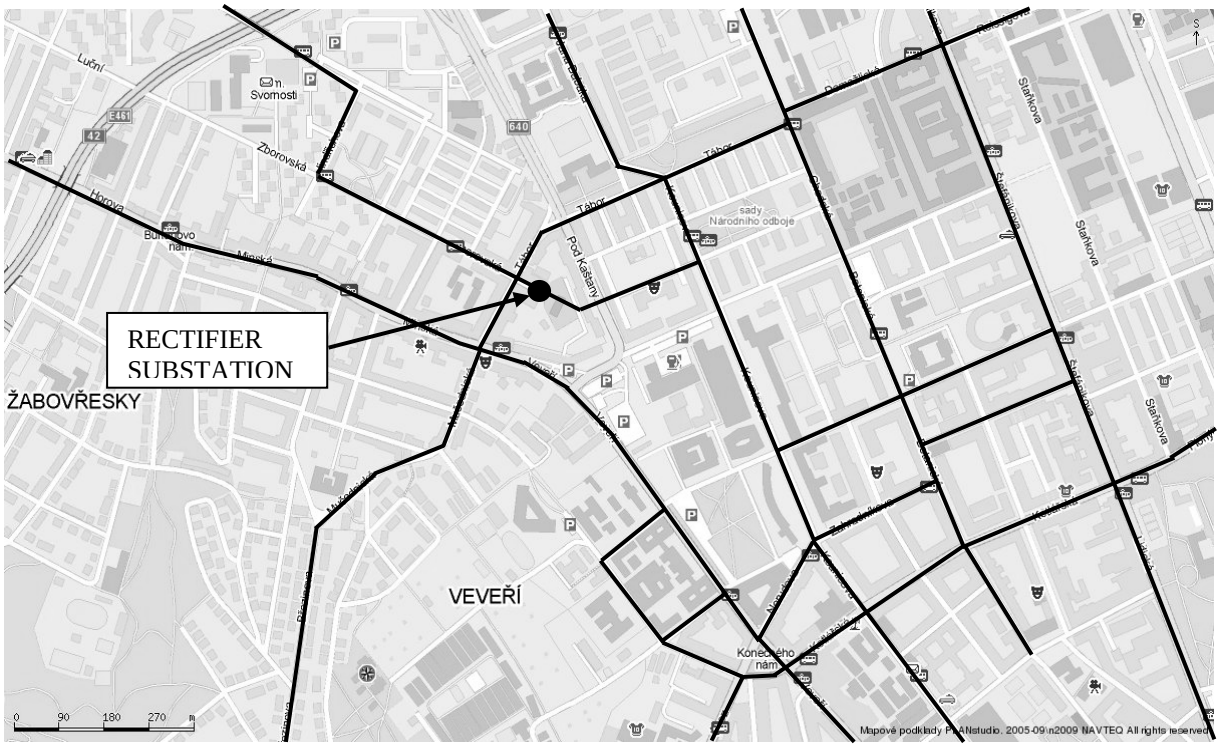

Figure 2: Traction equipment in Brno – Veveří.

Rails were only fed in the place that was close to the rectifier substation and electric current was led to all sections solely by rails. When trolleybuses were launched, feeding was connected to tram network, and the minus pole from the contact line route was connected to the contact line route without a switch, the rail was connected to the plus contact line route. Feeding by independent cables was established only in the sectors where trolleybuses went along streets without tram tracks. In some sectors with both tram and trolleybus transport, the tram contact line route was used for feeding trolleybuses. In the beginning this was convenient, but it had to be changed when TII trams were launched; this type required a higher volume of electrical current. At that time, a new system of rail feeding cables was introduced; each section has the same number of cables for both polarities. This process is in progress and has not been completed yet. Further changes are being carried out continuously; tram feeding and trolleybus feeding are being separated, which also has not been finalised yet. The goal of this process is to separate the tram feeding from trolleybus feeding, including the rectifying substations.

Brno – Veveří is fed mostly from the rectifying substation in Tábor (see Figure 2). This rectifying substation has, on the direct side, one system of bus bars fed by all rectifiers and this system is used for feeding trams and trolleybuses in this locality.

The section of tram track in Veveří street and along the Faculty of Civil Engineering VUT starts close to the cinema Lucerna and runs up to the crossroad Veveří – Kotlářská; it is 997m long – see Figure 3. Feeding from the rectifying substation Tábor is ensured by cables along Veveří, where two feed points are placed. One of the feed points is placed between the streets Mučednická and Šumavská and the second is placed in Rybkova, close to Veveří. Cables from the rectifying substation leading along Tábor street, turn into Veveří and than lead to the street Resslova. At this point, cables leave Veveří and lead along Resslova, Žižkova and Rybkova streets back to Veveří.

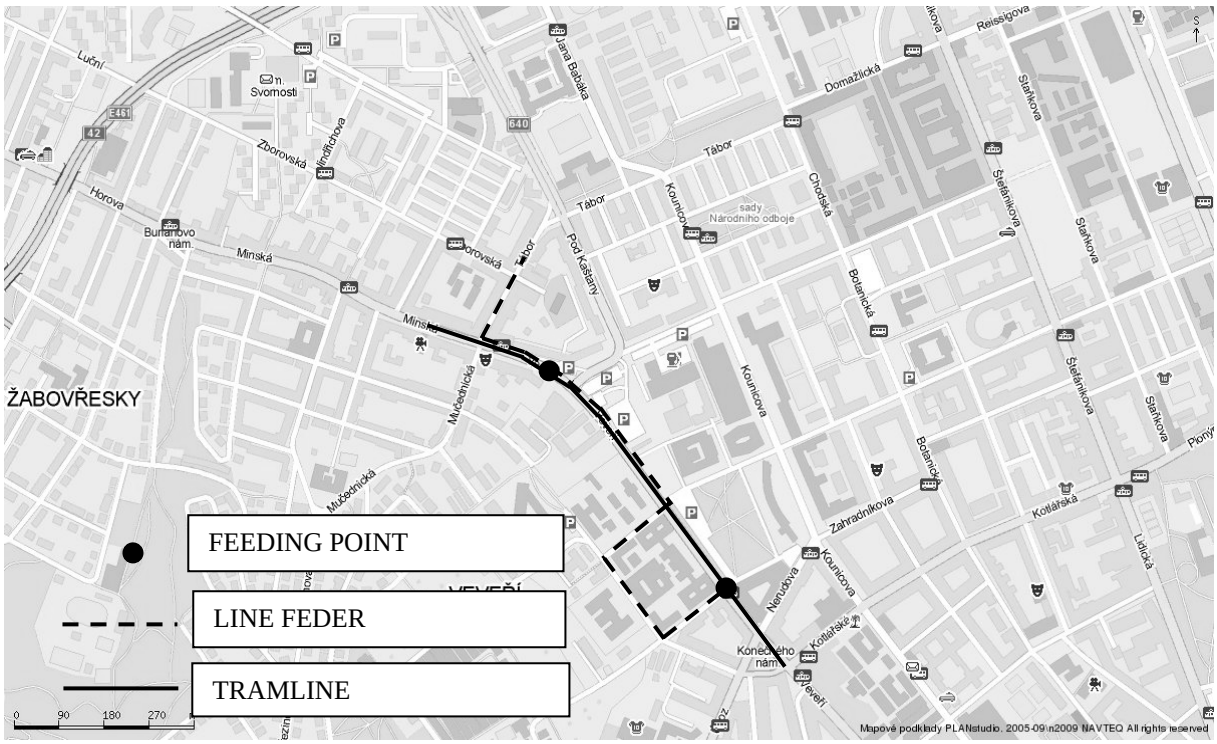

Figure 3: Tram-line Veveří.

Between feed points, a part of electrical current goes through the feeding cables, and a part goes through the contact line route and rails. For the minus pole, 37% goes through the contact line route and 63% goes through the feeding cables. For the plus pole, 87% goes through the rails and 13% goes through the feeding cables. The total maximum current in the above mentioned section

Reaches 2400A, according to measurements. In the section between streets Kotlářská and Nerudova, 853 regular tramways operate between 4.57 to 22.49 on weekdays. The heaviest period of traffic occurs between 7 a.m. and 8 a.m. with a total of 69 trams. The amount of necessary electrical current is influenced by two traffic lights and by the types of trams going through the section.

The section of trolleybus track in the street Kounicova and along the University of Defence starts between streets Tábor and Klusáčkova and goes to the crossroad Kounicova Zahradníkova and is 729m long – Figure 4. Feeding is placed solely at the stop Klusáčkova. Cables are placed according to the shortest possible way from the rectifying substation and both polarities are parallel. 492 trolleybuses go through this section every day and the maximum needed electrical current reaches 690A.

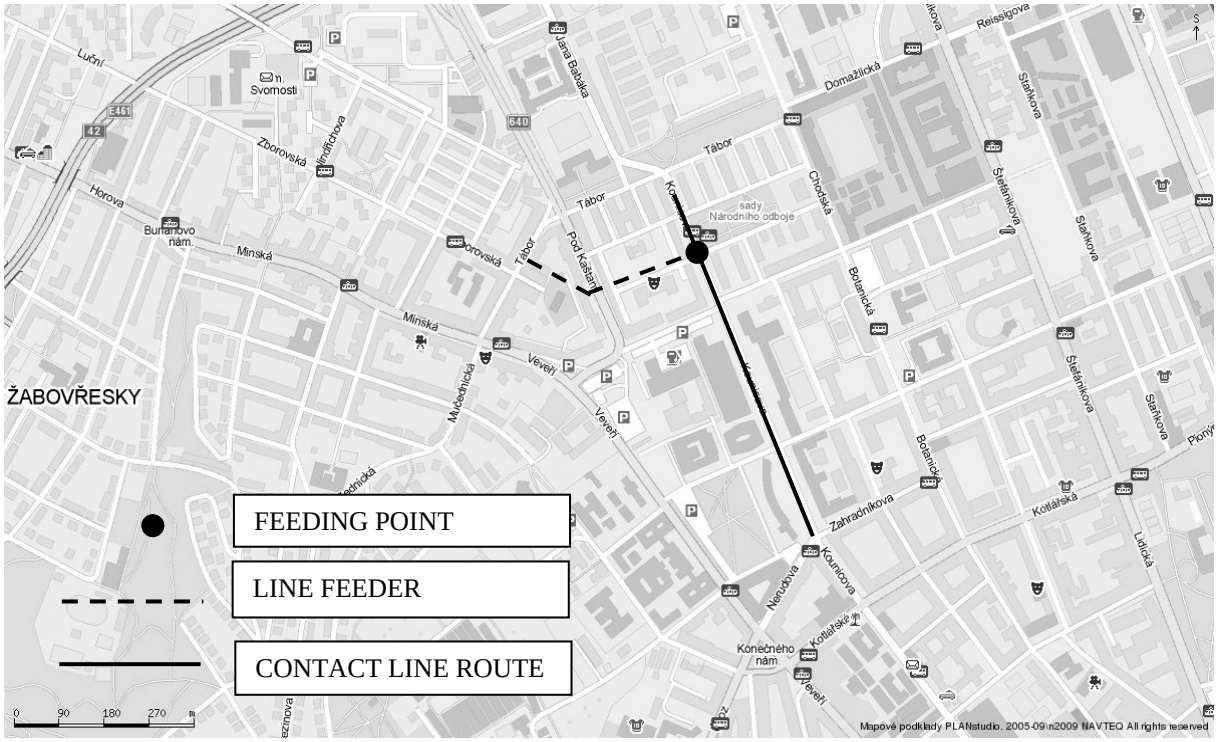

Figure 4: Trolley-bus line Kounicova.

The trolleybus track Úvoz – Kotlářská (see Figure 5) is fed from two rectifying substations - Tábor and Údolní. For feeding from the rectifying substation Tábor, a minus cable is placed up to feeder in Úvoz. The plus pole is connected to cables for the tram feeding in Veveří from the distribution box in Rybkova. The current consumption in Úvoz ranges from 600A to 1200A.

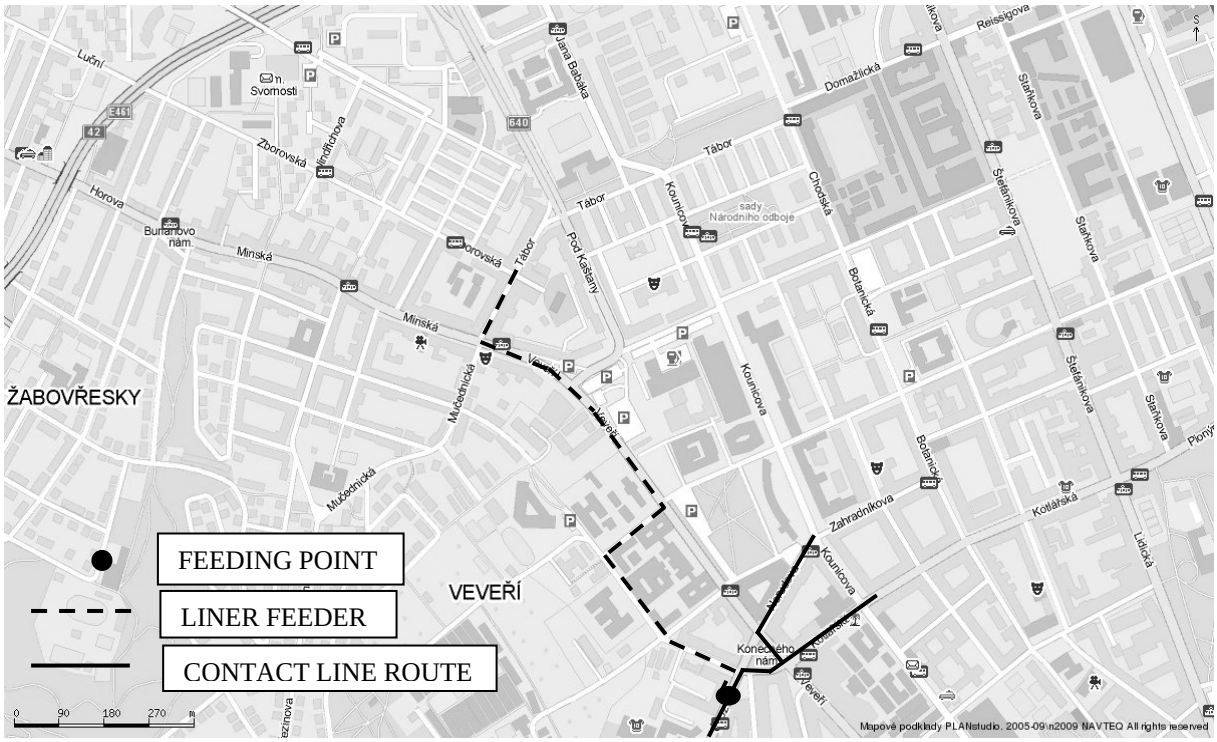

Figure 5: Trolley-bus line Úvoz Kotlářská.

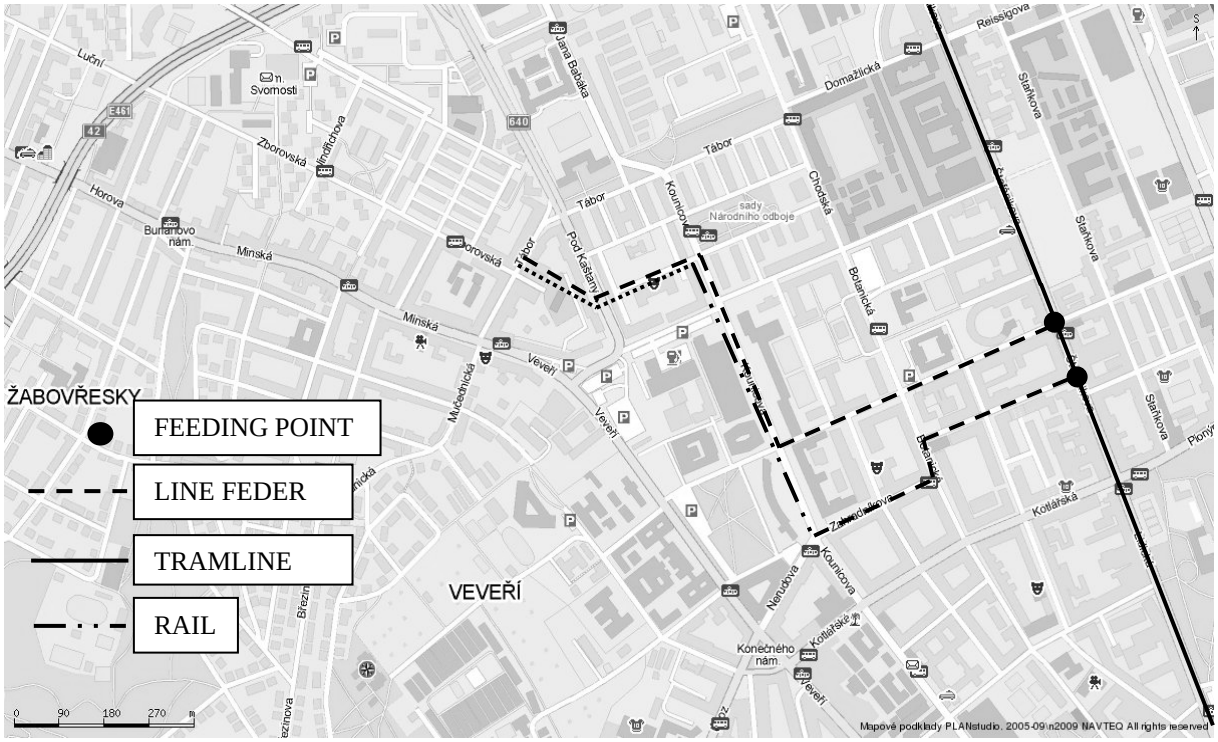

Figure 6: Tram-line Štefánikova.

The tram track in Štefánikova – see Figure 6 is fed from the rectifying substation in Tábor and from another one in the city centre. The cables for the minus pole are placed concurrently with cables for feeding traction in Kounicova and the stop Klusáčkova; they than turn to Kounicova street in the direction to the city centre and later to Šumavská. There is a feed point for the tram contact line route. The plus pole is carried from the rectifying substation

to the tram rails in Kounicova in the area of the tram stop Klusáčkova. Subsequently, the electric current goes through the tram rails up to the crossroad Kounicova – Zahradníkova. There the cables are connected to the rails; these cables are placed along the streets Zahradníkova, Botanická and Dřevařská up to the tram track rails in Štefánikova. The electric current consumption ranges from 300A to 1500A.

The return circuit for the plus pole (see Figure 7) utilizes the contact line routes, rails and return conductors. The individual sections are not divided by section insulators; they constitute one large system with more feeding cables.

There are, besides the direct current, elements of alternating current in the supply network. These are network frequency 50Hz, and the frequency of unfiltered rectifying 300 Hz. Further sources of various frequencies comprise of static converters, rectifiers, traction trains regulators, etc. The contact of current collectors and contact line routes are a source of irregular disturbance. This source strongly depends on temperature and air humidity. Freezing ice on contact line routes can cause serious problems.

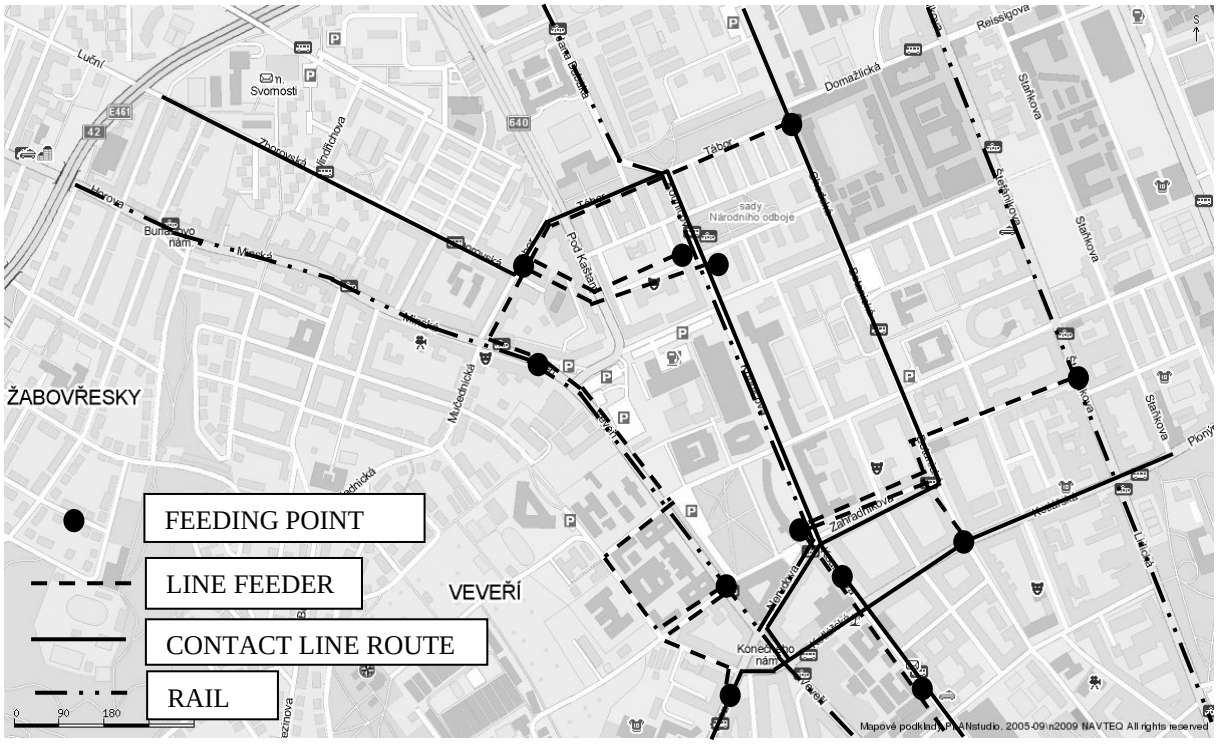

Figure 7: Return cables in Veveří.

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