AXONIS – Metro System Solution
CODATU – Istanbul, February 4th 2015
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Context reminder: Urban Population Growth ... The key demand driver

Travels and Pollution in constant increase....

Total urban population

52% in Emerging Countries
9% in Developed Countries

Need for sustainable urban transit growth
Typical Urban Mass Transit Segmentation

Urban system capacity as per today services

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- Buses
- BRT (Bogota)
- Tramways
- People Mover
- MONORAIL
- Light METROS
- Heavy METROS

Are specific systems effective?
- Tyres solution
- People Mover solution
- Monorail solution

- Brasil, India...
- 1981 - Kobe
- 1986 - Vancouver
- 1991 - Lyon
- 1998 - Paris
- 2002 - Copenhagen
- 2003 - Singapore
- 2008 - Lausanne
Typical Metro system LCC model

- 26% OPEX
- 10% CAPEX
- 14% E&M Equipments
- 22% Stations construction
- 28% Line Construction

30 years Operation & maintenance
Rolling stock

We must succeed to Reduce CAPEX and OPEX

Improve efficiency by designing “Integrated Metro System”
Agenda

- What is AXONIS
- Customer Benefits
- Proven sub systems to be seen
What is AXONIS – System 1/2

Proven Sub Systems Solutions
Standardised & Optimised together

Turnkey Solution
including Civil Works

NOT lot by lot

System Performance
> Optimized solutions: design, interfaces
> Overall performance guarantee
> Smooth Test & Commissioning phase

Engineering Expertise
> Sub Systems & integration
> Permanent expert support

Project Management
> Risk mitigation: costs, planning
What is AXONIS – System 2/2

**Civil Work**
- 45 m minimum curve
- Up to 6% slope
- Viaduct (Tunnel possible)
- Depot at grade
- Test Track possible

**Rolling Stock**
- 2 to 5 cars train configuration
- Cars size: 18 m x 2,7 m
- 100% motorised
- Front Evacuation Door
- Max speed 80 kph

**Power Supply**
- 750 Vdc power supply
- HESOP 2x1,2 MW or 2MW
- Medium Voltage Network of 22KV

**Capacity**
- 10000 to 45000 PPHPD

**Signalling**
- GoA4 : UTO / U400 Driverless
- 70 s headway minimum
- Centralised control center
- Operation supervision
- Communication network (Audio + Video)

**Track**
- Slab or Plinth concrete
- 3rd rail 750Vdc
- Underneath captation

**Depot Equipments**
- Bogie wheel reprofiling
- Cleaning
- Lifting
- Shunting vehicle
- Hydraulic & Electrical tooling …

**PSD**
- Full or Medium height

**ILS**
- Spare parts for warranty
- Specific Tooling for sub systems
- Training / Documentation
What is AXONIS – Easy to Insert

- Ability to operate on 45-m radius curves and 6% ramps
- 2-cars to 5-cars trains (Cars of 18 m length x 2.7 m width)
- Standard track gauge UIC 1435mm.
- System composed on sections on viaduct, at street level, or in tunnels
- Light and narrow viaducts: ~7 meters in width thanks to frontal evacuation system
- Minimized visual presence with 750VDC 3rd rail
- Tailor-made to each city’s architecture

Tunnels can be avoided in City centers
What is AXONIS – Quick to build

Construction time reduced considerably
3 to 4 years from order to entry into service

- Standard design of Driverless Operation mode
- Modular viaduct: manoeuvrable precast modules for easier transportation and swift construction
- Alstom’s APPITRACK fast track-laying technology possible
- Fully integrated System: track, power supply, signalling, PSD, trains to reduce Tests & Commissioning
What is AXONIS – Driverless

**UTO**

Flexible
Adaptation in real time to:
- Traffic demand & exceptional events

Regular
Headway robustness
Avoidance of track intrusion

Safe
Platform Screen Doors
Fail safe system
Audio & Video surveillance

Highly Available
Driverless operation
99.7% minimum

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For equal capacity a driverless system allows:

**Capex Optimisation**
- Less rolling stock
- Smaller station
- Land saving

**Opex Optimisation**
- Less energy consumption
- Optimized Km/train journey
- Optimized human resourced
  - Staffing reduced due to centralisation (no permanent staff on train/station)
  - Nb of people reduced on line for degraded modes
- Service disruption minimised
- Maintenance activities anticipated

* UTO: Unattended Train Operation (Grade of Automation Level 4)
What is AXONIS – Driverless – Operating Modes

Pre-Defined Standard Operating Modes for Optimisation

Driving Modes
- UTO mode for any operation: Wake up, Train insertion on line, Daily operation, withdrawal at end of day ...
- Manual mode only if ATC (Automatic Train Control) not available: Speed limitation.

Line operation
- Standard nominal Turnback in terminal station
- Nominal service movement
- Standard train injection, train withdrawal
- Recovery modes to cover exceptionnal failures standardised:
  > Partial service every 7 km
    - Manual driving mode
    - Local modes for equipment (PSD and Stations facilities for instance)

Centralised Rail System Management in OCC
- Equipement supervision (RS, Sig, COM, Stations and Depot Facilities, Power Supply)
- Traffic management
What is AXONIS – LCC improved

CAPEX and OPEX lower

- Less development cost thanks to system standardization
- Less civil works cost and city footprint impact
- Optimized depot and maintenance
- Less operation cost thanks to driverless operation
- Lower maintenance costs thanks to steel wheels & 100% motorization
- Up to 40% lower service energy consumption (HESOP sub-station, motorization and Eco-driving)
Agenda

- What is AXONIS
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Customer Benefits

- Smaller footprint
  - Smaller station
  - Smaller trace in the city

- Flexible and Safe
  - Compatible with viaduct, grade, tunnel operation
  - Frontal or lateral passengers evacuation

- Non Proprietary System
  - For line extension
  - For capacity extension

- CAPEX & OPEX reduced
  - Energy consumption / Less Km per train per day
  - Fleet optimisation

- System performances
  - 6% Slope, 45-m curve, capacity, availability above 99.7%
Agenda

- What is AXONIS
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Where to see Proven Sub systems

Proven Sub Systems Solutions
Standardised & Optimised together

Panama
Santo Domingo
Riyadh

Metropolis
Urbalis

Shanghai L10 in October 14
Beijing Airport Link
Singapore CCL
Riyadh when available

Nottingham until end July 14
Milano mid 2015
Riyadh beginning 2016

Appitrack

Civil Work
VSL Viaduct

London LUL at end 2014
Milano beginning 2015
Paris RATP
Riyadh

ALSTOM