



Sovereign-backed Financings

Approval Project Document

P000951 Türkiye: TCDD Railway Maintenance Modernization Project

Currency Equivalents

As of August 31, 2025

Currency Unit – Turkish Lira (TRY)

USD1.00 = TRY41.14

TRY1.00 = USD0.024

Fiscal Year

January 1 – December 31

Abbreviations

AIIB	Asian Infrastructure Investment Bank
DA	Designated Account
ECM	Entity in Charge of Maintenance
EIB	European Investment Bank
EMS	Environmental Management System
ERP	Enterprise Resource Planning
ES	Environmental and Social
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESP	Environmental and Social Policy
ESS	Environmental and Social Standards
EU	European Union
FM	Financial Management
GBV	Gender-based Violence
GDP	Gross Domestic Product
GRM	Grievance Redress Mechanism
IsDB	Islamic Development Bank
MDB	Multilateral Development Bank
MOTF	Ministry of Treasury and Finance
OHS	Occupational Health and Safety
PAP	Project-affected People
PDS	Project Delivery Strategy
PIR	Directive on Procurement Instructions for Recipients
PIU	Project Implementation Unit
POM	Project Operations Manual
PP	Procurement Plan
PPM	Project-affected People's Mechanism
PPP	Policy on Prohibited Practices
RMF	Results Monitoring Framework
SEA	Sexual Exploitation and Abuse
SH	Sexual Harassment
ToR	Terms of Reference
TCDD	Türkiye State Railways

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1. Executive Summary

1. The TCDD Railway Maintenance Modernization Project is a sovereign-backed loan of EUR350 million (approximately USD415 million) to the Republic of Türkiye. The total project cost is EUR535.7 million, including EUR185.7 million in government counterpart financing. The loan has a tenor of 15 years with a 5-year grace period and will be implemented from 2025 to 2030 by Türkiye State Railways (TCDD) through a dedicated Project Implementation Unit.

2. The Project aims to enhance the efficiency, safety, reliability, and sustainability of rail maintenance across Türkiye's 13,900-kilometer network by replacing outdated equipment and strengthening institutional capacity. It will finance the acquisition of 99 modern maintenance machines and provide training and certification for about 751 TCDD staff. The modernization will reduce machinery failures from 1.5 to 1.2 per month, cut maintenance-related delays from 100 to 95.27 minutes per 1,000 train-km, and lower the average fleet age from 25.5 to 23.6 years, while tripling the share of Stage V-compliant equipment.

3. The Project is Paris-aligned, with 88.67% (USD368 million) of AIIB financing qualifying as climate mitigation, expected to avoid around 21,648 tons of CO₂ emissions annually. It directly supports Türkiye's decarbonization and modal shift objectives under the 12th Development Plan (2024–2028) and the 2053 Transport and Logistics Master Plan.

4. Implementation readiness is ensured through a fully staffed PIU, supported by procurement and financial management consultants. Procurement will follow AIIB's Policy and Directive on Procurement Instructions for Recipients, using international competitive tendering. A Project Operations Manual will guide financial management, monitoring, and environmental and social compliance, supported by AIIB's supervision missions.

5. Environmental and social risks are classified as Category B, limited mainly to machinery transport and installation. A simplified Environmental and Social Management Plan (ESMP) consolidates TCDD's existing ISO-certified systems on environmental management, occupational health and safety, and grievance redress.

6. The Project aligns with AIIB's priorities on Green Infrastructure, Connectivity and Regional Cooperation, and Technology-enabled Infrastructure, and the Transport Sector Strategy. It complements AIIB's ongoing rail operations in Türkiye and the Middle Corridor, reinforcing Türkiye's role as a key logistics hub linking Europe and Asia.

Project No. and Name	P000951 TCDD Railway Maintenance Modernization Project		
AIIB Member	Türkiye		
Borrower	Republic of Türkiye		
Guarantor	Republic of Türkiye		
Project Implementation Entity	Ministry of Transport and Infrastructure, Türkiye; Turkish State Railways		
Proposed Amount of AIIB Financing (USDm)	USD415.00	Instrument type (Instrument subtype)	Loan (Direct Sovereign)
		Currency of financing requested	Euro
Sector (Subsector)	Transport (Rail transport)	E&S Category and Comments (if any)	B
Project Objective	To enhance efficiency, safety, reliability and sustainability of rail infrastructure maintenance across Türkiye.		
Project Description	<p>The Project will modernize Türkiye State Railways' (TCDD) maintenance capacity through the procurement and overhaul of 99 specialized machines, replacing an obsolete fleet where more than 60% are over 40 years old. Covering the 13,919 km national network of high-speed and conventional lines, the new fleet will include tamping and stabilizing machines, ballast regulators, catenary maintenance vehicles, diagnostic units, milling and grinding machines, and snow removal equipment. Modernized machinery will enhance safety, allow more frequent and precise inspections and reduce delays and disruptions in both freight and passenger services. The Project emphasizes sustainability by introducing Stage V emissions-compliant and energy-efficient machines, alongside eco-friendly maintenance practices. It will also provide targeted training for TCDD staff and strengthen institutional capacity for digital asset management, ensuring the long-term integration of new technologies and embedding modern maintenance protocols across TCDD's regional network.</p>		
Implementation Period	Start Date: December 01, 2025 End Date: December 31, 2030	Expected Loan Closing Date	December 31, 2030

Co-financing type	Standalone	Following other Financier's E&S Policy?	No
Lead financier		Following other Financier's Procurement Policy?	No
Financing Plan	Total: EUR535.7 million; AIIB: EUR350 million; GoT: EUR185.7 million.		
Policy Assurance	The Vice President, Policy and Strategy, confirms an overall assurance that the proposed Bank Financing complies with the applicable Bank operational policies.		

Risk	
Key Risks	Mitigation Measures
Insufficient or weak integration of ES measures into procurement and operational processes.	TCDD shall integrate ES requirements in technical specifications and procurement documents, ensure suppliers manage and report on ES risks, with AIIB providing support and oversight throughout the process.
Procurement of highly specialized maintenance machinery compromised by inadequate (incomplete or overly stringent) technical specifications.	AIIB engaged technical and procurement experts to review and refine TCDD's specifications and market research, ensuring tender documents are fit-for-purpose, aligned with international standards, and supported by measurable, testable parameters.
TCDD's limited experience with AIIB policies and practices across procurement, financial management, and environmental and	Targeted capacity building will be provided through the mobilization of specialized consultants and structured training for TCDD staff, supported and overseen by AIIB throughout Project implementation.

social safeguards may lead to implementation delays and compliance gaps.	
Economic Capital (ECap) Consumption	32.03USDm 8.78%

Strategic Alignment				
Alignment with AIIB's thematic priorities		Green infrastructure; Connectivity and Regional Cooperation; Technology-enabled Infrastructure		
Alignment with AIIB's strategies		Transport Sector Strategy		
Key Outcomes	Indicator	Unit of measure	Baseline (Year)	Target (Year)
Rail transport	Monthly average number of failures per maintenance machine	Number	1.50 (2025)	1.20 (2030)
Rail transport	Reduction in average age of machinery fleet	Years	25.48 (2025)	23.61 (2030)
Rail transport	Percentage of maintenance machinery meeting Stage V emissions standards	Percentage	9.6 (2025)	26.9 (2030)

Other Key Financing Requirements	
Conditions of Effectiveness	Project Operations Manual (POM) is furnished to the Bank's satisfaction.
Key Conditions for 1st Disbursement	NA
Key Covenants	All tender documents and contracts shall include Environmental and Social requirements consistent with national legislation and the AIIB Environmental and Social Framework, including Stage V emission standards and occupational health and safety provisions.

President	Liqun Jin
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Chief Investment Officer	Konstantin Limitovskiy
Director General	Xiaohong Yang
Project Team Leader	Natalia Sanz, Senior Investment Officer
Back-up Team Leader	Mohamed Sameh, Senior Investment Officer
Project Team Members	Cody Kho, Team Member Angel Frances Salcedo, SFD - Environment Specialist Dilfuza Kurolova, SFD - Social Development Specialist Bo Shi, SFD - Procurement Specialist Yogesh Malla, SFD - Financial Management Specialist Rafael Rashid, Climate Specialist Ebrima Ceesay, Project Counsel Jiaming Yu, Team Member

2. Context

2.1 Country and Macroeconomic Overview. Türkiye avoided a gross domestic product (GDP) contraction during the coronavirus disease (COVID-19) pandemic, expanding by 1.8% in 2020, one of the few countries globally to do so. Growth then accelerated to 11.8% in 2021 and 5.4% in 2022, supported by expansionary fiscal and credit policies. However, these measures also heightened inflationary pressures and exchange rate volatility, eroding reserve buffers and increasing corporate and banking sector vulnerabilities.

2.2 Following the May 2023 elections, the Government of Türkiye initiated a comprehensive stabilization program aimed at restoring macroeconomic balance. The program focused on monetary tightening, fiscal consolidation, and efforts to rebuild reserves and strengthen investor confidence. As a result, growth moderated to 3.3% in 2024, reflecting a transition toward more sustainable expansion. Inflation, which exceeded 80% in late 2022, declined to about 33% by September 2025, with one-year-ahead expectations near 22.3%. The current account deficit narrowed, external financing improved, and all three major credit rating agencies upgraded Türkiye's sovereign ratings in 2025: S&P to BB- in April, Moody's to Ba3 with a stable outlook in July, and Fitch affirmed BB- in July, reversing multiple downgrades between 2018 and 2022. Further details are available in Annex 4.

2.3 With the economy now rebalancing, Türkiye's medium-term outlook remains favorable. Growth is projected to stabilize around 3.5% in 2025 and gradually increase toward 4% as disinflation progresses and investor sentiment strengthens. Sustained policy discipline and continued structural reforms will be key to consolidating these gains and maintaining macroeconomic resilience.

2.4 Sector Overview. Türkiye's railway sector plays a vital role in the national transport and logistics system, supported by an extensive 13,919-kilometer network that includes both high-speed and conventional lines. The government has prioritized rail development in its 12th Development Plan and the 2053 Transport and Logistics Master Plan, positioning it as a key mode for improving logistics efficiency, reducing transport costs and advancing Türkiye's ambition to become a regional logistics hub. Türkiye's geographical position at the crossroads of Europe, Asia and the Middle East further reinforces its strategic role as a natural hub for international transit and logistics. Rail infrastructure also serves as a strategic function in enhancing connectivity between Europe and Asia, offering a lower-emission alternative to road transport and supporting Türkiye's climate and decarbonization goals. The government has articulated a clear ambition to become a regional transport hub through railways, supported by both domestic and international corridor projects. A major force of this strategy is the expansion of the high-speed rail network, with plans to grow from 2,600 kilometers (km) in 2025 to over 4,100 km by 2027. Flagship projects such as the Ankara–Izmir and Ankara–Istanbul super high-speed lines are expected to significantly reduce travel times and elevate the passenger experience. Complementing these domestic flagship projects, Türkiye is advancing large-scale initiatives such as the Eastern Türkiye Middle Corridor Railway Development Project (ETMIC), the Ispartakule-Cerkezkoý Railway Project and the forthcoming Istanbul North Rail Crossing Project (INRAIL), all financed by AIIB, which will further strengthen its contribution to the Middle Corridor linking Asia and Europe. In parallel, Türkiye is promoting the “Development Road” initiative to connect Iraq and the Gulf region to the Middle Corridor and the Mediterranean through Mersin Port, thereby consolidating its role

as a regional gateway, improving its international railway linkages and achieving the modal shift to green transportation.

2.5 However, the long-term success of these expansions depends not only on new construction but also on the strength of the underlying maintenance systems. Without reliable and modernized maintenance practices, even the most advanced infrastructure is vulnerable to operational bottlenecks, service disruptions and safety risks. Strengthening maintenance capacity, through upgraded equipment, digital asset management and institutional building, is therefore essential to ensuring the resilience, efficiency and sustainability of Türkiye's rail network.

2.6 Addressing Key Development Challenges and Project Contributions. Türkiye's railway sector faces structural and environmental challenges. Most freight transport in Türkiye today continues to move by road, resulting in higher costs, congestion and environmental pressures compared to rail. A significant portion of the maintenance fleet is outdated, with over 60% of machinery being over 40 years old, limiting the efficiency and reliability of maintenance activities. Rising train speeds, increased traffic volumes and the growing impacts of climate change, such as extreme temperatures, further strain the system. To achieve the targeted modal shift from road to rail, expanding infrastructure must be complemented by modern maintenance practices that ensure reliability, efficiency and competitiveness. In this context, railway maintenance has become a strategic priority, essential for strengthening operational resilience, modernizing infrastructure and supporting the broader goals of economic competitiveness and transport sector decarbonization.

2.7 The TCDD Railway Maintenance Modernization Project (the "Project") is designed to directly address key development challenges in Türkiye's railway sector by replacing outdated machinery, enhancing operational efficiency and building resilience against climate-related risks. By procuring modern, energy-efficient maintenance equipment and overhauling existing assets, the Project will reduce service disruptions, improve safety and enable more frequent and precise maintenance across the network. This will help mitigate the effects of aging infrastructure, rising traffic volumes and increased temperature stress on tracks. Additionally, by supporting institutional strengthening and exploring digital integration for maintenance planning, the Project contributes to long-term sustainability, aligns with decarbonization goals and enhances Türkiye's capacity to operate a modern, climate-resilient rail system that supports regional connectivity and logistics competitiveness. Beyond financing the procurement of equipment, AIIB's role is to help Türkiye achieve this transformation, embedding modern maintenance into sector practices and reinforcing its ambition to establish rail as a reliable and preferred alternative to road transport.

3. Rationale

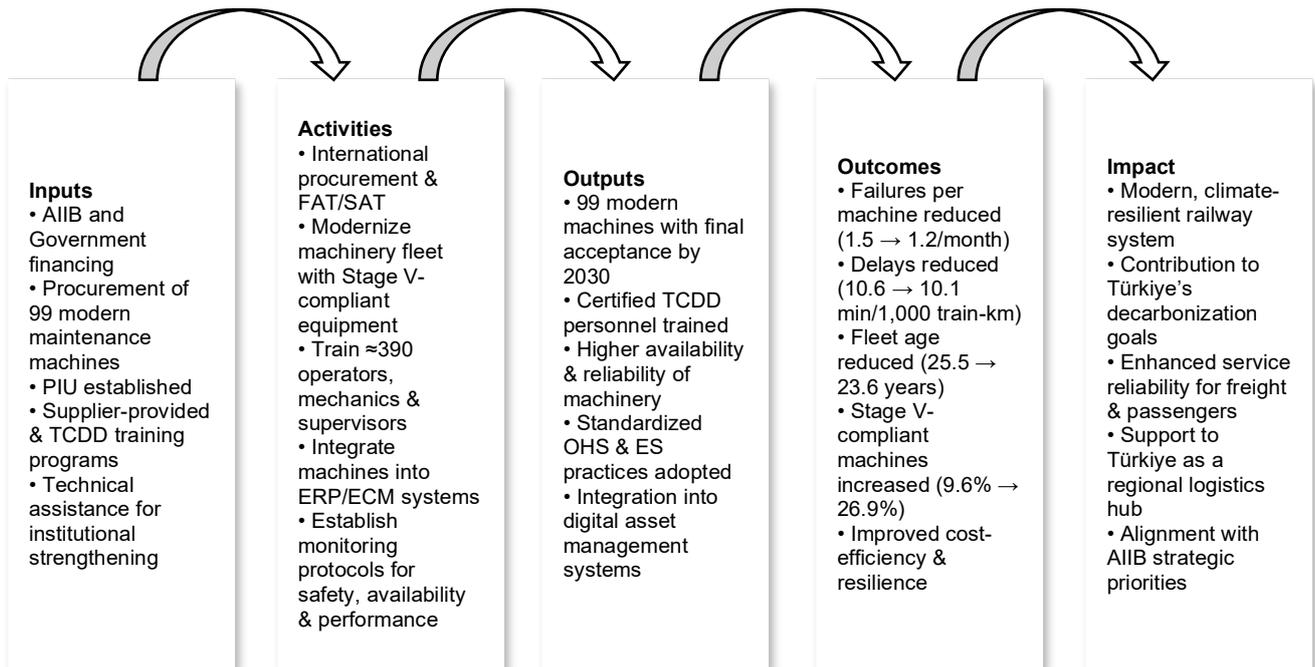
3.1 Project Objective. To enhance the efficiency, safety, reliability and sustainability of rail infrastructure maintenance across Türkiye.

3.2 Expected Beneficiaries. The Project is expected to generate broad-based benefits across Türkiye's transport sector. The primary beneficiaries will be rail users, including passengers and freight operators, who will experience enhanced safety, fewer delays and improved service reliability across the national railway network. The Project will also benefit regional economies by strengthening the reliability of key freight corridors, supporting Türkiye's strategic role as a regional logistics hub within the Middle Corridor. Indirect beneficiaries include Türkiye State Railways' (TCDD's) regional maintenance units, which will be equipped with modern machinery, improving operational capacity and reducing downtime.

3.3 Expected Results. The Project is expected to deliver measurable improvements in the efficiency, reliability and sustainability of Türkiye's rail maintenance system. By modernizing TCDD's rail maintenance fleet with 99 new units, the average age of the maintenance fleet will decrease from 25.5 to 23.6 years, while the share of machinery meeting Stage V emissions standards will nearly triple, supporting Türkiye's decarbonization commitments. Reliability of maintenance operations will improve, with the monthly average number of failures per machine projected to decline from 1.5 to 1.2, and maintenance-related delays will be reduced from 100 to 95.27 minutes per 1,000 train-km. The Project will also strengthen institutional capacity through the training and certification of 751 TCDD staff, including operators, mechanics and trainers, and ensure that all newly procured machines are integrated into TCDD's asset management system within three months of commissioning. Together, these results will enhance operational resilience, improve passenger and freight service reliability and reduce the environmental footprint of maintenance operations. Project objective and intermediate results indicators can be found in the Results Monitoring Framework (RMF) in Annex 1.

3.4 Theory of Change. Financing from AIIB and the Government of Türkiye, technical assistance and structured training programs coupled with procurement of 99 modern maintenance machines, will enable the modernization of an obsolete fleet and the establishment of a skilled operator base (Figure 1). These inputs will deliver outputs such as higher availability and reliability of machinery, improved safety standards and increased institutional capacity through digital asset management and certification systems. The outputs will in turn lead to outcomes, including reduced failures and delays, greater cost-efficiency in maintenance operations and alignment of the fleet with Stage V emissions standards. In the longer term, the Project contributes to the impact of a modern, climate-resilient railway system that enhances Türkiye's position as a regional logistics hub and supports its decarbonization and connectivity objectives in line with national plans and AIIB's strategic priorities.

Figure 1. Project's Theory of Change



FAT: Factory Acceptance Test, SAT: Site Acceptance Test.

3.5 Strategic Fit for AIIB. The Project is well aligned with AIIB's Corporate Strategy, as it contributes to the Bank's mission of Financing Infrastructure for Tomorrow by advancing sustainable, resilient and technology-enabled infrastructure in the transport sector. The Project supports AIIB's thematic priorities in three key areas: (a) it advances Green Infrastructure by replacing outdated maintenance equipment with modern equipment that meets stringent emission standards (Stage V engines), improving energy efficiency and reducing the environmental footprint of rail maintenance operations; (b) it supports Connectivity and Regional Cooperation by enhancing the reliability and capacity of Türkiye's rail network, a critical segment of the Middle Corridor, thereby reinforcing Türkiye's position as a regional logistics hub linking Europe and Asia and (c) it reflects AIIB's focus on Technology-enabled Infrastructure, by introducing modern maintenance machinery equipped with digital monitoring capabilities and ensuring their integration into TCDD's enterprise asset management systems, supporting predictive maintenance, improving data-driven decision-making, enhancing operational efficiency and moving TCDD from fragmented paper-based processes toward a fully digitalized maintenance environment.

3.6 The Project also aligns with AIIB's Transport Sector Strategy, which emphasizes developing safe, efficient and sustainable transport systems that promote economic and social development. By modernizing railway maintenance capacity, the Project strengthens network reliability and resilience, reduces service disruptions and improves safety, which are key objectives under the strategy. It also promotes the adoption of predictive maintenance practices and integration into ERP-based asset management, enhancing data-driven efficiency and lifecycle management. In doing so, the Project supports rail as a low-carbon mode of transport consistent with AIIB's commitment to climate action and contributes directly to Sustainable Development Goal (SDG) 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action).

3.7 Strategic Fit for Türkiye. The Project directly contributes to the objectives outlined in Türkiye's 12th Development Plan (2024–2028), which emphasizes strengthening transport infrastructure to drive economic growth and regional integration. Furthermore, it supports the goals of the 2053 Transport and Logistics Master Plan, which identifies rail as a strategic sector for transforming Türkiye into a global logistics hub. By improving maintenance operations and ensuring the availability and safety of rail services, the Project addresses key priorities in both strategic documents, supporting Türkiye's ambition to expand its rail network and enhance the competitiveness of its freight and passenger services.

3.8 The modernization of TCDD's maintenance fleet also serves as a direct enabler of Türkiye's broader strategic goals. By reducing maintenance-related disruptions and ensuring consistent service reliability, the Project facilitates the modal shift from road to rail identified in the 2053 Transport and Logistics Master Plan. Enhanced availability and efficiency of rail infrastructure lowers energy intensity per ton-km, supports greater use of electrified lines and contributes to Türkiye's decarbonization commitments. In addition, by underpinning the reliability of east–west freight corridors, the Project strengthens Türkiye's competitiveness under the Middle Corridor, ensuring uninterrupted transit flows and reinforcing its ambition to position itself as a regional logistics hub.

3.9 Paris Agreement Alignment (PAA) and Climate Finance. In accordance with the AIIB methodology for assessing alignment with the mitigation and adaptation goals of the Paris Agreement, the Project has been evaluated as aligned with both mitigation (BB1) and adaptation (BB2). The Project will count USD368 million or 88.67% of the Bank's finance toward climate finance after discounting for network-wide fossil fuel transport.

3.10 With regards to climate mitigation risks (BB1), the Bank's financing will be allocated to the acquisition of railway maintenance rolling stock, which will directly enhance the capacity, performance and long-term sustainability of railway infrastructure in Türkiye, enhancing modal shift away from other high emitting transport sectors such as road transportation for passenger and freight transportation. The Project is therefore considered to be aligned with BB1. With regards to physical climate risks (BB2), mobile vehicles and fleets are not considered to be at material physical climate risks due to their mobile nature. As such, the Project is also aligned with BB2.

3.11 Regarding climate finance, the Bank's use of proceeds will be directed toward railway machinery that improves the performance and supports a green mode of transportation. The Project will therefore count USD368 million or 88.67% of the Bank's finance toward climate mitigation finance.

3.12 Value Addition by AIIB. Beyond the provision of financing, AIIB brings technical and financial expertise, as well as knowledge of the railway sector in Türkiye,¹ that will enhance project planning, risk management and cost optimization for TCDD. The Bank's focus on sustainable practices will guide the adoption of green standards, such as emissions controls and energy-efficient machinery, aligning with both Türkiye's and AIIB's environmental and climate goals, supporting long-term sustainability in rail infrastructure. AIIB's engagement will help embed a modern maintenance approach into Türkiye's railway sector, ensuring that the

¹ For the railway sector in Türkiye, AIIB has approved the financing of [Ispartakule-Cerkezkooy Railway Project](#) and [Eastern Türkiye Middle Corridor Railway Development Project \(ETMIC\)](#) and is preparing the Istanbul North Rail Crossing Project (INRAIL).

rapidly expanding international railway networks become a reliable, efficient and preferable alternative to road transport, directly reinforcing its role as a regional hub within the Middle Corridor. AIIB also provides an opportunity for TCDD to familiarize itself with the rules, standards and best practices of multilateral development banks (MDBs), building capacity for future collaborations. This is the first MDB-financed operation with TCDD focused predominantly on maintenance machinery modernization (rather than rolling stock or construction). By doing so, AIIB fills a strategic gap by ensuring that Türkiye builds not only new lines or rolling stock, but also the core maintenance capacity (machines, systems and skills) needed for reliability, efficiency and preservation of the rail network's value.

3.13 Value Addition to AIIB. Unlike AIIB's previous railway construction and rehabilitation-focused projects in Türkiye, this Project emphasizes maintenance, granting the Bank valuable insight into the broader railway sector and enhancing its understanding of both operational and developmental needs. Additionally, expanding AIIB's portfolio in Türkiye's transport sector enhances the Bank's credibility and experience in the region. By promoting advanced, sustainable technology in maintenance processes, AIIB demonstrates its commitment to innovative, technology-driven and environmentally responsible solutions in infrastructure projects, reinforcing its focus on sustainability.

3.14 Lessons Learned. Lessons learned from railway AIIB-financed projects in Türkiye,² and past railway projects with TCDD financed by the European Investment Bank (EIB) and the Islamic Development Bank (IsDB),³ as well as from the Project team's own expertise in designing and supervising similar MDB operations, have been incorporated into the Project design to enhance implementation effectiveness and long-term sustainability. These include:

- (a) Technological Compatibility and Training: Prior TCDD projects revealed that without ensuring equipment compatibility and investing in user training, performance and durability may fall short. This Project ensures machinery is aligned with TCDD's infrastructure and operational standards and includes structured operator training.
- (b) Environmental and Social (ES) Management: Earlier rehabilitation projects showed that delays and overruns can stem from ES risks and weak Occupational Health and Safety (OHS) frameworks. To mitigate these, ES and OHS standards are embedded from the start, with strong procurement standards and monitoring.
- (c) Data and Monitoring Systems: Lessons from high-speed train equipment procurements highlight the benefits of integrated digital asset monitoring. Without it, maintenance becomes reactive rather than preventive. This Project mandates integration of new machines into TCDD's Enterprise Resource Planning (ERP) system for real-time performance tracking.
- (d) Safety and Occupational Health: Safety risks increase if new machinery is not paired with strong OHS training. This Project requires supplier-backed safety training, operator certification and compliance with ISO 45001.

² [Ispartakule-Cerkezkov Railway Project](#) and [Eastern Türkiye Middle Corridor Railway Development Project \(ETMIC\)](#).

³ [Ankara-Konya High Speed Railway Line Project](#) (IsDB), where tools, test equipment, facilities and multi-year maintenance/repair and cleaning services were part of the deliverables; [High-Speed Train Sets Project](#) (IsDB), which financed the purchase of rolling stock for TCDD, together with training and maintenance arrangements and [Irmak-Karabük-Zonguldak Railway Rehabilitation and Signalisation Project](#) (EIB), which involved track rehabilitation, signalization, permanent way works and upgrades to signaling/telecommunications.

4. Project Description

4.1 Components

4.1.1 **Component A: Maintenance Machinery Acquisition (Total EUR534.5 million; AIIB EUR349 million).** This component will finance the procurement of 99 modern railway maintenance machines to replace outdated equipment, reduce failures and service disruptions and enhance the efficiency and safety of maintenance operations. The new machines include tamping, stabilizing, grinding, milling, catenary, inspection, spraying and support vehicles, which together will modernize TCDD's maintenance fleet and strengthen its capacity to maintain both conventional and high-speed rail lines. The Project scope covers procurement and installation of the new machinery only; it does not extend to machinery operations, which will remain the sole responsibility of TCDD. The machinery to be financed under this component can be grouped under the following functions:

- (a) Inspection and Monitoring: These machines will assess the condition of the tracks and surrounding structures to detect early signs of wear or faults, helping to prevent accidents and reduce service interruptions.
- (b) Track Maintenance and Stabilization: To be used to realign, compact and clean the track structure, these machines will ensure smooth, safe train movement and extend the life of the railway infrastructure.
- (c) Electrification and Signal Maintenance: Specialized vehicles will maintain overhead power lines and signaling systems, ensuring reliable train operations, especially critical for electrified and high-speed lines.
- (d) General Support and Emergency Response: Mobile units will provide on-site repairs, transport personnel and equipment and carry out auxiliary tasks like weed control and inspections, enabling quick responses and efficient maintenance logistics.

4.1.2 **Component B: Institutional Capacity Strengthening (Total EUR1.2 million; AIIB EUR1 million).** This component will support consultancy services and technical assistance to strengthen TCDD's institutional capacity. Activities will include support for the Project Implementation Unit (PIU), training for operators and staff and specialized advisory services. The training program will specifically cover: (a) the safe and efficient operation of the 99 new maintenance machines and (b) routine maintenance and lifecycle management practices to ensure long-term sustainability of the fleet. Training will be delivered through supplier-provided modules, complemented by TCDD's in-house programs and integrated into the institutional training framework to embed modern maintenance protocols across the organization. This component will also provide flexibility for TCDD to engage independent technical consultants on-demand, for factory supervision, conformity assessments or site/study visits during machinery production.

4.2 Cost and Financing Plan

Item	Project Cost (EUR million)	Financing (EUR million and %)	
		AIB	Government of Türkiye
Component A. Maintenance Machinery Acquisition	534.5	349.0 (65.3%)	185.5 (34.7%)
Component B. Institutional Capacity Strengthening	1.2	1.0 (85.7%)	0.2 (14.3%)
Total	535.7	350.0 (65.3%)	185.7 (34.7%)

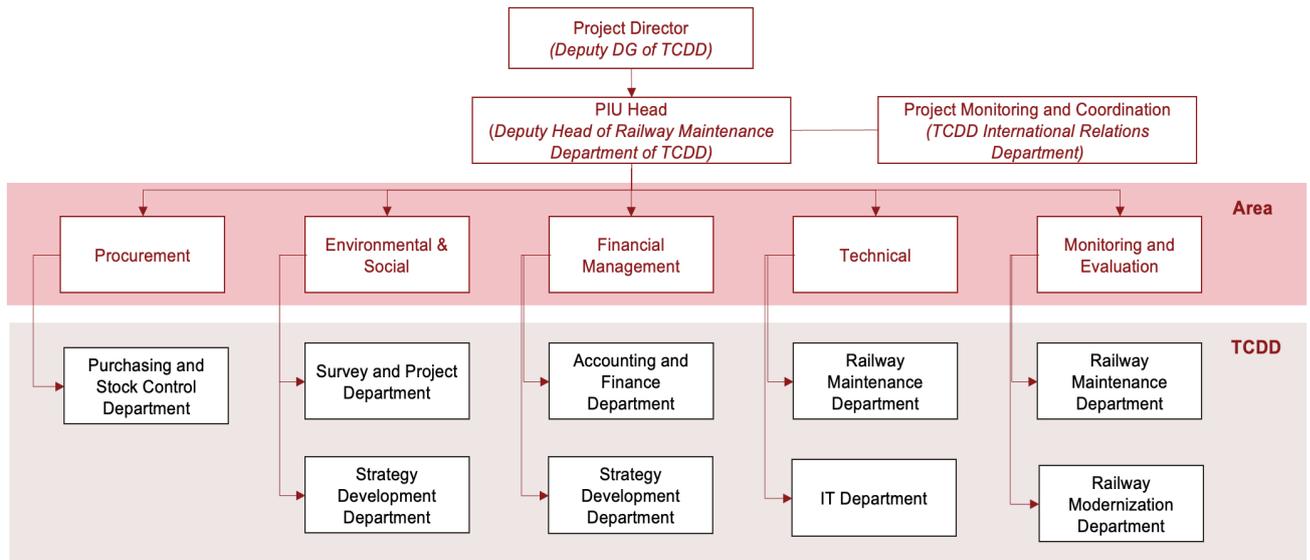
* Exclusive of taxes. Taxes will be fully covered with local resources.

4.3 Implementation Arrangements and Readiness

4.3.1 Implementation Arrangements.

- (a) **Project Implementation Entity:** TCDD will serve as the Project Implementing Entity (PIE) for the Project, operating through its central offices in Ankara. TCDD was established in 1927 under Law No. 1042 as a state economic enterprise. Operating under the Ministry of Transport and Infrastructure, it is responsible for the development, operation and maintenance of the national railway infrastructure. Its mandate is defined by laws governing state-owned enterprises, with restructuring in 2013 confirming its role as infrastructure manager. While TCDD is the PIE, the borrowing authority rests with the Ministry of Treasury and Finance (MOTF), which signs and channels external financing on its behalf.
- (b) **Project Implementation Unit:** TCDD has established a dedicated PIU to coordinate project preparation and manage day-to-day implementation activities, including procurement, supervision, monitoring and reporting. The PIU is composed of staff from multiple TCDD departments, as illustrated in Figure 2, with focal points established for each area. As this is TCDD's first AIB-financed Project, close coordination, regular oversight and targeted training will be essential to ensure alignment with AIB's policies and procedures throughout both preparation and implementation phases.

Figure 2. TCDD PIU Chart



- (c) **Procurement Arrangements:** Procurement of Goods, Works, Non-consulting Services and Consulting Services financed in whole or in part by AIIB shall be conducted in accordance with (1) AIIB's Procurement Policy (June 26, 2024), (2) Directive on Procurement Instructions for Recipients (PIR, July 26, 2024) and (3) the provisions stipulated in the Loan Agreement. Given that TCDD is a Public Entity as per the definition in AIIB's Procurement Policy, the specific provisions regarding Procurement by Public Entities in AIIB's Procurement Policy and PIR shall apply.

TCDD will implement all Project procurement activities, from planning, design and tendering to contract award and supervision. A dedicated PIU has been established within TCDD, involving relevant departments.

A Project Delivery Strategy (PDS), including a Procurement Plan (PP), has been prepared by TCDD and reviewed by the Bank. The PDS analyzes the Project's operational context, TCDD's institutional capacity and resources and the market conditions of maintenance machinery and sets out fit-for-purpose procurement approaches. Building on the comprehensive market research and analysis, the PDS proposes seven goods contracts structured by machine type, to be procured through International Open Competitive Tendering using the lowest evaluated cost (one-envelope) method. This approach reflects both the availability of machinery in the market and the production capacity of potential suppliers. The PDS will be updated regularly to reflect any changes, including updates arising from continued market engagement. All revisions to the PDS will be subject to the Bank's prior review and approval.

Advance Procurement and Retroactive Financing will be permitted, with retroactive financing capped at 20% of the loan amount and limited to eligible expenditures incurred up to 12 months prior to the Loan Agreement signing date. Any activities considered for retroactive financing shall be procured in accordance with the Bank's Procurement Policy and PIR. For the procurement of goods under International

Open Competitive Tendering, domestic preference may be applied during tender evaluation.

All procurement transactions between TCDD and the Bank will be managed through AIIB's Project Procurement Management System (PPMS).

- (d) **Financial Management (FM) Arrangements:** TCDD will have overall responsibility for the Project's FM. A dedicated PIU has been established within TCDD, supported by qualified staff from TCDD's Finance Department. The finance function will be additionally supported by an FM Consultant to be hired by TCDD in agreement with AIIB. The Finance Department will handle the Project budget preparation, maintain separate project accounting on a cash basis, manage funds flow and ensure timely financial reporting. The Project will follow TCDD's existing internal control processes and procedures, including internal audit. TCDD internal audit team will provide internal audit services for the Project activities and share the report with AIIB on a periodic basis on agreed Terms of Reference (ToR) with AIIB. The PIU will prepare and submit Interim Unaudited Financial Reports (IUFR) to AIIB within 45 days after the end of each financial semester. Annual audited Project financial statements, including the audit opinion and Management Letter, will be submitted to AIIB within six months from the end of each financial year.
- (e) **Project Operations Manual (POM):** A POM will be prepared by TCDD, in consultation and to the satisfaction of AIIB, and will be a condition for the loan effectiveness. The POM will serve as a comprehensive implementation guide for the Project, outlining procedures and responsibilities for planning, procurement, execution and monitoring of Project components. It will include fiduciary and environmental and social requirements and the application of AIIB's policies. The POM will define disbursement arrangements, reporting obligations and grievance redress mechanisms. It will include risk management procedures, monitoring and evaluation frameworks and oversight mechanisms tailored to the Project's scope.

4.3.2 **Implementation Period.** The implementation period for the Project is expected to be from December 2025 to December 2030, aligned with contract implementation and machinery delivery.

4.3.3 **Implementation Readiness.**

(a) Status of Feasibility Study: A Feasibility Study has been completed and updated by TCDD, detailing the technical, economic and operational rationale for the procurement and modernization of railway maintenance machinery. The study includes specifications for a wide range of equipment and outlines their alignment with Türkiye's expanding railway network and maintenance needs. Draft technical specifications for key machinery have also been prepared by TCDD in-house teams and have been reviewed by a technical expert engaged by AIIB to ensure they meet international standards and are suitable for inclusion in AIIB-financed procurement packages.

(b) Required Clearances/Approvals for Project Implementation: For the Loan Agreement to proceed to negotiation, the Project is required to be included in

TCDD’s Investment Program. In this regard, the 2025 Annual Investment Program, coordinated by the Strategy and Budget Office, confirms the inclusion of this Project, to be implemented by TCDD and with financing designated from external sources.

4.3.4 **Monitoring and Evaluation.** TCDD PIU will assume the primary responsibility for monitoring the Project's progress and performance, following the results indicators outlined in the RMF. Monitoring findings will be consolidated into progress reports to be submitted to AIIB (Table 2). The POM will define the specific monitoring responsibilities, coordination arrangements and reporting protocols, ensuring transparency and accountability throughout implementation.

Table 2. Reporting Requirements

No.	Report	Frequency
1	<p>Project Progress Reports including:</p> <ul style="list-style-type: none"> - Progress achieved by output as measured through the indicators' performance targets in the RMF. - Key implementation issues and solutions. - Updated implementation plan for the next six months. - <u>ES section</u>: staffing updates (employment type and gender composition) and training and certification programs for safe use of machinery, with attention to gender, inclusion, gender-based violence (GBV)/sexual exploitation and abuse (SEA)/sexual harassment (SH) and occupational health. Stakeholder engagement activities, grievances and incidents, actions taken for resolution and key findings and recommendations for future improvements. 	Semi-annual
2	<p>Interim Unaudited Project Financial Report including:</p> <ul style="list-style-type: none"> - Clear tracking of funds, their uses and financial progress received. - Breakdown of project expenditures by project activities and disbursements by sources of finance. - Identification of variances from the approved budget. - Key financial statements specific to the Project. 	Semi-annual
3	<p>Project’s Audited Financial Statements</p> <p>Annual project financial statements will be audited by the Board of the Treasury Controller (BoTC). The BoTC will conduct the Project audit based on International Standards on Auditing and in line with the agreed ToR with AIIB. The audit reports, including the audit opinion, audited project financial statements and Management Letter (letter on internal control weakness), will be provided to AIIB within six months after the end of each fiscal year. The audit reports excluding the Management Letter will be publicly disclosed by the client.</p>	Annual
4	<p>Project’s Completion Report</p> <p>The Project Completion Report evaluates a project’s full cycle, measuring how well it met objectives and its overall impact. It reviews timeline, budget and major design changes, as well as FM and ES safeguards. The report assesses sustainability, highlights key achievements, notes areas for improvement and captures lessons learned for future projects. Borrower feedback is included to provide insight into their experience and outcomes.</p>	End of Project

4.3.5 **Mid-term Review.** A mid-term review will be conducted once 50% of the loan amount has been disbursed, or within 2 years of loan effectiveness, whichever

comes earlier, with the objective of assessing implementation progress, evaluating the performance of TCDD's PIU and verifying alignment with AIIB's policies and operational requirements. The review will focus on the progress of the contracts, ES risk management, disbursement efficiency and overall monitoring of the Project's objectives. Lessons learned during the first implementation phase will inform any necessary adjustments to the POM and institutional arrangements for the remainder of the implementation period.

4.3.6 **AIIB's Implementation Support.** AIIB will conduct supervision and implementation support missions twice a year as well as periodic technical review visits to provide necessary implementation support at various project stages. In addition, AIIB will complement its supervision by mobilizing specialized consultants to ensure smooth execution of the procurement processes. A procurement consultant will support TCDD in preparing the standard bidding documents in line with AIIB's Procurement Policy, while a technical consultant will assist in reviewing technical specifications and ensuring alignment with international standards. These experts will provide hands-on guidance during the preparation of tender documents, workshops and bid evaluations, thereby reducing risks of delays, enhancing competition and securing fit-for-purpose maintenance machinery.

5. Project Assessment

A. Technical

5.1 Machinery Technical Specifications. TCDD has prepared draft technical specifications for the procurement of 99 maintenance machines as part of the Feasibility Study. These cover a broad range of equipment, including tamping machines, ballast regulators, stabilizers, switch tampers, rail grinding and milling machines, catenary maintenance vehicles and general support units. The documentation provides functional descriptions, performance requirements, such as minimum operating speeds and output capacities, and justifications linked to the age and obsolescence of the existing fleet. It reflects TCDD's operational experience and is generally well-structured, with a strong focus on compatibility with Türkiye's rail infrastructure.

5.2 A technical review assessed these specifications against international standards and market practices. The review found that while the specifications offer a solid operational basis, they are largely performance-driven and focus on current usage patterns, with limited reference to Stage V emissions compliance, digital interoperability or broader European standards. Further refinement, simplifying overly detailed provisions, clarifying safety and environmental requirements and introducing flexibility for specialized machines, will be undertaken with AIIB's technical consultant before tender. Additional details on the machine categories, design requirements and lessons from market feedback are provided in Annex 2.

5.3 Maintenance and Asset Management. TCDD operates under an Entity in Charge of Maintenance (ECM)⁴ framework with standardized procedures and forms for inspections, commissioning and decommissioning and corrective actions. For the new equipment financed under the Project, TCDD will integrate supplier manuals into its ECM system to ensure that all machinery is operated and maintained in accordance with international manufacturer standards. Building on this system, TCDD is now digitalizing asset management through an upgraded ERP platform.

5.4 Asset Management Digitalization. The ERP records the full lifecycle of each machine, from acquisition and registration to daily operation, preventive and corrective maintenance and eventual decommissioning. It links asset data with financial and operational modules, while personnel competence is supported through integration of training and licensing records. This digitalization covers:

- (a) Acquisition and Registration: New machines are recorded in the fixed asset and accounting system, with all technical specifications captured in the digital inventory.
- (b) Operation and Sustainability: Daily utilization, location and efficiency are tracked digitally, together with preventive maintenance schedules and corrective interventions.
- (c) Maintenance Management: Spare parts, consumables and service records are managed through ERP modules, ensuring accurate cost tracking and minimizing downtime.
- (d) Decommissioning: Assets at the end of their life cycle are formally retired from the system, with all data retained for institutional learning and audit purposes.

⁴ Entity in Charge of Maintenance (ECM) is an organization certified under European Union (EU) regulations to manage the maintenance of railway vehicles, responsible for ensuring that vehicles are safe to operate by establishing maintenance systems covering technical management, fleet maintenance planning, execution and quality assurance.

- (e) Personnel Competence and Training: Operator certifications, licenses and safety records are integrated, ensuring that only qualified staff manage and maintain railway equipment.

5.5 For this Project, digitalization will ensure that the newly procured maintenance machinery is fully embedded in TCDD's asset management system from day one, with reliable tracking of availability, maintenance history, costs and emissions compliance. It will also strengthen institutional capacity beyond this investment, supporting future AIB-financed railway projects in Türkiye through better risk management, long-term sustainability and operational efficiency, while creating a data-driven platform that enables benchmarking and performance monitoring across TCDD's entire fleet.

5.6 **Operational Sustainability.** TCDD's ability to ensure the long-term use and upkeep of the new maintenance machinery is supported by its established institutional structure, dedicated Railway Maintenance Department and sustained public financing for rail infrastructure. Operating costs, including staffing, fuel, spare parts and routine servicing, are covered through TCDD's annual budget allocations, which have historically provided stable funding for track maintenance and equipment operation. In addition, TCDD has adopted a formal policy framework that allows for the leasing of maintenance machinery to public institutions, SOEs and private contractors, subject to the condition that such rentals do not interfere with TCDD's own operational needs. Tariff schedules include rental, fuel and maintenance components, with revenues recorded under a dedicated accounting line and monitored through the BİM/MİM module.⁵ While leasing remains a secondary activity, it provides a supplementary revenue stream that enhances cost recovery and contributes to the financial sustainability of the fleet. Together, these arrangements provide a sound financial and institutional basis for lifecycle management of the new fleet.

5.7 **Deployment and Maintenance Network.** A deployment plan has been prepared to ensure balanced allocation of the new fleet across TCDD's nine Regional Directorates. Each region will operate a complete maintenance "set" (tamping machine, ballast regulator and dynamic stabilizer), while high-demand corridors such as Adana and Ankara (YHT) will receive additional tamping capacity. Specialized machines, including milling and grinding units, are assigned to regions with heavier freight traffic and tighter curves, where rail wear is most severe. Maintenance responsibilities are embedded in TCDD's existing institutional network of seven regional Mechanical Workshops for routine servicing, complemented by a central Factory Directorate in Ankara for heavy overhauls and revisions. This structure ensures that lifecycle management is anchored in existing institutions and capacities, enabling the fleet to be operated and maintained effectively throughout its service life. See Annex 2 for further details on deployment arrangements.

B. Economic and Financial Analysis

5.8 **Economic Analysis.** The Cost-Benefit Analysis (CBA) evaluates the economic viability of the Project over a 25-year lifecycle by comparing the with- and without-project scenarios. The principal economic benefits are: (a) fuel cost savings, (b) passenger time savings, (c) freight time savings and (d) reduction in greenhouse gas (GHG) emissions. The Project is assessed to be economically viable, with a projected economic internal rate of return (EIRR)

⁵ BİM/MİM (Bakım İş Makineleri) is TCDD's dedicated digital module for managing maintenance machinery, including registration, utilization, rentals, operator certification and integration with ERP/ECM systems.

of 26.7% and an economic net present value of USD746.1 million. The results remain robust under adverse conditions, including (a) a 20% increase in costs, (b) a 20% reduction in economic benefits and (c) a combined scenario of both 20% reduction economic benefits and a 20% increase in costs.

5.9 The modernization of TCDD’s maintenance equipment is expected to substantially improve the reliability and efficiency of track maintenance, enabling trains across all Regional Directorates to operate safely at higher average speeds. Annex 2 provides further details and summarizes the equipment allocations procured under the Project for each Directorate. These improvements are anticipated to indirectly increase the overall capacity of the railway network and shorten transport times for both passengers and freight. Furthermore, the Project is expected to reduce GHG emissions through the procurement of modern machinery designed with the EU Stage V emission standards and optimized for higher energy efficiency. Additional information is provided in Annex 3.

5.10 **Financial Analysis.** The maintenance equipment procured under the Project can also be deployed for railway construction and rehabilitation activities.⁶ Under its formal leasing policy, TCDD makes machinery available to EPC contractors engaged in railway expansion, as well as to municipalities and SOEs. Through these rental operations, TCDD generates incremental income from otherwise idle assets, while annual reporting requirements and integration with the BİM/MİM system provide oversight and transparency. Although leasing revenues are expected to remain modest compared to TCDD’s overall financial scale, they improve asset productivity and strengthen cost recovery mechanisms. TCDD remains primarily financed through budgetary support from the MOTF, which has consistently been sufficient to cover both operating and capital expenditures (Table 3). Given TCDD’s strategic role in the national transport system, fiscal transfers are expected to remain sustainable, with leasing revenues providing an additional buffer for long-term operational sustainability.

Table 3. TCDD Budget Allocation Summary

(in TRY million)	2018	2019	2020	2021	2022	2023
Revenue	881	1,183	1,196	1,617	3,858	5,336
Cost of sales	(2,337)	(2,831)	(3,122)	(3,754)	(7,155)	(11,843)
Operating expenses	(674)	(853)	(964)	(1,037)	(1,811)	(3,909)
Others	(2)	(3)	(3)	(4)	(9)	(4)
Net operating loss	(2,132)	(2,503)	(2,893)	(3,178)	(5,117)	(10,419)
Capital expenditure	(7,456)	(6,439)	(9,632)	(10,397)	(18,904)	(28,877)
Net funding requirement	(9,588)	(8,941)	(12,525)	(13,575)	(24,021)	(39,296)
Budget transfers and duties	9,736	10,606	12,709	17,089	31,165	53,576
Net surplus	149	1,665	184	3,514	7,144	14,280

*Source: MOTF

C. Fiduciary and Governance

5.11 **Procurement.** Detailed Project procurement capacity and risks assessment was conducted prior to appraisal stage. TCDD’s procurement capacity assessment demonstrates a strong institutional framework with some areas requiring targeted support. The main findings are as follows:

⁶ For example, a contractor working on a regional electrification package may lease a catenary maintenance vehicle, while a municipality upgrading tram lines may lease tamping or grinding machines.

- (a) TCDD has a clear system of accountability for procurement decisions taken by the Board of Directors, Director General and Deputy Director General through Delegation of Authority Orders published annually.
- (b) TCDD has extensive experience in procurement of railway maintenance machinery and other railway-related machines under the Turkish Public Procurement Law No. 4734 and has implemented five MDB-financed projects since 2005, one with the EIB and four with IsDB, including a high-speed train procurement project completed in 2023. This Project will mark TCDD's first engagement with AIIB.
- (c) Procurement processes are managed by qualified and experienced in-house staff through coordinated efforts across multiple departments.
- (d) TCDD maintains a robust record-keeping system with procurement and contract documents stored in both digital and hard copy formats. One notable gap identified is that most procurement staff lack familiarity with AIIB's procurement policy, processes and procedures and have limited proficiency in English, which require targeted capacity building.

5.12 While TCDD demonstrates strong procurement capacity to implement the Project, key project procurement risks were identified as follows: (a) relatively limited suppliers for some contracts were demonstrated in the Market Research Report submitted by TCDD, which may lead to potential high tender prices and (b) the use of overly stringent technical specifications may cause procurement-related complaints from potential tenderers, potentially resulting in delays of the procurement processes. The identified gap and risks will be addressed through the mitigation measures outlined in Table 4. The overall Project procurement risk level was assessed as Medium.

5.13 **Financial Management.** An FM assessment was carried out, which focused on TCDD's institutional capacity, staffing, planning/budgeting, funds flow, accounting, internal controls, reporting and audit arrangements. TCDD has prior experience implementing projects financed by international financial institutions (IFIs), including EIB, IsDB and the OPEC Fund. Based on the FM assessment, FM capacity is considered adequate and FM risk as "Medium."

5.14 **Staffing.** TCDD's Finance Department has adequate and qualified staff managing its activities. For this Project, TCDD will designate finance staff as key counterparts for FM, with overall responsibility for the Project's FM arrangements. To address the additional workload, TCDD will engage an FM Consultant to support the PIU's finance function. The consultant will be recruited based on terms of reference agreed with AIIB.

5.15 **Budgeting.** The Project will follow national planning and budgeting procedures and can only make expenditures up to the ceiling set in the National Investment Program. TCDD has included the Project in its multiyear investment program, with a planned allocation of about TRY24.76 billion, comprising external financing of TRY16.10 billion and government contribution of TRY8.66 billion. Government contribution will also cover 100% of the tax component. The FY2026 Project budget is under preparation and will be aligned with the PP.

5.16 **Accounting and reporting.** TCDD uses SAP for its entity-wide financial accounting and reporting. For Project financing, a separate budget is prepared and approved, with SAP allowing the segregation of project financial accounting and reporting from overall entity

transactions. TCDD will maintain records and ensure proper accounting of project funds on a cash basis. IUFRs will be prepared on a semester basis and submitted to AIIB within 45 days after the end of each reporting period. The format and content of the IUFRs will be agreed upon with TCDD and detailed in the POM.

5.17 Internal Controls and Internal Audit. TCDD's internal control framework is assessed as functioning effectively, supported by an independent internal audit unit composed of qualified staff reporting directly to senior management. The internal audit team operates in line with established methodologies and risk-based approaches. For the Project, the internal audit team will provide audit services covering project activities and share reports with AIIB periodically, in accordance with the ToR agreed with the Bank.

5.18 External Audit. TCDD has shared its audited entity financial statements for the last three years with AIIB and the Bank's review confirmed that the audits have been of acceptable quality and submitted on time. The statements reflect accumulated losses, which continue to be managed through regular capital injections from the National Government. For the Project, annual financial statements will be audited by the Board of Treasury Controllers in line with acceptable auditing standards. The audited Project financial statements, together with the audit opinion and Management Letter, will be submitted to AIIB within six months after the end of each fiscal year.

5.19 Funds Flow and Disbursement Arrangements. Disbursements under the loan will follow AIIB's standard disbursement methods: (a) advances to a Designated Account (DA) based on Statements of Expenditure (SOE), (b) reimbursement of eligible expenditures and (c) direct payments to suppliers or contractors. For payments in local currency, TCDD shall use advance method of disbursements. The Government's contribution, including taxes (value-added tax), will be provided by the MOTF to TCDD to enable payments to contractors. The Disbursement Letter will specify detailed arrangements, including authorized signatories, DA ceiling and minimum application thresholds.

5.20 Governance and Anti-corruption. AIIB is committed to preventing fraud and corruption in the projects it finances and places the highest priority on ensuring that such projects are implemented in compliance with its Policy on Prohibited Practices (PPP, 2016). Accordingly, AIIB's PPP applies to the Project. The work related to tender document preparation, tender/proposal evaluation and contract award and execution under the financing will be closely monitored by AIIB staff and consultants during Project implementation. AIIB reserves the right to investigate, directly or indirectly through its agents, any Prohibited Practices as defined in the PPP in relation to the Project and to take necessary measures to prevent and redress any issues in a timely manner, as appropriate.

5.21 Cybersecurity: Cybersecurity is an integral consideration in the digitalization of TCDD's asset management and maintenance systems. Building on its ISO/IEC 27001 certification on information security, TCDD applies internationally recognized standards for identifying risks, protecting digital assets and ensuring the confidentiality, integrity and availability of information. This certification strengthens TCDD's institutional capacity to manage sensitive maintenance data, safeguard operator and system records and establish controls to respond to evolving cyber threats. As systems transition from manual to automated processes and become increasingly integrated with centralized platforms, ISO/IEC 27001 provides a

structured framework for governance, continuous monitoring and improvement of digital resilience. The Project will align with these institutional practices, reinforcing TCDD's broader modernization agenda and contributing to safer and more reliable railway operations.

D. Environmental and Social

5.22 Environmental and Social Policy and Categorization. AIIB's Environmental and Social Policy (ESP), including the Environmental and Social Standards (ESSs) and the Environmental and Social Exclusion List (ESEL), applies to this Project. The Project assignment is classified as Category B considering the possible Environmental and Social (ES) risks due to the transportation process of 99 pieces of machinery from different locations, global suppliers using various transportation means, installation at the TCDD's existing workshops and the Project's readiness for the safe use of machinery during its operation. The Project is advanced with the use of modern equipment that meets stringent emission standards (Stage V engines) and efficient use of energy, therefore reducing the carbon footprint. Overall, ES impacts can be managed through operational best practice, in accordance with ESS1 (Environmental and Social Assessment and Management) requirements. There is no land acquisition or resettlement foreseen within the Project activities and Project actions are related to procurement of machinery only; therefore, ESS2 and ESS3 are not triggered.

5.23 Environmental and Social Instruments. TCDD's existing Environmental Management System (EMS) places greater emphasis on environmental aspects, with more limited coverage of social dimensions. To address this, the Project PIU has prepared a simplified Environmental and Social Management Plan (ESMP) that consolidates all available ES documents e.g., TCDD's existing management systems, such as the corporate-level EMS, OHS procedures and stakeholder engagement practices. The ESMP also addresses identified gaps in social coverage, including the integration of TCDD's internal grievance redress mechanism (GRM) for application under the Project.

5.24 During project implementation, including procurement, transport, installation and acceptance of machinery, the suppliers will be responsible for the transportation of the machinery. However, TCDD must ensure that (a) suppliers comply with all relevant ES and OHS requirements during transport and (b) any incident or accident related to the Project that has, or is likely to have, a significant adverse impact on the environment, communities, the public or workers (including OHS accidents or events affecting community health and safety), is promptly reported to TCDD. To ensure compliance, specific provisions will be included in the tender documents. For the operation phase, which is outside the Project scope, TCDD will continue to apply its ISO 14001-certified EMS.

5.25 The Project will be supported by a dedicated team comprising three TCDD departments: (a) Strategy Development, (b) Support Services and (c) Survey and Projects. These teams will maintain regular communication with suppliers on transportation arrangements, verify compliance with local environmental and safety regulations and oversee the implementation of required measures during transport and the safe use of machinery. TCDD has disclosed a simplified ESMP in English, referencing existing standard operating procedures (SOPs), ISO certifications and TCDD regulations, together with a full or summary Turkish translation on its

official website to ensure accessibility. The same documentation has also been disclosed on AIIB's website.

5.26 Environmental Aspects. The environmental impacts for the Project are expected to be temporary and localized, mainly during the transport and delivery of machinery by suppliers and installation at assigned maintenance workshops. Potential impacts include air pollution and noise, generation of solid and hazardous waste (such as packaging materials and obsolete machinery components) and possible leaks or spills from machinery transport vehicles.

5.27 Social Aspects. Social risks under the Project are considered limited, as the scope is confined to machinery procurement and does not involve construction works, land acquisition, resettlement or impacts on Indigenous Peoples. The main risks relate to potential labor violations within the supply chain during production and transport of machinery (by sea, road or rail) and to labor and working conditions for TCDD staff and contractors operating the new equipment. Operations and maintenance of the new machinery will require additional employees, to be met through a mix of new recruits and re-training of existing staff. Suppliers will provide equipment-specific training and certification, while TCDD will deliver ongoing mandatory training on OHS, GBV and SH in the workplace and other topics as needed (paragraph 4.34). These trainings are mandatory for all staff operating the newly procured machinery. Employment will follow national civil service regulations, including TCDD's legal obligation to meet the 4% quota for people with disabilities, supported by outreach through ISKUR. However, given the technical requirements for operating the machinery, employment of people with disabilities in these roles is expected to be limited. TCDD's Code of Conduct prohibits discrimination and addresses reputational risks and all training programs will be delivered inclusively, with particular attention to women's participation.

5.28 Occupational Health and Safety, Labor and Employment Conditions. Procurement of the new machinery will require the recruitment of additional personnel, including operators, maintenance workers, technical staff and engineers. Staffing needs will be met partly through new hires, all employed as civil servants, with an estimated 230 operators required. New operators will undergo two to three months of training on railway operational conditions, including train traffic, signaling, working at height and motor/electric/hydraulic systems, followed by specialized, machine-specific training (e.g., safe handling and emergency procedures). This training will be delivered by suppliers, through internships with experienced operators or at the designated training center and will culminate in certification with an operator's competency certificate. OHS training will be conducted internally by TCDD under its existing OHS Management System (OHSMS), certified under ISO 45001. This system is aligned with international standards to prevent accidents and injuries and includes the provision of appropriate personal protective equipment and other mandatory trainings.

5.29 Stakeholder Engagement, Consultation and Information Disclosure. Given the broad scope of the Project, stakeholder engagement involves a wide range of actors. TCDD has identified key stakeholders including the MOTF, Presidential Strategy and Budget Office, International Finance Corporation, General Directorate of TCDD, Railway Maintenance Department and its subdivisions and other relevant departments. While the Project's main activity, procurement of machinery, limits direct engagement, the associated processes of transportation and installation extend the range of stakeholders to include private sector

suppliers, international institutions, directly affected communities, commuters and the general public. Interaction with these stakeholders will be managed through the project-specific ESMP.

5.30 Project Grievance Redress Mechanism. The existing TCDD GRM will apply to this Project, ensuring that project-affected people (PAP) have access to a fair review of their cases and legal remedies. The GRM protects PAP, communities and workers from potential damages or violations, including gender-related issues, and handles such matters in a gender-sensitive manner. TCDD operates two GRM channels: (a) CIMER (<https://www.cimer.gov.tr/>), the government-led national system and (b) TCDD's internal system, both aligned with AIIB ESP requirements. The GRM process includes the Director General's approval and referral to the Auditing Board, which is mandated to conduct investigations. In line with national law on the protection of women from violence, any gender-sensitive complaints are processed through the national system, which involves the office of the public prosecutor. For this Project, both existing GRMs will be used, with the addition of a tagging system to distinguish Project-specific grievances from general complaints.

5.31 Bank's Project-Affected People's Mechanism (PPM). AIIB's Policy on the PPM will apply to the Project. AIIB established the PPM to provide an opportunity for an independent and impartial review of submissions from PAP who believe they have been or are likely to be adversely affected by AIIB's failure to implement its ESP in situations when their concerns cannot be addressed satisfactorily through the project-level GRM or the processes of AIIB's management. For information on AIIB's PPM, please visit <https://www.aiib.org/en/about-aiib/who-we-are/project-affected-peoples-mechanism/how-we-assist-you/index.html>. The availability of the PPM has been disclosed along with the ES instruments on the TCDD website and the provision is reflected in the project-specific ESMP.

5.32 Monitoring and Supervision Arrangements. A separate ES monitoring report will not be required; instead, ES updates will be integrated into the semi-annual Project Progress Reports. These updates will include: (a) progress on machinery specifications and acceptance by TCDD; (b) employment data, including type and gender composition; (c) training and certification activities related to safe transport and use of machinery (covering external and in-house training, content, selection process, gender and inclusion and GBV/SEA/SH and OHS modules); (d) stakeholder engagement activities, both external and internal; (e) grievances received (external and internal) and actions taken; (f) incident reports and follow-up measures and (g) key findings and recommendations for improvement. Further details will be provided in the POM. The Bank will conduct regular ES supervision missions during implementation— at least once a year, or more frequently depending on progress and Project complexity.

E. Climate Change

5.33 Climate Change. Investing in modern railway maintenance equipment contributes to the reduction of carbon emissions by enhancing trains' operational efficiency, reducing fuel and energy consumption. Well-maintained tracks and rolling stock extend the lifespan of assets, decreasing the frequency of resource-intensive manufacturing and replacement. Furthermore, when railway tracks are not maintained adequately, speeds may decrease significantly, which may lead to reduced volumes of freight and passengers transported. These volumes then risk reverting back to less efficient and higher emitting transport modes such as cars and trucks. Additionally, modern maintenance technologies can support the transition to

electrified rail, further cutting emissions and promoting environmental sustainability. In terms of climate alignment, the Project qualifies under BB1 (climate mitigation) by financing machinery that complies with Stage V emission standards which contributing to emission reductions and improved environmental performance. For BB2 (physical climate risks), the Project is also aligned, as the mobile nature of the maintenance fleet minimizes exposure to site-specific climate hazards, reducing vulnerability to physical climate impacts.

F. Gender Aspects

5.34 **Gender Aspects.** TCDD has a policy framework that allows adjusted employment arrangements for women and those in need of special support, consistent with national law and aligned with the company’s strategies. TCDD also implements mandatory trainings, where GBV/SH issues are not delivered as a separate module but are explicitly addressed in sessions with female participation. During the Environmental and Social Due Diligence (ESDD), it was noted that, although the company has a strategy to increase women’s participation in what remains a male-dominated sector, 93% of TCDD’s workforce was male as of March 2025. At the same time, the operation of heavy maintenance machinery requires prolonged deployment periods of at least 100 days and shared accommodation in confined spaces (up to four workers per room), which, given prevailing social norms in Türkiye, limits the likelihood of women being engaged in such roles. For this reason, female participation in the operation of newly procured machinery is expected to remain limited, though women are encouraged and welcomed to participate in related training programs.

5.35 Beyond direct operation of machinery, women already contribute meaningfully to TCDD’s maintenance functions in roles that do not require extended on-site deployment. Female staff are active in engineering design, planning, quality control and asset management.

G. Risks and Mitigants

5.36 Table 4 presents a summary of Project risks and mitigating measures.

Table 4. Summary of Risks and Mitigating Measures

Risk Description	Assessment (H/M/L)	Mitigation Measures
Program/Project Preparation Risks		
Technical specifications		
<ul style="list-style-type: none"> ▪ Procurement of highly specialized maintenance machinery compromised by incomplete or overly generic technical specifications. 	M	<ul style="list-style-type: none"> ▪ AIIB engaged a qualified technical consultant with extensive experience with railway maintenance equipment and knowledge of TCDD maintenance practice to review and finalize the technical specifications in close coordination with TCDD’s engineering teams, ensuring specifications are fit-for-purpose and aligned with international standards. ▪ AIIB has identified an international procurement specialist with extensive experience in procurement of railway components to support the technical

Risk Description	Assessment (H/M/L)	Mitigation Measures
		<p>specialist in reviewing the tender documents. This work will be carried out in close coordination with TCDD's engineering teams to ensure the specifications are fit-for-purpose and aligned with international standards.</p> <ul style="list-style-type: none"> ▪ Market research has been conducted by TCDD and is currently being reviewed and refined by the technical consultant mobilized by AIIB. The objective is to validate the market structure, assess supplier capabilities and enhance the procurement procedures and technical specifications accordingly. ▪ The technical and procurement consultants mobilized by AIIB will stress-test the specification to ensure the required technical parameters are measurable, testable and not unnecessarily restrictive.
Program/Project Implementation Risks		
Implementation capacity		
<ul style="list-style-type: none"> ▪ Project may face delays or inefficiencies due to limited capacity within TCDD to manage procurement, contract administration, FM and coordination across multiple departments. 	M	<ul style="list-style-type: none"> ▪ A dedicated and adequately staffed PIU has been established within TCDD, with clearly defined roles, including focal points for procurement, FM, ES safeguards and monitoring. Individual consultants will be hired to further enhance the capacity of the FM and procurement functions. Targeted training has started and will continue to be provided to ensure effective project delivery.
Financial management		
<ul style="list-style-type: none"> ▪ Delay or inadequate budget. ▪ Delay in timely availability of counterpart funds. ▪ New to AIIB FM and Disbursement procedures. 	M	<ul style="list-style-type: none"> ▪ TCDD will ensure that the Project budget is aligned with the annual procurement plan and the provisions of the Financing Agreement and will coordinate with the MOTF for timely processing and approval. ▪ TCDD will coordinate with MOTF to ensure the timely release of counterpart funds. ▪ TCDD will engage an FM Consultant, recruited on the basis of terms of reference agreed with AIIB, to support the PIU's finance function. ▪ AIIB will provide capacity building and training to strengthen the TCDD finance team's ability to manage Project-related financial activities.
Procurement of large and complex packages		
<ul style="list-style-type: none"> ▪ TCDD's first project with AIIB and procurement staff lack familiarity with AIIB's procurement policy, processes and procedures and have 	M	<ul style="list-style-type: none"> ▪ TCDD to hire an individual procurement consultant with experience in MDB operational procurement using its own resources to support the Project procurement. AIIB will continue to provide

Risk Description	Assessment (H/M/L)	Mitigation Measures
<p>limited proficiency in English.</p> <ul style="list-style-type: none"> ▪ Relatively limited suppliers for some contracts were demonstrated in the Market Research Report submitted by TCDD, which may lead to potential high tender prices. ▪ The use of overly stringent technical specifications may cause procurement-related complaints from potential tenderers, potentially resulting in delays to the procurement processes. 		<p>procurement assistance and fiduciary oversight during the entire Project cycle.</p> <ul style="list-style-type: none"> ▪ Market research has been conducted by TCDD and is currently being reviewed and refined by the technical consultant mobilized by AIIB. The objective is to validate the market structure, assess supplier capabilities and enhance the procurement procedures and technical specifications accordingly. ▪ TCDD to develop clear and balanced technical specifications that promote fair and open international competition among all potential suppliers. They shall be reviewed and commented on by the technical consultant mobilized by AIIB for TCDD consideration.
Time and cost overrun		
<ul style="list-style-type: none"> ▪ Delays in procurement processes, supply chain constraints, or inadequate packaging of contracts may lead to project implementation delays and cost escalations. 	M	<ul style="list-style-type: none"> ▪ TCDD has conducted a thorough market research and analysis and has proposed the optimal procurement approach, including contract packaging and realistic cost estimates, with support of AIIB PT and mobilized technical and procurement consultants.
E&S risks and impacts during implementation		
<ul style="list-style-type: none"> ▪ Insufficient or weak integration of ES measures into procurement and operational processes may result in non-compliance with AIIB's ES Policy and delays in project execution. ▪ Health and safety of operators and maintenance workers. 	L	<ul style="list-style-type: none"> ▪ TCDD to integrate ES aspects in the technical specifications and procurement documents. ▪ TCDD to ensure suppliers will be able to manage ES risk and report accordingly with actions taken to TCDD. ▪ TCDD to ensure workers are properly trained with the safe use of machinery and TCDD's health and safety protocols.

Annex 1: Results Monitoring Framework

Project Objective (PO):		To enhance the efficiency, safety, reliability and sustainability of rail infrastructure maintenance across Türkiye.							
Indicator Name	Unit of measure	Base-line Data 2025	Cumulative Target Values				End Target 2030	Data Source / Methodology	Responsibility
			2026	2027	2028	2029			
Project Objective Indicators:									
1. Monthly average number of failures per maintenance machine	number	1.50	-	-	-	-	1.20	Number of maintenance tasks per vehicle per month.	TCDD
2. Reduction in superstructure delays time by train-km	minute/ 1000 train-km	100	-	-	-	-	95.27	Delays categorized under superstructure are those directly caused by maintenance, renewal, or defects affecting the physical track structure, which includes rails, sleepers, ballast and track geometry.	TCDD
3. Reduction in average age of machinery fleet	year	25.48	-	-	-	-	23.61	Weighted average age of machine fleet based on unit type.	TCDD
4. Percentage of maintenance machinery meeting Stage V emissions standards	%	9.6	-	-	-	-	26.9	Count of machines with certified Stage V engines / total fleet.	TCDD
Intermediate Results Indicators:									
Component 1									
1. Number of machines procured with final acceptance	number	0	0	14	14	84	99	As per contracts' delivery schedule. Final acceptance is granted upon issuance of a report confirming that all technical criteria specified in the technical specifications have	TCDD

Project Objective (PO):		To enhance the efficiency, safety, reliability and sustainability of rail infrastructure maintenance across Türkiye.							
Indicator Name	Unit of measure	Base-line Data 2025	Cumulative Target Values				End Target 2030	Data Source / Methodology	Responsibility
			2026	2027	2028	2029			
								been fully met, performance tests have been successfully completed and acceptance procedures have been finalized.	
Component 2									
1. Number of TCDD staff trained in new machinery operations and safety protocols.	number	0	0	58	427	589	751	Trainers, operators and mechanics trained and certified by TCDD's Department of Education and Training, with supplier-provided modules.	TCDD
1.a. Number of TCDD operators trained in new machinery operations and safety protocols.	number	0	0	18	166	223	280		TCDD
1.b. Number of TCDD mechanics trained in new machinery operations and safety protocols.	number	0	0	30	241	336	431		TCDD
1.c. Number of TCDD trainers trained in new machinery operations and safety protocols.	number	0	0	10	20	30	40		TCDD
2. Yearly percentage of newly procured machines integrated into TCDD's asset management system within 3 months of commissioning.	%	0	0	100	100	100	100	Based on the final acceptance of the machines, the relevant machines will be integrated into the TCDD Asset Management System within 3 months.	TCDD

Annex 2: Project Technical Description

1. **Introduction.** This annex summarizes the planned procurement of 99 railway maintenance machines under the TCDD Railway Maintenance Modernization Project. It draws on the independent technical review of TCDD's draft specifications and outlines the purpose of the machines, the standards they must meet and the role AIIB will play in supporting the procurement process. The Project's central goal is to replace an aging fleet with modern, efficient and environmentally compliant equipment capable of maintaining both high-speed and conventional rail lines across Türkiye.

2. More than 60% of TCDD's current machines are beyond their useful life, leading to frequent breakdowns and inefficiencies. With the expansion of both high-speed and conventional networks, the time windows for maintenance are becoming tighter, requiring faster and more reliable equipment. Many existing machines also fall short of today's safety and environmental standards. Without renewal, TCDD risks higher maintenance costs, operational disruptions and reduced safety margins.

3. **Machine Categories.** The modernized fleet will consist of 99 specialized machines, covering the full spectrum of track maintenance tasks. Each category of machine plays a distinct role in the maintenance cycle, as summarized in Table A2.1.

Table A2.1. Machinery Description

Machine Type	Function	Benefit
Tamping machines (incl. express tampers)	Compact and realign ballast under sleepers after maintenance.	Ensures smoother rides, reduces train wear, speeds up maintenance.
Dynamic track stabilizers	Consolidate track by simulating train pressure after tamping.	Reduces early distortions, extends time between interventions.
Ballast regulators	Shape and distribute ballast evenly along the track.	Improves stability, drainage and safety, especially under heavy use.
Switch tamping machines	Maintain switches and crossings where derailment risk is higher.	Ensures smooth passage between track segments and safer operations.
Rail milling and grinding machines	Repair and finish rail surfaces, correcting defects.	Extends rail life, reduces noise, lowers replacement costs.
Catenary maintenance vehicles	Access and repair overhead electrification equipment.	Minimizes downtime from electrical faults, ensures reliable power supply.
Track maintenance and rescue vehicles	Transport staff, tools and spare parts to work or failure sites.	Reduces downtime by enabling rapid intervention on the network.
Diagnostic/inspection units	Monitor and measure track geometry and condition.	Provides data for preventive maintenance, reducing service disruptions.

4. **Standards and Requirements.** Clear and consistent technical requirements are essential to ensure that the new fleet is safe, sustainable and fully compatible with TCDD's operations. Procurement will be guided by the following principles:

- (a) **European and International Standards:** All machines must comply with EN 14033 (track construction and maintenance machines), EN 15746 (on-track machines), EN

12663-2 (structural requirements for railway vehicle bodies) and other relevant norms. Compliance will be demonstrated through certification and test reports, ensuring safety, performance and interoperability.

- (b) **Stage V Emission Compliance:** All diesel-powered machines will be required to use EU Stage V engines. These reduce particulate matter and nitrogen oxide emissions significantly compared to older technologies, aligning with Türkiye's environmental commitments and AIB's green finance objectives.
- (c) **Noise and Operator Safety:** Specifications will explicitly require compliance with noise standards (e.g., EN 15892) and include features such as 360-degree visibility, protective cabins with rollover protection, ergonomic seating, fire suppression systems and modern braking technologies. These measures safeguard both operators and the communities near railway lines.
- (d) **Interoperability:** Machines must be compatible with both high-speed and conventional networks, including sections with 25-kilovolt electrification. Requirements will ensure safe operations under live or switched-off catenary systems and smooth transfer between electrified and non-electrified tracks.

5. By setting these requirements clearly in the bidding documents, the Project will guarantee that all procured machines meet international benchmarks for safety, environmental performance and operational flexibility.

6. **Common Design Features.** Across all categories, the draft technical specifications emphasize certain common requirements that provide a baseline of safety, resilience and interoperability across the entire fleet, while allowing machine-specific features to be defined for specialized equipment.

- (a) **Operating Conditions:** Machines must function in a wide climate range (-20°C to +45°C) and under both ballast and slab track conditions, with day/night operability.
- (b) **Speed and Interoperability:** All units must be self-propelled, able to run alone or in multiple-unit formation, with a maximum speed of 100 kilometers per hour and compatible with both high-speed and conventional lines.
- (c) **Axle Load and Clearance:** Maximum axle load is limited to 22.5 tons, with compliance to TCDD's clearance and electrification gauges across the national network.
- (d) **Standards Compliance:** Specifications reference EN, UIC and IEC norms, with suppliers required to demonstrate conformity through certification and test reports.
- (e) **Cabin and Operator Safety:** Cabins must provide ergonomic working conditions, heating/cooling, safety glazing, fire suppression systems and noise/vibration protection. Fail-safe braking and modern suspension systems are mandatory.
- (f) **Lifecycle Provisions:** Each specification includes requirements for spare parts, tools, calibration equipment, training and documentation, ensuring long-term usability of the machines.

7. **Deployment and Maintenance Arrangements.** The allocation plan for the new fleet is guided by clear operational criteria to ensure demand responsiveness and system-wide efficiency. Core machines such as tamping, ballast regulators and stabilizers are deployed in

balanced combinations across the network, while specialized machines are assigned according to technical needs. For example, grinding equipment is allocated to high-speed corridors and milling machines to areas with tight curves and heavy freight traffic. Catenary and support vehicles are distributed proportionally based on the number of maintenance districts and the intensity of train operations. These allocations are anchored in TCDD's established maintenance network of regional workshops and a central factory, ensuring that lifecycle servicing capacity is in place from the outset.

8. As shown in Table A2.2, this criteria-driven plan results in a strategic distribution of 99 units across the nine Regional Directorates. Higher-capacity corridors such as Adana (6th Region) and Ankara YHT (8th Region) are assigned additional tamping resources, while other regions receive allocations proportionate to their traffic and maintenance demands. This targeted deployment ensures that both passenger and freight operations benefit from improved reliability and minimized service disruptions.

9. In parallel, maintenance capacity is structured to guarantee long-term fleet sustainability. Routine servicing will be carried out in seven Regional Mechanical Workshops located in Istanbul, Ankara, Izmir, Sivas, Malatya, Adana and Afyonkarahisar, while heavy repairs and overhauls will be centralized in the Factory Directorate in Ankara. This arrangement embeds lifecycle management into TCDD's maintenance ecosystem, supporting the effective use of the fleet throughout its service life.

Table A2.2. Equipment Allocation by Regional Directorate

No	Equipment Name	Regional Directorate									Total
		1	2	3	4	5	6	7	8	9	
1	Switch tamping machine	1	-	1	1	1	1	1	1	1	8
2	Tamping machine (continuously action with 32 tamping tines)	1	1	1	1	1	2	1	2	1	11
3	Dynamic track stabilizer	-	-	-	1	1	1	1	1	1	6
4	Ballast regulator	-	-	-	1	1	1	1	1	2	7
5	Rail grinding machine	-	-	-	-	-	-	-	1	-	1
6	Rail milling machine	-	-	-	-	-	1	-	-	-	1
7	Catenary maintenance vehicle	4	3	3	2	2	4	2	4	-	24
8	Track maintenance vehicle	4	3	3	5	2	3	4	17	-	41
	TOTAL	10	7	8	11	8	13	10	27	5	99

10. **Lessons from Market Research.** The market provided constructive feedback to refine specifications and encourage wider competition:

- (a) **Simplification:** Some requirements were too detailed and will be streamlined.
- (b) **Safety and Environment:** Standards will be clarified, especially for emissions and braking.
- (c) **Specialized Machines:** More flexible definitions will be used for equipment like milling and grinding units, where suppliers are limited.

11. **Procurement Approach and AIIB Support.** AIIB will support TCDD in running a transparent and competitive procurement process. This includes engaging a procurement consultant to help prepare the bidding documents and guide the tendering process, alongside

a technical consultant who will refine specifications, ensure compliance with international standards and review supplier proposals.

12. In addition, AIIB is working with TCDD to structure procurement “lots” so that core machines can be bid on by multiple suppliers, while more specialized machines can be grouped to attract qualified bidders. Contracts will also require lifecycle provisions, such as spare parts, operator training and workshop readiness, to ensure the new machines remain reliable and fully operational over the long term.

13. **Conclusion.** The procurement of 99 modern machines will transform TCDD’s maintenance capability, modernizing an outdated fleet with equipment that meets international standards. This will not only improve railway safety, efficiency and environmental performance but also strengthen Türkiye’s role as a regional transport hub. With AIIB’s support in procurement, technical standards and asset lifecycle management, the process will remain competitive, transparent and value-for-money.

Annex 3: Economic Analysis

A. Introduction

1. **General.** The purpose of the economic cost–benefit analysis (CBA) is to identify and quantify the key economic benefits and costs of the Project. The analysis focuses on Component A, which entails the acquisition of maintenance equipment. This investment is expected to enhance the efficiency and reliability of railway maintenance, thereby enabling trains to operate safely at higher average speeds.

2. As a result, the Project is expected to generate the following economic benefits: (a) maintenance cost savings, (b) passenger time savings, (c) freight time savings and (e) reductions in greenhouse gas (GHG) emissions. These benefits are based on forecasts of non-incremental traffic demand on the existing public railway network. Since the Project does not involve network expansion or the purchase of new rolling stock, the economic analysis assumes no additional traffic demand is generated. Table A3.1 summarizes the differences between the Without- and With-Project scenarios.

Table A3.1. Comparison Between Without- and With-Project Scenarios

Variables	Without Project	With Project
TCDD Railway Maintenance Fleet	Maintenance activities are carried out using existing equipment, with no replacement of aging assets and no additional operating expenses assumed.	Maintenance activities are carried out using both existing equipment and new equipment procured under the Project.
Delays	Worsening railway conditions result in more frequent delays for freight and passenger trains.	Reduction in freight and passenger train delays resulting from unplanned maintenance.
Average Train Speed	Average passenger and freight train speeds are projected to remain consistent with the historical average.	Projected to improve by 5% compared to the historical average.

3. The CBA was conducted using a discounted cash flow (DCF) approach to estimate the economic internal rate of return (EIRR) and the economic net present value (ENPV) of the proposed investments. The analysis assumes constant 2025 prices and exchange rates, with no currency fluctuations assumed beyond 2025. A standard sensitivity analysis was then applied to test the robustness of the EIRR and ENPV under pessimistic scenarios for benefits and cost projections.

B. Demand Analysis

4. **Methodology.** As the Project is not expected to stimulate additional traffic demand or significantly alter existing passenger or freight transport patterns, passenger traffic and freight volumes are assumed to remain at historical levels under the with-project scenario, as presented in Tables A3.2 and A3.3.

Table A3.2. Passenger Traffic Projection Summary

No	Line Section		Distance km	Historical Average	Projection
				2020 – 2024	2025 - 2050
				Number of trains per day	
1	Çetinkaya	Malatya	142	4	4

2	Malatya	Yolçatı	101	4	4
3	Malatya	Narlı	182	2	2
4	Narlı	Fevzipaşa	69	2	2
5	Fevzipaşa	Toprakkale	72	2	2
6	Ulukışla	Yenice	109	9	9
7	Hanlı	Bostankaya	45	3	3

*Source: TCDD

Table A3.3. Freight Volume Projection Summary

No	Line Section		Distance	Historical Average	Projection
				2020 – 2024	2025 - 2050
			km	Number of trains per day	
1	Çetinkaya	Malatya	142	45	45
2	Malatya	Yolçatı	101	28	28
3	Malatya	Narlı	182	36	36
4	Narlı	Fevzipaşa	69	39	39
5	Fevzipaşa	Toprakkale	72	39	39
6	Ulukışla	Yenice	109	27	27
7	Hanlı	Bostankaya	45	22	22

Source: TCDD

5. Furthermore, since the Project does not entail enhancements to TCDD's rolling stock fleet, the average passenger and freight train utilization are assumed to remain at historical levels.

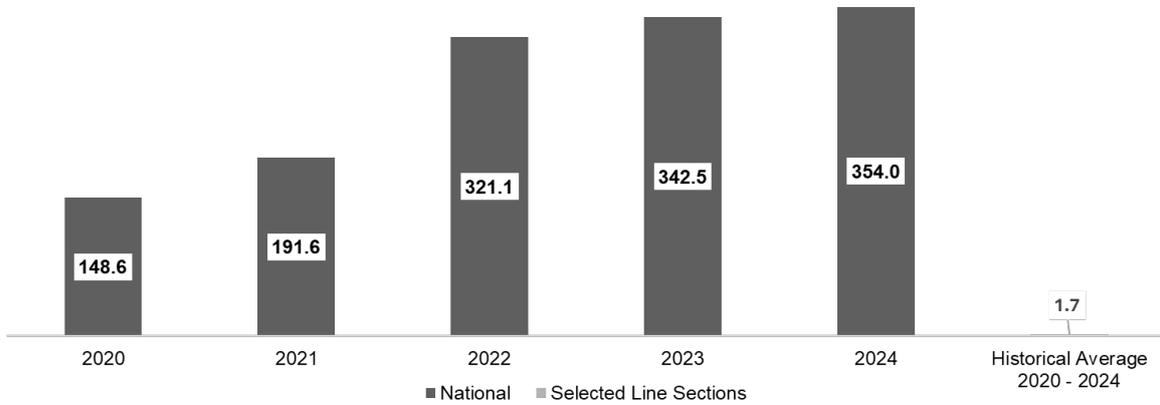
Table A3.4. Passenger and Freight Train Utilization Summary

No	Line Section		Passengers	Freight Volume, Net
			Passenger / Train	Ton/Train
1	Çetinkaya	Malatya	210	627
2	Malatya	Yolçatı	210	551
3	Malatya	Narlı	210	699
4	Narlı	Fevzipaşa	210	667
5	Fevzipaşa	Toprakkale	142	655
6	Ulukışla	Yenice	130	527
7	Hanlı	Bostankaya	210	586

*Source: TCDD

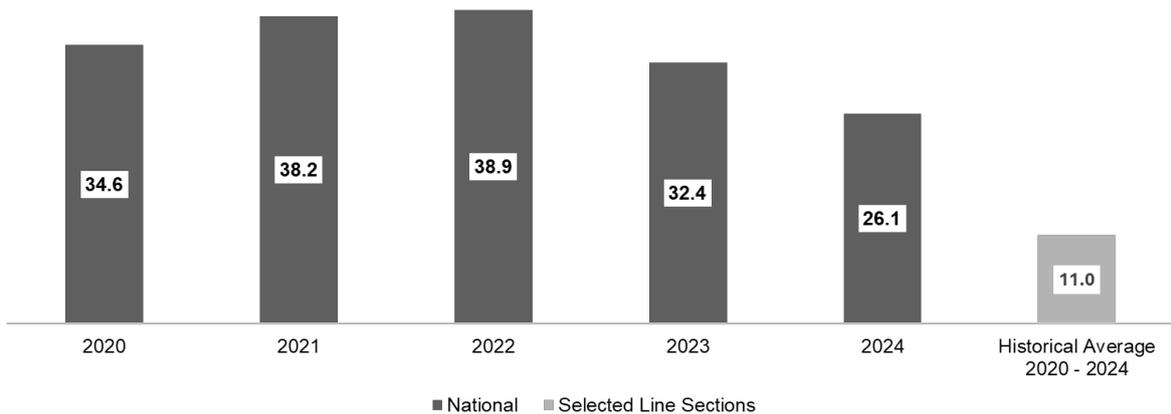
6. In 2024, traffic on the seven line sections accounted for 0.5% of Türkiye's total railway passenger traffic and 42.0% of total railway freight volumes. Figures A3.1 and A3.2 compare the average passenger and freight volumes transported on these line sections during 2020–2024 with the corresponding national aggregates.

Figure A3.1. Passenger Traffic Comparison
(million passengers)



*Source: TCDD, TURKSTAT

Figure A3.2. Freight Volume Comparison
(million ton)



*Source: TCDD, TURKSTAT

C. Economic Costs

7. **Capital Costs.** The capital costs consist of the financial costs of 99 specialized maintenance equipment items procured under the Project, which were subsequently adjusted by (a) excluding taxes and price contingencies and (b) applying shadow pricing using a standard conversion factor of 0.95.

8. **Recurring Costs.** The operation and maintenance costs are based on the feasibility study prepared by TCDD and reflect the projected maintenance expense. Operating expenses are estimated from the average annual maintenance requirements and related costs necessary to ensure the continued operation of the procured machines over their service life. Table A3.5 presents a summary of the maintenance cost assumptions.

Table A3.5. Maintenance Cost Assumption Summary

No	Equipment Name	Quantity	Maintenance per Year	Unit Maintenance Cost (USD)
1	Switch tamping machine	8	4	2,087
2	Tamping machine (continuously action with 32 tamping tines)	11	4	2,927
3	Dynamic track stabilizer	6	4	1,576
4	Ballast regulator	7	4	1,630
5	Rail grinding machine	1	4	5,834
6	Rail milling machine	1	4	5,834
7	Catenary maintenance vehicle	24	5	1,106
8	Track maintenance vehicle	41	4	928

*Source: TCDD

D. Economic Benefits

9. **Fuel Cost Savings.** Currently, 64% of TCDD's maintenance equipment is over 40 years old. Under the Without-Project scenario, TCDD would continue operating with its aging fleet. Under the With-Project scenario, the procurement of EU Stage V-compliant maintenance equipment will enhance the fuel efficiency of TCDD's maintenance fleet, reducing average fuel consumption per unit. This improvement will allow TCDD to carry out the same volume of maintenance activities¹ with lower fuel use, thereby generating cost savings.² Table A3.6 summarizes the projected efficiency gains and corresponding reductions in total fuel consumption.

Table A3.6. Fuel Cost Savings Summary

Fuel Cost Savings	Without Project	With Project	Improvement
Average fuel efficiency (Liters/Task)	57.27	54.60	2.67
Total fuel consumption (Liters)	2,356,392	2,246,644	109,748

*Source: TCDD

10. **Passenger Time Savings.** Under the Without-Project scenario, TCDD is expected to continue its railway maintenance activities using the existing maintenance fleet without replacing aging or obsolete equipment. This would lead to a gradual decline in the efficiency and reliability of maintenance operations. Evidence of this trend is reflected in the increase in passenger train delays caused by unplanned maintenance, which rose from 5.67 minutes per 1,000 train-kilometers in 2022 to 7.13 minutes per 1,000 train-kilometers in 2024.³

11. Conversely, under the With-Project scenario, the reliability of TCDD's rail maintenance operations is expected to improve, reducing the duration of train delays caused by unplanned track maintenance by 4.73%. Improved track conditions are also projected to raise the average passenger train operating speed from 50.0 kilometers per hour (kph) to 52.5 kph, resulting in average travel time savings of 2.8 minutes per passenger.⁴ The passenger value of time (VOT), derived from the national average gross salary and adjusted for wage inflation, is estimated at USD5.0 per hour for business travel (54.3%⁵ of total passengers) and USD1.7

¹ Under both the With- and Without-Project scenarios, TCDD is projected to complete 41,146 maintenance tasks each year.

² Assumes an economic diesel price of USD0.8 per liter, excluding duties subsidies and value-added tax.

³ While delays caused by unplanned maintenance will likely continue to worsen under the Without-Project scenario, this analysis assumed that delays remain constant at their 2024 values.

⁴ The average passenger trip is assumed to span 48.2 km.

⁵ Per Türkiye labour force participation rate, July 2025

per hour for leisure travel (45.7% of total passengers). Table A3.7 summarizes the projected efficiency gains to passenger travel.

Table A3.7. Passenger Time Savings Summary

Passenger Time Savings	Without Project	With Project	Improvement
Delay (Minutes/1000 Train-km)	7.13	6.79	0.34
Operating train speed	50.0 kph	52.5 kph	2.5 kph

*Source: TCDD

12. **Freight Time Savings.** As assumed under the Without-Project scenario, TCDD continues to rely on its existing maintenance fleet without replacing aging or obsolete equipment. Consequently, the efficiency and reliability of TCDD’s maintenance operations are expected to deteriorate progressively over time. This decline is evidenced by the increase in freight train delays caused by unplanned maintenance, which rose from 16.59 minutes per 1,000 train-kilometers in 2022 to 16.87 minutes in 2024.⁶

13. In contrast, the With-Project scenario assumes that improved reliability of TCDD’s rail maintenance operations will enhance freight transportation efficiency by reducing delays from unplanned maintenance by 4.73% and enhancing overall track conditions. Between 2020 and 2024, freight trains operating across the seven line sections listed in Table A3.3 traveled a total of 9.2 million kilometers annually. As a result of the improved track conditions, the average operating speed of freight trains is projected to increase from 24.0 kph to 25.2 kph, leading to an estimated 18,251–18,301 hours of freight time saved each year. Table A3.8 shows the projected operational improvements to the transportation of freight.

Table A3.8. Freight Time Savings Summary

Freight Time Savings	Without Project	With Project	Improvement
Delay (Minutes/1000 Train-km)	16.87	16.07	0.80
Operating train speed	24.0 kph	25.2 kph	1.2 kph

*Source: TCDD

14. International freight values were estimated using the total value of imports and exports transported by rail and the corresponding international freight volumes published by the Turkish Statistical Institute (TURKSTAT), yielding an average value of USD309 per ton.⁷ As international freight primarily consists of industrial goods and machinery, its average value is higher than that of domestic freight, which mainly comprises dry bulk commodities such as coal, iron ore, cement and grains. The estimated average value of domestic freight is USD103 per ton⁸. Time savings were applied to both domestic and international freight, based on the assumption that domestic freight accounts for 85.1% of total freight volumes and international freight for 14.0%, in line with the national rail freight composition in 2024.⁹

15. **Emission Reduction.** The Project is expected to achieve a net reduction in greenhouse gas (GHG) emissions by modernizing TCDD’s aging maintenance fleet with more

⁶ While delays caused by unplanned maintenance would likely to continue worsening under the Without-Project scenario, this analysis assumed that delays remain constant at their 2024 values.

⁷ Based on 2024 international freight data published by TURKSTAT, the average value of international freight transported rail (imports and exports) was estimated at USD1,237 per ton. For the purposes of this economic analysis, a conservative approach was adopted by applying a 75% discount to this value.

⁸ It is assumed that the average value of domestic freight transported by rail is equivalent to 33.3% of the average value of international freight.

⁹ The remaining 0.9% of freight volume corresponds to administrative freight, for which no time savings were assumed.

fuel-efficient, EU Stage V-compliant equipment. Absolute (project) emissions were estimated based on the projected fuel consumption of the new equipment, as well as expected freight and passenger volumes and their respective emission factors. For relative emissions, a degradation factor was applied to overall track conditions to simulate a Without-Project scenario, in which lower operating speeds, increased unplanned maintenance and associated delays would likely cause a modal shift of freight and passenger volumes from rail to higher-emitting transport modes, such as passenger cars and freight trucks.

E. Summary

16. **Results.** Based on the estimated economic costs and benefits, the Project EIRR is calculated at 26.7%, with an ENPV of USD746.1 million, indicating the Project's economic viability. To test the robustness of the analysis, three alternative scenarios were assessed: (a) a 20% increase in costs, (b) a 20% reduction in benefits and (c) a combined case assuming both a 20% reduction in benefits and a 20% increase in costs. In all scenarios, the Project EIRR remained above the social discount rate of 9%, as shown in the Table A3.9.

Table A3.9. Economic Analysis Results

Scenario	EIRR (%)	ENPV (USD million)
Base case	26.7	746.1
20% increase in costs	23.6	687.4
20% reduction in benefits	22.9	538.2
20% increase in costs and 20% reduction in benefits	22.0	479.4

17. Table A3.10 summarizes the economic cost and benefits streams.

Table A3.10. Economic Costs and Benefits of Project
(USD million)

Year	Capital Costs	Recurring Costs	Fuel Cost Savings	Passenger Time Savings	Freight Time Savings	Emission Reduction	Residual Value	Net Benefit
2026	76.0	-	-	-	-	-	-	(76.0)
2027	76.0	-	-	-	-	-	-	(76.0)
2028	76.0	-	-	-	-	-	-	(76.0)
2029	76.0	-	-	-	-	-	-	(76.0)
2030	76.0	-	-	-	-	-	-	(76.0)
2031	-	0.6	0.1	0.3	173.2	0.1	-	173.1
2032	-	0.6	0.1	0.3	173.7	0.2	-	173.7
2033	-	0.6	0.1	0.3	173.2	0.4	-	173.5
2034	-	0.6	0.1	0.3	173.2	0.6	-	173.6
2035	-	0.6	0.1	0.3	173.2	0.8	-	173.8
2036	-	0.6	0.1	0.3	173.7	1.0	-	174.5
2037	-	0.6	0.1	0.3	173.2	1.2	-	174.3

Year	Capital Costs	Recurring Costs	Fuel Cost Savings	Passenger Time Savings	Freight Time Savings	Emission Reduction	Residual Value	Net Benefit
2038	-	0.6	0.1	0.3	173.2	1.5	-	174.5
2039	-	0.6	0.1	0.3	173.2	1.7	-	174.7
2040	-	0.6	0.1	0.3	173.7	2.0	-	175.5
2041	-	0.6	0.1	0.3	173.2	2.2	-	175.2
2042	-	0.6	0.1	0.3	173.2	2.5	-	175.5
2043	-	0.6	0.1	0.3	173.2	2.7	-	175.8
2044	-	0.6	0.1	0.3	173.7	3.0	-	176.5
2045	-	0.6	0.1	0.3	173.2	3.3	-	176.4
2046	-	0.6	0.1	0.3	173.2	3.6	-	176.7
2047	-	0.6	0.1	0.3	173.2	4.0	-	177.0
2048	-	0.6	0.1	0.3	173.7	4.3	-	177.8
2049	-	0.6	0.1	0.3	173.2	4.6	-	177.7
2050	-	0.6	0.1	0.3	173.2	5.0	45.6	223.6

Net present value at 9%: USD746.1 million

Economic internal rate of return: 26.7%

Annex 4: Türkiye Sovereign Credit Fact Sheet

1. **Background.** Türkiye is an upper-middle-income economy with an income per capita of around USD18,000 (or around USD44,000 in purchasing power parity) and a population of around 86 million. Türkiye is a large, diversified, dynamic, and business-oriented economy. Since the early 2000s, it has experienced robust growth, averaging around 5.5% per year, driven by a strong focus on development, macroeconomic stability, sound fiscal frameworks, trade openness, and institutional reform. Over that period, income per capita has tripled and poverty levels have declined significantly.

2. However, from 2016 until mid-2023, Türkiye's sovereign credit rating has deteriorated, which has been attributed to a reliance on short-term stimulus to boost growth, unconventional and unanticipated policies, declining fiscal and foreign exchange (FX) reserves, high dependence on external financing and rising geopolitical risks. This has created financial vulnerability and led to periods of market volatility.

3. **Recent Developments.** During 2021-2023, the monetary policy was accommodative despite high and accelerating inflation, leading to sharp capital outflows. The currency lost two-thirds of its value in nominal terms, while inflation exceeded 80% at the peak in late 2022. Additionally, Türkiye faced several adverse shocks, including a surge in global energy prices and a devastating earthquake. While growth was still robust, these developments resulted in economic imbalances and poor market sentiment.

4. Since mid-2023, policies have been normalized under a new economic team, and the interest rate has been hiked to a high of 50%. Monetary tightening has gradually brought results. Inflation has declined to 33% and one-year-forward inflation expectations of market participants to 22.3%, which allowed the central bank to restart monetary easing and reduce rates to 40.5%. Furthermore, tighter fiscal policy is expected to contribute to rebalancing. While the deficit has widened in recent years, reflecting earthquake reconstruction spending, the government has announced a fiscal tightening program, including a freeze on non-essential capital expenditures, cuts in current spending, and a phased reduction of energy subsidies. Measures are also planned to broaden the tax base. These measures are expected to arrest fiscal deterioration and improve debt sustainability.

Table A4. Selected Economic Indicators

Selected Economic Indicators	2022	2023	2024	2025*	2026*	2027*	2028*
GDP growth 1/	5.4	5.0	3.3	3.5	3.7	3.7	3.8
Inflation (end-of-period) 1/	64.3	64.8	44.4	31.0	21.0	18.0	15.0
Fiscal balance	-1.1	-5.2	-4.6	-3.7	-3.8	-4.0	-3.8
Gross public debt	30.2	28.7	24.0	24.3	25.1	26.0	26.1
Gross public financing needs	7.2	7.6	7.4	5.4	5.1	5.9	6.4
Current account balance	-5.0	-3.6	-0.8	-1.4	-1.3	-1.2	-1.3
Gross external debt	50.5	45.2	41.3	39.8	40.9	40.4	39.9
Gross external financing needs	22.9	21.2	19.1	20.0	20.5	20.1	20.0
Gross FX reserves (USD billion) 2/	128.7	140.9	155.2	198.4
Exchange rate (TRY/USD) 2/	18.7	29.4	35.3	41.9

Sources: IMF WEO Oct 2025, country report 24/312, central bank; in percent of GDP, except where noted; ** = projections
Notes: 1/ Percent change, year-on-year; 2/ data from central bank, end-of-period, most recent as of Oct 27, 2025

5. In response to these positive developments, over the past two years, S&P, Fitch and Moody's each upgraded Türkiye's credit rating by two-three notches, to BB-/Ba3 with stable

outlook. The key factor behind the rating upgrades have been the strengthening track record of effective policymaking as well as Türkiye's resilience and reduced external vulnerability. The current account deficit has narrowed significantly, to 1.3% (on the rolling 12-month basis, as of June 2025). This improvement reflects a combination of lower global energy prices as well as strong export and tourism performance. FX reserves have risen to over USD190 billion, spreads have declined, and external financing has increased.

6. **Outlook and Risks.** With the economy gradually rebalancing, growth slowed in 2024, as anticipated, to 3.3%. According to the International Monetary Fund, economy is expected to grow by 3.5% in 2025 and 3.7% in 2026, before increasing in the medium term towards 4.0%. The shift toward more conventional policies has improved resilience and creditworthiness. However, the policy tightening may need to be sustained to accomplish full disinflation. Risks to the outlook include global policy uncertainty, regional tensions and volatile market sentiment, sensitive to domestic and global political and policy developments.

7. Türkiye's private sector has shown resilience in navigating the volatile environment. Large firms report adequate liquidity, positive short-term net FX positions and sufficient natural hedges against currency volatility. In the banking sector, despite recent shocks, capitalization remains adequate, non-performing loans are low and liquidity and profitability metrics are stable. Domestic banks have been able to rollover their funding, even amid high market uncertainty. Financial stability is supported by sustained residents' confidence and a willingness to maintain significant hard currency deposits in domestic banks.

8. According to the IMF, Türkiye's public debt is sustainable and projected to stabilize at around 26% of gross domestic product over the medium term. Key factors supporting debt sustainability include the government's strong balance sheet, continued access to financial markets, a proven track record of economic resilience and a dynamic economy with substantial growth potential. Likewise, Türkiye's external debt is expected to remain sustainable over the medium term.