

About Tunnelling in China

Roland Herr interviewed Professor Jenny Yan, China

Roland Herr interviewed Professor Jinxiu (Jenny) Yan. She is currently the Vice President of the ITA; Vice President of the Chinese Tunnelling and Underground Works Society of CCES and Deputy General Manager of China Railway Academy Co., Ltd.

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Professor Jinxiu (Jenny) Yan has been working in the tunnelling industry for more than 30 years. She has been involved in the most challenging railway tunnels, highway tunnels, metro and water tunnel projects in China, Malaysia, Laos, Nepal, Morocco, etc.

Roland Herr: China is one of the biggest tunnelling markets in the world. Could you describe briefly the tunnelling in China in general?

Professor Jenny Yan: By the end of 2017, China built and put into service 127,000 km railways, including 25,000 km high-speed connections. On these railway lines, there were 14,700 tunnels, adding up to a total length of 15,781 km. At the same time, China built 4.77 million km of highways, among which 136,000 km were expressways. On these highway lines, there were 16,281 highway tunnels, adding up to a total length of 15,240 km.

Transit growth in China continues and even accelerated in the past few years. This growth is not new, of course, Chinese cities have been adding transit rapidly over the past several decades. By the end of 2017, there were 165 rail-transit lines in 34 cities, adding up to a total length of 5,033 km including 3,884 km underground. Almost all large cities in China have rail-transit systems in operation, under construction or in planning stage. This rapid transit is ideal for the Chinese big cities and is unchallenged in its ability to transport large amounts of people at high frequency quickly over short distances, avoiding the traffic jams.

In the past 5 years, China has a huge increment of various traffic tunnels for operation, including 1,400 km for railway and 1,000 km for highway tunnels yearly. In 2016, 760 km metro has been put into operation and 889 km in 2017. In total, 36,103 km traffic tunnels are in operation by the end of 2017, not including a big number of tunnels for hydropower, water transfer, utilities and other purposes. The total number of tunnels is around 45,000 km. Moreover, there are about 20,000 km tunnels under construction and another 20,000 km tunnels in design and to be built soon.



Professor Jenny Yan on a construction site

Roland Herr: Do you plan to attract more international participants and how do you try to do that?

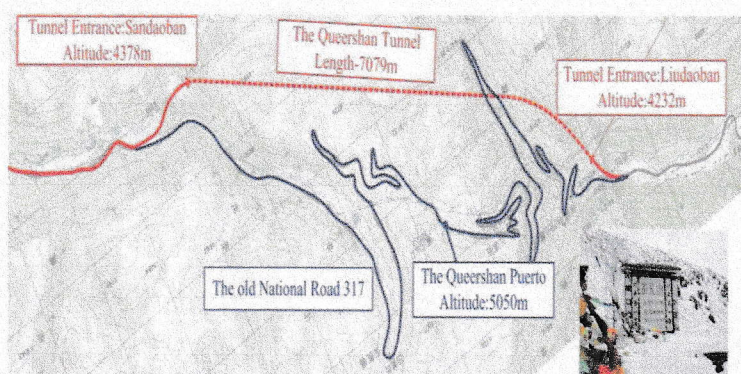
Professor Jenny Yan: The progress of tunnelling in China would not have been possible without the knowledge and experience sharing and strong support from the international tunneling industry. Many international companies have contributed a lot, such as TBM manufacturers (Herrenknecht, Lovat, Lowsuns, NFM, Robbins, Wirth, etc.), equipment manufacturers for drill and blast (Atlas Copco, Sandvik, Normet, etc.), material suppliers (BASF, etc.) as well as technical instruments suppliers (Leica, Trimble, Laurel, Geokon, Amberg, etc.) and international consulting companies (Aecom, Deutsche Bahn, Geodata, Jarts, Krna, Mott MacDonald, Obermeyer, Systra, etc.). All these companies as well as companies not mentioned here are mainly involved in the construction supervision of high speed railway projects and consulting for immersed tunnels (Cowi, Tec, etc.). All their involvement and contribution are important for the progress and their involvement is really very much appreciated by the industry.

Meanwhile, the development of tunnelling technology in China also contributes to the international tunnelling industry. You know, there are a huge number of tunnelling projects in China. The experiences and lessons learnt from those projects over the past 40 years are very costly and precious to those countries who are going to do the similar projects. In return, we shall and

actually we are ready to share these experiences internationally, through conferences, symposia, workshops and other media, like what we have been helped in the past.

Queershan Tunnel

As being absolutely necessary to highway building in some special areas, highway tunnel construction also has achieved great success. For instance, the Queershan Tunnel conquered a great number of technical problems during construction in high altitude and cold regions of plateau. National Road No. 317 (G317) built in 1951 is an important channel for transportation between China's Tibetan areas and the mainland. Due to the annually 10 months snowfall period and natural disasters like avalanches and debris flows, the Queershan Mountain section of G317 is known as "the most dangerous road in China". The Tunnel consists of a 7,079 m long main tunnel and a 7,108 m long pilot tunnel, with the entrance at an altitude of 4,378 m. It is the world's highest long highway tunnel. The tunnel was completed 15 years after the launch of the project and opened to traffic in September 2017. After the Queershan Tunnel was built and opened to traffic, the long-term traffic bottleneck is completely eliminated. The vehicles can pass through the Queershan in just over 10 minutes and have no longer to go around for more than two hours on dangerous mountain roads. The project is projected to become a new impetus to help drive the economic and social development of the remote Tibetan region.



New Guanjjiao Tunnel

As a solution to directly pass through high mountains and shorten travel time, railway tunnels play an important role in the development of railway networks in China. The epic project New Guanjjiao Tunnel is a typical case. The 32.69 km long New Guanjjiao Tunnel is a key project of the second line of the Xining-Golmud section of the Qinghai-Tibet Railway. It is the longest railway tunnel in China and the world's longest railway tunnel at high altitude. The project aims to address the problems of difficult operation and low efficiency as the existing railway has to climb over Mount Qinghai Nanshan in a time-consuming way. The new tunnel, a twin-tube tunnel with a single track in each tube, operates freight and passenger electrified rail services with a design speed of 160 km/h, thus reducing the travel time for the section of tunnel from two hours to only 20 min and greatly boosting the economic development of Qinghai Province and Tibet Autonomous Region.

Qamchiq Tunnel in Uzbekistan

China and Uzbekistan have successfully built the first railway tunnel by uniting as one overcoming difficulties during the construction, which is the longest railway tunnel in Central Asia and has been completed and put into operation in June 2016. The 19.2 km long tunnel goes through the Qurama Mountains and is part of the 169 km long Angren-Pap railway line, a major state project of Uzbekistan which connects the country's capital, Tashkent, with the eastern city of Namangan. By this tunnel, the travelling time for the section of this tunnel was greatly shortened from 2.5 h before to only 17 min now. The construction of the Angren-Pap railway was an important and difficult project. However, the project only took 900 days and was ahead of schedule by nearly 100 days. It was a big event in the national economic and social development of Uzbekistan, which greatly benefit the Uzbek people.

Roland Herr: Jenny, could you give some examples for leading light projects?

Professor Jenny Yan: China has proved the extreme importance of tunnelling in improving greatly people's life. I would like to show you three examples of railway and highway tunnels built by Chinese contractors in China and oversea:

- ▶ Queershan Tunnel ([see Box](#))
- ▶ New Guanjjiao Tunnel ([see Box](#))
- ▶ Qamchiq Tunnel in Uzbekistan ([see Box](#))

Roland Herr: What do you think is necessary to prepare Chinese tunnelling engineers for international projects?

Professor Jenny Yan: About 20,000 km tunnels will be built in the near future. Most of them are quite challenging since the simple ones have already implemented. The challenges include not only the big size of the tunnels, such as super long tunnels, very deep tunnels, huge large tunnels, tunnels at very high sea level but also tunnelling in very complex conditions, such as tunnelling in active faults, extreme sequencing ground, permafrost, high geothermal ground as well as in depopulated zone etc. China needs more help and involvement from the international tunnelling industry to overcome these challenges together.

Roland Herr: Which targets do you and the tunnelling society of China have for the future?

Professor Jenny Yan: My first involvement in ITA was 1990, during the 16th ITA general assembly, which is nearly 30 years ago. I deeply understand the extreme importance for international exchanges and cooperation, in which ITA plays a key role in this regard. I have been the "tunnel" linking Chinese Tunnelling Industry with ITA for many years.

The Chinese Tunnel and Underground Works Conference (CTUC) is organized every two years. In the past two events, international sessions were jointly organized by CCES (China Civil Engineering Society) and ITA. Five ITA presidents or past presidents gave lectures in the session of 2016 and major tunnelling projects worldwide have been addressed in 2018. CTUC has been growing very fast sharing lots of experiences and lessons from vast projects in China. The number of participants of the CTUC has been increased from 1,300 in 2016 to 1,700 in 2018. The coming event of CTUC 2020 is expected to exceed 2,000 participants. At the same time, CTUC will be turned into a full international Conference in 2020.

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