Brief Description of the Istanbul North Rail Crossing Project (INRAIL)

1.1 Project Background

The Istanbul North Rail Crossing Project ("INRAIL" or "the Project") is a flagship rail infrastructure investment located at the core of Türkiye's railway network, where east–west and north–south freight and passenger flows converge. At present, the country's only cross-Bosphorus rail link is the Marmaray immersed tube tunnel, an asset primarily designed for passenger services and subject to severe constraints on freight capacity and maintenance. Freight trains can only use Marmaray during limited nighttime windows, creating a major bottleneck that hinders the performance of Türkiye's main national and intercontinental rail corridors, increases logistics costs, and leads to inefficient mode shifts to road transport. This constrained situation results in higher greenhouse gas (GHG) emissions, congestion in Istanbul's metropolitan area, and missed opportunities for rail to capture time- and cost-sensitive international cargo.

To address these issues, the Project will construct a new 127-km, high-capacity, double-track, electrified, and fully signaled railway line that bypasses the Istanbul Metropolitan Area and provides an overland rail crossing of the Istanbul Strait (Bosphorus). The line will start at Çayırova on the Asian side and end at Çatalca on the European side, traversing the Yavuz Sultan Selim (YSS) Bridge, which was designed and built as a rail-compatible structure but has not yet been equipped with track and systems infrastructure. By following the North Marmara Motorway right-of-way, the alignment seeks to minimize new land acquisition and environmental impacts, while delivering a technically resilient solution with extensive tunnels and viaducts to ensure climate and natural hazard resilience.

The Project's overall development objective, which this contract supports, is to: "*increase the competitiveness and resilience of Türkiye's cross-Bosphorus railway connectivity along its main national and intercontinental corridors*". By achieving this objective, the Project will enhance the sustainability and safety of the national transport system, and achieve a shift towards a safer, environmentally friendly transport system reflecting a more balanced modal split.

INRAIL will directly enhance the operational viability and competitiveness of three strategic trade corridors:

- The Trans-Caspian Middle Corridor (MC) linking China and Central Asia to Europe;
- The proposed Iraq Development Road (IDR) connecting Asia and the EU via the Middle East and Türkiye; and
- The Türkiye–EU corridor, which accounts for one-third of Türkiye's international trade but remains underutilized by rail due to current capacity constraints.

By eliminating the single most critical bottleneck shared by these corridors, the Project will reduce logistics costs, lower GHG emissions by shifting freight from road to rail, and increase the resilience of Türkiye's logistics network.

Key project beneficiaries include:

- **Railway undertakings, shippers, and logistics service providers**, who will gain access to faster, more reliable, and cost-efficient freight itineraries across Eurasia;
- **Airports (IST and SAW)** and **air freight operators**, through new inter-airport and rail-air cargo connectivity;
- **Local communities and businesses** along the corridor, benefiting from improved transport efficiency and reduced road congestion; and
- **Turkish State Railways (TCDD),** as infrastructure manager and access regulator, through enhanced asset quality, reduced maintenance backlog, and increased track access revenues.

The Project is aligned with Türkiye's Transport and Logistics Master Plan 2053, the Updated First Nationally Determined Contribution (NDC) under the Paris Agreement, and the national goal of achieving net zero emissions by 2053. It supports the World Bank Country Partnership Framework FY24–28, particularly the High and Sustainable Productivity Growth and Disaster Resilience and Preparedness objectives, by promoting logistics connectivity, enabling modal shift to rail, and building climate- and seismic-resilient transport infrastructure. INRAIL aims to align with the EU's Trans-European Transport Network (TEN-T) objectives to strengthen cross-border rail connectivity between Türkiye and the EU. The project will follow voluntary alignment with the EU Technical Specifications for Interoperability (TSIs) as a strategic enabler of seamless operations, supply-chain integration, and long-term asset resilience. This alignment is intended to ensure interoperability with the EU rail network, particularly via Bulgaria and Serbia, and compatibility with the broader Turkish railway system and South-East European corridors. Accordingly, the Project shall be designed and delivered to satisfy the essential requirements of EU Directive on the interoperability of the rail system and implement the full suite of applicable TSIs across all railway subsystems, infrastructure, energy, control-command and signaling, rolling stock, and safety in railway tunnels. Interoperability constituents shall be placed in service only upon demonstration, through EC conformity assessment, that they meet the essential requirements for safety and operation and contribute to end-to-end interoperability with the EU rail system.

1.2 Project Implementation Arrangements

MoTI, through AYGM, has established a Project Implementation Unit (the "PIU") to carry out the coordination, implementation, and management of the Project, including liaison with consultants and the Contractor(s), as well as with relevant authorities and financing institutions, in accordance with the applicable legal framework and Financier requirements. MoTI, through AYGM (the "Employer"), will implement the Project in accordance with the Yellow FIDIC Book (FIDIC Conditions of Contract for Plant and Design-Build 2nd edition 2017 reprinted 2022 with amendments). Project implementation will involve the following parties:

- **Works Contractor(s)**: The Project is expected to engage more than one Design-Build (DB) contractor.
- **Construction Supervision Consultant** to administer the design-build works contract(s) on site, per FIDIC regulations, with the following duties: (a) administering the design-build contract(s) and ensuring full supervision and monitoring of the Contractor's performance, with timely completion, adherence to budget, and compliance with the Employer's Requirements, approved design, and contract terms; (b) safeguarding construction quality and overseeing site safety throughout the works; (c) managing all contractual matters between the Employer and the Contractor; and (d) facilitating the successful handover of the completed works as an operable and maintainable system.
- **Project Management Consultant (PMC)**: provides support to the PIU on the daily tasks of implementing and managing the Project, including complying with all Financier requirements and related financing agreements, as well as with national laws and obligations.
- **Project Implementation Oversight Consultant (PIOC):** the PIOC will provide independent project implementation oversight, including technical support and quality assurance throughout the project lifecycle to help meet Employer and Financiers' requirements. The PIOC will provide structured, periodic—and in some cases real time or near real time—oversight and quality assurance of key aspects of project implementation, including but not limited to design, construction, fiduciary performance, environmental and social performance, and risk management. The PIOC support is intended to ensure the timely, fit-for-purpose, and on-budget delivery of a flagship project of national and international importance.
- **Notified Body (NoBo) and Assessment Body (AsBo):** Certification bodies engaged by the Contractor to ensure that the Works are designed, constructed, tested and commissioned in full compliance with: Applicable Technical Specifications for Interoperability (TSIs); Applicable Common Safety Method for Risk Evaluation and Assessment (CSM-RA); Relevant national railway legislation of the Republic of Türkiye; and All certification and authorization requirements for placing the railway subsystem(s) into service.
- **Turkish State Railways (TCDD):** Railway infrastructure manager that will operate the Project following completion.

Following the successful Tests on Completion, the issuance by the Supervision Consultant of the Taking-Over Certificate, and the TSI conformity check by the Notified Body (NoBo) and Assessment Body (AsBo), the Project's facilities will be transferred to Turkish State Railways (TCDD), which will manage and operate the Project.

Figure 1: Project's Alignment

The implementation of the Istanbul North Rail Crossing Project (INRAIL) is planned to be tendered under two separate procurement packages.

The first package covers the civil works contracts, comprising four (4) lots encompassing infrastructure and superstructure railway works, contracted by AYGM under the conditions of contract specified in the World Bank's Standard Procurement Document (Request for Proposals, Works Design and Build, March 2025). These include the FIDIC Conditions of Contract for Plant and Design-Build for Electrical and Mechanical Plant, and for Building and Engineering Works Designed by the Contractor (Yellow Book, Second Edition 2017, reprinted 2022 with amendments).

The second package covers the Signaling and Telecommunication works, comprising a single lot, procured under the conditions of contract specified in the World Bank's Standard Procurement Document (Request for Bids, Plant, Design, Supply, and Installation, March 2025). Signaling and Telecommunication works will be procured separately and are not included within the scope of this tender.

1.3 General Scope of Work:

The civil works package for the Istanbul North Rail Crossing Project (INRAIL) is structured into four (4) Design and Build contract lots. The technical descriptions below are based on the preliminary design and are indicative of the scope of works anticipated under each lot. The precise configuration, dimensions, and quantities of structures shall be determined and confirmed through the detailed design process under each respective contract.

1.3.1 Project Design:

All construction and installation works will be delivered under a Design and Build implementation approach in accordance with the FIDIC Conditions of Contract for Building and Engineering Works Designed by the Contractor (Yellow Book, Second Edition 2017, reprinted 2022 with amendments). Under each lot, the detailed design obligations shall cover, inter alia, the following deliverables for submission and approval:

- Detailed Design: Civil and Structural Works.
- Detailed Design: Track / Superstructure Works.
- Detailed Design: Electrification and Systems Works.
- Detailed Design: Tunnel Electromechanical Works.
- Detailed Design: Station Works, where applicable to the lot.
- As-Built Documentation: All Disciplines.

The above design deliverables represent the minimum expected scope of design services under each lot. In delivering the detailed design, the Contractor shall carry out all tasks typically required for an infrastructure rail project of this nature, including — but not limited to — geodetic survey works, site investigations, and geological and geotechnical assessments; horizontal and vertical alignment design; hydraulic, hydrological, and drainage design; track superstructure design; design of civil structures along the line; detailed design of passenger stations covering civil, electromechanical, and systems integration aspects; electrification and mechanical systems design; and preparation of as-built documentation. The Contractor shall ensure that all design outputs are fully coordinated across disciplines, prepared in accordance with applicable Turkish technical standards, specifications, and regulations, and comply with the Employer's Requirements. All design documents shall be submitted for review and approval in accordance with the contractual programme.

1.3.2 Infrastructure and superstructure railway works:

The construction, electrification, and installation works to be delivered under each lot encompass all civil, structural, track, and systems works required to bring the railway infrastructure to operational readiness. The scope of works under each lot shall cover, inter alia, the following principal activities:

- Relocation of Existing Infrastructure and Utilities.
- Infrastructure Works: Tunnels, Structures, Stations, and Ground Improvement.
- Superstructure (Track) Works.
- Systems Installation.
- Testing and Commissioning.
- Final Acceptance.

The above activities represent the minimum expected scope of construction works under each lot. In delivering these works, the Contractor shall carry out all tasks typically required for an infrastructure rail project of this nature, including — but not limited to — the relocation of existing utilities and services; construction of all structures along the line, including NATM and TBM tunnels, cut-and-cover structures, viaducts, bridges, hydraulic structures, underpasses, overpasses, and retaining structures; ground improvement works; station construction, architectural finishing, and electromechanical works; monitoring of slopes, deep excavations, nearby structures, and settlement points; track works along the line including slab track, ballasted track, special trackwork, rail, and turnouts; traction power supply and electrification works; tunnel electromechanical systems including ventilation, emergency systems, and firefighting installations for underground structures; and railway trial operations leading to Final Acceptance. Signaling and Telecommunication works are procured separately and are not included within the scope of this tender.

The Contractor shall ensure that all works are executed in conformity with the approved detailed design, in full coordination across disciplines, in accordance with the applicable Turkish technical standards, specifications, and regulations, and in compliance with the Employer's Requirements and the contractual programme.

The project is structured into four (4) construction lots, each covering a distinct section of the INRAIL alignment and tailored to the specific engineering characteristics, tunnelling requirements, and station works pertaining to that section. Explanations regarding each lot are described below

1.3.3 General Description -Lot 1:

Lot 1 covers the eastern origin of the INRAIL alignment on the Anatolian side of Istanbul, commencing at the vicinity of the Çayırova TCDD Station and extending northwestward to the approach of Sabiha Gökçen Airport. Based on the preliminary design, the lot begins with a triangular (diamond) connection to the existing railway lines, separating into two arms, one double-line section of approximately 1,305.92 m and one single-line section of approximately 915.86 m, before continuing on the main double-track alignment for a further 26.470 km, terminating at km 26+470, some 200 meters beyond the end point of

TBM Tunnel 1D-2 at km 26+270. The total alignment length under this lot is approximately 27,8 km of double track and 916 m of single track. These figures are indicative and based on the preliminary design; final quantities and dimensions shall be confirmed through the detailed design process. This lot is the most tunnelling-intensive contract within the project, with underground works constituting the dominant share of the scope and cost, and it also includes the construction of a new underground passenger station at Sabiha Gökçen Airport.

Key Works and Structures:

- **Design Works:** The Contractor shall be responsible for the preparation of all preliminary and detailed design deliverables across all disciplines, including civil, structural, geotechnical, electrification, and tunnel electromechanical works, in accordance with the Employer's Requirements.
- **Infrastructure Relocations:** Prior to the commencement of principal works, the Contractor shall carry out all necessary relocation and protection of existing utilities and infrastructure affected by the alignment, including water supply, sewerage, electricity, gas, and telecommunications networks.
- **Earthworks and Slope Stabilization**: The Contractor shall execute all earthworks, formation grading, and slope stabilization measures required along the open alignment sections of the lot, ensuring a stable and construction-ready formation throughout the project corridor.
- **Soil Improvement Works:** Where required by ground conditions, the Contractor shall design and implement appropriate soil improvement measures. The method, depth, and extent of improvement shall be determined through the detailed design process.
- **Tunnels - TBM**: The principal tunnelling works within this lot comprises an extensive TBM (Tunnel Boring Machine) twin-bore tunnel drive extending over a significant length of the lot's alignment, constituting the single largest scope item within Lot 1. The TBM drive shall be executed portal to portal in accordance with the approved design. The Contractor shall be responsible for TBM procurement or lease, segment production, all tunnelling operations, and all associated temporary and permanent works.
- **Tunnels - NATM**: In addition to the TBM drive, the lot includes several New Austrian Tunnelling Method (NATM) tunnel sections, comprising turnout tunnels, single-line tunnels, platform tunnels serving Sabiha Gökçen Station, and connection and link tunnels. All NATM works shall be designed and constructed by the Contractor in accordance with the approved geotechnical design and support class selection.
- **Viaducts and Bridges:** The lot include viaduct structures in the vicinity of the alignment's commencement point, where the triangular connection to the existing Çayırova TCDD railway lines is established. The structural solution, span arrangement, and foundation type shall be determined through the detailed design process.
- **Minor Structures**: The Contractor shall design and construct all culverts, underpasses, and overpasses required along the alignment in accordance with the Employer's Requirements and the approved design.
- **Station Works - Sabiha Gökçen Airport Station:** This lot includes the construction of a new underground passenger station serving Sabiha Gökçen Airport, to be constructed beneath the

existing airport operational environment. This requires all necessary excavation, temporary support systems, and structural construction to be carried out within and adjacent to a live airport. The scope includes underground excavation and civil and structural construction of the station box and all associated below-ground structures; architectural and finishing works throughout all public and operational areas; and full installation of station electromechanical systems, including lifts, escalators, HVAC, MEP, and all public area installations.

- **Superstructure (Track) Works:** The Contractor shall complete all track works across the lot, including removal of any existing track infrastructure, construction of ballasted and ballastless track in accordance with the approved design, supply and installation of railway turnouts — including the turnout structures forming the triangular connection at the lot's origin — and rail expansion joints, and all track maintenance obligations during the construction period. Perimeter fencing shall be installed along the full extent of the alignment.
- **Electrification Works:** The Contractor shall design, supply, install, and commission the full electrification system across the lot, including catenary systems and conductors, traction substations, sectioning and insulation works, switchyard and electrical distribution systems, protection, metering, earthing and safety systems, and SCADA and telecommunications integration.
- **Tunnel Electromechanical Works:** The Contractor shall design and install all electromechanical systems within the tunnel structures, including ventilation, fire detection and suppression, lighting, emergency and evacuation systems, and all associated power and control systems.

The indicative structure list is provided in full in the Annexes to this document.

1.3.4 General Description -Lot 2:

Lot 2 covers the central section of the INRAIL alignment on the Anatolian side of Istanbul, commencing at km 26+470, approximately 200 meters beyond the end point of TBM Tunnel 1B in lot 1, and extending northwestward toward the Bosphorus crossing approach, terminating at km 52+079.50, some 50 meters beyond Bridge 12. Based on the preliminary design, the total alignment length under this lot is approximately 25.6 km of double track. These figures are indicative and based on the preliminary design; final quantities and dimensions shall be confirmed through the detailed design process. This lot is characterized by a combination of open alignment works, extensive NATM tunnelling through multiple separate tunnel structures, and a high concentration of viaduct and bridge structures traversing complex topography.

Key Works and Structures:

- **Design Works**: The Contractor shall be responsible for the preparation of all preliminary and detailed design deliverables across all disciplines, including civil, structural, geotechnical, electrification, and tunnel electromechanical works, in accordance with the Employer's Requirements.

- **Infrastructure Relocations:** Prior to the commencement of principal works, the Contractor shall carry out all necessary relocation and protection of existing utilities and infrastructure affected by the alignment, including water supply, sewerage, electricity, gas, and telecommunications networks.
- **Earthworks and Slope Stabilization**: The Contractor shall execute all earthworks, formation grading, and slope stabilization measures required along the open alignment sections of the lot, ensuring a stable and construction-ready formation throughout the project corridor.
- **Soil Improvement Works** Where required by ground conditions, the Contractor shall design and implement appropriate soil improvement measures, including both shallow and deep improvement methods as applicable. The method, depth, and extent of improvement shall be determined through the detailed design process.
- **Tunnels - NATM:** This lot encompasses a series of NATM double-track tunnels distributed across the alignment, passing through varying ground conditions. An escape tunnel serving the NATM tunnel system shall also be constructed. All NATM work shall be designed and constructed by the Contractor in accordance with the approved geotechnical design and support class selection. The number, configuration, and extent of tunnel structures shall be confirmed through the detailed design process.
- **Tunnels - Cut and Cover**: The lot includes cut-and-cover tunnel sections at specific locations along the alignment where underground construction is required using open-cut methods. The configuration and extent of these structures shall be confirmed through the detailed design process.
- **Viaducts and Bridges:** This lot has a high concentration of bridge and viaduct structures traversing the varied terrain of the Asian side. The structural solutions, including foundation types, span arrangements, and deck configurations, shall be determined through the detailed design process.
- **Minor Structures:** The Contractor shall design and construct all culverts, underpasses, and overpasses required along the alignment in accordance with the Employer's Requirements and the approved design.
- **Superstructure (Track) Works:** The Contractor shall complete all track works across the lot, including construction of ballasted and ballastless track in accordance with the approved design, supply and installation of railway turnouts and rail expansion joints, and all track maintenance obligations during the construction period. Perimeter fencing shall be installed along the full extent of the alignment.
- **Electrification Works**: The Contractor shall design, supply, install, and commission the full electrification system across the lot, including catenary systems and conductors, traction substations, sectioning and insulation works, switchyard and electrical distribution systems, protection, metering, earthing and safety systems, and SCADA and telecommunications integration.

- **Tunnel Electromechanical Works**: The Contractor shall design and install all electromechanical systems within the tunnel structures, including ventilation, fire detection and suppression, lighting, emergency and evacuation systems, and all associated power and control systems.

The indicative structure list is provided in full in the Annex to this document.

1.3.5 General Description -Lot 3:

Lot 3 is the most strategically significant lot within the INRAIL project, encompassing the Bosphorus crossing via the existing Yavuz Sultan Selim (YSS) Bridge, together with the approach alignments on both the Asian and European sides of the crossing. Based on the preliminary design, the lot commences at km 52+079.50, approximately 50 meters beyond the end point of Bridge 12, and extends to km 22+600 on the European side, terminating some 50 meters before Bridge 32. The total alignment length under this lot is approximately 32 km, including the Bosphorus crossing via the Yavuz Sultan Selim Bridge. These figures are indicative and based on the preliminary design; final quantities and dimensions shall be confirmed through the detailed design process. This lot is characterized by a high density of bridge and viaduct structures, multiple NATM and cut-and-cover tunnel sections, and the integration of the new railway infrastructure with the existing YSS Bridge structure.

Key Works and Structures:

- **Design Works**: The Contractor shall be responsible for the preparation of all preliminary and detailed design deliverables across all disciplines, including civil, structural, geotechnical, electrification, and tunnel electromechanical works, as well as structural assessment and interface coordination with the YSS Bridge authority, in accordance with the Employer's Requirements.
- **Infrastructure Relocations:** Prior to the commencement of principal works, the Contractor shall carry out all necessary relocation and protection of existing utilities and infrastructure affected by the alignment, including water supply, sewerage, electricity, gas, and telecommunications networks.
- **Earthworks and Slope Stabilization:** The Contractor shall execute all earthworks, formation grading, and slope stabilization measures required along the open alignment sections of the lot, including on the approach embankments to the YSS Bridge and along the European side approach corridor, ensuring a stable and construction-ready formation throughout the project corridor.
- **Soil Improvement Works:** Where required by ground conditions, the Contractor shall design and implement appropriate soil improvement measures across the lot on both the Asian and European sides of the Bosphorus. The method, depth, and extent of improvement shall be determined through the detailed design process.

- **Tunnels-NATM:** The lot includes a series of NATM double-track tunnels distributed across the approach alignments on both sides of the Bosphorus, passing through varying ground conditions. An escape tunnel serving the NATM tunnel system shall also be constructed. All NATM works shall be designed and constructed by the Contractor in accordance with the approved geotechnical design and support class selection. The number, configuration, and extent of tunnel structures shall be confirmed through the detailed design process.
- **Tunnels-Cut and Cover:** The lot includes several cut-and-cover tunnel sections at locations where ground conditions or urban constraints require underground construction using open-cut methods. The configuration and extent of these structures shall be confirmed through the detailed design process.
- **Viaducts and Bridges:** This lot contains the highest concentration of bridge and viaduct structures within the project, reflecting the topography of the Bosphorus approach corridors on both the Asian and European sides. Structures include major viaducts and bridges crossing valleys, waterways, and other obstacles. The structural solutions, including foundation types, span arrangements, and deck configurations, shall be determined through the detailed design process.
- **Bosphorus Crossing — Yavuz Sultan Selim Bridge** The railway crossing of the Bosphorus Strait is achieved through the utilization of the existing Yavuz Sultan Selim Bridge, using the track space already allocated on the bridge's dedicated lower deck reserved for rail use. The Contractor shall design and construct all works necessary to integrate the INRAIL railway infrastructure with the bridge's existing rail deck, including all structural connections, track systems, and associated electrification and systems works on the bridge. All interface works shall be carried out in close coordination with the relevant bridge authority and in accordance with the applicable technical requirements governing the existing structure.
- **Minor Structures:** The Contractor shall design and construct all culverts, underpasses, and overpasses required along the alignment in accordance with the Employer's Requirements and the approved design.
- **Superstructure (Track) Works:** The Contractor shall complete all track works across the lot, including construction of ballasted and ballastless track in accordance with the approved design, supply and installation of railway turnouts and rail expansion joints, and all track maintenance obligations during the construction period. Perimeter fencing shall be installed along the full extent of the alignment.
- **Electrification Works:** The Contractor shall design, supply, install, and commission the full electrification system across the lot, including catenary systems and conductors, traction substations, sectioning and insulation works, switchyard and electrical distribution systems, protection, metering, earthing and safety systems, and SCADA and telecommunications integration.
- **Tunnel Electromechanical Works:** The Contractor shall design and install all electromechanical systems within the tunnel structures, including ventilation, fire detection and

suppression, lighting, emergency and evacuation systems, and all associated power and control systems.

The indicative structure list is provided in full in the Annexes to this document.

1.3.6 General Description -Lot 4:

Lot 4 covers the European side of the INRAIL alignment, extending from the end of Lot 3 at km 22+600 northwestward to the Çatalca junction, where the alignment connects via a triangular (wye) junction to the Halkalı–Kapıkule High-Speed Railway Line. Based on the preliminary design, the lot terminates at km 28+584.96, at the intersection point of the two-track triangular connection arm with the existing Ispartakule–Çerkezköy Line. The total alignment length under this lot is approximately 37.8 km of double-track main line and approximately 2.0 km of single-track triangular connection arm, inclusive of the turnout installation works on the existing double lines. These figures are indicative and based on the preliminary design; final quantities and dimensions shall be confirmed through the detailed design process. This lot is characterized by a major TBM tunnel drive, significant NATM and cut-and-cover tunnel sections, an extensive viaduct and bridge programme, and the construction of Istanbul Airport Station within an underground structure already reserved for this purpose.

Key Works and Structures:

- **Design Works:** The Contractor shall be responsible for the preparation of all preliminary and detailed design deliverables across all disciplines, including civil, structural, geotechnical, electrification, and tunnel electromechanical works, as well as coordination with Istanbul Airport authorities and the Halkalı–Kapıkule project, in accordance with the Employer's Requirements.
- **Infrastructure Relocations** Prior to the commencement of principal works, the Contractor shall carry out all necessary relocation and protection of existing utilities and infrastructure affected by the alignment, including water supply, sewerage, electricity, gas, and telecommunications networks.
- **Earthworks and Slope Stabilization:** The Contractor shall execute all earthworks, formation grading, and slope stabilization measures required along the open alignment sections of the lot, ensuring stable and construction-ready formation throughout the project corridor.
- **Soil Improvement Works:** Where required by ground conditions, the Contractor shall design and implement appropriate soil improvement measures across the lot. The method, depth, and extent of improvement shall be determined through the detailed design process.
- **Tunnels: TBM:** This lot includes a major TBM (Tunnel Boring Machine) twin-bore tunnel drive extending over a significant length of the European side alignment, constituting a dominant cost and programme driver for this lot. The TBM drive shall be executed portal to portal in accordance with the approved design. The Contractor shall be responsible for TBM procurement or lease,

segment production, all tunnelling operations, and all associated temporary and permanent works.

- **Tunnels-NATM:** The lot includes NATM tunnel sections of varying lengths and ground classifications distributed across the alignment. All NATM works shall be designed and constructed by the Contractor in accordance with the approved geotechnical design and support class selection. The number, configuration, and extent of tunnel structures shall be confirmed through the detailed design process.
- **Tunnels -Cut and Cover:** The lot includes several cut-and-cover tunnel sections at locations where ground conditions or urban constraints require underground construction using open-cut methods. The configuration and extent of these structures shall be confirmed through the detailed design process.
- **Viaducts and Bridges:** The lot includes an extensive programme of viaduct and bridge structures crossing valleys and other topographic obstacles along the European side corridor. The structural solutions, including foundation types, span arrangements, and deck configurations, shall be determined through the detailed design process.
- **Minor Structures:** The Contractor shall design and construct all culverts, underpasses, and overpasses required along the alignment in accordance with the Employer's Requirements and the approved design.
- **Station Works: Istanbul Airport Station** This lot includes the completion of the underground passenger station serving Istanbul Airport. An underground structure has already been reserved and constructed in anticipation of the future station. The Contractor shall design and execute all works required to fit out and complete the station within the existing reserved structure, including all civil finishing works, architectural and finishing works throughout all public and operational areas, connection with the operational metro station, and the full installation of station electromechanical systems, including lifts, escalators, HVAC, MEP, and all public area installations.
- **Çatalca Junction — Connection to Halkalı–Kapıkule Line** The lot includes all works associated with the triangular (wye) junction near Çatalca, providing the INRAIL alignment's connection to the Halkalı–Kapıkule High-Speed Railway Line. The junction works shall include all civil, structural, and track works required to achieve a fully operational and interoperable connection between the two lines, including the turnout installation works on the existing double lines.
- **Superstructure (Track) Works:** The Contractor shall complete all track works across the lot, including construction of ballasted and ballastless track in accordance with the approved design, supply and installation of railway turnouts and rail expansion joints, and all track maintenance obligations during the construction period. Perimeter fencing shall be installed along the full extent of the alignment.
- **Electrification Works:** The Contractor shall design, supply, install, and commission the full electrification system across the lot, including catenary systems and conductors, traction

substations, sectioning and insulation works, switchyard and electrical distribution systems, protection, metering, earthing and safety systems, and SCADA and telecommunications integration.

- **Tunnel Electromechanical Works:** The Contractor shall design and install all electromechanical systems within the tunnel structures, including ventilation, fire detection and suppression, lighting, emergency and evacuation systems, and all associated power and control systems.

The indicative structure list is provided in full in the Annexes to this document.

Annex 1- Indicative Structure List — Lot 1

The structure list, descriptions, locations, and dimensions presented below are based on the preliminary design. All chainage references, lengths, and sizes are approximative and shall be confirmed through the detailed design process.

1. Tunnels

Location	Structure	Type	Start Point (approx.)	End Point (approx.)	Length (m) (approx.)
Asian Side	Tunnel 1A-1	TBM*	0+845	12+859	12 014
Asian Side	Tunnel 1A-2	NATM	12+859	13+231	372
Asian Side	Tunnel 1A-3	TBM*	13+231	14+150	919
Asian Side	Tunnel 1B-1	NATM	14+150	14+339	190
Asian Side	Tunnel 1B-2	TBM*	14+339	14+956	617
Asian Side	Tunnel 1B-3	NATM	14+339	14+451	112
Asian Side	Tunnel P (Station Tunnel)	NATM	14+451	14+851	400
Asian Side	Tunnel 1B-4	NATM	14+851	14+956	105
Asian Side	Tunnel 1C-1	NATM	14+956	15+145	189
Asian Side	Tunnel 1C-2	TBM*	15+145	17+868	2 723
Asian Side	Tunnel 1D-1	NATM	17+868	18+240	372
Asian Side	Tunnel 1D-2	TBM	18+240	26+270	8 029
Total					**26 042**

** TBM tunnels will be constructed as double-bore (twin tube). The lengths indicated represent half the total tube length (i.e., one bore).*

2. Viaducts — Wye (Triangular) Connection

Location	Structure	Start Point (approx.)	End Point (approx.)	Length (m) (approx.)
Asian Side	Viaduct A	0+255	0+705	450
Asian Side	Viaduct B	0+285	1+010	725
Total				**1 175**

3. Underpasses

Location	Reference	Chainage (approx.)	Size (m)
Asian Side	Underpass 1	0+075	10 x 6
Asian Side	Underpass 2	0+083	10 x 6
Total Number			**2**

4. Overpasses

Location	Reference	Chainage (approx.)	Size — Width x Length (m)
Asian Side	Overpass 1	0+343.560	12 x 30
Asian Side	Overpass 2	0+451.510	12 x 30
Asian Side	Overpass 3	0+714.530	12 x 50
Total Number			**3**

Annex 2- Indicative Structure List — Lot 2

The structure list, descriptions, locations, and dimensions presented below are based on the preliminary design. All chainage references, lengths, and sizes are approximative and shall be confirmed through the detailed design process. The indicative structure list is provided in full in the Annex to this document.

1. Tunnels

Location	Structure	Type	Start Point (approx.)	End Point (approx.)	Length (m) (approx.)
Asian Side	Tunnel-2	NATM	29+229	29+759	530
Asian Side	Tunnel-3	NATM	30+359	32+999	2 640
Asian Side	Tunnel-4	NATM	33+599	33+819	220
Asian Side	Tunnel-5	NATM	34+039	36+239	2 200
Asian Side	Tunnel-6	NATM	36+599	37+699	1 100
Asian Side	Tunnel-7	NATM	43+199	44+514	1 315
Asian Side	Tunnel-8	NATM	45+619	46+539	920
Asian Side	Tunnel-9	NATM	46+799	47+429	630
Asian Side	Tunnel-10	NATM	47+719	48+394	675
Total					**10 230**

2. Cut and Cover

Location	Structure	Start Point (approx.)	End Point (approx.)	Length (m) (approx.)
Asian Side	Cut and Cover-1	28+519	28+714	195
Asian Side	Cut and Cover-2	37+939	38+409	470
Total				**665**

3. Bridges

Location	Structure	Start Point (approx.)	End Point (approx.)	Length (m) (approx.)
Asian Side	Bridge-1	26+959	27+439	480
Asian Side	Bridge-2	28+189	28+349	160
Asian Side	Bridge-3	28+829	29+139	310
Asian Side	Bridge-4	36+309	36+384	75
Asian Side	Bridge-5	39+849	40+949	1 100
Asian Side	Bridge-6	41+014	41+609	595
Asian Side	Bridge-7	41+734	42+089	355
Asian Side	Bridge-8	42+214	43+139	925
Asian Side	Bridge-9	44+799	45+544	745
Asian Side	Bridge-10	49+184	49+579	395
Asian Side	Bridge-11	49+709	49+849	140
Asian Side	Bridge-12	50+949	52+029	1 080
Total				**6 360**

4. Culverts

Location	Reference	Chainage (approx.)	Size (m)
Asian Side	Culvert-1	26+723.815	2.00 x 2.00
Asian Side	Culvert-2	29+870.512	3.00 x 3.00

Asian Side	Culvert-3	30+122.649	3.00 x 3.00
Asian Side	Culvert-4	33+023.520	3.00 x 3.00
Asian Side	Culvert-5	39+017.251	2.00 x 2.00
Asian Side	Culvert-6	39+322.947	2.00 x 2.00
Asian Side	Culvert-7	47+506.000	2.00 x 2.00
Asian Side	Culvert-8	48+842.237	2.00 x 2.00
Total Number			**8**

5. Underpasses

Location	Reference	Chainage (approx.)	Size (m)
Asian Side	Underpass-3	26+675	10 x 6
Asian Side	Underpass-4	27+988	10 x 6
Asian Side	Underpass-5	33+023	10 x 6
Asian Side	Underpass-6	38+790	10 x 6
Total Number			**4**

6. Overpasses

Location	Reference	Chainage (approx.)	Size — Width x Length (m)
Asian Side	Overpass-4	28+456	12 x 30
Total Number			**1**

Annex 3- Indicative Structure List — Lot 3

The structure list, descriptions, locations, and dimensions presented below are based on the preliminary design. All chainage references, lengths, and sizes are approximative and shall be confirmed through the detailed design process. The indicative structure list is provided in full in the Annex to this document.

1. Tunnels (NATM)

Location	Structure	Start Point (approx.)	End Point (approx.)	Length (m) (approx.)
Asian Side	Tunnel-11	56+279	57+539	1 260
Asian Side	Tunnel-12	57+929	58+524	595
European Side	Tunnel-13	0+000	0+800	800
European Side	Tunnel-14	3+900	4+400	500
European Side	Tunnel-15	6+360	7+410	1 050
European Side	Tunnel-16	8+250	8+600	350
European Side	Tunnel-17	13+890	14+910	1 020
European Side	Tunnel-18	15+440	15+760	320
Total				**5 895**

2. Cut and Cover

Location	Structure	Start Point (approx.)	End Point (approx.)	Length (m) (approx.)
Asian Side	Cut & Cover-3	53+149	53+209	60
Asian Side	Cut & Cover-4	53+904	53+969	65
Asian Side	Cut & Cover-4A	58+524	58+808	284
European Side	Cut & Cover-5A	-0+452	0+000	452
European Side	Cut & Cover-5	1+100	1+300	200
European Side	Cut & Cover-6	1+535	1+590	55
European Side	Cut & Cover-7	2+200	2+505	305
European Side	Cut & Cover-8	12+000	12+110	110
European Side	Cut & Cover-9	16+185	16+240	55
Total				**1 586**

3. Bridges

Location	Structure	Start Point (approx.)	End Point (approx.)	Length (m) (approx.)
Asian Side	Bridge-13	52+529	52+919	390
Asian Side	Bridge-14	54+164	54+324	160
Asian Side	Bridge-15	54+729	54+824	95
Asian Side	Bridge-16	55+129	55+429	300
Asian Side	Bridge-17	55+869	56+159	290
Asian Side	Bridge-18	57+679	57+839	160
European Side	Bridge-19	0+870	1+030	160
European Side	Bridge-20	1+720	1+905	185
European Side	Bridge-21	2+640	3+410	770
European Side	Bridge-22	4+880	5+540	660
European Side	Bridge-23	8+670	8+980	310
European Side	Bridge-24	10+270	11+180	910

European Side	Bridge-25	11+335	11+660	325
European Side	Bridge-26	12+425	12+625	200
European Side	Bridge-27	12+780	12+980	200
European Side	Bridge-28	17+280	17+520	240
European Side	Bridge-29	18+640	19+620	980
European Side	Bridge-30	21+050	21+370	320
European Side	Bridge-31	21+520	22+150	630
Total				**7 285**

4. Culverts

Location	Reference	Chainage (approx.)	Size (m)
Asian Side	Culvert-9	53+044	2.00 x 2.00
Asian Side	Culvert-9A	53+509	2.00 x 2.00
European Side	Culvert-10	1+444	3.00 x 3.00
European Side	Culvert-11	3+645	2.00 x 2.00
European Side	Culvert-12	6+175	3.00 x 3.00
European Side	Culvert-13	7+590	2.00 x 2.00
European Side	Culvert-14	8+021	2 x (3.00 x 3.00)
European Side	Culvert-15	9+350	2.00 x 2.00
European Side	Culvert-16	12+150	2.00 x 2.00
European Side	Culvert-17	13+060	2.00 x 2.00
European Side	Culvert-18	13+432	2.00 x 2.00
European Side	Culvert-19	15+165	3.00 x 3.00
European Side	Culvert-20	15+990	2.00 x 2.00
European Side	Culvert-21	16+850	2.00 x 2.00
European Side	Culvert-22	18+360	2.00 x 2.00
European Side	Culvert-23	20+855	2.00 x 2.00
Total Number			**16**

5. Overpasses

Location	Reference	Chainage (approx.)	Size — Width x Length (m)
Asian Side	Overpass-5	54+453	12 x 30
European Side	Overpass-6	6+040	12 x 30
European Side	Overpass-7	6+224	12 x 30
European Side	Overpass-8	17+000	12 x 30
European Side	Overpass-9	19+535	12 x 30
Total Number			**5**

Annex 4- Indicative Structure List — Lot 4

The structure list, descriptions, locations, and dimensions presented below are based on the preliminary design. All chainage references, lengths, and sizes are approximative and shall be confirmed through the detailed design process. The indicative structure list is provided in full in the Annex to this document.

1. Tunnels

Location	Structure	Type	Start Point (approx.)	End Point (approx.)	Length (m) (approx.)
European Side	Tunnel-19	TBM*	26+330	29+718	3 389
European Side	Tunnel-19-A	NATM	29+718	30+091	372
European Side	Tunnel-19-B	TBM*	30+091	31+352	1 261
European Side	Tunnel-19-C	NATM	31+352	31+552	200
European Side	Tunnel-20-A	NATM	0+631	0+804	173
European Side	Tunnel-20-B	TBM*	0+804	2+384	1 580
European Side	Tunnel-20-C	NATM	2+384	2+935	551
European Side	Tunnel-20-D	TBM*	2+935	3+639	825
European Side	Tunnel-20-E	NATM	3+639	4+201	562
European Side	Tunnel-20-F	TBM*	4+201	5+600	1 399
European Side	Tunnel-21	TBM*	5+880	7+505	1 625
European Side	Tunnel-22	NATM	9+120	9+800	680
European Side	Tunnel-23	NATM	11+130	11+630	500
European Side	Tunnel-24	NATM	13+120	16+730	3 610
European Side	Tunnel-25	NATM	17+190	17+610	420
Total					**17 147**

** TBM tunnels will be constructed as double-bore (twin tube). The lengths indicated represent half the total tube length (i.e., one bore).*

2. Cut and Cover

Location	Structure	Start Point (approx.)	End Point (approx.)	Length (m) (approx.)
European Side	Cut & Cover-10	24+600	24+880	280
European Side	Cut & Cover-11	25+300	25+390	90
European Side	Cut & Cover-12	25+590	26+000	410
European Side	Cut & Cover-13	5+600	5+880	280
European Side	Cut & Cover-14	7+505	7+650	145
European Side	Cut & Cover-15	12+465	12+740	275
Total				**1 480**

3. Bridges

Location	Structure	Start Point (approx.)	End Point (approx.)	Length (m) (approx.)
European Side	Bridge-32	22+650	23+440	790
European Side	Bridge-33	23+650	24+250	600
European Side	Bridge-34	8+315	8+685	370
European Side	Bridge-35	10+160	10+700	540
European Side	Bridge-36	11+760	12+200	440

European Side	Bridge-37	17+760	18+000	240
European Side	Bridge-38	19+180	22+100	2 920
European Side	Bridge-39	23+872	23+912	40
European Side	Bridge-40	26+097	27+397	1 300
Total				**7 240**

4. Culverts

Location	Reference	Chainage (approx.)	Size (m)
European Side	Culvert-24	24+515	2.00 x 2.00
European Side	Culvert-25	25+190	2.00 x 2.00
European Side	Culvert-26	25+490	2.00 x 2.00
European Side	Culvert-27	26+175	2.00 x 2.00
European Side	Culvert-28	7+925	2.00 x 2.00
European Side	Culvert-29	8+945	2.00 x 2.00
European Side	Culvert-30	12+845	2.00 x 2.00
European Side	Culvert-31	16+860	2.00 x 2.00
European Side	Culvert-32	18+828	3.00 x 3.00
European Side	Culvert-33	22+237	3.00 x 3.00
European Side	Culvert-34	24+355	2.00 x 2.00
European Side	Culvert-35	25+340	2 x (3.00 x 3.00)
European Side	Culvert-36	25+825	2.00 x 2.00
European Side	Culvert-37	27+673	2.00 x 2.00
European Side	Culvert-38	0+902	2.00 x 2.00
Total Number			**15**

5. Underpasses

Location	Reference	Chainage (approx.)	Size (m)
European Side	Underpass-7	25+543	10 x 6
European Side	Underpass-8	27+898	10 x 6
European Side	Underpass-9	0+490	10 x 6
Total Number			**3**

6. Overpasses

Location	Reference	Chainage (approx.)	Size — Width x Length (m)
European Side	Overpass-10	24+917	12 x 30
European Side	Overpass-11	1+125	12 x 20
Total Number			**2**