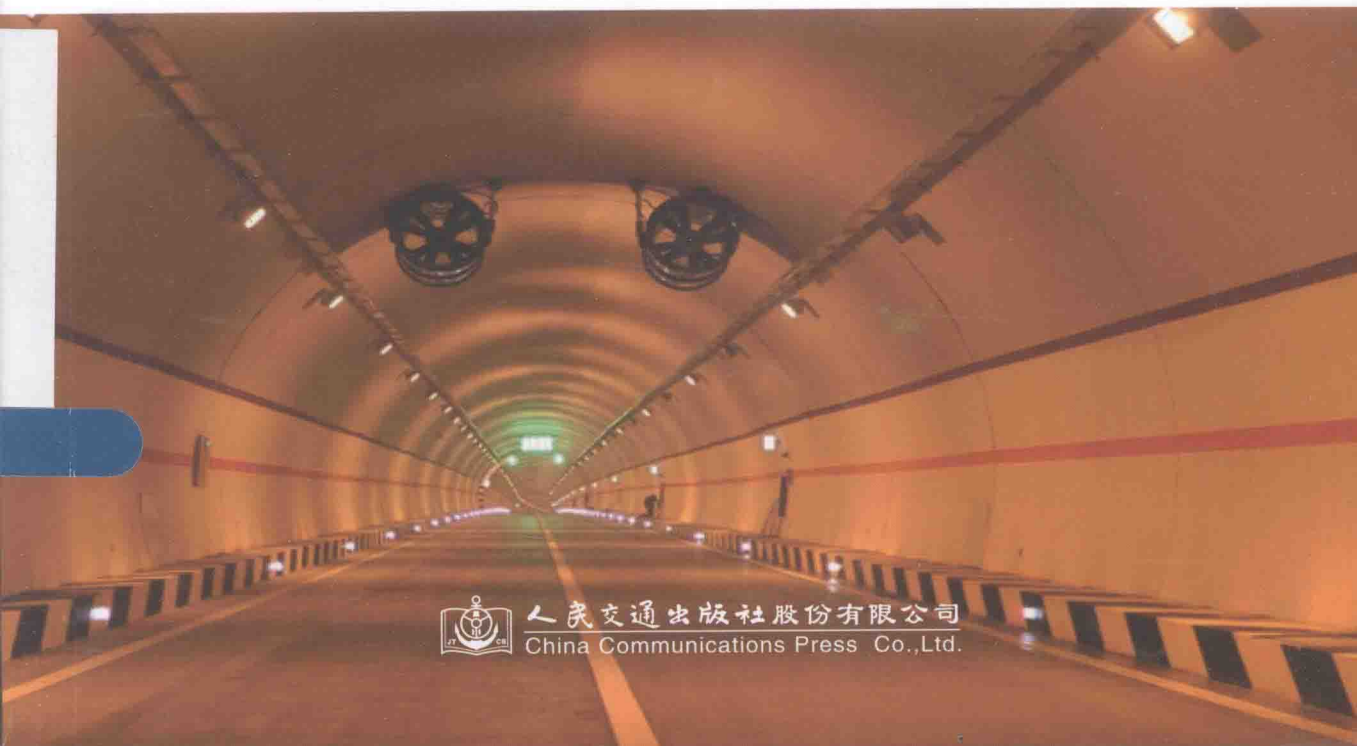
普通高等学校规划教材

隧道工程英语

English for Tunnel Engineering

郭敬谊　韦良文　主编



人民交通出版社股份有限公司
China Communications Press Co.,Ltd.

隧道工程英语

English for Tunnel Engineering

郭敬谊　韦良文　主编

人民交通出版社股份有限公司
China Communications Press Co.,Ltd.

内 容 提 要

本书是我国首部实用性、专业性较强的隧道工程专业英语教材。全书共14单元，每单元包括3篇课文（精读1篇，扩展阅读2篇），主要内容包括：隧道工程；隧道设施；隧道主体及附属结构；地质勘察；钻爆法；钻挖隧道；沉管隧道；明挖法；隧道开挖与衬砌；隧道通风；隧道照明；隧道给排水；隧道安全规定；隧道合同管理。

本教材可作为大专院校隧道工程相关专业和英文科技翻译专业学生的英语阅读教材，也可作为隧道工程行业的科技人员、商务人员、管理人员的培训教材以及参考用书。

图书在版编目(CIP)数据

隧道工程英语 / 郭敬谊，韦良文主编. —北京：人民交通出版社股份有限公司，2015.3

ISBN 978-7-114-12158-6

Ⅰ.①隧… Ⅱ.①郭… ②韦… Ⅲ.①隧道工程－英语 Ⅳ.①H31

中国版本图书馆CIP数据核字(2015)第066954号

English for Tunnel Engineering

书　　名：隧道工程英语
著 作 者：郭敬谊　韦良文
责任编辑：刘永芬　李　娜
出版发行：人民交通出版社股份有限公司
地　　址：(100011)北京市朝阳区安定门外外馆斜街3号
网　　址：http://www.ccpress.com.cn
销售电话：(010)59757973
总 经 销：人民交通出版社股份有限公司发行部
经　　销：各地新华书店
印　　刷：北京市密东印刷有限公司
开　　本：787×1092　1/16
印　　张：20.75
字　　数：460千
版　　次：2015年3月　第1版
印　　次：2015年3月　第1次印刷
书　　号：ISBN 978-7-114-12158-6
定　　价：38.00元

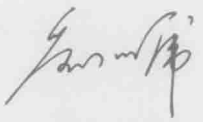
序

在当今经济全球化和区域经济一体化深入发展的背景下，“走出去”、“国际化”发展战略已成为中国工程承包商的一种必然选择。越来越多的中国工程设计、施工企业跨出国门、迈向世界，参与国际工程竞标并承建工程项目。尤其是近十年来，我国的涉外工程经历了跨越式发展，呈现出爆发式增长趋势。这就要求我们不仅要有精湛的设计、施工技术和先进的管理水平，还要拥有一批既有深厚的外语功底，又了解、熟悉、掌握涉外工程技术、商务运作和项目管理等知识的复合型人才。而当前的实际情况是该类型人才还十分匮乏，非常有必要加强这方面的教育培训及人才培养。

隧道是人类改造自然、利用自然最早的地下工程领域之一。如今，随着世界经济的发展和各发展中国家基础设施建设进程的加快，公路、城市道路等交通基础设施及地下空间、输送管道等建设需求越来越大，作为必须穿越山岭和埋置地下的工程，隧道是唯一方案；而在跨越江、河、湖、海的通道工程方案论证中，出于其自身优势及建造技术的进步，隧道在“桥、隧”之争中胜出的场合也日益增多。中国企业走向世界承建工程，隧道是一个主要的也是重要的对象和领域之一。因此，隧道工程方面的复合型技术人才的培养是一项当务之急的工作。

重庆交通大学外国语学院郭敬谊副教授和土木建筑学院韦良文副教授，长期从事隧道及相关工程的教学研究及工程翻译工作，具有良好的专业素养，且积累了大量理论及工程实践经验，积沙成塔、集腋成裘，主编了这本国内首部《隧道工程英语》教材。教材取材新颖经典、内容丰富、结构合理、实用性强，几乎涵盖了目前隧道工程的总体方案、工法、结构工程、附属设施、机电工程、项目管理等所有内容，具有一定的系统性、条理性和科学性，难度适中。本书不仅引用了国外著名隧道案例，同时还介绍了近年来国内的一些特色隧道工程的案例，是国内外隧道技术沟通的桥梁。

我很高兴地看到了《隧道工程英语》教材的书稿，在书稿即将付梓之前，我很乐于将本教材介绍给隧道工程技术、商务、管理工作者和工程翻译者等广大同仁，相信大家能从本教材的学习中获得裨益。也希望将来能有更多类似的著作出现，丰富和充实隧道工程外语体系，培养和造就更多优秀的隧道工程外语专业人才，促进我国涉外隧道工程的不断发展。



中交公路规划设计院有限公司隧道与轨道交通事业部

2014.11.06

前　言

《隧道工程英语》是为适应应用型本科人才培养目标需求，专门针对隧道工程专业英语课程和工程外语类翻译专业的教学大纲要求而编写的；同时兼顾了隧道工程专业科研、设计、施工等技术人员在阅读翻译技术文献、撰写科技论文、技术沟通、商务谈判和专业英语培训时的需要。本教材主要目的是培养和提高本科生和研究生的隧道工程英文文献的阅读理解能力和书面翻译能力。通过本教材的系统学习，学习者将会达到熟悉隧道英语文献的文体风格、提高英文阅读能力及翻译能力、掌握大量专业词汇和标准的表达方式的目标，同时还可以将英语学习与获取专业知识有机结合。

全书共14单元，每个单元由5大部分组成。第Ⅰ部分包含相关主题的3篇阅读材料，使学生系统掌握每单元的隧道专业知识及术语；第Ⅱ部分为隧道专业术语表，供学生记忆和选用；第Ⅲ部分为讨论问题和难句分析及中文译文，旨在活跃课堂和检查学生阅读理解的正确性，帮助学生正确理解原文和提高其英译汉的能力；第Ⅳ部分为汉译英翻译案例，通过分析案例，培养学生汉译英的技巧和能力，供学生在翻译练习中参考和模仿学习；第Ⅴ部分是汉译英课后练习，供学生课后借助字典、网络和翻译工具提高汉译英的能力和技巧。本教材建议学时为100学时，主讲宜由隧道工程专业教师或具备隧道工程基本知识或工程经验的英语教师担任。在使用本教材时，主讲教师可根据教学计划灵活掌握，选择全部或部分内容进行教学。

本教材系统讲解了隧道工程相关知识，并介绍了中国隧道的发展现状，内容选自最近出版的国内外专著、教材、杂志、技术标书、相关设计规范、国内外典型隧道工程的设计和施工文件等。

全书由重庆交通大学外国语学院郭敬谊副教授和土木建筑学院韦良文副教授主编。

在教材的大纲拟定和各章节编写过程中，我们有幸获得了许多国内外隧道工程设计单位和施工单位一线技术骨干、项目经理和总工程师的大力支持和帮助。他们一直参与了我们的整个编写过程，提出了很多有价值的建议，提供了丰富的工程案例资料，甚至亲自修改编写内容，在此一并致以衷心感谢！他们分别是：中交公路规划设计院有限公司副总工程师/教授级高级工程师刘晓东、副总工程师/隧道与轨道交通事业部总经理/教授级高级工程师刘明虎、张志刚博士、吕勇刚高工、黄清飞博士、林巍工程师；中铁隧道集团股份公司高级工程师朱文会和陈静；中国葛洲坝集团高级工程师吴趋书；重庆市轨道交通设计研究院高级工程师翁承显；上海市隧道工程轨道交通设计研究院工程师曾毅；香港迈进基建环保工程顾问有限公司(Meinhardt Infrastructure and Environment Limited)资深高级咨询专家张忠民(香港)；丹麦COWI公司(COWI A/S)高级工程师张金屏博士(丹麦)；林同棪国际工程咨询(中

国)有限公司[T. Y. Lin International Consulting (China) Co. ,Ltd.]高级工程师吴祥祖;参加过中国二滩水电站和南水北调工程建设的新奥法隧道专家 Hans Herbert Oberpichler(奥地利)和工程师 Günter Müller(德国)。

本教材是我国出版的首部隧道工程专业英语教材,由于编者水平有限,时间仓促,书中难免有不妥和疏漏之处,敬请读者批评指正。

联系方式:aliceguoyi@163.com; weiliangwen@163.com

编　者

2014 年 11 月

中国　重庆

目　录

Unit 1 Tunnel Engineering
隧 道 工 程

Ⅰ. Text

Text A Tunnel Classification and General Development Situation
隧道的分类及发展概况

Tunnel is an underground engineering building with portals at both ends and an important part of civil engineering, same as bridge and side slope supporting and retaining structures. It serves any of various functions-highway, railway, pedestrian passageway, water conveyance and gallery of pipelines. However, the standard tunnel definition posed from technological point of view at the tunnel conference of OECD in 1970 and the definition states that any strip-shaped building built by any means and ultimately used below surface of ground with clear span more than $2m^2$ is tunnel. By this definition, the range of tunnel is great and different tunnels can be classified by different criteria and different methods from different points of view. By ground, tunnel can be classified into rock tunnel (soft rock, hard rock) and soil tunnel. By geographical locations, tunnel can be classified into mountain tunnel, urban tunnel and subaqueous tunnel. By construction methodology, tunnels can be constructed by mining method, by cut and cover method, by shield method, by immersed tube tunneling method and by TBM method. By burial depth of tunnels, tunnels can be classified into shallow burial and deep burial tunnels. In cross section, tunnel can take one of the several shapes-circular, horseshoe and rectangular. By sectional area sizing standard defined by ITA (International Tunnel Association), tunnels can be classified into super-large section tunnel (over $100m^2$), large section tunnel ($50\text{-}100m^2$), medium section tunnel ($10\text{-}50m^2$), small section tunnel ($3\text{-}10m^2$) and extremely small section tunnel (less than $3m^2$). By number of traffic lanes, tunnels can be classified into single lane tunnel, double lanes tunnel and multi-lane tunnel. By length, tunnels can be classified into short tunnel (by regulation of rail tunnel: $L \leqslant 500m$; by regulation of highway tunnel: $L \leqslant 500m$), medium-long tunnel (by regulation of rail tunnel: $500m < L \leqslant 3000m$; by regulation of highway tunnel: $500m < L < 1000m$), long tunnel (by regulation of rail tunnel: $3000m < L \leqslant 10000m$; by regulation on highway tunnel: $1000m \leqslant L \leqslant 3000m$) and super-long tunnel (by regulation of rail tunnel: $L > 10000m$; by regulation of highway tunnel: $L > 3000m$). But it is commonly considered that tunnel classification by its purposes is relatively more explicit which is introduced in the following section.

1. Transit tunnel

Transit tunnel is mostly widely used and its function is providing a channel for traffic and movement of people and a free and smooth communication route. The following types are generally included.

1) Highway tunnel

Highway tunnel is the channel specially provided for vehicles. In the old age, the highway built in mountain regions usually winds around mountain to save works cost and the longer road line is preferred to avoid use of tunnel due to its high cost. With the development of social economy, production and the development of great number of expressways, a higher technical standard for road construction is raised requiring a flat and freeway wide road with gentle slope. Hence, when road has to cross or pass through mountain regions, many tunnel solutions are proposed. Building of tunnel plays an important role in aspects of improving the technology of road, shortening the traveling distance, improving the transporting capacity, and reducing road incidents. The domestic tunnel known as Qinling Zhongnanshan Tunnel(秦岭终南山隧道)is in length of 18.1km and its completion has saved approximately 60km by distance and 2 hours by time to cross the mountain Qinling.

2) Rail tunnel

Rail tunnel is the channel specially for train transportation. When a railway crosses the hilly regions, it must overcome the obstacle caused by the big difference of the altitude of the terrain. The slop for railways needs to be flat and gentle with the maximum slope gradient less than 24‰ (two engines pull). However, the hilly regions are usually limited by the terrain and impossible to stretch the rail-line across the regions, since the required elevation cannot be reached by the extension of the rail-line. In this case, the tunnel is a reasonable choice to cross through the hills, and its use can shorten the length of route, reduce slope gradient, improve operation conditions and improve train tonnage rating. For example, 48 tunnels are designed on the route from Baoji to Qinling on Baocheng Line accounting for 37.75% of total extension of the route, which demonstrated roles of rail tunnel in hilly regions.

3) Subaqueous tunnel

Subaqueous tunnel is the channel which is built under stream, river, lake, sea and ocean to provide the channel and passageway for vehicles and trains. When a communication route crosses over the stream, the river, the lake, the sea or the ocean, options of bridges, ferry boats and tunnels can be selected. But bridge is limited by its headroom and ferry boat has limited capacity. If these problems cannot be effectively solved, subaqueous tunnel is a very good solution. And its advantages include being from the impacts of weather, no influence on navigation, less space occupation of its rump and hidden communication facility during war time and thus it has won people's favor more and more. Many national subaqueous tunnels have been built across Huangpu

River in Shanghai and across Pearl River in Guangzhou. The disadvantage of the subaqueous tunnels is their high construction cost.

4) Subway

Subways are constructed underground in urban areas and are the channel for train transportation for the purpose of mitigating urban transportation burden. Subway is one of the effective solutions to the traffic congestions and the traffic jams in the large cities. Train transportation due to its large capacity, high speed, safe and timely transportation of passengers has become a powerful solution to transportation difficulties in the cities with large population. In China the completed underground rail transportation systems established in cities as Beijing, Shanghai and Guangzhou and other cities have played an important role in improving urban transportation and reducing traffic incidents. In other cities such as Shenzhen, Nanjing, Qingdao, Dalian, Wuhan, Shenyang, Chongqing, Haerbin and Chengdu, subways have been under planning and construction.

5) Navigation tunnel

Navigation tunnel is the channel specially intended for ship transportation and sailing. When canals have to cross watersheds, the powerful means of overcoming the difficulty caused by the big difference of the altitude of the terrain is to build canal whose advantages include shortening sailing distance, reducing operation cost, smoothening and straightening river channel, thus the navigation conditions are greatly improved.

6) Pedestrian underpass

Pedestrian underpass is a special underground pass way for passage of pedestrians. Pedestrian underpasses are generally constructed in highly populated downtown areas, which are crowded with passing pedestrians, dense traffic and thus prone to traffic accidents from time to time due to less care, for the pedestrian to cross street, railway and auto route. The function of the pedestrian underpass is to mitigate the traffic load on ground surface, reduce road accidents and facilitate the movement of pedestrians.

2. Aqueduct

Aqueduct is an important constituent of hydraulic engineering and hydroelectrical power plant. Aqueduct consists of the following types.

1) Water supply tunnel

Water supply conduit is built to supply water to hydroelectrical power generator set or mobilize water resources. The water diverted in water supply conduit is the driving power to drive generator sets of the power station. For that purpose, water supply conduit as a structure for water supply is required to have a inner wall with bearing capacity. But sometimes only part of water passes through the conduit and its inner wall is exposed to atmospheric pressure and low water pressure and even without water pressure. Hence water conduits with pressure and without pressure are classified.

2) Tailrace tunnel

Tailrace tunnel is built to discharge the waste water released from generators of a hydroelectric power plant.

3) Diversion tunnel or spillway tunnel

Diversion tunnels or spillway tunnels are built to divert water and discharge the flood in excess of flow limit of spillway and are important structures of hydraulic engineering works. The principal function of diversion or spillway tunnels is flood discharge.

4) Sediment discharge tunnel

Sediment discharge tunnel is built to wash away the sedimentation in reservoir and is a constituent of reservoir structure and its function is discharging mud and sand out of the reservoir by use of the sediment discharge tunnel which is also used to empty the reservoir for inspection or repair.

3. Municipal tunnel

In urban construction and planning, underground space is fully used. Various types of public facilities are placed underground, for which underground galleries are known as urban tunnels. Municipal tunnels are closely related to citizens' lives, work and production and they play an important role in assuring the normal life in the cities and the principal tunnel types are as follows.

1) Water supply tunnel

Water supply tunnel is built for the placement of the urban pipe networks for water supply. In cities, the important task of urban administrative infrastructure construction is the reasonable planning and arrangement of main water pipelines which is closely linked to human life and production activity. The water supply pipeline works shall not affect the urban landscape, shall not occupy ground surface to avoid man-made damage. Hence construction of underground gallery to contain these pipelines is a practical solution.

2) Sewage tunnel

The sewage tunnel is built for urban sewage discharge and conveyance system. The most part of urban sewage needs to be discharged into the rivers outside the cities except for the part which imposes severe impact on environment and is purified and recycled or discharged. That is why the underground sewage tunnel is needed. This type of tunnel generally diverts and discharge sewage by itself and thus takes form of egg mostly. It is feasible that sewage pipe is placed in a duct and the sewage is to be discharged through the sewage pipe. Garbage-blocking grate is placed at the inlet of the sewage tunnel to block the drifting miscellaneous wastes outside and to prevent the wastes blocking the passage of pipe.

3) Tunnel for pipelines

The tunnel is built for facilities of urban power energy supply (gas, heating, hot water). For the tunnel for pipelines in cities, the pipelines for energy supply are placed in the underground duct built for that purposes and the ducts go through treatments for anti-leakage and thermal reservation and the energy can be delivered safely to destinations for production and domestic use.

4) Duct for cables

In cities, to ensure that the electrical power cables and communication power cables are protected from harms or damages of human activities and to avoid the influence on urban aesthetics due to overhanging cables, the appropriate underground ducts are constructed to hold the cables underground.

In modernized cities, the above four types of urban tunnels with common properties are built into one common tunnel known as "common duct" in accordance with urban arrangement and plan. The common duct is the symbol of the reasonable managing and planning of the in frastructures in modern cities, as well as the proper means to use urban underground space and is the orientation of urban administrative planning and construction development.

5) Civil air defense tunnel

The tunnel is built for the purpose of civil air defense and works as a refuge in wartime. The urban civil air defense engineering is constructed to meet the demand of protection from air attack during wars. The civil air defense works is built for providing for people a refuge in case of emergency. Hence, during the civil works construction general requirement for living conditions must be considered. In addition to the arrangement of such facilities as drainage, ventilation, illumination and communication equipment, inventory of drinking water and food and necessary first aid facilities should be considered. The devices for prevention of blasting and impact waves need to be mounted at tunnel portals.

4. Mine tunnel

In mine exploitation, in order to enable the access to mine bed from outside of the mountain and transport the exploited mine stones to outside, the tunnel is built. There are following types of tunnels.

1) Haulage roadway

To make a tunnel through mountain to make access to mine bed and open a roadway step by step to reach all excavation surfaces. The former is known as the principal roadway and serves as the principal access for humans and the transport trunk road to underground mine zone. While the latter is distributed like tree branches to all excavation surfaces, and this type of roadway serves as temporary support to meet the needs of excavation of operators.

2) Water supply tunnel

It intends to supply clean water for use of excavating and extracting machines and pump waste water and catchments out of the tunnel.

3) Ventilation tunnel

Generally underground harmful gases swelling out from the stratum where the roadway passes through by mine tunneling method, the waste gas exhausted from excavators and the air exhaled by workmen are the prime pollutants in the roadway. If the stratum contains any mash gas, it will endanger the workmen's lives in the tunnel. Hence, to purify the air in the tunnel and create the pleasant working conditions, the ventilation tunnel is indispensable to extract the dirty air and bring in the fresh air.

In recent years, the national highway construction has developed rapidly, and 7918 expressway network in length of 85000 kilometers will be accomplished in near future. With large national population, the relevant authority is planning and completing national expressway network to meet people's needs of traveling out and the needs of economic development. Due to the high technical specification for formation of highway alignment when a highway enters into mountain area or heavy hilly area, tunnel is inevitably needed to pass through mountains and hills. Hence to build highway in the hilly and mountainous areas in middle and west China, the length of bridges and tunnels account for large proportion, which varies from 40% to 80%, and their construction is extremely hard. Yet being able to shorten distance in large margin is the outstanding advantage, thus greatly improving the operation efficiency. For example, the Zhongnanshan tunnel (终南山隧道) in Chengyu highway (成渝高速公路) is in length of 3km which is 42km shorter than the original old road. The application of tunnel economized on land and protected ecological environment.

Compared with the developed countries, the national highway tunnel of China started relatively late. But since China's reform and opening up in 1978, the construction of civil works have developed rapidly and the quantity and scale of tunnel construction have been expanded continually. In 1980s, the tunnel in length of over 1000m was initially built in the southeast coastal areas where the economy was relatively well developed. For example the Wutongshan tunnel (梧桐山隧道) in Shenzhen is in length of over 2000m in which full transverse ventilation was applied for the first time domestically. In 1990s, higher and higher requirement was raised for highway tunnel with rapid development of highways, and the significance of tunnel construction has been recognized and valued more and more by people, and highway tunnel projects spread over the entire mainland. Meanwhile tunnel construction and management became more and more complicated and highly demanded. In the construction of Zhongnanshan tunnel (终南山隧道) in Chengyu expressway (成渝高速公路) which was 3160m long and accomplished in previous time, harmful geological problems like rush-ins and mash gas were encountered in the tunnel excavation. The Erlangshan tunnel (二郎山隧道) as part of the Sichuan-Tibet highway (川藏公路) in length of 4000m is located in high altitude and cold areas, and during the excavation such challenges as highland stress and rock burst occurred. The built Qinling Zhongnanshan tunnel (秦

岭终南山隧道) is the longest tunnel in China with tunnel total length over 18km and in the course of its construction almost all types of harmful geological problems were encountered. What's more, the tunnel ventilation and operation environment were complicated and hard. By the end of year 2007, 4673 highway tunnels in total had been built in China, with the total length up to 2556km and the annual rate of increment of tunnel construction has been renewed from time to time in the past 20 years. Other accomplished domestic super-long tunnels are shown in following table 1.1.

Some Super-long Highway Tunnels Constructed and Accomplished in China Table 1.1

SN	Tunnel name	Length(m)	Location	Number of lanes	Mode of ventilation
1	Qinling Zhongnanshan Highway Tunnel 秦岭终南山隧道	18020	Shaanxi 陕西	2×2	Longitudinal ventilation by sections with 3 vertical shafts 3竖井分段纵向式
2	Dapingli Tunnel 大坪里隧道	12290	Gansu 甘肃	2×2	Longitudinal ventilation by sections with 2 vertical shafts 2竖井分段纵向式
3	Baojiashan Tunnel 包家山隧道	11500	Shaanxi 陕西	2×2	Longitudinal ventilation in sections with 3 inclined shafts 3斜井分段纵向式
4	Baotashan Tunnel 宝塔山隧道	10391	Shanxi 山西	2×2	Longitudinal ventilation with inclined shafts by way of air supply and extraction 竖斜井送排式纵向通风
5	Nibashan Tunnel 泥巴山隧道	9985	Sichuan 四川	2×2	Inclined shaft + vertical shaft longitudinal ventilation in sections 斜井+竖井分段纵向式
6	Mayazi Tunnel 麻崖子隧道	9000	Gansu 甘肃	2×2	Inclined and vertical shaft for air supply and extraction + jet fan longitudinal ventilation 斜竖井送排+射流风机纵向
7	Longtan Tunnel 龙潭隧道	8700	Hubei 湖北	2×2	Vertical pit for air supply and extraction + longitudinal jet fan 立坑送排+射流风机纵向式
8	Mixiliang Tunnel 米溪梁隧道	7923	Shaanxi 陕西	2×2	Air supply and extraction ventilation with single shaft in left(right) bore 左(右)洞单井送排式通风
9	Kuocangshan Tunnel 括苍山隧道	7930	Zhejiang 浙江	2×2	Longitudinal mode + semi transverse flow way (smoke extraction) 纵向式+半横流式(排烟)
10	Fangdoushan Tunnel 方斗山隧道	7581	Chongqing 重庆	2×2	Longitudinal ventilation with 2 inclined shafts for air supply and extraction 2座斜井送排式纵向通风