

中国铁道百科全书

运 输 与 经 济

Encyclopedia of China Railways

Transportation & Economy

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内 容 简 介

《中国铁道百科全书》是中国铁路第一部现代行业性百科全书,共分五卷,《运输与经济》为其中之一。本卷由铁路运输与经济两大部分组成,共包括铁路运输与经济技术基础、铁路行车组织、铁路客运组织、铁路货运组织、车站及枢纽、铁路装卸机械化、铁路运输经济、铁路财务会计、铁路运输统计等九个分支学科。各分支学科内容,按学科的体系、层次,以条目的形式进行撰写,共收入条目 654 个。书中通俗地、系统地、科学地、全面地阐述了各分支学科的基本理论、实践经验、历史沿革及发展趋势诸方面的基本知识。

为便于检索,书中除条目分类目录之外,还附有条目汉字笔画索引、条目外文索引以及内容索引,其中内容索引按汉语拼音排序并加注英文。

本书可供铁路管理人员、技术人员、铁路院校师生及广大铁路职工使用,也可供社会上具有高中以上文化程度的读者求知解疑。

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A

anquan jichu jianshe

安全基础建设(basic construction of safety) 安全工作必须高度重视安全基础工作,这是近年来中国铁路关于安全基础建设的理性思考。中心内容是重点抓好队伍素质、设备质量和安全管理三个方面。 关于提高队伍素质方面,提倡以人为本,善于发挥人的主导作用。在安全基础建设中,要始终把人的素质的提高、积极性的发挥作为首要的任务。干部以身作则,教育职工遵章守纪,并积极开展全员培训,提高岗位技能。 关于保证设备质量方面,要不断加强安全技术装备,使其经常处于良好状态,这是安全基础建设的重点内容。一方面要加快推进安全技术装备现代化的进程,采用新的技术装备,建立先进、可靠的铁路运输安全保障体系。另一方面要加强设备维修,使运输安全建立在可靠的物质基础之上。 关于加强管理方面,强调严格管理、科学管理、规范管理和有效管理。建立和健全相应的管理机制,即责任机制、落实机制和利益机制,强化班组和现场作业的控制能力。贯彻“安全第一、预防为主”的方针,使安全工作经常处于有序可控的状态。

参 考 书 目

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(林瑞耕 褚书铭)

anquanxian

安全线(safety siding) 为防止列车冒进行车信号机发生与其他列车冲突而设置的线路设施。它由不短于 50 m 的尽头线,和联结尽头线防护正线或到发线的道岔及信号等设施组成(如图所示)。从信号机到安全线尽端的距离一般大于 100 m,作为停车缓冲地段,以确保安全。

安全线布置示意图

(熊出天)

anquan yunshu

安全运输(safety of railway transport) 主要包括旅客安全运输、货物安全运输、安全行车及道口安全等,又称运输安全。以列车运行方式对旅客和货物进行运输,是铁路运输生产过程的基本特点。同样,列车安全运行即安全行车也就

成为铁路安全运输最重要、最核心的部分,所以旅客安全运输、货物安全运输在很大程度上都取决于安全行车。

铁路运输安全的状况反映了铁路运输的人员素质、设备质量、管理水平和社会环境的状况。世界各国铁路运输企业和政府当局历来都十分重视铁路运输安全,把防止铁路运输事故放在重要位置,并为此而进行不懈的努力。各国铁路和政府通过改善技术设备、加强管理和健全法制三个途径来不断改善铁路运输安全工作。

改善技术设备是保证运输安全的重要物质基础。线路、车站、机车车辆以及通信信号技术状态不良或发生故障是发生运输事故的重要原因。铁路初创时期,列车运行采用时间间隔制度。到 1842 年出现闭塞系统,用空间间隔制度取代了时间间隔制度,这是铁路技术管理的一大飞跃。随着科学技术的不断进步,现阶段各国铁路都在提高各种技术设备的性能、强度和可靠性,并积极研制、采用安全技术保障系统,切实保证安全运输。

建立和健全规章制度和严格纪律是保证运输安全的基本环节。大多数的事故都是由于违反规章制度、违反劳动纪律以及职工技术业务素质不良而引起的。由于人为因素所造成的事故在各国铁路行车事故中占有很大比重,因此控制人的不安全行为是至关重要的,各国铁路为此做了大量工作。为了有效地贯彻执行各种运输规章制度,各国铁路都注意职工的技术业务训练和纪律教育。许多国家还为此制定安全奖惩办法,开展安全月、安全周和各种形式的安全竞赛活动。在中国铁路,为保证运输安全所制定的安全法规和各种运输规章制度,都将安全工作列为中心内容,如中国铁路制定的《铁路技术管理规程》,既是铁路技术管理的根本大法,又是保证安全运输,特别是安全行车的基本法规。

加强安全管理和监督,是保证安全运输的重要手段。为了保证国家有关安全法的贯彻执行,加强铁路运输安全的监督管理,许多国家铁路设有专职的铁路安全监督机构,只是各国铁路安全监督机构的组织名称、形式和职能有所不同。

中国铁路的安全管理职能部门,是由铁道部安全监察司、铁路局和铁路分局安全监察室组成的三级机构监督检查安全工作,调查处理事故,参与制订安全法规,总结推广安全生产经验,以确保铁路运输安全。

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(沈庆衍 褚书铭)

B

baishi cheti keche

摆式车体客车(pendulum body car) 车体可以随运行时所通过的线路曲线半径和列车速度的变化作相应的侧向摆动,使作用在车体的离心力与其重力的分力达到平衡状态的客车。这种客车通常在高速列车中运用。

列车在曲线上运行时,由于离心力的作用,车辆向外会产生很大的侧向冲击,不但使旅客感到不适,还会使车辆发生倾斜、甚至有颠覆的危险。这种侧向力的大小与列车运行速度的平方成正比,与曲线半径成反比,由于限制了列车通过曲线时的速度。要克服这个问题,最好的办法是新修客运专线或彻底改造旧线,将曲线取直。但这样做投资大,周期长。因此,在利用既有线路并保留一定小半径曲线的条件下开行高速列车时,应考虑采用摆式车体客车。

发展概况 早在 20 世纪 30 年代美国就用摆式车体车辆进行了首次试验。在 50 年代和 60 年代,欧洲特别是法国、意大利、德国和英国也进行了一系列的试验。但投入商业运营则很晚。欧洲首次投入运营的是:1979 年由意大利制造的“Pendolino”列车和 1980 年在西班牙投入商业运营的“Talgo pendular”列车。进入 80 年代,摆式车体列车迅速发展,又有更多的列车投入运营。90 年代,欧洲的摆式车体列车已被视为“时尚”,并在六个国家(德国、西班牙、芬兰、意大利、瑞士和瑞典)运行,还有一些国家(克罗地亚、法国、挪威、波兰、葡萄牙、罗马尼亚、英国和捷克)计划采用。

意大利菲亚特公司于 1974 年试制出 ETR401 型摆式车体电力动车组,以后又陆续试制出 ETR450 型、ETR460 和 ETR480 型动车组用于罗马—佛罗伦萨高速线上,以后还计划用于新线上。客车车体的倾角为 8° ,通过曲线时的速度比一般列车能提高 20%,在直线上最高运行速度可达 250 km/h。瑞典 ABB 公司制造的 X2 型摆式车体动车组,1989 年用于斯德哥尔摩—哥德堡干线,最高运行速度为 200 km/h。更先进的 X2000 型摆式车体列车 1990 年投入运营。西班牙的 Talgo 型摆式车体列车用于西班牙的 11 条铁路线上,运行时速为 160 km,最高可达 200 km。德国是应用摆式车体列车最广泛的国家,凡开行时速达到 160~250 km 的旅客列车都采用摆式车体客车。计划 2000 年全德 6 600 km 的线路上将行驶新造摆式客车 120 列,成为欧洲拥有摆式车体列车最多的国家。中国第一条准高速铁路——广深铁路自 1994 年开通后,取得了较好的效益,为进一步提高广九线(广州—深圳—香港九龙)的运输能力和吸引力,广深铁路股份有限公司于 1998 年 4 月从瑞典 ABB 戴姆勒—奔驰交通公司引进了“新时

速”摆式车体列车(图 1),全列车总长(包括机车共 7 节) 165 m,列车总重 365 t,总座席数 415 个,最高运行时速 210 km,车体最大宽度 3 080 mm,车顶距轨面高度 4 300 mm,接触网电压 25 kV,最大持续功率 3 260 kW,采用再生制动、盘形制动和磁轨制动的组合制动方式。

图 1 “新时速”摆式列车

类型 按车体可倾摆的原理分为两类。

无源摆式系统 车体摆动的动力,来源于作用在车体上的离心力。其主要特点是不需要动力装置。如西班牙的 Talgo 摆式车体(图 2)的倾摆机构是带两根立柱的 U 形梁将两个自由轮装在一起,形成 Talgo 轮对(Talgo 意即轻型结构的关节连接式客车组),空气弹簧固定在两根钢柱的上端,悬挂装置大大高于重心,这样便得到了适当的倾摆力矩。当通过曲线时,空气弹簧根据车体的倾斜而变形,直到使离心力平衡。无源列车摆式系统具有结构简单,技术要求低,成本低,可靠性及可维修性好,但由于受摆动机构阻力的影响,其摆动幅度较小,一般为 $2^\circ\sim 5^\circ$ 。对离心加速度的补偿作用在 50% 以下,并有一定滞后作用。另外它的最大技术要求是摆动中心不能与摆动体的重心相重合,否则没有力臂,形不成力矩,因而也就不能实现摆动作用。同时,车体摆动时还会产生横向移动,使乘客感觉到有横向振动。

图 2 西班牙的 Talgo 摆式车体

有源摆式系统 它是靠外部动力强制车体倾斜,又称主动式摆式车体。如瑞典的 X2000 型摆式车体是依靠安放在二系悬挂之下的电液伺服机构来实现车体倾斜,倾斜角由安装在转向架上的加速度仪控制。加速度仪向倾摆机构提供的信号与转向架横向加速度成正比。由于该信号经过低通滤波器的处理,从而避免了由于钢轨不平顺而引起的假信号。为了使曲线运行速度能够提高 30%左右,则应抵消 70%~80%的横向加速度,车体最大倾斜角度达到 6°5',列车最大倾斜速率

控制在 4°/s,其舒适度水平可与普通旅客列车相同。由于有源摆式系统需要有驱动装置,所以需要有控制驱动装置的信号采集和信号转换系统。因此,与无源摆式系统相比,结构较为复杂,技术要求高,维修和运用成本相对较高。其优点是摆动中心与摆动体重心比较接近,甚至相互重合,因此在摆动过程中几乎不产生横向移动,对轮机安全性没有影响,对补偿作用不产生滞后影响。

世界主要国家的摆式车体列车

铁路名称	摆式车体类型	列车编组内容	制造年份	电 流制式	机车功率(kW)	定员	最大轴重(t)	最高运行速度(km/h)	最大倾摆角(°)	倾摆系统	最大允许欠超高(mm)
瑞典铁路公司	X2000	$M + 5R + R_c$	1990~1996	15 kV	4 000	331	17.5	200	8	液压	245
捷克铁路	S680	$M + R + M + R + M + R + M$		3 - 15 - 25	4 000	359	13.5	230	8	液压	
瑞士铁路公司	ICN2000	$M + M + R + R + R + M + M$	1999~2000	15 kV	5 200	465	15	200	8	电动	
德国铁路公司	VT605	$M + M + M + M$	1999~2000	DE	2 240	195	14.5	200	8	电动	300
意大利铁路公司	ETR480	$M + M + R + R + M + M + R + M + M$	1997~1998	3~25 kV	6 000	480	14.5	250	8	液压	275
西班牙铁路	Talgp	$L + nR$	1980~1998	E·D			17	220	3.5	自然式	282/245
法国国营铁路	TGV - P	$M + 8R + M$	1991~1998	1.5~25 kV	4 500	376	17	300	6.3	液压	260
芬兰国营铁路	S220	$M + M + R + R + M + M$	1995	25 kV	4 000	264	14.6	220	8	液压	255
澳大利亚昆士兰国营铁路	CAPRICORN	$M + R + M + M + R + M$	1998	25 kV		310	12	170	5	空气	
注: M = 动车 R = 拖车 R_c = 有司机室的拖车 L = 机车											

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(佟立本)

banzidong bise

半自动闭塞(semi-automatic block) 由人工办理行车联络手续,以出站信号机的开放显示作为行车凭证,列车出站压

上专用轨道电路,出站信号机即自动关闭,在列车到达对方站以前,两站的出站信号机都不能再次开放的闭塞方法。中国的半自动闭塞设备分单线用 64D 型和双线用 64F 型两种。

64D 型(单线用) 区间两端车站各设一台闭塞机,一段长度不少于 25 m 的专用轨道电路,以及出站信号机。三者之间以及两站的闭塞机间都有电气锁闭关系,如图所示。闭塞机包括两部分:一是操纵箱;二是继电器箱。操纵箱上有闭塞按钮 BSA、接车表示灯 JBD、发车表示灯 FBD、事故按钮 SGA 和计数器 JSQ 等,供车站值班员了解区间情况和办理闭塞用。车站出站信号机受本站闭塞机控制。专用轨道电路的作用为