

**ANNEX III**  
**TECHNICAL DESCRIPTION**

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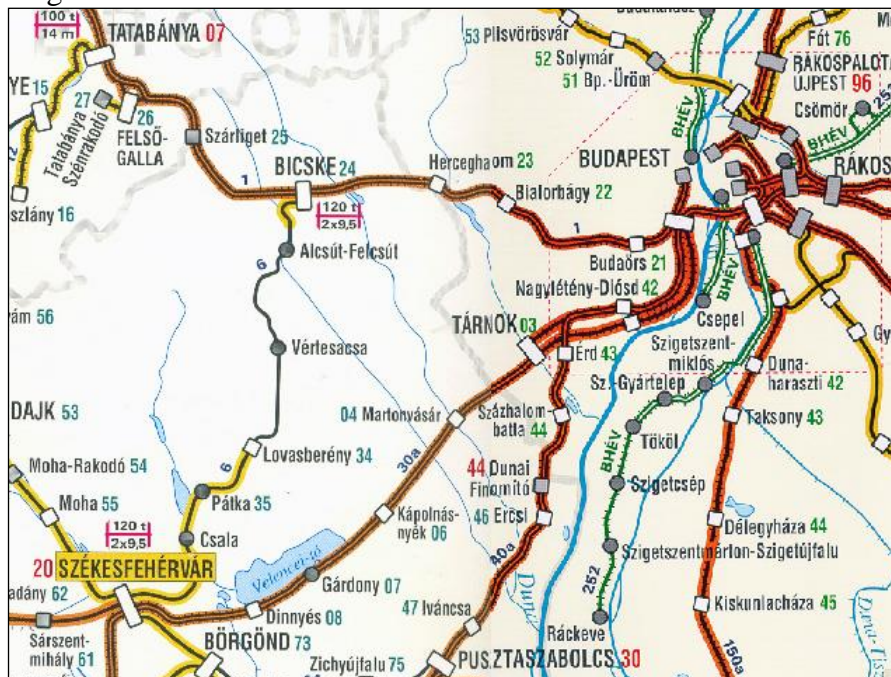
### PROJECT TECHNICAL SUMMARY

#### INTRODUCTION

The Budapest – Székesfehérvár railway line is part of the V Corridor of the Trans European Network. The Hungarian Railway is committed to raise the current situation of the network in order to match the European requirements for the modern transport systems.

Following the conclusions of the study prepared in 2005, “Improvement of the suburban transport conditions on the lines Budapest-Pusztaszabolcs and Budapest-Székesfehérvár between Budapest and Érd”, some specific tasks have been chosen for the modernization of the railway network. Other conclusions follow the Hungarian Transport Strategy (prepared in 2008) and Strategy of Development of Suburban Transport System of Budapest (prepared in 2008).

Such modernization tasks will contribute to the implementation of a high level railroad service on the Érd - Budapest transport corridor which offers the passengers attractive and favorable choice against the road traffic.



The modernization is expected to take place between years 2008 and 2012. It includes the reconstruction of the existing track together with the renewal of the whole signalling system, as well as the electrification and telecommunication facilities.

### A.1. The current situation of the network

The rail network of Hungary has suffered the detrimental effects of insufficient maintenance and lack of necessary repair works for many years. As a result, traffic is often delayed, quality of service is inadequate and travelling conditions are poor. Thus, rail transport has become unreliable, and railway has become much less attractive and competitive in comparison with other traffic sectors, road in particular.

<b>MAIN PROBLEMS TO BE SOLVED</b>	
<b>Track Conditions</b>	<ul style="list-style-type: none"> <li>▪ The poor condition of most of the tracks and track bed resulted in permanent speed restrictions. The poor track condition is enhanced at many sub-sections by poor drainage.</li> <li>▪ The lack of the second track on Budapest – Tárnok section significantly reduces the capacity of the whole section.</li> <li>▪ The demand to increase the axle load from 210 kN to 225 kN.</li> <li>▪ There are numerous speed restrictions due to small curve ratio, particularly at the station entrances and exits.</li> </ul>
<b>Platforms at the Stations</b>	<ul style="list-style-type: none"> <li>▪ Several stations have only rudimentary narrow platforms, which can only be accessed by crossing the tracks. While a passenger train is at the station no through traffic is allowed for safety reasons.</li> </ul>
<b>Signalling System</b>	<ul style="list-style-type: none"> <li>▪ Most of the stations have obsolete signalling., which can be one of the main reasons of serious accidents.</li> <li>▪ Since the existing signalling equipment is not able to eliminate the possibility of human error, the consequence of applying this equipment is a speed limit of 100 km/h (regulation of the National Railway Authority)</li> <li>▪ The safety protection at the numerous level crossings needs improvement. This applies similarly to fencing at critical sub-sections.</li> </ul>
<b>Electrification</b>	<ul style="list-style-type: none"> <li>▪ The overhead wire is badly worn over most of the route.</li> </ul>
<b>Telecommunications</b>	<ul style="list-style-type: none"> <li>▪ The telecommunications system is old fashioned in some stations and sections.</li> <li>▪ The passenger information system has to be modernized.</li> <li>▪ It is not possible to remote control the signalling, overhead wire power supply and other systems because of the lack of suitable telecommunication connections, resources and integration.</li> </ul>
<b>Environment</b>	<ul style="list-style-type: none"> <li>▪ The noise level exceeds the maximum permissible and acceptable level at some sub-sections (especially during night)</li> </ul>

**Changing of transport modes on stations and stops**

- Lack of P+R parking places
- Bus stops are too far away from the station or stop and are in an obsolete condition

## A.2. Modernization project

Taking into account the current state of the railway line and the need of staging of the modernization project, the description of the foreseen modernization tasks included in the present project can be presented as follows:

<b>MODERNIZATION TASKS</b>	
<b>Track Conditions</b>	<ul style="list-style-type: none"> <li>▪ Renewal of the track and track bed all along the line: the objective is increasing the track speed up to 160 km/h in the sections Nagytétény – Velencefürdo and Agárd - Székesfehérvár and to 120 km/h in the sections Kelenföld – Nagytétény and Velencefürdo – Agárd (due to dense built-in area)</li> <li>▪ Introduction of axle load 225 kN</li> <li>▪ Duplication of the track between Budapest Kelenföld and Tárnok</li> <li>▪ To increase capacity by changing tracks of the stations .</li> </ul>
<b>Platforms at the Stations</b>	<ul style="list-style-type: none"> <li>▪ Improving passenger safety and reduce train delays at stations where currently passengers have to access trains by crossing the tracks. Wider platforms and connecting underpasses will be constructed at most of the stations.</li> </ul>
<b>Signalling System</b>	<ul style="list-style-type: none"> <li>▪ Implementation of new electronic signalling system, adapted for the speed of 160km/h, which can be remote controlled from the Traffic Control Centre at Martonvásár.</li> <li>▪ Improvement of level crossing signalling system. Removing several level crossings replacing them with road underpasses, where it is possible.</li> <li>▪ Preparing for ETCS 2 in order to achieve interoperability with the European network.</li> </ul>
<b>Electrification</b>	<ul style="list-style-type: none"> <li>▪ Implementation of new catenary system</li> <li>▪ Implementing the remote control of the catenary power supply.</li> <li>▪ Implementation of points heating and its remote supervision</li> </ul>
<b>Telecommunications</b>	<ul style="list-style-type: none"> <li>▪ SDH transmission system deployment all along the line. Creating an integrated and homogeneous network, allowing remote control.</li> <li>▪ Implementation of modern passenger information systems</li> </ul>
<b>Environment</b>	<ul style="list-style-type: none"> <li>▪ To improve the environmental situation along the line, noise protection walls will be erected where it is regulated.</li> </ul>

## **RECONSTRUCTION OF BUDAPEST-KELENFÖLD STATION**

Some part of the existing track layout is to be reconstructed and new platforms for suburban traffic will be built within the scope of the "Construction of the new metro line no. 4" project.

### **CIVIL WORKS**

#### **Track reconstruction**

The following are the planned permanent way characteristics:

- In case of tracks no. I, II, III, IV, V, VI (4000 m long) and tracks no. outer III./a. IV./a. V./a. VI./a. XI./a. és XII./a: system 60 rail, LW mark RC sleepers, clamp fixing, 60 cm sleeper spacing, continuous welded execution, 57 cm crushed stone ballast.
- Each turnouts (41 groups of turnouts and 5 groups of crossings) will be replaced with B60-type switches mounted with raffles
- Each turnouts will be mounted with new points operating mechanism
- Two groups of new turnouts are to be installed into the track layout, to connect the second track of railway line 30/a. .
- The tracks must have continuous welding. The ballast is 32/50 mm grain size crushed stone.
- By the open line connection between chainages 54 and 59, all the 3 tracks will be rebuilt, the fourth will be constructed.

The expected speed after the conclusion of the works is as follows:

<b>Segment</b>	<b>Planned speed</b>
On tracks no. III, IV, XIV and XV (main tracks)	80 km/h
On tracks no. I, II, V, VI, VII, X, XI, XII, and XIII	40 km/h.

#### **Platform reconstruction**

Platform constructions will be carried out in the frame of another project ("Construction of the new metro line no. 4").

#### **Roads, level crossings**

There are no level crossings in the station.



## **Structures**

During the reconstruction of the station a 19,4 m wide, RC structure pedestrian subway will be built in chainage 42+70,8 for shared use with the METRO. The subway construction is not the part of this project.

The 8,0 m span pedestrian subway in chainage 42+34,2 gets a new function after finishing the new subway. The subway reconstruction is not the part of this project.

At chainage 54+25 a road subway reconstruction is not part of the project. The construction of 4-th track and to implement the 35 cm working ballast depth can be done on the structure.

## **Geotechnics**

In case of cohesive soils with not appropriate loading capacity the capacity of the sub-soil will be increased by the technology and structure designed by the contractor. The period of the track possessions can't be longer.

### **A.3. SIGNALLING**

Due to the changing the track layout towards Nagytétény and for connecting the new open line track No. IV ,modification of the D-70 type interlocking system is required.

The signalling works can be divided into two parts:

- 1.) The modification of the outdoor part of the signalling system because of the rail system changing (54/60 kg/m) in case of tracks and turnouts.
- 2.) The 4-th track connection from direction Budafok-Háros / Budafok-Albertfalva into the D.70 signalling system (outdoor and indoor part).

### **Power supply of signalling system**

The changing of the whole power supply system will be implemented. During the assembling of the new system the continuous operation can be supplied. The maximum time without operation is 4 hours.

### **Points heating**

In Budapest Kelenföld station 42 switches is planned to be set up with electrical heating.

2 pole transformers (in addition to the three presently existing ones) and 22 zone controlling points heating automatic boxes is to be installed. After increasing the primary capacity, the load of the existing pole transformers can be eased.

The controlling unit of points heating is to be installed in the station office.

The heating of the raffles must be ensured with 2 units, 1800 mm long each, 1 kW capacity, nearly 560 W/m unit capacity heating wires.

### **A.4. ELECTRIFICATION**

The project contains:

- Catenary works connecting to the 4-th track construction works to direction Budafok-Albertfalva, Budafok-Háros.
- Catenary works on tracks No. I—VI., T1, T2 and in case of additional tracks.

## **A.5. TELECOMMUNICATIONS**

The modernization of tracks No. I-VI. means mainly the modernization of telecommunication system of platform "A" and "B", which are the supplementary works of underground construction works No. 4.

In Budapest-Kelenföld station the visual and acoustic passenger information system will be rebuilt because of the construction of section I of Metro line no. 4.

A new power supply system shall be installed for the existing telecommunication equipment, which will be implemented in frame of the underground project.

## **A.6. OTHERS**

### **Outdoor lighting**

Budapest-Kelenföld railway station is crossed by the new metro line no. 4. The construction of the metro tunnel is affecting the existing outdoor lighting equipment and the platform roofing. Therefore, the outdoor lighting equipment of the area has to be rebuilt because of the partial demolition and rebuilding of the platform roofs. New platform lighting equipment shall be installed together with the new platform roofs. This activity will be implemented in the frame of another project.

The renewal of some part of the outdoor lighting in the switch area will be part of this project.

## RECONSTRUCTION OF BUDAPEST-KELENFÖLD – TÁRNOK LINE SECTION

The line section extends from **Budapest-Kelenföld (excluded)** to **Tárnok (included)**.

The total length of the reconstructed section is 19,1 km between sections 59+00 – 250+00.

The following are the stations and stops situated along the line section:

- Budafok-Albertfalva station (to be demolished during the reconstruction; it will function as stop)
- Budafok-Belváros stop
- Növény street stop
- Nagytétény station
- Nagytétény-Érdliget stop
- Érd-alsó station (to be demolished during reconstruction; it will function as stop)
- Tárnok station

The geographic conditions and alignment of the railroad line accounts for its reconstruction to reach the AGC parameters increasing the speed up to 160 km/h between Nagytétény-Tárnok. One of the main aim is to implement 225 kN axle load. The project recommendation includes - beside track development which assures higher velocity -the construction of wide platforms at stations and the renewal of some obsolete interlockings initiating the process for reaching interoperability. Along the section there is just single track constructed. It is intended to build the second track to manage the traffic rates.

Segment	Planned speed
Budapest Kelenföld – Nagytétény (restrictions in some places due to the existence of small radio curves)	120 km/h,
Nagytétény – Tárnok	160 km/h

### A.7. CIVIL WORKS

#### Track construction

The second track of railway line no. 30 starts in Budapest-Kelenföld station. Tracks of railway line no. 30 depart from track no. III (left track) and track no. IV (right track), while the tracks of railway line no. 40 depart from tracks no. V and VI. The station layout will be modified by changing the No. 19 turnout (54 XI system) to 60 XIV system turnout and the turnout no. 17 (60 XIV system) will be connected to turnout No. 11 and 19. On the open line section, between sections 54+00 – 59+00 all the four tracks will be reconstructed.

The second track will be built on the left side of the present one (the track is running on embankment)

During the project the present track will be reconstructed with corrections and besides on the left and side, a new second track will be constructed. The characteristics of the tracks are the following:

- Track-gauge: 1435 mm
- Rail inclination: 1:40
- Rail system: UIC 60
- Sleeper distance: 60 cm
- Sleeper type: LW, or equivalent
- Fastening: (SKL 14), or equivalent
- Ballast: crushed stone 32/50 mm
- Ballast thickness: 57cm, (minimum effective thickness: 35 cm)
- Track design: welded track.

Budafok-Albertfalva and Érd-alsó stations will be downgraded to stops. At Albertfalva station the BKV branch line and at Nagytétény station the branch line of Kémsavgyár will remain as open branch line.

In some sections noise protection walls will be constructed based on the Preliminary Environment Study

### **Platform construction**

The following are the proposed platform constructions tasks along the line section :

<b>Position</b>	<b>Operation</b>
Budafok-Albertfalva station	New island platform has to be constructed (55 cm high platform)
Budafok- Belváros stop	The existing platform will be improved, and a new platform will be constructed next to the new left track (30/55 cm high platform)
Növény street	A new stop will be constructed (55 cm high platform)
Nagytétény station	New platforms will be constructed (55 cm high platform)
Érdliget stop	The existing platform will be improved (55 cm high platform)
Érd-alsó stop	Platforms were reconstructed (in the frame of another project) (30 cm high platform)
Tárnok station	New platforms will be constructed (55 cm high platform)

The platforms of the stops have the useful length of 270 m. The platform access is possible through pedestrian subways. Along 50-50 m length on the platforms, platform roofing is needed, adjusted to the staircases and lifts. The platform pavement is: 8 cm block stone + 3-5 cm bedding sand+30 cm sandy gravel +grainy filling.

## Roads, level crossings

In the region of Érd Diósd a road is crossing the railway lines no. 30 and 40. A new public road subway was constructed in the frame of the KIOP programme in place of the two level crossings. In the scope of the construction of the public road a new stop at Érd-Alsó and two new pedestrian subways by the stop were also be built.

At Érd, Bagoly street the level crossing will be reconstructed. In frame of Phase 2 of this project a road bridge will replace the existing level crossing.

At Érd, Esküdt street and in Budapest at Kolozsvári and Campona street the level crossing will be reconstructed.

The level crossing at Nagytétény-Érdliget stop will be demolished.

## Structures

The improvement, reinforcement, extension and corresponding termination of the existing structures will be carried out according to the planned technical parameters.

<b>Place of structure</b>	<b>Planned construction works</b>
64+16,60 Árok utca passenger subway	Construction
66+99 Albertfalva passenger subway	Reconstruction
78+75 Hosszúréti árok bridge	Construction
86+10 hm signalling bridge	Construction
86+83 Duna utca bridge	Construction
87+72 Városház tér passenger subway	Reconstruction
90+45 Budafok Belváros stop, passenger subway	Reconstruction
99+90 Signalling bridge	Construction
94+39_Tóth J u passenger subway	Reconstruction
102+04 Vágóhíd utca road subway	Reconstruction
Road subway - Növény utca	Construction (in frame of another project)
111+10 „gyufagyári” railway overpass	Reconstruction
125+17,40 1,50/1,50 m long concrete bridge	Construction
135+57 Kolozsvári út passenger subway	Construction
144+62 1,50/1,50 m long concrete bridge	Construction
148+57,60 Csókási P. utcai passenger subway	Construction
160+79,10 Nagytétény állomás passenger subway	Construction
175+53,70 Tétényi utca passenger subway	Construction
183+36 Sulák árok bridge	Construction
187+40,30 Duna u. road subway	Construction
189+47,20 70 sz. út road subway	Construction
189+87,00 hm; Bara-patak structure	Construction
201+89,40 Tepecs árok structure	Construction
218+17 Érdi passenger overpass	Construction

224+53,50 Varjú utca subway	Reconstruction
Between 227 - 230 sections Harkály u. protecting wall	Construction
231+67,9 Sóskúti út subway	Construction
241+10 Tárnok passenger subway	Construction
244+93,00 Benta patak bridge	Reconstruction
Tárnok Benta patak passenger and bicycle bridge	Design and construction

Rebuilding the railway overpass at the matches' factory is needed. From operational point of view, at least 5,5 m height of the contact wire shall be ensured at the crossing structures; thus, the modification of the longitudinal section of the traction track is possible for ensuring the required height of the overhead wire in the corresponding railway line.

At Tomaj street a new pedestrian subway has to be built while at Állvány street the reconstruction of the present passenger subway is needed (XI district of Budapest).

The pedestrian subway at Budafok-Albertfalva station will be reconstructed in order to access the intermediate platform of the new stop. The 2 pedestrian subway in Budafok-Belváros station will be reconstructed (elevator installation, renewal). A new pedestrian and road subway will be constructed at the stop in Növény street in the frame of another project.

New pedestrian subways will be constructed in Nagytétény and Tárnok stations and at Nagytétény-Érdliget stop (for bicycles). The road subway at Duna and Vágóhíd street (XXII. District) will be wider after reconstruction. The railway bridge will be reconstructed serving match factory. Passenger subway at Kolozsvári street and Csókási Pál street (XXII. District) will be renewed, too. Passenger subway at Érd Duna street and Varjú street will be reconstructed. Road subway at Érd Sóskút street will be reconstructed. 2 pieces of passenger bridges will be renewed at Érd territory. A parking place and bus stop will be constructed at Tárnok station.

## **Geotechnics**

The construction of the second track results in an arrangement – because of the geometrical conditions – which does not make it possible to use the substructure (ballast, protective layer) of the existing track line.

On the major part of the observed section, the place of the second track is ensured; although the curve relations corresponding to the design speed and the span size of the existing structures require the extension of the existing embankment on certain sections.

Due to the height conditions in the cut of Érd the raising of track level is not possible; therefore an extension is needed on the left side of the cut.

### **Substructure design**

After the demolition of the existing track and substructure, the remaining water-bags, slag and the old drainage bed will be removed and its whole place will be filled with soil replacement (T material). On the sections, where the present embankment will be widened, the bottom of the water-bag can be channelled to the trench. At these places no soil replacement is needed.

The drainage of the line section can be solved with using the traditional trench system. In case of cuts the required trench surface can be ensured.

Next to main road no. 6, between 89+00 and 97+00, the place of the catchwater drain can only be provided by constructing a supporting wall.

In connection with the construction of the second track, supporting structures will be built at several points of the line. Between 89+00 – 97+00 and 204+00 – 219+00 space has to be ensured through the abutment walls. In order to ensure the drainage of the track, the supporting walls must be built as gabion walls.

Based on calculations it can be concluded that the stability after construction of the supporting wall is acceptable. During the construction, however, – due to the dynamic impacts caused by the traffic – provisional auxiliary structures or other technical procedures has to be applied in order to achieve a good stability rate.

On the Budapest Kelenföld - Tárnok line section, during the construction of the second track, significant embankment broadening will be made. It must be made at different embankment heights.

Along the line several new overhead line support poles will be set up or replaced. The poles shall be built with flat foundation. In the regular foundation depth grainy fillings (sand, sandy gravel), medium cohesive soils (sludge coarse silt) may be applied. The base foundations must be put under frost-line.

In the surrounding of the gabion walls and in 90+50 and 91+00, where the catenary poles will be erected on the existing supporting wall, special poles foundation has to be prepared.

## **A.8. SIGNALLING**

Between Budapest-Kelenföld – Nagytétény and Nagytétény-Tárnok stations, a new double track centralized or decentralized block system with new spacing will be installed, including the required open line telecommunication system. The train control function will be provided by the ETCS 2 system being built in the near future. A new power supply system for the two sections will be installed at Nagytétény station.

At Nagytétény and Tárnok stations new electronic interlockings with new power supply system must be installed replacing the existing ones. Preparation of remote control from Martonvásár station is also necessary.

At Érd-Alsó and Budafok-Albertfalva stations the current interlockings are to be demolished.

As a preparation for ETCS L2 the signaling system will have interfaces towards the ETCS 2.

A signaling system providing signaling functions during track construction phases at Tárnok station will be installed, which will be demolished after installing the new one.

### **Points heating**

Points heating is required for all of the station switches and open line branchings connected to the signalling system (Albertfalva BKV branching, Kénsavgyári branching, Nagytétény station, Tárnok station).

### **Switches**

- B 60 XI-1:9 type
- B 60. 1800-1:27,4 type
- The switches are of RC sleeper design, mounted with raffles.
- The points are heated.

## **A.9. ELECTRIFICATION**

From Kelenföld to Nagytétény station, and from Nagytétény station to Tárnok station the poles supporting the catenaries of the present line will be taken out (“P” and steel poles), because they are on the track route, or in the structure clearance, of the new track to be constructed according to the new geometry.

Because of the above-written, only about 5% of the present overhead line poles will be left along the whole length of the design section (lines, stations).

The present track layout of the stations will also be completely reconstructed. With the geometry changes the catenary system will be completely reconstructed in Kelenföld and Tárnok stations. Implementation of remote controlling of catenary switches is also necessary.

## **A.10. TELECOMMUNICATIONS**

### **Budapest Kelenföld – Tárnok line section**

In the line section, a new line cable and a new power cable together with an LPE 40 sleeve pipe for optical cable must be laid down.

Installation of an integrated line communication system (IRCS) is needed on the Budapest Kelenföld – Tárnok line section.

GSM-R system for modernizing the line radio system will be installed on the whole line section in frame of another project by the time ETCS 2 will have been installed in frame of phase 2 of this project.

At Budafok-Albertfalva, Budafok-Belváros, Növény utca, Érdliget, and Érd-alsó stops a remote controlled passenger information system, video monitoring system and by the lifts video door telephone system shall be built and facility will be implemented for ticket selling machines. At the stops the outdoor equipment must be mounted in vandal-safe containers.

The digital transmission technology (SDH) and an IP system must be built for FET (Energetic Remote Control System for Overhead Conductor) as well.

### **Nagytétény station**

A new station dispatcher system suitable for remote controlling will be built. Automatic and live word and visual information systems will be installed on the platforms and in the waiting room. Building out of the instruction giving acoustic system is needed at the point’s zones. On the operational areas, fire and security alarm systems together with video monitoring system shall be built. A new clock system equipped with “DCF” receiver has to be installed.

### **Tárnok station**

A new station dispatcher system, which is able to be remote controlled, will be implemented. Automatic acoustic and visual passenger information system will be installed on the platforms and in the waiting room. At the operational areas, fire and security alarm system and a new video monitoring system will be installed. A new clock systems equipped with “DCF” receiver will be installed as well.

## **A.11. OTHERS**

### **Outdoor lighting**

The outdoor lighting poles will be relocated and new columns will be set up at the stops and the stations.

The improvement of the present outdoor lighting system is required due to the new passenger platforms and pedestrian subways to be constructed. The works affect Budafok-Albertfalva and



Budafok-Belváros, Növény utca and Nagytétény-Érdliget stops, and Nagytétény and Tárnok stations.

**Buildings**

At Nagytétény and Tárnok station new building for passengers and for the signaling system will be constructed.

**P+R parking places**

At Növény street stop, at Nagytétény and Tárnok stations P+R parking places will be constructed.

**Bus stops**

At Tárnok station bus stop will be reconstructed.

## RECONSTRUCTION OF TÁRNOK – KÁPOLNÁSNYÉK LINE SECTION

The line section extends from Budapest- **Tárnok (excluded) to Kápolnásnyék (included)**. The initial chainage of the design section is at **250 + 00**, while the end chainage is at **439+69**. The total length of the line is **18,969 km**

The following stations and stops are situated in the line section:

- Martonvásár station
- Baracska stop
- Pettend stop
- Kápolnásnyék station

Comparing to its age, the condition of the tracks are poor. Due to the weakness in reconstruction and maintenance, along a large portion of the segment speed limitation is in force. In accordance with the expectations of the European Union, the intention is to rise up the permissible train speed up to 160 km/h and to install an axle load of 225 kN. Accordingly, significant interventions are required at the special branches of the overhead line, signalling devices and telecommunication system along the railway track.

The works on the line section will be staged as follows:

### **The description of the current situation is as follows:**

**Tárnok – Martonvásár line section** (250+00 to 317+45) Tracing of the existing railway track is straight along most part of the interstation section. Presently the standard slope on the line is 7.2 ‰. Disregarding some shorter sections, the earthwork of the tested section consists of transitory and bound soils. These slightly permeable and watertight soils respectively require the provision of drainage.

In both tracks UIC 54 type rails can be found with no clearance structures and several faulty welding joints (Sleeper distance: ~60 cm. Rail fixing: in the left track GEO, in the right track SKL-3. Sleeper type: LM, in the right track along 271+00 – 275+20 the sleepers were injured due to sliding. Ballast: crushed stone with varied contamination and thickness)

In the interstation there are two level crossings and one public road overpass. There are no buildings in the intersection at present.

**Martonvásár station** (317+45 – 335+25) It is a middle-size station along the Budapest – Székesfehérvár railway line. In the station there are 5 train receiving tracks (II-VI) at present, in addition to the one loading track (I) and one storing-hauling track (VII) and one loading-truncated track (I/a). The through tracks of the station are the tracks III and IV. Level access is provided to the tracks: it reduces the capacity of the station significantly. The last reconstruction of the station was in 1985. During this reconstruction the through tracks were rebuilt but the rest of the tracks were left completely untouched

In the shunt area from the side of the starting point the industrial track network of the former Betonútépítő Company is branching out; it has not been in use for a long time.

**Martonvásár – Kápolnásnyék interstation** (335+25 – 425+00) The railway line is straight along the whole intersection.

In spite of its age, the surveyed railway line is in a very poor condition. The track failures can be divided into two groups:

- Lowering caused by the locally muddy ballast

- Track failures due to foundation failures

In the long cuttings mostly covered ditches can be found with concrete slab or Barcs component cladding, and in the case of space limitations wall supported ditch components can be found, too. In general it can be said that cleaning of the ditches has not been provided and a portion of the cross section is filled in with fallen leaves; sewings and soil are washed out of the slope. Connection of the ditches from the side of the railway is inadequate as the berm is usually filled up with coarse material and as a result water running from the track is flowing behind the ditch components, thus the ditches are adequate only for removing water running from the slope.

In the intersection there are three level crossings and two public underpasses at present. In the intersection there are two buildings. The old guarding houses have been demolished and passenger waiting houses can be found at the station. The building at Baracska stop will not be concerned by the reconstruction, the one at Pettend is in a bad state and it will be demolished.

**Kápolnásnyék station** (425+00 – 440+70) The station is a middle station along the Budapest – Székesfehérvár railway line.

The station has four tracks of which three are receiving (I-III) and one is a loading (IV) track. In the shunt area from the direction of the starting point an industrial track network is branching out of track III., with three tracks at present. One track was used by RUFORM Bt. and two lead to the enclosed plant of CERBONA Rt. At present the track of RUFORM Bt. is out of use – the Company accomplishes loading at the CERBONA Rt. site. Traffic on the industrial tracks is minimal. The through tracks of the station are tracks I and II. The station building is located on the right side of the station. A loading area with varied paving can be found beside track IV, the large part of which is rented by foreign parties who do not transport by rail.

In the station one pedestrian underpass can be found in the shunting area from the direction of the starting point, guarded with a handrail. A road crossing can be found in the shunting area from the direction of the end point which connects the main road running on the left side of the station to the settlement located on the right side.

In the shunting area of the station from the starting point direction in segment 430+56 a pedestrian crossing protected with a handrail can be found by the old road crossing. Due to the traffic of an increased speed this crossing will be demolished and a pedestrian underpass is to be constructed at segment 434+12. In the end point of the shunting area the road crossing in segment 437+87 will be eliminated. Instead in segment 434+12 a common pedestrian and public road underpass and a connecting road network will be constructed.

No engineering structures can be found in the station.

In the station there are several buildings to be demolished because they are out of use or because their site is required for track construction (i.e, switching towers, auxiliary buildings for the guarding house, loading ramp, dispatcher building, former garage, etc.)

The last reconstruction of the station was in 1984. At that time the two through tracks were reconstructed but the rest remained untouched.

Kápolnásnyék station (427/440) has four tracks with the following track center distances: tracks I-II. 4.70 m, tracks II-III. 4.82 m, and tracks III-IV. 4.63 m. The station building on the right-hand side of the track is in chainage 43+303. There are train stops filled up to the rail top level of 300-300 m in front of the station building and in between the tracks I-II. and II-III. There are 300-350 m long stops filled up to the rail top level outside the station building and between the tracks I-I., and II-III. These have levelled approach. At present the useful lengths of the tracks is the following:

- Track I. 845/837 m,

- Track II. 682/679 m,
- Track III. 576/575 m,
- Track IV. 570 m.

On the left-hand side of the track there is a 60m long, 14 m wide open-air loading area and a paved storage space. A network of tracks leads to the material depot from the starting point of the station.

## **A.12. CIVIL WORKS**

Comparing to its age, the condition of the tracks is poor. Due to the deficiencies in reconstruction and maintenance, along a large portion of the segment speed limitation is enforced.

### **Track reconstruction**

The railway line is a double track both tracks will be reconstructed

The alignment of the existing railway track is straight along the majority of the span. Inter-track spacing is : 4,10 m, according to the measurements 4,06 – 4,15 m. Furthermore, tracks are drawn apart by means of curves of great radius in the span.

Instead of the present 54 type superstructure, system 60 permanent way will be laid in jointless form. The sleeper spacing will be 60cm, the ballast thickness is 57cm in order to introduce the 225 kN axle loading.

Regarding the vertical alignment no essential change has been planned; however, the present errors must be eliminated.

The earthwork and the different track structural layers must be made with 4% lateral slope.

No special permanent way structure will be constructed on the line section. During the reconstruction of the connecting sections temporary transition rails are needed.

### **Platform reconstruction**

In the following stations and stops raised platforms shall be built with the length of 270m:

- Martonvásár station (55 cm high platform)
- Baracska stop (55 cm high platform)
- Pettend stop (55 cm high platform)
- Kápolnásnyék station (55 cm high platform)

The platform pavement consists of the following: 8cm block stone+3-5cm bedding sand+30cm sandy gravel +grainy filling.

### **Structures**

- 1) 250+32: in the inner area of Tárnok the improvement of the 2,5 m span RC frame, existing pedestrian subway is planned
- 2) 257+11: the improvement of a 2 m span arch culvert for the bridging over Zámori creek is planned.

- 3) 264+80: the reconstruction of 0,63 m span covered culvert, temporary watercourse is planned into a 1,5/1,5 m span RC frame at 5 m distance from the present one, thus the culvert can be deconstructed.
- 4) 282+40: the reconstruction of 0,63 m span covered culvert, temporary watercourse is planned into a 1,5/1,5 m span RC frame at 5 m distance from the present one, thus the culvert can be deconstructed.

New pedestrian subways will be constructed in Pettend stop, and in Martonvásár station. The construction of a new public subway (for the cars, bicycles and for passengers) is planned at Kápolnásnyék station at the height of the present station building, which also connects the settlement with road no. 70. The overpass also replaces the – high traffic – public road level crossing at the end of the station. The public subway has 2x1 lanes and is partly crossing road no. 70. The renewal of the water proofing of the road subway at Martonvásár is planned.

### **Roads, level crossings**

Along the line section level crossings were built for low traffic and mainly for agricultural purposes. At Kápolnásnyék station new public road subway will be constructed because of the closing of the high traffic level crossing at the end point of the station. The level crossing at section 264/265 will be demolished.

### **Noise Protection**

Due to the importance of improving environment protection in certain areas the local governments demand the construction of noise protection walls in order to ensure the greater noise reduction.

A noise protection wall (3m height) will be constructed based on the Preliminary Environment Study in some sections.

### **Geotechnics**

Today the rail crown level of the two tracks are different, and the left track is in general lower, therefore different lowering will be made in the planned condition. More significant lowering will be made on the Tárnok - Martonvásár line section on the embankment beginning from chainage a 255+00 – 265+00, and 310+00. Besides this the tracks will be displaced with 2 m to the left on the embankment from chainage 310+00.

In order to introduce the 160 km/h speed, the defects of the existing substructure has to be terminated, the transition and cohesive soil substructure must be reinforced significantly and the drainage of the substructure is to be solved by constructing ditches and drains.

Reconstruction of the track is to be made with earthwork technology only or similar equivalent substructure improving technology.

## **A.13. SIGNALLING**

In the intersection between Tárnok – Martonvásár and Martonvásár – Kápolnásnyék new spacing, double track centralized or decentralized block and line level crossing system must be installed providing interfaces for ETCS 2 being constructed in the future.

At Martonvásár and Kápolnásnyék stations replacing the current mechanical, or relay type signalling system, new electronic signalling equipment providing interfaces to ETCS 2 will be installed.

A new RBC is intended to be installed at Martonvásár collecting signaling information for ETCS 2 and transferring information to GSM-R (transferring is the part of GSM-R project)

A Traffic Control Center will be constructed at Martonvásár station. This TCC must provide the possibility of remote controlling the whole section from Martonvásár station.

At Martonvásár station track construction phases will be followed with the existing interlocking, while at Kápolnásnyék a new equipment providing signaling functions during track construction phases must be installed.

After implementation of the new electronic interlockings the station signalling systems must be demolished.

### **Points heating**

In Martonvásár and Kápolnásnyék stations electrical points heating will be constructed:

- **In Martonvásár station** heating points will be installed on 13 switches. The cable system needed to power supply and to its operation shall also be constructed.
- **In Kápolnásnyék station** heating points will be installed on 10 switches. The cable system needed to power supply and to its operation shall also be constructed.

## **A.14. ELECTRIFICATION**

The following main points is to be taken into account during the implementation of overhead line works:

- Track geometry changes as a consequence of track reconstruction, requiring the replacement of major part of the poles,
- Worn condition of the existing overhead line equipment,
- The modification of pole spacing because of the development of  $\pm 300$  mm snaking
- Building in bronze messenger cable increasing the current loading capacity of the catenaries, which also extends the life span of the catenaries,
- Replacement of the cant poles and the moved anchoring bases in order to avoid accidents.

Based on the above-mentioned and according to the economic aspects and taking into account the reduced maintenance needs after the reconstruction (with some exceptions), the greater demolition of overhead line equipment and the constructing of new ones is required.

The planned improvement does not modify the overhead line system.

During the modernization of the overhead line system the planned 160 km/h speed must be taken into account.

Implementation of remote control of catenary switches will be installed as well.

## **A.15. TELECOMMUNICATIONS**

The remote control of the telecommunication equipment of the whole Tárnok – Székesfehérvár line section, including the passenger information system can be controlled and supervised from Martonvásár station.

It is a requirement that at a specific time switching between remote and local control modes can be possible at the stations.

At the whole line section a new line cable and power cable and a LPE 40 sleeve pipe must be laid down

A new integrated railway controlling system it is required to be built at the Tárnok – Székesfehérvár line section. GSM-R system shall be installed on the whole line section as a modernization of the line radio system (in frame of another project).

At Pettend and Baracska stops remote controlled acoustic passenger information system and a new clock system with DCF receiver will be installed with the outdoor equipment in vandal-safe containers.

In case of all the stations and stops a video control and fire and safety alarm system will be implemented.

A digital transmission technology (SDH) and IP network will be constructed ,as well.

## **A.16. OTHERS**

### **Outdoor lighting**

On the stops and in the stations the outdoor lighting poles will be relocated and new poles will be set up. The improvement of the present outdoor lighting system is needed, since new passenger platforms will be formed, and pedestrian subways will be constructed. The works affect Martonvásár station, Pettend and Baracska stops, and Kápolnásnyék station.

### **Buildings**

At Kápolnásnyék a new building will be constructed for passengers and for signaling system.

At Martonvásár a new building will be build for TCC and the signalling.

### **P+R parking places**

At Pettend and Baracska stop, at Martonvásár and Kápolnásnyék station P+R parking places will be constructed.

### **Bus stops**

At Kápolnásnyék and Martonvásár stations bus stops will be reconstructed.

## RECONSTRUCTION OF THE KÁPOLNÁSNYÉK-DINNYÉS LINE SECTION

The line section extends from **Kápolnásnyék (excluded)– to Dinnyés station (included)**. The initial chainage of the design section is at **43 9+69 km**, while the end chainage is at **577+ 00 km**. The total length of the line is **13,731 km**.

The following are the stations and stops situated in the line section:

- Velence stop
- Velence-fürdő stop
- Gárdony station
- Agárd stop
- Dinnyés stop (new construction)

The task is to implement a reconstruction which makes possible the attainment of 120 km/h speed between the Velencefürdő stop (incl.) and Agárd (incl.) line section, and 160 km/h design speed on the rest of the section. The planned solution is demanded by the fact, that –the line structure is suitable for 120 km/h speed along the whole design section – 40-50-60-80-100 km/h speed limitations can be found on the whole line with the exception of 2,1 km in the left, and 5,5 km in the right track owing to the bad condition of the permanent way, thus the speed of trains running on the existing track does not meet the requirements of the European Union.

Segment	Planned speed
Kápolnásnyék (excl.) – 474+00	160 km/h,
474+00 – 539+00	120 km/h
539+00- 577+00	160 km/h

### A.17. CIVIL WORKS

The main tasks along the rehabilitation project are the ones referred to the renewal of the track and track bed.

**The description of the current situation is as follows:**

On the whole section in principle the line tracking would be appropriate for a speed of 120km/h, however, due to the poor condition of the track – with exception of 2.1km on the left track, and 5.5km on the right track – speed restriction signals of 40-50-60-80-100 km/h can be found all along the line. Wet spots on the right track between chainages 434+00 – 497+00 are significant. After chainage 510+00 the muddy sections are frequently found along 3-25 sleeper lengths in both tracks.

Track	Position	Reduced speed limit (km/h)
Left side track	428+00 – 438+00	100



	438+00 – 442+00	60
	463+00 – 497+00	100
	497+00 – 539+00	50
	539+00 – 566+00	60
	566+00 – 581+00	40
Right side track	428+00 – 442+00	80
	497+00 – 499+00	60
	499+00 – 507+00	80
	507+00 – 517+00	80
	517+00 – 566+00	60
	566+00 – 579+00	40

There are only 3 curves along the planned section on the left hand side track. The first one is between chainages 443/449 with a radius of  $R = 1500$  m, an asymmetric left curve with clothoid transition curves. The second is at Gárdony station (502/508), with a radius of  $R = 4000$  m, similarly asymmetric, but a right curve with clothoid transition curves. The third is the right-hand entry curve (560/567),  $R = 1000$  m asymmetric clothoid transitioned simple curve.

The right- track of the alignment is more varied as a result of the track center displacements in the stops, as the platforms are between the tracks on the stations of Velence, Velencefürdő and Agárd. In the track displacements the curves are of  $R = 5000$  and  $R = 6000$  m, all of them asymmetric, with clothoid transition curves. According to the bill of curves the length of the transition curves is very varied (from 21 to 178 m), in several instances in between the curves following each other the length of the straight lines does not reach the specified 60m, and there are sections where the transition curves extend into each-other.

**Velence station** (462/466): the maximum width of the platform is 11.70 m, with a track center distance of 14.53 m. The (marked) pedestrian access to the platform leads through the underpass built at the starting point end, from both sides of the double-track. The station building is (464/465) 4.50 m wide, with both elevations spaced at a distance of 4.98 m from the axle of the track beside.

**Velencefürdő stop** (477/481): the maximum width of the platform is 11.33 m, here the track center distance is 14.09 m. The (marked) pedestrian access to the platform leads through the underpass built at the two starting points at both sides of the double-track. The station building is (479/480) 4,25 m wide, with the elevations spaced at a distance of 4,90m and 4,92 m from the axle of the track beside.

**Gárdony station** (497/511) has five tracks, with different inter track spacing values. The characteristic data for the station building are: tracks I-II and II-III: 4.76 m, tracks III-IV: 9.32 m, tracks IV-V.: 4.71 m. The axle of the station building situated in the left hand side of the track is in chainage 501+86. There are 300-350 m long stops filled up to the rail top level between the tracks I-II., II-III., III-IV., and IV-V. They have levelled approach. There is a 30m long asphalted area outside the station building. The lengths of the tracks appropriate for use at present are:

- Track I. 685 m,
- Track II. 685 m,
- Track III. 720 m,
- Track IV. 670 m,

- Track V. 502 m.

On the left hand side of track I there is a storehouse and a loading dock with a length of 110 m and width of 10 m. In the chainage 50+526 there is a pedestrian cross-over providing link between the areas outside the station.

**Agárd stop** (518/521): the maximum length of inter track spacing is 14.35 m. The (marked) pedestrian access to the platform leads through an underpass, built longitudinally in the first third from the starting point, from both sides of the double track. The station building is (479/480) 4.25 m wide, its elevations are spaced at 4.90 and 4.92 m from the axle of the neighbouring track.

**Dinnyés station** (566/579): it has four tracks, the track center distances are evenly 4.75 m. The axis of the station building on the right hand side of the track is in the chainage 569+72. There are 250 m and 216 m long stops filled up to the rail top level outside the station building between the tracks I-II. They have levelled approach. The lengths of the tracks appropriate for use at present are:

- Track I. 917 m,
- Track II. 803 m,
- Track III. 782 m,
- Track IV. 200 m.

There is a 40 m long 14 m wide side-loading-platform on the left hand side of platform IV.

### **Track reconstruction**

Along the section a jointless permanent way with UIC 60 rail system must be laid instead of the present permanent way of 54 rail system. For the introduction of the 225 kN axle loading, the sleeper distance must be 60 cm and the ballast thickness will be 57 cm.

In the region of lake Velencei, a special permanent way must be constructed. Considering an aesthetical landscape noise protection is not possible with the installation of a noise protection wall. In the segments determined by the environmental impact study, a special noise and vibration reducing component will be installed in the rail chamber.

### **Planned alignment survey and reconstruction of the stops' track**

Regarding the stops, the following are the issues to be improved in the reconstruction of the section:

- **Velence stop** (design speed: 160 km/h), conforming to the present track geometry, asymmetric transition curved circular curves were designed at the displacement of the right track (464/471) because of the interim platform.
- **Velencefürdő stop** (design speed: 120 km/h) the design conditions and principles are the same as in case of Velence stop.
- **Agárd stop** the displacement in the right track because of the platform (514/525) was solved by three, R=6000 m radius plain curves.
- **Dinnyés stop** 270 m long, rail crown+30 cm high, double sided platform will be built between chainages 55+650-55+820. In chainage 556+10 the platforms will be connected with a pedestrian subway.
- **Dinnyés station:** the entrance curve in both tracks (559/568) has R=1400 m and was transformed by 218,655m long cosine transition curves, thus the 160 km/h speed can be

ensured. This correction requires new earthwork building on about 700 m length. The biggest track center displacement is about 7m.

### **Reconstruction of the station tracks**

The following are the considerations regarding the stations:

- **Gárdony station:** before the starting point end of the misalignment of the right track is ended. Track no. I was transformed into a dead-end siding with service from the end point side, the warehouse building was demolished. Track no. II will be taken up along 460 m length in front of the station building. One of the 270 m long, middle access, rail crown+30 cm high platform will be built here. Because of its curve design, track no. II is slightly narrowing at the end point side. Track no. V will be at 10,00 m distance from track no. IV, making possible the construction of a second, rail crown+30 cm high, 270 m long platform. The subway can be started from the starting point side of the station building, designed with roofing and single-flight stairs on both platforms. The width of the subway is 4,0 m, its crossing angle with the tracks is 58° and is leading to the lake side part of the station.
- **Dinnyés station:** it will be again degraded to a shunting-station. Tracks no. I and II. (through main tracks) will stay in place, tracks no. III and IV will be terminated.

### **Platform reconstruction**

Island platforms can be found between the two tracks: at Velence, Velencefürdő and Agárd stops along a length of 270 m they will be reconstructed. The new platforms on the two sides at Gárdony station will have a length of 290 m. At the new Dinnyés stop 270 m long platforms will be constructed on the outer side of the tracks, closer to the settlement. Platform kerb has been planned with a concrete base sited on the earthwork. The pavement of platform: 8 cm space stone+3-5 cm bedding sand + 30 cm sandy gravel+ coarse backfill. Platform height will be 55 cm.

### **Building rehabilitation**

Regarding the building civil works operation, besides the pedestrian crosses –which are detailed in followings sections – some station buildings are to be demolished.

- **At Agárd stop** the station building on the platform will be demolished. This is justified by the speed increase foreseen in connection with the renewal, updating of the block section, whereby the stipulated extent of the wind suction zone will increase. Furthermore, covering systems of uniform appearance are planned to be constructed along the section, which would be of the canopy type, with the appearance of chequerwork.
- **At Velence stop** the station building on the platform will be demolished. This is justified by the speed increase foreseen in connection with the renewal, updating of the block section, whereby the stipulated extent of the wind suction zone will increase. Furthermore, covering systems of uniform appearance are planned to be constructed

along the section, which would be of the canopy type, with the appearance of chequerwork.

- **At Velencefürdő** stop the station building on the platform will be demolished. This is justified by the speed increase foreseen in connection with the renewal, updating of the block section, whereby the stipulated extent of the wind suction zone will increase. Furthermore, covering systems of uniform appearance are planned to be constructed along the section, which would be of the canopy type, with the appearance of chequerwork.

## Crossings

There is an urgent need of increasing the safety of the pedestrian passing through the tracks at the stations.

### Pedestrian Subways

The following are the seven (7) envisaged new pedestrian subways:

Position	Width	Length/ crossed under public road	Staircase flight of stairs pc/length (*)	“French” stairs pc/length	Length of ramp	Lift	Cutoff wall [cm]	Floor slab [cm]	Base slab [cm]	Side wall [cm]	Lower edge of the structure m (right center) track
451+32	4,00	39,9/ 70		1/ 24,6			50	40-33	30	25	111,83
467+87	4,00	37,1/70	1*/ 10,00	1/ 6,95	/ 110,28		50	40-33	40	25	108,24
473+22,	3,00	15,7/ no		2/ 24,10			50	40-34	40	25	105,36
481+13	4,00	33,4/ no	2*/ 10,45		1/ 99,15		50	40-33	40	25	105,13
501+26	4,00	55,5/ shore	2+2/ 9,10		2/ 82,15	2	50	40-33	40	25	105,25
521+90	4,00	35,6/ shore	2*/ 9,95		/ 104,0		50	40-33	40	25	104,70
556+11	4,00	19,1/no	2/ 8,85		2/ 54,9		50	40-33	40	25	104,72

- 1) 451+32: due to the speed increase, the new pedestrian subway will be constructed on the site of an existing pedestrian level crossing. Due to the closeness of the public road (main road no 70), the subway will run under the road also.
- 2) 467+84: due to the speed increase, the pedestrian subway at the Székesfehérvár end of Velence stop will be constructed on the site of an existing pedestrian level crossing. Due to the closeness of a main road (main road no. 70), the subway will run under the road also.
- 3) 473+22: due to the speed increase, the pedestrian subway will be constructed on the site of an existing pedestrian level crossing. Task of the subway is to transfer the resort's pedestrian traffic.
- 4) 481+13: due to the speed increase, at the Székesfehérvár side of Velencefürdő stop the pedestrian subway will be constructed at the site of an existing pedestrian level crossing. Due to the closeness of a main road (main road no. 70), the subway will run under the road also.
- 5) 501+26: at Gárdony station the new pedestrian subway will be constructed at the Budapest side of the platforms. The geometry is formed considering the double task of the subway. The subway must provide for the pedestrian railway traffic and the resort's pedestrian traffic under the railway simultaneously. Due to the local conditions and the departing and arriving traffic of the resort, the subway crosses the railway at an angle of 58°. On the lake side - due to the closeness of the public road to the railway - the subway had to be laid under the public road also.
- 6) 521+90: due to the speed increase and the large summer traffic, the pedestrian subway at the Székesfehérvár end of Agárd stop will be constructed at the site of an existing pedestrian level crossing. The subway runs under the road also due to the closeness of the public road (main road no. 70)
- 7) 556+11: for the pedestrian railway traffic, the new pedestrian subway will be constructed at the Budapest side of the platform at the new stop of Dinnyés village.

### **Pedestrian Subways**

A road subway will be constructed at Velence stop.

### **Pedestrian Crossings (labyrinth bars)**

The following are the nine (9) envisaged new pedestrian crossings to be built with labyrinth bars:

<b>Position</b>	<b>Characteristics</b>
486+34	2.70 m pedestrian crossing with labyrinth-bars
491+09	2.70 m pedestrian crossings with labyrinth-bars with guiding signals
496+88	2.70 m pedestrian crossings with labyrinth-bars with guiding signals
512+65	3.60 m pedestrian crossings with labyrinth-bars
517+73	3.60 m pedestrian crossings with labyrinth-bars with guiding signals
524+84	3.60 m pedestrian crossings with labyrinth-bars
527+78	3.60 m pedestrian crossings with labyrinth-bars
529+59	3.60 m pedestrian crossings with labyrinth-bars
532+54	3.60 m pedestrian crossings with labyrinth-bars

### **Roads and Level Crossings**

The following level crossings shall be reconstructed / formed:

<b>Position</b>	<b>Wide</b>	<b>Alpha</b>	<b>Protection</b>	<b>Pavement</b>
481+36	13,2 m	90°	with light- and half barrier	rubber pavement
491+15	12,0 m	90°	with light- and half barrier	rubber pavement
496+94	12,0 m	90°	with light- and half barrier	rubber pavement
517+63	14,4 m	90°	with light- and half barrier	rubber pavement
538+78	14,4 m	90°	with light- and half barrier	rubber pavement
568+06	18,0 m	45°	with light- and half barrier	rubber pavement

### **Noise Protection**

Due to the importance of improving environment protection, at certain areas the local governments demand the construction of noise protection walls in order to ensure the greatest possible noise reduction.

Taking into account the characteristics of each segment of the line (distance to the residential/holidays area, embankment on the side, cables installation, etc.), the position of the noise-protecting walls, as well as the height and distance from the track centerline has been calculated.

The resultant noise walls are listed in the Non Technical Summary of EIA.

### **Geotechnics**

On the line section an appropriate solution has been achieved only partially during the reconstruction completed in the 80'ies. That time in the region of lake Velencei, the subsoil having a low load bearing capacity was strengthened with an asphalt layer and on other areas a sandy gravel protection layer was installed. In the course of the surveys it was proved that the

asphalt protection layer ensured an adequate load bearing capacity, however on other sections the installation of a protection layer with a significant thickness is required. The required strengthening is presented in the following tables:

<b>LEFT TRACK</b>	
<b>Section interval</b>	<b>Planned layer structure</b>
43+969 – 46+700	20 cm impermeable type coarse layer with 30 cm sandy gravel under layer
46+700 – 47+460	20 cm impermeable coarse layer with 30 cm HK soil replacement, 1 layer geotextile underneath
47+460 – 49+786	An asphalt protection layer can be found
49+786 – 50+743	<ul style="list-style-type: none"> <li>▪ The main crossing track at Gárdony station: 20 cm impermeable coarse layer, with 30 cm sandy gravel underneath</li> <li>▪ Gárdony station - overtaking track: 30 cm impermeable type coarse layer</li> </ul>
50+743 – 51+150	<ul style="list-style-type: none"> <li>▪ Gárdony station – crossing main track: 20 cm impermeable type coarse layer with 50 cm sandy gravel soil replacement underneath</li> <li>▪ Gárdony station - overtaking track: 20 cm impermeable type coarse layer with 30 cm sandy gravel soil replacement underneath</li> </ul>
51+150 – 55+000	An asphalt protection layer can be found
55+000 – 56+100	30 cm impermeable type coarse layer
56+100 – 56+600	20 cm impermeable type coarse layer
56+600 – 57+700	<ul style="list-style-type: none"> <li>▪ 20 cm impermeable type coarse layer with 20 cm sandy gravel underneath</li> <li>▪ 30 cm 2/50 mines infertile, underlayer and 1 layer geotextile underneath</li> </ul>

<b>RIGHT TRACK</b>	
<b>Section interval</b>	<b>Planned layer structure</b>
43+969– 46+700	20 cm impermeable type coarse layer with 30 cm sandy gravel underneath
46+700 – 47+152	20 cm impermeable type coarse layer with 30 cm sandy gravel soil replacement underneath with 1 geotextile underlayer
47+152 – 49+710	An asphalt protection layer can be found
49+710 – 50+743	<ul style="list-style-type: none"> <li>▪ Gárdony station - crossing main track: 20 cm impermeable type coarse layer with 30 cm sandy gravel under it.</li> <li>▪ Gárdony station - overtaking track: 30 cm impermeable type coarse layer</li> </ul>
50+743 – 51+150	<ul style="list-style-type: none"> <li>▪ Gárdony station - crossing main track: 20 cm impermeable type coarse layer with 50 cm sandy gravel soil replacement underneath</li> <li>▪ Gárdony station - overtaking track: 20 cm impermeable type coarse layer with 30 cm sandy gravel soil replacement underneath</li> </ul>
51+150 – 55+000	An asphalt protection layer can be found
55+000 – 56+150	30 cm impermeable type coarse layer
56+150 – 56+450	20 cm impermeable type coarse layer – from up to down: with 50 cm coarse layer, 30 cm 0/70 crushed grain layer, a geogrid and 1 layer geotextile underneath
56+450 – 57+700	20 cm impermeable type coarse layer, 20 cm sandy gravel underneath and 30 cm 2/50 mines infertile and 1 layer geotextile



## A.18. SIGNALLING

In the intersection between Kápolnásnyék – Gárdony and Gárdony- Dinnyés new spacing, double track centralized or decentralized block and line level crossing system must be installed providing interfaces for ETCS 2 being constructed in the future.

At Gárdony station replacing the current relay based interlocking a new electronic signalling equipment will be installed. The new interlocking must provide the possibility to be remote controlled from Martonvásár station. At Dinnyés station a new electronic interlocking must be installed which is technically a part of the Gárdony interlocking.

Due to the displacement of the entry signals of the connecting stations, the block section spacing is slightly modified.

At Gárdony station track construction phases will be followed with the existing interlocking. After implementation of new electronic signalling system the station signaling system must be demolished.

## A.19. ELECTRIFICATION

**On the Kápolnásnyék – Gárdony line section** – considering the new track geometry and the new parameters to be achieved – some of the existing poles are not fulfilling the requirements. The damaged, tilted, cracked poles which are in a bad technical state or are too close to (2.6 m), or too far from (5.0 m) the new track centreline shall be replaced as required in the plan. These poles shall be dismantled and replaced by new ones.

The planned new poles shall fulfil the following conditions:

- Their side distances from the new track centreline will be 3.0 m (providing a view to the signals), and 5.0 m in the platform;
- Lengthwise division and the  $\pm 300$  mm winding;

All the catenaries of the Kápolnásnyék – Gárdony line section with the pendants, Y cables and fixed points shall be dismantled and reconstructed with new catenaries in accordance with the new track condition. The operating line and the supporting cable shall wind together. Bronze supporting cable shall be used for the new catenary.

**On the Gárdony – Dinnyés line section** – considering the new track geometry and the new parameters to be achieved – some of the existing poles are not fulfilling the requirements. The damaged, tilted and cracked poles which are in a bad technical state or are too close to (under 2.6 m), or too far from (5.0 m) the new track centreline, shall be replaced according to the plan.

The planned new poles shall be in accordance with the following requirements:

- Their side distance from the new track centreline is 3.0 m (providing view to the signals – in front of them within a distance of  $10v/3$  the old pole will remain in place over 2,85 m), or 5,0 m in a platform;
- Longitudinal division is on the basis of the last section in chapter 6.4.2 of the standard MÁV SZ 2922/1995 6.4.2. and the  $\pm 300$  mm winding if possible;

Along the whole line section the worn and torn operating lines – together with their pendants, Y cables, small- and large fixed points – and the supporting cable shall be replaced to ones of a bronze material (except for the operating line).

All the catenaries with the pendants, Y cables, small and large fixed points of Gárdony station shall be dismantled and replaced by catenaries which are appropriate for the new track condition. The operating line and the supporting cable shall wind together. Bronze supporting cable shall be used on main tracks crossing the stations. Over the auxiliary tracks at the stations

steel supporting cable shall be installed in such a way so that they will not cross the bronze supporting cables.

The compensated catenaries of the crossing tracks can be crossed only by compensated catenaries. The overstressing at the switching area of Gárdony station shall be replaced.

Implementation of remote control of catenary switches is also necessary.

## **A.20. TELECOMMUNICATIONS**

The remote control of the telecommunication equipment of the whole Tárnok – Székesfehérvár line section, including the passenger information can be done from Martonvásár station.

It is a requirement that at a specific time switching between remote and local control modes can be possible at the stations.

At the whole line section a new line cable and power cable and a LPE 40 sleeve pipe must be laid down

A new integrated railway controlling system is required to be built at the line section. GSM-R system will be installed on the whole line section as a modernization of the line radio system (in frame of another project).

At Velence, Velencefürdő, Agárd and Dinnyés stops remote controlled acoustical passenger information system and a new clock system with DCF receiver will be installed with the outdoor equipment in vandal-safe containers.

In case of all the stations and stops a video control and fire and safety alarm system will be implemented.

A digital transmission technology (SDH) and IP network will be constructed as well.

## **A.21. OTHERS**

### **Outdoor lighting**

At Gárdony station a new system must be implemented according to the new track geometry.

At Dinnyés stop a new system must be implemented. The lighting of the new pedestrian subways must be implemented.

### **P+R parking places**

At Dinnyés stop P+R parking places will be constructed.

### **Bus stops**

At Gárdony station bus stop will be reconstructed, at Velence stop a new stop station will be constructed.

## RECONSTRUCTION OF THE DINNYÉS – SZÉKESFEHÉRVÁR LINE SECTION

The line section extends from **Dinnyés station (excluded) to Székesfehérvár station (excluded)**. The initial chainage of the design section is at **577+60 km** while the end chainage is at **664+00 km**. The total length of the line is, therefore **8,640 km**.

There is no stations and stops included in the line section.

A new stop is to be constructed in the span at the road crossing at chainage 590+00, in the vicinity of Börgöndpuszta, where the Municipality has been urging the construction of the stop for a long time in order to facilitate the approach of the neighbouring village.

Segment	Planned speed
577+60 – 649+50	160 km/h,
649+50 – 658+50	140 km/h
658+50 – 664+00	100 km/h

### **The description of the current situation is as follows:**

The railway line is mainly of straight construction. The track reaches the Székesfehérvár station by means of two curves of great fraction angle. The alignment follows the ground level between the bedding of the lake Velencei and the end point with a ruling gradient of 7,2 ‰. A gradually deepening, max. 8 m cutting can be found on the entry curve of the Székesfehérvár station.

The alignment of the existing railway track is straight along the majority of the span. Following the Dinnyés station the inter-track spacing is reduced from 4,75 m to 4,10 m, due to the drawing apart of the right track between chainages 580+00 – 582+00. There is a 1250m radius curve of right direction between chainages 625+00 – 638+00, and then the track connects to the Székesfehérvár station by means of a 900 m radius curve between chainages 650+00 – 664+00. On the curve the tracks at 4,10 distance are drawn apart to 4,75 m. Furthermore, tracks are drawn apart by means of curves of great radius in the span.

### **Drainage systems**

There are unlined ditches in the cuttings. Generally it can be stated that ditch cleaning has not been solved; the ditches are partly filled with leaf-litter, sandy gravel and soil from the slope; since the reconstruction, for lack of maintenance, the original crests of the slopes have disappeared.

## **A.22. CIVIL WORKS**

### **Track reconstruction**

The railway line is a double track one, both tracks will be reconstructed.

In order to ensure the speed of 160 km/h, curve amendment is required between chainages 625+00 – 638+00, where a curve with  $R = 1700$  m was planned. The engineering structure of the M7 motorway, where the new track crosses the old one, represented a restriction to the curve amendment. Consequently the new track between chainages 612+00 – 631+00 will be moved apart to the left from the present one by a maximum distance of 100 m, and starting from chainage 63 + 100 it will get to the right from the same by a maximum distance 15 m. Starting point of the track amendment: 611+68, its end: 639+97.

At Székesfehérvár station, the presumed speed will be of 100 km/h. The entry curve has been reconstructed with the application of compound curves of  $R = 1000$  m and  $R = 950$  m

No essential change has been planned in respect of the vertical alignment; however, the present errors of it have been eliminated.

The earthwork and the different track structural layers shall be made with 4% lateral slope.

On the line section a jointless permanent way of system 60 shall be constructed instead of the present permanent way of system 54. The sleeper division shall be 60 cm, and the ballast thickness shall be 57 cm in the interest to introduce the axle loading of 225 kN.

On the line section no special permanent way shall be introduced – transitory rails are temporarily required until the reconstruction of the connected sections.

To ensure the conditions for a 160 km/h traffic speed, the base structure shall be constructed also according to the base structure requirements of the jointless tracks.

### **Platform reconstruction**

At Börgönd stop the new pedestrian subway with an opening of 3.0 m must be constructed in segment 590+72 in front of the road crossing. Platform for the right track is planned between segments 588+11 – 590+61, and for the left track it is planned between segments 588+20 – 590+70. The platform coating is 8 cm space stone+3-5 cm bedding sand+30 cm sandy gravel +coarse backfill.

The left hand platform can be accessed on a footway from the direction of the settlement and the right hand platform can be accessed through the pedestrian subway. On both sides ramps are planned for the invalids. On the outer side of both platforms handrails shall be constructed. Platform height will be 55 cm.

### **Roads and level crossings**

**At present** there are three road crossings and one road overpass along the span:

- In the suburb of the village Börgönd, in chainage 590+82 of the railway line, there is an earth road crossing constructed of 7,2 m wide Bodan elements, with light barrier controlled by the train. The road is a private road opened for public traffic
- The road crossing of main road 62 can be found in the suburb of Székesfehérvár, in chainage 610+90 of the railway line, with a diversion road before it, which is temporarily used when the crossing is closed.
- The overpass of the M7 motorway is in chainage 631+52. The engineering structure is a three-span bridge with reinforced concrete structure
- In the suburb of Székesfehérvár, in chainage 636+80 of the railway line, there is an earth road crossing constructed of 7,2 m wide Bodan elements, with light barrier controlled by the train. The road is managed by the Municipality of Székesfehérvár

**The planned road crossings reconstruction includes the following:**

- The level crossing of main road 62 will cease to exist during the reconstruction, instead of it a road overpass will be designed. It will be constructed in chainage 612+78 (in frame of another project).
- The crossings are planned to be covered by pre-fabricated pavement elements in 8,4 m width. The crossing in chainage 590+820 will be reconstructed practically in place, while the one in chainage 636+80, due to the curve amendment, will be slightly displaced in the crosswise direction; its new chainage is: 637+10.

### **Structures**

The railway line earthworks were designed without including bigger structures. On the area the live watercourse is crossing the permanent way in chainage 604+69; the number of structures is minimal on the design section:

- 1) 588+20: there is a 0,63 m span RC culvert, the closing of which is envisaged.
- 2) 590+72: the construction of a new, 3,0 m span pedestrian underpass is envisaged on the new stop of Börgönd.
- 3) 597+83: the reconstruction of the existing 1,5/1,5 m span RC portal bridge is planned.
- 4) 604+69: the reconstruction of the existing 6,0 m span RC trough bridge, permanent watercourse are planned.
- 5) 631+52: there is an overhead bridge of motorway M7; the structure is a three span RC structural bridge. The operator is NA Rt.
- 6) 661+94: there is a demolished 0,6 m span culvert, which cannot be detected under the main tracks.
- 7) 661+99: the reconstruction of the existing pedestrian overpass in Takarodó street is envisaged.
- 8) Between 640+00 – 658+38: a concrete lining wall can be found on the left side, demolition of which is envisaged because of the development of the standard open line cross-section.
- 9) 588+20: the structure can hardly be detected, its environment is disordered, and demolition of the structure is planned.
- 10) 661+94: an open culvert can be found under the side tracks, with a slope to the right, and connected to the 0,6 m concrete channel in Mártírok street. The culvert section under the main tracks was probably filled in during the last reconstruction. During the rehabilitation the part under the main tracks shall be discovered, and if the old structure extends into the ballast zone, it shall be demolished. The existing part shall be cleaned up.

The public road overpass in 631+52 was not subject of the design project. According to the plans the alignment will better adjust to the free span under the bridge, the tracks will be parallel to the pillars, the rail crown level will not change. The covered ditches next to the permanent way will be rebuilt according to the new line tracking.

### **A.23. SIGNALLING**

In the intersection between Dinnyés - Székesfehérvár new spacing, double track centralized or decentralized block and line level crossing system must be installed providing interfaces for ETCS 2 being constructed in the future.

At Dinnyés station a new electronic interlocking will be implemented which must have the possibility to be remote controlled. Track construction phases will be followed by the present signalling system.

Due to the displacement of the entry signals of the connecting stations, the block section spacing is slightly modified:

### **Connecting stations**

At the Dinnyés station at present D55 type signalling equipment operates. The present entry signals (C, D) are in chainage 580+26. The planned entry signals are in chainage 578+80 according to the plan made by RING-UVATERV Consortium. The overhead line section-limit has been developed accordingly.

At the Székesfehérvár station at present single-centre INTEGRA type signalling equipment operates. The entry signals (B, C) are at present in chainage 659+36. The planned entry signals (B, C) will be installed in chainage 660+36 at the place indicated by MÁVTI Kft

#### **Points heating**

It will be implemented at Dinnyés station (4 groups of turnouts). .

### **A.24. ELECTRIFICATION**

The railway line is electrified. In the course of the reconstruction the transformation of the overhead line is planned in accordance with the requirements of the designed traffic speed of 160 km/h. The new overhead line network will be constructed with the existing poles to a smaller extent and with the construction of new poles to a larger extent. Old poles will remain only if the distance of the pole edge from the planned track is greater than 2.60 m and its structure is suitable. The edge of the new poles will be 3.0 m from the new track. The planned poles are steel girder poles.

It is foreseen to remotely control the traction power supply facilities after the modernization of the telecommunications system takes place.

### **A.25. TELECOMMUNICATIONS**

At the whole line section a new line cable and power cable and a LPE 40 sleeve pipe must be laid down. A new integrated telecommunication system will be implemented at the whole section. At the stops new visual and acoustic passenger information system will be installed.

### **A.26. OTHERS**

#### **Outdoor lighting**

The construction of outdoor lighting is required at the new Börgönd stop.

## **RECONSTRUCTION OF THE PUSZTASZABOLCS – SZÉKESFEHÉRVÁR LINE SECTION**

### **A.27. CIVIL WORKS**

#### **Track reconstruction**

Presumably the reconstruction of the Budapest-Kelenföld – Székesfehérvár line section will be completed between 2008 and 2012. This short reconstruction period can be achieved only if construction works will be completed simultaneously on several line sections or stations. In the case of single track sections the present number of trains can not run. Due to the weak subsoil, on several sections the soil shall be replaced to a depth which will endanger the stability of the operating track also, thus the continuous exclusion of both tracks can be required also. Considering the above, the partial reconstruction of the Székesfehérvár – Börgönd – Pusztaszabolcs, and the Szabadbattyán – Börgönd railway line is required. In the 80'ies, the Székesfehérvár – Börgönd, and the Szabadbattyán – Börgönd line sections were reconstructed. However the Börgönd – Pusztaszabolcs line section is in a rather obsolete state. (the ballast is muddy, the sleepers are punk, the rail ends are bent). Due to the above, considering the 80 km/h planned speed (layout is suitable for 120 km/h speed, with speed limits where it is necessary) between Börgönd – Pusztaszabolcs, a permanent way replacement with used material is required along a length of around 18.000 track m – together with substructure strengthening and changing of ballast. The permanent way shall be constructed with used 54 rail system GEO fixed concrete sleeper and with welding 120 m long used rail of system 54. On the Szabadbattyán – Börgönd and Székesfehérvár – Börgönd line section only small reconstruction works are required.

On the renewed line section the required number of trains can run.

#### **Platform reconstruction**

At Börgönd and Zichyújfalu stations the renewal of platforms are necessary.

#### **Roads and level crossings**

Reconstruction of the level crossings on the Börgönd – Pusztaszabolcs line section is required for a 54 type level crossing with rubber components.

#### **Structures**

Renewal of structures between Börgönd – Pusztaszabolcs is necessary, at curve corrections new structure construction is necessary.

### **A.28. SIGNALLING**

Implementation of new barriers and protection system at level crossings are necessary. At Zichyújfalu the installation of a renewed D-55 type signaling system is planned.

Implementation of a new counter-route excluding signalling equipment with axle counters on the open line is necessary between Börgönd – Pusztaszabolcs. Implementation of level crossing protection between Szabadbattyán – Börgönd and Börgönd – Pusztaszabolcs, where it is necessary.

### **A.29. ELECTRIFICATION**

Electrification has not been planned within the framework of this program.

### **A.30. TELECOMMUNICATIONS**

Improvement of telecommunication equipment required for railway traffic is necessary. Cable laying is necessary between Börgönd and Pusztaszabolcs.