



भारतीय राष्ट्रीय राजमार्ग प्राधिकरण
(सड़क परिवहन और राजमार्ग मंत्रालय)
National Highways Authority of India

(Ministry of Road Transport and Highways)

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No.11041/218/2007-Admn

6th July, 2012

POLICY MATTERS-TECHNICAL (107/2012)

(Decision taken on File No. NHAI/CM/Elect/ETC/2012)

Subject: -Modifications in "Manual of Specifications & Standards" of 4 and 6 laning (IRC SP 84-2009 & SP 87-2010) w.r.t. Electronic Toll Collection (ETC) System.

NHAI is in the process of implementing nation-wide interoperable Electronic Toll Collection (ETC) System of National Highways.

2. Subsequent upon selection of Radio Frequency Identification (RFID) technology for Electronic Toll Collection, the Apex Committee constituted by MORTH had finalized the technical specifications of the RFID Tags and Readers.

3. With an objective to standardize ETC systems across National Highways in India, it has been decided to adopt RFID Readers & Tags in all the BOT and OMT projects.

4. Therefore, for all the BOT & OMT projects which are yet to be invited, the deviations in the "Manual of Specifications & Standards" (IRC SP 84-2009 & SP 87-2010) shall be incorporated in the "Schedule-D" of the draft concession agreement as per the enclosed modifications.

5. This issues with the approval of Chairman.

M. K. Sharma
06/07

(V.K.Sharma)

Chief General Manager (Coord./LA)

To,

All officers and employees of HQ/ZO/ROs/PIUs/CMUs/Site Offices

Modifications in “ Manual of Specifications & Standards” of 4 and 6 laning (IRC SP 84-2009 & SP 87-2010) w.r.t Electronic Toll Collection (ETC) System

Clause No. 10.4.10 to be read as:

Two toll lanes in each direction of travel shall be provided with the system of payment through Electronic Toll Collection (ETC) out of which one lane shall be dedicated for ETC exclusively and the second lane shall be standby ETC lane. The standby ETC lane may be converted to dedicated ETC lane in case of failure/maintenance of first ETC lane.

The Tag information shall be read and stored in the dedicated local Server as per the data format given in Annexure-1. The ETC transaction data shall be stored securely to avoid any misuse/ tampering by any unauthorized persons.

In future, if additional ETC lanes are required to accommodate increased number of Tag users, the Cash lanes shall be converted into dedicated ETC lanes depending upon the ETC usage.

The RFID Transceivers and Tags shall comply with the technical specifications given at Annexure-1.

Till the time Legal provision to penalise ETC violations (e.g Non-Tag or Invalid Tag vehicles entering dedicated ETC lane) is notified, provision of pre-screening of ETC Tags approx 50 – 70 meters prior to lane islands as per the layout plan shown in Annexure-2 will be made. The objective of ETC pre-screening is to eject the Non-Tag or Invalid Tag vehicles from the ETC lanes to adjacent cash lanes. The ETC pre-screening arrangement would involve installation of RFID Transceiver, a Boom Barrier and related signage.

Nation-wide ETC interoperability

- (i) Till the time Central Clearing House (CCH) is commissioned by the Service Provider for nation-wide interoperable ETC system, the ETC system will be in a stand-alone mode.
- (ii) Toll Plaza shall have necessary arrangements for issue, top-up and servicing the RFID Tags complying with the technical specifications indicated in Annexure-1.
- (iii) The road users who opt for RFID Tags will get registered with the basic details like Name, Address, Vehicle type, Vehicle registration no., Mobile no. etc by paying a nominal fee towards cost of the Tag. The Tag users may be charged an initial prepaid amount in multiples of Rs. 100/- at the time of registration. In case any Tag holder wishes to discontinue ETC services at any point of time after registration, full balance amount shall be refunded to him.

- (iv) When the Central Clearing House (CCH) is commissioned by the Service Provider for nation-wide ETC interoperability, the issuance of Tags shall be stopped by the Concessionaires. The entire database of ETC user account details shall be transferred to NHAI/ ETC Service Provider along with the balance amount of ETC Tag holders.
- (v) Necessary support shall be provided to ETC Service Provider in migration of ETC accounts from the stand-alone plaza to the Central Clearing House (CCH) for national interoperability. Also, provide all necessary technical support for operation of ETC interoperability.
- (vi) During the interoperable ETC mode, shall support ETC Service Provider in establishing data network between toll plaza and Central Clearing House (CCH) and transfer of ETC data.

Clause no. 10.4.12 to be read as

The total number of toll booths and lanes shall be such as to ensure the service time of not more than 10 seconds per vehicle at peak flow regardless of methodology adopted for fee collection. For purpose of guidance following parameters are suggested as a capacity of individual toll lane for design purpose:

- | | |
|--|---------------|
| (i) Semi-automatic toll lane
(Automatic vehicle identification but manual fee transaction) | 240 veh/hour |
| (ii) Electronic toll collection (ETC lanes)
(Toll collection through RFID Tags and no stoppage of vehicles) | 1200 veh/hour |

Not less than 2 middle toll lanes shall be capable of being used as reversible lane to meet the demand of tidal flow.

Toll plazas shall be designed for projected peak hour traffic of 20 years. As mentioned in Para 10.4.1, the stage construction of toll plaza in respect of number of toll lanes shall be allowed. If at any time, the queue of vehicles becomes so large that the waiting time of the user exceeds three minutes, the number of toll lanes shall be increased so that the maximum waiting time is brought down to less than three minutes.

(To be published in the Gazette of India, Part 1, Section 1)

No.H-25011/04/2011-P&P(Toll)Vol.II
सडक परिवहन एवम राजमार्ग मंत्रालय
MINISTRY OF ROAD TRANSPORT & HIGHWAYS

New Delhi, 110001 the August, 2011

RESOLUTION

The Government of India in response to public demand has constituted a Committee on 20th April, 2010 under the chairmanship of Nandan Nilekani, Chairman, Unique Identification Authority of India to recommend the adoption of Electronic Toll Collection (ETC) System across India's National Highways Network. The Committee has submitted its report on 28.6.2010 and to implement the recommendations of the Committee, Government has constituted an Apex Committee to finalise the required standards for the different components of ETC system and then suggest the operational methodology for implementation and operation of ETC. Apex Committee has finalised the specifications for the following :-

- (i) RFID Transceiver
- (ii) RFID Tag
- (iii) Data exchange format between Toll Plaza Server and the Central ETC System.

These specifications are meant for Unified Electronic Toll Collection System across the country for all toll plazas on the National Highways. The detailed specifications are given below:-

1. Specifications for RFID Transceiver

1.1 General

Sr.	Parameter	Particular
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 Isotropically 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.
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* 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.

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

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.

2. Specifications for RFID Tag :

The Tags shall be essentially non-transferable RFID transponders designed to be used in conjunction with compatible Transceivers and are meant to identify the vehicle for ETC application.

2.1 General

Sr.	Parameter	Particular
1	Power	Tags are Passive
2	Frequency	UHF 860 MHZ to 960 MHZ as per EPC Gen 2 standards
3	Data Transfer Rate	At least 512 kbps under ideal conditions & 64 to 512 kbps under field conditions
4	Protocol	EPC Gen 2, ISO 18000-6C
5	Dimensions (including the substrate/ backing)	Maximum area occupied on the windshield shall be 50 Sq. cm.
6	Material	Plastic substrate with printed antenna .
7	Physical printing of Tag ID on the Tag	The Tag ID shall be physically printed on the Tag using the Hexadecimal numbering system and shall be adequately clear for easy visual recognition .
8	Tamper Proof RFID Label	<p>The tags should be RFID Tamper Proof Label specially designed for tagging directly to a surface, such as Glass (windshield) of an automobile. Any attempt to rip or tamper the label (tag) should result in disabling the functionality of the tags to ensure a unique one to one relationship between the tag and the vehicle thereby preventing unauthorized tag removal and transfers. Such features of the RFID label should result in following actions:-</p> <ol style="list-style-type: none"> 1. Destroy or Damage the Antenna 2. Break the chip-antenna connection. <p>The manufacturing process, construction of tags and associated materials should ensure reliable tamper indication even when sophisticated tamper methods of Mechanical Attack (e.g. Razor Blades, Knives etc.), Chemical Attack (using Corrosives, Solvents etc.) and Thermal Attacks are employed.</p>

2.2 Environmental

Sr.	Parameter	Particular
1	Relative Humidity	95% Condensing
2	Operating Temperature	-20°C to 80°C ambient
3	Storage Temperature	-40°C to 100°C

2.3 Installation

Sr.	Parameter	Particular
1	Location	The RFID Tag shall be installed at a fixed location on the inside of the Windshield of the vehicle. *
2	Installation mechanism	The RFID Tag shall have a self-adhesive backing with which it can be fixed to inside of the windshield. The adhesive shall be such that

		<ul style="list-style-type: none"> • It allows reliable and accurate reading of the Tag by the Transceiver located at a specified distance. • The RFID chip and/ or the antenna get irreparably damaged when an attempt is made to remove the installed Tag from the windshield by any means. Detailed functionality is given in point No. 8 of Para 3.2.1 of this document. <p>The tamper proof attribute will be tested from accredited testing organization before taking delivery</p>
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*location to be optimized for each class of vehicle during trials

2.4 Memory

Sr.	Parameters	Particulars
1	Tag Memory (minimum)	Unique Tag ID – 64 bits. EPC memory – 240 bits
2	Data Retention	10 Years minimum with UV protection for normal sunlight exposure and ambient temperature of 45 Deg C

3. AVI PROCESSES

To ensure standardization as well as security in the system, vehicle identification as well as Tag commissioning & initiation processes are also defined below.

3.1 Tag Commissioning

3.1.1 Each Tag will be required to have a non-changeable and unique Tag ID, which must be read by the Transceiver at the point-of-sale.

3.1.2 At the time of commissioning, the point-of-sale module shall read the unique Tag ID and allocate an EPC code & a randomly generated initiation code. It shall then write the EPC code, Vehicle registration number, vehicle class code and the initiation code in the EPC memory area using the software module provided. The Tag ID, EPC code, Vehicle registration number, the vehicle class code and initiation code shall also be stored in the central database.

3.2 Tag initiation

3.2.1 Tag initiation will be a process carried out during Tag commissioning or when the original owner suspects a cloning of the Tag.

3.2.2 In the first case, the Tag initiation software shall generate a random initiation code, write in the Tag and store in the central database as mentioned in 4.1.2. Each time a Tag is read by the Transceiver for tag commissioning, a new initiation code will be generated, written on the Tag and stored in the central database along with other information.

3.2.3 In the second case, the Tag initiation software shall generate a random initiation code and read Tag ID, EPC code, vehicle registration number & vehicle class code from the Tag mounted on the windshield. After due verification from the central database, the value of initiation code shall be updated on the Tag as well as on the central database. Old initiation code and EPC code shall be marked for special handling for 'catching' the clone as and when the cloned Tag comes into contact with Transceivers at the toll gates.

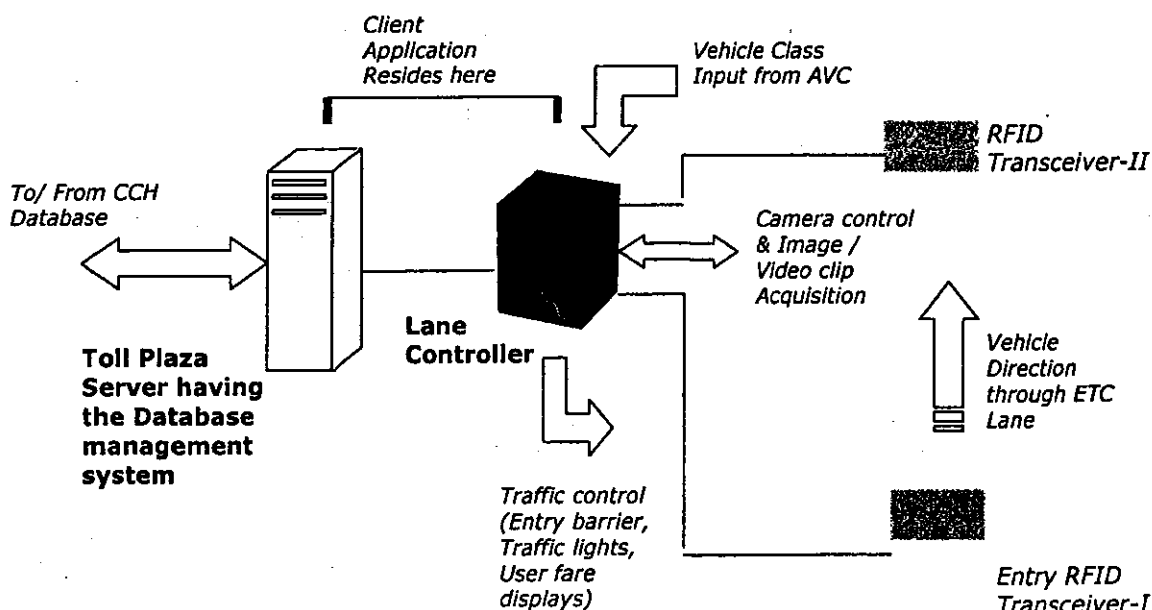
4. Automatic Vehicle Identification at Toll Point

4.1 The communication sequence between the Transceiver and Tag shall conform to ISO 18000-6C.

4.2 The Transceiver shall retrieve the Tag and EPC memory contents for those Tags whose EPC code satisfies the mask stored in the Transceiver for a matching entry. The EPC code shall be used to index into the database from where the Tag ID, Vehicle registration number, the Vehicle class code and the initiation code will be retrieved from the database and verified against the corresponding values read from the Tag.

5. DATA FORMAT

5.1 Schematic



5.2 Data downloaded from Central Database into Data Management System (Toll Plaza Server) and each lane controller

Sr.	Data	Size and format	No. of Values of Data Parameter to be stored in the Data Management System (Max.)	Remarks
1	Tag ID (The Tag ID on the Tag is only 8 bytes long but extra memory has been provided in the database)	20 Bytes per vehicle	5,000,000	Written into the Database during Tag commissioning
2	EPC Code	12 Bytes per vehicle	5,000,000	Written into the Database during Tag commissioning
3	Vehicle Registration number	12 Bytes per vehicle	5,000,000	Written into the Database during Tag commissioning
4	Vehicle Class code	2 Bytes per vehicle	5,000,000	Written into the Database during Tag commissioning
5	Initiation code	4 Bytes per vehicle	5,000,000	3 bytes random no. & 1 Byte checksum on Item nos. 2 to 5
6	Tag Status (Valid, Exempt, Blacklisted)	1 Byte per vehicle	5,000,000	-

The above data is downloaded from the central Data base at User-settable time intervals varying between 15 min to 8 hours.

5.3 Toll Tariff tables downloaded from Central Database into Data Management System (Toll Plaza Server) and each lane controller

5.3.1 This table contains the approved toll tariff records for the toll plaza. The toll tariff can be based on vehicle class, lane type, time of day and shall be applicable from a given start date only. The table will contain all the toll tariff records – the old, current and future. Any discounting for local road users must be done by the clearing house. The table is likely to be updated each time the toll tariff is revised (typically about once in 2 years).

Sr.	Data	Size and format	No. of Values of Data Parameter	Remarks
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			to be stored in the Data Management System	
1	Vehicle Class Code	2 Bytes	As many required	-
2	Lane Type	20 Bytes	As many required	Valid Values will be 'Cash Lane', 'ETC Lane', 'Premium cash lane.
3	Valid from Date	20 Bytes	As many required	Date of start of applicability of toll fare
4	Time Interval from	20 Bytes	As many required	Can be used for time differential toll charges
5	Time Interval till	20 Bytes	As many required	Can be used for time differential toll charges
6	Toll Amount	10 Bytes	As many required	-

5.4 Transaction Data generated by client application for ETC vehicle

5.4.1 Transactions generated (described under section 2.2.g.III in this document) by the client application is transferred to the Central Clearing House database. Each Transaction consists of the following items. Data Size are larger than what is required now and are designed to handle future expansion

Sr.	Data	Data Size	Remarks
1	Date and Time Stamp	20 Bytes	Time stamp of the vehicle passing through the toll plaza
2	Transaction identification	16 bytes	This field uniquely identifies the transaction and comprises of (1) Transaction Serial number (8 bytes), Lane Controller ID (2 bytes), Toll Plaza ID (3 bytes) and Toll Operator ID (3 bytes).
3	Tag ID	20 Bytes	As read from the vehicle and verified against the database
4	EPC Code	12 Bytes	As read from the vehicle and verified against the database
5	Vehicle Registration number	12 Bytes	As read from the vehicle and verified against the database

6	Vehicle Class code	2 Bytes	As read from the vehicle and verified against the database
7	Initiation code	4 Bytes	As read from the vehicle and verified against the database
8	Tag Status (Valid, Exempt, Blacklisted)	1 Byte	As read from the toll plaza replica of the CCH database
9	Toll Amount	10 Bytes	Non-Discounted. Any discount on this shall be implemented by the Clearing house
10	Vehicle Image	100 kb	JPEG format

5.4.2 Transactions shall be uploaded into the central Database at User settable time intervals varying between 5 minutes to 8 Hours (Vehicle image need not be uploaded to the Central database to minimize the network bandwidth).

5.4.3 The Data management system (Toll Plaza server) shall have the capacity to store at least 280,000 such transactions per lane.

5.5 Data in Central Database for ETC vehicle

5.5.1 Replica of this data (Item 1 to 6) shall be available at the toll plaza. The replica shall be made for only valid Tags including those that are listed for special handling.

Sr.	Data	Size and format
1	Tag ID (The Tag ID on the Tag is only 8 bytes long but extra memory has been provided in the database)	20 Bytes
2	EPC Code	12 Bytes
3	Vehicle Registration number	12 Bytes
4	Vehicle Class code	2 Bytes
5	Tag Status (Valid, Exempt, Blacklisted)	1 Byte
6	Initiation code	4 Bytes
7	Tag Registration Date	20 Bytes
8	Vehicle Owner details consisting of name, address, phone numbers, bank account details, credit card details, balance details (when paid, amount paid and current balance), valid-upto details (when the information is going to be not considered)	<p>a) <u>Name</u> – 90 Bytes (including first, middle and Surname)</p> <p>b) <u>Contact details</u>: Address – Free format Phone numbers (Landline and Mobile telephone numbers) – 15 bytes each E-mail address – Free format</p> <p>d) <u>Bank Account details</u>: Account No. – 12 Bytes Bank Name – 10 Bytes</p>

		Branch Name – 12 Bytes IFSC Code – 12 Bytes e) <u>Credit Card Details:</u> Credit card No – 16 Bytes Type of Card (Visa/ Master Card/...) – 11 Bytes Issuing Bank – 10 Bytes 'Valid up to' Date – 20 Bytes f) <u>Balance Details:</u> Date paid – 20 Bytes, Amount paid – 10 Bytes Current balance – 10 bytes g) <u>'Valid up to' Date</u> – 20 Bytes
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(Sanjay Bandopadhaya)
Joint Secretary to the Govt. of India
Tele No.23351061

ORDER

ORDERED that a copy of the resolution be placed on the Ministry's website for wide publication.

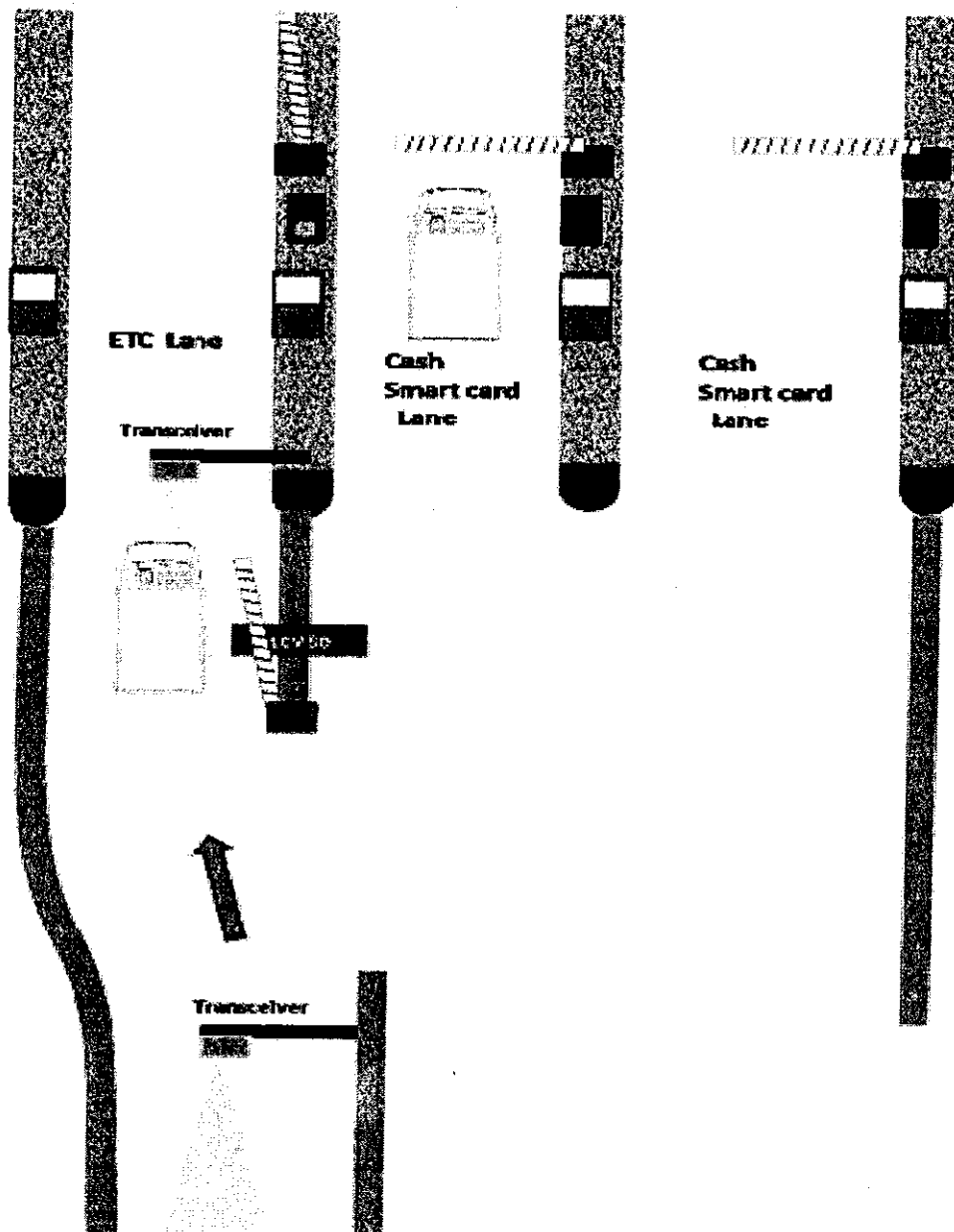
ORDERED also that the resolution be published in the Gazette of India for general information.

(Sanjay Bandopadhaya)
Joint Secretary to the Govt. of India
Tele No.23351061

To
The Manager
Government of India Press
(Bharat Sarkar Press)
FARIDABAD.

ETC pre-screening arrangement and operation

- (a) Vehicle with valid Tag : when the vehicle approaches the dedicated ETC lane, the first transceiver reads the Tag and allow the vehicle to proceed



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- (b) Vehicle without Tag or invalid Tag : when the vehicle approaches the dedicated ETC lane, the first transceiver detects vehicle as non-Tag / invalid Tag and bring down the barrier blocking the entry to ETC lane. This will force the vehicle to eject from the ETC lane and go to adjacent cash lanes.

