

# **TOLL ROADS AND CONTACTLESS MULTIAPPLICATION SMART CARDS**

Presenter: Swinder Grewal, Rangkaian Segar, General Manager Operations

## Rangkaian Segar:

The currently largest Malaysian Toll road and Public Transport Operators

## Teras:

Largest Malaysian Toll and Transport System Integrator

## Efkon:

Provider of Infrared and Contactless Smart Card Non-Stop Reader Technology.

*Contactless smart cards are more and more penetrating the road tolling market. The reduction of cash handling and maintenance are a home run for operators. Contactless smart cards are fast, convenient and highly secure which makes them suitable for performing financial transactions in congested and crowded operations.*

## **Understanding the Toll Road**

Toll Roads are very often built and operated by large private or semi-private consortia. The huge investments involved exceed the financing capability of most single corporations, and the required expertise is brought in by companies with backgrounds from international finance, construction, international law, and numerous consultants for operations and equipment of the road.

The profitability of the venture depends on how well the expected vehicle load is met and how freely tolls can be adjusted. The amount of money paid on toll roads is typically a political issue.

Collecting toll is a "Heavy duty operation", under conditions like rain, snow, dirt, exhaust gases and is therefore typically not "Smart" in nature.

Most toll roads worldwide still rely on manual collection of cash.

## **Cash Toll Collection**

A middle sized operation in USA collects cash only up to now. As denominations are odd numbers like \$0.85, the 700,000 transaction per day generate over 2 million coins that have to be collected, protected, counted, sorted, packaged and recycled. Cost of cash handling can be up to 5% of total toll revenue. At the same time, cash toll collection is quite slow and long lines are created if someone just does not have the right change or probably no money at all.

In some projects, cash is also accepted by Automatic Coin Machines which have a large funnel-shaped basket to pick up the coins. Despite special design of such equipment, maintenance of such machines is a permanent cost in the system. Stuck coins, dirty coins, dented coins, counterfeits, etc. require sophisticated apparatus which also has to be reliable under these conditions.

**Cash is dangerous, too.** Heavily armored vehicles are required to take the money from the toll plazas to protected central facilities, where all coins have to be sorted and counted. An operator in a South American country says it is so dangerous to transport cash on the road that they have to pick up the cash by helicopter from some remote toll plazas.

**The Human Factor:** It is of course never spelt out clearly and a well hidden secret, but loose cash shrinkage is a severe problem in toll road operation. Some of the project margins are so small that shrinkage may decide success or failure of the venture. The numbers vary of course strongly from country to country. Numbers cited are up to 40% of the collected cash which never arrives at the Investor who needs the money to repay his debts and keep the road in proper condition.

**Tokens and Tickets**

In order to reduce cash operations, operators have come up with ideas like issuing paper tickets, magnetic stripe cards and the like. These speed up the collection process and are less attractive to criminal action. They are however quite easy to copy or counterfeit. A large South American operator lost \$6m early this year because of counterfeit magnetic stripe cards.

**Contactless Smart Cards**

Smart cards are the choice for all security related purposes and are becoming more and more popular. Payphone cards are a typical example, which have already sold several billion pieces. While the contact smart cards display impressive numbers, they turn out to be inconvenient, slow and maintenance intensive and are therefore less suitable for use in tolling applications. Contact smart cards reportedly suffer from problems with dirt, dust, vibration, warpage and jammed slots and are also inconvenient to use in other transportation modes like buses, trains or taxis. The emergence of contactless smart cards has been the breakthrough in the application.

**Overview of Various Technologies**

Numbers Vary by Project and Country	Paper Ticket	Magnetic Stripe Card	Contact Smart Card	Contactless Smart Card
Number of Users	1	1,000	1,000	1,000,000
Cost Range	0.3-30 cents	\$ 0.30 to \$1	\$0.60 to \$5.00	\$1.20 to \$5.00
Cost per Use	0.3-30 cents	0.03-0.1 cents	0.06-0.5 cents	0.00012 cents (10 years)
Maintenance of Reader Device	none	high	medium	none
Security	low	low	very high	very high
Convenience/Speed	medium	low	very low	very high

## **Contactless Smart Card Based Concept - The Redefinition of ETC**

Introducing contactless smart card leads to a redefinition of ETC itself: Rather than operating a toll road, operators and drivers can be seen as part of a financial transaction system. The picture can be much bigger when intermodality becomes state of the art. (Intermodality means traveling with one means of payment but different means of transport). The system is then also suitable to extend into cross loyalty programs where for example frequent toll road users accrue gasoline bonus points.

Contactless smart cards do not need to be inserted in a slot. They are swiped across a reader surface up to a convenient distance and can even remain inside the wallet and are therefore very convenient to use. Contactless readers are maintenance free, without slots and moving parts and incur none of the above problems.

## **Road Tolling – A Killer Application!**

In order to run a successful smart card scheme it is mandatory to get one or two of the "Killer Applications" on board. The Killer Application is characterized by

- Large number of Users
- Sufficient reader density
- "Big-Bang" startup of the scheme
- Massive convenience advantage or compulsory use

Road tolling offers all of these, which makes it a useful vehicle to improve usage of electronic purses and similar schemes.

## **Systems for Non-Stop operation of Contactless Smart Cards**

Efkon of Austria has developed a most advanced solution based on contactless smart cards in combination with a in-vehicle device (OBU-On Board Unit) which accepts the card and extends its range up to 100 meter via an infrared communication link. The Infrared technology is easily combined with the contactless smart card readers and does not require any licenses or FCC certificates.

By using the extremely fast contactless smart card, transaction time can be reduced to less than 200 milliseconds including a sophisticated security procedure.

Systems using contact cards typically suffer from vibration and warpage, and mostly are too slow to perform real-time transactions.

## **Cost Reduction in Smart Tollway Operation**

By using the combined contactless smart card/infrared communication operators can save cost:

- Low cost "Touch and Go" contactless smart card readers can be installed at less frequented side exits.
- The price entry barrier for the drivers is very low (the cost of a suitable card is below \$3.00 at typical quantities). By taking a large number of drivers to electronic fare payment within short time, shrinkage of funds and collaboration between toll booth operators and drivers is cut to a minimum from the beginning.
- There is no need to install a non-stop lane in every plaza. This just needs to be done where the road needs to take more vehicles than the tolling station.
- The card provides for multiple applications which can be sold off to other service providers.
- The card can be used for advertising purpose. The contactless card is also visible during the entire ride which increases its advertising value.
- There is a fallback option to pay for the toll in case the non-stop gate is closed for repairs or the driver forgets to mount the equipment.
- If there are several operators, the easiest is to swap the cards to the next operator.
- Interoperability requirements are reduced to a transparent communication link..
- The road tolling application becomes one of many applications which reside on the card.
- Sometimes it is possible to use existing backend systems which have already been set up, for example by public transportation companies.

## **Easy Upgradability**

Non-stop ETC systems based on contactless smart cards are very flexible in upgrading:

1. a touch & go reader which is installed in the lane works with the contactless smart card
2. an OBU (On-Board-Unit, a small "box" mounted in the windscreen) reads the chip card data and sends them out to an overhead infrared terminal.
3. multilane free flow installations which use the same data format and backend software as (1) and (2), together with installations for automatic vehicle classification, identification and enforcement.

Typically, operators start with the touch & go solution and upgrade to non-stop tolling if traffic increases.

## **"One Piece Tags" versus "Two Piece Tags"**

If "ITS" means a combination of intelligent use of information technology in transport applications, here is an example:

Imagine a person leaving the house in the morning. She will open the garage with her smart card (access control), enter the toll road on a side exit using a touch/go reader (ETC), insert the card in her OBU and drive at full speed across the trunk road, enter the parking lot, draw money from the ATM (Banking), step on a bus to the city center (Ticketing), enter her company by presenting the card (time recording) and use the card for canteen payment (purse). The card may also carry her driving license (Id-function) and car ownership information. In addition she will collect loyalty points as she uses the cards in many places.

One of the world's most advanced ITS projects is operating in Malaysia and has already implemented multiple functions. The contactless smart card is used in the bus, light rail, "Touch and Go" road toll and several shops. The card has recently been cobranded with VISA and Mastercard by Hong Leong Bank. The total system was implemented by TERAS, a Malaysian System Integrator which specializes in Multiapplication projects. The non-stop ETC components were supplied by EFKON. Cards were supplied by Schlumberger, Gemplus, StoVal, Giesecke & Devrient and others. The system and clearing house are operated by Rangkaian Segar.

## **TOLL ROADS AND CONTACTLESS MULTIAPPLICATION SMART CARDS**

### CV of Max Staudinger (Speaker):

Max Staudinger holds an Engineering Degree from Graz University of technology and an MBA Degree from Webster University Vienna.

After various international assignments, Max Staudinger has been a major contributor in developing the contactless smart card market as Marketing Manager Asia/Pacific for Mikron Company and Philips Semiconductors Identification group.

Director Sales/Marketing of EFKON since 1999.