Toll Collection Systems

Technology Trend Impact on PPP’s & Highways’ Transport

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World Bank
Washington D.C.
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Contents

➢ To describe Toll Collection Systems;
➢ To outline the key components of each system;
➢ To outline what facilities are required to support each system;
➢ To outline the key issues in light of any “Cultural Issues”.

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Toll System Design
Technology Design Considerations

- Accuracy
- Reliability
- Operations
- Functionality

Toll System
Toll Collection Systems

Motorist/Vehicle Sub-System (MVS)
Toll Collection Sub-System (TCS)
Back Office Sub-System (BOS)
Toll Collection Process

Motorist Sub-System

(1) Inform
(2) Detect
(3) Classify
(4) Declare
(5) Collect
(6) Complete
(7) Enforce
(8) Back Office System

Toll Collection Sub-System

Back Office Sub-System

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AVAILABLE SOLUTIONS

- Traditional Toll Collection - Cash
- Free-Flow Toll Collection - Cashless
- Hybrid Toll Collection - Both
Manual Toll Collection
Manual Toll Collection

Comprises:

- Toll Plaza / Booths
- In-Lane Toll Equipment
- Toll Collectors & Staff
- Cash Handling System
- Back Office System
Toll Collection Processing

(5) Collect

(6) Complete

(7) Enforce

Exceptions
Non-payments
And violators

Video Capture
Check
Post Payment

Credit or Smart Card
Coin Machine
ETC
Voucher
Cash

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Manual Technology Choices

- Manual Toll Terminal
- Keyboard
- Touch Screen
Receipt Printer Technology Choices

- Printed Form
- Dot matrix printer
- Thermal printer
Vehicle Detection Technology

Loops

Video

Ultrasonic

IR/Laser/LED
ACM Technology Choices

- Automatic Coin Machine
- Dual Height ACM
- Coin Vault (2 or 4)
Voucher Technology Choices

- Paper Voucher
- Voucher Book
Smartcard Technology Choices

- **Smart Cards**
  - Contact Cards
  - Contactless Cards
  - Combi-Cards

- **Transponders with Smart Cards**
Toll Collection Processing

(5) Collect

(6) Complete
- Record each Toll transaction
- Record exceptions, non-payments and violations

(8) Back Office System

(7) Enforce

(9) Enforcement
- Images
- Payment

Existing ETC Account?
- Un-Usual Occurrence
- Citations

Records

ETC Account Management

Billing Statements

Reports

Manual

ACM

SmartCard

ETC
## Toll Technology Options

<table>
<thead>
<tr>
<th>Toll Options</th>
<th>Toll Volumes</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>250 - 350 VPH</td>
<td>98.00%</td>
</tr>
<tr>
<td>Automatic Coin Machine w/ Barrier (five coins)</td>
<td>450 - 550 VPH</td>
<td>98.50%</td>
</tr>
<tr>
<td>Automatic Coin Machine w/o Barrier (one coin/token)</td>
<td>500 - 700 VPH</td>
<td>95.00%</td>
</tr>
<tr>
<td>Vouchers/Script</td>
<td>500 - 900 VPH</td>
<td>98.50%</td>
</tr>
<tr>
<td>ANPR</td>
<td>600 - 1000 VPH</td>
<td>85.00%</td>
</tr>
<tr>
<td>Smart Card w/Barrier</td>
<td>700 - 900 VPH</td>
<td>99.50%</td>
</tr>
<tr>
<td>Electronic Toll Collection - Dedicated Lane w/Barrier</td>
<td>900 - 1100 VPH</td>
<td>99.96%</td>
</tr>
<tr>
<td>Electronic Toll Collection - Free Flow Lane</td>
<td>1800 - 2400 VPH</td>
<td>99.25%</td>
</tr>
</tbody>
</table>
Free-Flow Toll Collection
Free-Flow Toll Collection Components

System Components:
- In-Vehicle Unit or Transponder
- Roadside Equipment
- Video Capture
- Casual User Products
- Call Centre
- Back Office System
Free-Flow Toll Collection

1. Inform
   - (2) Detect
     - (3) Classify
       - (4) Declare
         - (5) Collect
1. Complete

- (6) Video Capture
  - (8) Back Office System
    - (9) Enforcement
      - Demand Notices
        - (On)

- Record Images and OCR
- Record each transaction
- Billing Statements
- Reports
- Records
- Non-transponder payments and potential violations
MLFF Collection Process

(5) Collect

(6) Video Capture

(7) Complete

Records ETC Transponder payments

Record Non-transponder and potential violators

ETC

Video Capture

ABC123

MLFF Collection Process
Free-Flow Processing

(5) Collect
Identified as non-transponder vehicle
Record each ETC transaction

(6) Video Capture
Record images and OCR

(7) Complete

(8) Back Office System
Images and OCR
Existing or Video Account?

Video Sort
- OFF
- OFF

- Post-Purchased Daypass or eTrip?
Pre-Purchased Daypass or eTrip?

(9) Enforcement
- Citations

Billing Statements
ETC Account Management
Reports

Demand Notices
Payment
Non-Payment or Response
ETC Transponders - DSRC

“Dedicated Short-Range Communications”
Technology Option - Transponders

Gantry/Structure

Transponder

Enforcement Camera

Antenna

Vehicle Detection and Classification Sensors

Deduction of toll requested

Toll charge confirmed & transaction forwarded to central computer

Vehicle classification and enforcement
Roadside Equipment

Vehicle Detection and Classification

ETC RX/TX

Gantry

Video Capture
Perceived EFC Benefits

- **Customers**
  - Convenience
  - Time savings
  - Security
  - Flexibility

- **Operators**
  - Customer satisfaction
  - Customer information
  - Lower O&M costs
  - Greater programme options

- **Transport Authorities**
  - Better perception of Transport
  - Framework for inter-operability
Evolution of EFC Technology

Type 1  Type 2  Type 3  Type 4  Type 5
RO      R-W    RW-D   RWD-SC  VPS

1986  2006+

Simple Complex, more intelligent

Single Dedicated Toll Lanes
Single Freeflow Toll Lanes
Multi-Lane, Dedicated Toll Plazas
Multi-Lane, Freeflow Toll Plazas
Area wide Integrated Multi-Lane, Freeflow Road Charging

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What is VII?

Creating an “Enabling Communication Infrastructure” to support Vehicle-to-Vehicle and Vehicle-to-Infrastructure Communications.

Why VII?

Enabling technology to support safety, mobility and demand management applications.
Interoperability?
Casual User Products
## Payment Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>1st Year</th>
<th>2nd Year</th>
<th>3rd Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call Centre</td>
<td>27%</td>
<td>20%</td>
<td>19%</td>
</tr>
<tr>
<td>Web</td>
<td>16%</td>
<td>25%</td>
<td>26%</td>
</tr>
<tr>
<td>Retail/Kiosk</td>
<td>37%</td>
<td>34%</td>
<td>36%</td>
</tr>
<tr>
<td>SMS</td>
<td>15%</td>
<td>19%</td>
<td>19%</td>
</tr>
<tr>
<td>Fax</td>
<td>4%</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Post</td>
<td>1%</td>
<td>&lt;1%</td>
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Low Transaction Credit Cards
Future Payment Methods

“Blink” and “WAVE”

Contactless Smart Cards
- MasterCard International
- VISA USA
- American Express
- J.P. Morgan Chase
- Citigroup Inc.

Ipsos-Insight Study
- 37 Million + Americans willing to use cards for $5 or less.
- 6.5 Million Americans willing to use it for transactions of $1 or less

Small value transactions
- M/C International est 400 billion xact
- Estimated $1.32 trillion by M/C
- VISA estimated $2 trillion
- VISA plans on setting a 1.65% fee
Hybrid Toll Collection
Hybrid Toll Collection Components

Comprises:

- In-Lane Equipment
- Toll Booths/Plaza plus
- Segmented Free-Flow Lanes
- Cash Handling System
- Toll Collectors and Staff
- Cash Collection for Casual Users
- ETC for Automated Sales
- Casual User Products
- Back Office System
- Call Centre Operations
Hybrid Pros & Cons

**Advantages:**
- Evolutionary Path for existing traditional cash facilities;
- Flexibility to Grow with ETC Demand;
- Handles Casual Users with Cash Operations;
- Installed with minimum disturbances.

**Disadvantages:**
- Worse of both worlds - cash and cashless systems;
- Higher staff overhead and operating costs;
- Dampens ETC penetration levels;
- Prevents minimising of operating costs.
Migration of Toll System

- Travel time savings
- Travel time certainty
- Lower vehicle costs
- Improved safety
- Reduced exhaust emissions
- High customer convenience
- Low road operations costs

✓ “Have tag will travel” without conscious effort;
✓ Time saving, travel time confidence;
✓ High standards of convenience and safety.
## Toll Technology Transactional Costs

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<th>Xact Cost</th>
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<td>.37 to .48</td>
</tr>
<tr>
<td>ANPR</td>
<td>600 - 1000 VPH</td>
<td>2.25</td>
</tr>
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KEY “Cultural Issues”

- Toll System must align with technical sophistication of the region/location;
- Legal and Policy framework for charging and enforcement of evasion of toll payments;
- Stand alone PPP or part of a “network” of toll roads;
- Rationalised system & data base of licence plate registration, ownership details;
- Flexible and clearly communicated methods of payment;
- ETC standards required for transaction processing, vehicle classification, video products & enforcement;
- Interoperability is fundamental for wider acceptance by the public and simplified billing.
Multiple PPP Programmes

Project - PPP1

Project - PPP2

Project - PPP3

Project - PPP4

Project - PPP5
Centralised BOCS - Regional/National
Road Pricing Scope and Definition
Questions and Answers
Thank You!

Jack Opiola
Principal
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