schenck process

APPLICATION REPORT

Metro de Santiago de Chile

MULTIRAIL® APC
Automatic Passenger Counting System for Train Passengers

we make processes work

One of the most important ways of controlling the operating costs of trains is to know the demand for transport at any given time.

MULTIRAIL® APC System delivers exactly that. It accurately determines the number of passengers carried between stations by trains travelling at line speeds.

The system also provides the following important information:

- Time interval between trains
- Hourly transport demand
- Density (passengers/m2/coach)
- Percentage of coach & train occupation
- Transport capacity per train:
    - Hourly
    - Daily
    - Weekly
    - Monthly...

This information for each passing train is made available to a superordinate system at specific times (hourly or online after each passed train).

The fundamental system properties of dynamic measurement repeatability and a low rate of measuring error are defined as factors for evaluation of the system.

Figure 1: Metro Santiago route network

Figure 2: Completely installed and connected measuring eyes

Metro S.A. of Santiago, Chile, ordered such a system, manufactured, supplied, installed, and commissioned by Schenck Process GmbH for its network.

Metro S.A. operates the second oldest underground system in South America, with 101 stations in a network of approximately 95km (as of 1st December 2010: 108 stations and 103 km).

Project Data

Two Schenck Process MULTIRAIL® APC Systems were installed in 2009 on Line 4, between the Francisco Bilbao and Principe de Gales stations.

Along this line, 24 sensing devices (called “measuring eyes”) were installed on both sides of six sleeper bays with a distance between sleepers of 750 mm. Installation of these sensors does not require the sleepers to be moved, nor does the track need to be cut, welded or disturbed in any way.

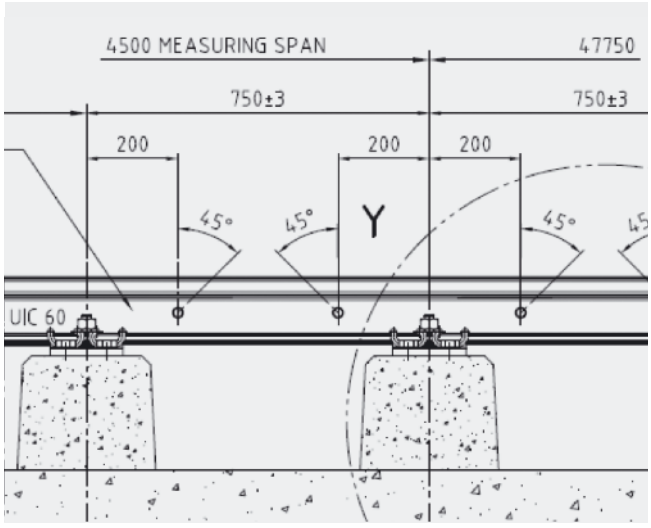

Figure 3: Arrangement of Measuring Eyes

Figure 4: Control electronics in control cabinet form

Installation of the MULTIRAIL® APC systems was carried out during metro operation down time, with an overall working window of only 3 hours per night.

The measuring eyes are connected to the control electronics installed in control cabinets located directly alongside the measurement tracks. An RF transponder / reader system used to identify passing trains is also connected to these control electronics. Power is supplied by a USV system integrated into the control cabinet.

A media converter integrated into the control cabinet transmits the data to the superordinate system (Control Point) using the customer's existing network.

Operating Sequence of the MULTIRAIL® APC System

Preconditions

Each train is identified by the number of axes and the wheelbase. Alternatively, RFID systems can be used.

The dead weight and other data (number of seats, standing area per coach, etc.) relevant to the calculation of the information required is stored in the central system for this train set.

Data Calculation

When a train passes overhead the train set is identified and the weight of the passenger carriages and the rail car is recorded and assigned to this train set. The total recorded data for the rail vehicle combination is transmitted to the superordinate system (Control Point) together with other assignment criteria such as direction, date and time of the measurement etc. The superordinate system performs the corresponding analysis, such as calculation of the passenger numbers, passenger density, percentage utilization of each carriage, train frequency etc.

Calibration of the MULTIRAIL® APC System

The MULTIRAIL® APC system is calibrated in two steps. Firstly, the individual carriages are driven over the measuring segment at operating speed to determine their empty weight. Then the individual weights of volunteers are measured and the volunteers are assigned to particular carriages of the train to be calibrated. The calibration can be transferred to full carriages on the basis of the theoretically determined carriage weights. The passengers were recruited and attended to by the network operator Metro de Santiago de Chile.

The reference persons were not required to disclose their names for their weight measurement – they were assigned to particular carriages or carriage sections only.

Figure 5: Determining the weight of the reference persons

Figure 6: The picture shows people during the train calibration test, which was carried out at Metro's non working hour.

Technical Data of the MULTIRAIL® APC System

Distance between sleepers:	0.75 m
Length of measuring section:	4.50 m with 6 measuring windows per track segment
Number of Measuring Eyes:	24
Axle load weighing range:	10 t
Measuring speed:	up to 80 km/h
Train set weight measuring accuracy:	
Specified for up to 80 km/h:	± 2 %
Achieved at up to 80 km/h:	± 0.5 %
Passenger counting accuracy:	
Specified for up to 80 km/h:	< 3 %
Achieved at up to 80 km/h:	± 2.5 %

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