Summary of the Environmental Impact Assessment report for the Tel Aviv Green-Line Light Rail Project

1.0 Introduction

The Green Line is one of the planned light rail lines as part of the public transportation system in the Tel Aviv Metropolitan area, as outlined in the National Outline Plan 23/4. The Green Line connects the southern parts of the Gush Dan Metropolitan area (Holon) and the outskirts of Rishon LeZion with Tel Aviv and the western part of Herzliya. The line serves as a significant component of the public transportation system, linking with other public transportation lines and contributing to the future development of the coastal strip between Tel Aviv and Herzliya. It provides accessibility to employment centres in Ramat HaHayal, Herzliya, Tel Aviv University, Holon, and Rishon LeZion.

This summary discusses three plans:

A. National Infrastructure Plan 71C, the northern section of the Green Line. The length of this section is 18.5 km and is divided into three main segments:
   1. The central segment extends from Shai Agnon Street through Levi Eshkol, Einstein, Haim Levanon, and Shalom Rosenfeld Street, crossing Ayalon Highway and Israel Railways tracks via a bridge until the Park Station on RoKah Boulevard. The length of this segment is approximately 6 km.
   2. The branch to Ramat HaHayal extends from the Park Station to the end of the branch in Ramat HaHayal, near the Atidim Industrial Zone. The length of this branch is approximately 4.5 km.
   3. The branch to Herzliya, this branch path depends on the evacuation of the Sde Dov Airport. Prior to the evacuation, the branch starts at the intersection of Shai Agnon and Levi Eshkol streets, continues through Levi Eshkol, Einstein, and along the future Ibn Gabirol street until the Abba Even and Naomi Shemer junction in Herzliya. After the evacuation of Sde Dov Airport, the branch to Herzliya is planned to begin on Shai Agnon Street, along the future Ibn Gabirol street, with the central segment potentially splitting eastward on Einstein Street. The length of the branch to Herzliya is approximately 8 km, with 2 km planned within Sde Dov Airport along the future Ibn Gabirol street. The branch to Herzliya also includes the Green line depot, which is part of the plan.

B. National Infrastructure Plan 71B, the central section of the Green Line. The central section of the Green Line is located within the city of Tel Aviv and extends from the intersection of Har Tzion and Shivat Zion Streets in the south to Shai Agnon Street in the north, near the Yarkon. The plan includes the underground section, the Yarkon Crossing via a bridge, and the continuation of the track on the ground. Along the track, there are 8 passenger stations, including 4 underground stations, 2 ground-level stations, one station on a bridge, and one station in a portal. The length of the Blue Line within this section is approximately 5 km.
   Since the Red Line precedes the Green Line and is currently in earlier planning stages, in coordination with the Ministry of Environmental Protection, it was decided that the area of Karlibach station, known as Karlibach corridor, shared by both the Red and Green lines, will be surveyed as part of the Red Line documents.

C. National Infrastructure Plan 71A, the southern section of the Green Line. The length of the Green Line in the southern section is 10.3 km within the city of Holon and 4.2 km within the city of Rishon LeZion. The track of the light rail extends from the corner of the streets Har Tzion and Shivat Tzion in Tel Aviv to the Moshe Dayan station in Rishon LeZion from the west and connects with Road No. 412 from the east, within an environmental survey area of 100 meters from the axis of the railway (on each side) and with a radius of at least 250 meters from point components.

1.2 Transportation

A. Northern section

The track of the light rail in the northern section of the Green Line is planned to pass through the cities of Tel Aviv and Herzliya.

In this section, a description of the existing public transportation system in the Green Line corridor will be provided, as well as principles for integrating the proposed system with various modes of public transportation in its surroundings.

In addition, an estimation and analysis of existing traffic volumes was conducted. The quantity of existing traffic volumes is calculated using the Metropolitan Transportation Model of the Ministry of Transportation for Tel Aviv, which is an activity-based model. This model was developed by Cambridge Systematics and is maintained by "Netivei Ayalon" (Ayalon Highways) with the leading experts in the field in Israel. Such a model provides a detailed description of travel patterns by creating dependencies among daily trips made by passengers and grouping them under a single trip. From the data analysis, it is clear that the vast majority of vehicles travelling on the track designated for the light rail during morning hours are private and commercial vehicles, constituting about 98% of the total traffic volume. Buses traveling on the track represent about 1.5% of the total transportation volume, and trucks constitute about 0.5% of the total transportation quantity.

B. Central section

The light rail line runs along the city Tel Aviv in main and secondary streets. The street hierarchy is presented in the Environmental Impact Assessment.

The line is planned to coexist with existing public transportation systems - buses and the railway. The bus service routes in the corridor of the green line are classified into 5 groups, with the different modes of transportation complementing each other, and a significant portion of the line's users will be passengers who arrived from one of the other public transportation systems or from one of the public transportation system routes.

Additionally, this section presents existing and projected traffic volumes for the year 2020 and addresses the movement of pedestrians and cyclists along the route.

C. Southern section

The light rail line passes through the cities Tel Aviv, Holon, and Rishon LeZion along central roads, secondary roads and local roads. The review of the existing and planned road system was done according to urban distribution:

1. Tel Aviv-Jaffa - The line runs along secondary and central roads, which are connected to local streets and other collector roads.
2. Holon - The light rail line passes through main central roads and secondary roads, where main streets, secondary, and local streets converge.

3. Rishon LeZion - In both branches, the line passes through local streets, and the western branch also passes through secondary roads. Local roads converge towards the line.

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From data analysis, it is clear that the vast majority of vehicles traveling on the designated light rail track throughout the day are private and commercial vehicles, accounting for 97.5% - 95.5% of the total traffic volume. Buses traveling on the track represent 3.5% - 1.9% of the total transportation volume, while trucks represent 0.8% - 0.3% of the overall traffic volume. Furthermore, data analysis reveals that the morning peak hours are the busiest hours of the day, with approximately 139,000 vehicles traveling on the roads, compared to around 121,000 vehicles during the midday peak hours and approximately 75,000 vehicles during off-peak hours.

1.3 Soil and Groundwater

In this section, the historical survey conducted along the track is presented. The chapter highlights active pollution sources and potentials of soil, surface water, and groundwater that exist within the planning area and its surroundings, as well as their impact on the plan. The survey was conducted in accordance with the "Guidelines for the Collection of Primary Data in Suspected Polluted Sites (Phase 1)", November 2003, and is largely based on information gathered from several soil surveys conducted in recent years by various entities, including the Ministry of Environmental Protection.

It should be noted that according to the National Master Plan for Water blueprint (National Master Plan 34/B/4), the track is located in Zone A, which is characterized by high groundwater sensitivities and is above areas vulnerable to the infiltration of upper aquifer water to the deep groundwater.

A. Northern section

The areas with pollution potential along the track are concentrated in places where past and present land uses are associated with discharges and waste containing hazardous substances, or are associated with storage of such materials, such as infrastructure and fuel depots. In contrast to the southern segments where the line passes, the northern segment is relatively newer, and its land use has been developed since the 1970s and onwards, in accordance with more advanced environmental and planning criteria. Examples include the development of open public spaces, sewage systems, wastewater treatment, separation of drainage flows, and measures to prevent pollution from sewers and fuel containers, such as cathodic protection.

In the northern section of the Light rail tramway, which consists mostly of soil, most soil pollutions that are not of industrial origin, if they exist at all, are localized point-source pollutions, resulting

from local runoff, improper maintenance, and so on. It is recommended that during the issuance of the required construction permits, the upper soil layer intended for replacement and removal before laying the rail infrastructure and placing a new layer of substrates should be examined to determine the need for treatment, removal, and/or potential use.

B. Central section

The survey revealed that the areas with pollution potential are concentrated in the southern parts of the segment: the old central station, the car repair area in the railway neighborhood, the Hassan Arafeh complex. The Reading power station area and the Sde Dov airport area are outside the survey boundaries. Since the main potential of polluted land is found in the common segment of the Red and Green lines, and since north of Carlebach Street, the land use has always been intended and actually used for residential, commercial, and public buildings, the Ministry of Environmental Protection concluded that the historical survey findings for the Green line will rely on the expanded historical survey prepared for the Red line.

In general, most soil pollutions in the segment, if present in the workshop areas, are localized point-source pollutions, resulting from continuous local runoff, improper maintenance, and similar factors. Soil sampling conducted in 2008 in the Carlebach Station area on Begin Street indicated that in this area, which has the highest potential for soil pollution along the main segment of the Green line, no pollutant concentrations exceeding threshold values were found.

The segment between Harkavyat Street and Carlebach Street passes through an area defined according to the "Environmental Outline Plan for Soil and Soil Gas Treatment in the Framework of Planning and Construction Procedures, December 2009, Ministry of Environmental Protection." This is an area where there is an obligation to test soil gases.

Accordingly, based on the results of the soil gas survey conducted for the soil segment of the Red line, NTA Company has decided to implement specific sealing measures to prevent the infiltration of soil gases in the underground passenger stations. In addition, during the detailed planning stage, active soil gas sampling will be carried out at 3 sampling points in the area designated for the construction of an underground station. This will be done to collect data on pollutant concentrations and assess the need for protection measures for site workers during the construction works.

1.4 Land uses, designated land, population density

This section examines the route of the light rail, the Green Line, against the background of national outline plans, regional outline plans, and urban development plans. It is found that there are no conflicts between these plans that apply to the areas where the light rail is intended to pass and the project itself.

A. Northern section

Since the entire route of the light rail is planned to pass through the jurisdiction of Tel Aviv District, this section includes an overview of the regional outline plan that applies to the areas of the two local authorities, Tel Aviv Jaffa and Herzliya, Regional Outline Plan 5 for Tel Aviv District, as well as building restrictions in the coastal strip.

Additionally, as mentioned, various urban development plans that apply to or are near to the areas of the light rail route were examined, as well as the planning trends to which the light rail route is intended to pass through.

B. Central section
A scan of approved plans and planning trends along the route was conducted (in text and diagrams), both at the local and national levels. In addition, a survey of land uses was conducted in the vicinity of the "Kokhav HaTzafon" neighborhood. The survey was based on field tours conducted in 2013, updated orthophoto imagery, and an urban map of the city of Tel Aviv. The survey was conducted within a strip width of 200 meters with a range of up to 100 meters on each side of the light rail track axis. Furthermore, within this framework, attention was also given to conservation buildings, the coastal strip of the Yarkon River, and existing infrastructure systems along the route.

C. Southern section
Within this framework, reference was also made to plans related to Ben Gurion Airport, relevant to this segment.
This chapter presents conservation buildings within a range of up to 100 meters from the rail axis along the light rail route. Additionally, this chapter presents the various land uses within a range of 100 meters on each side of the light rail track, as surveyed in the land use survey.
Furthermore, the population density for the target year 2030 is presented, based on population density data at a district level. The projected growth in population density in the Tel Aviv district is based on the average growth rate for the years 1993-2009 and stands at approximately 0.64%. The residential density for the target year 2030 is estimated at 13.1 residents per housing unit.

1.5 The vision and function of the street

<u>The urban function perception</u>
This chapter presents the urban function of the streets along the northern segment of the Green Line. Due to its length and complexity, the segment is divided into eleven distinct and differentiated subsections with their urban characteristics, for ease of reading and comprehension.

<u>Street Profile</u>
This chapter presents typical cross-sections of the street, both in the existing condition and in the proposed condition. From these cross-sections, one can determine the location of the railway within the street and visualize how the street section will appear after the project is implemented.

<u>Imagery and Identity</u>
This chapter describes the existing landscape textures and open spaces along the light rail route. It also presents a survey of mature trees along the route.

1.6 noise
This chapter deals with the evaluation of noise levels affecting sensitive recipients and their potential impact due to the construction and operation of the light rail on the Green Line. Noise measurements were conducted at 26 different measurement points following coordination with the Environmental Protection Office of Tel Aviv District:

A. 15 measurements of approximately 20 minutes each (hereinafter referred to as "short measurement") aimed at describing the noise levels for noise recipients during peak hours, taking into account the results of the long-term noise measurements at the respective points.

B. 5 measurements for approximately 3 hours each (hereinafter referred to as "long measurement") aimed at describing the distribution of noise levels during peak hours and serving as a reference point for the short measurements.

C. 6 measurements for about a week (hereinafter referred to as "extended measurement") aimed at describing the distribution of noise levels during different hours of the day and on different days of the week.

The existing noise levels at the measured points ranged between LAeq=57-72 dB. These levels are typical for densely urban areas, where the main source of noise is urban transportation noise.

1.7 Radiation

During the month of April 2014, measurements of magnetic fields and electromagnetic radiation were conducted along the Green Line light rail axis in the northern section.
Electromagnetic radiation and magnetic field values were measured at a height of 1 meter and at a sufficient distance from emission sources that do not characterize reference values. The test points were selected based on sensitive land uses or uses that include residential apartments. Sensitive locations include, among others, children's playgrounds, clinics, schools, gas stations, community centers, and the like.

The radiation measurement points were coordinated with the Radiation Division of the Environmental Protection Ministry, and the magnetic field values (mG) are presented in the report.

1.8 Ecology

This chapter presents the areas where unique ecosystems exist along the light rail tracks and their surroundings.

2. Detailed Explanation of the Reasons for the Proposed Plan's Preference

In general, the light rail is planned to pass through the central areas of the streets. Central alignment has advantages in creating a street segment where it is easy for passengers to navigate, serving both sides of the street equally, and allowing vehicle access to properties without disruption. However, in areas where central alignment has caused significant physical problems, such as locating points where street functionality was asymmetrical or where the implementation of specific turns was not possible, side alignments were also considered, provided that the existing entrances to the properties were limited and thus such alignment did not affect their functionality.

In addition, National Outline Plan 23/A/4, the National Outline Plan for the public transportation system in the Tel Aviv Metropolitan Area, established an updated network of alignments for public transportation Systems. The determination of the system was based on urban centers, attraction and generation points of movement, and positions in the network that led to the highest passenger capacity while reducing the maximum volume of private vehicles. Any deviation from the alignments

of the light rail (except for the allowed and detailed changes in the plan) compared to the alignments of the National Outline Plan constitutes a deviation from the National Outline Plan.

This chapter examines the planning alternatives that were considered from two perspectives: when deviating the rail alignment from the National Outline Plan 23/A/4, and when selecting an alternative where the light rail is aligned on one side of the street and not in the center of the road right or in areas where a dedicated under-pass is exists for the light rail.

2.1 Methodology for Examining Alternatives

The criteria for analyzing the various planning alternatives includes a wide spectrum of domains:
(1) Transportation and movement,
(2) Urban aspects, landscape, and environment,
(3) Engineering

The overall picture created from a graphically mapped representation assesses the advantages and disadvantages of each alternative and enables an effective evaluation. In terms of the criteria and the inclusion of measurements for selecting the chosen alternative, it was decided not to assign different weights to each criterion. The table below presents the possible scoring, on a scale of 1 to 5, where each score is translated into a color.

Scoring allocation per criteria:

Matching the criterion	Rating	Color
Irrelevant	0	White
Discrepancies	1	Red
Minimal adjustment	2	Orange
Partial match	3	Yellow
Good match	4	Light green
Full match	5	Dark green

The list of the criteria that were examined in evaluating the alternatives is presented in the Environmental Impact Assessment. The following are key points that emerged during the review:

A. Northern section

Within the framework of the planning of the northern section, changes were defined in the Tel Aviv district, in these 2 areas: Sde Dov and the Ayalon crossing area.

Sde Dov

According to the National Outline Plan 23 /a/ 4, the green line crosses the land area of Sde Dov. At the beginning of the planning process, it was found that the alternative proposed in the national outline plan for the Sde Dov area does not align with the plan for vacating Sde Dov, nor does it align with the alignment plan on Levi Eshkol Street prior to the vacating of Sde Dov. Additionally, there is uncertainty regarding the timing of vacating the area containing a civilian airport and a military base, and whether it will be relocated as a whole or in parts. Consequently, the planning team examined

an alternative for transitioning through the Sde Dov area once it becomes available. One alternative is the actual national outline plan itself, and the other is an alternative based on the Sde Dov crossing and continuation along Ibn Gabirol Avenue. This alternative is better suited to the outline plan of Tel Aviv and provides service to the developing and planned neighborhoods along the coast.

In addition to the alternatives prepared to incorporate the Sde Dov vacated area, the possibility that the implementation of the light rail project in the northern section of the green line would begin prior to the vacating of Sde Dov was taken into account. For this reason, the planning team prepared a layout for the light rail suitable for this stage. According to this layout, the light rail is planned to pass through the Levi Eshkol axis.

The comprehensive plan includes, in its entirety, both alignments (Levi Eshkol and future Iben Gavirol) in order to allow flexibility in routing under any scenario.

A security facility, the Ayalon Crossing, and the Israeli exhibition center (EXPO)
At the junction of Hayim Levanon/George Weiss Streets, the alignment of the green line turns eastward, crossing the paths of Ayalon and the Israeli railway.

According to the alternative plan, the alignment continues from the junction along Weiss Street, diagonally crossing the Ayalon intersection on a bridge approximately 1,050 meters long. It bypasses the Israeli exhibition center area to the north along Isaac Ramba Street and continues along the Bechor Shitrit axis. This alternative does not provide a connection to the Israeli railway at the University Station, which is essential in creating an efficient public transportation system. Therefore, the planning team decided to explore additional alternatives that are more efficient from an engineering and urban perspective for crossing the security facility area and Ayalon highways. During the planning process in this section, two additional alternatives were examined for crossing the security facility area, Ayalon highways and the Israeli exhibition center.

The underpass alternative beneath Rozenfeld Street, which connects to two bridges with a total length of about 500 meters, was chosen. This underpass also allows for a connection to the University Station of the Israeli railway and the Israeli exhibition center. The advantages of this alternative are reflected in good connectivity to the Israeli railway and access to the Israeli exhibition center area, while avoiding ecological and archaeological damage to Tel Monis. The approval from the Ministry of Defense for this alternative (and opposition to other alternatives) tipped the scales in favor of selecting this alignment.

Evaluation of alternatives for micro-alignment of the track

The light rail is planned to pass through the center of the streets where the alignment is located. Central alignment has advantages in creating a street section where it is easy for passengers to navigate, serving both sides of the street equally, and allowing vehicle access to properties without disruption. However, in areas where central alignment has created significant physical problems, especially in locations where street function was asymmetrical or implementation was not feasible, alternative side alignments were also considered.

Examination of alternatives for level of construction along the Depot

This section presents the principles and planning considerations that were examined for the proposed alternatives for development within the depot area.

Examination of alternatives for the location of mobilization sites -
The mobilization sites area will be used for the construction of temporary buildings and facilities required for the establishment of a public transportation system, including engineering buildings, buildings for employees and administration. Any area within the of mobilization sites can be used. The planning team recommends the establishment of sites that span an area of approximately 2 dunams or more, at distances of 1.5-2 km between sites, and an end site (end of the line) with a size of approximately 6 dunams.
During the permitting stage, the contractor will choose, with the approval of the relevant authorities, the designated area for locating the mobilization sites from the proposed locations above and within the blue line areas of the plan. A total of 15 mobilization sites are proposed. Details of these sites appear in the Environmental Impact Assessment.

B. Center section

The planning of the Green Line is based on the alignment approved in National Outline Plan 23 /A/ 4. The alignment has no alternative locations, only "micro" alternatives within the approved corridor. The only approved deviation from the National Outline Plan is found in the alignment on Begin and Hashomer Streets.

Most of the light rail system is planned as an at-grade system. Only if the surface alignment is problematic from a transportation and/or urban perspective, the option of an underground light rail is considered. In some sections of the Green Line, it is found that the width of the road right in the underground alternatives does not allow for maintaining sufficient width for sidewalks and adequate bicycle lanes while preserving a satisfactory level of service for motorized traffic. In accordance with the request of the Tel Aviv Municipality and due to transportation limitations, it was decided to recommend an underground alternative in these sections.

Not all parameters that were examined were identical throughout the entire section. A distinction was made between the evaluation of alternatives for the underground section and the At-grade sections, according to the required criteria for their evaluation. In the surface sections, emphasis was placed on evaluating alternatives from an urban and environmental perspective, and in the underground section, emphasis was placed on the engineering aspect.

In addition, alternatives for the location of passenger stations and tunnel construction methods were also evaluated.

In the northern part, a side route was chosen where the light rail will pass on a side alignment towards the west. The crossing of Yarkon Street will be done on a separate bridge for the light rail.

The crossing of Rokach Boulevard will also be done on a separate bridge for the light rail, which will end at the planned station near to the future transportation center. In effect, the Rokach Station will be a station on a bridge.

In the central part, an underground alternative was chosen where the portal is located north of Nordau Street, and the light rail runs along Iben Gabirol Street in a pair of tunnels beneath the highway center. Therefore, on most streets, the number of travel lanes remains unchanged.

In the southern section, an underground alternative was chosen where the alignment passes through Begin Street, south of the railway junction, and continues to Hashomer Street. The portal is located south of Levinsky Street. A sunken and open (uncovered) passenger station is planned north of Levinsky Street, following the portal. In this case, on Har Tzion Boulevard, travel lanes are reduced at the road level, leaving two travel lanes on the western side and a single lane on the eastern side. This alternative is a deviation from National Outline Plan 23 /A/ 4.

The location of the passenger stations is derived from the horizontal alignment of the light rail.

The evaluation of alternatives for the tunnel section in Carlibach corridor is detailed in the Environmental Impact Assessment of the Red Line. Additionally, the evaluation of alternatives for the tunnel construction method focused on the section between Iben Gabirol and Carlibach streets.

The underground section from Iben Gabirol to Carlibach begins at the intersection of Nordau and Iben Gabirol Streets and extends to the end of the level separation at the Carlibach intersection, with a length of approximately 2,600 meters. The total length of the tunnel is 2,350 meters (with the underground stations and portals calculated separately). The evaluation of the excavation methods for the tunnel section focused on three excavation methods:

1. T.B.M (Tunnel Boring Machine)
2. Cut & Cover
3. New Austrian Tunneling method (N.A.T.M)

At this stage, the planning team recommends the TBM method for tunnel construction and the C&C method for constructing underground stations and portals.

C. Southern section

In the Tel Aviv district, the light rail alignment corresponds to the alignment detailed in National Master Plan /234א/ throughout its entire length. However, in the central district, the light rail alignment deviates from the national master plan in the area of Derech HaMaccabim and HaYovel junction, where it passes through open agricultural land, north of the approved alignment. This deviation is mainly due to emerging planning trends in the program's environment, engineering considerations, specific geometry required for the entry of trains into the depot, and the need for integration with the Blue Line of the public transportation network.

Evaluation of alternatives for micro-alignment of the track

In general, the light rail is planned to pass through the center of the streets where the alignment is located. Central alignment has advantages in creating a street section where it is easy for passengers to navigate, serving both sides of the street equally, and allowing vehicle access to properties without disruption. However, in areas where central alignment has created significant physical problems, especially in locations where street function was asymmetrical or implementation was not feasible, alternative side alignments were also considered.

The evaluation was conducted for the following sections: Ben Tzvi Street, Holon Junction, HaLohamim Square Kugel, Aryeh Shenkar Street Holon, Pinchas Mikey Street Holon, Avraham Bar Street Rishon LeZion, Moshe Dayan Boulevard Rishon LeZion.

3. Chapter 3 - Description of the Proposed Plan

The Green Line is part of the metropolitan urban system operated by the light rail technology of the mess transit transportation network. This system integrates the best modern planning technologies in infrastructure and vehicles. The modern light rail system is a rail-based system that is generally separated from general traffic, and requires its own road right, and receives absolute priority at traffic lights.

A. Northern section

The northern section of the Green Line, planned as part of the light rail project in Tel Aviv, starts at the center of Shai Agnon Street in Tel Aviv and ends in two branches: one in the Ramat Hachayal employment area and the other in the western employment area of Herzliya. This overview refers to the components and facilities along the line from the Agnon/Levy Eshkol Junction and onward, on its two branches. In the first stage, prior to the evacuation of Sde Dov Airport, the alignment will continue north along Levy Eshkol Street until the Levy Eshkol/Einstein Junction, where the route will turn east along Einstein Street until the Einstein/Chaim Levanon Junction. On Chaim Levanon Street, the route will turn south until Shalom Rosenfeld Street, and from there, it will turn east on Shalom Rosenfeld Street, passing under Ayalon Highway, with a connection to the University/ Israeli exhibition center Station of Israel Railways, until the planned "HaPark" station near the Israeli exhibition center. The rest of the alignment to Ramat Hachayal includes a passage through B'chor Shetrit Street and Raoul Wallenberg Street until the Neve Sharett neighborhood.

In the second stage, after the evacuation of Sde Dov Airport, the line will cross the airport area on the "Continuation of Iven Gavirol" route until it intersects with Einstein Street, and from there, it will continue east as described above. According to the plan, at a later stage, the branch will continue to Herzliya from Einstein Street until the intersection of Naomi Shemer/Aba Even Streets in the western employment center of Herzliya.

B. Center section

The central section of the Green Line extends from Shivat Zion Street in the south to Shai Agnon Street in the north of Yarkon, including crossing the Yarkon. This section, which extends for approximately 5 km, is divided into three sub-sections:

Northern Sub-Section: At-grade section that includes crossing the Yarkon River and Rokach Boulevard on a bridge and side alignment on Shai Agnon Street, where a terminal station will be located in this stage. Along the station, an operational element called "pocket track" will be built, which aims to facilitate movement and allow the light rail to turn back southward. In the future, the line will continue northward to Herzliya. Another branch will continue eastward towards the Atidim employment area in Ramat HaChayal.

Central Sub-Section: The section extends from the Carlibach station northward Carlibach Street, the intersection of Carlibach /Yehuda HaLevi/Iven Gavirol Street, along Iven Gavirol Street until the corner of Shimon HaTarsi Street, continuing to the Nordau Portal. The section, mostly underground, consists of two parallel and separate tunnels connected by 9 emergency exits. The main tunnel alignment opens to three underground stations: Dizengoff, Rabin, and Arlozorov. Further north from the portal, in the underground section, the Nordau station is located.

Southern Sub-Section: The section that connects the underground alignment through the Levinsky Portal and continues underground to the intersection of Menachem Begin Street and the Rakevt street. The section includes the Levinsky station, located in the lower part of the portal.

<u>Yarkon River Crossing</u>

The Green Line will cross the Yarkon River on a dedicated bridge for the light rail, which will be built between the Bar-Yehuda Bridge and the Osishkin Bridge. The bridge has a length of approximately 155 meters with a span of 8.14 meters. The bridge will pass over Bnei Dan Street, above the Yarkon River, and parallel to Iven Gavirol Street. The bridge will be built in the spirit of the existing Bar-Yehuda Bridge, which crosses the Yarkon River, and will connect to a bridge over the Rokach Boulevard axis.

In close proximity and westward to it, a bridge is planned for pedestrians and a bicycle path in order to create continuity for walking and cycling routes. Furthermore, the pedestrian path will descend to ground level at the intersection of Iven Gavirol Street/Rokach Street.

C. Southern section

The southern sub-section of the Green Line connects the city of Holon and the outskirts of Rishon LeZion (both westward and eastward) with the city of Tel Aviv in general, and the main metropolitan business center in particular. The section begins on Har Tzion Boulevard, south of the Levinsky intersection, continues southward to the intersection of Lebon/Ben-Zvi Streets (Abu Kabir intersection), turns eastward to the Holon intersection, and then southward again along Levi Eshkol and Kugel Streets until the old center of Holon on Sokolov Street. In this area, the line splits into two branches: western and eastern. The western branch route passes through

Shnekar, Pichman, Barakat, and Arlich Streets within the Holon area and continues along Avraham Bar and Moshe Dayan Streets in Rishon LeZion. The western route terminates at the Moshe Dayan terminal. The eastern branch route continues from Sokolov Street along Jerusalem Boulevard, crosses Highway 4, and connects to Highway 412 opposite the Vulcani Institute. The route runs at ground level and serves the employment areas of Holon and Rishon LeZion, including densely populated urban areas, and only in the northern part of Holon and the eastern part of Rishon LeZion does the line pass through open areas designated for future development.

The length of the section within Holon is 10.3 km, and within Rishon LeZion is 4.2 km. Along the southern section, 26 ground-level stations are planned, including five "main stations" and two optional stations (in the area of 500 H in Holon and Hayuvel Boulevard in Rishon LeZion). The main stations, where a meeting point is planned between the public transportation system lines and themselves and/or a meeting point with other public transportation means, are: Holon Junction, Sokolov, and Golda Meir in Holon, and Moshe Dayan Terminal and Hamakabim Station near to Highway 412 in Rishon LeZion.

Additional system components include Holon Depot - the operational area for maintenance and storage of the light rail vehicles, located east of the Holon interchange on Highway 4, Technical rooms, energy supply systems, and accompanying infrastructure such as cables, generators, and transformation stations are also included. In several focal points where there is expected traffic conflict between the light rail and the ongoing vehicle traffic along the corridor, level separation is planned while giving priority to the light rail. This includes, for example, the redesign of Kugel Square and the intersection of Jerusalem Boulevard/Mifratz Shlomo. An additional element is located between the Sokolov/Kugel junction and Avivim Street to allow trains coming from the western branch to turn east towards the depot facility.

3.1 Fixed Components, Infrastructure, and Facilities along the track

This section details the engineering criteria for planning a light rail track and determining the track's width, height, and elevation, track alignment, minimum radii, gradients, measures for vibration mitigation, and more.

The planning of the railway corridor is based on the standard planning documents received from NTA - Design Standard Manual (DSM). This section presents the engineering criteria for planning the track alignment and station platforms.

3.2 Stations and Facilities along the alignment

This section provides an overview and a brief description of the stations along the Green Line. The planning of the stations and their locations along the alignment is done through an examination of their urban influence range. The influence range around them is approximately 500 meters in a straight line, equivalent to a practical walking distance of about 750-800 meters.

A. Northern Section

Along the alignment 8 stations are planned in the central section, 6 stations in the branch to Ramat HaHayal, and 12 stations in the branch to Herzliya. Additionally, out of the total of 26 stations along the entire northern section of the Green Line, 3 stations are defined as main stations. The distance between the stations is approximately 500 meters in densely populated urban areas and about 1000 meters in open areas where the track passes through.

In the program area, there are four types of stations:

1. Lateral Station - a situation where the track passes between the two continuous platforms, which are facing each other on both sides.
2. Embedded Lateral Station - when at least one of the platforms is embedded in an existing sidewalk, and the track passes between the two continuous platforms, which are facing each other on both sides.
3. Submerge Station - a station located below street level.
4. Elevated Station - a station located above street level.

In addition, this section presents illustrations of the structures within the program area: the Einstein/Nemir Junction, the submerging of the Light Rail on Shalom Rosenfeld Street, the Ayalon Crossing Bridge, the Rokach Boulevard Crossing Bridge, and the Pinchas Rosen Bridge.

B. Center section

Along the track, 8 passenger stations are planned. The stations Carlivach, Dizengoff, Rabin, and Arlozorov are underground stations, the Levinsky Station is submerged within a portal but open to the sky, the Rokach Station is located on a bridge, and the rest are located on the ground.

The exact location of the stations is not final and may change during the detailed planning stage.

All underground stations have a two-level structure within a "box" made of "Salary walls" and/or piles, as shallow as possible, with 2-3 entrances. The entrances to the underground stations are located on sidewalks, squares, open public areas, and in buildings, in coordination with planned projects and existing structures.

The platforms of the underground station consist of the following: separation and railing (0.30m) + facilities strip along the platform (0.90m) + margins (0.70m) + obstacle-free area (1.3m).

The minimum platform width is 3.2 meters, and in cases where the number of passengers requires a larger operational width, the platform width is expanded according to calculations. Generally, a platform with a width of 3.2 meters is suitable for all stations in both directions, except for Levinsky and Dizengoff stations, where a continuous width of 3.7 meters is required in the northern direction.

The infrastructure of the underground stations includes, among other things, electrical and communication systems, air conditioning systems, and additional engineering facilities for their continuous operation. A detailed description of each of these systems is provided within this chapter.

C. Southern Section

In total, along the southern section, 27 stations are planned, including 5 main stations. The distance between the stations is approximately 500 meters in densely populated urban areas and about 1000 meters in open areas.

In the program area, there are four types of stations:

1. Lateral Station - a situation where the track passes between the two continuous platforms, which are facing each other on both sides.
2. Embedded Lateral Station - when at least one of the platforms is embedded in an existing sidewalk, and the track passes between the two continuous platforms, which are facing each other on both sides.
3. pedestrian mall Station: A situation where the track passes between the two platforms, which are facing each other on both sides. The station is located on a pedestrian street only, without vehicular traffic.
4. Staggered Station: A situation where the track passes between the two platforms, which are facing each other on both sides, and on both sides of the intersection diagonaly.

In addition to these, this chapter provides a brief overview of the four planned Level separations within the implementation of the light rail project in the southern section: the under-pass of the western route in Levi Eshkol Street, the under-pass of Kugel Square, Holon, the under-pass of Mifratz Shlomo Street/Yerushalayim Boulevard, Holon, and the Jerusalem Bridge over Highway 4.

Tunnels

Within the scope of the plan, two parallel tunnels are planned, each with a total length of approximately 4.5 km, an outer diameter of approximately 7.5 meters, and an inner diameter of 6.5 meters. Between the tunnels, a variable free space is planned at a distance of up to 3.8 meters.

Along the light rail tunnels, emergency cross passages (C.P - cross passage) are planned at approximately 250-meter intervals between the passages.

During the detailed planning stage, the construction method for the tunnels and connecting tunnels will be determined.

This section specifies the process of tunnel excavation using the three working methods examined in Chapter 2, as well as the temporary support systems required for it. In addition, consideration is given to issues related to soil conditions, soil contamination, and prevention of groundwater pollution.

Portals

The portals are crossings that connect the AT-grade part to the underground part of the rail tunnels. The portals are planned to be located on Iben Gabirol Street, from the north to Nordau Street, and on Har Tzion Boulevard, from the south to Levinsky Street. The location of the portals is determined between the intersections, so there is no need for cutting or canceling existing crossings. This location does not affect pedestrian traffic on the street beyond adding width to the road, the same as along the entire alignment. In the preliminary design stage, the

design team recommends constructing the portal structures using the C & C method. This section presents typical width sections in the portals, with specific attention is given to landscaping treatment at the tunnel entrances.

3.3 Energy Systems, Associated Infrastructures, and Emergency Systems

This section presents the principles of lighting systems (interior, exterior, and emergency) to be used in the light rail trains. Additionally, the section presents the layout of the technical rooms planned along the light rail route.

A. Northern Section
Along the northern section, 13 technical rooms are planned, usually located underground in an available open area near the track. A technical room includes the functions of supplying electricity to the line and stations, as well as control and communication necessary for operating the transportation systems.

B. Southern Section
Along the southern section, eight technical rooms are planned, usually located underground in an available open area near the alignment. A technical room includes the functions of supplying electricity to the line and stations, as well as control and communication necessary for operating the transportation systems.

This section also presents the power system for the Green Line, which is a high-voltage power system that includes overhead cables and contact cables carried by cantilevers. The cables are not supported or directly connected to buildings or structures along the railway corridor. The driving voltage is 1,500 volts DC. This choice of voltage level allows for lower traction currents, resulting in smaller cable diameters that are less prominent and cause less electromagnetic interference (EMC) related to current.

In addition to the overhead power system used in this project, three alternatives for light rail power were examined, excluding the overhead power system as they were not applicable: embedded third rail (induction or direct contact), energy generated within the train cars - such energy is primarily generated by diesel-electric generators or by fuel cells installed within the rolling stock, and energy storage within the train cars - in this method, energy is stored in batteries or supercapacitors.

3.4 The description of the depot plan

The depot facility is essentially a kind of "factory" that includes various operations: track maintenance, washing, sand filling, housing, and storage areas. The design of the facility is shaped to resemble a "production line" process in order to create a continuous flow of processes without unnecessary disruptions or train movements. Such a design allows for the best possible handling within the shortest timeframe.

The northern depot will be constructed west of the future interchange Rav-Makar on Highway 2 and 20, north of Altneuland Road, and east of the alignment, along Yeshayahu Leibowitz Street. The area will have a rectangular shape. Access to and from the depot will be through switchers connecting the railway tracks (north-south) on the northwestern side of the site. The activities at the Herzliya depot will be limited to light operations, including washing, sand filling, routine maintenance, and housing.

The southern depot will be constructed east of Highway 4 on an area of approximately 100 dunams, along the Holon and Rishon LeZion border, near the existing industrial zone in eastern Holon, and it is planned within the meteorological compound. Currently, the area is characterized by agricultural land and dirt roads, and along its southern side passes the new "HaSairim Bridge," which is part of the "Holon East" interchange. The area has an equilateral triangular shape, with its base parallel to the southern side of the interchange bridge. The eastern side faces the meteorological compound, and the western side runs parallel to Highway 4 to allow for railway access (main exit) towards Tel Aviv. The depot is planned to have a height of approximately 36.00 meters to accommodate the height of the bridge passing over Highway 4 towards Jerusalem Street. It is likely that there will be a need to fill part of the depot area to a height of approximately 36.00 meters. It is important to note that the existing height of Highway 4 near the depot is around elevation 27.50+, so the retaining wall required between Highway 4 and the depot will be approximately 9.0 meters high.

The facility is designed in a way that allows for accommodating the planned train fleet. The depot can accommodate 60 light rail cars, each with a length of 37.5 meters, or alternatively, 30 cars with a length of 75 meters. The total planned train fleet in the depot for operational purposes is 49 light rail cars plus 8 reserve operational cars. The size of the train fleet in the depot is calculated based on passenger projections for the year 2040.

The depot facility includes the following buildings and facilities: residential area, light maintenance buildings, sand filling facility, washing facility, control and monitoring center, management building, and security.

3.5 The mobile railway component

This section specifies the technical parameters according to the updated planning standards of NTA, as of this stage of light rail planning, which include wheel types, braking system, speeds, and noise levels of the mobile equipment.

3.6 Rail Laying Works

This section deals with several subtopics

<u>Diversion of existing infrastructure and the laying of required infrastructure.</u>

The establishment of the light rail project presents a significant opportunity to improve and upgrade a large number of infrastructure elements along the alignment for the benefit and welfare of the city's residents. The operations for the removal and relocation of existing infrastructure systems for the purpose of clearing the path for the light rail require careful considerations and substantial resources. Therefore, it is of great importance to locate these systems and assess the complexity of their relocation, if they are found within the designated light rail alignment. Due to the need for a sterile strip of utility lines, all infrastructure elements within the light rail corridor will be relocated. The relocation of infrastructure will be carried out using conventional methods for underground infrastructure works in the city, utilizing excavators and trenching for pipe laying on streets, while partially or temporarily closing the work area.

Treatment of Contaminated Soil

Since most of the alignment passes through underground soil and the accompanying infrastructure, a procedure for treating contaminated soil is presented (if discovered during construction works). The procedure addresses solutions for handling excess soil, excavation, removal of excavated material, storage, transportation, and disposal of contaminated soil, among other aspects.

This section presents accepted methods for treating excavated soil in general and contaminated soil in particular. It also introduces conventional methods for excavating soil, types of analyses to be conducted, and additional actions to be taken for the purposes of disposal and storage of soil.

Worksite Location and mobilization

Throughout all stages of the construction works, worksite locations and mobilization must be established. In other words, a construction site should be in close proximity to a logistical base (a mobilization area) where offices, construction materials, equipment, and necessary services for project execution will be set up.

This section discusses considerations for choosing worksite mobilization locations, such as location, accessibility, prevention of environmental and scenic disturbances, and more. Additionally, the subsection examines the required components and elements in a mobilization site, such as office caravans, private vehicle parking, heavy machinery parking, waste containers, and more.

Site mobilization management Plan

The mobilization sites that will operate for the establishment of the Green Line will be located in a densely urban environment and therefore will be subject to environmental constraints. The construction and implementation stages of these sites will be formulated by the winning contractor of the tender. The contractor will be required to submit a supplementary environmental document for approval by the Ministry of Environmental Protection and the accompanying team as a condition for establishing the sites.

Visual and Permanent Land Restoration

Performing preliminary demolition works and preparing the street surfaces for the light rail's arrival is a fundamental principle for the efficient restoration of the street landscape. These actions are carried out from the outside inward, including the preparation of sidewalks to their final condition and the preparation of traffic island for the light rail. The land restoration operations during the works will be planned at a later stage, closer to implementation and after the selection of executing contractors, and will be included in the environmental documents submitted to the program's accompanying team. The scenic restoration operations will be conducted during the works according to the final visual appearance plan of the program area.

In addition to the visual restoration operations, this section addresses the importance of tree preservation and presents guidelines for planting new trees according to NTA guidelines, as stated in the Urban Tree Integration Policy for public Transportation Systems document.

Proposals for Additional Required Arrangements

Any intervention in a vibrant and bustling living system, such as the establishment of a passenger-oriented transportation system in a densely populated and urban area, affects the functioning of the urban fabric and has implications for the residents' quality of life. However, it should be noted that long-term compensation may outweigh the short-term "suffering". Despite the aforementioned, the initiative should take measures to minimize the undesirable consequences originating from the construction works. This section presents these measures.

3.7 Operational and Traffic Data for the Operational Stage:

A. Northern Section

This section presents the planning data regarding the number of trains and their frequency, the number of trains during peak hours, and the number of trains in the morning and evening sections for the target year 2030, according to the division into two different travel lines (Rochach Industrial Area Atidim, Rochach Aba Even Street, Herzliya).

The data presented in this report is relevant to the target year 2030, while the data for Herzliya is relevant to the target year 2040. The data regarding the number of trains is derived from the three service lines that will operate along the Green Line, from north to south.

In addition to the planned passenger trains, there are a number of trains that run on the tracks not for passenger transportation but for operational purposes.

During the late-night to early-morning hours, there is a window of opportunity when there is no movement of passenger trains on the track. This window is utilized for ongoing maintenance activities on the tracks. This section presents the planned data for the number of trains according to their types that will operate during the night.

The railway traffic data presented in this overview is based on the updated operational forecasts of NTA. This data is subject to change over time due to forecast updates, changes in fundamental assumptions, progress in planning, etc. Therefore, there is a difference between these data and the railway traffic data presented in the overviews of the southern and central sections of the Green Line. As the detailed planning stage progresses, traffic forecasts and related aspects such as acoustics (noise and vibrations) and radiation will be updated for all sections of the line.

B. Central Section

The railway traffic along the Green Line operates on several service lines. The central section is the shared section for these lines. Therefore, the railway traffic data for this section is derived from the possible movements along the Green Line. This section presents the number and frequency of trains, travel speeds divided into sections, expected changes in vehicle traffic volumes, and principles for coordination with other public transportation systems.

C. Southern Section

This section presents the planning data for the number of trains and their frequency, the number of trains per hour, and the total number of trains during the day and evening in both directions. It is divided into three different travel lines: (Levinski garden in Tel Aviv - Sokolov Street in Holon, Sokolov Street - Moshe Dayan Terminal in Rishon LeZion, Sokolov Street - Hayuvel Boulevard (junction with Highway 412).

The number of trains is derived from the three service lines that operate along the Green Line, from north to south. In addition to the planned passenger trains, there are also a number of trains that run on the tracks for operational purposes and not for passenger transportation. During the late-night and early-morning hours, there is a window of opportunity where there is no passenger train movement on the track. This time window is utilized for ongoing maintenance activities on the track.

This section also presents the planning data for the number of trains according to their types that will operate during the night.

<u>Principles for coordination between the light rail system and the existing and planned public transportation system</u>

There are several public transportation modes. The system planning takes advantage of the relative benefits of each mode. In order to increase the use of public transportation and shift trips from private vehicles to it, it is necessary to improve the attractiveness and convenience for the passenger - the pedestrian. Good connectivity between the modes and integrated planning as one combined system, along with friendly planning of interface points between the integrated system and the urban fabric, with an emphasis on

pedestrians, ensures the development of a transportation-friendly environment and enhances accessibility levels.

The maximum traveling speed according to sections

The maximum speed of light rail travel is mostly derived from the track alignment through which it passes, and it will be fully adapted to the geometric alignment of the track, its curvature, and road conditions. Generally, it can be said that the permissible travel speed in urban sections is 50 km/h and 25 km/h in sections designated for pedestrians, such as the Pedestrian zone.

Evaluation of changes in traffic volumes along the alignment

The evaluation of changes in traffic volumes is based on traffic data received from the Metropolitan Transportation Model of the Ministry of Transportation for Tel Aviv, which is an activity-based model. This model was developed by Cambridge Systematics and is maintained by "Netivei Ayalon" (Ayalon Highways) with the leading experts in the field in Israel. Such a model provides a detailed description of travel patterns by creating dependencies among daily trips made by passengers and grouping them under a single trip. The model includes several modes and know how to provide results for the current state of traffic (2010 network) and future target years 2020, 2030, 2040. Under the guidance of the Ministry of Transportation, this is the model that requires planning work in the Tel Aviv metropolitan area, serving as a directive for all government and private planning bodies.

The evaluation of changes in traffic volumes compares two types of data: the future state of traffic volumes without the Green Line and the future state of traffic volumes after the activation of the Green Line.

From the analysis of the data received, it can be seen that a significant decrease in the quantity of private and commercial vehicles will occur in the southern segment, both during morning and midday peak hours and off-peak hours. As a result of the Green Line's operation, the number of these vehicles will decrease by approximately 13.5% to 11% in 39 travel segments, which account for about 51% of all segments. Furthermore, the analysis of the data shows that the quantity of buses will decrease by approximately 50% along most of the travel segments during the test hours. The quantity of trucks, on the other hand, will remain unchanged in most of the segments. It should be noted that only a few travel segments that were examined will experience an increase in the quantity of private and commercial vehicles.

As a result of the Green Line's operation, there will be a decrease of approximately 4% in the total volume of transportation in the northern segment. The quantity of private vehicles will decrease by approximately 4.5% due to the operation of the light rail line. In contrast, the quantity of trucks will increase by about 35%. Additionally, the analysis of the data shows that the quantity of buses remains unchanged in the majority of the travel segments. Regarding the volume of bus traffic in different segments, it should be noted that the

current planning stage does not include any plans to align the bus system with the operating schedule of the Green Line.

Main station locations

Light rail lines in the national master plan 23/A/4 create a network with connectivity between high-capacity transportation lines, between themselves, and with other public transportation systems, primarily the railway network of Israel Railways, which feeds into them. Therefore, one of the most significant topics is the determination of main station locations at the intersection of passenger transportation lines and other public transportation modes, in a way that enables fast and efficient passenger transfer between them. The location of stations is determined considering various factors, particularly the reduction of walking distances, consideration of pedestrians and cyclists, and coordination among all factors that influence public transportation.

The integration of a main station in the urban environment can increase accessibility to it. In the station's surroundings planning, the expansion of sidewalks and crossings is considered to facilitate a more efficient connection between transportation modes and rapid boarding and alighting of passengers from the passenger transportation system, including bicycle accessibility. As mentioned, a "main station" by definition is a station located at the meeting point between different passenger transportation lines and/or between public transportation modes and passenger transportation lines, allowing for seamless transitions between them.

3.8 Drainage

The alignment of the light rail is mostly based on existing roads and paved streets, without creating new open spaces, dirt roads, etc. The development and implementation of the project are not expected to generate additional drainage beyond the existing amounts, and it is not expected to affect the overall drainage quantity. Drainage works will involve the relocation and diversion of existing water drainage lines within the work area without altering the flow scheme.

Furthermore, the Tel Aviv municipality requires that during the project's construction, the number of drainage lines be increased, and in some cases, the diameter of the line will also increase. Hence, the development of the light rail in the city complements the urban drainage system. Light rail tunnels will be drained to nearby stations. Portals and stations will concentrate the water runoff through sloping floors that direct the water to the lowest points where drainage outlets will be located. Suction facilities for stormwater will be installed at the underground train stations of Levinsky, Arlozorov, Dizengoff, and Rabin.

3.9 Planning and Implementation Stages

A. Northern section

The description of the works for establishing the line is conceptual at this stage. A detailed planning stage will provide a scheduled timetable for each phase.

The works for establishing the alignment will include: excavation of the rail strip, installation of communication and electrical lines, construction of electricity poles, drainage works, pavement, and compaction of existing roads. Finally, landscaping, paving, signage, and painting works will be carried out.
The works include asphalt and sidewalk removal within the alignment area, pavement, compaction, and adjustment of asphalt or sidewalks, including the relocation of paving stones or garden stones for adaptations.

B. Central section
In this early planning stage, the execution phases for the establishment of the Green Line project and specifically the central segment can be described, but only in a conceptual. A detailed description and presentation of a planned schedule for each phase will be provided during the detailed planning stage.

The planning team recommends implementing the stations in separate stages in order not to close the entire Iben-Gavirol Street. Additionally, it is recommended to first construct the dedicated bridge for the light rail in order to cross the Yarkon river, as this bridge will serve as a passage between the mobilization area in Yarkon Park and the alignment (tunnels and stations) along Iben-Gavirol Street.

During the permitting stage, the traffic arrangements to be implemented in the intermediate stage will be decided upon. Therefore, a detailed breakdown of this sequence will appear in the environmental/traffic documents for execution.

In the detailed planning stage, the implementation stages for the landscape restoration work will be determined, both during the construction process and upon completion of the work.

C. Southern Section
The description of the works for the establishment of the line is conceptual at this stage. In the detailed planning stage, a planned schedule will be provided for each stage. The works for establishing the alignment will include excavation of the rail strip, installation of communication and electrical lines, construction of electricity poles, drainage works, pavement, and compaction of existing roads. Finally, landscaping, paving, signage, and painting work will be carried out.

The works include asphalt and sidewalk removal within the alignment area, pavement, compaction, and adjustment of asphalt or sidewalks, including the relocation of paving stones or garden stones for adaptations.

The measures for soil restoration during the works will be planned at a later stage, closer to implementation, and after selecting the executing contractors. These measures will be included in the environmental documents submitted to the program's accompanying team.

Landscape restoration activities will be carried out during the works in accordance with the final visual design of the program area.

4. Details and assessment of environmental impacts

4.1 Changes in land use and land designation

Conflicts with existing uses

The majority of the Green Line in the relevant section passes through the road reserve of existing and planned roads, so it generally does not create conflicts with existing land uses. However, along the light rail track, there are several different structures that create conflicts with the light rail track, requiring planning changes or, alternatively, their evacuation/demolition to create the planned track.

Limitations on land uses and designations

The track does not impose limitations on land uses or designations since the majority of it passes through the road reserve of existing or approved streets. However, there may be exceptions regarding the cancellation or addition of parking spaces along the track.

Changes and limitations on roads and parking

The railway track does not impose limitations on existing roads except for new traffic arrangements specified in the following section. Most of the stations along the track are at street level and located on the track, including side platforms generally with a minimum width of 3.3 meters. Access to the stations is also at street level through planned capacity pedestrian crossings located near the light rail stations. As mentioned, the light rail track creates conflicts with the balance of on-street parking and parking lots for vehicles. Since the impacts and limitations are minimal, no other alternatives need to be considered for the alignment, station locations, and station access.

In the detailed planning stage, possible alternatives will be specified to mitigate negative impacts and limitations, if any, on land uses and designations in the vicinity of the light rail track.

4.2 Traffic Changes

The implementation of the Green Line should also consider the needs for infrastructure evacuation while minimizing disruptions to traffic in the various areas where the construction of the line takes place. This section presents the implementation stages of the project during the construction phase and their impact on traffic in the streets where the light rail track will pass. Additionally, this section examines the traffic changes after the

completion of the project and the start of the operational phase. The transportation impact will be evident both along the light rail track and along major roads in the program's vicinity.

Furthermore, in the central section, in the Tel Aviv area at the current planning stage, the traffic arrangements during the construction phase are not definitively known and precise, as they are derived from an earlier planning stage, after selecting the working method for excavating the underground track tunnels. However, it should be noted that traffic changes and traffic arrangements throughout the city of Tel Aviv are frequent occurrences.

Additionally, there is one location where negative impacts are expected in the context of pedestrian crossings along the street in the Nordau area. In this segment, there is an issue with the remaining sidewalk width between the travel lanes and the curb. It should be emphasized that pedestrian crossings are also possible along the curb, so we anticipate a minor negative impact on pedestrian accessibility in this area.

4.3 Ground water and Upper Water Sources

The general geographical location of the Green Line is in the western part of the coastal plain, in the basin of the Ayalon and Yarkon rivers. The area is characterized by an elevation ranging from 3+ to 30+ meters above sea level, at a distance varying from a few hundred meters to several kilometers east of the coast. In certain areas, characterized by hilly terrain, such as the area south-east of Tel Aviv University, the surface elevation reaches over 40+ meters.

Hydrology and Ground Waters

In the past 10 years, the water level of the ground waters has reached a maximum of 1.5 to 2.3 meters above sea level and a minimum of 1.09 (-) meters below sea level. Therefore, during the construction period of the LRT, it should be assumed that the ground water level reaches up to 2+ meters relative to sea level and during a 1:100 probability event, it could even rise to 6.5+ meters. This means that in relatively low-lying areas, depending on the amount of precipitation in a given year, underground structures such as technical chambers and/or bridge foundations may become submerged or located within the water layer. The risk of contamination of the ground waters in such cases may be high only if there is or will be activity in that area with the potential for soil and ground water pollution.

A. Northern section

Except for the technical chambers, the under-pass of the light rail at the Nemir Einstein junction and the foundation of the bridge pillars, the light rail track is planned to be entirely at-grade. The construction of the rail laying, including the required bedding and infrastructure, will be carried out to a depth of 2.0-1.6 meters below the surface.

The depth of the ground waters along the rail track ranges from 0 to 2 (-) meters below sea level. Therefore, the rail laying works, including excavations for the construction of the technical chambers at a depth of 5 meters below the surface, are not expected to impact the ground waters along the entire track.

B. Central section

The route of the main section is located above the coastal aquifer. The tunnel sections and station boxes are located within the upper 0-10 meters of the aquifer's waters. The green line tunnels are primarily located in a karst terrain composed of two types: rocky karst and sandy karst, with the transition zone between them.

No significant impacts are expected as a result of the rail construction on the Yarkon River, as the rail will be placed after the construction of the dedicated bridge for the light rail. Similarly, no significant impacts are expected on the ground waters and upper water sources due to the rail construction at the ground level.

During the detailed planning stage, after selecting the working methods for excavating the light rail tunnels and constructing the station boxes and portals, an assessment will be conducted to evaluate the impacts and risks on the abyssal waters.

C. Southern section

The route of the southern green line is located above the coastal aquifer, a groundwater reservoir that extends in the subsoil of the coastal plain in Israel. The aquifer spans an area of approximately 1,800 cubic kilometers, from Mount Carmel in the north to the Gaza Strip in the south, and extends westward from the coastline to 7-20 kilometers eastward. In November 2014, water level measurements were conducted in the coastal aquifer by the Hydrological Service of the Water Authority. The measurements indicated that most of the aquifer experienced rises in the water level.

The route of the light rail in the southern section is planned to be entirely at-grade. The construction works for laying the tracks, including the necessary foundations and infrastructure, will be carried out up to a depth of 2.0-1.6 meters below the ground surface. The depth of the groundwaters along the rail route ranges from 0 to 2 (-) meters below sea level. Therefore, the construction works for laying the tracks and excavating the technical rooms at a depth of 5 meters below the surface are not expected to cause any impact on the abyssal waters along the entire route.

In light of the regulations of public health (sanitary conditions for drinking water drilling) and in accordance with the exemption permits, it appears that there is no obstacle to carrying out the planned works in areas outside the protected groundwater drilling zones. Therefore, there is no hindrance to the request and approval of permits in accordance with the provisions of the exemption regulations.

4.4 Drainage

A. Northern Section

This section deals with the impact of the construction of the railway line and its facilities on the drainage systems of sensitive ecological systems. It concerns the Pardesim Stream area in the eastern part of the route and the Naman Compound area in the vicinity of Herzliya, where a winter pool is held annually, which the Pardesim Stream is planned to cross.
The section presents findings and recommendations for the light rail to pass without affecting the drainage of these ecological systems.

B. Central Section

During the construction works and operational stage, there will be no change in the current flow scheme. The development and implementation of the project are not expected to generate quantities of runoff beyond the quantities currently produced, and it is not expected to affect the overall runoff volume, both within and outside the program boundaries.
In addition, since the entire visible area of the Yarkon River is developed, whether for the park or as part of the development of the Northern Star neighborhood and the facilities in the Reading parking area, and since the railway passes through this section in an elevated alignment, no blockage of the railway is expected as a result of flooding, and no changes are expected in the existing drainage system in the vicinity of the stream, within and outside the program boundaries.

C. Southern Section

In this section, principles for designing a drainage system are presented for the southern section of the Green Line. These principles are based on an assessment of the current situation and a proposed planned drainage system that integrates optimally with the existing system and minimizes the expected changes in drainage as a result of the project's construction, which could affect sensitive ecological systems.

The planning takes into account the alignments of the existing drainage systems as received from various sources: the Nature and Parks Authority, water and sewage corporations, and materials collected from planners dealing with drainage systems along the light rail route for municipalities.

The design of the new drainage systems is tailored to the planned alignment of the light rail and the other planned and existing underground systems along the light rail route (water, sewage, electricity, and communication), as well as the above-ground systems (landscape and lighting). The planning takes into account the future needs of the cities as derived from urban planning factors and is reflected in the expansion of service areas and coordination regarding future systems that the cities intend to implement along the light rail route as part of urban development plans.

The light rail route passes through urban streets where existing drainage systems are present. The addition of the light rail does not add additional pavement areas beyond the existing ones, and therefore the light rail project does not add excessive runoff that should be accommodated by the drainage systems beyond the existing quantities.

As part of the detailed design, drainage points will be designed along the light rail route, connecting them to the existing systems.

4.5 Noise

In assessing the noise levels resulting from the project, different considerations were given to its two stages: the construction stage and the operational stage. The expected noise impacts in each stage differ in nature, as do the criteria applicable to each stage.

The noise during the construction stage is noise from construction equipment, similar to the noise generated during the construction of a new building or infrastructure work on a street. The noise during the operational stage is transportation noise similar to road traffic noise or train noise.

Another significant difference between the two project stages is the duration in which they occur. Construction noise is relatively short-term noise (up to a few years) while the noise from the project's operation is long-term, lasting throughout the project's duration.

Noise during the construction stage

The potential for noise generation resulting from the construction of the light rail is divided according to the nature of the work and its proximity to noise-sensitive uses near the construction site.

A. Northern Section

The construction work of the light rail in this section involves the construction of the railway line in At-Grade sections, and in locations where level separation is expected, either underground or on a bridge, such as the Einstein/Namir Interchange area, the light rail passing over a bridge at the Pinchas Rosen Interchange, and more.

B. Central Section

The construction work of the light rail, in terms of noise generation and the spread of such noise, is divided as follows:

- Construction of the railway line in At-Grade sections.

- Construction of the railway line transitioning from At-Grade sections to underground sections (portals) and stations.
- Excavation process using TBM and/or the NATM method.

C. Southern Section

The construction work of the light rail in this section involves the construction of the railway line in At-Grade sections.

During the current design stage, the progress of construction during the implementation phase is not yet known definitively and accurately, and it will be determined during the detailed planning.

The noise criterion for the construction phase is based on the Abatement of Nuisances Law, 5721-1961, and its regulations that have been enacted, guidelines and the Ministry of Environment's policy, and other sources.

In this section, an assessment was made of the potential noise impacts, and possible solutions were provided to mitigate them during the construction phase.

The environmental noise potential assessment along the route is presented in this section. These locations will be specifically examined in later design stages to assess the potential for possible noise impacts.

Noise during the operational phase

This section presents noise calculations for the following situations:

1. Noise calculations for the existing condition.
2. Noise levels in the target year with the project in operation, in a scenario where the light rail line exists and operates.

Prediction of noise from light rail and motorized traffic (vehicle movement) was conducted using two separate models for noise calculation: a model for calculating light rail noise and a model for calculating road noise. In this project, the environmental impact of railway noise is examined, in close proximity to motorized traffic noise. The main environmental impact is due to changes in motorized traffic volumes as a result of the project, rather than direct noise from the light rail.

A. Northern Section
Along the route of the northern Green Line, no deviations from the noise criterion were predicted for any of the receptors.

B. Central Section
Noise calculations were conducted for two areas where the railway runs at ad-grade level, where there can be acoustic impact from the light rail on the environment: in the northern part

from Shai Agnon Street to the Noredau Portal, and in the southern part from the Levinski Portal to the boundary of the National Infrastructure Plan on Har Tzion Street. It was examined whether the noise level from the light rail traffic conforms to the guidelines of the National Infrastructure Committee, and measures should be taken to reduce noise if necessary.

No deviation from the noise criterion was found for any of the examined receptors.

C. Southern Section

A deviation from the noise criterion was found for the noise receptors on Shenkar and Pikman Streets. During the detailed design, an additional acoustic report will be prepared to examine the possibilities of meeting the noise criterion, whether through track treatment or residential mitigation measures.

4.6 Vibrations

When assessing the vibration levels resulting from the light rail project, two stages of the project should be considered: the construction phase and the operation phase (similar to the discussion on noise above). The expected vibration impacts differ between the stages, as do the applicable criteria for each stage.

Construction Phase

The potential for vibrations resulting from the construction of the light rail is divided according to the nature of the work and its proximity to sensitive uses near the construction site.

A. Northern Section

In this section of the Green Line, the construction of the LRT refers to the construction of the railway line in the At-Grade sections.

The progress of the construction works is not known definitively and precisely in the current design stage, and it will be part of the detailed design.

It should be noted that, generally, unlike noise and other potential disturbances, the spread of vibrations resulting from construction works using machinery is limited to relatively short distances from the source of the vibrations.

B. Central Section

The construction works are divided as follows, in terms of the generation and spread of vibrations:

- Construction of the railway line in At-Grade sections
- Construction of the railway line transitioning from At-Grade sections to underground sections (portals) and stations.
- Excavation process using TBM and/or NATM methods.

The execution of the At-Grade sections is similar in essence to road paving, except for the actual track laying process. The track laying process itself also does not involve significant activities that generate high-intensity vibrations. Therefore, these sections are not expected to have vibration-related disturbances.

During the construction phase of the portals and underground stations, various drilling machines and excavation works with crawler bulldozers may cause vibrations, depending on the type of machinery and the location of the vibration receivers relative to the work area.

It is expected that the duration of these works will be prolonged over many months, and therefore the vibrations may affect recipients close to the heavy machinery operations.
In this section, a detailed description will be provided regarding the type and content of the execution documents that will be submitted with the progress of the design, as well as a range of possible solutions if sections are identified where there is concern about the occurrence of vibrations that exceed the criterion.

For the construction phase, vibration levels resulting from the light rail transit were considered, and no deviations from the vibration criterion were found.

C. Southern Section
In this section of the Green Line, the construction of the light rail refers to the construction of the railway line in At-Grade sections.

The progress of the construction works is not definitively known or precise at the current design stage, and it will be part of the detailed design.

It should be noted that, in general, unlike noise and other potential disturbances, the propagation of vibrations resulting from the execution of works with construction equipment is limited to relatively short distances from the source of the vibrations.

Operation Phase

A. Northern Section
For the assessment of the potential occurrence of vibrations resulting from the operation of the light rail, calculations were carried out regarding the propagation of vibrations from the planned railway tracks to the closest recipient buildings. No deviations from the vibration criterion were found.

B. Southern Section

For the assessment of the potential occurrence of vibrations resulting from the operation of the light rail, calculations were carried out regarding the propagation of vibrations from the planned railway tracks to the closest recipient buildings. No deviations from the vibration criterion were found.

4.7 Electromagnetic Fields

This section includes a theoretical characterization of the safety of electromagnetic fields for humans and their effects on the use and purposes of the ground as a result of potential disturbances in areas near to the light rail infrastructure.

Along the Green Line, sections of the railway tracks were scanned to locate buildings and ground uses that may be affected by the electromagnetic emissions from the overhead power lines that supply the traction component and the operation of the railway on the line.

The recommended threshold by the Ministry of Environmental Protection, under typical maximum load conditions, for the magnetic flux density is lower than 4 mG. Calculation, with a conservative approach, showed that the safe range is 5.5 meters from the railway track. No buildings were identified along the track that are closer than this distance.

4.6 Vibrations

When assessing the vibration levels resulting from the light rail project, two stages of the project should be considered: the construction phase and the operation phase (similar to the discussion on noise above). The expected vibration impacts differ between the stages, as do the applicable criteria for each stage.

Construction Phase

The potential for vibrations resulting from the construction of the light rail is divided according to the nature of the work and its proximity to sensitive uses near the construction site.

A. Northern Section

In this section of the Green Line, the construction of the LRT refers to the construction of the railway line in the At-Grade sections.

The progress of the construction works is not known definitively and precisely in the current design stage, and it will be part of the detailed design.

It should be noted that, generally, unlike noise and other potential disturbances, the spread of vibrations resulting from construction works using machinery is limited to relatively short distances from the source of the vibrations.

B. Central Section

The construction works are divided as follows, in terms of the generation and spread of vibrations:

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During the construction phase of the portals and underground stations, various drilling machines and excavation works with crawler bulldozers may cause vibrations, depending on the type of machinery and the location of the vibration receivers relative to the work area.

It is expected that the duration of these works will be prolonged over many months, and therefore the vibrations may affect recipients close to the heavy machinery operations.
In this section, a detailed description will be provided regarding the type and content of the execution documents that will be submitted with the progress of the design, as well as a range of possible solutions if sections are identified where there is concern about the occurrence of vibrations that exceed the criterion.

For the construction phase, vibration levels resulting from the light rail transit were considered, and no deviations from the vibration criterion were found.

C. Southern Section
In this section of the Green Line, the construction of the light rail refers to the construction of the railway line in At-Grade sections.

The progress of the construction works is not definitively known or precise at the current design stage, and it will be part of the detailed design.

It should be noted that, in general, unlike noise and other potential disturbances, the propagation of vibrations resulting from the execution of works with construction equipment is limited to relatively short distances from the source of the vibrations.

Operation Phase

A. Northern Section
For the assessment of the potential occurrence of vibrations resulting from the operation of the light rail, calculations were carried out regarding the propagation of vibrations from the planned railway tracks to the closest recipient buildings. No deviations from the vibration criterion were found.

B. Southern Section

For the assessment of the potential occurrence of vibrations resulting from the operation of the light rail, calculations were carried out regarding the propagation of vibrations from the planned

railway tracks to the closest recipient buildings. No deviations from the vibration criterion were found.

4.7 Electromagnetic Fields

This section includes a theoretical characterization of the safety of electromagnetic fields for humans and their effects on the use and purposes of the ground as a result of potential disturbances in areas near to the light rail infrastructure.

Along the Green Line, sections of the railway tracks were scanned to locate buildings and ground uses that may be affected by the electromagnetic emissions from the overhead power lines that supply the traction component and the operation of the railway on the line.

The recommended threshold by the Ministry of Environmental Protection, under typical maximum load conditions, for the magnetic flux density is lower than 4 mG. Calculation, with a conservative approach, showed that the safe range is 5.5 meters from the railway track. No buildings were identified along the track that are closer than this distance.

As well, since the plan allows for changes in the location of the railway tracks in different sections at later stages, possible measures were described in which they can be utilized, if necessary, to reduce the impact range on residential structures from the electricity poles.

In addition, the magnetic flux level outside the technical rooms located along the line was examined according to a representative plan for a technical room. Outside the room walls, the magnetic field flux is below 4 mG.

In areas above the room ceiling, the magnetic field flux may reach tens of milligauss at a height of 1 meter above the ground in the room. At magnetic field flux levels like these, there is no restriction on movement and free passage of people above the rooms. However, uses requiring public presence in such places, such as placing seating benches above the room ceiling or people staying in public areas above the station, should not be allowed.

The recommended measures by the planning team, in order to reduce the impact, include, among other things: magnetic shielding of transformer cells, ceiling of the cells, and part of the walls with panels and insulation layers and/or interior design and positioning of technical rooms so that problematic elements in terms of magnetic field flux are located in less sensitive areas for human presence.

In the early design stage, measurements of the electromagnetic radiation field at radio frequency outside the railway area (based on European standards) were not conducted in order to assess electromagnetic compatibility between electronic systems and the electromagnetic field in the vicinity of the railway area.

In the detailed design stage, it is necessary to ensure that the electromagnetic field complies with the standard within a range of 10 meters from the railway.

This situation will not cause interference to electronic systems from the electromagnetic field at radio frequency, but it may cause interference to AM radio receivers up to a range of 1.5 km.

Interference to life-supporting medical electronic equipment in healthcare facilities is considered highly critical. The immunity of this equipment to electrical fields is V/m 3 (according to IEC 601-1-2), and at a distance greater than 10 meters, the electrical field is lower than that. Other recommendations regarding equipment in healthcare facilities are in the relevant chapter.

This review does not assess the effects on buried infrastructure such as telephone cables, internet, power lines, water pipes, fuel pipes, gas pipes, etc., which may involve corrosion and/or induction of voltages. This is because at this planning stage, there is no accurate and detailed information about the location of these infrastructures in relation to the light rail axis and their geometric relationships (distance and parallelism) with the axis. In the event that during the final planning stage, infrastructures are found that require attention, several possible solutions will be detailed.

4.8 Urban Street Profile and Function

The impacts on the nature and function of the street are presented in the document "Urban Integration" prepared for the plan by the architects "Perach Tzafir". Measures to prevent disturbances and negative effects resulting from the proposed changes in the street section are presented throughout this review, according to the discipline of each chapter.

In addition, this review describes the temporary and final landscape restoration actions taken in order to minimize negative urban effects and optimally integrate the light rail alignment into the existing landscape. It should be emphasized that not all disciplines are expected to cause disturbances and negative effects. On the contrary, the plan has been designed to best adapt to the existing situation and, in some aspects, even reduce the negative impacts. For example, we anticipate a significant reduction (approximately 50%) in bus traffic along the corridors where the light rail alignment will pass.

4.9 Ecology

A. Northern Section

The light rail alignment passes through some of the last remaining natural sites in the Tel Aviv urban area. In the western sandy areas of Herzliya and Tel Aviv, a significant disruption is expected in relation to the overall alignment, but this disruption is reasonable and will occur due to approved construction plans and ongoing planning processes.

The alignment is planned near to the existing development and does not pass through the high-quality sandy areas in the Tel Michal and Tel Rekhet regions. However, the alignment does cross humid cultivation areas, such as, (Nahal Naman Pool, and high-quality sandy areas in the southern part. These areas are designated for development as

part of various plans, and therefore, the future development as a whole is expected to impact the high-quality cultivation areas within those plans.

Since the plan is in areas designated for development, it is unclear to what extent the ability to preserve high-quality areas, and measures to minimize the impact need to be examined. The northern section of the Green Line, with an emphasis on the Hertzliya branch, is expected to operate following the implementation of Plan 3700 and Plan 2200, the Turquoise Coast. Therefore, the detailed recommendations are conceptual, and their implementation should be further evaluated in the design process.

The Tel Monis area, defined as highly sensitive due to its ecological and archaeological uniqueness, is expected to be preserved as a result of the previous alternative to the Ayalon Highway crossing, which outlined the underground passage of the light rail beneath Shalom Rozenfeld Street and the parking lots in the area.

B. Southern section

As part of the light rail planning for the Green Line, changes are being made to the traffic arrangements in the Holon Junction area and the nearby winter ponds. These changes, at the time of this planning stage, are intended to be implemented in two phases: before its evacuation and after the evacuation of the complex for urban services.

Within the scope of the appraisal, various alternatives were examined, including the location of the stations and its different facilities, as well as alternative locations for the descent route from Ayalon Road, connecting to Levi Eshkol Boulevard. It was found that all the examined alternatives do not affect the pond filling process. The railway infrastructure itself, including the track alignment, stations, and facilities, does not have an impact on the extensive pond complex, which includes the floodplain areas and the well area. The railway infrastructure is located in built areas that are distant from the ponds. These areas do not serve as a source of sedimentation for the ponds.