Q6

What is the technology being employed for electronic toll collection on highways. What are its advantages and limitations? What are the proposed changes that will make this process seamless? Would this transition carry any potential hazard?

UPSC Civil Services Mains 2024 · GS III · 10 marks · Infrastructure

Infrastructure: Energy, Ports, Roads, Airports, Railways etc.

Core demand of the question

- Name the technology used for electronic toll collection on Indian highways
- State advantages and limitations of that system
- Explain proposed seamless changes and any potential hazard of the transition

Revision summary

Electronic toll collection on Indian highways uses RFID FASTag, settled on NPCI's NETC rail.

Advantages are less cash leakage, less idling and a digital trail.

Limitations are failed reads, double deduction, lane mixing and plaza-only coverage.

The proposed seamless step is GNSS-based free-flow tolling, often with ANPR, so the car need not stop.

The transition hazard is continuous location tracking, spoofing and hard-to-dispute bills unless data rules and refunds are strong.

Introduction

- **Indian national highways moved from cash booths to FASTag:** a **radio-frequency identification** sticker on the windscreen, read in the lane, settled through banks on the **National Electronic Toll Collection** platform. The aim was a shorter queue. The next aim is a highway that **does not stop the car at all**. Each step trades a little **privacy and billing risk** for speed.

Body

FASTag and what it already does

The working technology is **passive RFID**. The tag is linked to a prepaid or bank account. A roadside reader identifies the vehicle class and deducts a toll. **NPCI's NETC** switches the payment among banks. **NHAI and State concessionaires run the plazas. Advantages are real: less idling**, less cash leakage, a digital trail against under-reporting, and some **fuel and time saved. Limitations are also real: a failed read** still creates a queue; **double deduction** and wrong-class charges produce grievances; a driver without a working tag is a **lane problem**; local roads and some State plazas lagged the national mandate; privacy is limited today because the tag mainly proves **presence at a plaza**, not a continuous track.

- **Peg:** FASTag became the default on national highway plazas after a nationwide push in the late 2010s.
- **Peg:** NETC is the payment rail; RFID is the sensor.

Seamless transition and its hazard

- **The proposed next step is** barrier-free electronic tolling**: GNSS / GPS-based** distance charging, often paired with **automatic number-plate recognition** cameras at validation points, so the car does not halt at a boom. A satellite trace can bill **actual kilometres**, which is fairer on a long corridor than a flat plaza fee. The potential hazard is not science fiction. **Continuous location** is a richer personal dataset than a plaza beep. It can be **abused for surveillance**, commercial profiling, or a leak. **Spoofing and jamming** of GNSS, and camera errors, can create **wrong bills**. A poor connectivity stretch can drop a trip record. If a **back-end dispute system** is weak, seamless hardware becomes a new harassment. Governance therefore has to travel with the sensor: **data minimisation, retention limits, audit of who queries a vehicle path, and a fast refund**. Technology without that is a faster plaza and a slower citizen.
- **Peg:** GNSS plus ANPR is the usual global kit for free-flow tolling; India has announced this direction for national highways.
- **Peg:** The hazard is location privacy and billing error, not the RFID sticker itself.

Flow diagram

FASTag RFID -> NETC bank rail

NETC bank rail -> Plaza deduction

GNSS ANPR free-flow -> Distance bill

Distance bill -> Privacy and error hazard

Plaza deduction -> Shorter queue

Conclusion

Electronic tolling today is RFID FASTag on NETC. It cut cash and some queues, and it still fails at the reader. GNSS free-flow can make the highway seamless if billing and data protection are built in. Without them the hazard is tracking and a wrong charge with no boom to argue at.

Facts & figures

FASTag
A windscreen RFID tag linked to a payment account for highway tolls.

NETC
National Electronic Toll Collection, the NPCI switch that moves the toll from the tag-issuing bank to the plaza.

NHAI
The National Highways Authority of India, the main plaza and policy owner on national highways.

GNSS tolling
Satellite-based distance charging meant to replace stop-and-go plazas with free-flow billing.

ANPR
Cameras that read number plates, used to validate a GNSS trip or catch a vehicle without a valid account.