



Case Study | China

Beijing Subway Line S1

Background

Beijing Subway Line S1, also known as Beijing Maglev Line, is the first Beijing rail transit line that uses maglev technology, and it is also the first line that supports medium and low speed maglev trains with the Automatic Train Operation (ATO) function. From Shichang Station to Pingguoyuan Station, there are 8 stations on the line, all of which are elevated. The line is approximately 10.2km long and uses medium and low speed maglev trains throughout its entire length, with a maximum speed of 120 km/h.

This is the first maglev project that Frauscher has participated in worldwide, through the cooperation with CRSC. Frauscher's wheel detection system in this particular project consists of wheel sensor RSR180 and evaluation board IMC, installed across the line for track vacancy detection under the control of the Magnetic Automatic Train Control (MATC) system.

Requirements

Line S1 adopts the F-type rail, and its levitation distance from the train is 8-10mm. Due to the signal system requirements of the operation mode of medium and low speed maglev trains, the train's position must be detected in a timely and reliable way. Since maglev trains do not have wheels, traditional wheel-based detection systems cannot be directly applied to maglev traffic engineering. Therefore, to ensure that the wheel detection system functions correctly and is able to accurately detect the position of the maglev train, it was necessary to adapt the trackside equipment.

Levitation of the train is achieved due to the existence of electromagnetic forces between the electromagnet and the track which ensures that the train runs without any physical contact. Unlike ordinary railways, the magnetic flux leakage (MFL) of the levitation magnetic field and the magnetic field induced when vehicles pass the maglev track may cause electromagnetic interference (EMI) to the trackside equipment and thus affect the detection accuracy, which puts extremely high requirements on the anti-EMI ability of the wheel sensors.



Wheel Detection System RSR180-IMC



Solutions

This project is implemented with wheel induction boards hoisted on the bottom of the maglev train. The special design of the boards and the connections ensure that the train position is detected accurately and reliably, meaning this method can effectively solve the problem of maglev trains not being able to utilise trackside detection equipment. In addition, with regards to possible EMI problems, Frauscher provides a wheel detection system composed of the Frauscher Wheel Sensor RSR180 and information evaluation board IMC, effectively resisting magnetic track brakes.

Furthermore, given that all stations on the S1 line are elevated stations, the installation and maintenance of trackside equipment also poses a big challenge. However, the RSR180 has a flexible installation method which copes effectively with this challenge. The simple and convenient operation simplifies the difficulty and complexity of on-site installation and subsequent maintenance. The safety and stability of this installation method have been proved by vibration-type tests and extensive field application experience.

For safety assessment of the sensor analog signal, the IMC board can be centrally implemented in the equipment room to ensure that there are no electronic components at the trackside.

Conclusion

The wheel detection system RSR180-IMC is suitable for many different applications. In addition to tracking vacancy detection, it can also be applied to level crossing protection, switching tasks and many other applications, providing safe and reliable track occupancy status and train direction information.

Maglev transportation is a key research and development plan in the "13th Five-Year Plan" of China (2016-2020). Participating in the construction of the Beijing Line S1 project fully proved Frauscher's market competitiveness and technological leadership in China's railway signalling industry.

Key Facts

Operator	Beijing Subway	Application	Wheel Detection
Partner	CRSC	Wheel Detection System	RSR180-IMC
Country	China	Segment	Medium and low speed maglev
Project start	2017		