INCREASING CAPACITY

Extending Bangkok's Blue Line

Delivery of a metro system in a turnkey approach including 35 three-car trains over a minimum project period

Project highlights

- Very tight project schedule with only 27 months from project start to trial run in one section of the system
- Railway operation taken up three months ahead of schedule in a very challenging project time plan of 36 months
- A lightweight stainless-steel car body and state-of-the-art traction technology reduces energy consumption
- Interior and exterior LED lights reduce maintenance costs and energy consumption
- >99.99% availability on original line, which is serviced by Siemens Mobility

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BANGKOK

An ever-growing city

In Thailand's capital Bangkok commuters spend countless hours in traffic jams, but the number of private vehicles in use continues to grow. This comes at extensive costs and above all at the expense of human health. Whereas roads cannot tackle these problems, public transport can. That is why the city planned to increase the number of people using mass transit systems.

The metro systems in place were used frequently. In peak hours the Blue Line, Bangkok's first subway system, needed to run all available trains. This initial line was delivered as a turnkey rail system by Siemens in 2004 and included 19 three-car trains.

The project

Year of completion	2020
System length	28 km
Number of stations	19
Fleet size	35 3-car trains
Headway/ signaling	120 s /ATO
Maximum operating speed	80 km/h
Grade of automation	GoA 2
Supply voltage	750 V DC, third rail
Project duration	36 months

Blue Line Extension

In 2017, the Bangkok Expressway and Metro Public Company Limited (BEM) and CH. Karnchang Public Company Limited awarded a consortium of Siemens Mobility and ST Electronics (Thailand) Limited a contract to deliver rail technology for the extension of Bangkok's Blue Line Metro.

Siemens Mobility's scope of delivery included 35 three-car metro trains, the signaling system, the traction power supply and all the equipment for the depot and workshop as well as project management. The project was executed in a turnkey approach, with Siemens Mobility also handling the integration of the telecommunication and platform screen door system.

In addition, the company is to perform maintenance service for the transit system for a period of ten years. Commissioning of the line extension carried out section by section in 2019. BEM is the operator of the Blue Line. A large part of the extension, from Hua Lamphong to Lak Song in the south and from Bang Sue in the north to Tha Pra, runs above ground, with 22 kilometers over viaduct. The line will transport up to 500,000 passengers per day.

System integration and project management

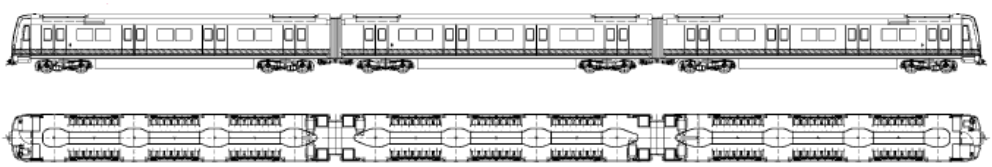
Siemens Mobility delivered the extension in a turnkey approach and thus was responsible for the design of the overall transit system and integration of all subsystems, as well as smooth interaction with four civil contractors. Testing and commissioning on the system was conducted in very short periods without interfering with ongoing operations. Seamless integration of the extension into the existing line without any interruption of commercial service was guaranteed.

To prepare for operation, personal of the customer as well as Siemens Mobility's own staff was trained extensively, with a transfer of technical knowledge taking place in the process. Overall, the turnkey setup and efficient project management made it possible to open section by section for a public demo run starting in July 2019. The full extension was already in operation on December 23, 2019 – three months before contractually agreed. The project team also had a focus on safety, achieving a total of 742,000-man hours with zero safety incidents.

Rolling Stock

The trains on the Blue Line Extension are an evolution of existing Bangkok metro trains with an improved car design. The rolling stock was designed for manual operation. The trains are capable of carrying more than 800 passengers each and have a top speed of 80 km/h. They were manufactured in Vienna, tested in the Test and Validation Center Wegberg-Wildenrath in Germany and shipped by sea vessel to Thailand.

Additionally, the existing fleet of 19 metro trains from Siemens Mobility was upgraded in the project.



Technical data

Train configuration	Mc-T-Mc (Motor Car - trailer car - motor car)
Wheel arrangement	Bo'Bo'+2'2'+Bo'Bo'
Car body material	stainless steel
Track gauge	1,435 mm
Length over coupler of train	65,100 mm
Width of car	3,120 mm
Floor height above top of rail	1,160 mm
Max. axle load	15.9 t
Number of seats per train	126
Passenger capacity per train (6 pass./m^2) (8 pass./m^2)	 878 1,119
Passenger doors per car	2 x 4 bi-parting outside sliding doors
Door width	1,400 mm

Design Concept

During design of the new metro vehicles, a focus was placed on reduction of lifecycle costs. The car body of the train is of lightweight stainless-steel construction, reducing energy consumption and allowing passenger capacity to be increased through an optimized interior layout. Four electrically powered 1,400 mm-wide doors are arranged on each side of the cars and enable passengers to board and leave the train rapidly, minimizing dwell times at stations. This increases system capacity.

Passenger comfort is increased by a particularly effective high-performance air-conditioning system, taking into account the local weather conditions with prevailing high temperatures and humidity levels. An innovative air diffuser system was implemented for efficient and comfortable air supply, avoiding the risk of water condensation. An updated stanchion arrangement increases the safety for passengers. The rolling stock is compliant with a high safety level according to latest standards EN 50126, 50128, 50129 and IEC 61508 and fire safety according to NFPA 130 / EN 45545.

Car Bodies

The metro train has been designed with a lightweight stainless-steel construction. The exterior car body surfaces are painted, and the color stripes are made of adhesive foil.

Passenger Information System

The Passenger Information Display and Announcement System provides both visual and audio information about the train. Displays for the train's destination are installed on the exterior of the cars. Inside, dynamic map displays are installed above each door to show the current station and the name of the next and previous station. Each car also includes displays above the windows for emergency messages, operational news and for advertisements.

Signaling
Siemens Mobility delivered a safe and reliable signaling system. It includes Trainguard LZB 700 M, a continuous automatic train control system with a high-performance solution for automatic train protection (ATP) and automatic train operation (ATO). It optimizes both punctuality and headways as well as eases the burden on the driver – who can then focus more on passenger safety. The modular system is used on more than 22 metro lines worldwide that need to increase traffic volume with short headways.

The Trainguard LZB 700 M equipment, for example, enables actual driving instructions to be displayed continuously in the driver's cab. It also allows for the continuous monitoring of train speeds. Signals can be reduced to a minimum, as only necessary for degraded mode operation.

Communication System and platform screen doors
The communication system as well as half height platform screen doors were designed and implemented by the consortium partner ST Electronics. 40 platform sides have been equipped with twelve platform screen doors each. Siemens Mobility integrated both systems into the overall system for guaranteed availability.

Electrification
Electrification comprises a 750 V DC third rail system. The system is connected to the local power provider and feeds electricity into the systems via two bulk power stations. Power transformers convert this to 24 kV, while 16 traction power supply stations provide power throughout the entire system. An emergency power supply system consisting of a generator, DC charger and battery ensure guaranteed availability. The system is designed for a headway of two minutes. A Sitras RSC (RailSCADA) network control system is used for the control, monitoring, archiving, and evaluation of traction power supply

Depot workshop equipment
The new 35 trains are maintained at the existing Rama IX depot in the city center of Bangkok, which was delivered by Siemens Mobility in 2004 and upgraded as part of this contract during ongoing operations. Additionally, Siemens Mobility designed,

installed, and commissioned a state-of-the-art new depot for efficient service and maintenance of the metro trains. A total of 15 sets of depot workshop equipment were procured and commissioned for this.

Maintenance services

Siemens Mobility Thailand is in charge of service and maintenance of the existing fleet and infrastructure 24/7 in a condition-based maintenance approach by utilizing a computerized maintenance management system. During peak hours when all trains need to be utilized, the Siemens Mobility team achieved a high system availability rate of >99.9%. In addition to a maintenance contract of ten years for the Blue Line Extension, the project also includes an extension of the current service contact for another 5.5 years.

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