TRACK WORKS

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Alstom Track Offering

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**TW4**
- Concrete track for rubber tyre metro

**TW3**
- Concrete track for steel wheel metro

**TW2**
- Concrete Track using APPITRACK

**TW1**
- Concrete Track with sleepers for LRT

> Compliance with every track specifications
Some track works figures

Kilometers of single tracks

- TW1: 285 km
- TW2: 124 km
- TW3: 406 km
- TW4: 92 km
- TW5: 522 km
- TOTAL: 1428 km

5 references solutions

- Ballast track (TW5: 37%)
- Concrete track with sleepers for LRT (TW1: 9%)
- Concrete track using APPITRACK (TW2: 9%)
- Concrete track for rubber wheel metro (TW4: 6%)
- Concrete track for steel wheel metro (TW3: 28%)

Reference solutions
Complete track works capabilities

HUMAN RESOURCES
- Strong for design & procurement support in French Office
- Recruitment of skilled people for local design office
- Minimise expatriates: Project Manager and Construction Manager

SOURCING
- Local: Pre-cast concrete sleepers plant, concrete
- Regional: rail, ballast, sleepers
- International: clips, turnouts

EQUIPMENTS
- Local investigations on heavy plants & tools available for renting
- Accurate availability planning of in house heavy equipments

> Alstom has a local approach to every track project worldwide
Our Key Expertise: Track Engineering

In-depth Expertise provides cutting-edge as contractor

- **Conceptual Eng. and global Performance**
  - Environmental (Noise & Vibration, stray current...)
  - Track alignments definition and optimisation
  - Interfaces with other subsystems
  - Reliability, Availability, Maintainability, Security performance
  - Safety case

- **Detailed design**
  - Technical specification
  - Components design and type tests
  - Construction drawings
  - Constructability of design
  - Survey methods
Innovative infrastructure solutions

APPITRACK
Track laying technology

HATT
High attenuation tram track

High Attenuation Sleeper
Antivibration solution

> R&D products and solutions are based on a proven design already implemented on existing projects
APPITRACK PROJECTS
APPITRACK
Modern technology for track laying

Step 1: Slipformed concrete

Step 2: Fasteners insertion

Step 3: Completed slab with fasteners

Step 4: Completed track

Step 5: Finished track
APPITRACK - Automatic Pin & Plate Inserter for TRACK

- Accelerates construction => up to 6 times less than the traditional method
- Preserves the environment and reduces carbon emission
- Reduces civil works, concrete volumes and dust
- Reduces noise and disturbances
- Ensures cost effective & high quality track construction due to the machine’s high precision
- Less painful operations and 3 to 4 times less accident hazards

Average daily speed in linear meter: 150 lm for tram (maximum 403 lm) 400 lm for metro

- A fully mechanized installation method developed by Alstom
### APPITRACK

Some project data

#### JERUSALEM PROJECT – Completed
- Average Appitrack output: 95 lm / day
- Average Manual teams output: 21 lm / day
- 19km done as of today in appitrack/completed

#### ALGIERS PROJECT – As of 28th February 2011
- Average Appitrack output: 79 lm / day
- Average Manual teams output: 18 lm / day
- 16km done in appitrack out of 33km

#### REIMS PROJECT – Completed
- Average Appitrack output: 128 lm / day
- Average Manual teams output: 22 lm / up to 5 teams
- 14km done in appitrack/completed

#### CLEO PROJECT – As of 28th February 2011
- Average Appitrack output: 130 lm / day
- Average Manual teams output: 22 lm / day

> Installation program can be more aggressive to increase Appitrack usage
APPITRACK Metro – A new solution

> Tests successfully done in Singapore (length of pumping > 400m)
> Control of concrete consistency test successfully done in Singapore for slipforming
  > Optimised planning
  > Optimised cross section (less concrete)
  > No Stray Current Corrosion Control (to be estimated)
  > Comparable perimeter as a new typical project
  > Insertion tests done with rebars
  > Successful Pumping Tests (> 400 m)
  > Development of fastening systems with approved suppliers
  > Free for tender in November 2010
  > 30 potential projects within 4 years

Appitrack (optimised) versus typical project (excluding depot) - 12.2 %
HAS (High Attenuation Sleeper) : An alternative to floating slab track
HAS - High Attenuation Sleeper
An alternative to floating slab track

> Use of a rigid hull
  - Reduction of stiffness (no vertical friction between sleeper and hull)
  - Friendly maintenance (sleeper easily clipped in the hull)

> Concept of track with sleepers
  - Friendly construction (standard production rate without discontinuity)
  - Reduction of tunnels diameter (FST systems being thicker)

> Concept of track with sleepers
  - Attenuation higher than 20dB at 63Hz
Advantages of HAS over FST

- Less concrete (optimisation of the cross section)
- Less manhours required for installation
- Same method than rest of the line
- No stress on the linear planning of works
- Adjustable to specific Rolling stock data
- Friendly Maintenance
HATT: High Attenuation Tram Track
**HATT – High Attenuation Tram Track**

- **Preserve neighbourhood comfort**
  - Attenuation over 10 dB
  - Urban insertion

- **Reduce floating slab track quantity**
  - Reduction of more than 25% of the trackworks costs
  - Reduction of worksites costs
  - Reduction of interfaces (Civil Works, drainage, APS)

- **An existing alternative solution**
  - Proven system: already installed
  - « proven use » and « proven design » system type
  - Trackworks antivibratil systems installation
  - Continuous rail support
  - Less concrete and no tapis
TRACK WORK REFERENCES