The experience of Ascendi in design and implementing a Multi-Lane Free-Flow Tolling System (MLFF)

IRF World Meeting 2010 – 16th World Meeting

Pedro Pinto

Lisboa, May 25 - 28, 2010
AGENDA

- Ascendi
- Framing
- Project organization
- MLFF architecture solution
- System functioning

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Ascendi is a Portuguese Company who operates in the transport sector. The major shareholders are Mota-Engil (construction company) and BES (bank sector).

Road Concessions:
- Portugal: 7 + 3 Concessions > 1425 km’s
- Spain: 3 Concessions > 290 km’s
- Mexico: 1 Concession > 60 km’s
- Brazil: 1 Concession > 400 km’s
- Presences in Mozambique and Slovaquia

More than 2150 km’s of roads under operation.
11 years building and operating new roads

1999 - North Concession - 175 km
2000 - Costa de Prata Concession - 110 km
2001 - Beiras Litoral e Alta Concession - 173 km
2002 - Grande Porto Concession - 56 km
2007 - Grande Lisboa Concession - 91 km
2008 - Douro Interior Concession - 270 km
2010 - Pinhal Interior Concession - 550 km

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Location:

- North Concession
- Grande Porto
- Douro Interior
- Costa da Prata
- Beiras Litoral e Alta
- Pinhal Interior
- Grande Lisboa

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Ascendi is closing an agreement with the Portuguese Government to change two Concessions working in shadow toll schema to a real toll schema (Grande Porto and Costa da Prata).

Due to the technical characteristics of these concessions a *Multi-Lane Free-Flow* (MLFF) system was considered to be the best solution.
THE MLFF TOLL SYSTEM
Main features of MLFF System

MLFF System characteristics, under the agreement established in December 2008

- Fully automated system requiring no human intervention for collection;
- Open System with main road Charging Points (CP) in selected sub-stretches:
  - Costa de Prata – 22 CP
  - Grande Porto – 26 CP
- Each CP will collect a toll rate corresponding to its predefined influence area;
- Vehicle identification through ELP (*Electronic License Plate*) reading or photograph with License Plate Recognition using OCR technology;
- The CP transactions comprised in a journey will be clustered in a single business transaction that is in everyway similar to that of a closed system transaction, in which the toll amount charged is determined by the entrance and exit interchange.

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System functioning characteristics derive from the implementation of a Vehicles Electronic Identification System (VEIS), accordingly with PT legislation (May 18th 2009)

- All vehicles to be equipped with Electronic License Plate (ELP)  
  [OBU with DSRC technology compatible with existing toll collecting system]

- Payment systems available:
  
  - Primary collection to be available by CTCE (Certificated Toll Collecting Entities, eg: Via Verde)
    - Payment system under contract (direct debit)
    - Pre-payment anonymous system
    - Pre-payment system with user’s identification
  
  - Secondary collection to be available in CTT (Portuguese Post Office Company)
    - Post payment anonymous system

- Enforcement collection model previewed for non payments;

- Previewed a schema to apply to foreign cars.

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**MLFF TOLL SYSTEM**

**TOLL Collection processes**

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**Collection Entities**

- **PRIMARY COLLECTION (CTCE)**
- **SECONDARY COLLECTION (CTT)**
  - *Up to 5 days [1]*
- **SECONDARY COLLECTION (Concessionaire)**
  - *15 days after notified (Art 10° of L85/2006)*

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**CONCESSIONAIRES**

- **ENFORCED COLLECTION**
  - **Conc.**
  - **InIR**

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**ENFORCED COLLECTION**

Toll collection through the appeal of an administrative offence regime, with payment of administrative costs and fine

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[1] From 00:00 of the day following the passage

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**MLFF**

**TOLL SYSTEM**

**TOLL Collection processes**
June 1st 2009: Contract date for the beginning of the project

September 1st: 1st System Release

10 CP
Send transactions to Via Verde and CTT (Post-Payment)

July 1th: Global Operation

48 CP
Support to processing of manual verification (ALPR)
Send transactions to Via Verde and CTT (Post-Payment)
All collecting processes available (primary, secondary e enforcement)
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The Organization Model to support the project management is based on the following principles:

- Five parallel Working Lines coordinated by a common Program Management team.
- Each Working Line deals with specific subsets of the system.
**PROJECT ORGANIZATION**

**Involved Entities**

**ECOSYSTEM of ENTITIES INVOLVED IN THE MLFF SYSTEM IMPLEMENTATION AND OPERATION**

**PT STATE**
- Grantor of the Concession Contracts

**EP**
- Publicly owned private company entitled to the toll income.
- Grantor of the Tolling Service Contracts

**EQUIMETRAGEM**
- Private Company owned by Ascendi assuring the implementation, operation and maintenance of the MLFF System

**STATE (Public Services)**
- Entities that exchange the necessary information for the operation of MLFF system

**TOLL COLLECTING ENTITIES**
- Certified entities by SIEV to assure toll collecting services in the system:
  - Primary Collection – Via Verde, or others
  - Secondary Collection - CTT

**SUPPLIERS OF DIFFERENT SYSTEM SUBSETS**
- RSE & OBO
- Q FREE
- Software CBO
- Q FREE
- CBO
- Comunications network
- Civil Works, Inf., Elec.
- Civil Works, DC
- manvia

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<tr>
<th><strong>Involved Entities</strong></th>
<th><strong>References:</strong></th>
</tr>
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<tr>
<td><strong>Portuguese Consultant Supplier of Project Management Office (PMO + PSO)</strong></td>
<td>SIRESP in Portugal; NHCC in Portugal; ELP study for PT Nacional Authorities</td>
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<td><strong>Norwegian Supplier of Electronic Tolling Systems (DSRC or Satellite)</strong></td>
<td>ETC in Portugal and Bangkok; Congestion Charging in Stockholm; Truck Tolling System in Slovakia; MLFF in Sydney; DSRC Tags</td>
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<td><strong>International Consultants implementing CBO</strong></td>
<td>Via Verde in Portugal; Dulles Greenway USA; Toll Collect (PMO) in Germany; HGV Tolling in Czech. Rep.</td>
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<td><strong>German Supplier for the CBO Software (ETC – vertical solution)</strong></td>
<td>Via Verde in Portugal; Vespucio in Chile</td>
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<td><strong>Portuguese Telecom Supplier of the communication network</strong></td>
<td>Telematic and Tolling Networks (NetBand) – Portugal and others;</td>
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<td><strong>Portuguese Supplier for civil works and gantries</strong></td>
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The MLFF system is structured in three major components:

1. RSE - Roadside Equipment
2. OBO - Operational Back-Office
3. CBO - Commercial Back-Office
SYSTEM’S ARCHITECTURE
Charging Point Functional Architecture – RSE

**Vehicle Detection and Classification Subsystem**
- Detection of vehicle passage
- Determination of vehicle’s class through volume characteristics (height, width, length, trailer existence)

**Electronic Collecting Subsystem**
- Reading of vehicles’ OBU

**Video Subsystem**
- Vehicle image capture: front, back and context
- Vehicles’ Automatic License Plate Recognition

**Lane controller Subsystem**
- Correlation of data from different subsystems
- Transmission to Back-Office System

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SYSTEMS' ARCHITECTURE
Charging Point – Gantries
SYSTEMS' ARCHITECTURE
Charging Point – Gantries with equipments
SYSTEM’S ARCHITECTURE
Functional Architecture of Operational Back-Office – OBO

**Interface with Charging Points**
- Transactions collection
- RSE monitoring and parameterization
- Distribution of toll rates lists and status lists

**Transactions Processing**
- Transaction validation (treatment of anomalies, discrepancies, offenses)
- Second level of automatic license plate recognition
- Transaction rerate process
- Consolidation of unitary transactions into business transactions (includes journey analyses, and transaction recovery)

**Rate Management**
- Definition of toll rates
- Simulation of toll rate application

**Interface with Comercial Back-Office**
- Transfer of business transactions to CBO
- Support of customer data base
SYSTEM’S ARCHITECTURE

Functional Architecture of Commercial Back-Office—CBO

**Processes of Secondary and enforcement collection**

- Owner and Driver Identification, when necessary
- Issuance of written notices

**Collection Management**

- Payments reception
- Management accounts of customers
- Management of financial reconciliation processes
- Management of financial flows

**Claims Management**

- Treatment of Customer Claims
- CRM
- Contact Center

**Interfaces with External Entities**

- Information exchange with collecting entities (CTT, VV and others)
- Information queries to other entities (e.g., IMTT, InIR, vehicle owner to CRA)
SYSTEM’S ARCHITECTURE
CBO and External Entities [1 of 2]

**Estradas de Portugal**
- Owner of Toll Income

**Instituto de Infra-Estruturas Rodoviárias**
- Enforcement collection process
- Information exchange

**Instituto da Mobilidade e Transportes Terrestres**
- Conventional to electronic license plates association
- ELP’s issuer lists

**SIEV / Back-Office Operator**
- Reception of ELP’s lists (lists of ECP, white lists and/or black lists)
- Sending of traffic public events

**Conservatória do Registo Automóvel**
- Identification of vehicle owners

**Collecting Entities and others Financial Entities**
- Business transaction forwarding and reception of information about payments

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SYSTEMS' ARCHITECTURE
Back-Office – Data Center
AGENDA

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- Project organization
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- System functioning

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SYSTEM’S MAIN FUNCTIONALITIES

Global Vision

- Vehicles passage on a Charging Point
  - RSE system
- Transactions - Operational Processing
  - OBO system
- Transactions - Commercial Processing
  - CBO system

- Vehicles’ Detection and Classification
- Interface with Charging Points
- Invoicing
- Electronic Collection
- Rates Management
- Collecting
- Video
- Transactions Processing
- Customers management
- Lane Controller
- Others Interfaces and Monitoring
- Interface with External Entities

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SYSTEM’S FUNCTIONING
Lane Equipment – RSE System

Vehicles’ Detection and Classification Subsystem
Electronic Collection Subsystem
Video Subsystem
Lane controller subsystem

Rear Camera
Front Camera
Context Camera
Antena TX
Antena RX
Vehicles’ detection and classification lasers

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SYSTEM’S FUNCTIONING
Lane Equipment – RSE System

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SYSTEM’S FUNCTIONING
Lane Equipment – RSE System

Front Photo

Rear Photo

Context Photo

Automatic Licence Plate Recognition (ALPR)

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SYSTEM’S FUNCTIONING
System’s Main features and modules – OBO – Examples

Transactions’ Processing
Ex: Validation by operator
SYSTEM’S FUNCTIONING
System’s Main features and modules – OBO – Examples

Others Interfaces and Monitoring
Ex: Real-Time Monitoring

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## SYSTEM’S FUNCTIONING

**Collecting**

- System’s Main features and modules – CBO – Examples

- **Collecting**

- **Invoicing**

**Invoicing**

- Dados cabeçalho p/documento cálculo fatura 10000000077

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- **Invoicing**

- Dados do cabeçalho para o documento de faturamento 10000000031

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SYSTEM’S FUNCTIONING

System’s Main features and modules – CBO – Examples

Customers’ management

Ex: Issue of notice with fine

Interface with External Entities

Ex: Sending of enforced collection process to InIR

Histórico da advertência: síntese
Thank You!

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