CITYVAL & AIRVAL

Urban & Airport passenger transport solutions
CITYVAL & AIRVAL: The latest generation of transport system with rubber-tire vehicles for Unattended Train Operation

CITYVAL is designed to improve flexibility, performance and efficiency in urban environments.

AIRVAL is the solution specially adapted to modern airports needs.

1983: The very first fully automated metro system in the world
Facing the current challenges of cities and airports

- Modern cities need high performing and energy efficient feeder lines to connect to metros and light rail systems.
- The number of airports is growing world-wide and they are expanding in their size. Airports require interconnection between terminals and to intermodal transport systems.
- Transportation links must fit in highly dense existing environments.

**For cities**
Feeder lines for large cities transportation network
Main transportation links for mid-sized cities

**For airports**
Shuttles for fast transfer between existing and new terminals or other transport installations (rail, parking...)

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CITYVAL & AIRVAL: an efficient global solution

- **Optimized CAPEX** (E&M and civil work) and high price/performance ratio:
  - short headways allowing reduced trains & stations length
  - operation according to passenger demand

- **Scalability** for driverless operation from 1,000 to 35,000 pphpd

- **Ride** comfort & safety

- **Easy integration** within the environment:
  - high energy efficiency through regenerative braking and optimized train control
  - reduced noise level
  - tight curve capability
  - high gradient / steep slope capability
  - low vibrations

- **Environmental friendly**:
  - 95% recyclability
  - high lifecycle including a 30-year life span
  - no brake particle emissions
Combination of rubber-tire technology and fully automated operation increases transportation efficiency and enhances quality of service (1/2)

<table>
<thead>
<tr>
<th>Rubber-tire</th>
<th>Full automation</th>
<th>Combination of rubber-tire and full automation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High performances (acceleration, deceleration) thanks to the adhesion capability</td>
<td>• Highly secured journey with the highest level of safety</td>
<td>• Limited infrastructure costs thanks to reduced train and station lengths allowed by train performances and reduced intervals between two trains</td>
</tr>
<tr>
<td>• Minimized civil work costs with optimized line integration according to local constraints: tight curves and high gradients for appropriate ratio between viaduct, tunnel and at-grade sections</td>
<td>• Simplified and customizable operation modes according to the passenger demand</td>
<td>• Limited waiting times in station by high frequency level</td>
</tr>
<tr>
<td>• Easy scalability of transportation capacity through adjustable intervals</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Combination of rubber-tire technology and fully automated operation increases transportation efficiency and enhances quality of service (2/2)

<table>
<thead>
<tr>
<th>VAL</th>
<th>CITYVAL &amp; AIRVAL: the best value for money</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Highly optimized gauge to address special insertion constraints</td>
<td>• State-of-the-art automated train control (CBTC)</td>
</tr>
<tr>
<td>• Compatible with existing Val lines</td>
<td>• Limited energy consumption, including full electric service braking</td>
</tr>
<tr>
<td></td>
<td>• Modular train arrangement and flexible interior and exterior design</td>
</tr>
<tr>
<td></td>
<td>• Improved passenger comfort with last-generation communication &amp; information system</td>
</tr>
</tbody>
</table>
**VAL systems: 30 years of successful project implementation**

1983: Inauguration in Lille, France, of the first fully automated rubber tire metro system (without driver nor attendant on board)

2013: 150 km lines installed or under construction; almost 1000 Val cars in the world (in operation or to be delivered)

<table>
<thead>
<tr>
<th>Project</th>
<th>Status</th>
<th>Km</th>
<th>No. of vehicles</th>
<th>No. of stations</th>
<th>Opening date</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lille – Line 1 (France)</td>
<td>In service</td>
<td>13.2</td>
<td>108</td>
<td>18</td>
<td>1983</td>
<td>Urban</td>
</tr>
<tr>
<td>Lille – Line 2 (France)</td>
<td>In service</td>
<td>31.8</td>
<td>178</td>
<td>43</td>
<td>1989</td>
<td>Urban</td>
</tr>
<tr>
<td>Paris – Orly Airport (France)</td>
<td>In service</td>
<td>7.2</td>
<td>16</td>
<td>4</td>
<td>1991</td>
<td>Airport</td>
</tr>
<tr>
<td>Chicago – O’Hare Airport (US)</td>
<td>In service</td>
<td>4.3</td>
<td>15</td>
<td>6</td>
<td>1993</td>
<td>Airport</td>
</tr>
<tr>
<td>Toulouse – Line A (France)</td>
<td>In service</td>
<td>12.5</td>
<td>86</td>
<td>18</td>
<td>1993 2004</td>
<td>Urban</td>
</tr>
<tr>
<td>Taipei (Taiwan)</td>
<td>In service</td>
<td>10.8</td>
<td>102</td>
<td>12</td>
<td>1996</td>
<td>Urban</td>
</tr>
<tr>
<td>Rennes – Line 1 (France)</td>
<td>In service</td>
<td>9.3</td>
<td>48</td>
<td>15</td>
<td>2002</td>
<td>Urban</td>
</tr>
<tr>
<td>Turin – Line 1 (Italy)</td>
<td>In service</td>
<td>14.8</td>
<td>116</td>
<td>23</td>
<td>2006</td>
<td>Urban</td>
</tr>
<tr>
<td>Paris – CDG Airport L1 (France)</td>
<td>In service</td>
<td>3.3</td>
<td>14</td>
<td>5</td>
<td>April 2007</td>
<td>Airport</td>
</tr>
<tr>
<td>Paris – CDG Airport L2 (France)</td>
<td>In service</td>
<td>0.9</td>
<td>22</td>
<td>3</td>
<td>June 2007 +</td>
<td>Airport</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>June 2012</td>
<td></td>
</tr>
<tr>
<td>Toulouse – Line B (France)</td>
<td>In service</td>
<td>16</td>
<td>99</td>
<td>20</td>
<td>June 2007</td>
<td>Urban</td>
</tr>
<tr>
<td>Uijeongbu (South Korea)</td>
<td>In service</td>
<td>11</td>
<td>30 (with A/C)</td>
<td>15</td>
<td>2012</td>
<td>Urban</td>
</tr>
<tr>
<td>Rennes – Line B (France)</td>
<td>Under design (contrat awarded)</td>
<td>12</td>
<td>38</td>
<td>15</td>
<td>2019</td>
<td>Urban</td>
</tr>
</tbody>
</table>
Siemens scope is usually full E&M system, O&M and Civil Works can also be covered.

- Roll. Stock
- SYS
- ATC/SIG
- PSD
- COM
- TRW
- M&S Facil.
- PSD

**Civil Works**
- Tunnel
- Viaduct
- Stations

**E&M**

**O&M**

**Oper. Maint.**

- SYS: System Engineering
- ATC: Automatic Train Control
- SIG: Signaling
- PSD: Platform Screen Doors
- COM: Communications network
- TRW: Track Works
- M&S: Maintenance & Storage facilities
- PDS: Power Distribution System

Fully in charge of
In charge of Basic Design

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CITYVAL & AIRVAL: high passenger comfort and security, high-end transportation service

- Train consist: from 1 to 6 cars
- Capacity: from 1,000 to 35,000 pphpd
- Proven driverless CBTC train control system
- Constant train flow adaptation to the demand, last minute train insertion
- On-demand service
- End-less service (24/7, 365 days per year)

- Customizable modern design
- Large windows and doors (1.95 m)
- On-board air-conditioning
- Dynamic information and internet access
- Real time video surveillance
- High acceleration & deceleration rates

CITYVAL & AIRVAL: high passenger comfort and security, high-end transportation service
CITYVAL & AIRVAL modern design
Sample layout for airport application
Scalable capacity from 1,000 up to 35,000 pphpd
Allows adaptation to higher traffic without service disruption

Line capacity range of CITYVAL / AIRVAL

- Capacity in pphpd
  - 35,000
  - 30,000
  - 25,000
  - 20,000
  - 15,000
  - 10,000
  - 5,000

- Headway
  - 60 sec.
  - 90 sec.
  - 120 sec.
  - 150 sec.

- Car sizes
  - 6 cars
  - 5 cars
  - 4 cars
  - 3 cars
  - 2 cars
  - 1 car

- Density
  - 6 p/m²
  - 4 p/m²

Passengers per hour per direction
Worldwide success with the highest availability records

• **Availability rate** > 99.5%

• **Redundancy** for critical equipment: traction, brake, and ATC are designed with built-in redundancy. For example:
  • For traction, most failures affect less than 1/3 of the traction power, the remaining 2/3 is sufficient to move the vehicle in the worst case conditions (maximum load)

• **Intrusion protection** on the line and in the stations:
  • Access by unauthorized persons is prevented by the civil work structures, by the platform doors in the stations, and by a controlled-access system for all emergency and services gates
Highest safety records
4 billion passengers transported for 30 years

- Complies with the latest UITP recommendations on safety issues
- Cancellation of the human factor for safety-critical actions
- Platform edge protection
- Safe braking model
- SGS, the Siemens Guidance System, a modern active guiding system (Siemens patent) certified by German TüV organism
- Fail-safe design: Our automatisms detect the possible dysfunctions, identify the causes and automatically act so as the systems goes to the safest state
- Siemens SAS engineering manager is member of the ASCE 21 committee and other European committees
CITYVAL & AIRVAL: Frontal evacuation available as an option allows Civil Works optimization

- Full-surface opening of the front end
- No aesthetical difference when closed
- USA ASCE21
- NFPA 130
- Europe EN 62267
- Two easily walkable evacuation paths via the concrete running surfaces
- Two stairways for a quick vehicle evacuation to the track
CITYVAL & AIRVAL: Energy efficiency
Optimized algorithms for reduction of energy consumption

- 100% electrical braking in nominal service
- Re-use of recovered energy is optimized by the regulation of trains position executed by the driverless system
- Maximum re-use of recovered energy with sideway energy storage
- Driverless CBTC Train Control System allows immediate adaptation of traffic to demand
- Fleet optimization
Feel free to contact us for further information and discussion