

TERMS OF REFERENCE (ToR)

Hiring a Consulting firm for development, enhancement and maintenance of D-toll System

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1. Background

1.1 National Context

The Government of the People's Republic of Bangladesh, through the ICT Division and its implementing arm a2i (Aspire to Innovate), has undertaken a strategic initiative to modernize the country's toll collection infrastructure. Bangladesh's rapid infrastructure expansion — including bridges, expressways, flyovers, and urban road networks — has created an urgent need for a unified, interoperable, and technology-driven Electronic Toll Collection (ETC) ecosystem.

Currently, toll collection is managed by multiple independent authorities including the Bangladesh Bridge Authority (BBA), Roads and Highways Department (RHD), Local Government Engineering Department (LGED), Dhaka South City Corporation (DSCC), and the Ministry of Housing and Public Works (MoHPW). Each authority operates its own payment mechanisms, creating fragmentation, revenue leakage, commuter inconvenience, and significant operational inefficiency.

1.2 The D-Toll Initiative

The D-Toll Integrated Toll Management System is a national interoperability initiative that establishes a unified electronic toll collection ecosystem across Bangladesh. D-Toll enables toll operators, financial institutions, payment gateways, and government agencies to operate through a single, common platform — ensuring seamless toll payment, full financial transparency, revenue assurance, and a substantially improved commuter experience.

The D-Toll platform has been operational in initial form at select toll plazas under BBA management, including the Padma Bridge, Jamuna Bridge and the First Dhaka Elevated Expressway. The platform currently supports RFID-based vehicle identification, basic wallet functionality, and integration with selected Mobile Financial Services (MFS) and commercial Banks.

1.3 Rationale for Enhancement

To support immediate operational requirements and prepare the platform for nationwide expansion, a six-month Development, Enhancement, Integration, Operations & Sustainability Program is proposed. This program addresses the following critical gaps identified in the current D-Toll ecosystem:

- Absence of a dedicated citizen-facing mobile application for Android and iOS platforms.
- Limited wallet interoperability across multiple financial service providers and payment aggregators.
- Lack of a self-service web portal for vehicle registration, wallet recharge, and transaction history access.
- Insufficient disaster recovery infrastructure and business continuity mechanisms.
- Inadequate monitoring, alerting, and operational visibility tools.
- Limited customer support infrastructure and absence of a formal ITSM framework.
- Security vulnerabilities requiring formal assessment and remediation.
- Low public awareness and adoption

2. Review of the Existing System

2.1 About the Organization

The D-Toll system is governed and operated under the ICT Division of the Government of Bangladesh through the a2i Programme. The Bangladesh Bridge Authority (BBA) serves as the primary operational deployment partner, with the Roads and Highways Department (RHD), DSCC, LGED, BRTA and MoHPW as secondary stakeholders and future integration targets.

a2i (Aspire to Innovate) is a joint programme of the Government of Bangladesh supported by the United Nations Development Programme (UNDP). It spearheads digital transformation of government services, and D-Toll represents one of its flagship infrastructure digitization initiatives by A2i.

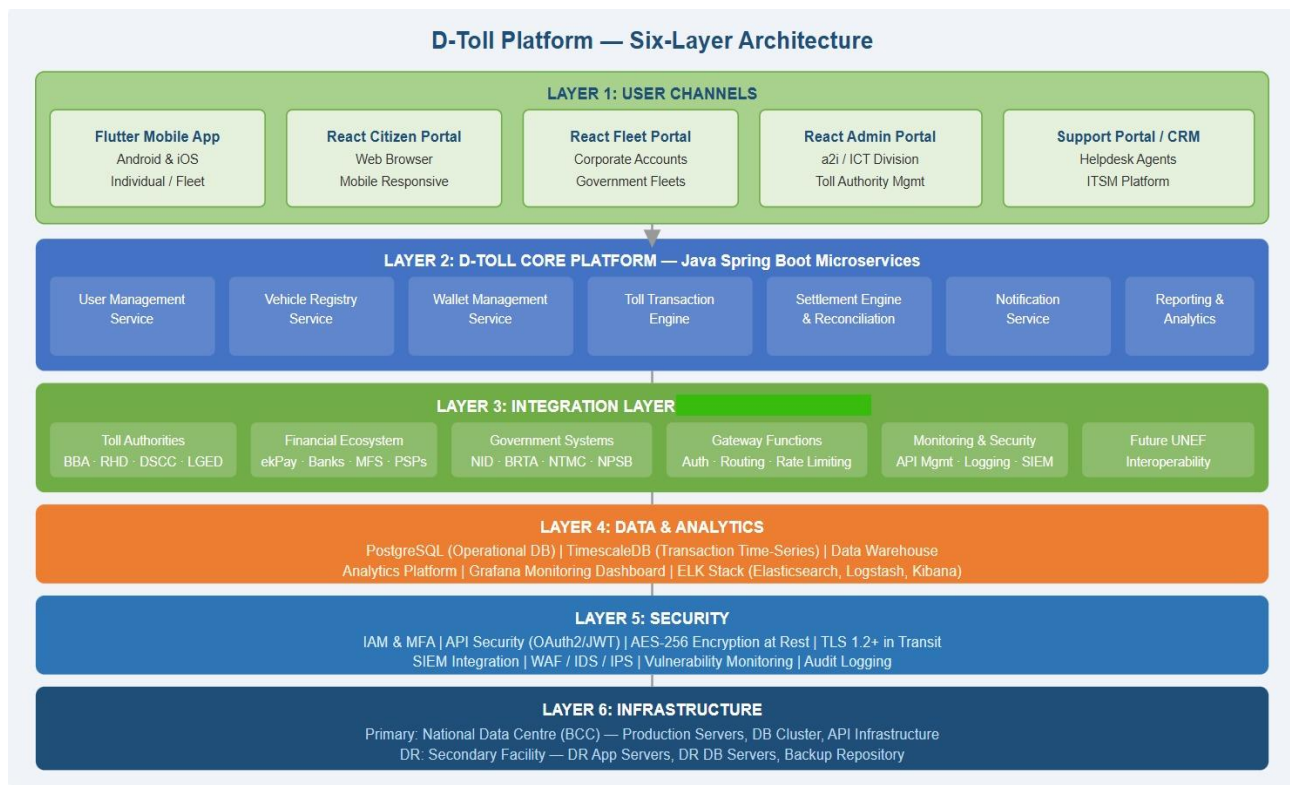
2.2 Existing Services, Resources, Infrastructure, Connectivity and Data Status

The existing D-Toll platform comprises the following deployed components:

2.2.1 Core Platform Components

- ETC Transaction Engine for real-time toll deduction processing.
- National Toll Processing Service integrated with BBA toll plaza infrastructure.
- RFID Validation Engine connected to the BRTA API for tag verification.
- Toll Calculation Engine with configurable rate schedules per vehicle class.
- Interoperability API Gateway for third-party system connections.
- Payment Gateway Integration supporting MFS, PSP, PSO and Banks.
- Vehicle Verification Service linked to the national vehicle registration database.
- Real-time Monitoring Dashboard (limited scope).
- Analytics & Reporting Engine.
- Notification Service (SMS and basic app push).
- Security & Identity Management module.
- Central Data Warehouse (operational).
- Audit & Compliance System.

D-Toll High Level Diagram



2.2.2 Deployed Toll Infrastructure

The following BBA, RHD, DSCC, LGED, BIWTA and MOPHW toll facilities are currently operational under D-Toll:

SI	Toll Facility	Authority	Status
1	Padma Bridge	BBA	Operational
2	Jamuna Bridge	BBA	Testing Done
3	Muktarpur Bridge	BBA	Integration Pending
4	Karnaphuli Tunnel	BBA	Integration Pending
5	First Dhaka Elevated Expressway	BBA	Integration Pending
6	BBA Bridges & Expressways	BBA	Integration Pending
7	RHD	RHD	Integration Done
8	CTG Expressways	MoHPW	Integration Planned
9	Jatrabari Flyover	DSCC	Integration Planned
10	1490 m Long PC Girder Bridge on Panchpir Bazar-Chilmari Upazila	LGED	Integration Planned
11	Barishal, Paturia, Chandpur, Ashuganj Ferry toll	BIWTA	Integration Planned
12	Traffic Prosecution	DMP	Integration Planned

2.2.3 Field Infrastructure (Common deployment by the toll authorities)

The field-level infrastructure supporting D-Toll operations comprises:

- RFID Readers deployed at toll lanes for contactless vehicle identification.
- ANPR (Automatic Number Plate Recognition) Cameras for secondary vehicle verification.
- Smart Gate Controllers for automated barrier management.
- Vehicle Sensors and Loop Detectors for vehicle classification.
- Lane Controllers for multi-lane transaction processing.
- Traffic Monitoring Systems integrated with toll plazas.
- Cashless ETC Lanes dedicated to electronic toll deductions.

2.3 Problems and Challenges

The following problems and challenges have been identified through operational experience and stakeholder consultations:

2.3.1 Technical Challenges

- Absence of a native mobile application for citizens forces reliance on cash and limited third-party MFS interfaces.
- Multi-wallet reconciliation across MFS and banks is manual and error-prone.
- Current web interface is not mobile-responsive, limiting self-service adoption.
- Disaster Recovery infrastructure is inadequate — RPO and RTO targets cannot currently be guaranteed.
- RFID tag lifecycle management (registration, validation, blocking, replacement) lacks a unified citizen-facing interface.
- Fleet management capability is absent, preventing corporate and government fleet operators from onboarding efficiently.

2.3.2 Operational Challenges

- No formal ITSM framework — incident management, problem management, and change management are ad hoc.
- Customer support is limited to informal channels with no ticketing or SLA-based resolution tracking.
- Monitoring coverage is incomplete — proactive alerting for transaction failures, API degradation, and infrastructure anomalies is insufficient.
- Security vulnerabilities have not been formally assessed through penetration testing or source code review.

2.3.3 Adoption Challenges

- Commercial fleet operators, bus operators, and logistics companies lack tools suited to their bulk registration and centralized payment needs.
- Financial institution onboarding for new PSPs is slow due to the absence of a standardized API onboarding framework.

2.4 Sign-off & Operation Review Committee

A designated committee by A2i and relevant stakeholders will review the Sign-off & Operation.

2.5 Data, Environment and Facilities to be Provided by Client

The Client (a2i / ICT Division) shall provide the following to the consulting firm:

- Access to existing D-Toll platform source code, API documentation, and system architecture documents.
- Access credentials and API endpoints for BRTA database.
- Access credentials and sandbox environments for MFS, Banks and TakaPay payment integrations.
- Access to the National ID Verification API (NID API) through the relevant government gateway.
- Access to the national vehicle registration database API.
- Existing production and staging server environments hosted at the National Data Centre (NDC), Bangladesh Computer Council (BCC).
- Existing monitoring infrastructure access for baseline assessment.
- Existing SLA documentation, incident logs, and operational reports for baseline performance assessment.
- Meeting facilities and coordination support for stakeholder workshops and training sessions.

3. Proposed System / Services

3.1 Objective

3.1.1 Technical Objectives

The technical objectives of this engagement are to:

- Develop and deploy native D-Toll mobile applications for Android and iOS platforms using Flutter, providing citizens with a comprehensive, fast, and accessible interface for toll payment, wallet management, RFID management, and transaction history.
- Enhance and deploy full-fledged web-based citizen self-service portal using React.js that enables vehicle registration, wallet recharge, transaction history download, refund requests, and customer support access from any web browser.
- Enhance the existing wallet management and reconciliation framework to support multi-wallet operations, automated reconciliation, settlement reporting, and a standardized financial institution onboarding process.
- Integrate toll operators (BBA, RHD, DSCC, MoHPW, LGED) along with PPP model-based toll collectors and financial institutions through a structured API onboarding, sandbox testing, UAT, and production deployment pipeline.
- Upgrade the operational monitoring infrastructure to provide 24x7 visibility, proactive alerting, and health dashboards covering all platform components.
- Establish a Disaster Recovery environment meeting an RTO of ≤ 1 hour and RPO of ≤ 15 minutes, supported by hourly incremental and daily full backups with quarterly DR drills.

3.1.2 Operational Objectives

- Establish a formal customer support framework including ticket management system, CRM, complaint resolution workflows, and SLA-based escalation management.
- Implement an ITSM platform covering incident management, problem management, change management, release management, and SLA reporting.
- Conduct a comprehensive security assessment including Vulnerability Assessment & Penetration Testing (VAPT), source code review, security gap analysis, and remediation roadmap.

- Ensure business continuity readiness across all platform components with documented and tested BCP procedures.

3.1.3 Strategic Objectives

- Increase registered D-Toll user base by enabling simplified mobile onboarding and expanding payment channel coverage.
- Reduce transaction failure rate to below 0.5% across all toll facilities and payment channels.
- Improve interoperability readiness to support future National Unified Electronic Toll Collection (UNEF) framework adoption.
- Support nationwide ETC expansion by ensuring the platform architecture is scalable, multi-operator capable, and compliant with future transport and smart mobility initiatives.

3.2 Scope

The scope of this assignment encompasses eleven (11) functional components to be delivered within an six-month program period. The Consulting firm shall be responsible for end-to-end delivery including design, development, enhancement, integration, testing, deployment, documentation, training, and operational stabilization for all components described herein.

The technology stack for this engagement is preferable as follows: Java Spring Boot (microservices architecture) for all backend services, React.js (TypeScript) for all web-based frontend interfaces, and Flutter for all mobile application development (Android and iOS). Any deviation from this technology stack requires prior written approval from the A2i designated domain.

3.3 Functional Requirements

3.3.1 Functions and Features

Component 1: Customer Experience Enhancement

This component focuses on enriching the citizen-facing experience within the D-Toll platform through enhanced vehicle management capabilities, a multi-channel notification system, comprehensive transaction services, and automated top-up functionality.

Vehicle Management

The Vehicle Management module has already been developed and is currently operating in the pilot phase. The selected consulting firm shall enhance, optimize, and scale the existing module to support nationwide deployment by incorporating all required functionalities, integrations, performance improvements, security features, and scalability requirements in accordance with the D-Toll system architecture.

The system enables citizens to register personal and commercial vehicles by providing the vehicle registration number, chassis number, vehicle category, and other applicable owner information. Multiple vehicles shall be supportable under a single user account, enabling family vehicle management where multiple family members' vehicles are linked under one household profile. Fleet management capability shall be provided to allow commercial operators — including bus operators, truck operators, and logistics companies — to register and manage multiple vehicles under a centralized fleet account. Vehicle ownership transfer workflows shall allow change of registered owner without loss of toll history data.

User Notification System

The User Notification System has already been developed and is currently operating in the pilot phase with SMS-based notifications only. The selected consulting firm shall enhance and extend the existing notification system to support nationwide deployment by implementing a comprehensive, multi-channel notification framework. The enhanced solution shall support SMS, push notifications, email, and other configurable communication channels, along with notification templates, delivery tracking, user preferences, multilingual support, and integration with all relevant D-Toll services.

The platform shall support a three-channel notification architecture. SMS notifications shall be triggered for all critical transactions including toll deductions, recharge confirmations, low balance alerts, and violation notices. Push notifications shall be delivered to registered mobile devices for real-time event updates. Email notifications shall be generated for monthly toll statements, refund status updates, and formal dispute resolution communications.

Ledger Services

The Ledger Services module has already been developed and is currently operating in the pilot phase. The selected consulting firm shall enhance, optimize, and scale the existing module to support nationwide deployment. The enhanced solution shall provide citizens with a comprehensive transaction history interface featuring date-range, vehicle-level, toll authority, and transaction status filtering. The system shall support downloadable account statements in PDF and Excel formats. It shall also provide real-time refund status tracking, enabling users to monitor pending, approved, and disbursed refunds. In addition, the module shall include a dispute management system that enables citizens to raise transaction disputes with supporting documentation, track the status of their disputes, receive resolution updates, and maintain a complete audit trail of all dispute-related activities.

Auto Top-Up Capability

The Wallet Top-up module currently supports manual wallet recharges by integrated payment aggregator through third-party payment applications and is operational in the pilot phase. The selected consulting firm shall enhance the existing module to support nationwide deployment by implementing an intelligent Auto Top-up Framework. The enhanced solution shall enable citizens to configure a minimum wallet balance threshold that automatically triggers a recharge from their linked payment instruments. The system shall support configurable recharge amounts, multiple funding sources, immediate and scheduled auto-recharge options, retry mechanisms for failed transactions, user consent management, and configurable notification alerts upon successful, failed, or cancelled auto-recharge transactions. The solution shall also provide users with the ability to enable, disable, and manage Auto Top-up settings through the D-Toll mobile application and web portal.

Component 2: Wallet Enhancement Framework

The wallet enhancement framework shall transform D-Toll's current single-wallet model into a comprehensive multi-wallet ecosystem capable of interoperating with the full spectrum of Bangladesh's financial services landscape.

Multi-Wallet Support and Synchronization

The system shall support simultaneous linkage of multiple wallet types including bank wallets (Internet Banking, Debit Card, Credit Card), Mobile Financial Service (MFS) wallets, Bangla QR standard and Payment Service Provider (PSP) integrations. A wallet synchronization engine shall maintain real-time balance consistency across all linked wallets and the D-Toll internal ledger.

Reconciliation Automation and Settlement Reporting

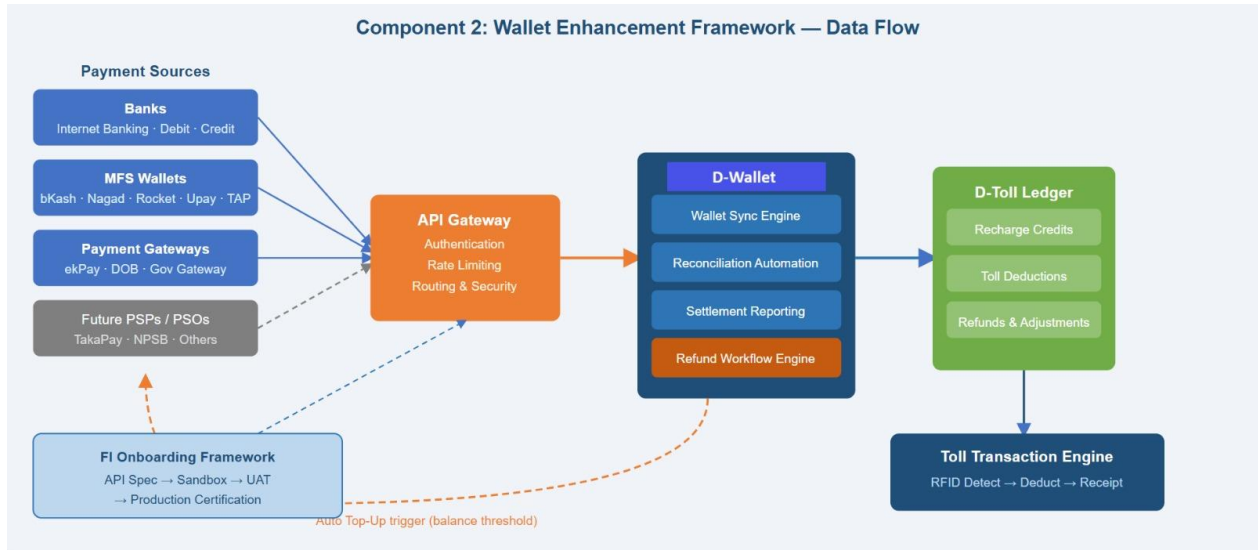
An automated reconciliation engine shall perform hourly, daily, weekly, and monthly reconciliation of all D-Toll transactions against payment gateway records, financial institution settlement files, and toll authority transaction logs. Discrepancy identification, flagging, and resolution workflows shall be integrated. Settlement reporting dashboards shall provide a2i, toll authorities, toll collectors and participating financial institutions with real-time and historical settlement status.

Financial Institution Onboarding Framework

A standardized onboarding framework shall be established enabling new banks, MFS providers, PSPs and PSOs to integrate with D-Toll through a documented, sandbox-tested, and production-validated process. Both Government-owned payment aggregators/gateways and private payment aggregators/gateways shall be supported.

Refund Workflow Enhancement

The refund management process shall be re-engineered to support automated refund initiation, multi-step approval workflows, direct disbursement to the citizen's linked wallet or bank account, and end-to-end audit trail maintenance.



Component 3: Development of Web-Based Citizen Portal

A fully functional, mobile-responsive web portal shall be developed using React.js (TypeScript) to serve as the primary self-service channel for citizens who prefer desktop or browser-based access over the mobile application.

The portal shall provide the following functional capabilities:

- User registration and profile management with NID-based identity verification.
- Vehicle registration and management including add, edit, remove, and ownership transfer.
- Wallet management covering balance viewing, recharge initiation, and auto top-up configuration.
- Transaction history with multi-dimensional filtering and downloadable PDF/Excel reports.
- Refund request submission and status tracking.
- Dispute management for transaction queries.
- Customer support ticketing and live chat integration.
- Downloadable monthly statements and formal receipts.

The portal shall be fully accessible via standard web browsers on desktop, tablet, and mobile devices, with a mobile-responsive interface ensuring usability on smaller screens without requiring the dedicated mobile application.

Component 4: Mobile Application Development

Native mobile applications shall be developed using the Flutter framework for simultaneous deployment on Android (Google Play Store) and iOS (Apple App Store) platforms. The applications shall represent the primary citizen engagement channel for D-Toll services.

The mobile application shall serve the following user categories:

- Individual Users: Private vehicle owners and their family members.
- Commercial Operators: Bus operators, truck operators, and logistics companies.
- Corporate Accounts: Large transport operators and government fleets.

The application shall comprise the following core functional modules:

Module 1: User Registration & Authentication

Citizens shall register using their mobile number, verified through OTP. National Identity Card (NID) verification shall be mandatory for full account activation. The authentication framework shall support PIN-based login, optional biometric login (fingerprint / face recognition) where device hardware supports it, and device binding to prevent unauthorized access. The complete user journey shall follow the sequence: Mobile Number Registration → OTP Verification → NID Verification → Profile Creation → D-Toll Account Activation.

Module 2: Vehicle Management

Users shall be able to add vehicles by providing the vehicle registration number, chassis number, vehicle category, and owner information. The system shall support the following vehicle categories: Motorcycle, Car/Jeep, Microbus, Pickup, Bus, Truck, Trailer, and Heavy Vehicle. Functions shall include add vehicle, bind vehicle, view vehicle information, unbind vehicle, transfer vehicle ownership, and view vehicle status. All vehicles shall be linkable to the user's D-Toll wallet for automatic toll deduction. The system should have the capacity to register bulk vehicle entry and bulk vehicle checking with registration.

Module 3: RFID Tag Management

RFID tag data retrieval shall be performed via the BRTA API integration. The application shall support tag validation, tag registration, tag binding to a vehicle, and lifecycle management through statuses of Active, Suspended, Blocked, and Replaced. Citizens shall be able to view RFID tag status, report tag issues, and request tag replacement through the application.

Module 4: D-Toll Wallet

The system shall provide a unified d-Toll wallet dashboard, accessible through both the web portal and mobile application, displaying the current wallet balance, latest recharge amount and date, pending toll deductions (if any), and low-balance notifications.

The unified d-Toll wallet shall support wallet operations including adding funds through all supported payment channels, processing eligible refunds to linked accounts, transferring balance between vehicles registered under the same user account, and configuring automatic top-up.

The system shall maintain a comprehensive wallet transaction ledger, recording all wallet activities, including recharges, toll deductions, refunds, and balance adjustments, along with transaction timestamps, toll plaza names, and unique transaction identifiers.

Note: No separate wallet engine shall be developed for the web portal or mobile application. The d-Toll platform shall utilize a single, centralized wallet mechanism that serves both the web and mobile application, ensuring a unified wallet balance, transaction history, and payment experience across all user interfaces.

Module 5: Payment & Recharge

The following payment channels shall be supported for wallet recharge:

- Banks: Internet Banking, Debit Card, Credit Card.
- Mobile Financial Services and available PSPs/PSOs/wallets.
- Payment Aggregator Gateway, Direct Operator Billing (DOB), and NPSB.

Recharge options shall include instant recharge (immediate credit), scheduled recharge (at a future time), and auto recharge (triggered by balance threshold).

Module 6: Subscription Management

The Toll Pass & Subscription Management Module shall provide a flexible and scalable framework enabling D-Toll to offer prepaid, subscription-based, credit-based charging, concessionary, and usage-based toll access products for individual users, commercial operators, government fleets, and future smart mobility programs.

The module shall support configurable pass creation, subscription lifecycle management, automated billing, entitlement validation, usage monitoring, and integration with participating toll operators and financial institutions.

The design shall accommodate current requirements and future national Electronic Toll Collection (ETC) expansion initiatives, including UNEF interoperability, congestion pricing, dynamic tolling, and mobility-as-a-service (MaaS) programs.

Module 7: Toll Transaction Management

The complete toll transaction flow from RFID detection to receipt generation shall be transparently tracked within the application. Transaction details shall include date and time, toll plaza name, toll lane, location, toll authority, vehicle number, toll amount, and post-deduction wallet balance. Real-time push notifications shall be sent at the moment of toll deduction. Transactions shall be viewable as receipts with downloadable excel & PDF capability.

Module 8: Toll History

A comprehensive transaction history interface shall support filtering by date range, vehicle, toll authority, toll plazas, toll lanes and transaction status. Export options shall include PDF, Excel, and email statement delivery.

Module 9: Fleet Management

Corporate and fleet accounts shall have access to bulk vehicle registration, a centralized fleet wallet, driver assignment to vehicles, cost center mapping for departmental billing, and fleet analytics including per-vehicle toll expenditure, route frequency analysis, and monthly fleet reports.

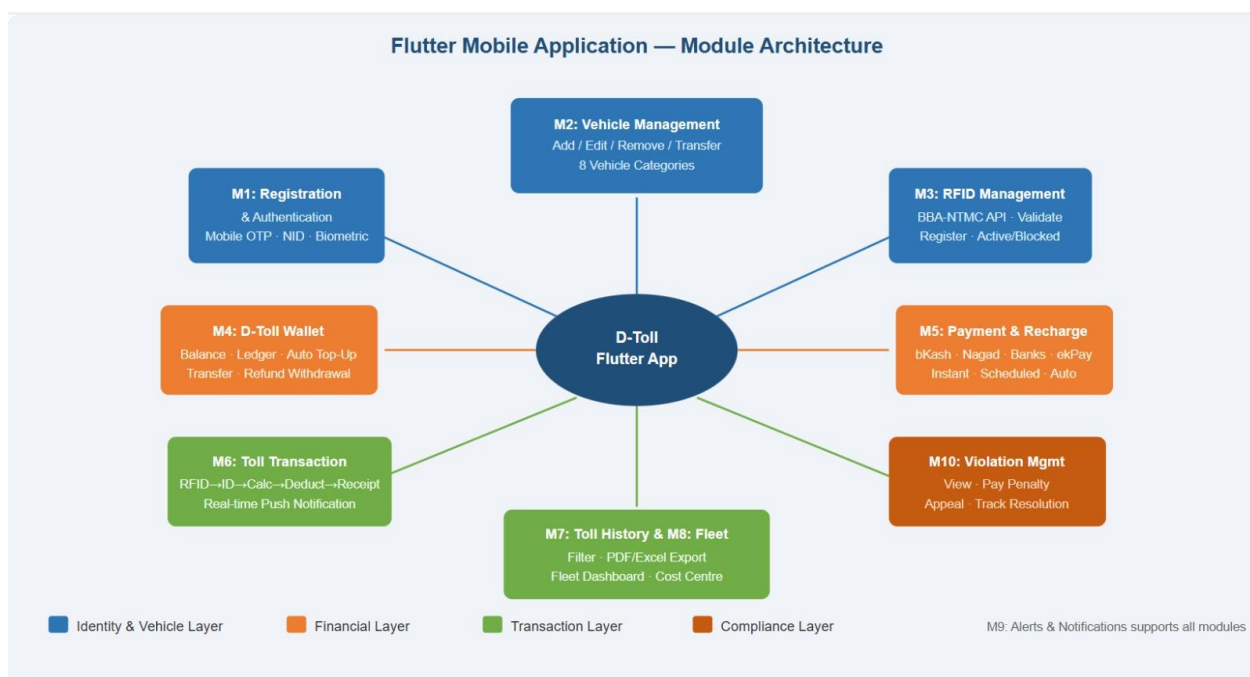
Module 10: Alerts & Notifications

Push notifications shall cover toll deductions, low balance alerts, RFID issues, and recharge confirmations. SMS notifications shall be sent for critical transactions where push delivery cannot be guaranteed. Daily, Date range, Monthly statement and customized emails shall be sent automatically to registered email addresses.

Module 11: Violation Management

The violation management module shall handle insufficient balance violations, invalid RFID flags, blacklisted vehicle alerts, and unauthorized passage records. Citizens shall be able to view violations, pay penalties online, submit appeals with supporting documentation, and track resolution status.

The application shall include the following key screens: Splash Screen, Login/Registration, Dashboard, My Vehicles, RFID Management, Wallet, Recharge, Transaction History, Toll Receipt Details, Fleet Dashboard, Violations, Profile & Settings, and Notifications.



Component 5: Toll Authority, Traffic division (Bangladesh Police) & Financial Institution Integration

This component addresses the expansion of D-Toll's integration ecosystem through structured API development and onboarding of toll operators and financial institutions.

Integration APIs shall be developed using Java Spring Boot for the following entity types:

- Toll Operators: BBA (existing, enhancements required), RHD, DSCC, LGED, and MoHPW systems.
- Financial Institutions: Banks, MFS providers, and PSPs beyond the current integration set.
- Traffic division Bangladesh Police
- Full integration with the payment gateway.
- Monitoring Platforms: Integration with centralized monitoring and alerting infrastructure.

The integration lifecycle shall follow a structured process: API specification and documentation → sandbox environment setup → Integration and testing → UAT with the relevant authority → production deployment → post-deployment monitoring. All integrations shall conform to the REST API standards, shall use HTTPS with mutual TLS where required by the integrating authority, and shall be documented in the API Specification Document.

The D-Toll platform shall provide a **Dynamic API Configuration and Integration Management Framework** that enables the Super Administrator to onboard and configure new organizations through the administrative portal without modifying the core application source code.

The framework shall allow the Super Administrator to:

- Register and manage new organizations.
- Configure organization-specific API endpoints.
- Define request and response parameters.
- Configure request headers, authentication methods, query parameters, path variables, and payload structures.

- Configure request and response field mappings based on the respective API documentation.
- Manage API versions and activation status.
- Configure timeout, retry, and endpoint settings.

The framework shall be metadata-driven, allowing standard RESTful APIs to be onboarded through configuration rather than software redevelopment. As a result, future organizations supporting standard REST APIs can be integrated directly through the administration portal without requiring changes to the core application.

Source code modification shall only be required for specialized integrations involving proprietary, legacy, or non-standard APIs that cannot be accommodated through the configurable integration framework.

Component 6: Disaster Recovery & Business Continuity

The Disaster Recovery (DR) infrastructure shall be upgraded to meet formal RTO and RPO targets, ensuring that a P1-class outage can be recovered within one hour with no more than fifteen minutes of transaction data loss.

DR infrastructure enhancements shall include:

- Real-time database replication between the primary production environment and the DR environment.
- Automated backup processes: hourly incremental backups and daily full backups stored in an off-site backup repository.
- DR application server provisioning mirroring the production environment specifications.
- Automated DR failover scripting and runbook documentation.

DR testing shall be conducted quarterly, with each drill covering: triggered failover, verification of service availability on DR infrastructure, RPO measurement through data consistency checks, RTO measurement through service restoration timing, and formal drill report submission to the Project Steering Committee.

Component 7: Operational Infrastructure Support

The firm shall establish and maintain the complete operational infrastructure required for D-Toll platform operation throughout the program period. This includes application servers (Java Spring Boot services), database servers (primary and replica), monitoring infrastructure, backup systems, security systems, P2P connectivity between toll plazas and national data center, cloud infrastructure on the National Data Centre.

A 24x7 monitoring framework shall be implemented covering all platform components with automated alerting, real-time health dashboards accessible to authorized a2i and ICT Division staff, and performance metrics tracking against SLA targets.

Component 8: Customer Support Operations

A formal customer support framework shall be established comprising:

- Ticket Management: A CRM-based ticketing system for logging, tracking, and resolving customer complaints with automated SLA timers and escalation triggers.
- Complaint Resolution: Defined resolution workflows for common complaint categories including failed transactions, wallet discrepancies, refund delays and vehicle registration problems.
- Escalation Management: Multi-level escalation paths from frontline support to technical operations to firm management for complex issues.

Component 9: IT Service Management (ITSM)

An ITSM platform aligned with ITIL best practices shall be deployed and configured for D-Toll operations. The platform shall cover:

- Incident Management: End-to-end incident lifecycle management from detection through resolution, with P1-P4 priority classification and SLA-bound response and resolution timers.
- Problem Management: Root cause analysis workflows for recurring incidents, known error database maintenance, and preventive action tracking.
- Change Management: Formal change request, review, approval, and implementation tracking for all platform changes including emergency change procedures.
- Release Management: Controlled release planning, scheduling, and post-release validation for application and infrastructure updates.
- SLA Reporting: Monthly SLA performance reports covering uptime, transaction success rates, API availability, customer complaint resolution, and critical incident resolution metrics.

Component 10: Security Assessment & Compliance

A comprehensive security assessment shall be conducted covering all D-Toll platform components:

- Vulnerability Assessment: Automated and manual scanning of all application and infrastructure components to identify security vulnerabilities.
- Penetration Testing: Controlled ethical hacking exercises simulating external and internal threat scenarios to identify exploitable vulnerabilities.
- Source Code Review: Manual and automated review of Java Spring Boot backend services, React.js frontend code, and Flutter mobile application code for security anti-patterns, injection vulnerabilities, authentication flaws, and data exposure risks.
- Security Gap Analysis: Comparison of current security posture against applicable standards and government ICT security directives.
- Remediation Roadmap: Prioritized remediation plan for all identified vulnerabilities, with critical and high-severity findings remediated within the program period.
- Security Monitoring: Deployment of security monitoring controls including API security controls, and encryption verification.

Component 11: Public Awareness & Stakeholder Engagement

A structured public awareness and stakeholder engagement program shall be conducted to improve D-Toll adoption and operational readiness:

- User Education Materials: Tutorial videos, user guides (Bangla and English), and FAQ documents for distribution through all channels.
- Stakeholder Workshops: Dedicated 8 workshops for toll system's stakeholders to support smooth integration, change management, and operational handover. Client will bear all the cost except resource honorarium for the workshop.

3.3.2 User and User Roles

User Category	Sub-Category	Key Capabilities
Citizen / Individual	Private Vehicle Owner	Vehicle registration, wallet management, toll history, refund requests
Citizen / Individual	Family Account Member	View family vehicles, view transactions, receive notifications
Commercial Operator	Bus / Truck Operator	Fleet registration, centralized wallet, driver assignment, fleet analytics
Commercial Operator	Logistics Company	Bulk registration, ERP integration, cost center mapping
Corporate Account	Large Transport Operator	Corporate wallet, bulk transactions, MIS reporting
Corporate Account	Government Fleet	Government fleet management, audit trail, compliance reporting
Toll Authority & BD traffic Division	BBA / RHD / DSCC / MoHPW/Traffic Division	Toll rate configuration, transaction monitoring, revenue reporting
Financial Institution	Bank / MFS / PSP	Settlement data access, reconciliation feeds, onboarding management
Platform Administrator	a2i	Full system administration, user management, configuration, audit
Customer Support	ITSM	Ticket management, complaint resolution, customer history access

3.3.3 Security and Privacy Policy

The D-Toll platform handles sensitive personal data (NID information, vehicle ownership records, financial transaction data, and biometric credentials) and is therefore subject to the following security and privacy requirements:

- **Identity & Access Management:** Role-based access control (RBAC) shall be enforced across all system components. Privileged access shall require multi-factor authentication (MFA).
- **Data Encryption:** All data shall be encrypted at rest using AES-256. All data in transit shall be encrypted using TLS 1.2 or higher. API communications shall use HTTPS with certificate pinning in the mobile application.
- **NID Data Handling:** NID verification shall be performed through the official government NID API. NID numbers shall not be stored in plaintext and shall be hashed using approved cryptographic functions.
- **Financial Data Compliance:** Financial transaction data handling shall comply with PCI-DSS principles applicable to payment intermediaries.
- **Session Management:** Session tokens shall expire after defined inactivity periods. Concurrent session controls shall be implemented in the mobile application.
- **Audit Logging:** All administrative actions, configuration changes, and security events shall be logged in an immutable audit trail integrated with the SIEM system.
- **Privacy Policy:** A formal privacy policy in Bangla and English shall be published within the mobile application and citizen portal, clearly stating data collection, usage, storage, and retention policies.

- Vulnerability Management: Critical and high-severity vulnerabilities identified during VAPT shall be remediated within 20 days. Medium-severity findings shall have remediation plans within 45 days.

3.3.4 Integration and External Dependencies

SI	External System / Service	Stakeholder	Integration Type	Readiness Status
1	BRTA Database API	BRTA, Bangladesh Bridge Authority, Roads and highways, NTMC	REST API (Spring Boot Client)	Active — Enhancement Required
2	National NID Verification API	Election Commission & a2i	REST API (Spring Boot Client)	Active
3	National Vehicle Registration DB	BRTA	REST API (Spring Boot Client)	Active — Coordination Required
4	Payment Gateway	PSP/PSO/A2i	REST API	Active — Full Integration Pending
5	MFS Gateway	MFSs	REST API	Pending
6	Bank/Card Gateway	Banks	REST API	Pending
7	TakaPay Gateway	Bangladesh Bank	REST API	Integration Pending
8	Other existing and upcoming financial Institutes	Other financial Institutes	REST API	Integration Planned
9	BBA toll operators	Existing toll operators	REST API	Partial Integration
10	RHD toll operators	Roads & Highways Department	Interoperability API (Spring Boot)	Integration Pending
11	DSCC Toll System	Dhaka South City Corporation	Interoperability API (Spring Boot)	Integration Planned
12	MoHPW Expressway System	Ministry of Housing & Public Works	Interoperability API (Spring Boot)	Integration Planned
13	National Payment Infrastructure (NPSB)	Bangladesh Bank	API	Future
14	Traffic Division	Bangladesh Police	API	Future

3.3.5 Hosting Requirement and Plan

All D-Toll platform components shall be hosted in compliance with Government of Bangladesh directives on national data hosting. The hosting architecture shall be as follows:

Primary Production Environment (National Data Centre/ BCC/ as per the client):

- Java Spring Boot microservices deployed on containerized infrastructure (Docker / Kubernetes).

- PostgreSQL database cluster with TimescaleDB extension for time-series transaction data.
- API Gateway layer (Spring Cloud Gateway) with load balancing and rate limiting.
- Monitoring infrastructure (Prometheus, Grafana, ELK Stack).
- Security infrastructure (WAF, IDS/IPS, SIEM).

Disaster Recovery Environment (Secondary Facility, BCC or designated DR site as per the client):

- DR Application Servers mirroring production microservices.
- DR Database Servers with real-time replication from primary.
- Backup Repository with automated backup storage and retention management.

3.4 Non-Functional Requirements

3.4.1 Sizing, Performance and Scalability Requirements

Parameter	Requirement
System Uptime	≥ 99.5% per month (excluding planned maintenance windows)
Transaction Success Rate	≥ 99.5% of initiated toll transactions
API Availability	≥ 99.5% for all published APIs
Concurrent Users	Support ≥ 50,000 concurrent mobile/web users
Peak Transaction TPS	Support ≥ 500 transactions per second during peak toll hours
API Response Time	≤ 2 seconds for 95th percentile of all API calls under normal load
Mobile App Launch Time	≤ 3 seconds cold start, ≤ 1.5 seconds warm start
RTO (Recovery Time Objective)	≤ 1 hour for P1-class outages
RPO (Recovery Point Objective)	≤ 15 minutes
Scalability	Horizontal scaling capability to 3× baseline capacity without architecture changes

3.4.2 Coding Convention

The following coding conventions and standards shall be mandatory for all development work:

- Java Spring Boot: Java 17 LTS or higher. Follow Google Java Style Guide. RESTful API design using OpenAPI 3.0 specification. Microservices shall be independently deployable and loosely coupled. Unit test coverage ≥ 80% for all service classes.
- React.js Frontend: TypeScript with strict mode enabled. React 18+ with functional components and hooks. Airbnb ESLint configuration. Responsive design using CSS Grid and Flexbox. Accessibility compliance per WCAG 2.1 Level AA.
- Flutter Mobile: Flutter 3.x (latest stable). Dart null safety enforced. BLoC or Riverpod state management. Platform-adaptive UI components. Widget test coverage ≥ 70%.
- Version Control: Git with GitFlow branching strategy. All code hosted in an ICT Division / a2i approved repository. Pull request reviews mandatory before merge to main branches.
- API Standards: REST with JSON. OpenAPI 3.0 documentation for all APIs. Versioned endpoints (e.g., /api/v1/). Consistent error response format across all services.

3.4.3 Business Continuity Plan

The Consulting firm shall develop and test a comprehensive Business Continuity Plan (BCP) for the D-Toll platform. The BCP shall address:

- Identification of all critical platform components and their maximum tolerable downtime.
- Failover procedures for application servers, database servers, and API gateway.
- Communication protocols for notifying stakeholders during an outage.
- Roles and responsibilities matrix for incident response and recovery.
- Quarterly DR drill schedule with documented outcomes and improvement actions.
- Escalation matrix linking operational incidents to executive notification thresholds.

3.4.4 Accessibility

The D-Toll platform (Web Portal, Mobile App, and Digital Services) shall be designed, developed, and maintained in compliance with the **Digital Service and Web Designing Guideline for Inclusive Accessibility 2022 (Bangladesh)**, **WCAG 2.2 Level AA**, and relevant disability inclusion regulations.

The vendor shall ensure:

- Accessibility is treated as a mandatory functional requirement throughout the project lifecycle.
- Full accessibility support for users with visual, hearing, physical, cognitive, and multiple disabilities.
- Compatibility with assistive technologies such as **NVDA**, **JAWS**, **VoiceOver**, **TalkBack**, screen magnifiers, keyboard-only navigation, and voice input systems.
- Accessible design features including proper text alternatives, captions, color contrast, responsive layouts, keyboard navigation, scalable fonts, and accessible forms.
- Accessibility compliance across all web interfaces, mobile applications, reports, manuals, downloadable documents, and digital content.
- Accessibility testing using automated tools and manual testing methods, including screen reader and keyboard navigation testing.
- Submission of Accessibility Compliance Plan, Accessibility Test Reports, Accessibility Conformance Report (VPAT/ACR), and remediation reports.
- Facilitation of independent accessibility audits and rectification of identified accessibility issues before final acceptance.

3.4.5 Documentation Plan

The Consultant shall produce and maintain the following documentation deliverables throughout the program:

Document	Description	Due By
Monthly Progress Reports	Monthly delivery progress, risk status, and SLA performance	Monthly
System Architecture Document / SRS	Full architecture of all platform components, layers, and integrations	Month 1
Application Design Document	Detailed design specifications for all application modules	Month 2

Document	Description	Due By
API Specification Document	OpenAPI 3.0 specification for all D-Toll APIs	Month 2
Database Design Document	ER diagrams, schema definitions, and data dictionary	Month 2
Operational SOP	Standard Operating Procedures for all platform operations	Month 3
Incident Response SOP	Step-by-step incident classification, response, and escalation procedures	Month 3
Disaster Recovery SOP	Detailed DR failover and recovery procedures with checklists	Month 3
User Manual	End-user guide for mobile app and citizen portal (Bangla & English)	Month 3
Administrator Manual	System administration guide for a2i / ICT Division operations team	Month 3
Security Operations Guide	Security monitoring, alert response, and vulnerability management procedures	Month 3
Technical Manual	System Overview, Installation and Deployment Guide, Configuration manual, database manual, API documentation, Source code documentation, change management manual, maintenance manual, connectivity manual, security manual, operations manual, disaster recovery manual, troubleshooting manual, release note and version history	Month 5
Knowledge Transfer Report	Formal training completion report with assessment results	Month 6
Key Performance Indicator Reporting	Annex A.7	Month 6
Full functionality Testing Report	Web and App based full functions	Month 6

3.4.6 Standards, Tools and Technologies preferred to be Used

Layer	Technology / Tool	Version / Standard
Backend Framework	Java Spring Boot	Java 17 LTS, Spring Boot 3.x
Web Frontend	React.js (TypeScript)	React 18+, TypeScript 5+
Mobile Application	Flutter (Dart)	Flutter 3.x stable, Dart 3+
Database (Transactional)	mysqlDB	Defined by a2i Technology team/ Updated stable one
Database (Time-Series)	mysqlDB	Defined by a2i Technology team/ Updated stable one
Containerization	Docker	Docker 24+

Layer	Technology / Tool	Version / Standard
Container Orchestration	Kubernetes	K8s 1.28+
API Specification	OpenAPI	3.0
Authentication	OAuth 2.0 / JWT	RFC 6749 / RFC 7519
Monitoring	Prometheus + Grafana	Latest stable
Log Management	ELK Stack (Elasticsearch, Logstash, Kibana)	Version 8.x
CI/CD	GitLab CI / Jenkins	Defined by a2i Technology team/ Updated stable one
Security Scanning	OWASP ZAP, SonarQube	Defined by a2i Technology team/ Updated stable one
Version Control	Git (GitFlow)	a2i own repository

3.4.7 Quality Assurance and IT Audit Requirement

The Consulting firm shall maintain a quality assurance framework throughout the program lifecycle:

- Unit Testing: All Java Spring Boot services shall have $\geq 80\%$ -unit test coverage measured by JaCoCo. All Flutter widget and business logic code shall have $\geq 70\%$ test coverage.
- Integration Testing: All API integrations (payment gateways, toll authority systems, NID, BRTA) shall undergo comprehensive integration testing in sandbox environments before production deployment.
- Performance Testing: Load testing simulating $10\times$ expected peak TPS shall be conducted before each major release using Apache JMeter or k6.
- Security Testing: VAPT shall be conducted by an independent a2i security team (not the development team) prior to production deployment.
- User Acceptance Testing (UAT): Formal UAT shall be conducted by designated a2i representatives for all major deliverables before acceptance sign-off.
- IT Audit: The a2i IT audit function shall have the right to conduct independent audits of the system, codebase, infrastructure, and processes at any time during the contract period.
- Code Quality: SonarQube static analysis shall be integrated into the CI/CD pipeline. Critical and blocking SonarQube findings must be resolved before any release.

3.5 Critical Components in Delivering the Services

The following components are identified as critical to program delivery and shall receive priority attention, dedicated resources, and heightened monitoring:

Critical Component	Risk if delayed	Mitigation Measure
NID API Integration	Blocks mobile app registration and citizen onboarding	Engage a2i for government API access from Week 1; develop mock NID service for parallel development
Flutter Mobile App (Android/iOS)	Core citizen-facing channel — delay impacts all adoption metrics	Dedicated Flutter team; phased delivery: core modules Month 2, full feature set Month 3
Multi-Wallet Reconciliation Engine	Financial discrepancies risk stakeholder trust	Engage financial institution API owners in Month 1; automated reconciliation testing weekly

Critical Component	Risk if delayed	Mitigation Measure
DR Infrastructure Deployment	P1 SLA breach risk without DR capability	DR environment to be established by end of Month 2 and tested by Month 4
BBA/RHD /DSCC/MOPHW/BD Police API Integration	Limits national rollout scope	Initiate formal API onboarding with BBA/RHD /DSCC/MOPHW/BD Police from Month 1 with a2i coordination support
Security Assessment & Remediation	Go-live risk if critical vulnerabilities unresolved	VAPT to begin by Month 2; critical findings resolved before Month 5 production deployment

3.6 Development & Approach Methodology

3.6.1 Development & Implementation Methodology

The program shall follow an Agile Scrum development methodology with two-week sprint cycles. Given the fixed six-month timeline and the multi-component nature of the program, the following phased delivery approach shall be adopted:

Phase	Duration	Activities
Phase 1: Foundation	Month 1	Architecture finalization, UI/UX design (Figma prototyping), infrastructure setup, API framework setup, team onboarding, detailed project plan
Phase 2: Development	Month 2-3	Flutter mobile app development, React citizen portal development, wallet enhancement engine, monitoring dashboard, RFID module, Spring Boot API development
Phase 3: Integration	Month 2-4	Toll operator API integration (BBA/RHD /DSCC/MOPHW/BD Police), financial institution integration, Payment Aggregator integration, system integration testing, User Acceptance Testing (UAT)
Phase 4: Sustainability & Handover	Month 4-6	DR testing, security assessment and remediation, knowledge transfer, production stabilization, documentation finalization, formal handover

3.6.2 System Design & Development Plan

The system design shall follow a microservices architecture with the following design principles:

- Domain-Driven Design (DDD): Each Spring Boot microservice shall own a clearly bounded domain (User Service, Vehicle Service, Wallet Service, Transaction Service, Notification Service, etc.).
- API-First Design: OpenAPI 3.0 specifications shall be authored before implementation begins, enabling parallel frontend (React/Flutter) and backend (Spring Boot) development.
- Event-Driven Architecture: Asynchronous inter-service communication shall use message queuing (Apache Kafka or RabbitMQ) for non-critical event propagation (notifications, analytics events).
- Twelve-Factor App Principles: All Spring Boot services shall follow twelve-factor app methodology for configuration management, statelessness, and deployment portability.

3.6.3 Testing Plan

Testing shall be organized across four levels:

1. Unit Testing: Automated unit tests for all Spring Boot service classes (JUnit 5 + Mockito), React components (Jest + React Testing Library), and Flutter widgets (flutter_test).
2. Integration Testing: API-level integration tests validating all external integrations (payment gateways, NID, BRTA, BBA/RHD /DSCC/MOPHW/BD Police) in sandbox environments.
3. System Testing: End-to-end test suites covering complete user journeys (registration → vehicle add → recharge → toll deduction → receipt) on staging environment.
4. Performance Testing: Load tests simulating 10× peak TPS using Apache JMeter. Stress tests to identify system breaking points. Results to be submitted as a formal Performance Test Report.

3.6.4 User Acceptance Test (UAT)

Formal UAT shall be conducted for each major deliverable milestone. The UAT process shall include:

- UAT Test Plan preparation by the Consultant and approval by a2i at least two weeks before UAT commencement.
- UAT test execution by designated a2i / ICT Division representatives in a dedicated UAT environment.
- Defect tracking in the project's ITSM platform with severity classification and resolution SLAs.
- UAT sign-off by a2i upon resolution of all P1 and P2 defects.
- Regression testing following defect resolution to confirm no unintended impacts.

3.6.5 Migration of Legacy Data

The existing D-Toll platform contains operational data including registered user accounts, vehicle records, RFID tag bindings, wallet balances, and historical transaction records. A formal data migration plan shall be developed and approved by a2i prior to execution. Key migration requirements:

- Zero data loss for all existing wallet balances and active vehicle registrations.
- Transaction history records shall be preserved and accessible through the new portal and mobile app.
- Dual-run period of minimum 48 hours where both old and new systems process transactions before final cutover.
- Data validation scripts shall verify record counts, balance totals, and referential integrity post-migration.
- Rollback plan shall be documented and tested before production migration execution.

3.6.6 Risk Management Plan

Risk	Probability	Impact	Mitigation
Delay in government API access (NID, BRTA)	High	High	a2i to facilitate API access from Week 1; mock services for parallel development
Payment gateway integration complexity	Medium	High	Begin integration engagements in Month 1; dedicated integration engineer per gateway
Flutter App Store approval delays	Low	Medium	Submit to Play Store and App Store by end of Month 2 for review buffer
BBA/RHD /DSCC/MOPHW/BD Police API non-readiness	High	Medium	Agree on API specifications early; develop adapter layer for flexible integration
Security VAPT critical findings delaying production	Medium	High	Begin VAPT in Month 2; remediate critical findings continuously
Resource attrition in the consulting firm team	Low	Medium	Consultant to maintain resource continuity plan; knowledge sharing mandatory
DR infrastructure procurement delay	Low	High	DR environment procurement to be initiated in Month 1

3.6.7 Deployment and Implementation Plan

Deployment shall follow a blue-green deployment strategy to minimize downtime during releases. The deployment pipeline shall include:

- Development Environment: Daily automated builds from feature branches.
- Staging Environment: Sprint-end deployments for integration testing and UAT.
- Production Environment: Bi-weekly controlled releases following UAT sign-off, using blue-green deployment with automated rollback capability.
- Mobile App Deployment: Play Store and Apple Store releases managed through a2i consoles, with phased rollout (10% → 50% → 100%) for major releases.
- Release Notes: Formal release notes to be submitted to a2i for every production deployment.

3.6.8 Training and Knowledge Transfer Plan

The consulting firm shall deliver a structured knowledge transfer program ensuring that the D-Toll Operations Team at a2i / ICT Division can independently manage, monitor, and support the platform after project completion.

Training Session	Audience	Duration	Topics Covered
System Architecture	a2i Technical Team	2 Days	Microservices design, Spring Boot services, database schema, deployment architecture
Infrastructure Administration	a2i Technical Team	2 Days	Kubernetes management, database administration, backup procedures, scaling
Application Administration	a2i Technical Team	2 Days	Admin portal usage, configuration management, user management, integration monitoring

Training Session	Audience	Duration	Topics Covered
ITSM Operations	a2i Technical Team	1 Day	Incident handling, change management, problem management, SLA tracking
Security Operations	a2i Technical Team	1 Day	SIEM monitoring, alert response, vulnerability management, security audit procedures
Disaster Recovery	a2i Technical Team	1 Day	DR failover procedures, backup restoration, RTO/RPO verification
Customer Support Operations	Support Team & toll authorities	1 Day	CRM usage, complaint handling workflows, escalation procedures

Success criteria for knowledge transfer: minimum 75% operational readiness of D-Toll internal team, minimum 80% training assessment score for all participants, and formal acceptance sign-off by a2i and ICT Division.

3.6.9 Support & Maintenance Plan

The Consultant shall provide the following support during and after the program period:

- During Program (Months 1–6): Dedicated development support, bug fixes within 24 hours for P1 issues, weekly progress reporting, and proactive monitoring of all integrated systems.
- Post Go-Live Stabilization (Month 6+): A minimum three-month post-go-live stabilization period shall be provided with reduced-intensity support including bug fixes, performance tuning, and minor enhancement deployment.
- SLA-Bound Support: All support activities shall be bound by the SLA matrix defined in Annex-A.

3.6.10 Work Distribution & Team Composition

Role	Qty	Minimum Qualification	Key Responsibilities
Project Manager	1	– Bachelor's/Master's in Computer Science or Engineering or any relevant discipline. – At least 10 years of experience in software development, with - At least 2 years in a leadership role. – Preferred certification in PMP, PRINCE2, Scrum Master, or equivalent.	Overall delivery, stakeholder management, risk governance, reporting
Solution Architect	1	– Bachelor's/Master's in Computer Science or Engineering or any relevant discipline. – At least 10 years of experience in software development - At least 2 years in a solution architect role. – Preferred certification in TOGAF, AWS, Azure, Google, or Oracle Solution Architect.	Architecture design, technology decisions, integration framework
Infrastructure Expert	1	– Bachelor's/Master's in Computer Science or any relevant discipline. – At least 6 years of experience in infrastructure - At least 2 years in a system design or lead role and delivered at least two enterprise infrastructure	End to end backend connectivity maintenance with A2i and

Role	Qty	Minimum Qualification	Key Responsibilities
Lead Senior Java Spring Boot Developer	1	deployments. – Certification in AWS/Azure preferred. – Bachelor's in Computer Science or any relevant discipline or graduate in any discipline. – At least 10 years of experience in software development. -At least 6 years in a senior or lead developer role. – Strong coding, code review, and mentoring capability.	connected authorities. Backend service development, API implementation, database design
Backend Developer (Java, Spring Boot)	7	– Bachelor's in Computer Science or any relevant discipline or graduate in any discipline. – At least 6 years of experience in software development. -At least 4 years in a back-end development role. -Developed and maintained at least two scalable server-side applications or APIs. – Strong grasp of server-side logic, performance, and database management.	Backend service development, API implementation, database design
Frontend Developer(React)	2	– Bachelor's in Computer Science or Engineering or any relevant discipline. – At least 5 years of experience in software development. -At least 2 years in a front-end development role. - Delivered at least two responsive and accessible web applications. – Strong understanding of UI design, performance optimization, and accessibility.	Citizen portal, admin portal, fleet portal development
Senior Flutter Developer	1	– Bachelor's in Computer Science or Engineering or any relevant discipline. – At least 10 years of experience in software development. -At least 6 years in a front-end development role. -Delivered at least two responsive and accessible web applications.	Mobile app development for Android and iOS
Flutter Developer	1	– Bachelor's in Computer Science or any relevant discipline or graduate in any discipline. – At least 7 years of experience in software development. -At least 4 years in a full-stack development role. - Designed and developed at least two end-to-end web application modules or systems. – Skilled in both front-end and back-end development, with ability to lead modules independently.	Mobile app development for Android and iOS
Database Administrator	1	– Bachelor's/Master's in Computer Science or any relevant discipline. – At least 8 years of experience in database	Database design, optimization,

Role	Qty	Minimum Qualification	Key Responsibilities
		administration. -At least 6 years in a DBA role. Managed at least two production-grade databases. – Preferred Certification in Database administration, or equivalent preferred.	replication, backup management
QA Expert	1	– Bachelor's/Master's in Computer Science or any relevant discipline. – At least 8 years of experience in QA -At least 4 years in a QA leadership role. Managed at least two test-heavy projects. – Certification in QA tools or frameworks preferred.	Test planning, automation, UAT coordination, performance testing
QA Engineer	2	– Bachelor's in Computer Science or any relevant discipline or graduate in any discipline. – At least 5 years of experience in software testing. - At least 3 years in a QA role. Participated in at least two test cycles. – Familiar with test cases, bug tracking, and functional testing.	Test planning, automation, UAT coordination, performance testing
Security Expert	1	– Bachelor's in Computer Science, IT, or any relevant discipline. – At least 10 years of experience in support. - At least 4 years in application or incident management. -Supported at least two live systems.	VAPT execution, source code review, security remediation, SIEM setup
UX/UI Designer	1	– Bachelor's in Design, or any relevant discipline. – At least 10 years of experience in device responsive UI/UX design. -At least 5 years in a lead role. - Designed at least two full digital products.	User journey design, prototyping, accessibility compliance
Business Analyst	1	– Bachelor's/Master's in BBA, ICT, MIS, or any relevant discipline. – At least 10 years of experience in business analysis. -At least 8 years in a digital project role. Contributed to at least two requirement documents..	Requirements analysis, stakeholder liaison, UAT support, documentation
Technical Document Writer	1	– Bachelor's in IT, or any relevant discipline. – At least 5 years of experience in software development documentation. -At least 2 years in system or user guide writing. Produced documentation for at least two platforms. – Skilled in writing and editing tech content.	CRM setup, helpdesk framework, support team training

Note: *** Infra Expert & two (2) backend developer shall work on this project working at A2i premises and rest backend developers shall work from the consulting firm premises to develop & maintain 24/7 support during the contract tenure. ***

3.6.11 Expected Deliverables

SI	Deliverable	Description	Timeline	Acceptance Authority
1	Integration APIs	Toll operator (BBA, RHD, DSCC, MoHPW), DMP, BRTA and financial institution APIs (Spring Boot)	Month 1-	a2i
2	ITSM Platform	Incident, problem, change, and release management platform (Months 1-8)	Month 1-6	a2i
3	Reimbursable Payments	SMS, email gateway and email, resource person associated honorarium	Month 1-6	A2i
4	API Documentation	OpenAPI 3.0 specification for all D-Toll APIs	Month 2	a2i
5	Fleet Management Module	Corporate and fleet functionality for commercial operators	Month 2	a2i
6	Mobile Application (Android)	Flutter-based D-Toll citizen app — Play Store deployment	Month 3	a2i
7	Mobile Application (iOS)	Flutter-based D-Toll citizen app — App Store deployment	Month 3	a2i
8	Security Assessment Report	VAPT, source code review, gap analysis, and remediation roadmap	Month 3	a2i
9	SOP Documentation Package	Operational, incident response, DR, and security SOPs	Month 3	a2i
10	Auto Top-Up Framework	Automated recharge capability integrated with all payment channels	Month 3	a2i
11	Enhance Citizen Web Portal	React.js self-service portal — production deployment	Month 4	a2i
12	Monitoring Dashboard	Operational monitoring solution — 24x7 coverage, alerting, health dashboards	Month 4	a2i
13	Wallet Enhancement Engine	Multi-wallet, reconciliation, and settlement platform (Spring Boot)	Month 4	a2i
14	Customer Support Platform	CRM and Helpdesk implementation with SLA tracking	Month 4	a2i
15	RFID Management Module	RFID registration and lifecycle management via RHD & BBA-NTMC API	Month 4	a2i
16	Go-Live Readiness Report	Final operational readiness assessment before production go-live	Month 4-5	a2i

17	Disaster Recovery Environment	Secondary recovery environment with RTO ≤ 1hr, RPO ≤ 15min	Month 3-6	a2i
18	Knowledge Transfer Completion Report	Training completion, assessment results, and operational readiness certification	Month 4-6	a2i
19	Monthly Progress Reports	Delivery status, risk register update, SLA performance report	Monthly	a2i
20	Key Performance Indicator Reporting	Annex A.7	Month 5	a2i
21	Full functionality Testing Report	Web and App based full functions	Month 5	a2i

Annex-A: Service Level Agreement (SLA) Matrix

A.1 Purpose

This SLA defines the service performance, incident response, recovery commitments, and operational support requirements for the D-Toll Integrated Toll Management System throughout the program period and beyond.

A.2 Incident Priority Classification

Priority	Classification	Description
P1	Critical / Out of Service	Nationwide toll transaction failure, core platform unavailable, payment processing outage affecting all toll facilities
P2	Service Interruption	Partial service degradation affecting one or more toll operators or payment channels, with no viable workaround
P3	Non-Service Affecting	Functional issue with a viable workaround available; degraded user experience without transaction failure
P4	Service Request	Information request, configuration request, minor enhancement request, or non-urgent query

A.3 Service Response Matrix

Priority	MTTA	MTTR	Status Update Interval
P1 – Critical Outage	5 Minutes	1 Hour	Every 15 Minutes
P2 – Service Interruption	10 Minutes	4 Hours	Every 60 Minutes
P3 – Non-Service Affecting	1 Hour	24 Hours	Every 6 Hours
P4 – Service Request	20 Minutes	1 Business Day	Daily

A.4 Availability Requirements

Service Component	Target Availability
D-Toll Core Platform (Spring Boot Services)	99.50%
Wallet Service	99.50%
API Gateway (Spring Cloud Gateway)	99.50%
Monitoring Platform	99.00%
Mobile Application Services (Flutter Backend)	99.00%
Citizen Portal (React.js)	99.00%
Payment Integration Services	99.50%
RFID Validation Service	99.50%

A.5 Disaster Recovery Targets

Parameter	Target
Recovery Time Objective (RTO)	≤ 1 Hour
Recovery Point Objective (RPO)	≤ 15 Minutes
Backup Frequency (Incremental)	Hourly
Backup Frequency (Full)	Daily
DR Drill Frequency	Quarterly
DR Drill Report Submission	Within 5 business days of each drill

A.6 Support Coverage

Support Type	Coverage Hours
Helpdesk Support (Citizen Queries)	Business Hours (Sunday–Thursday, 9:00 AM – 5:00 PM)
Critical Incident Support (P1/P2)	24×7 (including holidays)
Infrastructure Monitoring	24×7 Automated (with on-call engineer)
Security Monitoring	24×7 Automated (with on-call security engineer)
Escalation Management	24×7

A.7 Key Performance Indicators

KPI	Target	Measurement Method
System Uptime	≥ 99.5%	Monitoring platform uptime logs
Transaction Success Rate	≥ 99.5%	Transaction database success/failure ratio
API Availability	≥ 99.5%	API Gateway health metrics
Customer Complaint Resolution Rate	≥ 95%	CRM ticket resolution statistics
Critical Incident Resolution within SLA	≥ 95%	ITSM SLA compliance reports
DR Drill Completion	100% of quarterly drills completed	DR drill reports
Knowledge Transfer Readiness	≥ 75% operational readiness	Training assessment scores

Annex-B: Project Deliverable Matrix

Refer to Section 3.6.11 Expected Deliverables for the complete deliverable matrix.

B.1 Milestone Schedule

Phase	Month	Key Milestones
Phase 1 – Foundation	Month 1(Over the contract period)	Architecture document finalized; UI/UX prototypes approved; infrastructure provisioned; API framework (OpenAPI specs) completed; project plan approved
Phase 2 – Development	Month 3(Over the contract period)	Flutter mobile app (core modules) deployed to staging; React citizen portal deployed to staging; wallet enhancement engine deployed; monitoring dashboard live; RFID module completed
Phase 3 – Integration	Month 3-4(Over the contract period)	BBA, RHD and DSCC API integrations completed; ekPay and new MFS integrations live; all UAT sign-offs obtained; performance test report approved; VAPT report submitted and critical findings remediated;
Phase 4 – Sustainability	Month 5(Over the contract period)	DR testing completed and report submitted; VAPT report submitted and critical findings remediated;
Phase 5 – Handover and Closing	Month 6(Over the contract period)	knowledge transfer completed; production go-live; final handover accepted by a2i

Annex-C: Knowledge Transfer Plan

C.1 Objective

To ensure the sustainable, independent operation of the D-Toll platform by the internal D-Toll Operations Team at a2i and ICT Division after completion of the program. Vendor shall ensure a minimum of 75% operational readiness of the internal team is achieved and formally certified by program end.

C.2 Target Audience

- D-Toll Operations Team (a2i / ICT Division)
- a2i Technical Development Team
- Bangladesh Bridge Authority (BBA) Technical Representatives
- Roads and Highways Department (RHD) Technical Representatives
- Participating Financial Institution Technical Contacts

C.3 Knowledge Transfer Areas

Training Domain	Area	Topics Covered
Technical	System Architecture	Spring Boot microservices design, React.js component architecture, Flutter app structure, database schema, integration patterns
Technical	API Management	Spring Cloud Gateway configuration, API versioning, rate limiting, authentication, monitoring
Technical	Database Administration	PostgreSQL / TimescaleDB administration, query optimization, replication management, backup and restore procedures
Technical	Infrastructure Management	Kubernetes cluster management, Docker operations, cloud infrastructure (NDC), CI/CD pipeline management
Technical	Security Administration	SIEM monitoring, alert triage, vulnerability scanning, security audit procedures
Technical	Disaster Recovery	DR failover procedures, backup verification, RPO/RTO testing, recovery runbooks
Operational	Monitoring Platform	Grafana dashboard usage, Prometheus alert configuration, ELK log analysis, capacity monitoring
Operational	Incident Management	ITSM platform usage, incident classification, escalation procedures, SLA tracking
Operational	Change Management	Change request process, release approval workflow, rollback procedures
Operational	Customer Support	CRM platform administration, complaint handling workflows, escalation matrix usage
Functional	Wallet Operations	Reconciliation engine operation, settlement reporting, dispute management
Functional	Toll Operations	Transaction processing oversight, RFID management, violation management

Training Domain	Area	Topics Covered
Functional	Fleet Management	Corporate account management, bulk registration, fleet analytics

C.4 Documentation Deliverables

The Consulting firm shall provide the following documentation as part of the knowledge transfer package: System Architecture Document, Application Design Document, API Specification Document (OpenAPI 3.0), Database Design Document, Operational SOP, Incident Response SOP, Disaster Recovery SOP, User Manual (Bangla & English), Administrator Manual, and Security Operations Guide.

C.5 Training Schedule

Session	Duration	Target Audience
Architecture & System Design Training	2 Days	a2i Technical Team
Stakeholder consultation on tech framework	1 day	A2i & All relevant stakeholders
Infrastructure & DevOps Training	2 Days	a2i Operations Team
Application Administration Training	2 Days	a2i Technical & Operations Teams
ITSM Operations Training	1 Day	Operations & Support Teams
Security Operations Training	1 Day	Security & Operations Teams
Disaster Recovery Training & Simulation	1 Day	Operations Team
Customer Support Operations Training	1 Day	Customer Support Team(333/ a2i team)

C.6 Success Criteria

- Minimum 75% operational readiness of D-Toll internal team verified through simulation exercises.
- Minimum 80% average training assessment score across all training participants.
- Successful execution of at least one full end-to-end operational simulation (DR drill, incident simulation, change deployment).
- Formal Knowledge Transfer Completion Report accepted and signed by a2i Programme Coordinator and ICT Division.

Annex-D: Architecture & Integration Framework

D.1 Target Architecture

The D-Toll platform architecture is organized into six logical layers, each with defined responsibilities and technology components:

Layer	Description	Technology Components
Layer 1: User Channels	All citizen and corporate access interfaces	Flutter (Android/iOS Mobile Apps), React.js (Citizen Portal, Fleet Portal, Government Fleet Portal, Customer Support Portal)
Layer 2: D-Toll Core Platform	All backend business logic services	Java Spring Boot Microservices: User Management, Vehicle Registry, RFID Management, Wallet Management, Toll Transaction Engine, Settlement Engine, Notification Service, Reporting & Analytics Engine
Layer 3: Integration Layer	API gateway and external system connectors	Spring Cloud Gateway (Authentication, Routing, API Management, Rate Limiting, Security); Integration adapters for BBA, RHD, DSCC, LGED, MoHPW, ekPay, Banks, MFS, NID, BRTA, NTMC
Layer 4: Data & Analytics	All data storage, processing, and analytics components	PostgreSQL (Operational DB), TimescaleDB (Transaction Time-Series), Data Warehouse, Analytics Platform, Monitoring Dashboard (Grafana)
Layer 5: Security	Platform-wide security controls	IAM, MFA, API Security (Spring Security/OAuth2), SIEM Integration, Vulnerability Monitoring, AES-256 Encryption at Rest, TLS 1.2+ in Transit
Layer 6: Infrastructure	Physical and virtual hosting environment	Primary: National Data Centre (BCC) — Production Servers, DB Cluster, API Infrastructure, Monitoring. DR: Secondary Facility — DR App Servers, DR DB Servers, Backup Repository

D.2 Integration Architecture

The D-Toll integration architecture follows an API-first, hub-and-spoke model with Spring Cloud Gateway serving as the central API management layer. All external systems connect to D-Toll exclusively through the API Gateway, ensuring centralized authentication, authorization, rate limiting, and monitoring for all integrations.

The national D-Wallet platform provides the financial middleware layer between citizens' payment channels and the central D-Toll ETC platform. Citizens interact with D-Toll through their preferred payment interface (Bank Applications, MFS Apps such as bKash/Nagad/Upay, PSP Applications, or the UNEF Mobile App / D-Toll Flutter App, or the React Web Portal). All of these connect to the National D-Wallet Platform via Secure API, which in turn communicates with the Central D-Toll ETC Platform via Encrypted Data channels.

The Central D-Toll ETC Platform connects downward through Interoperability Sync to the four toll authority systems: BBA System (Padma Bridge, Jamuna Bridge, Muktarpur Bridge, Karnaphuli tunnel, Dhaka Elevated Expressway, and upcoming BBA toll plazas), RHD System (With one tolling system by RHD and other necessary toll related parameters), DSCC System (Jatrabari Flyover) and MoHPW System (Chittagong Expressway).

At the field level, all toll authority systems connect to the Field Infrastructure & Car Detection Devices layer comprising RFID Readers, ANPR Cameras, Smart Gates, Vehicle Sensors, Lane Controllers, Traffic Monitoring systems, and Cashless ETC Lanes. Real-time Transaction Processing flows from field infrastructure back to the Central D-Toll ETC Platform.

D.3 Future National ETC Expansion

The architecture shall be designed and implemented to support the following future expansion objectives of the National Unified Electronic Toll Collection (UNEF) framework:

- **National UNEF Interoperability:** The API Gateway and integration layer shall be designed to accommodate UNEF standard protocol compliance as it is finalized by the relevant government authority.
- **Multi-Operator Toll Clearing:** The settlement engine shall support centralized clearing of toll transactions across all participating toll authorities, with operator-level settlement reconciliation.
- **Centralized Settlement Framework:** A national settlement framework connecting D-Toll to Bangladesh Bank's national payment infrastructure (NPSB) shall be supported through the architecture.
- **Cross-Agency Toll Collection:** Citizens shall be able to use a single D-Toll account for toll payment across BBA, RHD, DSCC, LGED, BIWTA and MoHPW facilities without any re-registration.
- **Nationwide RFID Interoperability:** RFID tags issued by any participating authority shall be recognizable and processable at all toll facilities connected to the D-Toll ecosystem.
- **Smart Mobility Integration:** The architecture shall provide API hooks for future integration with smart mobility platforms, urban traffic management systems, and multimodal transport payment initiatives.

D.4 Proposed Payment Schedule (Excluding Reimbursable)

Phase	Payment	Key Milestones
Phase 1 – Foundation	10%	Inception & SRS; Architecture document finalized; UI/UX prototypes approved; infrastructure provisioned; API framework (OpenAPI specs) completed; project plan approved.
Phase 2 – Development	20%	Flutter mobile app (core modules) deployed to staging; React citizen portal deployed to staging; wallet enhancement engine deployed; monitoring dashboard live; RFID module completed
Phase 3 – Integration	20%	BBA, RHD and DSCC API integrations completed; Payment aggregator and new MFS integrations live; all UAT sign-offs (web & app) obtained; performance test report approved; 1st VAPT report submitted and critical findings remediated;
Phase 4 – Sustainability	20%	DR testing completed and report submitted; Final VAPT report submitted and critical findings remediated;
Phase 5 – Handover and Closing	30%	knowledge transfer completed; production go-live; final handover accepted by a2i

D.5 Reimbursable Items (Actual payment)

SI	Reimbursable cost	Measuring Unit	QTY	Month/delivery time
1	SMS/month (with masking)	No of SMS	350,000	1-6
2	Email/month	No of email	350,000	1-6
3	P2P VPN connectivity establishment	No of connections	10	1-6
4	P2P VPN connectivity	No of connections	15	1-6
5	Resource Person honorarium	Man Day	8	1-6
6	Testing car (KM/month)	KM	6800	1-6
7	Test Macbook Pro(times) latest version	Pieces	2	1
8	Test Mobile Phone (Android device) latest version	Pieces	1	1
9	Test Mobile Phone (ios device) latest version	Pieces	1	1

Reimbursable expenses shall be paid on an actual basis, subject to submission of proper supporting documents and approval by the competent authority.

*Vehicle Support for Project Coordination and Field Activities details

The Consulting firm shall provide dedicated transportation support throughout the **six (06)-month contract period** to facilitate project implementation, stakeholder coordination, field inspections, integration activities, testing, and deployment.

The transportation service shall include travel for meetings and coordination activities with, but not limited to, the following organizations:

Bangladesh Bridge Authority (BBA)
 Roads and Highways Division (RHD)
 Ministry of Housing and Public Works (MoHPW)
 Bangladesh Police
 Bangladesh Road Transport Authority (BRTA)
 Bangladesh Bank
 Dhaka South City Corporation (DSCC)

In addition, the Consulting firm shall provide transportation support for visits to each designated bridge, tunnel, toll plaza, and expressway covered under the project. Each site shall be visited **at least Eight (08) times** during the contract period to support activities including, but not limited to, stakeholder meetings, technical assessments, system integration, User Acceptance Testing (UAT), pilot operations, live testing, training, and formal commissioning or launch.

The Consulting firm shall provide a **well-maintained vehicle of model year 2018 or newer**, with a seating capacity of **ten (10) persons**, equipped with a **valid BRTA RFID tag/sticker** to ensure seamless access through Electronic Toll Collection (ETC) facilities where applicable.

The quoted transportation cost shall be deemed inclusive of all associated expenses, including fuel, driver remuneration, driver accommodation (where overnight stays are required), bridge and expressway tolls, parking charges, vehicle maintenance, and any other incidental travel-related costs. No separate payment shall be made for these expenses.

List of proposed toll installations:

SL	Bridge Name	District
1	Shahid Mayez Uddin Bridge	Narsingdi
2	Meghna-Gomoti Bridge (Meghna Toll Plaza)	Sonargaon, Narayanganj
3	Meghna-Gomoti Bridge (Gomoti Toll Plaza)	Daudkandi, Cumilla
4	3rd Shitalakshya Bridge	Narayanganj
5	Sayed Nazrul Islam Bridge (Bhairab Bridge)	Bhairab
6	Charsindur Toll Plaza	Narsingdi
7	Madhumati Bridge (Kalna Bridge) Toll Plaza	Kalna, Narail
8	Karnaphuli Bridge (Shah Amanat Bridge) Toll Plaza	Chattogram
9	Rupsha Toll Plaza (Khan Jahan Ali Bridge)	Khulna
10	Paksey Toll Plaza (Lalon Shah Bridge)	Kushtia
11	Karnaphuli Tunnel	Chattogram
12	Jamuna Bridge	Tangail/Sirajganj
13	Padma Bridge (Mawa Toll Plaza)	Munshiganj
14	Moktarpur Bridge	Munshiganj
15	First Dhaka Elevated Expressway (Airport Entry)	Dhaka
16	Chattogram Elevated Expressway	Chattogram
17	Payra Bridge	Barishal
18	Jatrabari Flyover	Dhaka
19	N8 Expressways	Dhaka- Mawa-Vanga

D.6 Duration of the project

- Six months

"Subject to the approval of the project extension and availability of funds."

D.7 TOR vetted by

- Roads and Highways division, Bangladesh Bridge authority, Dhaka South City corporation, Bangladesh Roads and Transport authority, Bangladesh Police (Traffic Division).