



**BUDAPEST  
FEJLESZTÉSI  
KÖZPONT**

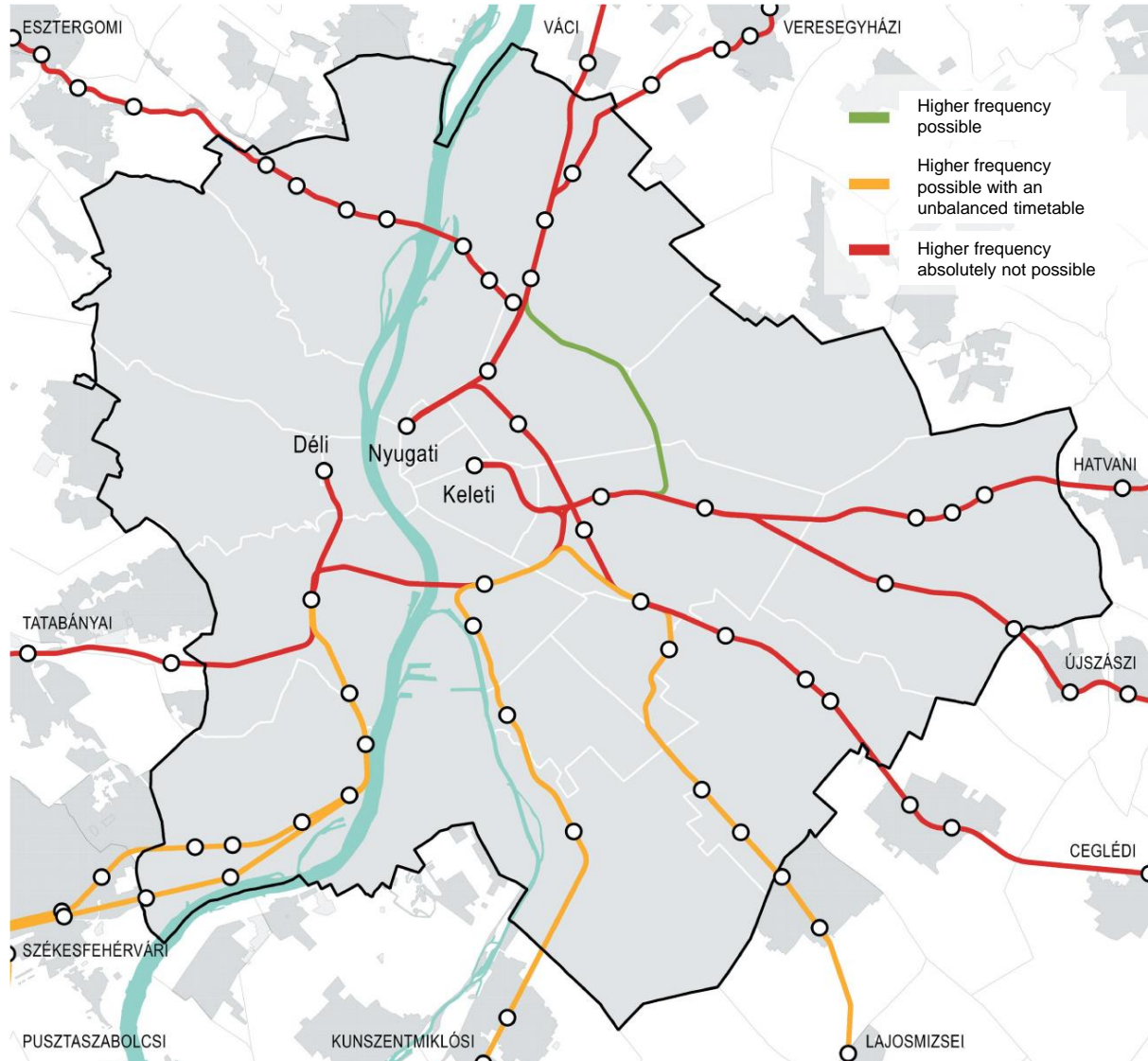
# **CORNERSTONE OF THE BUDAPEST RAIL NODE STRATEGY: THE DANUBE TUNNEL**

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Budapest Development Agency**

**2021. november 17.**

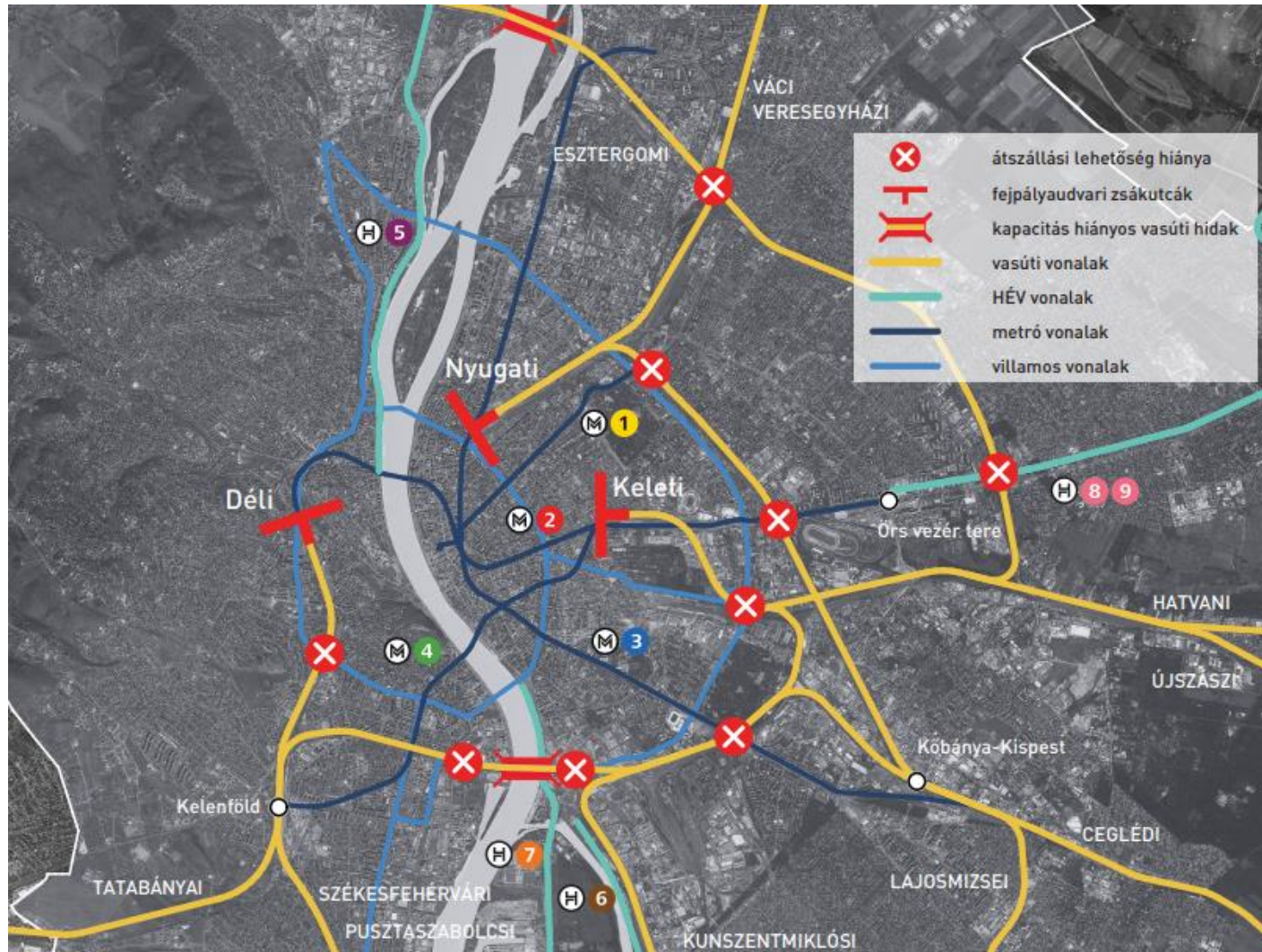


## BUDAPEST RAILWAY NETWORK – WHY DOES IT NEED TO BE DEVELOPED?



- The Budapest network runs on **full capacity**.
- Rail is not desirable, due to **low frequency** and a **low number of direct urban connections**.
- A higher frequency is not feasible today due to full capacity on the lines and head stations.

# THIS OBSOLETE STRUCTURE HINDERS RAIL TO TAKE A BIGGER ROLE IN PUBLIC TRANSPORT



- The **number of opportunities to change modes is limited**, in many cases trains pass through tram and bus lines without stopping.
- The **current head railway stations are obstacles** in front of higher train frequency.
- **Few and overcapacitated crossing opportunities over the Danube.** The two bridges connecting Buda and Pest:
  - **Újpest Railway Bridge** only lets through trains on Line 2 (Esztergom).
  - The **Southern Railway Bridge** is one of the most frequented rail lines in the country, being the **only connection with high enough capacity** to bridge East to West.

## A SMALL TOWN'S WORTH OF POPULATION LEAVES BUDAPEST FOR THE SUBURBS EACH YEAR

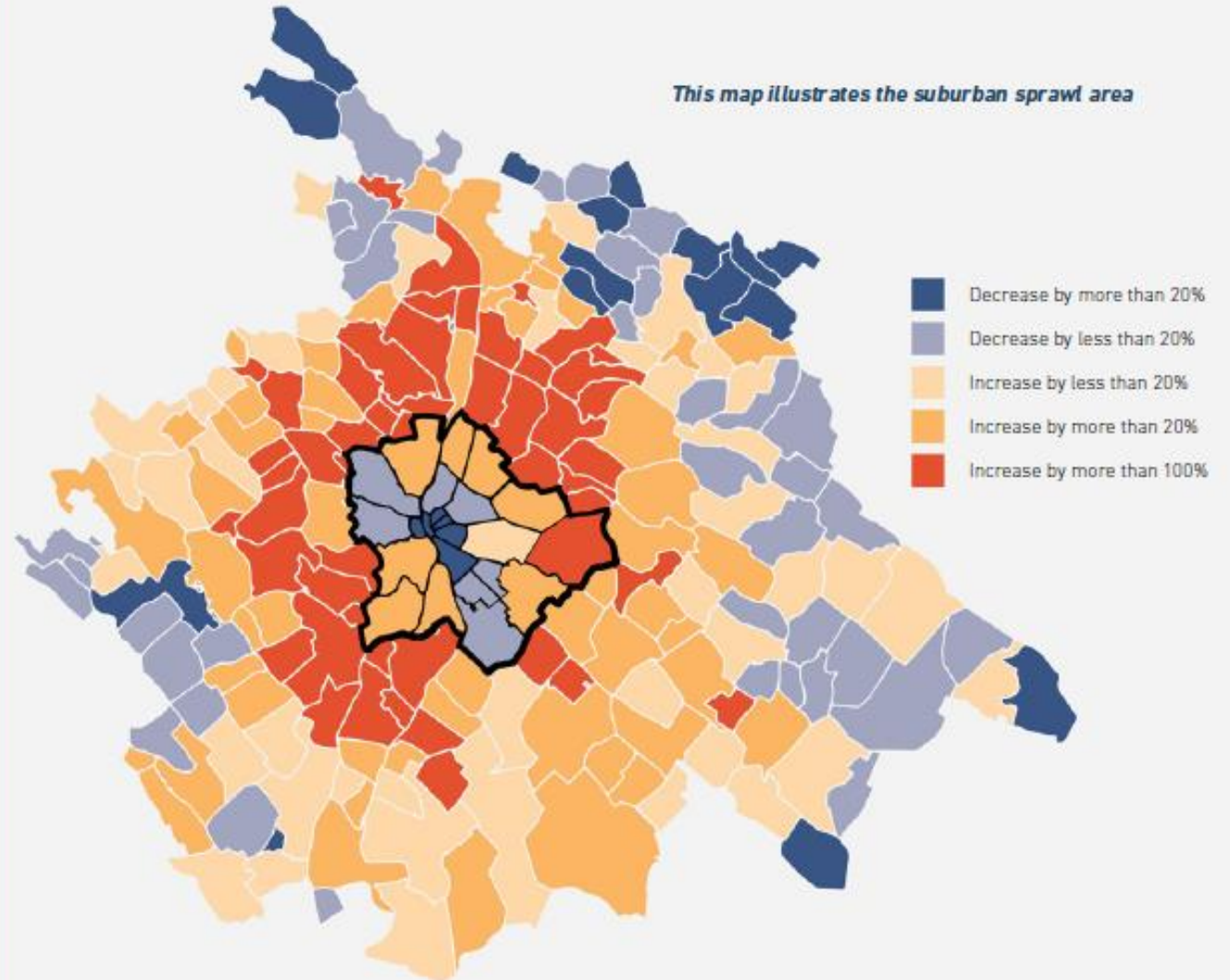
— The Budapest metropolitan area's population of 3 million people could increase by 200 000 by 2040.

— Suburban sprawl is parallel with downtown depopulation. **Between 1960-2017:**

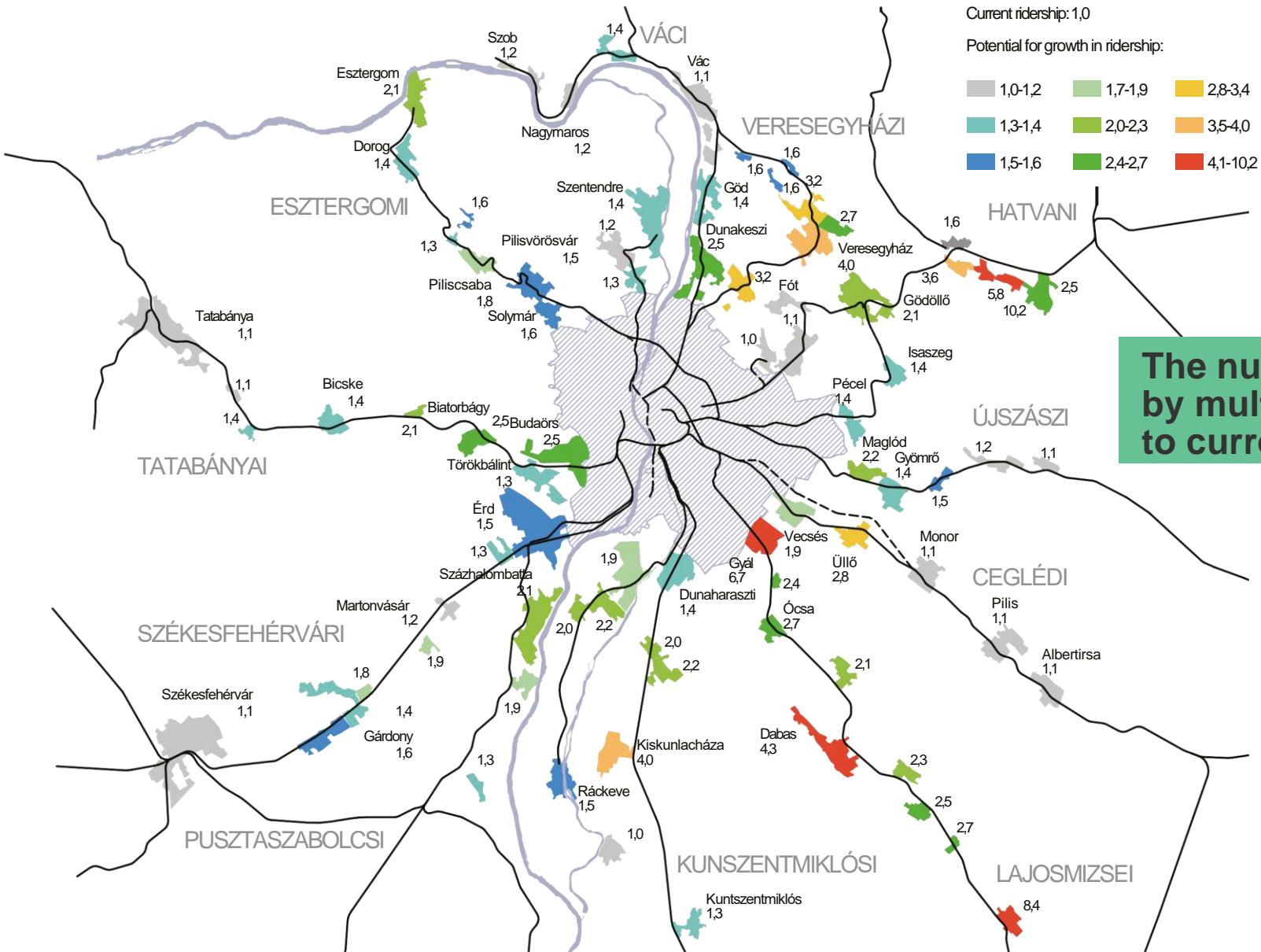
- population of Budapest's inner districts has halved,
- while the suburban population has increased by 60%.

— According to the population forecasts, by 2040:

- population of Budapest will increase by 2.76%,
- while the suburban population will increase by 13,25% – this means that 15% of Hungary's population will live in this surrounding urban area.



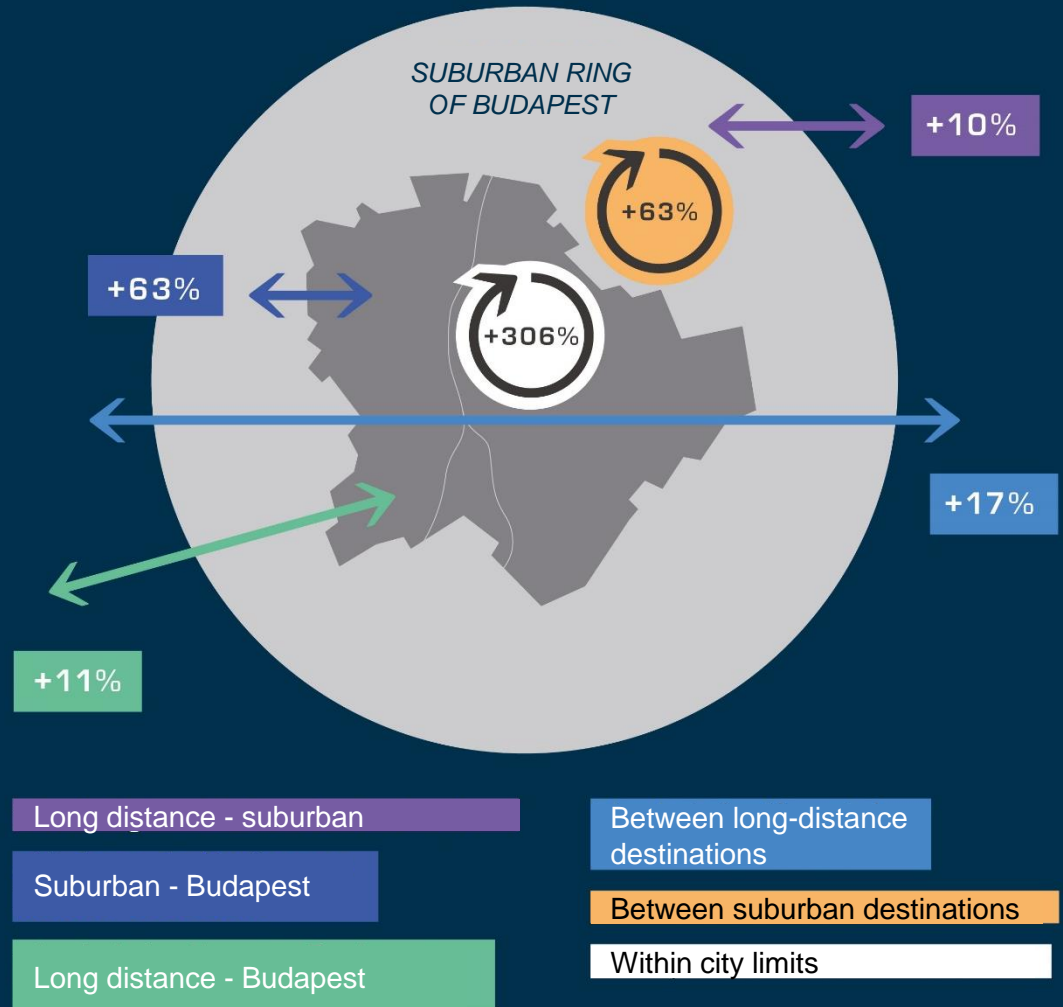
# HOW MANY SUBURBAN COMMUTERS WOULD CHOOSE RAIL IF THE CONDITIONS WERE RIGHT?



The numbers show the potential for growth, by multiples in rail passengers, compared to current figures.

## RIDERSHIP IN AND AROUND BUDAPEST IS LIKELY TO DOUBLE



- **Rides within city limits can be increased fourfold.**
- Ridership in the suburbs is projected to grow by 63%.
- Long-distance and international travels will see a 10% growth.
- **Summarizing, the daily MÁV Start rides concerning the Budapest metro area will exceed half a million, which is an 80% growth..**
- Within this figure, suburban and urban rides constitute a 97% growth.
- According to traffic analysis, due to the suggested railway developments, there will be 115 thousand new passengers from changing modes.



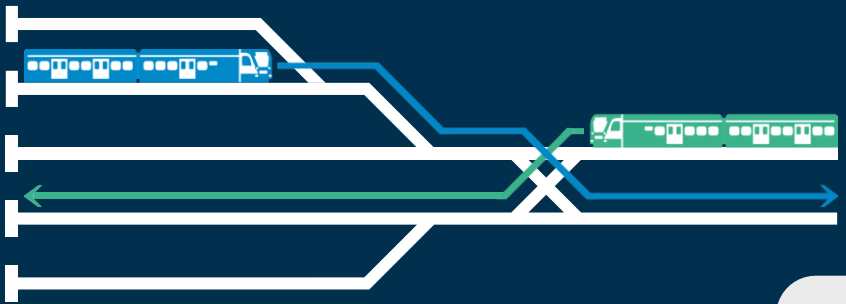
*HÉV ridership not involved in the data*

# WHY IS THE THROUGH SYSTEM BETTER THAN HAVING HEAD STATIONS?

**TRAINS CROSSING BUDAPEST  
LIMITS PER HOUR PER DIRECTIONS**

CURRENT:  42 TPH  
GOAL:  93 TPH

## EXTENDING THE CAPACITY OF HEAD STATIONS



 Goals not met

## THROUGH SYSTEM



 Approximately similar CAPEX

 Goals met

- Inbound trains need to turn, arriving and departing trains cross each other paths.
- 2 trains per track can be turned in an hour.
- Extending head station capacity demands more land in high land value areas in the city centre.

- In through stations, trains can carry on within minutes, traffic is flowing.
- 12 trains per track can be served in an hour.
- Transforming head stations into a through system opens up huge spaces for redevelopment.

**BIG CITIES THROUGHOUT EUROPE ARE TRANSFORMING THEIR HEAD STATIONS INTO THROUGH SYSTEMS, IN MANY CASES WITH THE HELP OF TUNNELS.**

**RAILWAY HAS ITS RENAISSANCE.**





## BACKGROUND OF THE PROJECT

- The Government supports the Budapest Development Agency (BFK) in analysing the feasibility of the Tunnel:
- 1247/2016 (V. 18.) Govt. Decree about the IKOP funding
- 1564/2018 (XI. 10.) Govt. Decree about the directions of development for the Budapest Rail Node
- Planning is funded by the EU and Hungarian budget.



- BFK trusted an international consortium with the leadership of Főmterv to deliver the Study.

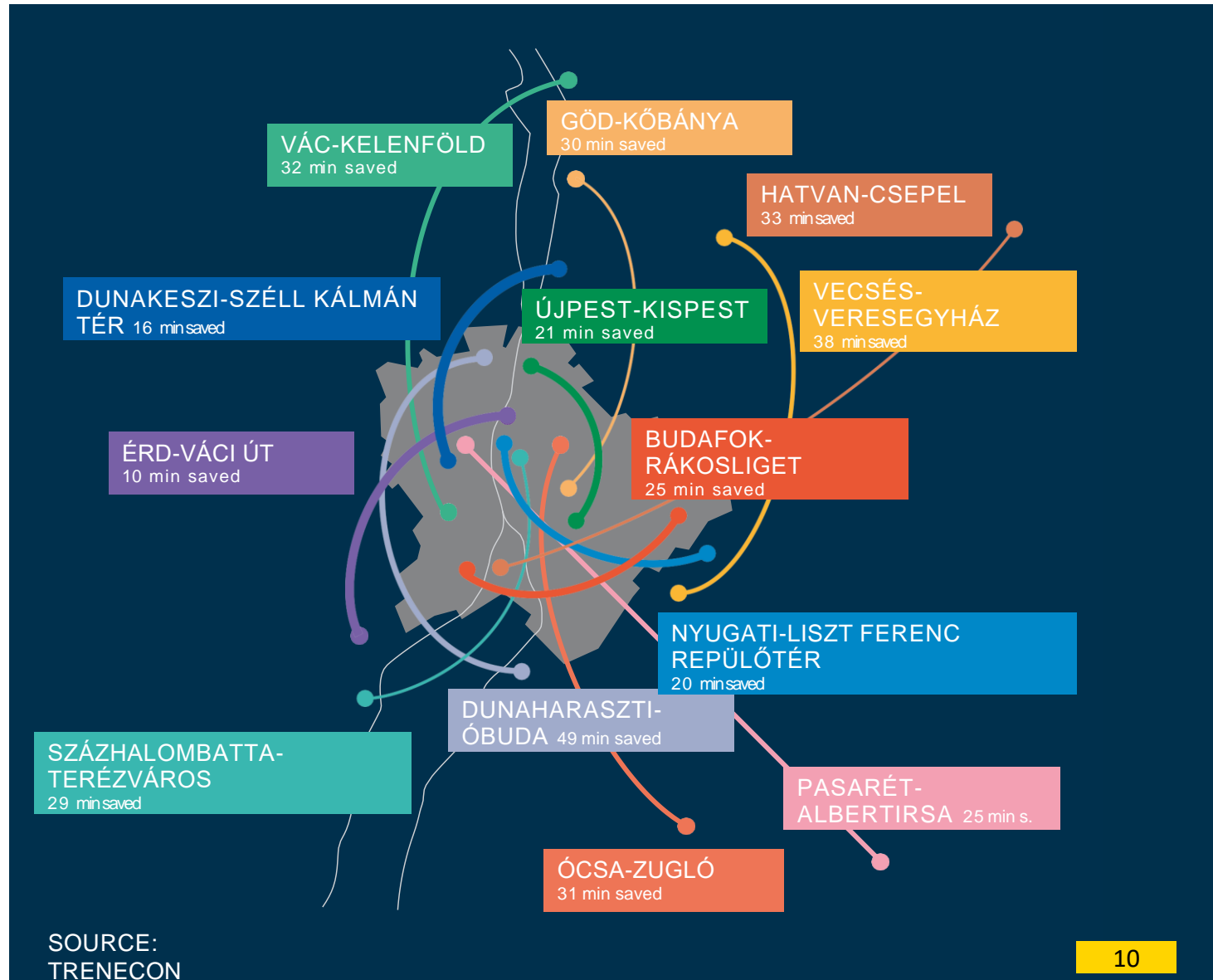
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- A wide range of expertise is involved in the planning process.



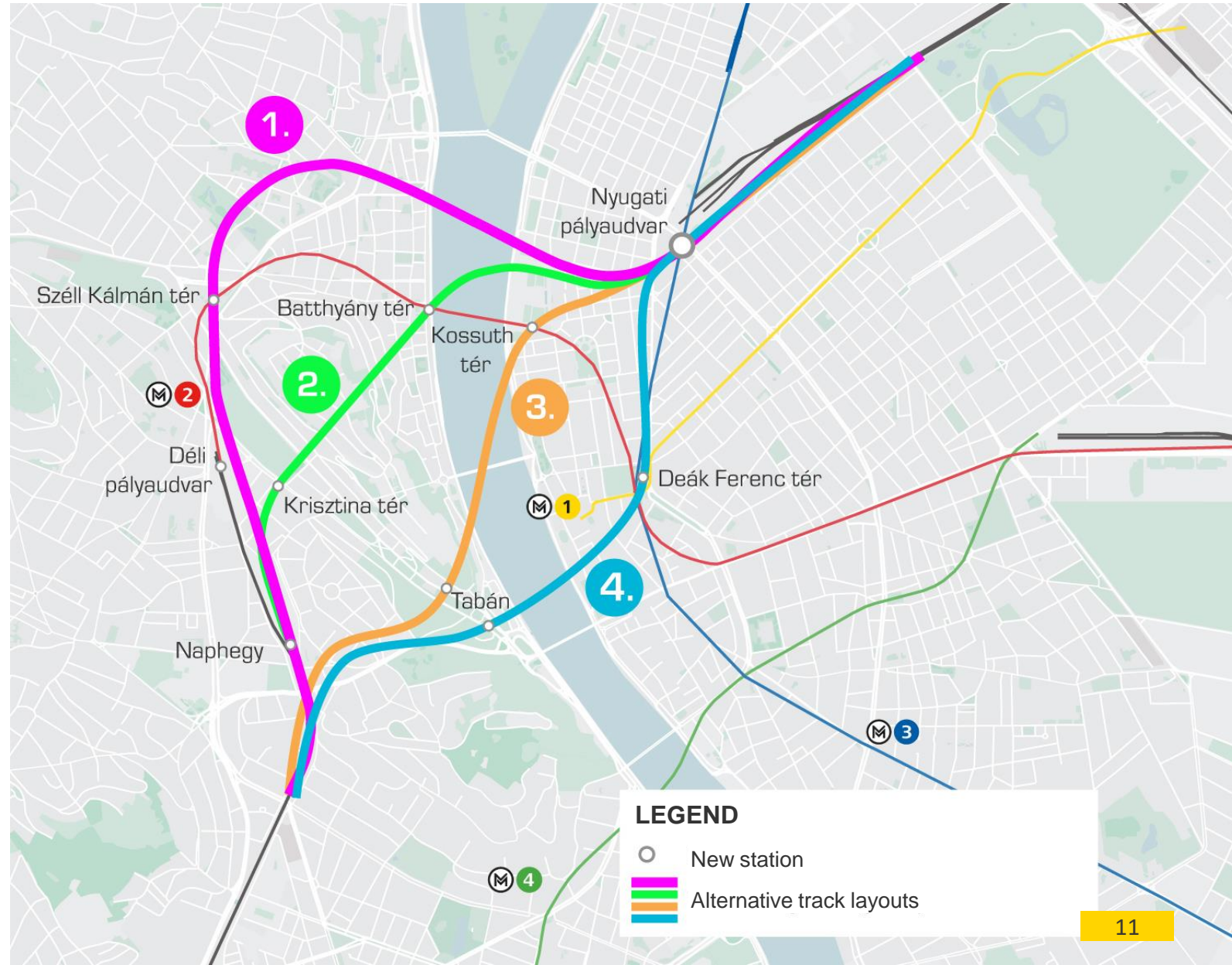
## THE TUNNEL AS THE CORE PIECE OF THE NETWORK

- Two Danube crossings provide much needed flexibility.
- The new crossing between Déli and Nyugati RS will
  - Be a brand new connection and provide opportunities for new service lines
  - Open up the inner city
  - Increase the role of rail within the urban transport mix
  - Increase capacity and provide the opportunity to close Déli RS
  - Eliminate a bottleneck in the Transeuropean network.
- The through system opens up urban space for redevelopment.
- This system invites the most passengers to change modes from individual transport.

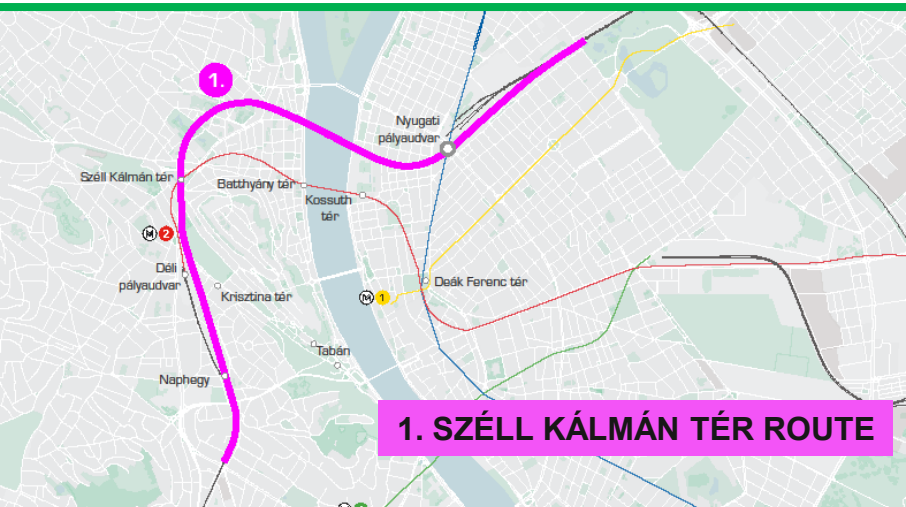


## THE 4 DIFFERENT TRACKS TO BE ANALYSED

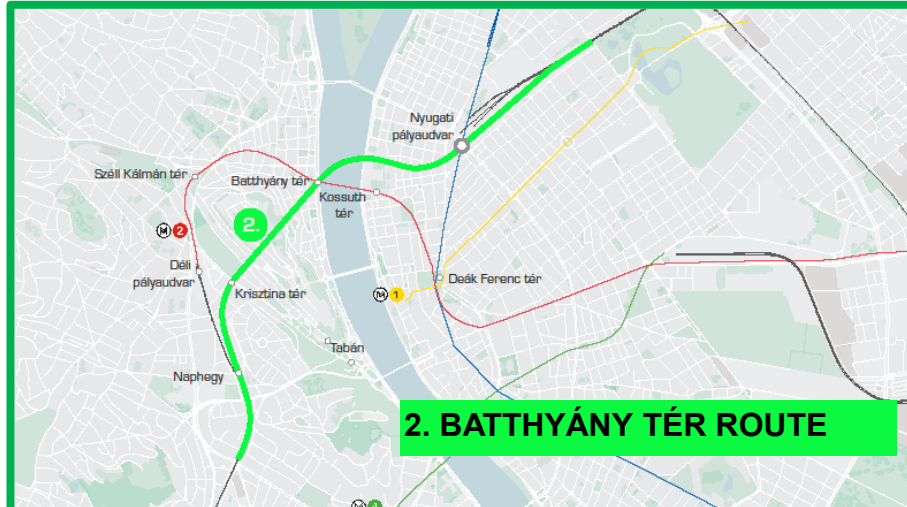
- Four different track layouts were analysed between Kelenföld and Nyugati RS.
- The difference between the layouts lies in the connection to M2 metro line.
- 1. SZÉLL KÁLMÁN TÉR route
- 2. BATTHYÁNY TÉR route
- 3. KOSSUTH TÉR route
- 4. DEÁK TÉR route



## THE 4 DIFFERENT TRACKS TO BE ANALYSED



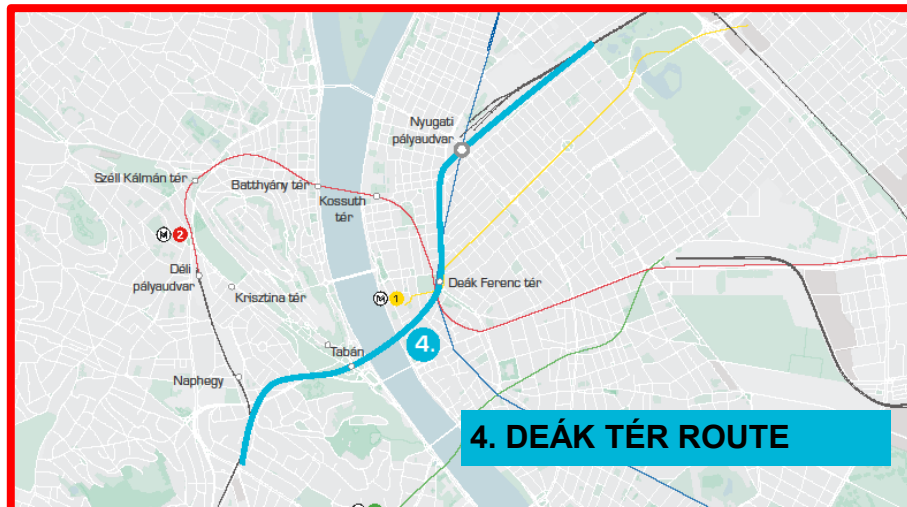
**FEASIBLE ALTERNATIVE**



**FEASIBLE ALTERNATIVE**



**NOT FEASIBLE**



**NOT FEASIBLE**

The track layout is greatly influenced by the existing metro lines and the Danube crossing.

**Kelenföld**

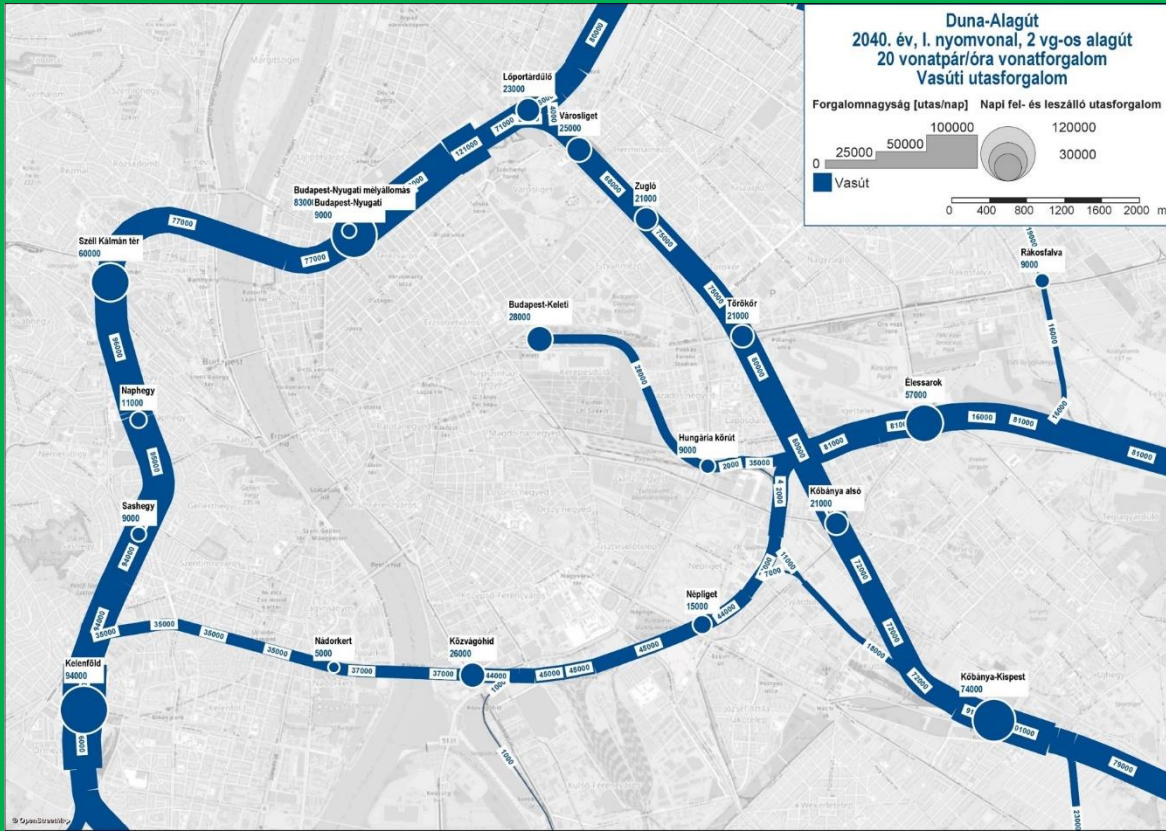
**94 th passenger / day**

**Széll Kálmán tér**

**63 th passenger / day**

**Nyugati underground rail station**

**83 th passenger / day**



**Kelenföld**

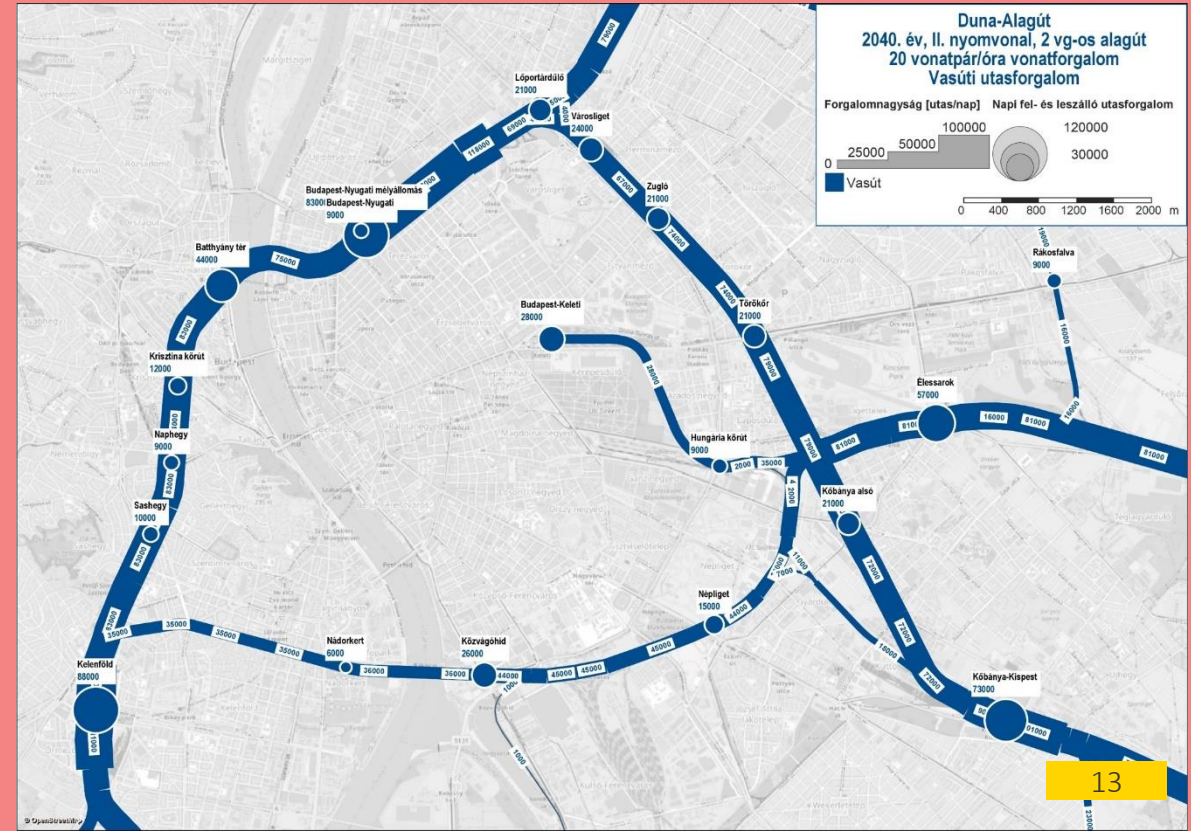
**88 th passenger / day**

**Batthyány tér**

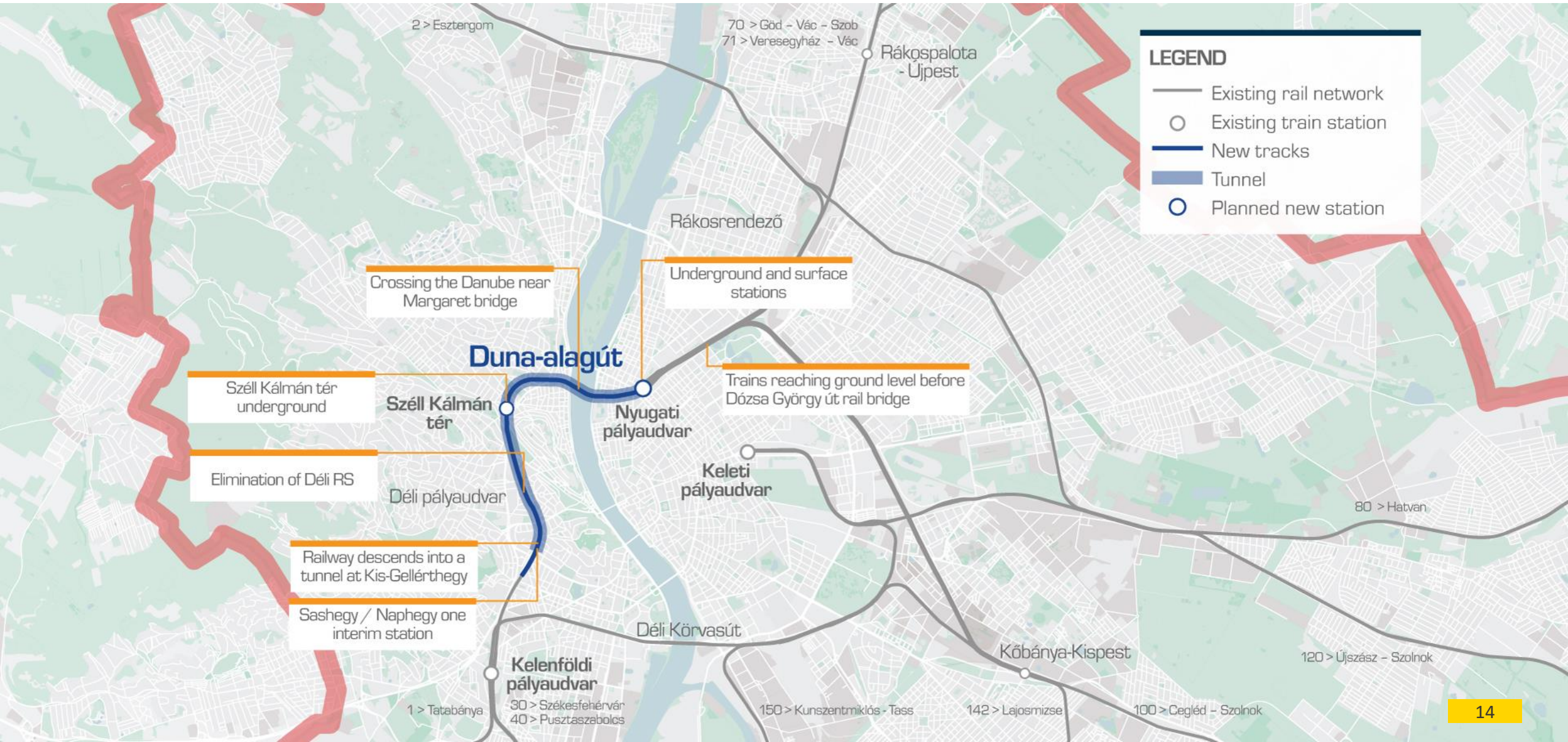
**44 th passenger / day**

**Nyugati underground rail station**

**83 th passenger / day**



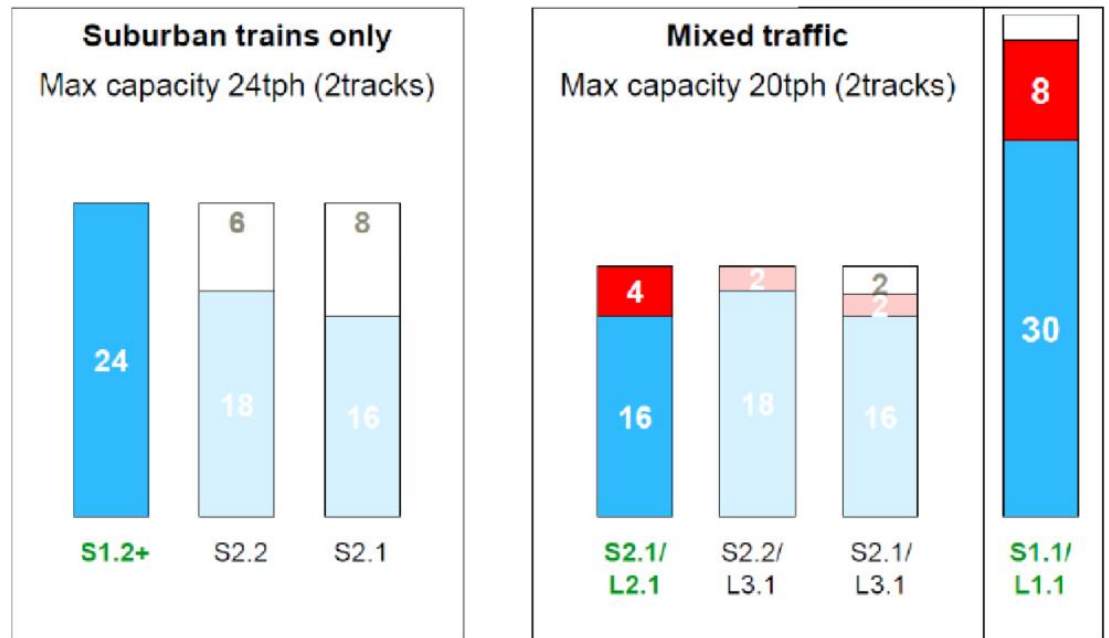
# CHOSEN AND PLANNED TRACK FOR THE TUNNEL



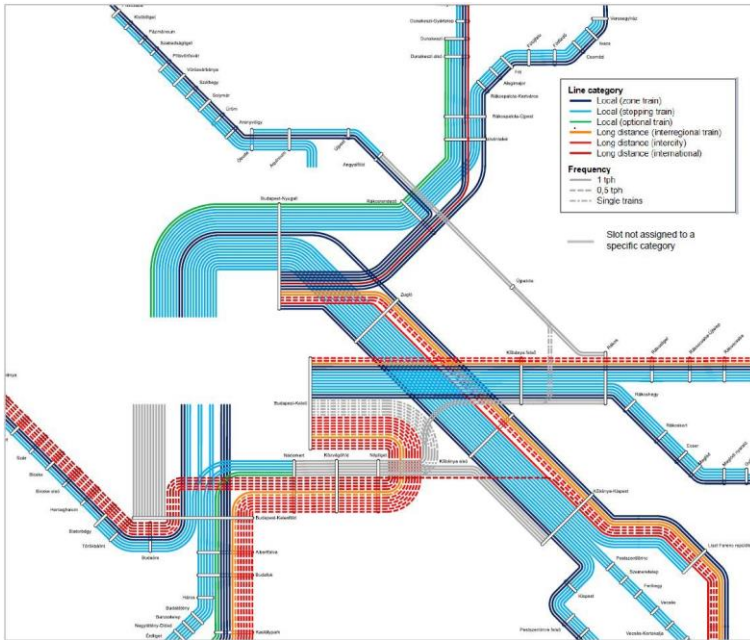
## Different scenarios for the amount of trains in the Tunnel

			Suburban				
variant			S0	S1.1	S1.2	S2.1	S2.2
tph			0	30	20	16	18
Long distance	L0	0		30	20 +4	16	18
	L1.1	8	8	38	28	24	26
	L1.2	6	6	36	26	22	24
	L2.1	4	4	34	24	20	22
	L3.1	2	2	32	22	18	20

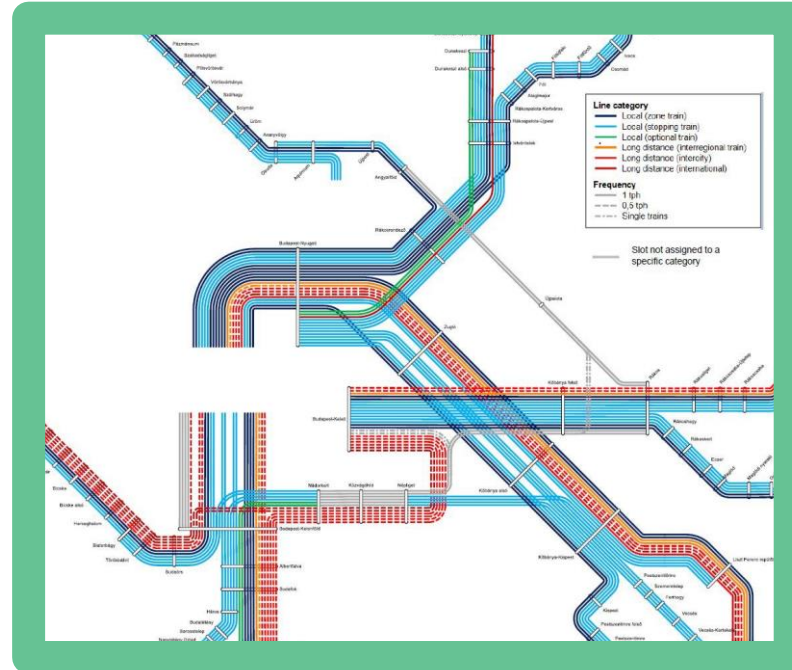
## Alternatives chosen for detailed analysis



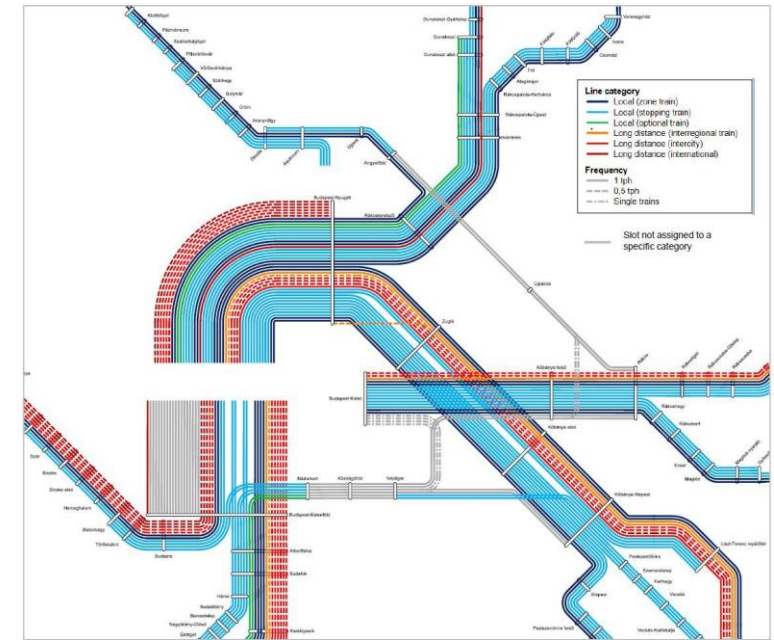
# ALTERNATIVES FOR THE TUNNEL SCHEDULE



24 train/h/direction suburban traffic, 2 track tunnel



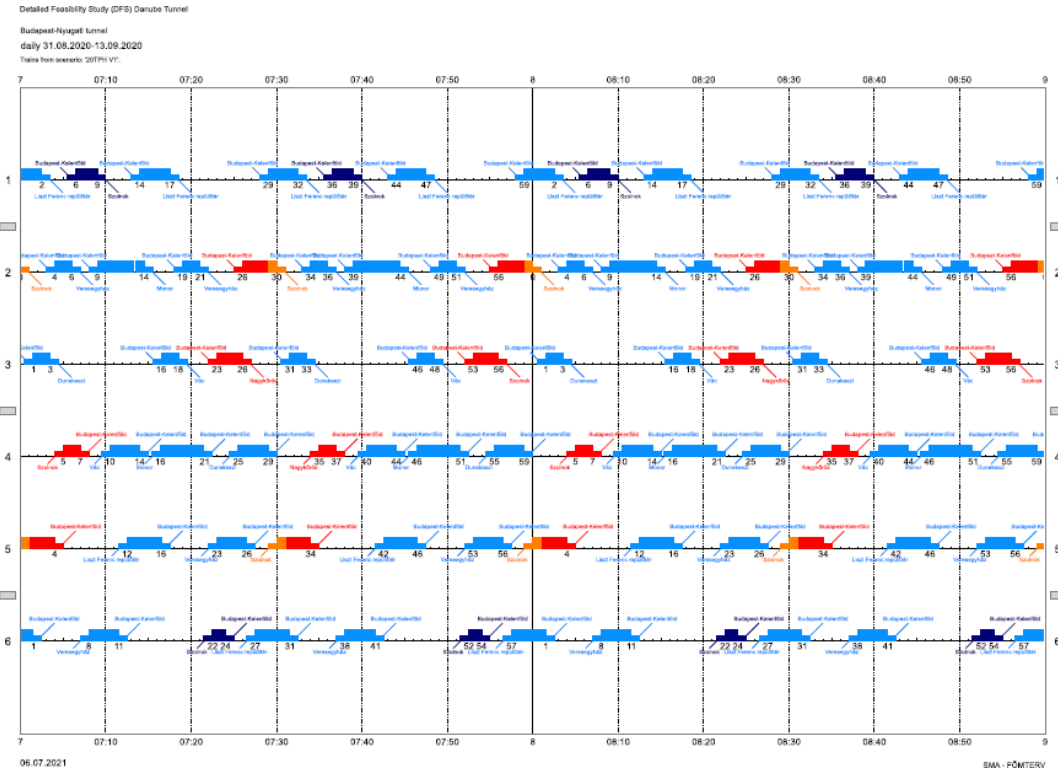
20 train/h/direction mixed traffic, 2 track tunnel



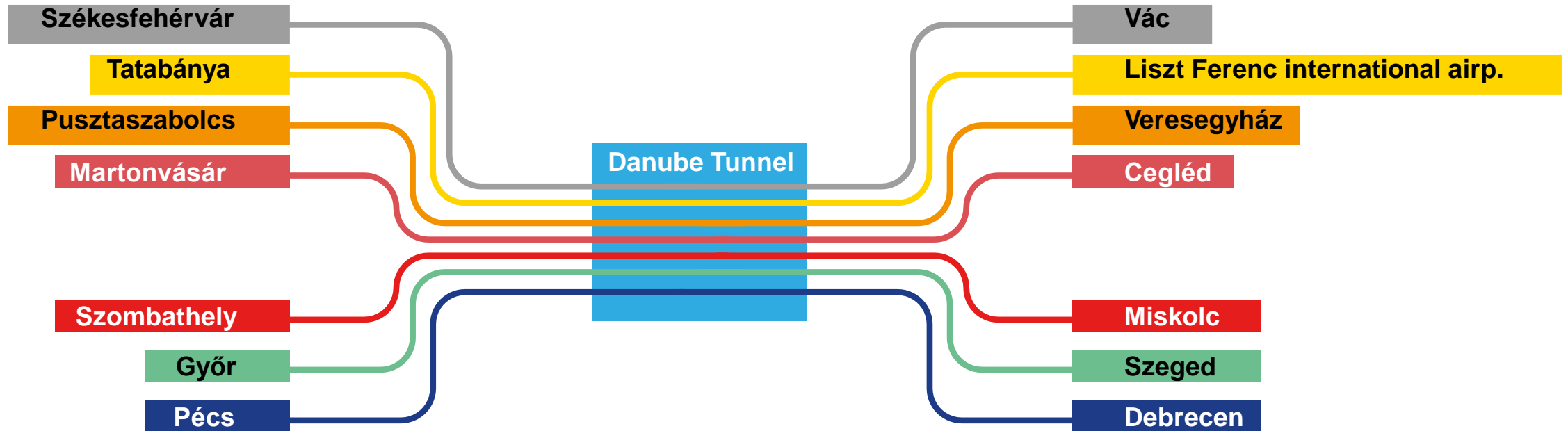
38 train/h/direction mixed traffic, 4 track tunnel



- **The 4 track Tunnel is not efficient**, because Westbound trains cannot be filled, while train ridership from Pest to only until Kelenföld is also below optimal.
- Nyugati RS can only be the **country's main station with mixed traffic**.
- 20-22 train/h/direction mixed traffic is optimal, **2,5 minutes headway** is possible
- Nyugati underground station with **8 tracks**, Széll Kálmán tér underground station with **4 tracks**
- **Maximum 1 station** can be inserted between Kelenföld and Széll Kálmán tér in either Sashegy or Naphegy areas.



## A FEW EXAMPLES FOR POSSIBLE ROUTES



## TRAIN TRAFFIC DURING RECONSTRUCTION PERIODS



- It is our objective for **Nyugati** RS to operate during the entirety of the reconstruction, at least with a decreased capacity.
- The traffic of **Déli** RS can be upheld during most of the reconstruction.

## THE RENOVATION OF NYUGATI RS IS CRUCIAL

**THE ABSOLUTELY OBSOLETE INFRASTRUCTURE IS OPERATED BY HUMAN POWER TO THIS DAY. THE ELIMINATION OF THE HEAD STATION SYSTEM CANNOT BE PROLONGED ANYMORE.**

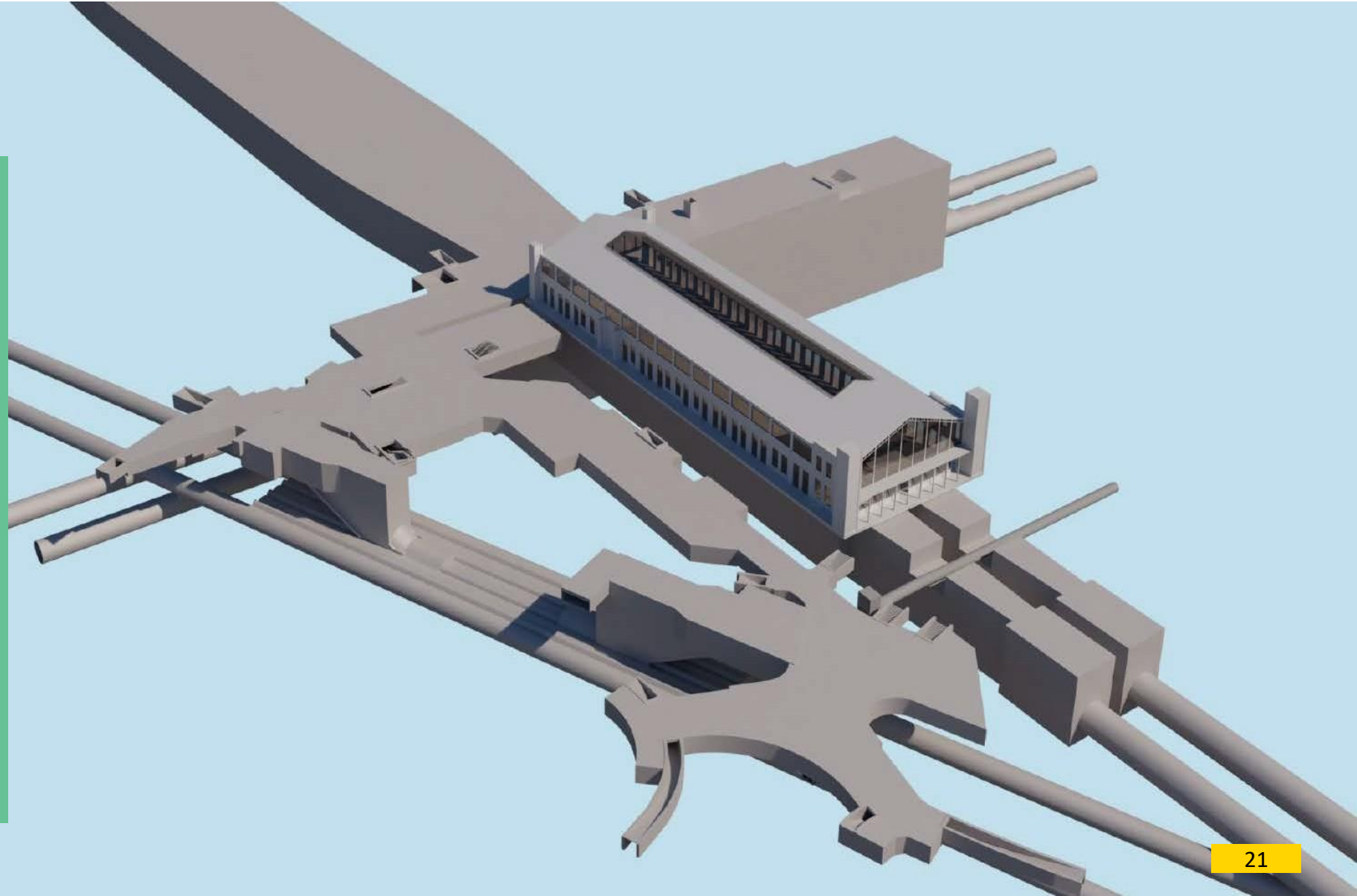


## THE PRELIMINARY ANALYSIS FOR THE LOCATION OF THE NYUGATI UNDERGROUND STATION

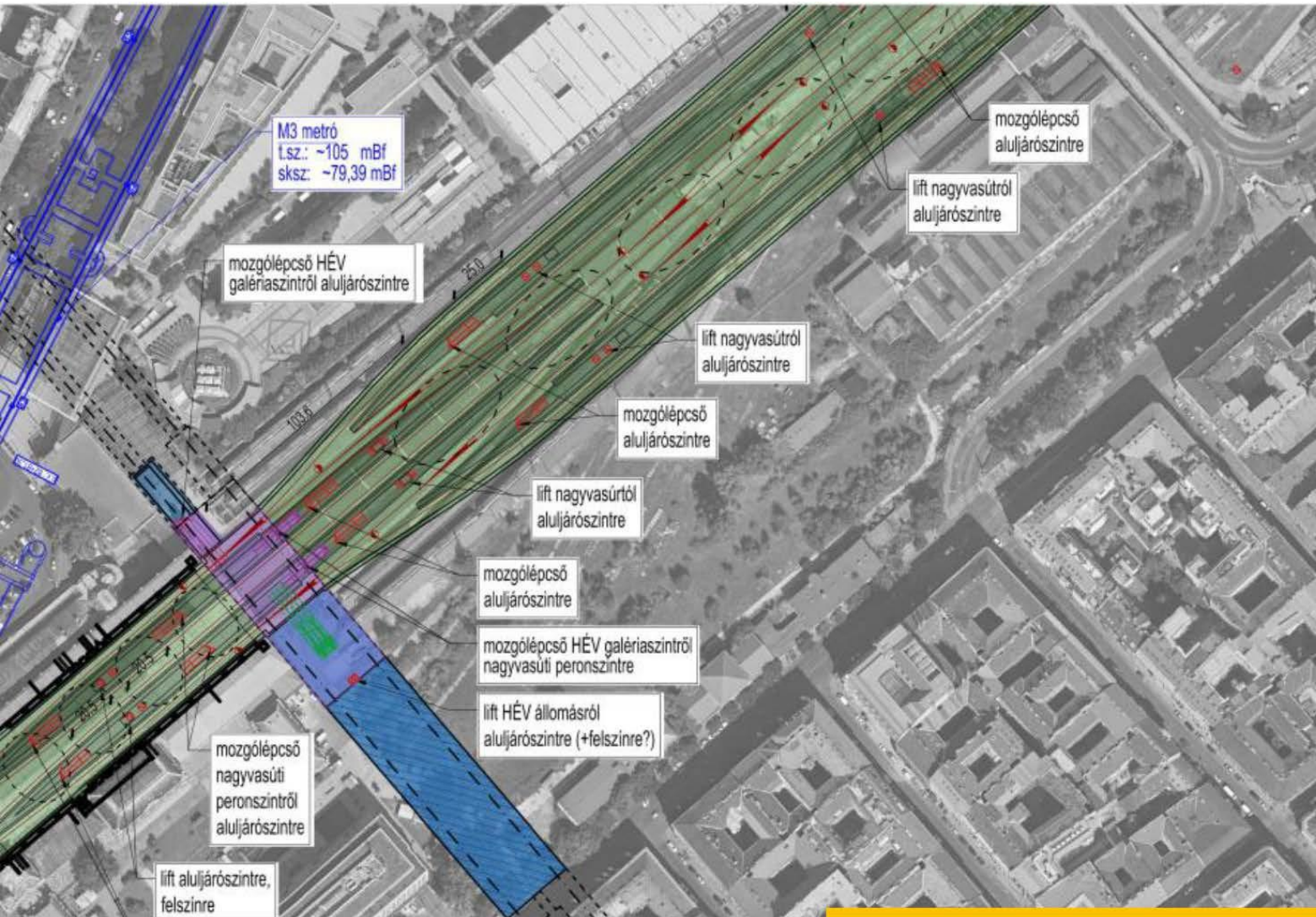
The location of the underground station can be:

- Under Eiffel hall
- Behind Eiffel hall
- Below Eiffel tér (by the side)

Platforms have to be close to Grand Boulevard, there isn't enough space below Eiffel tér, demolishing the office building is not suggested.



## BASIC INPUT PARAMETERS FOR THE UNDERGROUND STATION



Eiffel hall should carry an iconic rail function as the main piece of the through system.

The tracks have to reach the current elevation by Dózsa György út.

The future M5 metro station will be situated on the North end of the hall, in a perpendicular fashion.

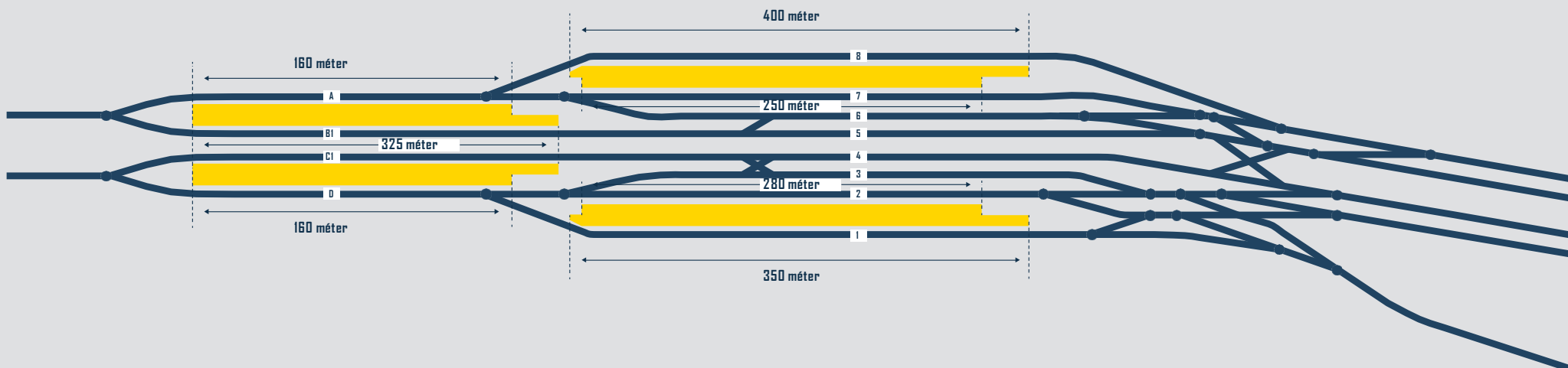
## PROPOSED TRACK LAYOUT FOR THE UNDERGROUND STATION

### FUNCTIONS:

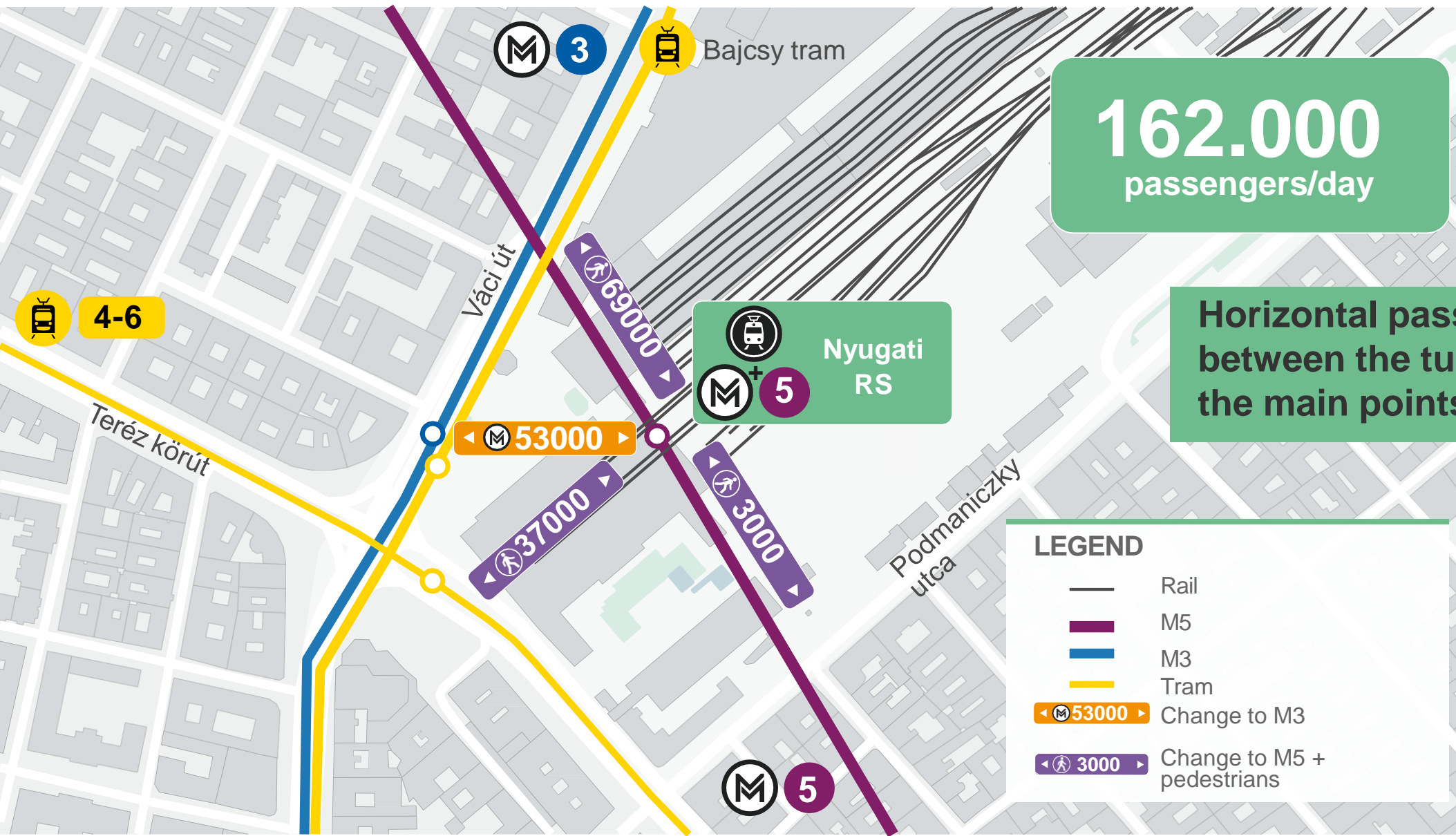
- After the construction Nyugati RS will be the main (through) station of Hungary.
- Budapest will be connected here to the High-speed rail network.
- Connection provided to the Liszt Ferenc International Airport, with 20 min travel time.

### LOCATION:

- 4 track under the historic hall with two central platforms for suburban trains.
- From the end of the hall till Ferdinánd híd, two more central platforms serving long-distance trains
- Track layout of the surface station will be altered as a result of the construction.

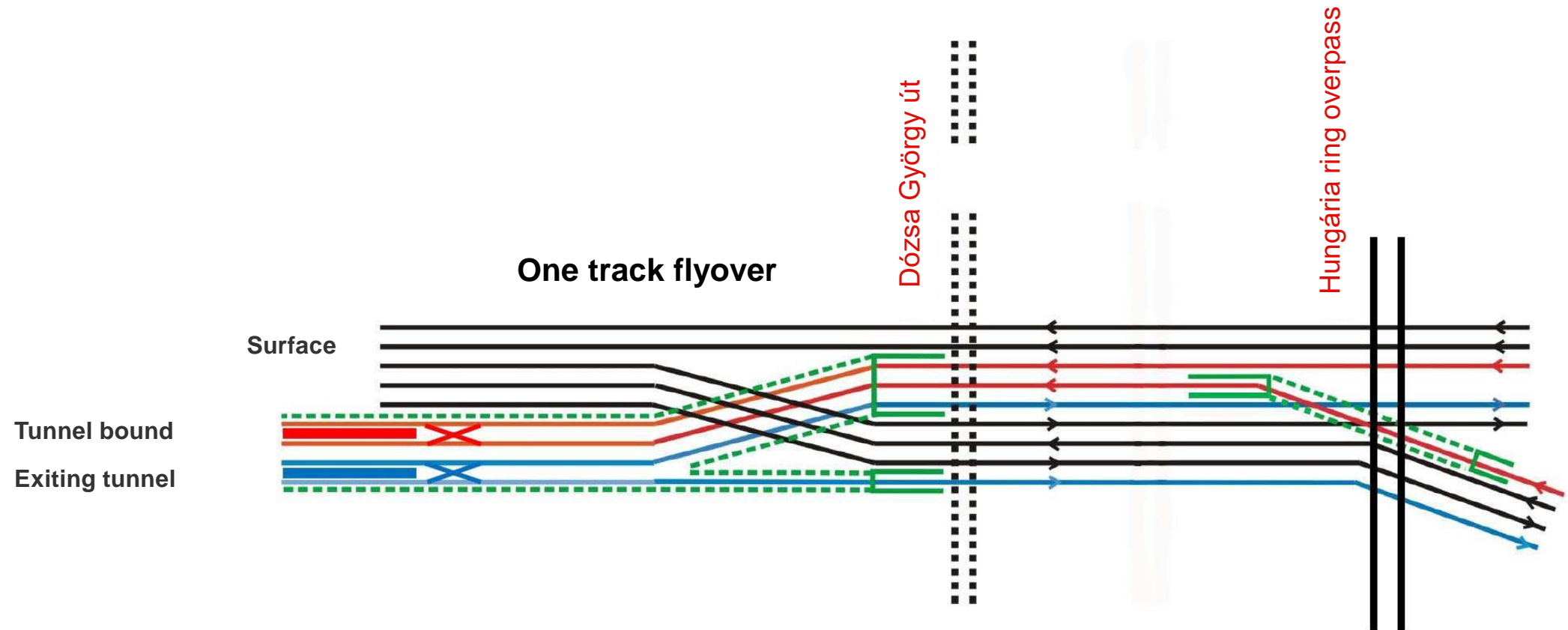


# PASSENGER FLOWS IN NYUGATI RS





# CONNECTION BETWEEN NYUGATI RS AND VÁROSLIGET

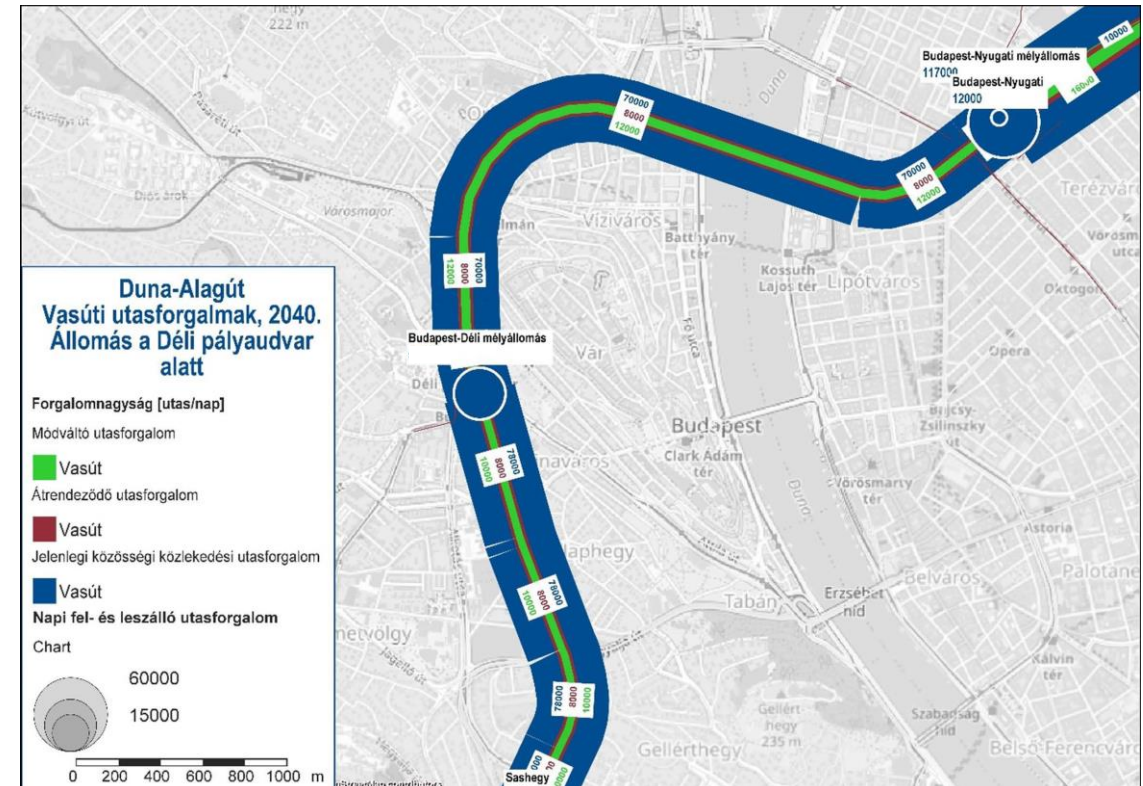


## Szél Kálmán tér underground station



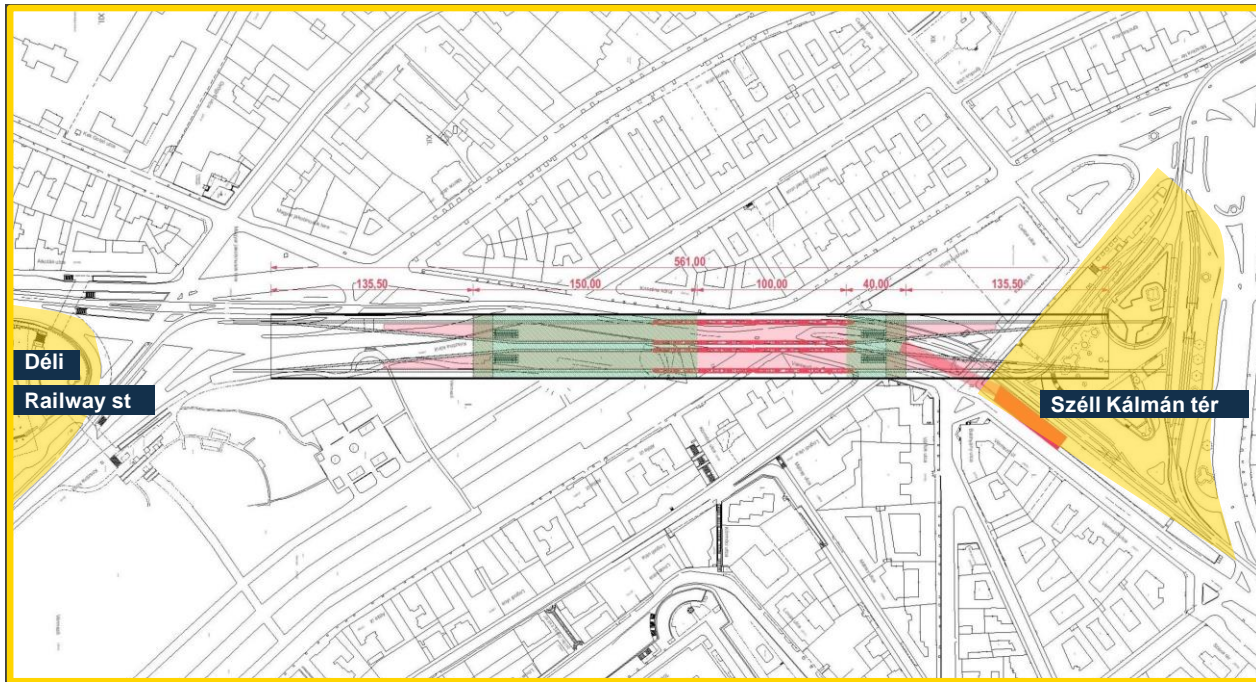
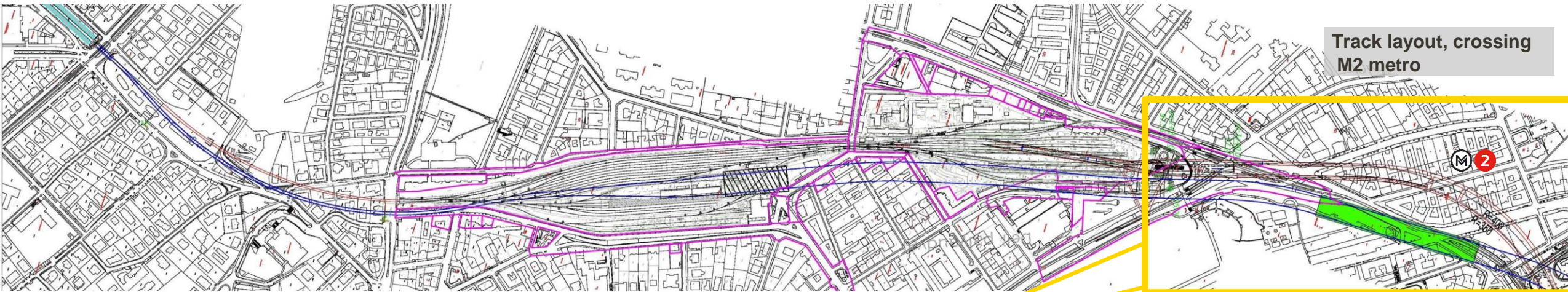
**Szél Kálmán tér expected daily ridership  
63 th / day**

## Déli RS underground station



**Déli RS expected daily ridership  
51 th / day**

## LOCATION OF SZÉLL KÁLMÁN TÉR STATION



- Pushed up as much as possible to the square, exit at Várfook utca
- 2nd exit at Magyar jakobinusok tere

## LOCATION OF SZÉLL KÁLMÁN TÉR STATION



- The new central station of Buda instead of Déli RS.
- Two exits: one towards the square, one at Magyar jakobinusok tere.
- Direct connection to M2 metro via a passenger tunnel.
- Main exit at Várfoke utca.
- 4 track underground station with 300 meter long platforms in order to provide InterCity train connection.
- Passengers from this station can travel Westbound, towards the Pest suburbs, East and North directions.

## ANALYSED SURFACE STATION AT VILLÁNYI ÚT



2 TRACK 230m PLATFORM STATION  
WITH AN EXIT AND ELEVATORS AT  
BOTH ENDS

## ANALYSED UNDERGROUND STATION AT NAPHEGY

Underground station alternative:



POSSIBLE LOCATION FOR THE BORING  
MACHINE AT THE OPERATIONS AREA OF DÉLI RS

- The new tunnel must have a maximum decline from Villányi út to reach the drilling site.
- The new tunnel must pass the existing tunnel at Kis-Gellérthegy from the East.
- The underground station can have 2 tracks with a central platform 300 metres long in 24 metres deep.
- Must be suitable for starting and operating the boring machine.
- Can only be situated in the centrally within the operations area, for the drills to avoid the garages at Mészáros utca.
- Allows the continuous operation at Déli RS.

# ONLY ONE STATION POSSIBLE IN BETWEEN KELENFÖLD AND SZÉLL KÁLMÁN TÉR UNDERGROUND STATION

Due to scheduling challenges, only one train station can be built between the two major Buda stations. Naphegy can only be built underground, together with the boring machine site. We are currently analysing the optimal solution.

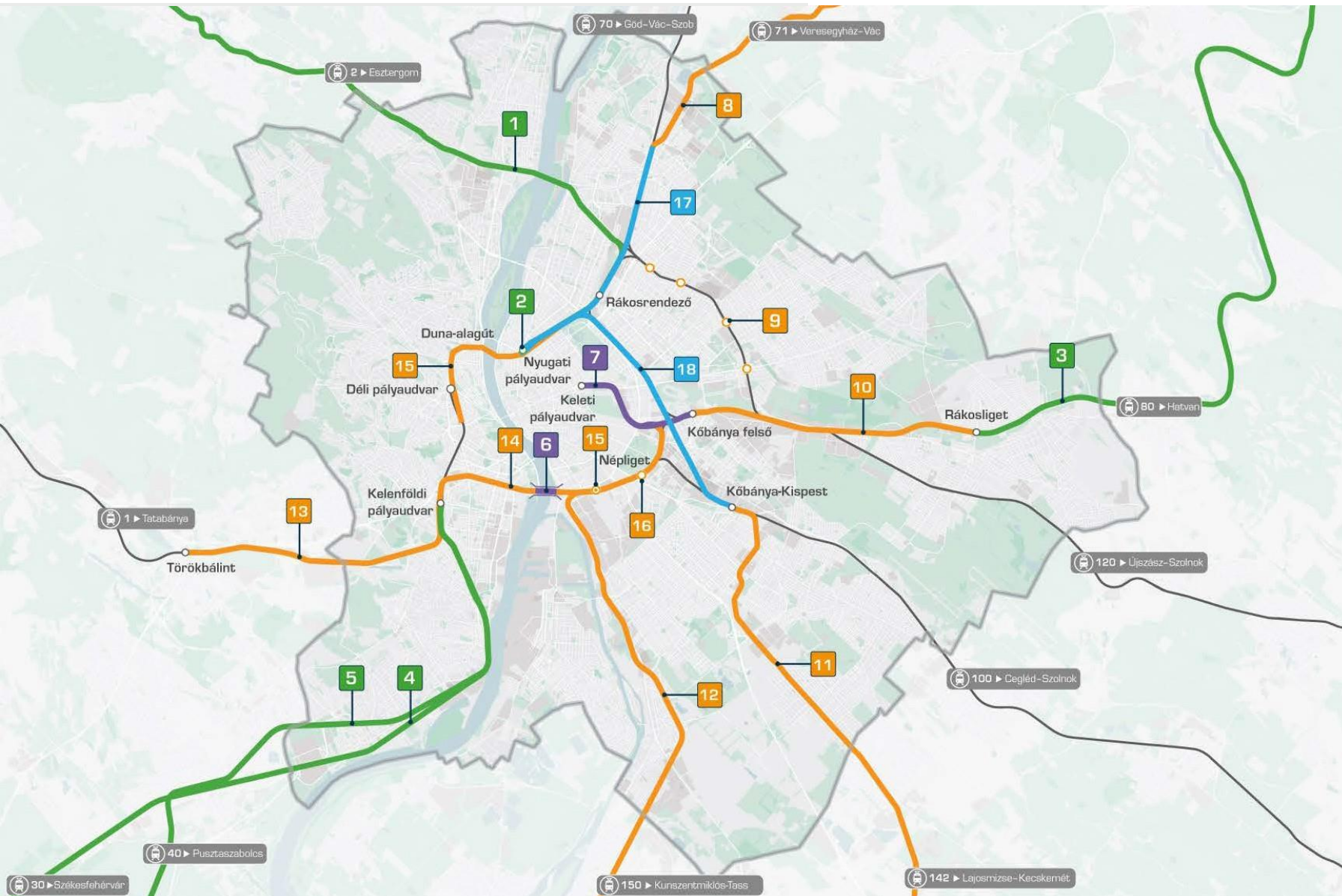
## TASKS UNTIL THE END OF THE PROJECT

- Finalising the timetable
  - Routes and timetables after the development
  - Determining the rolling stock demand
- Planning the lines leading into Nyugati RS
  - Needs for capacity extensions at Kelenföld, Kőbánya-Kispest and Rákospalota-Újpest
- Location of MÁV maintenance functions
- Environmental impact study
- Cost-benefit analysis





# DEVELOPMENTS OF THE BUDAPEST RAIL NODE STRATEGY



## Finished

- 1 Budapest - Esztergom
- 2 Nyugati pályaudvar műemlék csarnok felújítás
- 3 Budapest - Hatvan
- 4 Budapest - Pusztaszabolcs
- 5 Budapest - Székesfehérvár

## Under construction

- 6 Összekötő vasúti híd
- 7 Keleti-Kőbánya felső szakasz

## Under planning

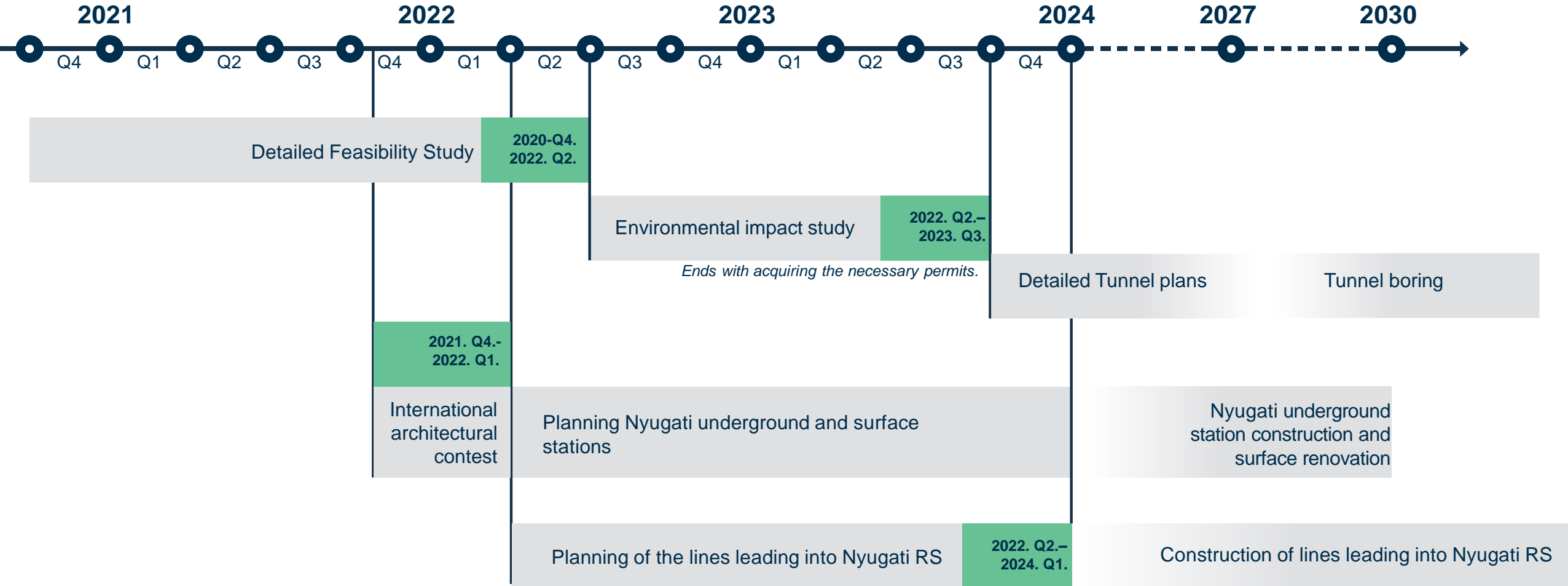
- 8 Budapest - Veresegyház - Vác
- 9 Új megállók
- 10 Kőbánya felső - Rákosliget szakasz
- 11 Budapest - Lajosmizse - Kecskemét
- 12 Budapest - Kunszentmiklós - Tass
- 13 Kelenföld - Törökbálint szakasz
- 14 Déli körvasút
- 15 Ferencváros külön szintű vasúti keresztezés
- 16 Népliget megálló

## Preparations

Nyugati bevezető szakaszai

- 17 Nyugati pályaudvar - Rákosalota - Újpest
- 18 Nyugati pályaudvar - Kőbánya- Kispeszt

# TIMETABLE OF PLANNING AND CONSTRUCTION TASKS



### Vonal vastagsága

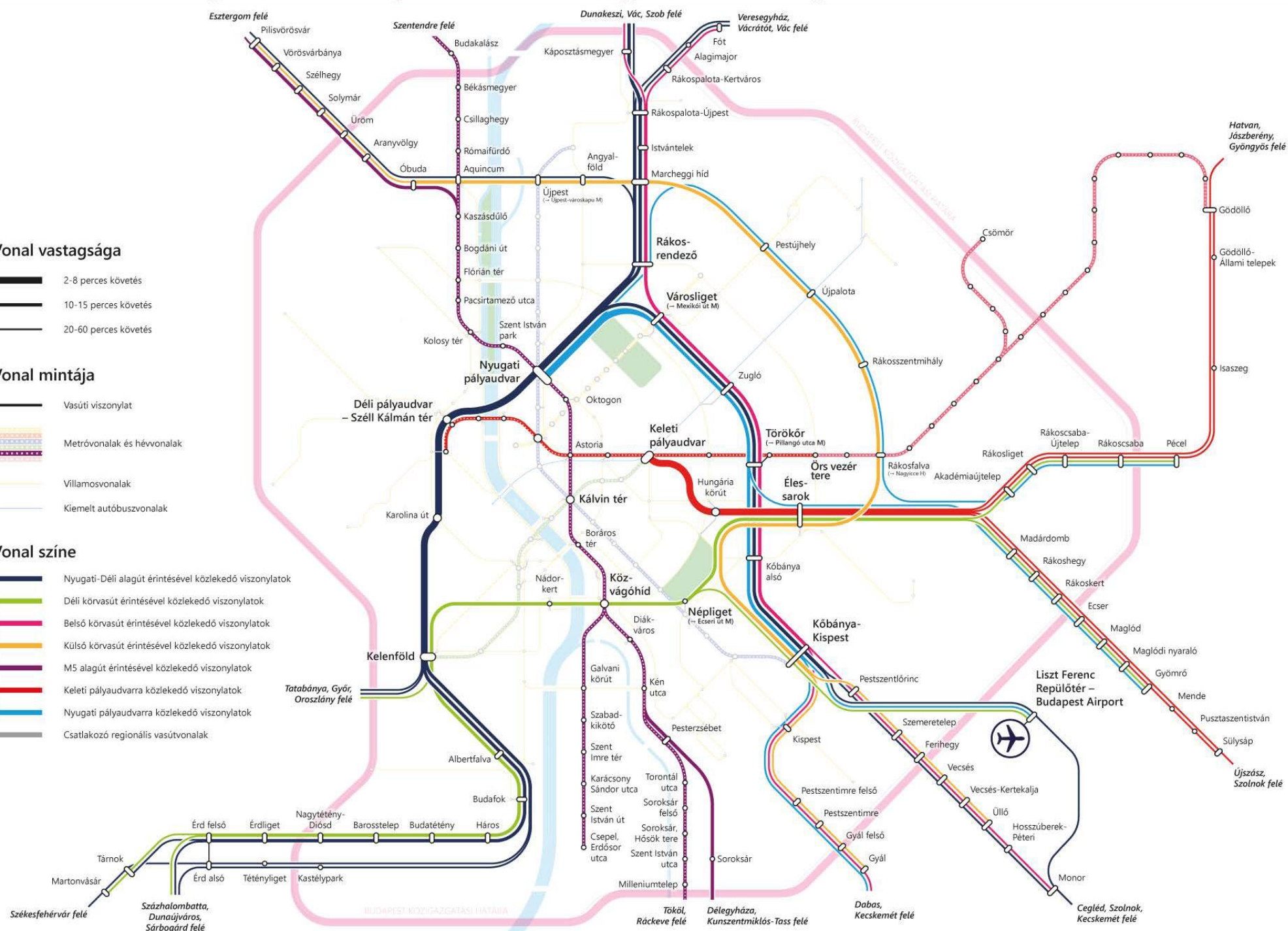
- 2-8 perces követés
- 10-15 perces követés
- 20-60 perces követés

### Vonal mintája

- Vasúti viszonylat
- Metróvonalak és hévonalak
- Villamosvonalak
- Kiemelt autóbuszvonalak

### Vonal színe

- Nyugati-Déli alagút érintésével közlekedő viszonylatok
- Déli körvasút érintésével közlekedő viszonylatok
- Belső körvasút érintésével közlekedő viszonylatok
- Külső körvasút érintésével közlekedő viszonylatok
- M5 alagút érintésével közlekedő viszonylatok
- Keleti pályaudvarra közlekedő viszonylatok
- Nyugati pályaudvarra közlekedő viszonylatok
- Csatlakozó regionális vasútvonalak





**BUDAPEST  
FEJLESZTÉSI  
KÖZPONT**

**THANK YOU FOR YOUR  
ATTENTION!**

