Tel-Aviv metro M1 North
Assessment of NTA planning

for
The region of Drom Hasharon and the municipalities of Herzliya – Kfar Saba – Raanana – Ramat Hasheron

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Contents

0. Assessment Statement

Environmental impact of metro systems

The planning stage for a metro system in the Tel-Aviv metropolis is in full swing. The routes for three lines have been designed and published to the general public.

The construction of a new metro system must be such, that it ideally serves the maximum number of people around the alignment. But service means good access and short travel times, requirements that are inherently contradictory. Both construction and presence of such a system will have environmental impact such as (but not limited to) dust, vibration, noise and so-called electromagnetic emission during construction and during operation respectively. A clearly predefined optimum solution between all kinds of conflicting factors is not available. The only way out is the use of professional knowledge and common sense.

Assignment

The region of Drom Hasharon and the municipalities of Herzliya, Kfar Saba, Raanana and Ramat Hasharon have asked Microsim to professionally assess both the plans of NTA and the proposals they generated for alternatives. This report summarizes the assessments and proposes the best alternatives to the NTA plans with a short substantiation.
Microsim has almost fifty years of professional experience in road traffic and rail systems, both in the areas of planning, implementation and system integration. In the area of rail systems, Microsim has knowledge and experience both in infrastructure and in rail vehicles.

Assessment

A professional opinion has been written on an issue by issue basis. Some issues are more general of nature and some are area specific or even location specific. That has been addressed as such in the text of the report. Under the header of "proposed alternative", the changes or alternatives describe in short what, to the professional opinion of the assessor, is a better option than the one planned by NTA.

This assessment does not show all the detailed information that is available. It summarizes the core arguments for the proposed alternatives. Additional and more detailed information can be made available on request.

The over-all conclusion of the assessment is: there is sufficient room for improvement.

Leusden, The Netherlands,
January 11th, 2021
(authorized signature)

Ir. D. van Bekkum,
(managing director and assessor)

Acknowledgements

This assessment was written by the assessor, with professional support of:
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Fabian Wegewijs, senior expert in railway operations planning at Movares Netherlands.

1. Introduction

1.1 Planning of M1

In July 2020 Israel's National Infrastructures Committee decided to publish details of the northern section of the M1 line of the Tel Aviv Metro for public objections.

The M1 line, planned by NTA – Metropolitan Mass Transit System and the Planning Administration will extend over 85 kilometers with 62 stations. The line will connect Rehovot and Lod in the south with central Tel Aviv and Kfar Saba and Raanana in the north.
The M1 line will connect with major railway stations such as Tel Aviv Savidor Central, Hashalom and Hagana as well as institutions like Tel Aviv University, the Interdisciplinary Center in Herzliya and Meir Hospital in Kfar Saba. It will provide transportation for employment centers like the Raanana North and Kfar Saba east industrial parks. Some of the stations will also connect with the Tel Aviv light rail and the other two Tel Aviv Metro lines M2 and M3.
Execution of the plan will have a far-reaching impact on real estate and environment. Although the M1 line will be completely underground, some underground land is planned to be requisitioned as well as land around the stations. Once built, the metro system will also prevent certain underground construction and because of that, high-rise construction along its routes.

1.2 Assessment of plans

The Region of Drom Hasharon and four municipalities (Herzliya, Kfar Saba, Raanana and Ramat Hasharon) have assessed the plans. The assessments focus mainly on issues of environmental impact (especially construction, effects on buildings, noise and vibration) and of routing, location of stations, and partially on traffic and transport at a higher level than M1.

The Regional Councel and the Municipalities intend to formally submit objections. They believe that, on various aspects of the plans, justification and better information is needed and better options are possible and can be implemented. The five have asked Microsim to take part in the assessment process and provide a professional opinion both on the NTA plans and on their own proposals for changes of or alternatives to the NTA plans.

This report illustrates the assessments and proposed improvements with sketches. No professional railway technical drawings were made to substantiate the arguments. If necessary, those can be made of course, but for the purpose of efficiency and speed, that has not been done so far.

1.3 Technical assumptions

This assessment and the associated professional opinions have been based on a couple of technical assumptions. Sometimes data were not available to the assessor at the time of writing. Sometimes they seemed to be not available at all. In order to perform an assessment, data have been used which are common knowledge or common practice from railway and metro technology in general.

Ground, geology and hydrology.

It is obvious that planning a metro system requires a thorough investigation of soil geological structures and hydrology along the planned alignment. For the purpose of this report, it is assumed that those investigations have been carried out.
On the other hand, proposals for changes in the alignment have not been checked against geological and hydrological conditions of the soil. So, for the purpose of this assessment, it is assumed that those conditions are acceptable with regard to the proposal.

Alignment

Along the alignment, stations and their platforms are required by the NTA as being straight. Though curvature with a (very) large horizontal radius could be acceptable from an engineering and passenger safety point of view, the NTA requirement will be respected.

Horizontal curves will differ from location to location, but there is a certain minimum that must be respected for a horizontal radius. Such a minimum depends on a number of factors, like dimension of carriages of trains, desired speed, wheel-to-rail contact, noise, etc. Absolute minima as small as 180

meters might be possible. For the purpose of this report, the assessment assumes a minimum horizontal radius of a track curve to be 300 m, which has been used as a requirement for proposed changes of the plans.

Location of stations

The location of stations depends on environmental factors, mainly on potential ridership from and to residential areas, centers of concentrated human activities such as universities, hospitals, industrial zones or offices. On the other hand, stations are a key element in the transportation process, mostly in terms of time used for the boarding and alighting of passengers and the associated acceleration and deceleration losses of the trains. The dilemma is to choose between the number of stations to maximally serve passengers and the number of stations to maximize transportation speed and minimize the number of trains needed at a certain service level.

An important parameter from the point of view of passengers is the maximum acceptable distance from a passenger's origin or destination to the nearest station. A lot of research has been done on what is called the maximum acceptable walking distance. That depends on a lot of all kinds of (also personal) factors. But as a general figure, various statistical distributions show that a walking distance of 500 to 700 meters or less is acceptable to 90% of metro system passengers[1][2][3]. However, NTA seems to maintain a 800 meter radius (or air distance) as a standard figure.
Practically the ridership coverage of a station is visualized on maps by circles around the center point of a station. But that circle is the maximum acceptable air distance to the station. In reality, walking distances are dictated by the street pattern. That means that the walking distance has a lower coverage than the air distance. Conversely, the walking distance is on average 25% longer than the air distance (see the example of figure 1.3.1).

figure 1.3.1

The practical consequence is, that a maximum acceptable walking distance to the center point of a station of 800 meters can be represented on maps with a circle having a radius of 640 meters. Conversely, a radius of 800 meters represents a walking distance of 1000 meters.
Figure 1.3.1 also shows the method that should be used to calculate the real walking distance to a station. Blank areas indicate areas with no potential passengers for a station. These data must also be used to dertermine the position of stations. There is no information that the NTA plans have used such data or did such calculations.

Train and station lengths

Planning an alignment and having to respect the requirement of straight platforms means that station length is a condition to take into account. The maximum length of trains presently planned by the NTA is seven (7) carriages of 18 meters long which makes up a maximum train length of 126 meters. To allow for some float in the position of trains along the platforms, NTA uses a platform length of about 170 meters. With additional space at both ends of the platforms it is assumed that the station length at platform level will be 200 meters at a maximum. The available drawings seem to be consistent with that assumption.

[1] Jarrett Walker: Human Transit, April 2011
[2] Paydar et al.: Walking towards Metro Stations, 2020
[3] CROW: Walking Distances, 2017

Cross-over turnouts

This type of turnouts (or switches) is necessary, to have trains cross over from one track to the other. That must happen at end-of-line locations in order to reverse direction of travel. Double crossovers (diamond crossovers) are used when it is necessary to be able to cross over from either track to the other within a limited length of track. They are planned also for exceptional operational situations, such as track maintenance or temporarily blockage of one of the tracks. A certain level of operation then can be maintained by having trains cross over and allow bi-directional traffic on (a limited part of) the other track. The number of switches in a line is a matter of risk assessment on exceptional situations. Railway design does not have general rules. For the purpose of this assessment, it is assumed that there are no strict requirements as where cross over switches must be located.

1.4 Structure of this document

Chapters 2, 3, 4 and 5 assess the plans on general issues that are applicable for all parts of the M1 alignment. Chapters 6 and following deal with issues which are location specific.

2. Construction technology and logistics

Present plan

The drawings of NTA also show which space adjacent to the alignment will be used (or even requisitioned) for construction activities. The significance is, that the claimed space will not be available for others i.e. local authorities and/or residents.

Assessment

Underground metro systems can be constructed in various ways. The choice depends on many (most local) factors and of course the costs. For the purpose of this report we distinguish closed methods (mostly boring) and open methods (excavation or cut-and-cover). From the available information, it is not always clear which of both methods will be applied where. And if available, there is no information on why a specific method was chosen for a certain part of the alignment. That makes it difficult to assess whether all spaces claimed, are absolutely necessary for construction and if alternative locations would be acceptable as well.

Different methods have different cost profiles, but also a different degree of risk and degree of obstruction and trouble for the environment. If no information is available on why certain construction methods were chosen, it is impossible for the environment to assess whether or not and how, the planned construction has balanced the interests of the metro project against the interests of the environment. Worst case, the present plan could show the optimum for the M1 project without any consideration for the environment.

If we assume that human safety will be dealt with adequately, then there are two additional aspects to consider relative to construction:

- risk in terms of unintended or unexpected subsidence, damage to existing structures and environmental nuisance such as spatial obstruction, noise, vibration, etc;
- spatial needs for construction materials and machines and construction logistics.

On both aspects, there is (at least to the assessor) no information available.

Proposed alternative

What is needed to perform a realistic assessment is:

- a construction risk analysis that evaluates the alignment plan. That analysis must show the expected risks of construction, the evaluation of various mitigating measures and the chosen set of measures as part of the alignment plan with an estimate of probabilities;
- a construction logistics plan, explaining the need for land use, planning the land to be used for logistics and explain the balance of interests of the project versus the interests of the environment.

3. Noise and vibration

Present plan

The present plan has an alignment that passes through densely populated areas. In many cases, the tunnel will be right below residential buildings, at a depth of 15-30 meters below the surface.

Therefore, nuisance from noise and vibrations should be considered. Furthermore, the present plan has an alignment that passes at relatively close distance to hospitals: Loewenstein Hospital (at less than 100 meters from the proposed alignment) in Raanana and Meir Hospital in Kfar Saba (at approximately 200 meters from the alignment). That means that also disturbance of sensitive equipment by vibrations should be considered.

Assessment

Vibrations and noise can both occur during the construction phase and during the operation phase. This assessment focuses on the operation phase. The following types of noise and vibrations are to be expected:

- Airborne noise (noise that propagates through the air). This will mainly occur at locations with the track at surface level, or near ventilation shafts or stations.
- Ground-borne vibrations (vibrations that propagate though the ground and into buildings). This can result in perceptible vibrations in residential buildings close to the tunnel, or in disturbance of sensitive equipment in hospitals or research centers.
- Ground-borne noise (noise head in buildings generated by vibrations propagated through the ground). This is a well-known phenomenon for underground railway lines. At low unnoticeable vibration levels, people can already be annoyed by this type of noise.

There are multiple standards available for the assessment of noise and vibrations. It is not known to the assessor which guidelines or standards NTA uses, and whether an Environmental Impact Assessment on noise and vibrations has been carried out. The characteristics of the vibrations in the buildings depend on the properties of the metro trains, the properties of the railway superstructure, the properties of the ground, the distance to the tunnel, and the properties of the buildings.

Proposed alternative

The assessor does not have the information to define an alternative at this moment. However, based on the alignment, a noise and vibration assessment must be performed. This assessment should also consider ground-borne noise, because it is a well-known phenomenon in houses above underground railway lines. Examples of people suffering from ground-borne vibrations and noise exist worldwide, especially at locations where the metro passes at a short distance. Ground-borne noise can well be mitigated by measures in the railway superstructure like soft baseplate pads, ballast mats or floating track beds. Also, an alternative alignment further away (vertically and horizontally) from the residential buildings can reduce noise and vibrations. There is no standard figure on how far is far enough. That depends on various factors, such as (but not limited to), composition of soil, depth of the alignment, construction method of tracks, curvature, foundation of buildings, etc.

4. Electro Magnetic Compatibility

Present plan

The present plan has an alignment that passes at a relatively close distance to hospitals: Loewenstein Hospital (at approximately 400 meters from the planned alignment) in Raanana, and Meir Hospital in Kfar Saba (at approximately 200 meters from the planned alignment). That means that also electromagnetic compatibility (EMC) must be considered.

Assessment

The metro system will be designed (without doubt) for EMC with(in) the existing environment. Both infrastructure and trains are electric systems that conduct electric currents. Those currents generate magnetic fields of the same frequency as their own. The risk that could materialize is the combination of high currents (some thousands of amperes) and extremely low frequencies (below 40 Hz). Some types of hospital instruments are particularly sensitive to that kind of magnetic fields and will disfunction.

It is known to the assessor that NTA performed an Environmental Impact Assessment (EIA) on EMC. The EIA (chapter 4) stated that the metro system would not cause electromagnetic interference in its environment. That conclusion was wrong, mainly because it did not take extremely low frequencies into account. Substantial electromagnetic emission and interference from the metro system must be expected. Humans and "regular" electronic equipment will not suffer from such emission, but some types of equipment used in hospitals can and probably will disfunction. That is a risk that must be analyzed. And if it is a probable risk, mitigating measures must be taken.

Recent Microsim studies on M1 south and M2 showed that effects of EM emission from M1 must be expected at distances up to 500 meters (reports are confidential, but known to NTA and NIC).

Proposed alternative

Because it is not known which types of equipment the hospitals use, specific measures or alternatives cannot be defined right now. Mitigating measures however must in many instances be found in a design of traction power supply that is different from what is usual, both in trains and in infrastructure. So rather than defining an alternative today, it is necessary to perform a risk analysis first, based on "hard" data of the hospital's instruments.Standard figures cannot be given because sensitivity of instruments depends both on the emission of M1 and on the properties of the instruments.

5. Station type

Present plan

The NTA drawings show a station design that has (without any exception) same level platforms (also called "wide stations").

Assessment

Though this is a common design in metro systems around the world, construction of stations under narrow streets can be very problematic, due to increased environmental risks for example caused by subsidence of soil adjacent to buildings and subsequent damage. Therefor many metro systems, especially in older city areas have applied split level platform stations, for the purpose of this report called "narrow stations".

The assessor has no information whether a risk analysis on human safety has been performed that substantiated the decision on station design, prior to publishing the plans. The effect of high impact calamities may have been considered and the risks of terrorist attacks may have led to the conclusion that split level platform stations could not be implemented. But there is no information on how that analysis was carried out and what the results are.

It is the assessor's opinion that such information must be provided for assessment when available. If not available, such a risk and safety analysis must be performed as an integral part of the assessment which station lay-out is the most appropriate in situations with critically little horizontal width.
Apart from safety, station lay-out of both same level platforms and of split-level platforms must also be weighed against the risk of nearby buildings being damaged or even demolished. So, similar to safety risks evaluation, also a construction risk evaluation is necessary.

Proposed alternative

Therefore, stations with so-called split-level platforms should be an option where construction of same level platforms have substantial construction disadvantages for the environment. At certain locations in the city centers, where width is a serious issue the use of split-level platform stations must seriously be considered. This type of stations exists in metro systems in Europe (i.e. London, Paris, Vienna, Milan), North America (i.e. Washington, New York, Los Angeles, Atlanta, Montreal, Vancouver) and Asia (i.e. Taipeh, Hong Kong, Shanghai, Tokyo, Bangkok). Therefor there is no basic argument not to consider that option, and decisions should be made on the basis of local factors and an appropriate risk analysis.

Safety and safety risks in underground constructions (in short "tunnel safety") is a matter of three basic elements: (i) the physical properties of a construction, (ii) the safety systems within the construction, such as (but not limited to) signing, equipment to prevent calamities and reduce their effects, (iii) procedures for escape, evacuation and alarming emergency services. That combination must be designed to assure the highest (reasonably achievable) level of safety.
And if proper analyses have been carried out, then decisions should be made on a location specific basis.

6. Line split in Ramat Hasheron north

Present plan

M1 splits into two branches and the split of the tracks is planned to be located close to the intersection of Sokolov street and Yavne street. From the drawings it is concluded that tracks will split but will not cross at the same level. A split-level crossing requires one of two tracks to dive under the other and that has been planned at Sokolov St.
The split is a very diverging one. One pair of tracks runs north from Sokolov St into Herzliya's Ben Gurion Blvd. The other pair of tracks makes a 90 degree turn from Sokolov St to the east into Yavne St. See drawing M1-103298-1011.

Assessment

This plan has a substantial impact on the environment, both predictable in terms of occupation of space and expropriation and in terms of the risk to damage existing buildings. Choosing another location is easy because there is a better alternative with much less intrusion to the environment.

Proposed alternative

A better alternative is to plan the split south of the city in the area between the underpass of highway 5, Ha-Saraf St and Rishonim Rd (figure 6.1). One branch then turns north into Sokolov St. The second branch follows Rishonim Road, then turns north-east at Shmuel Kakham Square, continues to Yavne St and then turns east again in line with Yavne St to connect with the TAAS West station. This alternative alignment is also such, that entry into Sokolov St and into Rishonim St has minimum amount of construction under existing buildings.

Given the very direct connection from Ramat Hasharon east to south, it can be argued whether a small stabling facility for two trains (just east of TAAS West station) will be especially useful. A large stabling facility has already been planned in Ramat Hasharon south.

figure 6.1

The effect of the alternative alignment will have another positive effect. Both M1 and M15 run mainly along or in between residential buildings, and there are extremely sensitive buildings or monuments. Partially the alignment will be further away (on the southern side of the city and the split will cause a less dense traffic pattern on each of the branches. That will cause less nuisance in terms of noise and vibrations. If split level stations (and alignments) are considered, then tracks above each other could cause less vibrations than tracks adjacent to one another, but the difference will be little.

7. Stations in Ramat Hasheron

Present plan

One station (Sokolov) has been plannen in the city center, just south-west of Bialik St. Sharaf station in Ramat Hasharon south has been planned by NTA under Ha Sharaf St, between the track curve to the stabling yard in the south-west and the track curve into Sokolov St in the east. Also see drawing M1-103298-1013.

Assessment

The location of Sokolov station is well chosen. It has good coverage in all directions. Sharaf station serves the areas north of the alignment, but on the southern side of the station there are hardly any origins or destinations that generate ridership.

Proposed alternative

If the M1 line split can be constructed in the south, then the location of Sharaf station should be moved to southern Sokolov St (position A in figure 9.1). That results in a much better coverage of the city. In order to maintain sufficient distance between two stations, the presently planned Sokolov station should be moved to the northern side of Bialik St (position B in figure 7.1). Then the distance between the two Sokolov stations becomes about 800 m. This may be a little short but it gives good coverage east and west of Sokolov St.

In order to cover parts of the neighbourhoods of Hadar, Neve Rasko and Neve Magen, an additional station is proposed just after the alignment curve to the north, approximately in line with HaNoter St (position C in figure 7.1)

figure 7.1

8. Alignment through Herzliya

Still in the process of assessment, will be reported later.

9. Stations in Herzliya

Still in the process of assessment, will be reported later.

10. Alignment through Raanana

Present plan

The present plan shows an alignment along railway station Raanana West, which then turns with a long reverse curve into Ahuza St. at Moshe Dayan St. The alignment then turns north into Schwartz St and Akiva St and ends shortly after Tidar station east into the planned depot area drawings (M1-103298-1006 to M1-103298-1001).

Assessment

A significant part of the alignment must be bored under residential buildings, both because of the S-curve between Station west and Ahuza St and because of the curve from Ahuza St to Schwartz St. That is a cause for serious concern, because the necessary surveys and investiogations were not carried out, or if they were carried out they were not published. And therefor it is not known, how construction risks and nuisance during operations will be managed and mitigated.

Then there are questions about the use of a connection to the railway. The M1 station has been planned next to the railway station. At first sight it may seem brilliant to plan an easy change from train to metro and vice versa, but the question is, how many passengers will appreciate such a facility. Looking from a broader transport perspective, there are serious doubts about the number of people changing in these stations. Both the structure of the Israeli railway system and the alignment of M1 do not immediately suggest a high number of transfer travellers. M1 is definitely not a feeder line for the railways, and whether M1 will feed the railways is very doubtful. Where would transfer passengers come from and want to go to?

And as a third there is the question of the level of service by M1 of central Raanana. The municipalty summarized a couple of things in figure 10.1.

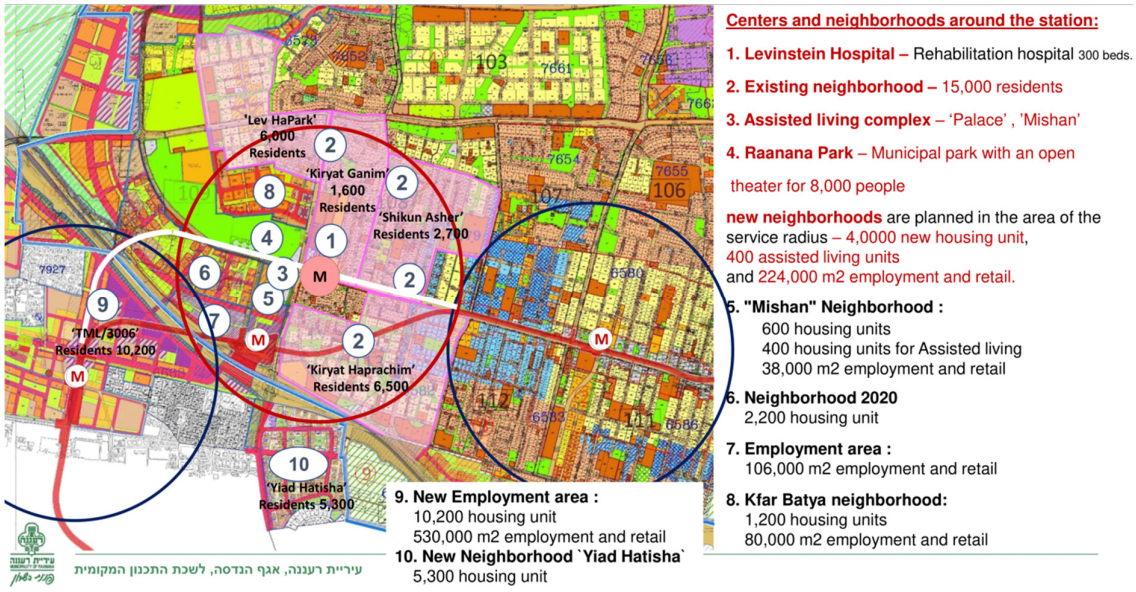

figure 10.1

The figure shows what would have to be served by station West in south-western Raanana. The coverage circles in figure 10.1 are a little misleading, because they have a radius of 800 m. That assumes an acceptable walking distance of 1000 meters, which is far too optimistic. A circle with its center point at the intersection of Ahuza St and Jerusalem Rd lists what is needed. Especially a good public transport facility near the Loewenstein Rehabilitation Hospital is crucial.

The planned alignment will run directly under residental buildings in Kiryat Haprachim and along Schwartz St. That represents a serious risk for ground borne noise and vibrations which must be carefully investigated. Also the risks of damage by the M1 construction has not been made explicit. The alignment under Ahuza St is much better.

Proposed alternative

The following alignment will provide a better service to the Raanana community:

- from Ahuza St straight on via Park Path and then turn to the south to connect with IDC station in Herzliya;
- from Ahuza St around eastern Raanana and parallel to highway 4 to the north.

The first proposed change must be followed by a new location for a station in the west of the city (see chapter 11). Special attention must be paid because this alignment will pass through two water wells. During construction measures must be taken to avoid pollution of the water.

The second one is expected to cause much less intrusion due to construction and has a lower risk of noise and vibration during operations.

Both proposed alternatives are also much better in terms of risk of ground borne noise and vibrations due to larger distances to buildings.

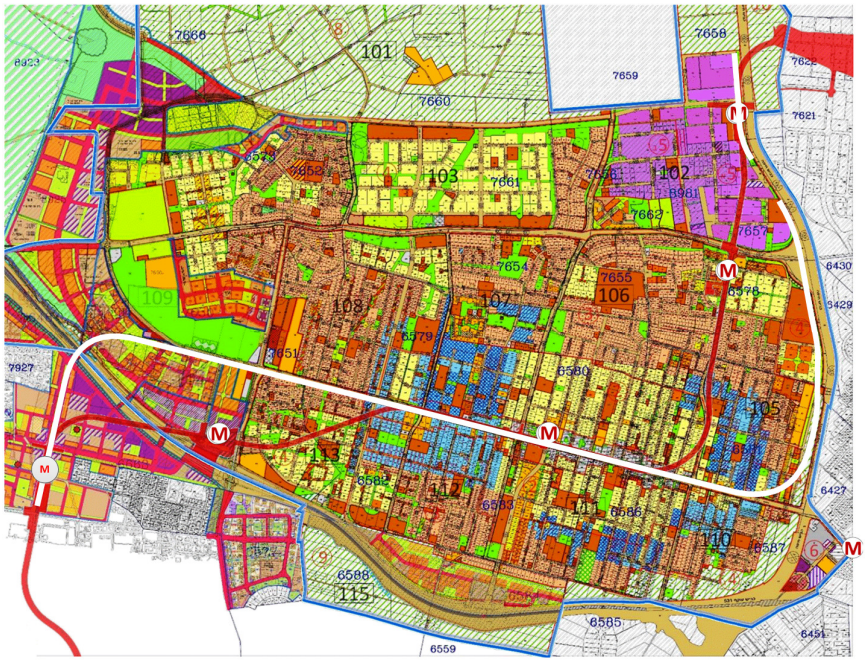

figure 10.2

11. Stations in Raanana

Present plan

The present plan locates four stations within Raanana municipality: Tidhar, Akiva, Center and West (next to the railway station) The total distance between Tidhar and West is 4365 m, with a longest of 1998 and a shortest of 690 meters see drawings M1-103298-1006 to M1-103298-1001).

Assessment

The average distance of stations is slightly less than 1200 meters, but the distribution of three distances is very uneven: 1777, 1898 and 690 meters. Between Akiva and Center, even along the line, the maximum acceptable walking distance of 800 meters will not be reached. Figure 11.1 illustrates that fact. The maximum acceptable walking distance is assumed to be 800 meters, which results in coverage with circles in the figure, having a radius of 640 meters.
Figure 11.1 shows that the present plan provides rather poor service in western central Raanana, especially caused by three stations located relatively far from one another.

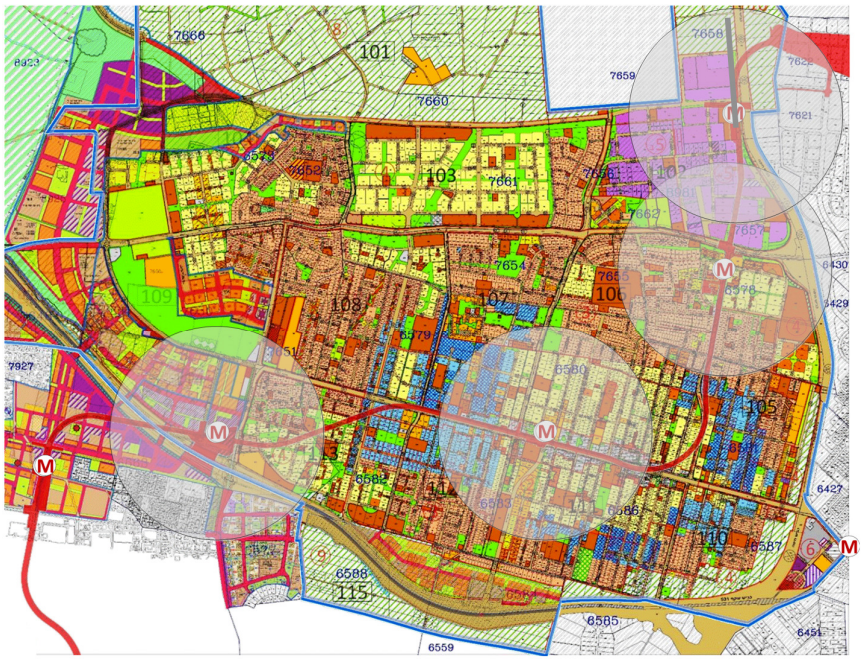

figure 11.1

Proposed alternative

The alternative is to skip the stations West and Akiva and have four stations along the alignment with three of those at different locations (see figure 11.2).

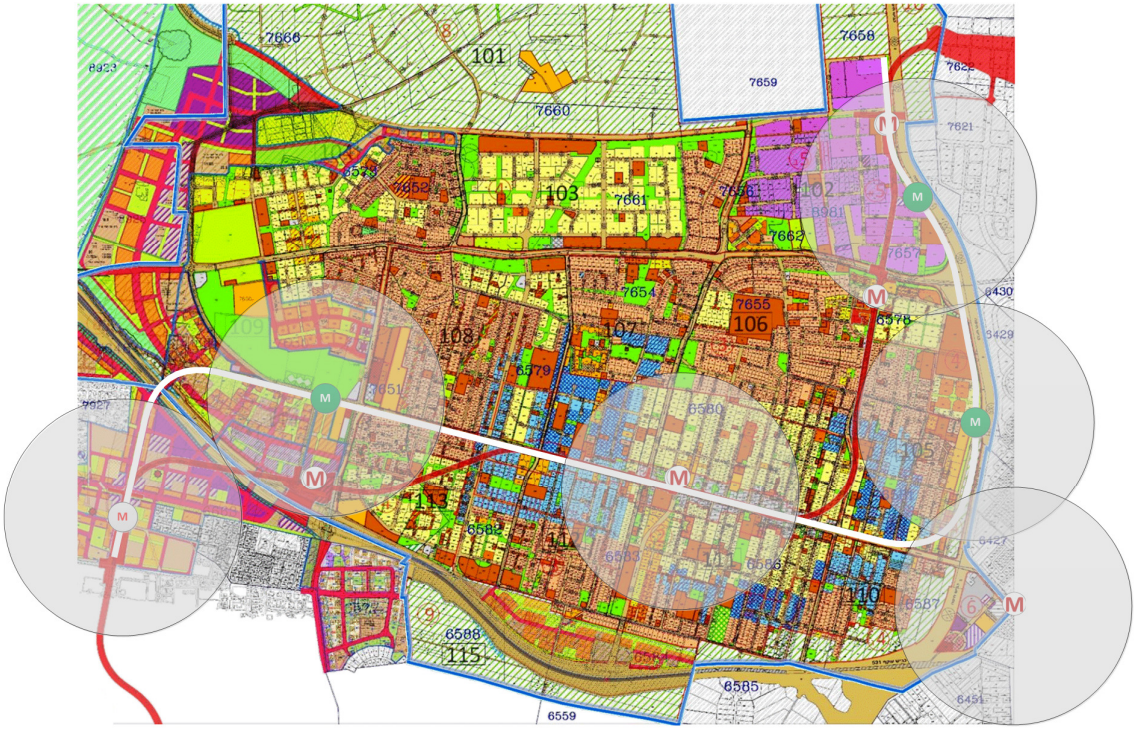

figure 11.2

The station West should be relocated to Ahuza St close to Jerusalem Rd. Another station should be located around Yaara St on the east side of the city adjacent to highway 4. And Tidhar station should

be moved a little from its planned position to around HaNofar St north of the highway 4 interchange. The last two stations should have underpasses or walkway bridges over the highway for easy access to and from western Kfar Saba.
Additional stations will cause a longer time for a round trip of each train. The extra time needed depends on a number of factors, but will be order of 30 to 60 seconds, which includes time losses for deceleration and acceleration and the actual duration of the stop.

A depot next to Eyal-Tira interchange in the east will have the effect that there is room for a conventional and underground tail track on the western side of highway 4. No underpass of highway 4 will be needed.

Though it is the assessor's opinion that coverage of central Raanana could be improved with an additional station at Ahuza St, the municipality agrees with a plan as pointed out in figure 11.2.

12. Alignment through Kfar Saba

Present plan

The alignment follows Ein Hai St, the 402, then turns right into Tchernikovski St and follows Weizmann St til its end in the south-east. It then turns noth-east and continues under Eli Hurvitz St til the last station and the tail track south-east of the neighbourhood of Yoseftal (see also drawings M1-103298-1035 till M1-1032-1040)

Assessment

The planned alignment is considered adequate. Though there is always the risk of ground borne noise and vibrations which must be investigated, the alignment represent the best possible solution also in that respect.

Proposed alternative

No changes to the planned alignment are proposed.

13. Stations in Kfar Saba

Present plan

The alignment through Kfar Saba has a length of aproximately 6 km and five (5) stations have been planned within this segment of M15 (East, Elkalai, Center, Weizmann and Tchernikovski).

Assessment

The total distance between East and Tchernikovski is 4519 m. The average distance is 1130 meters with a longest of 1282 meters and a shortest of 905 meters. That is quite even.

Proposed alternative

No changes to the planned position of stations are proposed.

14. Depot in Kfar Saba north-west

Present plan

The present plan of M1 has an end station in north-eastern Raanana (Tidhar). Then the alignment has a curve to the east and a depot/workshop at about 380 m^2 adjacent to residential areas of Kfar Saba. The plan totally consumes that space at the cost of an important ecological zone within the boundaries of the Region of Drom Hasharon.

Assessment

There are a number of reasons why this location is not suitable for a depot/workshop (see figure 14.1), especially considering the fact that a good alternative is available.

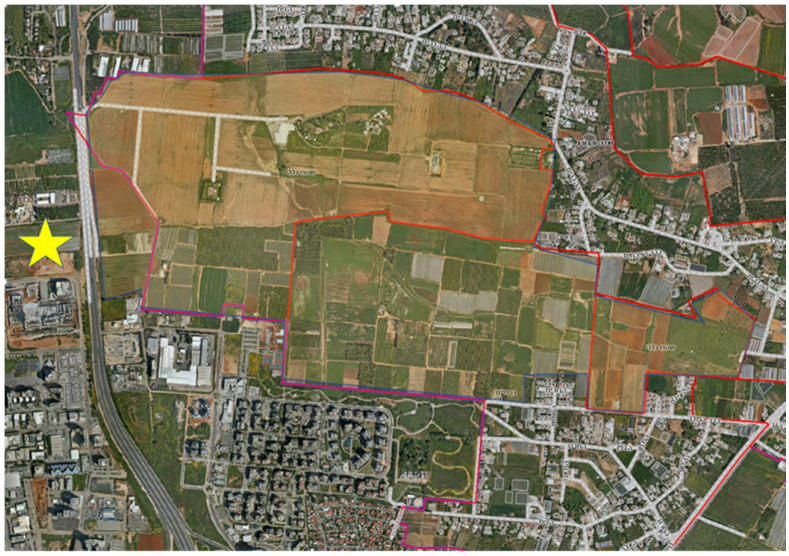

figure 14.1

The distance to the residential area is only 260 m. That will cause nuisance by noise, especially when stabled trains are scheduled for regular service early in the morning and when trains will be stabled for the overnight stay late at night.
The depot is planned to occupy the terrain of a confined ecological area. Anything built in that area will disturb the balance between open space and existing built areas around it.
On the western side of highway 4 (within the municipality of Raanana) is an ecological bottleneck (marked by a yellow star) which will also be negatively affected by the presence of a depot/workshop.
The plan does not even refer to nuisance or noise pollution (both air borne and ground borne in the residences north of the planned depot (Sde Varborg). And it is not clear whether or not measures have been planned to minimize noise pollution.
So there is every reason to look for a serious alternative.

Proposed alternative

The proposed alternative for the location of the depot next to the Eyal-Tira interchange of highway 6 has been substantiated in chapter 16.

15. Double crossover construction site in Kfar Saba

Present plan

The present NTA plan shows a double cross over switch directly east of Kfar Saba Center station in the alignment at kp 3+300 and a construction site and the use of a construction site south of the alignment opposite Ha Galil St.

Assessment

According to information of the municipality, the construction site is planned in a historical garden, to commemorate Israeli soldiers who gave their lifes in the line of duty for their country. It is also next to the entrance of the city's main heritage monument of remembrance and commemoration and also next to the military cemetry. It is inappropriate to use the garden or even part of it as a construction site. It is also not clear at all whether that construction site is needed for the construction of the switch over.

Proposed alternative

If the construction site is needed for the construction of the swich over, than that has to be removed or constructed somewhere else in the line. If the construction site is not needed for the construction of the swich over, than it must simply be removed from the plan. If a cross over switch is needed, then it must be moved to the nearest available location along the line, either to the west or to the east.

16. Depot in Drom Hasharon

Present plan

The NTA has planned a depot at Kfar Saba north-west, just east to highway 4 and directly adjacent to a residential area, consuming an important area of agricultural activities of the Drom Hasharon Region. There is (of course) no present plan for another location of the depot.

Assessment

Not applicable.

Proposed alternative

It is proposed to plan the M1 north depot in an area just north of the Eyal-Tira interchange of highway 6 and south of Tira. This is considered a much better location because there will be much less invironmental intrusion and there is plenty of space (see figure 16.1). The yellow line represents the alignment of the railway and the white line represents the alignment of M15 at ground level.

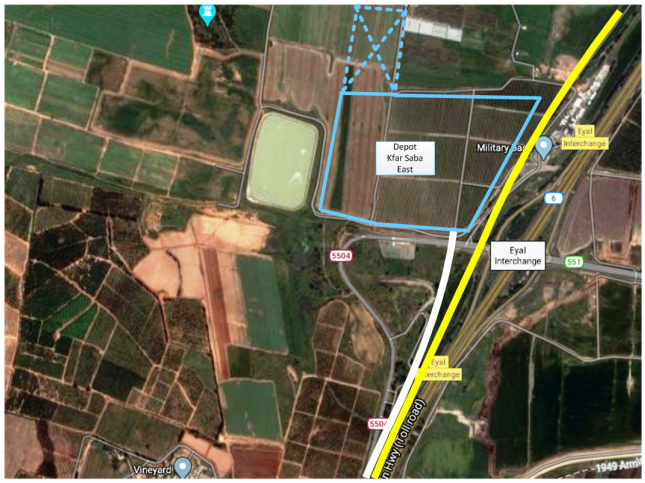

figure 16.1

There have been plans for the construction of a land port in this area, which means that this area is so-called planning area at Israeli state level. The dimensions are shown in figure 16.2.

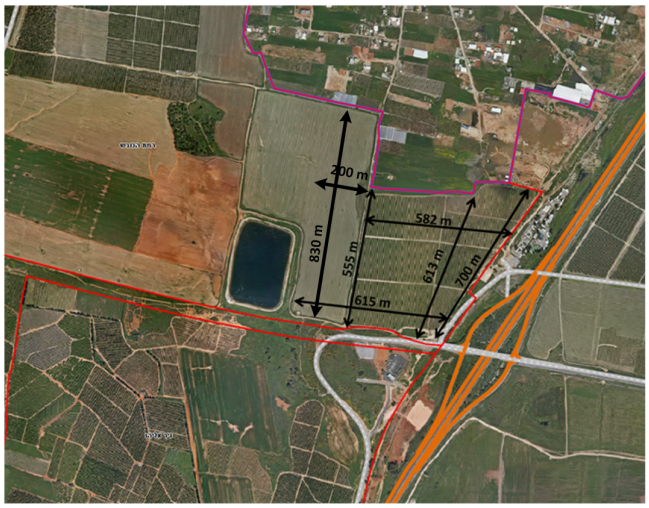

figure 16.2

The total surface of the available area is approximately 375,000 m^2, indicated with a blue lined polygon in figure 16.1. If necessary, more space can be made available on the north-western side (indicated with a dotted blue polygon and a blue dotted X). That would increase the area with a maximum of 200 x 275 meters or additional 55,000 m^2, compared to the 380,000 m^2 in Kfar Saba north-west.

The distance to residential areas is at 900 meters and towns and cities in the region are at least some kilometers away. Nuisance due to noise and vibrations will probably not be high, if any.

The opportunity also comes at a price: M15 has to be extended. But it is highly unlikely that the costs will be around 1 billion ILS per km (the average of the entire M1/M15 line). For various reasons, the extension will be cheaper than the M1 average, because construction costs are lower. And is more important: such an extension also leads other opportunities.

17. Combined station M15 and Eastern Railway in Drom Hasharon

Present plan

The NTA plan does not include a connection to highway 6 and the eastern railway.

Assessment

The width of the ecological corridor west of the Eyal-Tira location today is 1600 meters. It must also serve an infrastructural connection by (future) road 551 of the trans Israel highway 6 in the east and the coastal highway 2 in the west. That will significantly strengthen the attractiveness of a good connection to M15.
The present end of the line and the last station serves the citizens of Kfar Saba east. M15's last station lacks the possibility for a park-and-ride facility and it will not serve as an attractive location to change from car to metro. Furthermore there are serious plans to construct the so-called eastern railway, connecting Hadera and Lod and a station is planned next to Nir Eliyahu (see figure 17.1).

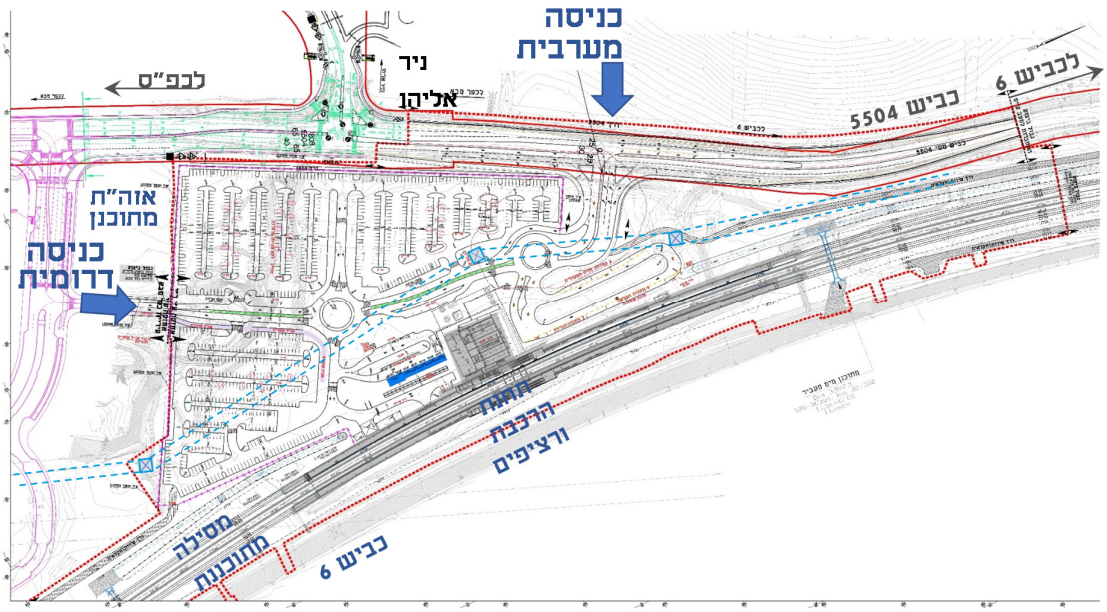

figure 17.1

At this point in time, it is designed as a railway-only station. It would serve two tracks and the plan includes parking space adjacent to the station.
The station is directly east of Nir Eliyahu and not too far from the industrial area in the triangle of highway 6 and road 5504. But the air distance to M15 station Kfar Saba east will be almost 2.5 km, not close enough to be attractive.

Proposed alternative

This would be a good time to consider the design of a combined metro-train station, which can offer a good connection between both rail systems. The train station would not only serve passengers with a local destination, but also long distance travelers that want to commute by M15 to and from the city centers in the metropolis.
For people riding by car along highway 6 that want to visit the city centers, this could be the location to change from car to metro, thus affecting the modal shift in the Tel-Aviv region towards public transport.

It is proposed to construct an M15 station directly adjacent to the Nir Eliyahu train station. For practical and cost reasons, it should be built at ground level and the connection to the depot can easily be built at ground level, with an alignment parallel to the eastern railway (see figure 17.2). The yellow line represents the railway, and the white line represents the M15 at ground level.

figure 17.2

Note: the capacity of the presently planned parking facilities next to Nir Eliyahu railway station must be reconsidered in order to create a full park-and-ride facility for three modes of transport. And it should also be able to facilitate passengers from the environment that simply come from their homes by car, park here and make use of the metro.

18. Kfar Saba east: extension of alignment

Present plan

The present NTA plan located the last station of the line at Kfar Saba East under Eli Hurvitz St (see drawing M1-103298-1040). The end of line is a conventional tail track adjacent to Yoseftal with two double cross over switches and four stabling tracks for four trains.

Assessment

Not applicable.

Proposed alternative

A depot at Eyal-Tira and a metro station near Nir Eliyahu must be connected to the presently plannen end of line in Kfar Saba east. The most appropriate alignment has been shown in figure 18.1. The narrowest width between highway 6 and the surroundings is about 50 m, which is normally adequate for two railway tracks and two metro tracks including space besides both rail alignments.

With an M15 station at Nir Eliyahu at ground level, the line will have to surface from below ground level to ground level approximately 300 meters south of the station at an incline of about 2,5%. From that point on to the station and further north to the depot, the tracks will run at ground level, adjacent to the tracks of the mainline eastern railway. The blue line represents the presently planned M15 alignment, the yellow line represents the railway, the grey line represents the M15 underground extension and the white line represents the M15 extension at ground level.

figure 18.1

Though there is good reason to believe that noise in this area will have less impact than in Kfar Saba west, it must be evaluated very carefully in order to be sure that one bad situation will not be exchanged for another. The noise from both the highway, and the eastern railway and the above ground metro might be too much for the residents in the surroundings. Therefor expected noise levels must be predicted (by calculation or simulation) in order to determine the risk. Where applicable, mitigating measures (such as noise barriers and rail dampers) must be designed and constructed as part of the alternative plan. Nuisance from noise and vibrations cause by the underground segment of the tracks probably will be very limited to none.

19. Additional station in Kfar Saba east

Present plan

The presently planned end of M15 has a conventional tail track after the curve after the East station, with facilities for access and room for simple maintenance activities (see drawing M1-103298-1040). It has four stabling tracks for four trains.

Assessment

The tail track is extremely long for the intended purpose. The distance between the end of the curve after the East station and the double cross over switch is 500 m. Reading from the drawing, that seems necessary in order to have a good place for the employment of TBMs (tunnel boring machines). The site must be prepared with cut and (later) cover techniques.
If this is a suitable site for the start of tunneling, then tunneling can both be done into the south-western and into the north-eastern direction. And the latter has to do with the proposed extension of the line towards Nir Eliyahu. And then the tail track will no longer be needed at this location.

Proposed alternative

Kfar Saba is replanning this environment. On and around this location, there are major plans for urban renewal and the construction of 5000 residential units. Therefor it is proposed to build a station at this location. Both the alignment of M15 to the south and south-west, a connection with Nir Eliyahu railway station will be a strong incentive to move the modal split from car to public transport.

DvB/-