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Bridging the gap between conventional Toll Plaza Based Open Tolling schemes and distance based Closed MLFF ETC schemes: The Case of the Hybrid Toll System in Greece

by

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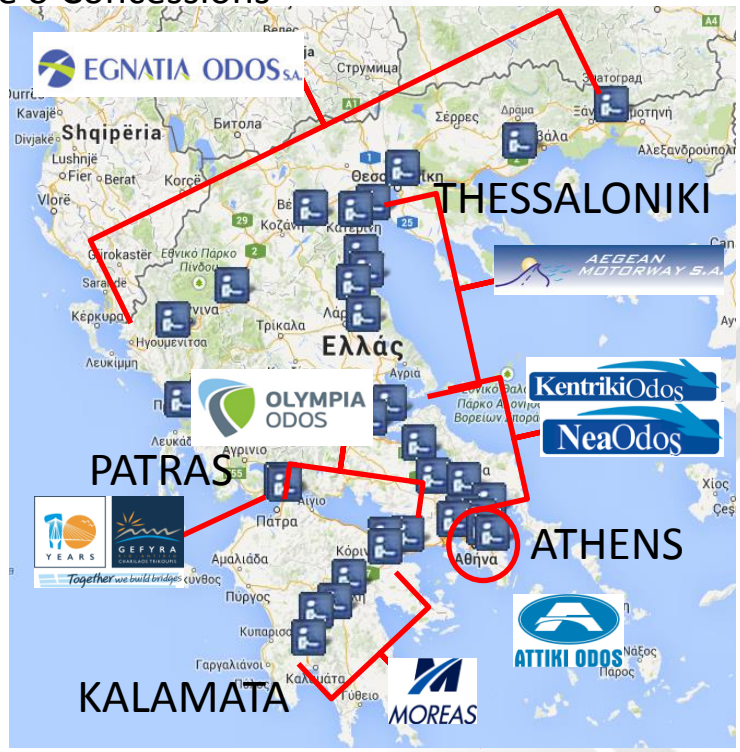
Current Tolling Environment in Greece

- Before 2007-2008, inter-urban motorways operated by the State without a comprehensive national tolling strategy. Mainline Plazas operated in one direction, every 80-120 km, with very few Ramp Plazas.
- 2007-2008 most inter-urban motorways transferred to private o Concessions
- Pre-existing dense interchange design did not make a conventional closed toll system feasible, due to extremely large number of interchanges and ramp plazas needed
- So the implementation of the Open / Zone based Tolling System in Inter-urban Motorways was and still is the only viable choice, with bi-directional Mainline Plazas every 30-40km in order to achieve better segmentation of toll fees thus fairer charging , and ramp plazas in selected interchanges to eliminate toll avoidance
- Today – 1545 km of Tolled Motorways, Bridges and Tunnels in operation (not incl. sections to be constructed)

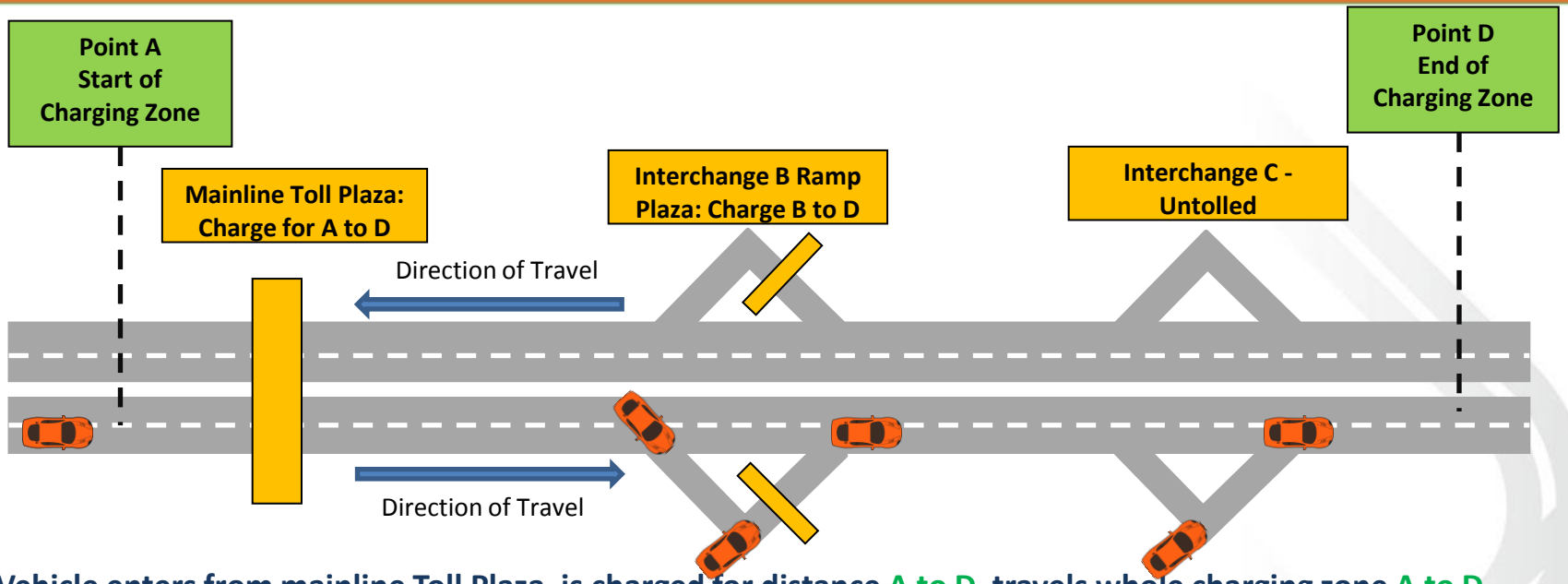


Mainline Toll Plazas

Stops at frontal tolls in main routes Before and After Concessions			
Route	Athens-Patras 200km	Athens-Thessaloniki 500km	Athens – Kalamata 240km
Before	2	6	2
After	5	12	7

	Network length (km)
Egnatia Odos	696 (*)
Attiki Odos	65
Olympia Odos	205
Aegean Motorway	230
Moreas	148
Nea Odos	173
Kentriki Odos	25
Gefyra	3,3
Total	**1545,3**

Zone Based Tolling Concept- Issues & Criticism



Case 1: Vehicle enters from mainline Toll Plaza, is charged for distance A to D, travels whole charging zone A to D
✓ Fair charge

Case 2: Vehicle enters from ramp Toll Plaza, is charged for distance B to D, travels part of charging zone B to D
✓ Fair charge

Case 3: Vehicle enters from mainline Toll Plaza, is charged for distance A to D, but travels ONLY part of charging zone A to B X Unfair Charge, user has paid for a larger distance than the one travelled!

Case 4: Vehicle enters from untolled interchange C, travels to end of Charging Zone D, no charge

Main issues & criticism:

- **Frequent stops at mainline plazas every 30-40 km**
- **Relatively Unfair charging, especially for local frequent users who perform daily trips and are most affected**

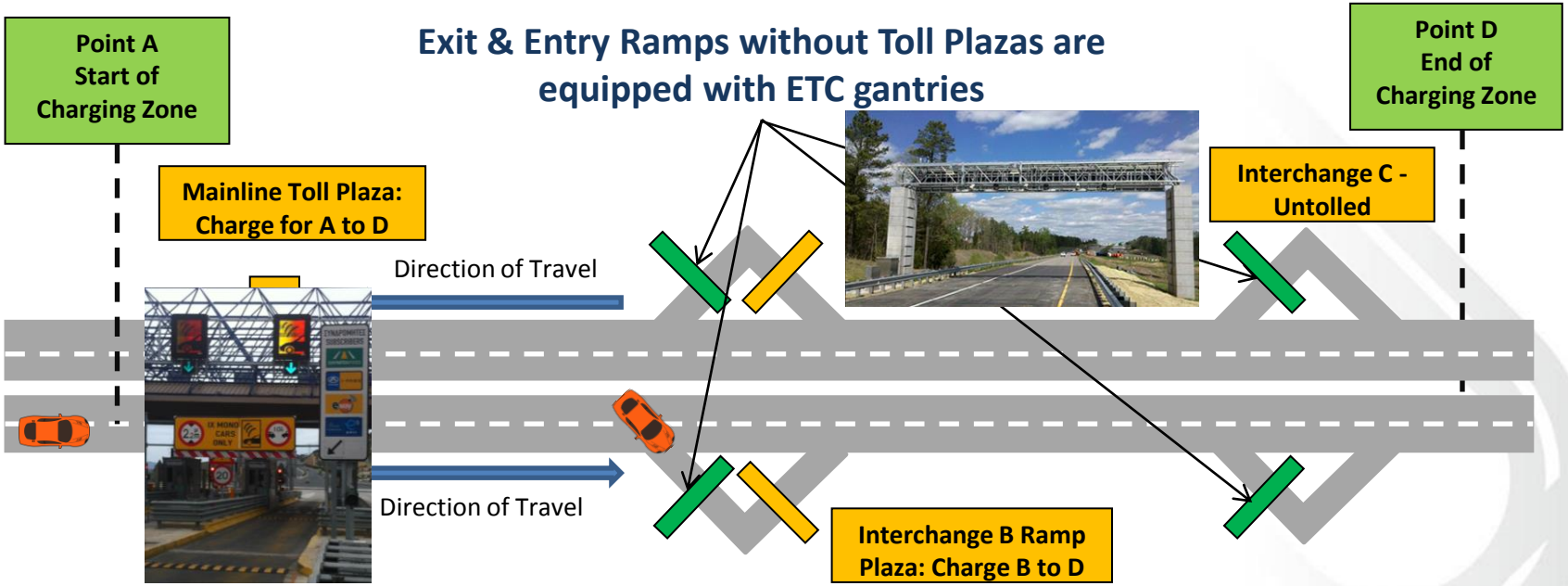
Possible Solutions for Improved Service and Fairer Charging

- Implement a fully closed conventional toll system with ramp toll plazas in all entries and exits
  - Too expensive to construct and operate toll plazas in all ramps due to:
    - ✓ Density (large quantity) of mostly pre-existing Interchanges
    - ✓ Existing interchanges not designed for Ramp Toll Plaza construction
- Implement a full closed Multi Lane Free Flow ETC system in all entries and exits
  - Enforcement issues – Private Operators are not legally allowed to issue fines
  - State should implement robust & extensive mechanism for enforcement and guarantee Tolls to Private Operators
  - Bad quality of license plates makes Automatic Number Plate Recognition difficult
  - Lack of up to date global vehicle registration database
  - Requires very high ETC penetration (today ~28% average) , achievable only through mandatory equipping of all vehicles with tags
  - Privacy issues - Cash lanes are required by Concession Agreements for user privacy protection
  - Other legal, commercial and contractual issues

Why not combine the best of the two solutions?

- Enhance zone based system with traditional plazas, by adding ETC gantries in strategically selected ramps, creating a combined or **"Hybrid"** system which is **closed and distance based** for ETC users and zone based for Cash users.
- It is at the users discretion to select how to be charged (Cash or ETC) based on their needs, without discrimination

The Hybrid ETC Tolling System Concept & How it Works



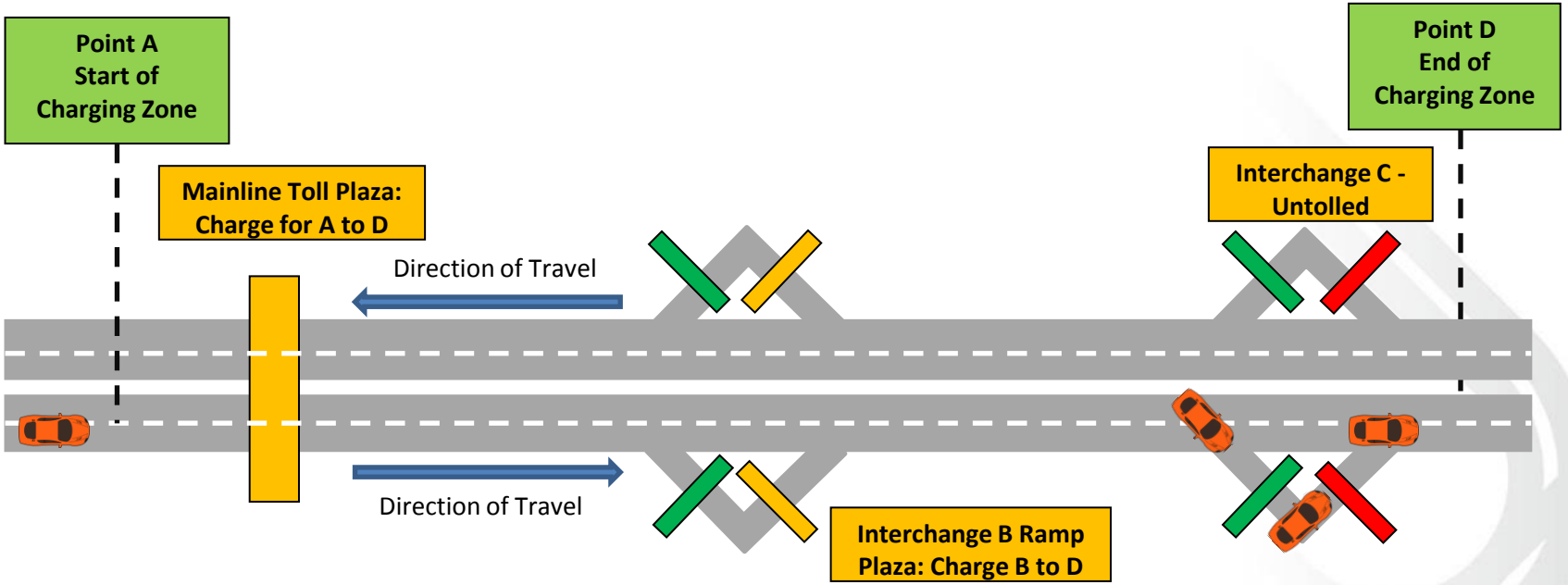
Vehicle enters from mainline Toll Plaza ETC lane, is charged for distance A to D, but travels ONLY part of charging zone A to B

When Vehicle exits at Interchange B, ETC gantry records the vehicle & tag

The Toll System matches the transaction from the Mainline Plaza with the passage recorded from the ETC Gantry, and generates a rebate (credit) to the user's ETC account equal to the distance not travelled B to D. Final Toll Paid = (A to D) – (B to D) = A to B i.e. actual distance travelled

✓ Fair charge

Enforcement - Eliminating the Risk of Fraud



Vehicle enters from mainline Toll Plaza ETC lane, is charged for distance A to D, and exits at interchange C, after being detected by gantry. The rebate is received for distance C to D, so user has paid for A to C

However the same vehicle immediately re-enters the motorway from interchange C, and travels until the end of the charging zone, having paid for A to C instead of A to D. Loss of revenue for C to D

Solution: Equip the 2 remaining ramps of interchange C with Enforcement Gantries

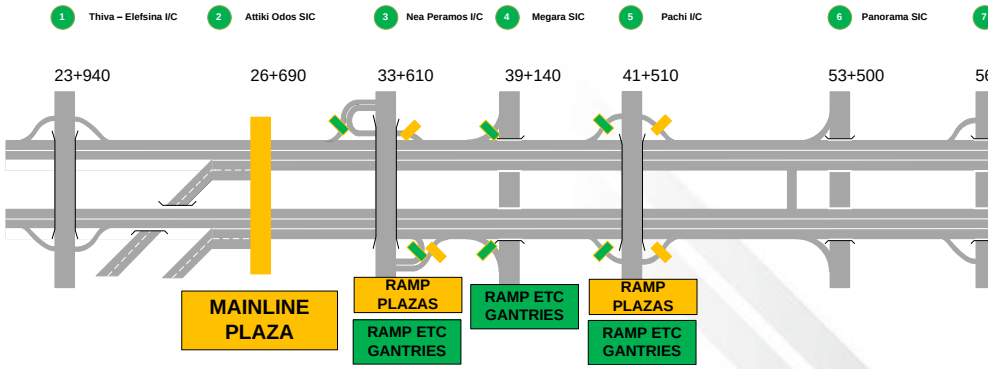
Enforcement gantry reads tag and/or license plate, system matches the passage from the rebate gantry and cancels the rebate. Charge A to D with NO revenue loss

ETC Gantry Placement Strategy & Equipment

Placement Strategy main criteria:

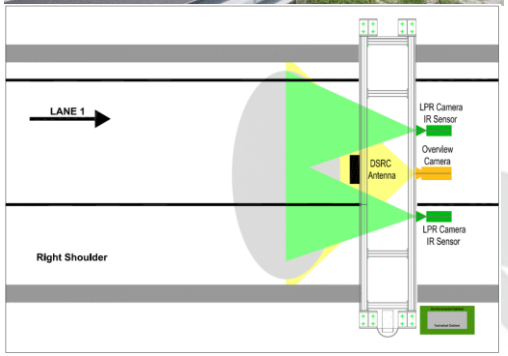
✓ The provided rebate is significant (i.e. no need for gantry placement close to the end of Charging Zone)

✓ Equipped Interchanges must serve adequately populated areas (i.e. not with very low traffic)



ETC Gantry Equipment:

- **ETC Antennae** to cover ramp width and read tags, using multiple tag reads to track vehicle position
- **License plate capture cameras**, to track vehicle movement through the capture zone and identify specific vehicles for enforcement and answering to claims for missed rebates
- **Overview Video cameras,** as a backup to assist in identifying vehicles when no tag has been detected and plate image is not available
- **Gantry controller** which connects and manages all devices
- **Power and Communication equipment**
- **Gantry structure,** to mount equipment, specially designed not to require lane closure for maintenance
- **No classification subsystem needed,** classification performed at conventional Toll Plaza



Hybrid ETC Tolling System Benefits

- Answers to social demand for distance based charging, especially where there is a real need
- Takes advantage of existing Toll Plaza infrastructure without affecting existing open toll system
- Provides flexibility in future expansion of system where needed as well as developing commercial policies
- Does not make ETC mandatory. Users who wish to pay with cash can still do so, but without the benefit of rebates
- Makes ETC more attractive thus increases ETC penetration
- Imporvement in Level of Service
- Does not increase the risk for toll evasion (as is the case with MLFF). Users first pay in full, and then eligible trips receive rebates
- Most cost effective way to implement distance based charging in motorways with existing conventional zone based open toll system, where MLFF or Satellite tolling are not yet viable options
- Paves the way for MLFF
- Infrastructure (ETC gantries) can be re-used in case of migration to MLFF

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Considerations Prior to Decision for Implementation

Even though the Hybrid System solution may seem as a *"Panacea"*
(via Latin from Greek *Panakeia,* meaning something that will solve all the problems of a particular situation)

Careful examination is required prior to decision to determine if the Hybrid System is the appropriate solution:

- ✓**Is there really a significant public demand for a distance based charging scheme? YES**
- ✓ **Is the traffic on the affected "overcharged" routes significant? YES**
- ✓**Can the public demand be adequately satisfied with other means, e.g. special commercial policies for local & frequent trips? NO**
- ✓ **Can MLFF or Satellite Tolling be easily implemented NO**
- ✓**CAP-EX and OP-EX, can it be handled? YES**
- ✓**What will the cost of rebates be in the long run, taking into account increase in ETC?**
- ✓**Is the financial stability of the project secured? YES**

If the answers to these questions are as per above, then Hybrid is the way to go!

Conclusions

- The Hybrid ETC System can convert a zone based Open System to a distance based ETC system
- Very good solution in cases where MLFF ETC is not possible, while there is already a pre-existing infrastructure of conventional toll plazas
- Answers to demand for a more fair approach to charging, thus alleviates reaction to tolls
- Can be combined with other commercial policies
- Promotes ETC and can be considered as a first step towards MLFF, while increasing Level of Service
- Careful examination on necessity and feasibility is required on a per case basis, including commercial, technical and financial analysis.

Thank you for your attention

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