Indian Highway Management Company Limited (IHMCL)

RFQ for shortlisting of System Integrator(s) for implementation of Hybrid ETC System at Toll Plazas on National Highways

Tender No. IHMCL/HETC/2018/08

Indian Highways Management Company Limited (IHMCL)

Regd Office: Room No.402, NHAI HQ, G5&6, Sector-10, Dwarka, New Delhi-110075

(CIN- U74140DL2012PLC246662)

Corporate Office Sector-19, Dwarka, New Delhi-110075

Phone : 011 2804 2710

email: info@ihmcl.com

web site:www.ihmcl.com

14-Aug-18

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This Documents comprises of six parts.

DISCLAIMER

The information contained in this Request for Qualification document (the "RFQ") or subsequently provided to prospective Applicant(s), whether verbally or in documentary or any other form by or on behalf of IHMCL or any of its employees or advisors, is provided to Applicant(s) on the terms and conditions set out in this RFQ and such other terms and conditions subject to which such information is provided.

The issue of this RFQ does not imply that the Authority is bound to select or shortlist pre-qualified Applications for the Bid stage or to appoint the Selected Applicant or Contractor, as the case may be, for the Project and the Authority reserves the right to reject all or any of the Applicants or Applications without assigning any reason whatsoever.

The assumptions, assessments, statements and information contained in the RFQ, may not be complete, accurate, adequate or correct. Each Applicant should, therefore, conduct its own investigations and analysis and should check the accuracy, adequacy, correctness, reliability and completeness of the assumptions, assessments, statements and information contained in this RFQ and obtain independent advice from appropriate sources.

Information provided in this RFQ to the Applicant(s) is on a wide range of matters, some of which may depend upon interpretation of law. The information given is not intended to be an exhaustive account of statutory requirements and should not be regarded as a complete or authoritative statement of law. IHMCL accepts no responsibility for the accuracy or otherwise for any interpretation or opinion on law expressed herein.

IHMCL, its employees and advisors make no representation or warranty and shall have no liability to any person, including any Applicant under any law whether written or otherwise , statute, rules or regulations or tort, principles of restitution or unjust enrichment or otherwise for any loss, damages, cost or expense which may arise from or be incurred or suffered on account of anything contained in this RFQ or otherwise, including the accuracy, adequacy, correctness, completeness or reliability of the RFQ and any assessment, assumption, statement or information contained therein or deemed to form part of this RFQ or arising in any way for participation in this RFQ.

IHMCL also accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance of any Applicant upon the statements contained in this RFQ. IHMCL may in its absolute discretion, but without being under any obligation to do so, update, amend or supplement the information, assessment or assumptions contained in this RFQ.

PART-I: NOTICE INVITING APPLICATIONS

NOTICE INVITING APPLICATIONS

1. Applications are invited by the Indian Highways Management Company Limited (IHMCL) to empanel the following:

Name of the Work	Document Fee(non-refundable)	Closing date and time
Shortlisting/empanelment of System Integrator(s) for implementation of Hybrid Electronic Toll Collection (ETC) System at Toll Plazas on National Highways	INR 5,000/- (Rupees Five Thousand Only)	31 August 2018 (Upto 15:00 Hrs IST)

The RFQ document may be downloaded from the NHAI and IHMCL website indicated below. The Applications shall be liable for summarily rejection unless accompanied by the requisite document fee as indicated above. IHMCL shall not be responsible for any postal delay. Applications submitted after the closing date/time shall be summarily rejected.

IHMCL reserves the right to accept or reject any or all Applications for the project, before signing of Contract Agreement without thereby incurring any financial or other liability to the affected Applicants.

Address for communication and for Application submission:

The Chief Operating Officer/General Manager
Indian Highways Management Co. Ltd. (IHMCL)
2nd Floor, MTNL Building,
Sector 19, Dwarka
New Delhi 110 075

Phone: +91-11- 28042710
Email: info@ihmcl.com   Website: www.ihmcl.com

PART II: DEFINITIONS

2. DEFINITIONS

In this document, the following terms shall have respective meanings as indicated:

"Applicable Law" means the laws, rules or regulations and any other instruments, having the force of law in Republic of India, as in force from time to time.

"Authorized Representative" means any person/agency authorized by IHMCL.

"Applicant/Bidder" means a 'firm' or 'Consortium' which participates in the subject RFQ and submits its application/bid.

"Application/Bid" means the documents submitted by the Applicant in response to this RFQ.

"Commencement date" means the date upon which the Service Provider receives the notice to commence the work issued by IHMCL.

"Contract" shall mean & include RFQ , Notice for Inviting Tender (NIT), the tender documents and letter of acceptance thereof and the formal agreement, to be executed between IHMCL and the Service Provider together with the complete documents referred to therein including the conditions with appendices and any special conditions, the specifications, designs, drawings, bill of quantities with rates and amounts. All these documents taken together shall be deemed to form one Contract and shall be complementary to each other

"IHMCL" means Indian Highways Management Company Ltd.

"Law" or "Legislation" - shall mean any Act, notification, bye law, rules and regulations, directive, ordinance, order or instruction having the force of law enacted or issued by the Government of India or State Government or regulatory authority.

"Letter of Award (LOA)" means the issue of a signed letter by IHMCL to Successful Bidder conveying its intention to accept the offer of Successful Bidder and awarding the work mentioning the total Contract Value.

"Local Currency" means the Indian Rupees

"MoRTH" means Ministry of Road Transport and Highways

"NHAI" means National Highways Authority of India.

"Party" shall mean IHMCL or Applicant individually and "Parties" shall mean IHMCL and Applicant collectively.

"Personnel" means persons hired by the Service Provider as employees and assigned to the performance of the Services or any part thereof.

"RFQ" shall mean this Request for Quotation dated 14 August 2018, including the written clarifications & Corrigendum/Addendum issued by IHMCL in respect of the

RFQ from time to time.

"Services" means requirements defined in this RFQ including all additional services associated thereto to be delivered by the Successful Applicant.

"Service Provider/System Integrator" shall mean the bidder shortlisted/empanelled post this RFQ process.

"**Shortlisted Applicant"** means the Applicant(s), who, after the complete evaluation process, has been issued the Letter of Intent by IHMCL

PART-III : INSTRUCTIONS TO APPLICANTS

Application Conditions

3.1 Eligibility to Apply: -

Applicants who fulfil the following eligibility criteria are eligible to apply-

(i) The Applicant should be an entity operating in the field of Tolling Systems for Highways and should have successfully executed the supply, install, commission & maintenance of Tolling systems for at least 10 Electronic Toll Collection (ETC) Lanes with RFID transceivers across one or more projects.
(A certificate from Authorized Signatory of the Bidder as proof for the above in the format specified in Section 6.5: Business Plan)

(ii) Applicant shall have positive net worth in each of the last three consecutive financial years, the last financial year being taken as financial year ended on 31st March-2017. For the purposes of this RFQ, net worth (the "**Net Worth**") shall mean the aggregate value of the paid-up share capital and all reserves created out of the profits and securities premium account, after deducting the aggregate value of the accumulated loses, deferred expenditure and miscellaneous expenditure not written off, as per the audited balance sheet, but does not include reserves created out of revaluation of assets, write back of depreciation and amalgamation.
(A certificate from the Statutory Auditor as proof for the above in the format specified in Section 6.3: Applicant's Financial Capacity)

(iii) The Applicant shall have average annual turnover of INR 20 Crores (Rupees Twenty Crore) for last three Financial Years the last financial year being taken as financial year ended on 31st March-2017.
(A certificate from the Statutory Auditor as proof for the above in the format specified in Section 6.3: Applicant's Financial Capacity)

(iv) The Applicant should not have been sanctioned or blacklisted or debarred by any government department/agency/PSU for material non-performance or contractual non-compliance in the last 3 years.
(Undertaking to be provided by the Authorized Signatory of the Bidder on its letterhead)

(v) **The Applicant or Bidder may be:**
   i. A Company incorporated and registered in India under the Companies Act, 2013/1956.
   OR

   ii. A Wholly Owned Subsidiary (WOS) Company registered in India of a Foreign Company having requisite experience. For considering the experience of the Foreign Holding Company ("**Parent Company**"), the

WOS registered in India should provide an undertaking from their Parent Company confirming thereby:

a. Perpetual and unconditional access to assets, intellectual property, expertise, personnel and facilities of the Parent Company to the WOS;

b. Sharing of risks and profits of the WOS by the Parent Company; and

c. That the Parent Company has sufficient representation and control of the management of WOS to control the activities of the subsidiary.

d. That the Parent Company is holding and shall continue to hold 51% (Fifty one percent) shareholding in Indian Company at all times during the Contract period and sufficient representation in the management of Indian Company to control the activities of such Indian Company.

Subject to and fulfilment of the conditions as mentioned above, the experience and the details of the Parent Company will be considered, otherwise the details/ experience of WOS only, will be considered.

It is clarified that under this concept, there is no involvement of Parent Company; the WOS shall participate as a sole applicant.

OR

iii. A Joint Venture (JV)/ Consortium subject to fulfilling following conditions:

a. All Partners of the JV/Consortium shall be entities incorporated and registered in India under the Companies Act, 2013/1956.

b. Maximum number of partners in the JV or Consortium shall be two, including the Lead Partner;

c. The Partners in a JV or Consortium shall be jointly and severally liable;

d. The Lead Partner in the JV or Consortium shall be single largest partner in terms of Capital contribution to the Capital of JV/Consortium.

e. The eligibility/ experience of JV or Consortium shall be considered cumulatively.

f. The eligibility/ experience of any partner of JV or Consortium shall be considered only if the partner is proposed to hold at least twenty-six percent (26%) of capital contribution in the JV/ Consortium.

g. The parties in JV or Consortium cannot be part of any other JV / Consortium or bid individually for the same project. Effectively one party shall be bidding only once, either as a standalone company or as a part of Consortium / JV for this project.

The documentary proof in support of the experience(in the form of copy of work order and completion certificate from its clients indicating the names of projects undertaken, scope of work of each project, name of client, start date, date of completion, value of the project etc.) shall be submitted as part of the eligibility documents. The details of the said proofs of experience should be submitted in the prescribed format.

3.2 Technical Evaluation Criteria

The eligible bidders will be evaluated under the following Technical Evaluation Criteria:

S.No.	Criteria	S.No.	Sub-Criteria	Maximum Marks
A	Financial Strength	A1	Bidder's Average Annual Turnover over the last 3 financial years (FY 2014-15, 2015-16 and 2016-17). • INR 20 Cr to 40 Cr : 5 Marks • >INR 40 Cr. to 60 Cr : 10 Marks • >INR 60 Cr. to 80 Cr : 20 Marks • >INR 80 Cr. to 100 Cr : 30 Marks • >INR 100 Cr: 40 Marks	40
B	Technical Strength	B1	Experience in implementing & operationalising ETC Lanes using RFID transceivers • 10 to 50 Lanes : 10 Marks • 51 to 100 Lanes : 15 Marks • 101 to 150 Lanes: 20 Marks • 151 to 200 Lanes: 25 Marks • > 200 Lanes: 30 Marks	30
		B2	Experience in implementing & operationalising Toll Management System for Cash Lane • 0 to 50 lanes : 10 Marks • 51 to 100 lanes: 15 Marks • 101 to 150 Lanes: 20 Marks • 151 to 200 Lanes: 25 Marks • > 200 Lanes: 30 Marks	30

Total	100

Only Bidders scoring at least total technical score of 75 shall be shortlisted.

The Applicants/Bidders must provide all supporting documents specified above in support of each technical requirement as per format provided in Section 6.6 – Format for Technical Experience.

3.3 POWER OF ATTORNEY:-

The Applicant should submit a notarized Power of Attorney in the format provided at Section 6.4 authorizing the signatory of the Application to sign the Bid/Application and all related documents.

3.4 CONTENT OF RFQ

3.4.1 The RFQ should be read in conjunction with any addenda or clarifications issued subsequent to publication of RFQ.

3.4.2 Applicants are advised to study the RFQ carefully. Submission of the Application will be deemed to have been done after careful study and examination of all instructions, eligibility norms, terms and requirement specifications in the RFQ with full understanding of its implications. Applications not complying with all the stipulations and requirements as set forth in this RFQ are liable to be rejected at the sole discretion of IHMCL. Failure to furnish all information required in the RFQ or submission of an Application not substantially responsive to the RFQ in all respects will be at the Applicant's risk and may result in the rejection of the Application.

3.5 COST OF BIDDING:

The Applicant shall bear all costs associated with the preparation and submission of the Application and IHMCL will in no case, be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

3.6 CLARIFICATION ON RFQ

3.6.1 All Applicants are required to go through the RFQ document and submit their queries/ clarifications to IHMCL at info@ihmcl.com, or in writing within 07 days (shall be received by IHMCL) from the date of publication of this RFQ. IHMCL will neither acknowledge nor respond to any queries received after this date.

3.6.2 Pre-Application conference meeting(s) will be held at G 5 & 6, Sector-10, Dwarka, New Delhi-110075 on 21 August 2018 at 11.00 AM.

3.6.3 IHMCL will publish the clarifications to the Applicants' queries on NHAI and IHMCL website only. No separate information or communication will be sent to any particular Applicant in this regard.

3.6.4 Save and except as provided in this RFQ, IHMCL shall not entertain any correspondence with any Applicant in relation to acceptance or rejection of any Application.

3.6.5 Applications shall be deemed to be under consideration immediately after the Applications are opened and until such time IHMCL makes official intimation of qualification or disqualification to the Applicants. While the Applications are under consideration, Applicants and/ or their representatives or other interested parties are advised to refrain, save and except as required under this RFQ, from approaching or contacting through any means, IHMCL and/ or their employees/ representatives on matters related to the Applications under consideration.

3.7 AMENDMENT OF RFQ

3.7.1 At any time prior to the closure of time for submission of Applications, IHMCL, for any reason, whether at its own initiative or in response to the clarifications requested by prospective Applicants may modify the RFQ by issuing amendment(s) or Corrigendum.

3.7.2 Any Corrigendum /Addendum issued as aforesaid shall be part of the RFQ and shall be displayed /communicated on *www.ihmcl.com* and www.nhai.gov.in. No separate communication will be passed to any Applicant in this regard.

3.8 LANGUAGE OF APPLICATION

The Application prepared by the Applicant, as well as all correspondence and documents relating to the Bid exchanged by the Applicant and IHMCL shall be written in English language only.

3.9 PREPARATION AND SUBMISSION OF APPLICATION

The Applications shall be submitted in a sealed envelope which shall bear the identification: **"Applications for Shortlisting of System Integrator(s) for implementation of Hybrid ETC System at Toll Plazas on National Highways"**, which should contain following details:

(i)   Document fee of Rs. 5,000/- in the form of Demand Draft
(ii) Technical Application.

The technical application shall contain the following:

a. Index of documents with page number;
b. A cover letter on the letter head of the Applicant in the prescribed format at Section 6.1
c. Power of Attorney (in original) in favour of the authorized signatory of the Applicant in the prescribed format at Section 6.4; the Power of Attorney should be executed on a non-judicial stamp paper of appropriate denomination and should be registered or duly notarized by a notary public.
d. Documents in support of justifying the eligibility criteria prescribed in this document

3.9.1   The envelope shall be addressed to the following officer and shall be submitted

at the following address:

    ATTN. OF: Mr. Rajesh Tripathi
    DESIGNATION   Senior Manager, IHMCL
    ADDRESS: 2nd Floor, MTNL Building, Sector 19, Dwarka,
                             New Delhi-110075
    E-MAIL ADDRESS: info@ihmcl.com

3.9.2   If the envelopes are not sealed and marked as instructed above, IHMCL assumes no responsibility for the misplacement or premature opening of the contents of the Application submitted and consequent losses, if any, suffered by the Applicant.

3.9.3   Applications submitted by fax, telex, telegram or e-mail shall not be entertained and shall be summarily rejected.

3.10   APPLICATION VALIDITY

3.10.1 Applications shall remain valid for a period of 180 days from the last date of Application submission. Any Application valid for a shorter period shall be rejected as non-responsive.

3.10.2 In exceptional circumstances, IHMCL may solicit Applicant's consent to an extension of the period of validity. The request and the responses thereto shall be made in writing; however, no modification to such Application shall be permitted.

3.11   DOCUMENT FEE

3.11.1 Document fee: The document fee (non-refundable) of Rs. 5000/- (Rupees Five thousand only) in the form of a demand draft / pay order drawn in favour of "Indian Highways Management Company Limited." Drawn on any Scheduled bank payable at New Delhi shall be submitted by the Applicant.

3.11.2 Any Application not accompanied by an acceptable Document Fee shall be rejected by IHMCL as non-responsive.

3.12   ALTERNATIVE PROPOSALS BY APPLICANTS

Applicant shall submit only one offer for each package that fully complies with the requirement of the RFQ including conditions of Contract. Conditional offer or alternate offer will not be considered further in the process of tender evaluation.

3.13   FORMAT FOR SIGNING OF APPLICATIONS

3.13.1 The Applicants are required to fill up and submit all the formats.

3.13.2 The Application shall be signed by a duly authorized person to sign on behalf of the Applicant. All pages of the Application except any un-amended printed literature shall be signed and sealed by the person signing the Application.

3.13.3 The Application shall contain no overwriting, alterations or additions. If it is necessary to correct errors made by the Applicant, in which case such corrections shall be made by scoring out the cancelled portion, writing the correction and signing by the authorized signatory of the Application.

3.14 FORMAT FOR SUBMISSION OF PROPOSALS

3.14.1 Technical Application will have to be submitted ONLY in HARD BOUND (Hard bound implies such binding between two covers through stitching or otherwise whereby it may not be possible to replace any paper without disturbing the document) form with all pages sequentially numbered either at the top or at the bottom right corner of each page. It should also have an index giving page wise information of above documents.

3.14.2 The outer envelope shall indicate the name and address of the Applicant to enable the Application to be returned unopened in case it is received after Application Submission Time is over and is, therefore declared "Late Received".

3.14.3 If the envelopes containing Application Documents are not sealed and/or marked as required herein above, IHMCL will assume no responsibility for the Application's misplacement or premature opening.

3.15 KEY DATES

Sl. No.	Event Description	Date
1.	Invitation of RFQ (NIT)	14 August 2018
2.	Last date for receiving queries	20 August 2018
3.	Pre-Application conference	21 August 2018
4.	Authority response to queries latest by	27 August 2018
5.	Application Due Date	31 August 2018 (Upto 15:00 Hrs IST)
7.	Opening of Applications	at 11.30 Hrs 04 September 2018
8.	Declaration eligible / qualified Bidders	within 30 days from Application Due Date

3.16 DEADLINE FOR SUBMISSION OF APPLICATIONS

3.16.1 Complete Application containing all envelopes as specified must be received by IHMCL at the address specified in the NIT on or before 31.08.2018 up to 15:00 Hrs.(IST). In the event of the specified date for the submission of Applications being declared a Non-working day for IHMCL, the Applications will be received up to the specified time on the next working day.

3.16.2 IHMCL may, at its discretion, extend the deadline for submission of Applications by issuing an amendment in which case all rights and obligations of IHMCL and the Applicants previously subject to the original deadline will thereafter be subject to the deadline extended.

3.16.3 Offer by fax / e-mail will not be accepted and shall be treated as void ab-initio.

3.17 LATE SUBMISSION

Applications received after the deadline shall not be considered and shall be rejected and returned to the Applicant unopened. No representation or communication would be entertained in this regard from any Applicant.

3.18 MODIFICATION AND WITHDRAWAL OF APPLICATIONS

3.18.1 Applicants may modify or withdraw their Application before the deadline.

3.18.2 The modifications or withdrawal shall be submitted in a separate sealed envelope and marked as 'Modifications or withdrawal" as appropriate. No Application shall be modified or withdrawn after the deadline for submission of Applications.

3.19 OPENING OF APPLICATIONS

3.19.1 Technical Applications will be opened at 11:30 Hrs. (IST) on 04.09.2018 at IHMCL Corporate Office , 2nd Floor , MTNL Building, Sector -19,Dwarka,New Delhi-110075.

3.19.2 Applicant's authorized representative may attend the opening, and those who are present shall sign the Attendance Sheet evidencing their attendance.

3.19.3 The Applicant's names, Application modifications or withdrawals and such other details as IHMCL at its discretion, may consider appropriate, will be announced at the time of opening.

3.19.4 Technical Applications shall be opened first and based upon the evaluation of Technical Applications, IHMCL shall announce the names of the Applicants who have been shortlisted for supplying the requisite equipment's. It is hereby clarified that only these shortlisted Applicants may be invited for supplying the equipment's.

3.20 EXAMINATION AND EVALUATION OF APPLICATIONS

3.20.1 Any time during the process of evaluation, IHMCL may seek for clarifications from any or all Applicants. Failure of any Applicant to provide the required clarifications within the stipulated timeline may result in rejection of its

Application, at the sole discretion of IHMCL.

3.20.2 Phase-1: Test of Responsiveness:

As part of the evaluation process, IHMCL shall first determine whether each Application is responsive to the requirements of this RFQ. An Application shall be considered responsive only if:

i.   Technical details are received as per the format required under this RFQ ;
ii.   Application is accompanied by the document fee as specified
iii. Application is accompanied by the Power of Attorney in the format as required under this RFQ ;
iv.   Application contains all the information as required (complete in all respects);
v.   Application does not contain any condition or qualification;
vi.   Application is accompanied by Power of Attorney for Lead Member of Consortium and the Joint Bidding Agreement as specified in RFQ, if applicable;
vii. it is not non-responsive in terms hereof

IHMCL reserves the right to reject any Application which is non-responsive and no request for alteration, modification, substitution or withdrawal shall be entertained by IHMCL in respect thereof.

First, the envelope containing Document fee will be opened and if it is found to have been furnished by the Applicant in the prescribed manner to the satisfaction of IHMCL, then the second envelope containing Technical Proposal documents shall be opened. At any stage during the evaluation, if the Document fees is found to be invalid or missing, the respective Applicant's Application shall be summarily rejected.

3.20.3 Phase-2: Technical Proposal Evaluation:

The Technical Applications will be evaluated by an Evaluation Committee. The Applicant shall have to fulfil all the Eligibility Criteria as specified here in, in totality and submit all the required documents. These documents will be scrutinized in this phase of evaluation. Those Applicants who do not fulfil the terms and conditions of Eligibility Criteria as specified in this tender will not be eligible for further evaluation.

The Applications that meet the Eligibility Criteria will subsequently be scutinized under the Technical Evaluation criteria. Only the Applicants meeting threshold score of 75 marks will be shortlisted.

Ealuation of Technical Proposals by IHMCL shall not be questioned by any of the Applicants. IHMCL may ask Applicant(s) for additional information, visit to Applicant's site and/ or arrange discussions with their professional, technical faculties to verify claims made in Technical Application documentation from the Applicant on the already submitted Technical Proposal at any point of time.

3.21   PROCESS CONFIDENTIALITY

Information relating to the examination, clarification, evaluation, and comparison of Applications and recommendations for the award of a Contract shall not be disclosed to Applicants or any other persons not officially concerned with such process until the award to the Successful Applicant has been announced. Any attempt by an Applicant to influence IHMCL's processing of Applications or award decisions may result in the rejection of his Application.

3.22   SHORTLISTING CRITERIA

3.22.1 IHMCL will shortlist Applicants who's Application has been determined to be responsive in terms of this RFQ.

3.23   IHMCL'S RIGHT TO REJECT ANY OR ALL APPLICATIONS

Notwithstanding anything contained herein, IHMCL reserves the right to reject any Application, and to annul the bidding process and reject all Applications at any time before signing of Contract Agreement, without thereby incurring any liability to the affected Applicant(s) or any obligation to inform the affected Applicant(s) of the grounds for such decision.

3.24   CONFIDENTIALITY

3.24.1 The Applicant shall keep confidential any information related to this RFQ with the same degree of care as it would treat its own confidential information. The Applicants shall note that the confidential information will be used only for the purposes of this tender and shall not be disclosed to any third party for any reason whatsoever.

3.24.2 Information relating to the examination, clarification, evaluation and recommendation for the Applicants shall not be disclosed to any person who is not officially concerned with the process or is not a retained professional advisor advising IHMCL in relation to, or matters arising out of, or concerning the bidding process. IHMCL will treat all information, submitted as part of the Bid, in confidence and will require all those who have access to such material to treat the same in confidence. IHMCL may not divulge any such information unless it is directed to do so by any statutory entity that has the power under law to require its disclosure or as may be required by law or in connection with any legal process or such information which would be available in public domain.

3.24.3 At all times during the performance of the Services, the Applicant shall abide by all applicable IHMCL, NHAI/MoRTH's security rules, policies, standards, guidelines and procedures. The Applicant should note that before any of its employees or assignees is given access to the Confidential Information, each such employee and assignees shall agree to be bound by the term of this tender.

3.24.4 The Successful Applicant should not disclose to any other party and keep confidential the terms and conditions of this Contract, any amendment hereof, and any Attachment or Annexure hereof.

The obligations of confidentiality under this section shall survive termination of

the Contract.

3.24.5 Applicants shall not be under a declaration of ineligibility or blacklisting for corrupt and fraudulent practices by the Central Government, the State Government or any public undertaking, autonomous body, authority by whatever name called under the Central or the State Government.

3.25   CORRUPT OR FRAUDULENT PRACTICES

IHMCL will reject a proposal for award and appropriate the Performance Security, if it determines that the Applicant recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question.

IHMCL will declare the Applicant ineligible, either indefinitely or for a stated period of time, to be awarded a contract by IHMCL if it at any time determines that the Applicant has engaged in corrupt or fraudulent practices in competing for the contract, or during execution.

"Corrupt practice" means the offering, giving, receiving, or soliciting of anything of value to influence the action of a public official or employee of IHMCL in the procurement process or in Contract execution.

"Fraudulent Practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of IHMCL and includes collusive practice among Applicants (prior to or after Application submission) designed to establish bid process at artificial non-competitive levels and to deprive IHMCL of the benefits of free and open competition.

3.26   MISCELLANEOUS

3.26.1 The Application Process shall be governed by, and construed in accordance with, the laws of India and the Courts at New Delhi shall have exclusive jurisdiction over all disputes arising under, pursuant to and/ or in connection with the Bidding Process.

3.26.2 IHMCL, in its sole discretion and without incurring any obligation or liability, reserves the right, at any time, to;

3.26.2.1 suspend and/ or cancel the Application Process and/ or amend and/ or supplement the Bidding Process or modify the dates or other terms and conditions relating thereto;

3.26.2.2 consult with any Applicant in order to receive clarification or further information;

3.26.2.3 retain any information and/ or evidence submitted to IHMCL by, on behalf of, and/ or in relation to any Applicant; and/ or

3.26.2.4 Independently verify, disqualify, reject and/ or accept any or all submissions or other information and/ or evidence submitted by or on behalf of any Applicant.

3.26.3 It shall be deemed that by submitting the Application, the Applicant agrees and releases IHMCL, its employees, agents and advisers, irrevocably,

unconditionally, fully and finally from any and all liability for claims, losses, damages, costs, expenses or liabilities in any way related to or arising from the exercise of any rights and/ or performance of any obligations hereunder, pursuant hereto and/ or in connection with the Bidding Process and waives, to the fullest extent permitted by applicable laws, any and all rights and/ or claims it may have in this respect, whether actual or contingent, whether present or in future.

3.26.4 If the Applicant has committed a transgression under this RFQ such as to put its reliability or credibility into question, IHMCL shall be entitled to blacklist and debar such Applicant for any future tenders/contract award process in its sole and absolute discretion.

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PART IV- CONDITIONS OF CONTRACT

4.1 CONDITIONS OF CONTRACT

These Conditions shall supplement or amend the other parts of the Bidding Documents and whenever there is a conflict; provision herein shall prevail over those in the other parts of the Bidding Documents.

4.2 GOVERNING LANGUAGE

All correspondence and other documents to be exchanged by the parties shall be written in the English language. The version written in English language shall govern its interpretation.

4.3 APPLICABLE LAW

Appropriate laws as in force in Republic of India shall apply.

4.4 INTERPRETATION

In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined.

4.5 The Applicants are expected to examine all terms and instructions included in the RFQ Document. During preparation of the technical proposal, the Applicants shall make their own assessment of staff to undertake the assignment.

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PART V - Scope of Work

5.1 **Background:**

In order to remove the bottlenecks associated with manual toll collection and ensure seamless movement of traffic and collection of toll as per the notified rates, the Government had decided to introduce Electronic Toll Collection (ETC) across National Highways in India. Some of the State Governments have also expressed willingness to implement ETC at Toll Plazas on State Highways under their jurisdiction.

IHMCL has been mandated by NHAI for providing services of Hybrid ETC and Toll Management Systems at the toll plazas allotted by NHAI to IHMCL for implementation of Hybrid ETC infrastructure and Toll Management Systems.

5.2 **Objective:**

To cater to the above requirement, IHMCL intends to empanel Service Provider(s) to undertake the supply, installation, integration, testing, commissioning and configuration of all required hardware & software systems & sub-systems for Hybrid ETC and Toll Management Systems at the toll plazas in a time bound manner. Service provider is also expected to provide round the clock maintenance for the same during the entire period of contract such that the required services are available at the toll plazas as per service level requirements.

5.3 **Detailed Scope of Work:**

The subsequent sections capture details regarding potential work that may be awarded to shortlisted Applicants by IHMCL. IHMCL reserves the right to reduce/add details to the scope to better satisfy the requirements.

5.3.1 **Supply, Installation and Integration:**

i. The service provider shall supply, install, integrate, test, commission and configure all required hardware & software systems & sub-systems for Hybrid ETC and Toll Management System at the designated Toll Plazas upon instructions from IHMCL.

ii. Service provider shall ensure to supply items as per BOQ at site as per direction from IHMCL and get them verified by respective PIU. Prior to site acceptance test, the responsibility of providing storage and security for supplied material shall be in the scope of service provider.

iii. Service Provider shall be fully responsible for the safety of equipment which shall be delivered or installed at site before commencing SAT by respective PIU. Prior to SAT, if any equipment/sub-equipment/consumable gets non-functional/damaged due to any reason whatsoever, excluding scenarios covered under force majeure, then service provider will be liable for replacing of damaged item without imposing any extra charges to IHMCL.

iv. For each toll plaza, IHMCL shall invite bids from the shortlisted Service Provider(s) to commence work on the specified Toll Plaza Sites as per instructions/timelines received from NHAI for installation of Hybrid ETC System and Toll Management System.

v. Service provider shall complete the Installation, Integration, Commissioning of Hybrid ETC system and sub systems as specified in Annexure-A on such specified sites within 30 days of the receipt of notification. The service provider shall be responsible for system integration so that the Hybrid ETC and Toll Management System including the sub-system(s) work coherently and are able to exchange data/information electronically, among themselves (if applicable), as well as with the acquirer bank and central clearing house for ETC program without any financial implication to Toll Operating Agency and IHMCL/NHAI.

vi. Service provider shall ensure to complete all pre-requisite minor civil works i.e. pole foundation/ sensor foundation/ cabling chamber/lane ducting, plaza to Lane connectivity, Median Extention etc. pertaining to hybrid ETC system and Toll Management System. Major civil works i.e. PQC work, toll plaza canopy, toll booth, etc. are not in the scope of service provider.

vii. Service provide shall provide and install valid throughout the period of contract antivirus and operating System license at lanes as well as plaza level in the system highlighted in BOQ items of this document.

viii. Service Provider shall providse equipments performance monitoring tool/report for calculating uptime of equipments and provide necesseary access to IHMCL/NHAI.

5.4 **Defect Liability Period(DLP):**

I. DLP will commence from a time of Take Over Certificate(TOC) /Site Acceptance Test (SAT) issuance and will run for a period of two years (24 month).

II. Maintenance, repair and replacement of all hardware, software, peripherals and sub components of all BOQ items shall be the responsibility of Service Provider without any cost to IHMCL/NHAI.

III. Service provider shall resolve all faults in a specified timeframe as per the priority of the equipment to minimize closure of the lanes.

IV. Service provider shall be fully responsible for the warranty of all items which shall be supplied by them. Service Provider shall ensure to resolve all faults of equipment/Sub-equipment/consumables which are linked to spare dependency within 24 hours from the time when the fault actual occurs and for this as indicated through equipment monitoring toll or intimated by IHMCL/NHAI/Toll Operating Agency, adequate spare quantity to be maintained at site level for critical items specially Hybrid ETC equipment. If the time for rectification exceeds 24 hours, 1% penalty on daily basis shall be imposed on service provider from the amount which shall be reserved for completion of DLP.

V. Corrective of all defective materials and workmanship in the installation will be carried out as required within this period. All de-snagging will be expediently completed within this period.

VI. The Service provider shall provide 24X7 on-site support. during the DLP period.

5.5 Service provider shall adhere to the maintenance of ETC & TMS Equipment, Periodic Preventive Maintenance of equipment, Timely Corrective Maintenance, Software Maintenance, Remote Software support for the Hybrid ETC & Toll System. **Operation and Maintenance:**

i. Maintenance, repair and replacement of all hardware, software, peripherals and sub components of all BOQ items throughout the contract period shall be the responsibility of Service Provider in adherence to the SLA without any further cost to IHMCL.

ii. Service provider shall intimate PIU/Toll operating agency for any corrective action to be taken on ground to resolve any major issue which shall take more than 2 hours of lane closure.

iii. The Service provider shall provide 24X7 on-site support during the operation & maintenance period.

iv. Service Provider shall take prior approval from respective PIU before updating any version of Lane / Plaza application, for which, a software modification request shall be submitted to PIU for seeking approval.

v. IHMCL/NHAI holds the right to ask Service Provider to replace any staff if found and proved unsuitable/ indulged in unwanted activities.

vi. Any damage cause due to mishandling of equipment by the service provider employees shall be borne by service provider.

5.6 **Other activities:**

i. Toll Management System should be able to support all kind of Fare structures & Payment methods including, but not limited to, Daily Pass, Return Pass, Monthly Pass, Discounted tariffs, Exemptions, Open / Closed fare schemes etc. and shall meet the Tolling System requirements of the respective Concession Agreement, including subsequent regulation/ notification thereon by IHMCL/NHAI/MoRTH.

ii. The BOQ (As defined under Annexure-A) by IHMCL/NHAI may increase/decrease according to the further requirement at sites.

iii. The Service Provider shall arrange for all insurances pertaining to the scope of work and it shall be deemed that any related costs are included in the price Application.

iv. The scope of the service provider will also include civil, electrical, networking works required to complete installation/commissioning of Hybrid ETC and Toll Management System and associated peripherals on the plaza.

5.7 **Service Level Requirements (SLA)**

5.8.1 System Downtime Calculations

i. The uptime availability of all systems and sub-system of Hybrid ETC and TMS is provided in Annexure-A. The permissible downtime for critical systems and sub-systems is 7 hours per lane per month.

ii. The downtime for a toll lane shall be calculated at a cumulative level when any of the critical components as mentioned in Annexure-A is non-operational for that specific lanes/plaza.

iii. For all other components of Hybrid ETC System and TMS, the uptime availability shall be 99% per lane per month.

iv. Scheduled downtime is defined as a period of time when system will remain unavailable for conducting necessary preventive maintenance, urgent repairs etc. The maximum scheduled downtime for any Site shall be 4 hours per lane per month.

v. The formula for calculation of Hybrid ETC System availability shall be as follows:

System Uptime = [1 – {A/(B – C)}*100], where
        A = Time for which system is down per month basis scenarios
        B = Total time in a month

        C = Scheduled downtime basis section 8.4.1(iv)

vi. The Service Provider shall maintain adequate inventory/spares to ensure the service levels prescribed in clause 8.4.1(i) are adhered.

vii. In case of non-adherence to service levels as defined, penalties of 5% of quarterly invoice amount shall be detected.

viii. The Service Provider along with the Toll Operating Agency shall ensure that all transaction files of the Hybrid ETC systems are uploaded as per the service levels defined in the NETC program.

5.8 **Routine Maintenance**
Scheduled downtime / Routine maintenance is defined as a period of time when system will remain unavailable for conducting necessary preventive maintenance, urgent repairs etc. The maximum scheduled downtime for any site shall be 4 hours per lane per month. The objective of electronic equipment maintenance shall be to ensure reliability, to enhance its economic life and to improve its efficiency. Routine maintenance consists of a fixed set of checks, measurements, cleaning and

calibration. These activities shall be based on Equipment Service Provider's specifications and general maintenance practices that include but not limited to:

- Checking the condition of components, e.g. check connections for signs of deterioration.

- Check voltage levels: Power supply levels are crucial to the effective operation of electronic equipment. Borderline levels could lead to intermittent faults and damage to components.

- Voltage level changes are caused by the deterioration of capacitors, transformers and semiconductor components.

- Certain measurements can also be performed to check the status of elements of the system, i.e. impedance and isolation tests.

- Mechanical components need routine cleaning and lubrication to ensure their effective   operation.

5.9   **Data Retention**, **Back-up and Restore Operations:**

Data Retention:

Data for each plaza shall be retained for entire Agreement period in the Toll Plaza Server. The backup devices and media as per current industry practice shall also be provided.

The Service provider shall ensure adequate security measure for safe guarding of Toll Transaction data, by providing, off site Disaster recovery or Data Storage mechanism.

The service provider shall also be responsible to extract and provide data /information based on requirement of law Enforcement Agencies of Govt. of India/ State based on specific approvals on case-to-case basis.

However, it will be limited to the data captured in Hybrid ETC and Toll Management Systems as per standard operations and the data being retained as per retention schedule.

Data Back-up & Restore:

Service provider shall also demonstrate the backup & restore procedure successfully. The Service Provider shall prepare and implement a proper Data Backup & Restore policy with IHMCL's approval, to ensure data safety and avoid data loss, in case of any untoward incidents.

Such policy shall ensure Back-up & Restore of Toll Transaction data at least once in a week.

5.10   **Statutory and Others:**
IHMCL shall reserve the right to get the security / compliance audit of the Hybrid ETC and Toll Management Systems done at any time through any agency appointed for the purpose and the service provide shall extend all support & cooperation for smooth conduct of said Audit.

The Service Provider shall abide by all statutory guidelines and comply with rules/ regulations/guidelines framed by NHAI/IHMCL and/or Ministry of Road Transport & Highways from time to time; It shall be responsibility of the service provider to incorporate such changes within the stipulated time frame into the Toll Management System.

The Service Provider shall comply with the guidelines and/ or Specifications and Standards including the revisions thereof issued from time to time by Ministry of Road Transport & Highways Govt. of India / IRC. In absence of which, the system and equipment provided by the service provider shall meet relevant American or European/ British standards & specifications.

5.11 Technical Specifications & Standards

The minimum technical specifications & the standards to be adhered have been prescribed under Annexure-B. The Service Provider shall ensure to provide the equipment meeting the prescribed requirements.

5.12 Acceptance Test and Approvals

After installation of Hybrid ETC and Toll Management System at the toll plazas in the current scope of work, a Site Acceptance Test (SAT) shall be carried out at these plazas to test the system functionality and performance.

The SAT shall be carried out as per the Circular: IHMCL/ETC/Operations/2017/Phase-III/361/CO-II/01 dated September 28, 2017 issued by the NHAI.

Commissioning: Once Site Acceptance Testing has been concluded and the Service Provider has attended to and remedied all reported defects, the system shall be ready to be commissioned and taken into operation.

Third Party Check: For Acceptance Testing, IHMCL reserves the right to appoint a third party to carry out Acceptance Testing on behalf of IHMCL. The service provider shall have no objection on the same & will cooperate with such appointed third party/ consultant.

Failure by the Service Provider to complete the Works and to have remedied all reported defects by the Prescribed Date for commissioning shall result in the application of the penalties for delays prescribed under liquidated damages in the Contract Agreement.

5.13 System Development Progress Reporting

The Service Provider shall note that they are obliged to provide hardware and software progress reports, if any, as the works proceeds. These reports shall be in the English language for project management purposes.

5.14 Other Works

a) Service Provider's Design Responsibility

The Service Provider shall be required to produce engineering design drawings of all Toll Management Systems components / system, electrical installation and computer & data transmission network systems. It shall be the Service Provider's responsibility to adhere to the designs submitted during the implementation of Hybrid ETC systems and Toll management systems at the plazas. In case of any changes in the systems the service provider shall modify and resubmit the designs. The design should be

submitted by the service provider within 7 days of receipt of notification of commencement of work.

b) Electricity Requirements

The Service Provider shall be required to submit the design of the electricity load requirement for the Toll Management Systems / ETC Equipment, which shall include the cabling, distribution boards, and clean earthing system, in regard to its suitability for the Toll Management Systems and ETC components. Toll Management Systems equipment earthing shall be separated from the toll plaza utility power earthing. Earthing for all equipment shall be the responsibility of the Service Provider.

c) Cabling to UPS Loads

The Service Provider shall supply, install, terminate and connect all cabling from the power DB to the entire field and control room equipment. The cable shall be suitably sized and earth PVC insulated and steel wire armoured copper cables. Wire armouring may be omitted, if the cables are drawn through a conduit.

d) Cable tray

The Service Provider shall provide adequate perforated cable trays and/or cable support wherever required, for all cabling required in Toll Lanes / Booths & Plaza Building.

e) Cable Numbering

All cables installed shall be numbered with ferules, in accordance with the universal cable numbering system, in such a way that any person shall be able to understand & identify cabling for specific equipment.

All cables shall be ISI marked, fire retardant type and shall be terminated with proper lugs & joints as per best industry practices.

Part VI – Annexures & Forms

6.1   APPLICATION FORM

(In Bidding entity's Letter head)

_____
(Date)

From,   To,
(Name & Address of the Applicant)   Chief Operating Officer/General Manager
_____   Indian Highways Management Co. Ltd.
_____   2nd Floor, MTNL Building, Sector –19,
                                                         Dwarka
                                                         New Delhi 110 075

Subject: _____

Ref.: Application No_____

Dear Sir/Madam,

After examining/reviewing the Application Documents for _____etc. the receipt of which is hereby duly acknowledged, we, the undersigned, are pleased to apply for empanelment to execute the whole of the Job for the item in conformity with, the said RFQ Documents, including Corrigendum / Addenda Nos. _____.

We confirm that this Application is valid for a period of <u>180 days</u> from the date of opening of Application, and it shall remain binding upon us and may be accepted by any time before the expiration of that period.

Until a final Contract is prepared and executed between us, the Application together with your written acceptance thereof in your notification of award shall constitute a binding Contract between us.

We undertake that, in competing for (and, if the award is made to us, in executing) the above Contract, we will strictly observe the laws against fraud and corruption in force in India namely "Prevention of Corruption Act 1988" and other applicable law. We understand you are not bound to accept any Proposal you receive.
Yours sincerely,

(Signature of the Authorized signatory):
Name and Designation of the Authorized signatory: Name and Address of Applicant:

Phone, Fax & E-Mail

6.2   UNDERTAKING

(In Bidding entity's Letter head)

1.   I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.

2.   The undersigned also hereby certifies that neither our Company M/s_____ have abandoned any work of National Highways Authority of India/IHMCL nor any contract awarded to us for such works have been rescinded, during last three years prior to the date of this Application.

3.   The undersigned hereby authorize(s) and request(s) any bank, person, firm or corporation to furnish pertinent information deemed necessary and requested by IHMCL to verify this statement or regarding my (our) competence and general reputation.

4.   The undersigned understands and agrees that IHMCL may ask for further qualifying information, and agrees to furnish any such information at the request of IHMCL.

5.   We confirm that we have not been blacklisted /debarred by any central/state Government department/organization or Quasi Government agencies of PSU.

6.   We confirm that no criminal proceeding is pending against our company/firm or any of its Directors/ Partners in any court of law.

7.   We also confirm that we have not been convicted by any court of law for any of the offenses under any Indian laws

_____
___
(Signed by an Authorized Officer of the Applicant)

_____
__
Title of Officer

_____
Name of Applicant

_____
DATE

6.3 APPLICANT'S FINANCIAL CAPACITY

(In Bidding entity's Letter head)

_____
(Date)

From,
(Name & Address of the Applicant)
_____
_____

To,
Chief Operating Officer/General Manager
Indian Highways Management Co. Ltd.
2nd Floor, MTNL Building, Sector –19, Dwarka
New Delhi 110 075

Subject: ---

Tender Ref. No.:--

Dear Sir/Madam,

We hereby certify that the financial capacity of M/s. _____ (Name of the Applicant) for the last three financial years (ending 31st March of the financial year) is as given below:

Financial capacity for the last 3 Financial Years (FYs) in Indian Rupees (INR)				
	FY (2014-2015)	FY (2015-2016)	FY (2016-2017)	Average
Annual Turnover				
Net Worth				

Yours Sincerely,

(Signature of Statutory Auditor)
Name of the Statutory Auditor:
Name of the Statutory Auditor Firm:
Seal:

6.4 Power of Attorney

Know all men by these presents, we, M/s .... (name of Firm/ Company and address of the registered office) do hereby constitute, nominate, appoint and authorise Mr/ Ms.. son/daughter/wife

of…………………………….. and

presently residing at .... , who is presently employed with us and holding the position of .... as our true and lawful attorney (hereinafter referred to as

the "Authorised Signatory or Attorney") to do in our name and on our behalf, all such acts, deeds and things as are necessary or required in connection with or incidental to submission of our quotation for empanelment as the agency for -----------------------, proposed by Indian Highways Management Co. Ltd., including but not limited to signing and submission of all applications, proposals and other documents and writings, and providing information/ responses to IHMCL, representing us in all matters before IHMCL, signing and execution of all contracts and undertakings consequent to acceptance of our proposal and generally dealing with IHMCL in all matters in connection with or relating to or arising out of our proposal for the said assignment and/or upon award thereof to us.

AND, we do hereby agree to ratify and confirm all acts, deeds and things lawfully done or caused to be done by our said Authorised Signatory or Attorney pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts, deeds and things done by our said Authorised Representative in exercise of the powers hereby conferred shall and shall always be deemed to have been done by us.

IN WITNESS WHEREOF WE, ...THE ABOVE NAMED PRINCIPAL HAVE EXECUTED THIS

POWER OF ATTORNEY ON THIS .... DAY OF ...., 2018

For ....
(Signature, name, designation and address)

Witnesses:
1.

2. Notarised

Accepted

....
(Signature, name, designation and address of the Attorney)

Notes:
The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executants(s) and when it is so required the same should be under common seal affixed in accordance with the required procedure. The Power of Attorney should be executed on a non-judicial stamp paper of appropriate denomination and should be registered or duly notarised by a notary public.

Wherever required, the Applicant should submit for verification the extract of the charter

documents and other documents such as a resolution/power of attorney in favour of the person executing this Power of Attorney for the delegation of power hereunder on behalf of the Applicant.

For a Power of Attorney executed and issued overseas, the document will also have to be legalised by the Indian Embassy and notarised in the jurisdiction where the Power of Attorney is being issued. However, Applicants from countries that have signed the Hague Legislation Convention 1961 need not get their Power of Attorney legalised by the Indian Embassy if it carries a conforming Apostles certificate.

6.5 BUSINESS PLAN
(In Bidding entity's Letter head)

1   Name of the Applicant/Lead Member of Consortium:

2   Information on ongoing/existing ETC Projects that satisfy the technical qualification criteria as specified in this RFQ:

Serial Number	Name of Project	Duration	Staff details

3   Information on ongoing/existing Cash Lanes that satisfy the technical qualification criteria as specified in this RFQ:

Serial Number	Name of Project	Duration	Staff details

4   Ability of the Bidder to supply the following equipment and time required for same

  i.   Please confirm if the Applicant can supply the equipment(s) as specified in Annexure-A.
  ii. Equipment that cannot be supplied by Applicant
  iii. Time required for supply

For and on behalf of (Name of the Applicant - if Consortium, Name of Lead Member)
(Signature of Authorized Representative)

_____
(Name, Title, and Date)

6.6 Format for Technical Experience

(On Bidding entity's Letter head)

(To be submitted separately for each experience)

Format for Experience

Assignment Name	
Client's Name and Complete Address	
Number of ETC lanes and Cash Lanes	
Location of Toll plaza	
Start Date	
Completion Date	
Details of supply, install, commission & maintenance of Tolling system	

(Copies of Work orders/Agreement/Client certificate to be attached along with)

(Authorised Signatory)

Signature:

Name:

Designation:

Bidding entity's name

Address:

Dated: ….. /…../2018

Annexure-A

1. ETC equipment

The following table captures the list of equipment required at plaza and lanes. The minimum standard expected of these equipment is captured in subsequent sections of this document, while the number of equipment expected to be provided as part of project is as follows[1]:

	Lane Level		
1.	RFID ETC transceiver near Pay-axis - mounted on canopy	No	1
2.	Electronics Enclosure	No	1
3.	Lane Controller with Industrial PC	No	1
4.	AVC including sensors, loop and detector	Set	1
5.	User Fare Display with mounting pole	Set	1
6.	Automatic Barrier Gate	No	1
7.	Overhead Lane Status light (OHLS)	No	1
8.	Traffic light with mounting pole	Set	1
9.	Loops with detector	Set	2
10.	Incident Capture Camera with mounting pole	Set	1
11.	License Plate Image Capture Camera with mounting poles	Set	1
12.	TFT Monitor	No	1
13.	Customized industrial grade keyboard	No	1
14.	Thermal Receipt Printer	No	1
15.	Barcode Reader with stand	No	1
16.	Violation light & Alarm (on existing pole) and Foot switch in booth	No	1
17.	Booth CCTV camera with voice recording	No	1
18.	Cabling/Networking/Installation/Commissioning (Lump sum)	LS	1
19.	Software – Lane Level	No	1
20.	Intercom Slave unit in booth	No	1
21.	Lane Level UPS	No	1
	Plaza Level		
22.	Plaza Servers in hot-standby configuration	No	1
23.	Workstations for MIS, Cashup, Audit & LSDU (Lane status display unit in control room)	No	4
24.	24 Port Network switch (Layer 3)	No	2
25.	Internet router for connection to the CCH	No	1
26.	Software – Plaza level	Job	1
27.	Broadband Internet connection with minimum 2 Mbps link	Facility	1
28.	UPS system as required for complete Hybrid ETC Toll Plaza system	No	2
29.	Network Video Recorder (NVR) for CCTV recording with adequate storage	No	1
30.	CCTV cameras for Plaza building surveillance (server room, control	No	4

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[1] Please refer specification details of the equipment as captured in this Annexure.

	room, cash room, admin)		
II – Operation & Maintenance per toll plaza			
31.	Quarterly O&M charges	Per Lane	1

2. Software Specifications

2.1. Functional Requirements

2.1.1. General Requirements

This functionality shall meet the lane operation described in the subsequent sections.

2.1.2. Transaction Data Format:

The following shall be the minimum data that make up an ETC transaction

(i)   Transaction ID
(ii)   Tag ID (TID, EPC, and User Memory)
(iii)   Plaza and Lane ID
(iv)   Date and Time Stamp
(v)   AVC Class
(vi)   Image of vehicle (JPEG)

The above may be modified during project execution in order to optimize the performance.

2.1.3. Transaction Processing

The System shall:

(i)   Have functionality to feed in transaction data through RFID ETC transceiver, Hand-held devices and manually entry of Registration no. of vehicles.

(ii) Validate each transaction for completeness (e.g. possessing all the related information like Tag ID, Vehicle class etc.)

(iii) check for duplicate transactions (e.g. the same tag cannot be used in the same direction within a specified duration at the same plaza)

(iv)   support generation of a wide variety of reports as given below but not limited to:

   (a)   Revenue reports
   (b)   Traffic reports
   (c)   Daily / Weekly / monthly reconciliation reports
   (d)   Violation reports
   (e)   Equipment availability reports

(v) Security

   (a)   Login feature for accessing the System
   (b)   Access the system based on roles definition
   (c)   Storage of Sensitive data like password in an encrypted format
   (d)   Use of Complicated passwords: password should be more than 6 characters and should have at least one numeric character.

(e)   Automatic logging of every sensitive action in the system.

(vi)   Scalability

The System / Servers shall be scalable to support increase in Tag Users / ETC transactions in future. During the time of system commissioning each lane of the system shall be capable to support 5 million tag users and 30,000 (Thirty thousand) transactions per day and at the end of 5 years shall be capable enough to support 20 million tag users and 45,000 (Forty five thousand) transactions per day.

Automatic Lane closure

The ETC lane shall close automatically in case of detection of failure of critical equipment like Transceiver, Boom barrier, critical vehicle guidance signs (Traffic Lights), Incident Capture System etc. In such cases the OHLS shall display that ETC lane is closed and the ETC exit barrier shall remain closed. Thus any vehicle entering the ETC lane is automatically 'ejected' into the neighboring mixed / manual lane.

3.   Toll Plaza Equipment and Software Specifications

The subsequent sections capture the specifications of various equipment that may be required as a part of this project. Please note that this is in exhaustive list of all ETC equipment and the entire set may not be required in the current phase. Applicants are requested to refer to the detailed BOQ captured in the preceding sections of this Annexure. Also, the specifications are a minimum standard, and the supplier may choose to include products with specifications that exceed the standards, post approval from IHMCL.

3.1.   RFID ETC Transceiver near pay axis (mounted on canopy)

3.1.1.   General

Sr.	Parameter	Minimum Specifications
1	Frequency	UHF 865 MHZ to 867 MHZ *
2	Communication	Ethernet/ Serial communication (EIA standard RS 232 C / RS 485)
3	RF Power maximum	1 W – transmitted & 4 W – EIRP (Equivalent Isotopically Radiated Power) *
4	Reading distance	With the Transceiver mounted typically at a height of 6 m above the road surface, the coverage of the antenna shall not exceed a diameter of 3.6m.
5	Antenna	Circularly Polarized
6	Protocol	EPC Gen 2, ISO 18000-6C and shall comply with the general conformance requirements of the standard
7	Visual diagnostics	The Transceiver shall have LED indicators for sense, transmit Fault and Power which shall be visible clearly to the operator on ground while the system is operational.

* is in the wireless license free band for RFID use in India. Typical existing product(s) for 'RFID- based-ETC' operates in the 865 MHz – 868 MHz band.

3.1.2.   Environmental

Sr.	Parameter	Particular
1	Enclosure	Light weight enclosure for the RFID Transceiver and circularly polarized antenna
2	Environmental	IP 65 or better for outdoor units

3	Relative Humidity	95% Condensing
4	Operating Temperature	-20°C to 55°C
5	Storage Temperature	-40°C to 85°C

3.1.3. Operating Characteristics

Sr.	Parameter	Particulars
1	Air Interface & Adaptive Noise Features	The Transceiver technology employed should have the capability to optimize read rates for the vehicle identification application and adapt to instantaneous noise and interference level
2	Application capability	1. Should have read reliability exceeding 99.**5**% in the distance range specified. 2. Diagnostic and Reporting Tools
3.	Upgradeability	The firmware should be upgradable to support future protocols.
4	Transaction Capability	Reading of Tag & EPC memory for at least 2 Tags per second for a moving vehicle with a speed limit of 40 kilometres/ hour.
5.	Driver Software	The transceiver driver software shall be provided along with the transceiver that will interface to the ETC client through socket interface and handle the communication with ETC client. The packet structures shall be as notified in the ETC client-transceiver interface. The driver software shall implement filtering using a range of EPC-codes provided by set of bit pattern masks.

3.2. Electronics Enclosure

3.2.1. The Interface Electronics and all related peripheral/controllers should be enclosed in an IP65compliant cabinet.

3.2.2. Locking System: Enclosure shall have a **unique** key allowing access to the electronic.

3.2.3. Door monitoring: The cabinet door shall be monitored utilizing proximity switch. Door open / close events shall be recorded as incidents identified by time and Lane. The incidents are to be displayed on the plaza software subsystem.

3.2.4. Cabling Layout: All external cables shall be protected against the effects of lightning and shall comply with all requirements for the control of interference from EMI. All data cables shall be screened and shall be properly separated and shielded from all power cables.

3.2.5. Ventilation and internal temperature: All equipment endorsed by the cabinet shall be kept at a temperature consistent with manufacturers recommendations.

3.2.6. Finishing: The cabinet surfaces shall be protected from the environment in which it shall be used and the Equipment Contractor shall specify the surface treatments to be applied. Each cabinet shall be painted and numbered in a manner consistent with the toll lanes and consistent with all equipment related functions (e.g. reporting to the plaza software subsystem).

3.2.7. Cable dressing: All cables (power & signal) shall be properly routed and dressed with suitable railings inside the enclosure and ties.

3.2.8. Cable numbering: The signal & power cable terminations shall be identified by proper numbering. In addition to the termination at the controller end, this numbering shall also be maintained at locations where the cables are exposed (like manholes, junctions) and at the peripheral end. Further, all the individual component boards shall be properly identified by labeling.

3.2.9. Cable terminations: The signal & power cable (from the peripherals) terminations shall be kept separated inside the cabinet. The cable routing inside the enclosures shall be done in a proper manner, so that, aesthetics apart, the cable faults can be traced and faulty cables replaced, easily and less time consuming.

3.3. Lane Controller with Industrial PC

3.3.1. Functional Requirements

3.3.1.1. The Toll Lane Controller (TLC) is situated in the tunnel underneath the toll lane or in the booth and has the principal task of controlling the toll collection function and all the peripheral equipment, transmitting information and data on all lane activities to a local ETC Server and receiving other control information and data from the ETC server. It also has the function of controlling all the peripherals connected to it.

3.3.1.2. All hardware, software, TLC interface to peripherals and local ETC Server shall be supplied by the equipment supplier.

3.3.1.3. The TLC software shall be developed to operate as ETC toll lanes as is defined under earlier section of this document.

3.3.1.4. All lane operating data shall be stored in the local hard disk drive in the lane. Adequate RAM shall be provided to prevent "Thrashing" of the hard disk drive. The hard disk shall have enough memory to load and maintain all necessary program tables (like ETC black list, white list, discount list etc.) and data in memory, to optimize the toll collection functionality. Each transaction data collected from the lane peripherals shall be stored in the local hard disk of the TLC in a separate encrypted file placed in a folder automatically created with the month's name at the start of each month, before being transmitted to the master database in the local ETC server. This data shall remain in the local hard disk irrespective of transmission to the local ETC server until a period of 1 month. At the start of the 7th month, the 1stweek's data shall be deleted from the hard disk on the basis of FIFO logic.

3.3.1.5. Further, there should be a mechanism for auditing the real time data transmission (including incidents) over a predetermined time period (say 30 minutes) and automatic data retrieval from the lane in case of data mismatch.

3.3.1.6. The TLC must be capable of storing the following minimum information:

    i.   1 month of Transaction data including image associated with incidents
    ii.   Tag Whitelist as mentioned
    iii.   Tag Blacklist as mentioned
    iv.   5 Tariff Table (active and pending)

A transaction record shall contain all the necessary information to enable complete control and auditing of the system.

3.3.1.7. The minimum required fields are as follows:

✓   Transaction Sequence Number
✓   Date
✓   Time
✓   Plaza
✓   Lane
✓   Shift
✓   Tag Vehicle Class (TVC)
✓   Automatic Vehicle Class (AVC)
✓   Image ID (in case of a violation transaction)

The transaction time shall be the time when a Tag is detected at **transaction** area.

3.3.1.8.   The TLC shall be capable of interfacing with at least the following peripheral equipment:

- Toll Collector Display
- User Fare Display
- Vehicle guidance signals (Traffic Lights)
- Overhead Lane Sign
- Automatic Exit Barrier
- Exit Barrier Loop
- AVC system including AVC loop
- Barrier Arm Optical and other methods of Protection
- Electronic Toll Collection Equipment
- Incident Recording (CCTV) System
- License Plate Image Capture Camera

3.3.1.9.   The TLC shall be capable of communicating with the local ETC server. Communication shall consist of data necessary to build a complete database in the local ETC server, from which the required financial and operating reports and statistics can be generated. The local ETC server shall also receive and log any reportable incidents occurring in the lane, which shall be transmitted real-time to the Incidents Computer (IC) for action by the toll supervision staff. In terms of incidents, real-time shall mean the time from the occurrence of the incident to the storage of the incident and the subsequent display of the incident on the IC; shall not be greater than *2 seconds*.

3.3.1.10.   As described above, all data entries shall be sequentially numbered and referenced to other related entities. The incidents that occur during a transaction shall refer to that transaction. Transactions and incidents shall refer to the applicable financial entity in which they occur.

3.3.1.11.   An automatic / manual data validation process is required to check for data continuity and missing/duplicate data. An audit trail of manual corrections is required. The data validation process shall be linked to a "data not complete" message that will be indicated on reports if data is missing / pending validation / consolidation.

3.3.1.12.   Further, the TLC (via the AVC) shall monitor the lane at all times for any traffic violation or incident; and for failure of any of the toll equipment. The level of incident reported to plaza via the peripherals in the toll lane, or reported to the LOCAL ETC SERVER shall be a parameter setting in the software available at a definable level.

3.3.1.13.   The TLC shall also be capable of receiving messages from the local ETC Server. These messages will contain data on the Tariff tables, classification table, whitelist, tag blacklists, ETC

account balance, etc. Should the link between the TLC and the LOCAL ETC SERVER fail, a system to download such information locally into either end (TLC &LOCAL ETC SERVER) is to be made available.

3.3.1.14.   The CCH maintains a vehicle class description that is generic to all toll plazas. However as the vehicle class description at each toll plaza for the same vehicle may be different, the TLC shall maintain a mapping of the CCH Vehicle class to the Plaza Vehicle class. The TLC generated transaction shall always refer to the Plaza vehicle class.

3.3.1.15.   Extended operation of the TLC in the Local Mode must be possible. The system shall manage its data storage capacity to ensure adequate free space for the operating system, application and data. The system shall provide warnings regarding free-space when the storage capacity reduces to predefined critical limits. If the data storage on the TLC reaches this critical limit, it shall immediately instruct the plaza to stop processing of transactions any further and inform the supervisory staff to initiate a data extraction procedure. The data extraction shall be carried out via a thumb drive or portable computer and restored in the LOCAL ETC SERVER.

3.3.1.16.   The Equipment Supplier shall provide the details on the TLC data management strategy.

3.3.1.17.   Time throughout the entire toll collection system shall be synchronized with reference to the LOCAL ETC SERVER.

3.3.2.   TLC PC Specification:

3.3.2.1.   The following minimum configuration requirements shall be met:

a) Grade   :   Cabinet Industrial PC
b) Motherboard   :   Industrial Grade
c) HDD   :   based on estimated storage requirement for 6 months TLC data (at least 160 GB in case estimated capacity is lesser)
d) RAM   :   2 GB or latest
e) Processor   :   Intel I3 or equivalent
f) Processor speed   :   I 2 Ghz min
g) NIC   :   1 Gbps X 2 Numbers On-board
h) PCI Slot   :   2 Nos. Spare
i) USB Port (for authorized):   4 nos.
j) Frame grabber card (if used for Capturing images) : 1 no with 2 channel capable to capture frames at the same time on both channels

3.3.2.2.   The TLC shall receive UPS power from the UPS distribution panel. Any special electrical protection / interface unit shall be provided by the Contractor, if required, based on the needs of the device. The power distribution to the lane peripherals from the TLC shall be adequately protected with the help of surge arresters, lightning protection, etc.

3.4.   AVC including sensors, loop and detector
3.4.1. Accuracy Level

The AVC system shall be 100% auditable and accuracy of vehicle counting should be 99.5% and classification accuracy shall not be less than 98%.

3.4.2. Auditability

The AVC System shall comply with the following auditability criteria:

3.4.2.1. Each transaction recorded by the system shall be uniquely and sequentially numbered.

3.4.2.2. The AVC shall be able to provide information to a laptop or to a computer connected to the same network as on AVC computer that shall be used for auditing the classification of the AVC as well as the classification of the lane operator.
The audit function shall be done in the following manner:

The auditor shall
a) connect to the AVC computer through network or RS-232 port of the AVC computer.
b) Start audit application/data extraction application
c) Supply Plaza name, AVC number, User id and Password
d) Enter the date and duration for the audit.
e) Press enter to start data extraction (any time the auditor shall be able to cancel current command to start with other specific duration).
f) Obtain output of the audit report in XLS format and it shall contain at least the following:
   i. Transaction sequence number
   ii. Date & time of the transaction
   iii. Lane ID
   iv. Shift ID
   v. TLC class
   vi. AVC class
   vii. MOP
   viii. Incident type and details associated with the transaction, if any

3.4.2.3. The Contractor shall provide a data extraction tool to the Authority, it shall be possible to extract the AVC/TLC data for a user defined period in XLS format using that tool.

3.4.2.4. For audit purposes, it shall be possible to enable all transactions as incidents in order to grab LPIC images and ICS image for Supervisor / Auditor review per lane / direction / all lanes.

3.4.3. Description and Functions

3.4.3.1. The automatic vehicle classification equipment shall be located in the lane before the position of RFID Transceiver #2.

3.4.3.2. The purpose of the AVC is to sense the presence of a vehicle (differentiate it from non-vehicular crossing), to measure and interpret certain physical characteristics of the vehicle as it passes through the AVC.

3.4.3.3. The AVC shall be able to distinguish between classes as per the applicable notifications of MORTH

3.4.3.4. This class information shall be stored locally at AVC level and communicated to the TLC. Simultaneously a still image of the vehicle shall be captured / grabbed by the Incident Capture System (ICS) Camera as the vehicle triggers the AVC sensors. The TLC shall then check whether this AVC class matches the vehicle class (the CCH Class mapped to the Toll Plaza class) as read from the tag. If there is a discrepancy between the two classifications, the license plate image (captured when the vehicle passed through the ETC exit) and the ICS

camera image shall be saved and stored with all transaction and incident information watermarked on them. The images and discrepancy information shall be communicated to the Local ETC server for further action and processing by the toll supervision staff.

3.4.3.5.   The Equipment Contractor shall submit details of the performance of existing AVC systems duly validated by the existing operators of the systems.

3.4.3.6.   The AVC shall be capable of detecting and reporting the following vehicle movements and incidents in the lane to the TLC:

- The AVC system must be able to count and distinguish two wheelers, autos and four-wheelers separately.
- Vehicle Standing – the vehicle presence sensing equipment stays active for longer than a preset time. The preset time shall be parameter settable.

3.4.3.7.   All AVC elements (loops, light curtain, cameras, etc.) shall be fully weatherproof and installed in a location where vehicle damage by accident is not possible.

3.4.3.8.   When the TLC is inoperative, or communication between the TLC and the AVC is severed, the AVC shall record the last transaction number transmitted and shall be able to independently count and record (store) vehicle classes passing through or over it. A sequential vehicle counter at AVC level shall be implemented to reconcile. The AVC shall have its own battery backup and data extraction facility on to a CD or to a laptop computer.

3.4.3.9.   The AVC shall be able to generate violation if the ETC lane is not logged- in and a vehicle passes through it.

3.4.3.10.   In following cases, the AVC shall generate an alarm on the plaza level and send record to incident control system for supervisory action apart from the incidents defined:

- Degraded classification (in case of any single Transmit / Receive failure)
- Unable to classify

3.4.3.11.   The accuracy of the AVC shall not be affected by temperature or any weather /environmental conditions and shall be independent of vehicle speed / weight.

3.4.4. AVC System Design and Approval

3.4.4.1.   Functional requirements:

3.4.4.1.1.   The AVC shall be able to automatically classify the classes of vehicles as indicated in the vehicle class table to an accuracy of 99.60% without manual intervention and class correction or validation. Unless, the above criteria is achieved, the AVC shall never classify a vehicle to any defined category in the Classification table; it shall be categorized as unable to classify so that it triggers an incident and there is no chance for revenue loss. This can be used to fine tune the AVC to improve the accuracy later.

3.4.4.1.2.   The functional specification for the AVC shall include the hardware, software and operational requirements. The design requirements of the AVC are to be seen as a system in which all failures, events and other events are logged, stored and managed. The following design criteria shall be used in the AVC:

- AVC Classification Table
- AVC Configuration
- Vehicle Detection and Classification
- AVC Interfaces
- AVC Technical Requirements
- Data Storage

3.4.4.1.3. All operating data shall be stored on the local hard disk drive of the AVC computer. "Thrashing" of the hard disk drive shall be prevented. The AVC shall have enough memory to load and maintain all necessary program tables and data in memory. All other transaction data shall be stored on the local hard drive of the AVC and a copy to be transmitted to the LOCAL ETC SERVER.

3.4.4.1.4. The following minimum information is to be stored at AVC level:

  i.   Classification table
  ii.   AVC configuration
  iii.   Data of at least one year (transaction, event, AVC centric incident etc.)

3.4.4.1.5. Two separate streams of data, carrying vehicle classification information from TLC and AVC shall be copied at LOCAL ETC SERVER level for comparison, evaluation and audit purposes. There shall be provisions for drawing separate reports for TLC and AVC classifications at LOCAL ETC SERVER level. An AVC accuracy and reconciliation report shall be present in the toll system.

3.4.4.2. The performance of the AVC shall form the basis for the accuracy checks, functional tests, installation, commissioning and handover to achieve the required accuracy and performance. All design and installation approvals shall be obtained from IHMCL before installation and commissioning. The Contractor shall submit a detailed list of vehicles with photographs and Indian RTO authorized classification category of all models of vehicles found in India as part of Technical specifications delivery. The configuration of AVC classification table into the system shall be done in the presence of the authorized representative of IHMCL.

3.4.4.3. The plaza lane area detailed AVC layout including the following items shall be provided at the time of technical specifications delivery by the Contractor so that the design process can be implemented at site. The Contractor shall ensure that the equipment layout is in conformance with the Lane Design Drawings as provided by the Authority.

3.4.4.4. The system architecture shall provide the details of the equipment layouts and the physical location of each component of the system in the ETC toll lane.

3.4.4.5. The loop detector units/cards shall conform to the following minimum requirements.

3.4.4.6. The unit shall be easily removable and shall be fitted with at least two (2) loops per card.
3.4.4.7. The unit shall have a minimum of 4 separate adjustable sensitivity and frequency levels.
3.4.4.8. The unit shall have indicators for vehicle presence, loop on/off and failure.

3.4.4.9. The light curtain installed shall comply with the following specification and are mounted in a manner as to ensure that the following minimum specifications are adhered to at all times.
- Ensure that no vehicle can pass through the AVC and miss axle counting.

- Number of Axles per vehicle is accurately counted for every vehicle passage.
- Sensor replacement time shall not exceed 30 minutes.

3.4.4.10. It shall be noted that the equipment enclosures shall be mounted in the tunnel running under the plaza, sufficient ventilation shall be provided by the equipment Contractor for this enclosure and the enclosure shall have IP65 protection.

3.4.4.11. The AVC enclosure shall be mounted in the tunnel. The AVC enclosure shall be secured using suitable corrosion resistant fixtures, and all fixtures shall be approved before the mounting of the AVC can take place.

3.4.4.12. The AVC enclosure shall be provided with a switch to detect that the AVC door is open or closed, and the status shall be updated at plaza level in real time.

3.4.4.13. All mounting shall be done in a neat and professional manner and shall be approved by the Authority.

3.4.4.14. All AVC cables that enter the enclosure shall be protected between the enclosure and the sensors, using a suitable flexible steel re-enforced trunking / cable tray / ducting as approved by the Authority to reduce the risk of tampering. All the cable entries to the AVC enclosure shall be sealed properly with glands / sealant, as approved.

3.4.4.15. The quality control procedure manual shall be provided with the proposal by the equipment Contractor, which shall include a minimum of:

- AVC Installation Log Sheet
- Loop Resistance Testing and Loop Earth Testing Procedure
- Cross-talk Verification Process

3.4.4.16. Loop Chatter (Bobbing) Verification Process

3.4.4.17. Basis of classification logic of AVC

3.4.5. AVC Controller Configuration

The following minimum configuration requirements shall be met:

a) Grade : Industrial PC
b) HDD : based on estimated storage requirement for 6 months TLC data (at least 160 GB in case estimated capacity is lesser)
c) RAM : 2 GB or latest
d) Processor : latest Intel Processor
e) Processor speed : latest available in the market at the time of delivery
f) CD / DVD R/W : latest available in the market at the time of delivery
g) NIC : 1 Gbps X 2 Numbers On-board
h) PCI Slot : 2 Nos. Spare
i) USB Port : 4 nos.

3.4.6. AVC Enclosure

The AVC and all related peripheral controllers should be enclosed in an IP65 compliant cabinet.

1. Locking System: Each cabinet shall have a **unique** key allowing access to the AVC.
2. Door monitoring: The cabinet door shall be monitored utilizing proximity / limit switch. Door open / close events shall be recorded as incidents identified by time and Lane identification. The incidents are to be displayed on the plaza level.
3. Cabling Layout: All external cables shall be protected against the effects of lightning and shall comply with all requirements for the control of interference from EMI. All data cables shall be screened and shall be properly separated and shielded from all power cables.
4. Ventilation and internal temperature: All equipment endorsed by the cabinet shall be kept at a temperature consistent with manufacturers recommendations.
5. Finishing: The cabinet surfaces shall be protected from the environment in which it shall be used and the Equipment Contractor shall specify the surface treatments to be applied. Each cabinet shall be painted and numbered in a manner consistent with the toll lanes and consistent with all equipment related functions (e.g. reporting to the plaza software subsystem).
6. Cable dressing: All cables (power & signal) shall be properly routed and dressed with suitable railings inside the enclosure and ties.
7. Cable numbering: The signal & power cable terminations shall be identified by proper numbering. In addition to the termination at the controller end, this numbering shall also be maintained at locations where the cables are exposed (like manholes, junctions) and at the peripheral end. Further, all the individual component boards shall be properly identified by labeling.
8. Cable terminations: The signal & power cable (from the peripherals) terminations shall be kept separated inside the cabinet. The cable routing inside the enclosures shall be done in a proper manner, so that, aesthetics apart, the cable faults can be traced and faulty cables replaced, easily and less time consuming.

3.5. User Fare Display with mounting pole

3.5.1. Description and Function

3.5.1.1. The User Fare Display (UFD) shall be located in the toll lane in a position where it is readily visible to and readable by Users from the pay point. The display has the primary purpose of informing the User of the vehicle. It shall convey ETC balance information & low balance warnings, public relations and seasonal messages.

3.5.1.2. The UFD shall be of variable message type and shall have high intensity LED or similar Operator approved display of 10 characters per line in two lines with the option of scrolling for displaying seasonal messages.

3.5.1.3. The UFD shall send status information to the TLC for interface with plaza subsystem.

3.5.2. Specifications
The following minimum specifications shall be met:

a) Size   : 750 X 400 mm
b) Display   : Red LED
c) Visibility Range   : 10 m
d) Enclosure   : MS
e) MTBF   : 50,000 hours
f) MTTR   : less than 30 minutes

3.5.3. Power Source

The UFD shall receive UPS power from the TLC. Any special electrical protection / interface unit shall be provided by the Contractor, if required based on the needs of the device.

3.5.4. Protection

The UFD shall be IP 65 rated or better.

3.6.   Automatic Barrier Gate

3.6.1.   Description and Functions – Automatic Barriers

3.6.1.1.   The lane exit barrier shall be suitable for high- speed ETC transactions. One full open-close cycle shall not take more than 1.2 seconds. The barriers are being used in the ETC express lane, the barriers shall be capable of full lane open from a close state in less than 0.6 seconds.

3.6.1.2.   The housing and any mounting frame shall be fabricated from corrosion-resistant materials. They shall be IP 55 rated. The barrier shall be driven electrically. The motor shall not be damaged when the barrier is blocked in any position. Exit barriers shall have presence detectors independent to the AVC system to prevent barrier arms coming down on vehicles while passing. This shall be in the form of infrared units and dedicated embedded loops. Apart from the barrier arm, the mechanism may not have any moving protrusions that pose a risk to persons standing in close proximity to the barrier.

3.6.1.3.   The barrier arm shall be fabricated from a light, corrosion resistant material readily and inexpensively available in India.   The barrier arm shall further have a protective mechanism whereby controlled fracture of the barrier arm occurs without damage to the housing or motor in the event of frontal collision. Preference will be given to non-destructive break-away mechanisms. Further, there shall be a protection mechanism to detect the presence of vehicles to avoid accidental hitting on the vehicles, whenever the boom is triggered for closing.

3.6.1.4.   Suitable power supply scheme shall be implemented by the Contractor to feed the Exit barrier to protect the source from being damaged due to electrical surges / spikes injected by the dynamic (inductive) load. Further, the drive shall be so designed as to the damping factor is just sufficient for the drive to operate the booms without any jerks during open / close to avoid freak hitting by the exiting vehicles.

3.6.1.5.   Barrier arms shall have retro-reflective red stripes in accordance with the local traffic sign standards.

3.6.2.   Specifications

3.6.2.1.   The following minimum specifications shall be met:

     a)   Boom Length   : 3 m or 3.5 m
     b)   Boom Material   : Aluminium

3.6.3. Power Source

The Automatic Barrier Gate shall receive power directly from dedicated online UPS. Suitable protection shall be provided by the Contractor at the load end to protect the Boom Barrier. The Contractor shall fulfil any specific earthing requirement.

3.6.4. Protection

The Automatic Barrier Gate shall be IP 55 rated.

3.7. Overhead Lane Status Sign (OHLS)

3.7.1. Description and Functions

3.7.1.1.   The Over Head Lane Sign (OHLS) is located above the center of the lane at the lane entrance. The purpose of the OHLS is to indicate to the User whether the toll lane is open for the processing of vehicle or closed. A red cross is used to signal that the lane is closed, whilst a green arrow is used to indicate that the lane is open to traffic.

3.7.1.2.   Signs must be sufficiently bright and directed to indicate to a motorist, approaching the toll plaza, at a distance of *300 m* on a bright cloud free day that the lane is available for use. The OHLS status shall also be visible up to a peripheral view of 45 degrees from the travel axis.

3.7.1.3.   At any situation, both RED and GREEN part shall not glow simultaneously. Under failure conditions, only Red Cross shall be displayed until rectification.

3.7.2. Specifications

The following minimum specifications shall be met:

a)	Size	: 300 mm X 300 mm
b)	Display (Cross)	: Red LED
c)	Display (Arrow)	: Green LED
d)	LED	: 5mm in diameter, 8000 mCd
e)	Visibility Range	: 150 m (under extreme weather conditions)
f)	Enclosure	: IP 65 or better grade

3.7.3. Power Source

The OHLS shall receive UPS power from the TLC.

3.7.4. Protection

The OHLS shall be IP 65 rated or better.

3.8. Traffic lights with mounting pole

3.8.1. Description and Functions

3.8.1.1. The Traffic Light (TL) shall be located in the toll lanes in a position where it is readily visible to users of the toll road, usually on the side of the lane beyond the toll booth. The traffic light shall consist of two traffic light heads mounted on a suitable pole. An amber signal with arrow is used to indicate that the user should take suggested path, whilst the green signal is used to indicate that the user should proceed.

3.8.1.2. At any situation, both AMBER and GREEN part shall not glow simultaneously. Under failure conditions, only Amber arrow shall be displayed until rectification.

3.8.2. Specifications

The following minimum specifications shall be met:

a) Size   : 200 mm Φ
b) Display (Stop) : Amber LED
c) Display (Start) : Green LED
d) Visibility Range : 20 m (under normal visibility conditions)
e) Enclosure   : SS (stainless steel) or Polycarbonate

3.8.3. Power Source

The TL shall receive UPS power from the TLC. Any special electrical protection / interface unit shall be provided by the Contractor, if required based on the needs of the device.

3.8.4. Protection

The TL shall be IP 65 rated or better.

3.9. Loops with detector
Dimension as suggested by the Service Provider/System Integrator and detector specification as per AVC specification chapter.

3.10. Incident Capture Camera with mounting Poles
3.10.1. The cameras shall be charge coupled device (CCD) color cameras equipped with fixed focal manual iris lenses and night vision capabilities. The cameras shall require a minimum of 1.8 lux for usable image/video. The CCTV systems shall have adequate surge and lightning protection.

3.10.2. The model selected shall have image compensation capability to ignore stray lighting / vehicle lighting so that ICS and LPIC shall render meaningful output for verification.

3.10.3. The camera should be able to capture snapshots also.

3.10.4. Camera Location

The Equipment Contractor shall determine the best mounting positions for the cameras so that effects, such as, direct sunlight and stray lighting is negated. The cameras shall also be protected from or be resistant to high winds and moisture. Vibration shall be minimised such that the image quality is never compromised.

Each camera shall view and detect vehicle images for its lane. The cameras shall be located so that sidelong profile of the vehicle is obtained as it crosses the AVC, so that the number of axles of the vehicle crossing the AVC shall be clearly visible when the vehicle is exiting the lane. The camera shall have an automatic adjustment of brightness. The housing shall be an IP-65 rated Enclosure to withstand adverse weather conditions.

3.11. License Plate Image Capture Cameras

Each camera shall view and detect vehicle images for its lane. The cameras shall be located so that sidelong profile of the vehicle is obtained as it crosses the AVC, so that the number of axles of the vehicle crossing the AVC shall be clearly visible when the vehicle is exiting the lane. The camera shall have an automatic adjustment of brightness. The housing shall be an IP-65 rated Enclosure to withstand adverse weather conditions

3.12. TFT Display

The TFT display/Fee Collector Display (FCD) shall be located on the fee collectors desktop and shall be screwed or bolted through the counter top, the position of the FCT shall be finalized with the employers engineer at time of installation, suitable mounting brackets manufactured from stainless steel shall be provided to fix the screen to the desktop. All nuts and bolts are used to secure the FCT to the booth counter top shall be stainless steel. It shall be the system's interface to the fee collector, to display the status of transactions and status of the lane peripherals.

Minimum Technical specifications for the TFT display shall be as follows:

Description	Remarks
Display Type	TFT with Diagonal Size of 18.5" Minimum
Cables	Power Cable 1 x VGA Cable (15- pin HD D – Sub)
Cable routes	Power cable: 15 meters VGA Cable: 15 meters (terminated to the SVGA Port at the LC via booth ducting)
Color	Manufacturer's Original Color
Voltage Requirement	AC 230 V (50 / 60 Hz)
Power Consumption	80 W
Operating Temperature	0 degree C to 50 degree C
Relative Humidity	20 % to 80 %
Design Criteria	- Min. Resolution: 1024 X 768 / 60 Hz - Aspect Ratio : 4:3 - Number of Colors: 16.2 M, (6bit+FRC) - Video bandwidth: 70 MHz - Viewable size: 18.5" Minimum - MTBF: 30,000 hrs - MTTR: 0.25 hrs

3.13. Customized Keyboard

The keyboard on the Fee Collector terminal for Registration of toll operations shall be a programmable Industrial Grade keyboard. The industrial grade keyboard shall be fully programmable; this however must be approved by the Engineer before supply. These keys will be used to enter data of:

    (1) Staff Id number
    (2) Vehicle Classification
    (3) Type of Transaction
    (4) Accept/Cancel Transaction
    (5) Method of payments Selection
    (6) Operate OHLS
    (7) Numeric Keypad with backspace button for numeric corrections
    (8) Class Cancel
    (9) Bleed-off button
    (10) Violation Cancel/Accept Button
    (11) Simulation Button (Only for use during Maintenance Mode)
    (12) Alpha Numeric Keys in QWERTY format

Customized Programmable Keyboard Features and minimum Specification shall be as follows:

- Shall have Powerful programming capability
- Programming under DOS and Windows, multiple page, multiple level, whole range key content, time delay, position sense answer back code, etc.
- True spill-resistant design
- Optional blank key, double key for alternative key group layout
- Optional MSR
- 70 programming keys + 6 position control key
- Key top size: 18 mm x 22 mm for single key
- Interface: PS/2 or USB
- Dimension (maximum): 340 mm (W) x 150 mm (D) x 58 mm (H) or vendor/OEM specific
- Weight: upto 1.2 kg
- Color: OEM Specific

3.14. Barcode Reader with stand

Desktop mounted fixed Barcode reader shall be installed in the toll booth on the FC desktop in lanes.

The motorists upon reaching the pay-axis of the lane will produce the return/ daily pass ticket he had collected from the FC at the first entry lane. The FC will place the ticket on the barcode reader which will read the 2D barcode printed on the ticket. The LC will get the transit details from the barcode which are required to validate the validity of the ticket and authenticate based on the vehicle class (already selected by the FC while the vehicle was approaching) for processing of the transaction.

System Integrator shall note that handheld/handy barcode scanner/readers will not be allowed in any case, even if the same is provided with the stand. The scan rate of the handheld readers is very less which delays the transaction processing. The possibilities of damages in handheld barcode readers are very high. Hence only desktop mounted BCR shall be supplied.

BCR Features and minimum Specification shall be as follows:

- BCR shall be a High performance 2D omnidirectional laser scanner
- Shall have Programmable sleep mode; Reactivated by simple push of a button
- BCR shall perform Full automatic scanning operation
- Depth of Field: 300 mm (EAN 0.33 mm / 13 mil, PCS = 90%)
- Scan Patten: 7 directions of scan field, 24 scan lines

- Scan Rate: 2400 scans/sec for omnidirectional scanning
- Dimension (maximum): 152 mm (H) x 152 mm (W) x 91 mm (D); Weight: not more than 500 g
- Interface: USB or Serial

3.15. Themal Receipt Printer

3.15.1. The thermal receipt printer (RPR) shall be used to print receipts in the lanes. The printer shall be provided with the automatic advance function of the paper after printing so that the space for the first line of printing is aligned under the print head thus reducing the time taken to produce a receipt.

3.15.2. For design purpose, it shall be assumed that receipts will be approximately 70mm in length. The Employer (NHAI) and project/plaza information will occupy space on the top. The area under this shall be used for particular printed data. The System Integrator shall take the approval from the Employer for the format of the receipt.

3.15.3. Minimum Technical specifications for the RPR shall be as follows:

Descriptions	Remarks
Dimension	Maximum up to 145mm (W) x 195mm (D) x 148 (H)
Weight	Shall be less than 2 kg
Installation and Fixing Details	Installed and fixed on the Fee Collector desk
Cables	- Power cable - Serial RS232C/ Parallel /USB
Cable routes	Power cable is terminated to the HLC Termination Block via booth ducting. Data cable is connected to the HLC
Color	Cool White/Dark Grey
Power Supply Requirement	24 VDC $\pm$ 7%
Access for maintenance, modularity of construction	The cover can be opened for maintenance. It also has paper sensors. Off-the-shelf product
Operating Temperature	5 C to 50 C
Relative Humidity	5 % to 90 %
Design Criteria	Print Speed: 47 LPS Print font: 9x17/12x24 Print column capacity: 56/42 columns
	Character size (mm): 0.99(W) x 2.4 (H) / 1.41 (W) x 3.4 (H) Paper dimension (mm): 79.5 $\pm$ 0.5 (W) x 83 (diameter) Paper thickness: 0.06-0.07 mm Auto cutter life: 1.5 million cuts Real-time printer status: Auto status back (ASB) messages MCBF: 52 million lines MTBF: 360,000 hours, Overall MTTR: 0.25 hrs

3.16. Intercom Slave Unit inside Booth

This specification lays down the general, functional and technical requirements of intercom slave communication unit to be used as a sub-system in the Booth at the Plaza.

ISCU shall be used for communication between the Toll Collector at the lane and the auditor/ supervisor at the Plaza building.

ISCU shall have the following functions:

- Voice communication installed in the booths shall provide hands free two-way verbal communication between the supervision staff in the control room and the Collectors. The Collector shall be able to attract the attention of the auditor in the control room by pressing a single button on the intercom slave unit in the booth.

- The equipment shall also have the facility to allow the supervision staff to monitor communication in the booth between the Collector and the user or between any booth without alerting the Collector.

- The voice communication system shall operate independently of the Plaza Toll management system.

- Voice communication shall also be implemented in various rooms of the plaza building and at building access points.

- Two-way communications shall be possible as soon as the auditor responds by selecting the appropriate lane button on the Master Communication unit

- One-way communication shall be possible from the Control Room intercom to all lanes simultaneously (broadcast)

ISCU shall meet the following minimum technical specifications:

Descriptions	Minimum Specifications
Installation and Fixing Details	Fixed in the booth. (wall/desktop mount)
Speech Method	Hands-free
Wiring distance	120 meters with 0.202 mm diameter (33 AWG) cable, 300 meters with 1.024 mm diameter (18AWG) cable
Speaker	20 ohms
Power Consumption	6 W (max.)
Power Supply Requirement	Power supply from Master System
Wiring	2 wires, non-twisted
Environmental Considerations	Operating Temperature of $10^{\circ}C$ to $50^{\circ}C$
Reliability	30,000 hrs

The System Integartor may also propose/ provide an IP based intercom system.

3.17. Master Communication Unit (MCU)

This specification lays down the general, functional and technical requirements of master communication unit to be used as a sub-system in the Plaza.

The master communication unit MCU is a master communication system to control communication between the Collector at the lane and the auditor at the Plaza building. The unit will be located in the Control room and controlled by auditor/ supervisor.

Technical Specifications:

Descriptions	Remarks
Power Source	24V DC
Current Consumption	Max. 1A, 80mA in standby
Communication	Push-to-talk at master station hands free at sub
Calling	LED and intermittent ringing tone at master until answered
Frequency Response	770 – 6800Hz
Total Harmonic Distortion	3% @ 1000Hz at 20 ohms
Mounting	Wall or desk mount
Wiring	2 conductor per sub station
MTBF	30,000 hrs

3.18. Closed Circuit TV (CCTV) (General)

3.18.1. General

This part of the RFP covers the equipment and services to be supplied under CCTV equipment to be installed at the Plazas. The CCTV equipment shall be categorized as two types, CCTV for lanes and CCTV for Plaza surveillance.

The CCTV for lanes shall be:

(1) Booth CCTV cameras

The CCTV for Plaza surveillance are:

(2) Network Video Recorder (NVR)
(3) Video Management Software (VMS)
(4) Plaza Building Security CCTV cameras

All the cameras shall be IP based and shall be connected to the Plaza Network video recorder (NVR). The video management software (VMS) installed on NVR shall provide the facility to control the cameras at the Supervision Control room at the Plaza Buildings. The video recording of each camera shall be stored at for a period of minimum 30 days.

The functionality of the CCTV cameras provided by the Bidder shall be described as follows:

Booth CCTV cameras – These cameras shall be installed inside of the booth to capture the activities of the Collector all the time and especially when doing the transactions along with the view of the paying vehicle. The position of the booth camera shall be decided accordingly. These cameras shall have inbuilt voice recording and SD memory card of minimum 32GB for local storage of videos and voice recordings.

Plaza Building Security CCTV cameras – These cameras shall be intended for monitoring of security areas such as the plaza compound, general parking area, Toll

Control Room, cash room, plaza building lobby, Collector walkway, server room, UPS room, tunnel, parking, staircase, cash van loading area, etc.

The design of the CCTV system for the plaza shall consider the following: -

(1) Provide effective supervision and control
(2) Easy to use
(3) Self-contained system
(4) Increase span of management
(5) Reduce unnecessary travel
(6) View / evaluate situations quickly
(7) Motion detection
(8) Savings on time and manpower
(9) Easy access to video information and quick playback
(10) Minimize the use of security guards
(11) Eliminate unnecessary responses to false alarms
(12) Provision for future scalability

3.19. Booth Level CCTV

The booth CCTV camera shall be an IP based fixed dome type color cameras installed inside the booth to capture the activities of the Fee Collector while performing his operations. The camera also shall capture the view of the paying vehicle while capturing the transaction video.

These cameras shall have inbuilt voice recording and SD memory card of minimum 32GB for local storage of videos and voice recordings.

These cameras shall be connected to the NVR installed at the control/server room at each Plaza building.

The camera and NVMS shall be capable of triggering alarms in case of Video motion detection, manual trigger, digital input, periodical trigger, system boot, recording notification, camera tampering detection and audio detection. The triggering alerts can be controlled by the control room operator.

Technical Specifications of the Booth Cameras shall be as follows:

The technical specifications mentioned hereunder are minimum guidelines. The Applicant shall not deviate materially from the specifications specified herein.

Parameters	Minimum Specifications
Image Sensor	1/2.8" Progressive CMOS
Maximum Resolution	1920x1080 (2MP)
Lens Type	Fixed Focal
Focal Length	f = 2.8
Aperture	F1.8
Field of View	110° (Horizontal), 64° (Vertical), 135° (Diagonal)
Shutter Time	1/5 sec. to 1/30,000 sec.
Day/Night	Removable IR-cut filter for day & night function
Minimum Illumination	0.08 Lux @ F1.8 (Color) 0.001 Lux @ F1.8 (B/W)
IR Illuminators	Built-in IR illuminators, effective up to 25 meters or better IR LED*8
On-board Storage	SD/SDHC/SDXC card slot
Compression	H.265 & MJPEG
Maximum Frame Rate	30 fps @ 1920x1080 In both compression modes
Maximum Streams	4 simultaneous streams
S/N Ratio	Above 55dB

Parameters	Minimum Specifications
Dynamic Range	97dB or better
Video Streaming	Adjustable resolution, quality and bitrate
Image Settings	Adjustable image size, quality and bit rate, Time stamp, text overlay, flip & mirror, Configurable brightness, contrast, saturation, sharpness, white balance, exposure control, gain, backlight compensation, privacy masks, Scheduled profile settings, Seamless recording, smart stream, 3D Noise Reduction, Video Rotation
Audio Capability	Audio input /output (full duplex)
Compression	G.711, G.726
Interface	External microphone input Audio output
Protocols	IPv4, IPv6, TCP/IP, HTTP, HTTPS, UPnP, RTSP/RTP/RTCP, IGMP, SMTP, FTP, DHCP, NTP, DNS, DDNS, PPPoE, CoS, QoS, SNMP, 802.1X, UDP, ICMP
Interface	10 Base-T/100 BaseTX Ethernet (RJ-45)
ONVIF	Supported
Alarm Triggers	Video motion detection, manual trigger, digital input, periodical trigger, system boot, recording notification, camera tampering detection, audio detection
Alarm Events	Event notification using digital output, HTTP, SMTP, FTP and NAS server, SD Card File upload via HTTP, SMTP, FTP, NAS server and SD card
Connectors	RJ-45 for Network/PoE connection Audio output DC 12V power input Digital input : 1, Digital output :1
LED Indicator	System power and status indicator
Power Input	Max. 9 W (PoE)
Safety Certifications	CE, LVD, FCC Class B, VCCI, C-Tick
Operating Temperature	Temperature: -10°C to 50°C

3.20. Network Video Recorder (NVR)

H.265 Linux-based embedded standalone NVR shall be provided. Shall support 16-Channel /24-Channel / 32-Channel network cameras. The NVR shall be ONVIF compliant and scalable configuration with features to help users to set up and manage advanced IP surveillance systems with ease. The NVR shall also support remote and mobile access, via web based application, and app for both iOS and Android devices.

The NVR shall have minimum following technical features:

     a) H.265 Compression Technology

     b) Plug & Play One Button Auto Setup

     c) Intuitive, Intelligent and Interactive UI
     d) Live viewing, recording and Playback features
     e) Embedded Linux OS or OEM Specific
     f) Support RAID 0/1/5 Storage
     g) Up to 12MP Camera Liveview & Playback
     h) Dual Lan Network Ports with Failover Function
     i) ONVIF Open Platform

3.21. CCTV cameras for Plaza Building surveillance (Server room, Contorl room, Cash room, admin)

The system shall be connected to the NVR. The VMS installed on NVR shall provide the facility to control the cameras at the Supervision Control room at the Plaza Buildings.

The cameras shall be for monitoring of security areas such as plaza compound, security garage, Control Room, Change of Shift Room and Cash Counting Room, Lobby, Hallway, Tunnel, Fee Collector Walkway, parking, staircase, DG room, electrical room, server room, UPS room, Loading Bay, etc.

These cameras shall be

a) **Fixed lens Bullet CCTV night vision colour cameras**.

The bullet cameras installed outdoor shall be installed in the weather proof enclosure.

Technical Specifications of the Plaza Surveillance Cameras shall be as stated hereunder. The technical specifications mentioned hereunder are minimum guidelines. The Bidder shall not deviate materially from the specification specified while preparing the Technical Proposal of the Tender.

Fixed lens Bullet CCTV night vision color cameras

Parameters	Minimum Specifications
Image Sensor	1/2.8" Progressive CMOS
Maximum Resolution	1920x1080 (2MP)
Lens Type	Fixed-focal
Focal Length	f = 3.6 mm
Aperture	F2.1
Field of View	83° (Horizontal), 53° (Vertical), 91° (Diagonal)
Shutter Time	1/5 sec. to 1/30,000 sec. or better
Day/Night	Removable IR-cut filter for day & night function
Minimum Illumination	0.06 Lux @ F2.1 (Color)
	0.001 Lux @ F2.1 (B/W)
IR Illuminators	Built-in IR illuminators, effective up to 30 meters
On-board Storage	Slot type: SD/SDHC/SDXC card slot
	Seamless Recording
Compression	H.265 & MJPEG
Maximum Frame Rate	30 fps @ 1920x1080
	In both compression modes
Maximum Streams	4 simultaneous streams
S/N Ratio	50 dB or better
Dynamic Range	95 dB or better
Video Streaming	Adjustable resolution, quality and bitrate, Stream
Image Settings	Adjustable image size, quality and bit rate, Time stamp, text overlay, flip & mirror, Configurable brightness, contrast, saturation, sharpness, white balance, exposure control, gain, backlight compensation, privacy masks, Scheduled profile settings, 3D Noise Reduction, Video Rotation, Defog
Audio Capability	Two-way audio (full duplex)
Compression	G.711, G.726
Interface	External microphone input

Parameters	Minimum Specifications
	Audio output
Users	Live viewing for up to 10 clients
Protocols	IPv4, IPv6, TCP/IP, HTTP, HTTPS, UPnP, RTSP/RTP/RTCP, IGMP, SMTP, FTP, DHCP, NTP, DNS, DDNS, PPPoE, CoS, QoS, SNMP, 802.1X, UDP, ICMP, ARP, SSL, TLS
Interface	10 Base-T/100 BaseTX Ethernet (RJ-45)
ONVIF	Supported
VCA	Line crossing detection, field detection, loitering detection
Alarm Triggers	Video motion detection, manual trigger, digital input, periodical trigger, system boot, recording notification, camera tampering detection, audio detection
Alarm Events	Event notification using digital output, HTTP, SMTP, FTP and NAS server, SD Card
	File upload via HTTP, SMTP, FTP, NAS server and SD card
Smart Focus System	Fixed Focus
Connectors	RJ-45 cable connector for Network/PoE connection
	Audio input
	Audio output
	DC 12V power input
	Digital input: 1, Digital output:1
LED Indicator	System power and status indicator
Power Input	DC 12V
	IEEE 802.3af/at PoE Class 0
Power Consumption	Max. 9 W
Casing	Weather-proof IP66-rated housing
	Vandal-proof IK10-rated metal housing (Casing Only)
Safety Certifications	CE, LVD, FCC Class A, VCCI, C-Tick
Operating Temperature	10°C to 50°C

3.22. 24 port Network Switches (Layer 3)

3.22.1. General

The System Integrator shall supply and install network equipment at each Plaza and each toll gate to connect Plaza building system with toll lane systems. At the Plaza, the System Integrator shall supply and install all equipment, cables, connectors, terminals and other miscellaneous materials necessary to establish a working local area network connecting these two systems.

The network configuration shall be determined by the System Integrator. The cost of the network devices and materials that is not explicitly listed in the BOQ of this Contract but necessary for the system shall be deemed as included in the cost of appropriate items and the Contract Price, and no separate payment shall be made.

8-Port PoE industrial grade rugged managed switch with 2 fibre port shall be provided in each lane to connect all lane peripherals. No unmanaged switch shall be provided in the HES lane. This 8-Port switch shall be installed inside the Electronic Enclosure of the Hybrid Lane Controller. Managed switch will ensure that the data transmission between the lanes and PMS is smooth and faster. This will also prevent data broadcasting from lanes which may result in chocking of the entire network and slows the data transfer and efficiency of the lane equipment.

3.22.2. 24 Port Layer 3 Switch with 4 Fiber Port

Switch should support port security, DHCP snooping, Dynamic ARP inspection, IP Source guard, BPDU Guard, spanning tree root guard.

Switch should be IPv6 Certified/IPv6 logo ready and Switch / Switch's Operating System should be tested and certified or in process of certification for EAL 2/NDPP or above under Common Criteria Certification.

Switch should have 1:1 redundant internal power supply. Power supply modules, fan modules and transceivers modules should be hot swappable.

Should support IEEE Standards of Ethernet: IEEE 802.1D, 802.1s, 802.1w, 802.1x, 802.3ad, 802.3x, 802.1p, 802.1Q, 802.3, 802.3u, 802.3ab, 802.3z, 802.3az.

Switch shall have minimum 24 nos. 10/100/1000 Base-T ports and additional 4 nos. SFP uplink ports loaded with MMF modules with dedicated stacking ports

Switch shall have wire rate performance and 48 Gbps of dedicated stacking bandwidth.

3.23.   ETC Server (Plaza Server)

3.23.1. The local ETC server is responsible for the control, data storage, processing and administration of the toll operation. It shall be the responsibility of toll management server to synchronize all activities of toll collection process, data and time of all workstations.

3.23.2. There shall be a separate partition for Operating System. All Data files shall be stored in a separate partition. Image files shall have a separate 3rd partition. This scheme is applicable not only for the LOCAL ETC SERVER but in all levels of Toll System.

3.23.3. Storage sizing at each level shall be backed up with corresponding file size per transaction / record as part of technical specifications delivery. If required, the HDD finalized as part of BOQ shall be revised to handle the data storage capacity requirement as per the requirement without any additional cost to the Purchaser.

3.23.4. General Requirements

3.23.4.1.   The manufacturer of the server and workstations shall:

➢ Be a well-known and established company worldwide in the field of Information Technology.
➢ Have an established and appointed representative or authorized agency in project location.

3.23.4.2.   The Contractor of the server and workstations shall:

➢ Be a well-known and established IT hardware supply company in project location.
➢ Be a registered representative of the original equipment manufacturer in project location.
➢ Be capable of supplying adequate after-sales service and support on 24X7 basis.

3.23.5. Platform

3.23.5.1.   The server shall make use of minimum 64-bit platform.

3.23.5.2.   Configuration

- Processor board: shall have the capacity to accept up to 4, 64-bit central processor units.
- Central Processor Unit/s: shall be 64-bit, Xenon 3 GHz or superior latest available speed at the time of delivery to the site.
- Number of Processors: 2
- RAM: 8 GB (Upgrade up to 16GB)
- RAID (Redundant Array of Inexpensive Disks): shall use RAID5 with hardware RAID controller.
- SCSI Controller: shall have a minimum of two channels
- HDD: hot swap disks of latest available speed; capacity shall be based on data retention of all data for a period of 5 years
- DVD R/W: latest available speed
- Network Devices: 3X10G (Gigabit) LAN NIC (Network Interface Card)
- Power Supply: shall have a dual hot swap power supply to provide redundancy
- Connectivity: Two (2) standard communications ports (D sub 9 pin), Four USB (Universal Serial Bus) ports (High Speed USB 2.0), SVGA Screen port
- Light path diagnostic with external visible panel
- LCD display for server operational log (events)
- Integrated system management processor on board
- Redundant hot swap fans
- Optical scroll Mouse
- 17" TFT monitor

3.23.5.3.   The server including all accessories listed above shall be installed in rack.

3.23.6. Software Compatibility

The server shall be capable of supporting the following software platforms:

Operating System:
Windows
UNIX
LINUX (64bit platform) or compatible

Database:
Industry standard

3.23.7. Backup Device

Backup device shall be connected with the server through a SCSI controller card and shall be DLT drive 80/160 GB.

3.24.   Archive Storage Device

3.24.1. This device shall be connected with the server through a USB port and shall be of any reputed make with service and support availability in India and of RAID configuration.

3.24.2. This device shall contain all the archived data on a monthly basis after the 5 year retention period. It shall be possible to restore a COPY of the archived data for selected months to the live database as and when required and can be removed immediately after it serves its purpose. Since, this data is to be utilized only for reporting purposes, all the transaction and related data shall be retained in the Archive until the end of contract period.

3.24.3. However, the LPIC, ICS images grabs, AVC profile against each transaction can be archived separately on DVD / Tape after the 5 year retention period and will not be stored in the Server Hard disk and USB based Archive storage device.

3.25. System Image Storage Device

3.25.1. A separate secure external HDD shall be supplied for storing the ghost images of all fresh installation of lane / AVC controller and other modules, local ETC Server, etc. After restoring this ghost image, it shall be possible to import / configure the lane / equipment specific characteristics before normal operation of the equipment. Any data required shall be restored from the back-up device. In case of local ETC Server restoration, the current day data after backup to external storage device can be retrieved from the lanes.

3.25.2. System Software

3.25.2.1. The system shall be in Domain environment and all workstations must connect to that domain.

3.25.2.2. An additional secondary server shall be provided, which shall take over immediate charge of Primary server in case of its failure. In other words, this shall be a hot stand by to the primary server in all aspects.

3.25.2.3. The specification, make, model of all the accessories of the secondary domain controller shall be same as that of the primary domain controller.

3.26. Licensing

License for each server, workstation operating system, Database management system software, database maintenance software (like TOAD, etc.) or any other software (MS-OFFICE package, Adobe, GHOST etc.) used in toll system, which requires a license, shall be provided by the Contractor in the name of the Authority without any additional cost to the Authority.

3.27. Database Management System

3.27.1. Database shall be a relational database management system.

3.27.2. Lane system shall not have any direct database access. Data from the lane going to the database shall be through dedicated software that runs on database server.

3.28. Data Network

3.28.1. The data network shall be Ethernet format. The network shall use TCP/IP protocol and the cabling shall be STP / MM OFC and it shall be compatible with all network system and equipment.

3.28.2. Care shall be taken to ensure that the cable and the network switches used between two equipment shall be able to cater to the speed of the higher NIC.

3.29. Remote Access

Remote access shall be through a safety system as a remote connection server or firewall system. The Toll system network shall be compliant with the majority remote access equipment and remote access system and it shall be configured with any remote system available at site.

3.30. Hardware and Software Control System

3.30.1. Hardware and Software fault logging system. This shall include all information regarding faults, downtime and repair time, imported from the ETC Server.

3.30.2. Help Menu

An intuitive and interactive help system that can be activated from anywhere in the TMS system.

3.30.3. Security System

3.30.3.1. A facility to allow the Authority to manage users and their access levels.

3.30.3.2. The plaza ETC system shall at its highest level determine access to the separate modules by any employee. It shall have the facility to define the employee according to an associated level or duty, and provide a mechanism, whereby access is restricted.

3.30.3.3. All FDD and CD R/RW of workstation shall be disabled and except Administrator no one shall have any right assigned to add, remove or modify any program on any of the workstations.

3.30.3.4. Nothing other than toll collection and operations function shall be accessible to any level of toll operation function. If need arises, then the user shall logout, exit the application using administrator rights.
After this Logoff from the system the user shall login into Windows with Administrator rights and perform any required action. This is applicable for all levels of the Toll System.

3.31. Workstations Management

At any time, if the purchaser wants to add additional workstations and its peripheral hardware from the system, shall be able to do so without any additional cost to the purchaser.

3.32. Interfaces

The system shall be designed using Open interface architecture at all levels of hardware used. In future, it shall be possible for the Authority to change any make / model of any hardware without dependency on the Contractor.

3.33. Data Management and Integrity

3.33.1. Data Integrity

The basic need for data integrity is the account closing at the administrative level. The closing process assumes that all data from the lanes has been introduced into the database.

This can be resumed to:

- ➢ Guarantee the data in database is complete
- ➢ Guarantee the data in database is correct

This is accomplished with:

- ➢ Checksum: let detect errors in data
- ➢ Data type sequencing: let detect missing sequence
- ➢ Communication sequence: this is a periodic messaging to allow detection of communication failure

Since, the whole Toll Collection system is designed to detect and subsequently prevent misuse in any manner and collect all collectible revenues, any transaction / operation performed in any level of the Plaza ETC system shall be recorded in the system on detecting a definitive positive / negative confirmation only. Usage of any other irrelevant keys under such conditions shall display a warning message to use the correct keys.

3.33.2. Data Sequence

Each message / transaction shall have its own sequential number.

3.33.3. Missing Data Detection and Resolution

3.33.3.1. The conditions to be sure all data is in the database in a given moment are:

- a) All message sequences received were correct (no checksum errors)
- b) There were no jumps in message sequential number
- c) There were no jumps in message type sequential number
- d) The Communication sequence is being received with no gaps and small permissible delays.
- e) The message sequence type counters into Communication sequence are in accordance with the counters received in actual messages.

3.33.3.2. The program used to insert lane messages into the database keeps making the above checks. If any problem is detected, it is signaled to plaza level.

3.33.3.3. If any of the conditions above fail, the system signals a problem with the data on a connected workstation in graphical form i.e. for each lane by hour. The resolution of the problem is:

   a) If there is a data error (message received with bad checksum or bad data fields) the system automatically tries to read the TLC / AVC message again.
   b) If data is missing, the normal way to solve this will be to make an export from TLC and import in Administrative System using lane data import function. If the problem persists,

The specific situation will have to be analysed by going in details like which kind of data sequence is missing - revenue or non-revenue, the missing sequence details shall be made available just by clicking on the failure block of the lane data as represented by the lane data failure graphics.

3.33.4. Data Import / Export System

3.33.4.1. Reports Information
To a Microsoft Excel, comma separated and MS Access compatible database file.

3.33.4.2. Data Backup & Restore System

Data shall be backed up onto a removable medium on a regular basis for removal from the premises. *Contractor shall submit a backup process and plan with the proposal, Authority's agreement and approval is required before its implementation.*

3.33.4.3. Data archiving / restore

3.33.4.3.1. Data archived on removable media on a regular basis shall be as specified under clause 6.21.5.2
3.33.4.3.2. All data shall be transferred / appended to removable electronic media / USB based Archive Storage device at monthly intervals and stored after the expiration of the prescribed period for retention of the data on various system levels, the data may be removed from the system. The plaza ETC system shall provide the facility to perform these functions.

3.33.5. Data Redundancy

3.33.5.1. All transaction and incident data shall be retained duplicated and stored within the various levels of the toll collection system such that should any level or component of that level suffer a partial or total failure, the data is not irretrievably lost to the system. In addition, it shall be possible to reconstruct and restore the data for the failed level form the stored data into its original format.

3.33.5.2. Data retention times within the various levels shall be at least:

   a) Vehicle Processing at Lane Level: 1month

   b) **Plaza level:**
      - Detailed Data: 36 months

- Archived Data on USB Archive Storage: 10 years

3.33.6. Data Transfer

No workstation / controller can be used as a router to send data to the server database; all data shall be reported directly to the server.

3.34. Incident Management Workstation

3.34.1. This module facilitates the supervisor to acknowledge incidents and to correct class discrepancies generated at lane level. Incident capture camera and License plate capture camera image/s and sensor outputs shall help supervisor in deciding the correct class of the vehicle and other validation actions.

3.34.2. Incident Management

3.34.2.1. The GUI shall be so designed that it shall be possible for the Supervisor to view at least the following information corresponding to each incident:
   – Plaza ID
   – Lane ID
   – User ID (of the user who was logged in lane at the time of incident generation)
   – User Name (corresponding to above User ID)
   – Transaction Number
   – Transaction Date & time
   – TLC Class
   – TLC / TAG VRN
   – TLC MOP
   – AVC Class
   – Axle Count
   – Processed by (User ID of the Supervisor who processed the incident)
   – Supervisor Name (corresponding to Processed by User ID)
   – Corrected Class
   – Corrected VRN
   – Supervisor Action
   – TAG Media ID
   – ICS image (with watermarked Date / Time stamp, transaction number, incident type, etc.)
   – LPIC image (with watermarked Date / Time stamp, transaction number, lane VRN, etc.)
   – Event details (events / anomalies associated with this transaction – each transaction starts when Valid TAG Media is detected – for media based transactions / AVC Loop is triggered – for violations and ends when the vehicle liberates the AVC loop)

3.34.2.2. For processing of incidents / review of processed incidents, the Supervisor can filter the list of incidents based on the following:
   – Plaza ID (Default – All) Drop down menu form
   – Lane ID (Default – All) Drop down menu form
   – User ID (Default – All) Drop down menu form

- Transaction Date & time duration – From & To (Default – Current Date) User configurable
- TLC Class (Default – All) Drop down menu form
- TLC MOP (Default – All) Drop down menu form
- AVC Class (Default – All) Drop down menu form
- Axle Count (Default – All) Drop down menu form
- Processed by (Default – All) Drop down menu form including blank which shall be the case until incident is processed.
- Corrected Class (Default – All) Drop down menu form including blank which shall be the case until incident is processed.
- Supervisor Action (Default – All) Drop down menu form including blank which shall be the case until incident is processed.
- Event details (Default – All) Drop down menu form
- Processed Incidents / Not Processed Incidents

3.34.2.3. In addition to the above, it shall be possible for the Supervisor to search for a particular record based on any / combination of the following search criteria:
- User ID
- Transaction Number
- TLC Class
- TLC / Media VRN
- TLC MOP
- Processed by
- Corrected Class
- Corrected VRN
- Supervisor Action
- TAG Media ID

3.34.2.4. Based on the MOPs defined in the system and the Incident configuration, it shall be possible for the Supervisor to correct the class of the vehicle, Vehicle Registration Number (VRN) and Confirm / Reject the Lane MOP.

3.34.2.5. The incidents can normally be processed by Supervisor by performing selections / feeding information on one and / or all of the below fields:

- Corrected Class
- Corrected VRN
- Comments (optional)

3.34.2.6. It shall be possible for the Supervisor to perform these actions only by double clicking on a particular incident to view all information in detailed view before processing the incident.

3.34.2.7. It shall be possible at Plaza ETC system level to configure following on selection menu basis in order to activate and deactivate by administrator level function:

1. Capture of ICS image none, for selected type of incident, for all types of incident, for all transaction.

2. Capture of LPIC image none, for selected type of incident, for all types of incident, for all transaction.
3. Record and report incident transaction at incident management system, none, for selected type of transaction, for all transaction.

3.35. Other functions

3.35.1. In addition to the above primary function of the Supervisor, the following functions shall be performed by the Supervisor:

   a) Data Completeness
   b) Shift Consolidation
   c) Day Consolidation
   d) Month Closure
   e) Lists Transfer Status

The above functionalities are explained in detail below.

3.35.2. Data Completeness

3.35.2.1. The Supervisor can verify the status of data transfer between the lanes and workstations on an hourly basis. Wherever, the data transfer status is not OK, a separate process shall be available through which the Supervisor can re-request data transfer to correct the status.

3.35.2.2. The Data completeness procedure shall check at least the following minimum items:
   – Transaction sequence jump
   – Transaction sequence reset
   – Gap in time (if regular data packets are not updated), etc.

3.35.2.3. The Data completeness procedure needs to be defined and a separate document shall be provided by the TCE Supplier on how this feature is to be accomplished in the system.

3.35.3. Day Closure

3.35.3.1. The Day Closure option is used by the Supervisor to close each Operational day. When the Supervisor selects this option, the system shall display the current status of Operation in terms of data exchange.

3.35.3.2. When, the supervisor closes the day, the following conditions shall be verified by the system before generation of Day Closure Report:

   a) Data completeness
   b) Data transfer to CCH completeness

3.35.3.3. If any of the above checks fail, the system shall display an alert (POP-UP) to the Supervisor to perform these pending operations before day closure.

3.35.3.4. This procedure shall ensure that no data generated is left unattended for review / reconciliation.

3.35.4. Month Closure

3.35.4.1.   Month closure is performed on a monthly basis on a complete calendar month. Once, this option is selected any day pending closure shall be brought to the notice of the Supervisor.   For ensuring that all data and all corrections are complete and no deconsolidation whatsoever shall be required any further, the month closure for a particular month shall be performed on the 2nd day of the subsequent month (configurable).

3.35.4.2.   Once, this operation is performed, no changes whatsoever can be made through the application to the transaction data of the corresponding month whatsoever. Deconsolidation option shall not be available and all manual overrides with respect to these transactions shall not be possible.

3.35.4.3.   Whenever, this operation is confirmed, system shall ensure that this operation is performed after debt recovery. A warning message to this effect shall still appear for the Supervisor to ensure and confirm that the debt recovery process for the month for which month closure is being performed is already complete.

3.35.5. Lists Transfer Status

3.35.5.1.   In addition to the transaction data, there can be various lists related to users, media, classification, fare, configuration, parameters etc. which shall be transferred between server and workstations / lanes.

3.35.5.2.   The status of all such lists shall be displayed on selection of this option. The status shall include the following:
- a) Name of the list
- b) Version of current transfer
- c) Version of previous transfer
- d) Date & time
- e) Frequency of transfer (in HH:MM format)
- f) Transfer Status

3.35.5.3.   It shall be possible for the supervisor to re-request / re-transfer any failed list transfers.

3.35.5.4.   Also, all lists shall be retained in the system along with date of activation and date of expiry in addition to the version details.

3.35.5.5.   All the above listed functionalities are the core responsibilities of the Supervisor and only he / she can perform the above functions. Any user of a higher user-group though can view the actions performed by the Supervisor / current status but cannot modify anything unless explicitly so mentioned.

3.35.6. Fare table management

3.35.6.1.   The following functions shall be performed by the Toll Manager:

a) Fare table management (updation / revision subject to Project Manager authorization in the system through his login)

b) Whenever a new version of fare table is generated, the old fares and contracts shall be picked up by default. It shall be possible for the user to further modify these fares and set the date / time of activation.

3.35.7. Other Toll Manager Functions

3.35.7.1. Incident Management

The Plaza manager can view and access all features / options of this function. However, he / she cannot perform any modifications / corrections.

3.35.7.2. Data Completeness

On certain conditions when the Data completeness status cannot be corrected due to false triggers, non-revenue data missing, revenue data missing, etc., an option shall be available for the Plaza manager to manually override such statuses in order to restore the operational flow.

3.35.8. Users Management

The following are the various user groups that shall be available in the system:

Operations	Finance	System
Project Manager	Finance Manager	Administrator
Toll Manager	Cashier	Maintenance
Supervisor		

3.35.8.1.   When the user is created for the first time, all the information below is mandatory.

      a) Name
      b) Address
      c) Date Of Birth
      d) Contact Person
      e) Contact Number
      f) Email ID (optional)
      g) User ID
      h) Activation date
      i) Valid upto

3.35.8.2.   The status of account and Date of creation shall be displayed against all the existing users in the system. User account can never be deleted from the system once created, as there can be operations / transactions performed by the user that exists in the database and is required for reporting purposes.

3.35.9. Administrator Functions

In addition to the normal functions listed above, administrator can perform the following operation.

3.35.9.1. Lists Transfer Management

The administrator can manually copy the latest version of lists from the local ETC Server and restore the same in all the lanes.

3.35.10. Incident reporting levels

3.35.10.1. The system will allow the assignment of a level of importance to each incident and also define if the incident should be acknowledged by the supervisor.

3.35.10.2. The system has different levels of importance that can be assigned to different types of incidents. They shall be colour coded to facilitate easy visualization by the supervisor.

3.35.11. Incident Recording

ICS image capturing start from loop occupation to loop liberation and an additional configurable time limit after loop liberation of that transaction. Image capturing shall timeout after 30 seconds (configurable) after loop occupation irrespective of the above condition.

3.35.12. System Configuration for Incident management

One number of Incident management workstation with following configuration and peripherals shall be supplied by the Contractor.

The following minimum configuration requirements shall be met:

a)	Make	:	Reputed Branded
b)	Grade	:	Workstation
c)	HDD	:	based on estimated storage requirement for 6 months data (at least 160 GB in case estimated capacity is lesser) of latest RPM
d)	RAM	:	4 GB or latest
e)	Processor	:	latest Intel Processor
f)	Processor speed	:	latest available in the market at the time of delivery to the site
g)	CD ROM	:	latest available
h)	PCI Slot	:	2 Nos. Spare
i)	USB Port	:	4 nos.(high speed)
j)	NIC	:	1 Gbps On-board
k)	RS232 port	:	2
l)	LPT port	:	1
m)	PS2 port (mouse)	:	1
n)	PS2 port (keybrd)	:	1
o)	Monitor	:	Colour 17" TFT
p)	Mouse	:	Optical
q)	Keyboard:	Standard	

3.36.   UPS

3.36.1. Online UPS with 4 hours of backup and sizing based on power requirement calculation, shall be provided by the Applicant. The UPS design shall take the following into account:

a) The system shall be capable of maintaining an uninterrupted power supply to the UPS loads for a sustained period of at least 4 hours under full load conditions from a fully charged battery.

b) It shall also be capable of continuously supplying power to the system under an intermittent interruption cycle.

c) The UPS shall be capable of operating at input voltages of 210/380Volts ±10% and 50 Hz ±2.5 Hz.

3.36.2. Lane Level UPS:

Parameter	Minimum Specification
UPS with Battery	Online
Rating	As per power requirement (125% of connected load)
Backup	2 Hours
Input Voltage	155-305 VAC
Input Frequency	50H z
Output Voltage	230 VAC
Output Waveform	Sine Wave

3.37.   Software – Lane level
As described under various sections of this document.

3.38.   Software – Plaza level
As described under various section of this document.