高等教育“十二五”规划教材
交通运输组织学国家级精品课程建设丛书

Special English for Traffic and Transportation

交通运输专业英语

贾晓燕 杨菊花 主编

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内 容 简 介

本书针对交通运输专业特点，结合铁路行车组织、铁路客运组织和铁路货运组织等的发展特点，分别介绍了铁路机车车辆管理、高速铁路、限制口能力、多式联运、移动闭塞信号、集装化运输、列车运行图、车流管理、改善编组作业和繁忙线路管理等问题，构建了该专业完整的专业英语体系。

书中每个单元后均设置了对应的专业词汇表、长难句翻译和句子分析，为理解全文提供了相应的支撑和参考。另外，全书 12 个单元后均附有对应的辅助阅读材料，对于扩大学生的阅读量、拓宽教材的专业覆盖面等具有较好的效果。

本书可作为高等院校交通运输和物流工程等专业的教材或参考书，亦可作为交通运输、物流、集装箱等相关部门干部、职工的培训和学习用书。

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前　言

交通运输专业英语对于运输领域科技工作者来说，是进行学术交流、了解国际运输业发展动向、学习他国交通管理经验和获取尖端科技材料的有效手段。近年来，我国铁路体制改革、客货运改革进行得如火如荼，相关的专业知识也随之发生日新月异的变化。同时国外交通运输业也呈现出新的发展趋势。因此，必须熟练掌握专业英语这一工具。本书旨在培养和提高读者利用英语学习、研究和应用交通运输专业理论和技术的能力，致力于提升教材的专业性、实用性和实践性。

本书根据铁路运输组织特点，针对行车、客运、货运等不同内容，从不同期刊和相关教材中节选了若干篇反映当前铁路运输发展状况的报道和科技论文，按教学需要进行单元编排，并依据专业词汇、词组在课文中出现的次序编制生词表，同时对文中的长句、难句加以注释，使学习者能更好地了解和掌握书中的有关内容。而每个单元增选的辅助阅读材料也能够扩大专业英语方面的背景信息，对于增加学生的阅读量、拓宽教材的专业覆盖面等具有较好的效果。

本书由兰州交通大学贾晓燕主编，杨菊花负责第 1～6 单元的编写工作和前期资料收集工作。在教材撰写过程中，得到宋健业老师持续的关注和支持，在此表示深深的感谢！

由于时间仓促，本书选材范围不够宽泛，在全书内容的组织等方面，难免存在不妥和疏漏之处，恳请读者批评指正。

作者

2013 年 11 月于兰州

目 录

Unit 1

Railway Rolling Stock Planning

Part 1 Text

More than one hundred eighty years passed since that magnificent September day in 1825 when for the first time in history a steam-locomotive hauled a passenger train. The legendary Locomotion was driven by George Stephenson personally. Hundreds of enthusiastic people got in open coal wagons in Darlington and a great celebration started two hours later in Stockton as the train arrived there. This ride proved the concept of steam-hauled passenger railways. Within a couple of years, the horses were utterly released from their duties of pulling heavy wagons between Darlington and Stockton.

Railways looked in those by-gone years quite differently from our understanding of railways today. There was no timetable at all; the numerous railway operators could run their trains whenever the trajectory was free; they literally fought for the right of using the tracks. There was no safety system; collision was only avoided by the low speed of the trains (and later, when they became faster, by sheer luck). The carriages had no springs; the passengers must have felt relieved after the 12-mile journey. Nevertheless, the Stockton and Darlington Railway was a financial success.

The pioneers of passenger railways would be quite astonished to see what their dreams have evolved into. Railways are now part of our everyday life. Trains operate according to carefully set-up timetables, safety has the highest priority and comfortable carriages make long journeys easily bearable. Railways gained large social importance, too. Once stand-alone small railway lines has grown to large companies and has become a solid pillar of economy. For over a century, the development level of a country was directly measured by the density of its railway network. Today, passenger and freight railway transportation play an important role in the economy of many countries.

For many years, railway companies did not have to face much competition in public passenger and freight transportation. In the past decades, this changed drastically. The railways has lost a large part of their market share to automobiles. Recently, air traffic took over many middle-distance and long-distance train travelers. In addition, a directive of the European Union required opening the national railway market in the 90's. Till then, most state-owned railway companies in Europe had been the only ones to provide railway services in their countries; after liberalizing the market, they had to compete for the customers. These developments urge the railway companies to attract more customers by raising their service level and to cut their costs down by working more efficiently. Improving their planning process contributes to reach both of these goals.

Railway companies are nearly inexhaustible sources of planning problems. Till recently, all of them have been dealt with manually; many are still handled without automation and optimization. Railway applications attracted the attention of mathematical research. Many of the problems are of a combinatorial character and suitable for operations research methods. Conversely, problems of railway practice have an influence on operations research by showing interesting and useful directions to extend existing methods and to explore new ones. In the last decade, more and more computer-aided tools turned out to improve the railway planning process significantly. Besides intensive research, the virtually exponential increase of computational power contributes a lot to these successful applications. Nonetheless, comparing the number of existing operations-research-based planning tools to the plenty of railway problems indicates that there shall be enough railway-related research topics for a long time. Also, mathematical research shall certainly continue on railway optimization topics that have not been addressed so far. In any case, it shall be exciting to see to what extent railway planning can be automated and optimized in the coming years and decades.

Planning the railways for years, months, weeks or days ahead leads to substantially different problems; in this regard, railway planning problems can be strategic, tactical, operational and short-term.

Another way to classify railway planning problems is based on their target: they concern the timetable, the rolling stock and the crew. Timetabling answers the questions which locations are to be connected by direct trains and when the trains have to run. Rolling stock planning determines how many locomotives and passenger carriages are needed and how to use them for trains. Crew scheduling of most passenger railway operators concerns the questions how many train drivers and conductors are needed and how to assign them to the trains. These three topics include problems of very different characteristics. Timetabling determines the railway network while crew and rolling stock scheduling allocate the available resources. But the requirements in crew and rolling stock planning differ substantially, too. For example, rolling stock units are bound to the tracks so they can block the way through a station for each other. Crew has much more flexibility as train drivers and conductors can just walk from one platform to another. However, crew scheduling has to respect wishes of the employees, sometimes at the cost of efficiency. A well-known recent example of that is the case of the cost-efficient crew schedules of NS in 2001 which turned out to be unacceptable for train drivers and conductors. The employees' wishes result in very complex requirements on the crew schedules; the rules in rolling stock planning are usually simpler.

Strategic planning determines the amount of rolling stock needed in the future. In the other planning stages, the available rolling stock is to be assigned to the timetable services. Tactical, operational and short-term planning takes different levels of detail of reality into account, so the requirements of the schedules have to fulfill differently for the planning phases. Tactical planning produces the basic shape of the weekly schedule, operational planning refines this for the actual calendar weeks. Short-term planning modifies these schedules to comply with some requirements that are not dealt with in earlier planning phases. Moreover, short-term planning supervises the execution of the schedules.

The three major objectives in rolling stock planning are service quality, operational costs and robustness. A good service quality means that trains have enough seat capacity to cover the passenger demand. Also, rolling stock on inter-city trains with many long-distance passengers is expected to provide more comfort environment than regional trains. A higher service quality encourages more travelers to use the train instead of their cars. When running the trains, railway operators have rolling stock related expenses such as electricity or fuel consumption and maintenance costs; efficient schedules can minimize these expenses. Everyday, railway operations have to face with disruptions and delays; robust rolling stock schedules are less affected by them. Robustness of the schedules can be increased when the number of possible sources for delays is kept low and spreading of delays is prevented as much as possible. Hence the rolling stock schedules can also contribute to raising the punctuality of the railway system. Of course, these criteria contradict one another; the operators have to find a good balance of them.

Strategic and tactical planning only considers these criteria. In operational and short-term planning, however, time is often too short to look for a schedule that matches best the objective criteria above. More important in such cases is to come up quickly with a solution that fulfills the requirements and that ensures an acceptable level of service quality, efficiency and robustness.

Part 2 New Words and Expressions

steam [sti:m] *vt. vi.* 蒸，散发
n. 蒸汽；精力
adj. 蒸汽的

locomotive ['ləukə,məutiv, ,ləukə'm-] *adj.* 火车头的；运动的
n. 机车；火车头

haul [hɔ:l] *n.* 拖，拉；用力拖拉
vt. vi. 拖运；拖拉

passenger ['pæsindʒə] *n.* 旅客；乘客；过路人

legendary ['ledʒəndəri] *adj.* 传说的，传奇的
n. 传说集；圣徒传

enthusiastic [in,θju:zi'æstik] *adj.* 热情的；热心的；狂热的

celebration [,seli'breiʃən] *n.* 庆典，庆祝会；庆祝；颂扬

utterly ['ʌtəli] *adv.* 完全地；绝对地；全然地；彻底地，十足地

timetable ['taim,teibl] *n.* 时间表；时刻表；课程表

trajectory ['trædʒiktəri, trə'dʒek-] *n.* 轨道，轨线；弹道

literally ['litərəli] *adv.* 照字面地；逐字地

safety ['seifti] *n.* 安全；保险；安全设备；保险装置

collision 美[kə'liʒən] *n.*（意见，看法）的抵触，冲突

sheer [ʃiə] *adj.* 绝对的；透明的；峻峭的
adv. 完全；陡峭地
vt. vi.（使）偏航；(使)急转向
n. 偏航；透明薄织物

carriage ['kæridʒ] *n.* 运输；运费；四轮马车；举止；客车厢

spring [spriŋ] *n.* 春天；弹簧；泉水；活力；跳跃

adj. 春天的

vt. 使跳起；使爆炸；突然提出；使弹开

vi. 生长；涌出；跃出；裂开

evolve [i'vɔlv] *vt.* 发展，进展；进化；使逐步形成；推断出

vi. 发展，进展；进化；逐步形成

bearable ['bɛərəbl] *adj.* 可忍受的；支持得住的

density of its railway network 铁路网密度

drastically ['dræstikəli] *adv.* 彻底地；激烈地

long-distance *adj.* [通信] [交] 长途的；长距离的

vt. 打长途电话给

adv. 通过长途电话

liberalize ['libərəlaiz] *vt.* 使自由化；宽大

vi. 自由化

inexhaustible [ˌinig'zɔːstəbl] *adj.* 用不完的；不知疲倦的

automation [ˌɔːtə'meiʃən] *n.* 自动化；自动操作

optimization [ˌɔptimai'zeiʃən, -mi'z-] *n.* 最佳化，最优化

combinatorial [kəmˌbainə'tɔːriəl] *adj.* 组合的

conversely ['kɔnvəːsli] *adv.* 相反地

computer-aided *adj.* [计] 计算机辅助的，电脑辅助的

significantly [sig'nifəkəntli] *adv.* 意味深长地；值得注目地

exponential [ˌekspəu'nenʃəl] *adj.* 指数的

n. 指数

computational [kəmpjuː'teiʃənəl] *adj.* 计算的

indicate ['indikeit] *vt.* 表明；指出；预示；象征

address [ə'dres] *vt.* 演说；从事；忙于；写姓名地址；向……致辞

n. 地址；演讲；致辞；说话的技巧

strategic [strə'tiːdʒik] *adj.* 战略上的，战略的

tactical ['tæktikəl] *adj.* 战术的；策略的；善于策略的

classify ['klæsifai] *vt.* 分类；分等；编组

timetable ['taimˌteibl] *n.* 时间表；时刻表；课程表

rolling stock *n.* 机车车辆（特指车辆）

crew [kruː] *n.* 队，组；全体人员，全体船员

vi. 一起工作

	vt.	使当船员
schedul ['skedʒul]	*n.*	[医]目录，图表，清单，调度
conductor [kən'dʌktə]	*n.*	导体；售票员；领导者；管理人
block [blɔk]	*n.*	块；街区；大厦；障碍物
	vt.	阻止；阻塞；限制
	adj.	成批的，大块的；交通堵塞的
flexibility [ˌfleksi'biliti]	*n.*	灵活性；弹性；适应性
efficiency [i'fiʃənsi]	*n.*	效率；效能；功效
complex ['kɔmpleks]	*adj.*	复杂的；合成的
	n.	复合体；综合设施
refine [ri'fain]	*vt.*	精炼，提纯；改善；使……文雅
calendar ['kælində]	*n.*	日历；历法；日程表
	vt.	将……列入表中；将……排入日程表
modify ['mɔdifai]	*vt.*	修改，修饰；更改
	vi.	修改
supervise ['sjuːpəvaiz]	*vt.*	监督，管理；指导
	vi.	监督，管理；指导
execution [ˌeksi'kjuːʃən]	*n.*	执行，实行；完成；死刑
robustness [rəu'bʌstnis]	*n.*	[自]鲁棒性；[计]稳健性；健壮性
regional ['riːdʒənəl]	*adj.*	地区的；局部的，整个地区的
electricity [ˌilek'trisəti]	*n.*	电力；电流；强烈的紧张情绪
consumption [kən'sʌmpʃən]	*n.*	消费；消耗；肺痨
maintenance ['meintənəns]	*n.*	维护，维修；保持；生活费用
disruption [dis'rʌpʃən]	*n.*	破坏，毁坏；分裂，瓦解
delay [di'lei]	*vi.*	延期；耽搁
	vt.	延期；耽搁
	n.	延期；耽搁；被耽搁或推迟的时间
robust [rəu'bʌst, 'rəubʌst]	*adj.*	强健的；健康的；粗野的；粗鲁的
punctuality [ˌpʌŋktju'æliti]	*n.*	严守时间；正确；规矩
criteria [krai'tiəriə]	*n.*	标准，条件（criterion 的复数）
contradict [ˌkɔntrə'dikt]	*vt.*	反驳；否定；与……矛盾；与……抵触
	vi.	反驳；否认；发生矛盾

Part 3 Notes to the Text

1. Nonetheless, comparing the number of existing operations-research-based planning tools to the plenty of railway problems indicates that there shall be enough railway-related research topics for a long time.

译文：尽管如此，但是比较现有的基于运营研究的规划工具数量和大量铁路问题，则意味着今后将长期存在充足的铁路类研究课题。

句子解析："comparing the number…"动名词做主语，"indicates"做谓语，宾语为"that"引导的"there be"从句。

2. Timetabling answers the questions which locations are to be connected by direct trains and when the trains have to run.

译文：运行图回答了哪些车站间开通直达列车和列车何时运行的问题。

句子解析："Timetabling"做主语，"answers"为谓语，"the questions"做宾语，并由"which"和"when"引导 2 个从句来修饰限定。

3. A well-known recent example of that is the case of the cost-efficient crew schedules of NS in 2001 which turned out to be unacceptable for train drivers and conductors.

译文：最近此类问题的一个广为人知的案例是 2001 年 NS 推出的成本效益铁路员工派班表，该表最终受到机车司机和乘务员的排斥。

句子解析："A well-known recent example…"是主语，"is"是系动词做谓语，"the case of…"是宾语，"which"引导的定语从句修饰的是宾语的定语"…crew schedules…"。

4. Tactical, operational and short-term planning takes different levels of detail of reality into account, so the requirements of the schedules have to fulfill differently for the planning phases.

译文：策略的运营短期规划将现实细节的各个水平都考虑进来，因此，派班表的需求必须根据规划阶段分别完成。

句子解析："Tactical, operational and short-term planning"做主语，"take…into account"是固定搭配，表示考虑，句中"takes"是谓语，"levels"做宾语，"so"引导的是结果状语从句。

Part 4 Supplementary Reading Text

European Rail Traffic Management System

The European Union (EU) launched an integrated programme of research and development in 1996 to set up a common, coherent and consistent rail transport policy for safety and operational procedures. This was also aimed at developing a harmonized European railway network in order to fulfill the interoperability requirements and to improve, and optimize the rail operation with high level of safety. The work, under this research programme, focused on the development of the European Rail Traffic Management System/European Train Control System (ERTMS/ETCS) with a generic system: onboard command/control, transmission system and safe communication based on radio(Global System Mobile for communication-Railway(GSM-R)). The advantages of an international interoperable system expected by the railways can be summarized as:

(1) Cross border interoperability.

(2) Improvement of the safety of national and international train traffic.

(3) Improvement of international passengers and freight train traffic management.

(4) Shorter headway on heavily trafficked lines, by driving on moving block, enabling exploitation of maximum track capacity.

(5) The possibility of step-by-step introduction of the new technology.

(6) Enabling Pan-European competition between the manufactures of ERTMS/ETCS components and strengthening the position of the European railway industry on the world market.

The ERTMS system intended as a future unified standard European Train Control System (ETCS) was decomposed into 5 levels in order to allow progressively a migration from existing train control systems, but only level 2 is considered in this paper. The ERTMS/ETCS system is partly on the trackside sub-system (interlocking, control centers, etc.) and partly on board sub-system(train and driver interface, ATP and ATC).

Different levels have been defined to allow each individual railway administration to select the appropriate ERTMS/ETCS application, according to their strategies, their trackside infrastructure and the required performance. ERTMS/ETCS Application Level 2 means that the train is equipped with ERTMS/ETCS operating on a line controlled by a Radio Block Centre and equipped with Eurobalises and Euroradio including the train location and integrity proving performed by the trackside.

The State Transition Diagram (STD) for the operational railway represents all the states of a train, from mainly static to full dynamics during journeys controlled by the traffic management system, currently baselined as ERTMS Level 2 Train Control System. The 13 states for the train have been analyzed form the perspective of key actions responses and triggers for transition in the Unified Modeling Language (UML) syntax referred to as Sequence and Collaboration Diagrams (S&Cs). There exists one Sequence and Collaboration diagram for each train state represented in the STD.

The states of the system and the key functions, actions, exchanges between actors and responses within each state as depicted by STD and pertinent S&Cs have constituted the basis for the systematic hazard identification of ERTMS level 2 system. Once the key system functionality for a level 2 configuration was captured on Sequence and Collaboration diagrams, the data and control exchanges between various actors were scrutinized from the view point of potential deviations which could lead to hazardous system states. Guide-Words were applied to each system function, action, exchanges or response in a Sequence and Collaboration diagram and the most appropriate ones selected. The nature of exchange, e.g. Data, Control/Command was also identified and noted. The potential hazard associated with the Guide-Word applied to a system state, exchange or function was next articulated by the study panel (largely came from EU railways DB, SNCF, Railtrack & FS) and recorded. The potential or likely causes and consequences (accidents) were subsequently elicited from the expert panel and noted. For each hazard, a preliminary and subjective assessment was carried out by the panel in terms of the potential likelihood and severity of the accidents. The derived index is captured in the hazard record as means of prioritization during analysis.

The systematic Hazard Identification of the ERTMS level 2 system carried out in accordance with the above process generated a total of 152 system level hazards. The captured hazards were sequentially numbered and identified with respect to the S&C source diagram from which they were derived. The hazards were also maintained in a bespoke database developed for online capture and maintenance of system hazards.

The detailed analysis of ERTMS Core Hazards has involved coding of main causalities arising from the failures of Onboard, Trankside and non-ERTMS functions and sub-systems within the operational railway. The Quantified Apportionment Engine(QAE) enables an overall apportionment of the 1,000 and 1,100 series risks to causal classification codes. These are in turn sub-divided into Control Command Constituents which provide the essential functions for the core interoperable system. The QAE has been employed to compute the contributions of the ERTMS/ETCS and the rest of the infrastructure to Passenger, Worker, Neighbor and Average Population safety within the ERTMS Level 2 operational railway.

The systematic framework adopted for the safety study of the ERTMS/ETCS railway generates detailed forecasts for the three main groups exposed to the risks of operational railway. This, besides the average population statistics, provide four different perspectives from which the tolerability of key ERTMS hazard can be assessed. The current conclusions are primarily based on the average population risks which can be extended into other specific groups if and when appropriate.

The core and sub-core hazards represent the system level ERTMS/ETCS hazards for which tolerability will be derived based on the average population safety target. For a thorough description of the sub-core hazards refer to the detailed analysis reports produced for each ECH by analytical organizations.

The causal and consequence analyses of the ERTMS/ETCS Core Hazards have generated the following annualized rates considered tolerable for the 10 core and 40 sub-core hazards. It is possible to normalize these THRs against some specific aspect of the train and infrastructure in order to ensure independence from the reference operational environment (EUROE). The most likely metric for normalization for onboard related hazards is that of per train hour of operation and as for trackside, RBC hour has been considered a reasonable choice.