



# 上海市沿江通道工程浦东段选线思路简介

虞振清

(上海市市政规划设计研究院, 上海 200031)

**摘要:** 上海市沿江通道工程对于构建浦东对外联系通道、优化公路集疏运体系、支撑国际航运中心建设有着积极的战略意义,是“十二五”期间上海市公路建设重点项目之一。沿江通道浦东段衔接了外高桥地区大量港区、保税区、物流堆场等重要设施,是实现通道整体功能的关键路段之一,而其沿线复杂的建设条件与敏感因素,又使之成为全线工程最大的难点之一。为此,浦东段方案从用地、交通功能、工程可实施性、敏感点处理、环境影响、社会稳定风险等多角度,先后对多条路线走向方案开展比选研究,并最终形成了沪通铁路线位、S20 外环南侧线位两大重点研究方案,为全线工程的推进奠定了基础。

**关键词:** 沿江通道; 浦东段; 外高桥; 选线

## 0 引言

上海市沿江通道规划为高速公路,北起 G1501 郊环(北环)江杨北路节点,经宝山吴淞圈围区域、炮台湾公园、浦东外高桥地区,南止于 G40 长江隧道五好沟立交,全长约 30 km,其两端分别与规划 S16 沪宜高速公路、G1501 郊环(东环)衔接,构成上海的沿江沿海大通道。沿江通道工程对于构建浦东与长三角间便捷的联系通道、优化上海国际航运中心集疏运通道有着重要的战略意义。同时,沿江通道工程可使郊环、外环在外高桥及吴淞地区实现彻底分离,能够极大改善外环隧道交通状况,并为其创造封闭大修条件。目前,上海市沿江通道工程已纳入《上海市城市道路、公路“十二五”规划》,其工程前期研究正处于加速推进的过程中。

沿江通道工程在预可阶段分为浦西段、越江段、浦东段。其中,浦西段总体采用既有 G1501 郊环线位新建沿江通道主线高架,越江段则采用盾构形式从吴淞圈围区域外穿越国际邮轮码头,并下穿炮台湾公园、黄浦江后于浦东滨江森林公园接地,与浦东段工程相接。

沿江通道工程浦东段主要位于外高桥地区,全长约 20 km,是本工程难度最大的路段之一。浦东段沿线基本为建成区,制约因素众多,主要有外高桥各港区、外高桥发电厂及沿线高压走廊(目前外高桥地区 S20 环内布设有 3 路 500 kV、4 路 220 kV 高压走廊,接入外高桥发电厂、二厂、三厂)、合流污水箱涵及竹园污水处理厂、外高桥保税区、规划沪通铁路及其车站货

场等。如何协调、处理好这些控制因素与沿江通道的关系,并使工程方案具备可行性,是确保沿江通道工程实现整体功能、发挥最大效益的关键和难点。

## 1 选线思路

服务上海国际航运中心建设、进一步强化构建外高桥港区的集疏运通道是沿江通道的重要功能之一。因此,如何将浦东段工程与港区紧密衔接是本次选线的关键。其次,外高桥地区现状已属高度城市化、高密度开发区域,如何协调建成区与高速公路选线之间诸如用地、交通、环境等方面的关系亦是难点。为此,结合区域现状与规划,从用地、交通功能、沿线敏感点、工程可实施性及投资等多角度,开展浦东段选线方案的比选研究。

### 1.1 用地

沿江通道工程浦东段基本位于外高桥地区,沿线码头、堆场密布,是上海最为重要的港口区域之一。由于沿江通道为新规划高速公路,原规划并未预留专用道路用地及红线,给选线工作制造了较大难度。因此,必须在结合现状及规划用地的基础上,本着集约化的思想,尽量减少线位对周边地块的影响,同时又能使沿江通道工程对区域产生较好的服务功能,做到双赢。

### 1.2 交通功能

沿江通道工程是外高桥港区对外集疏运体系中又一条重要的通道,其线位与日后功能的发挥息息相关。因此,其线位应能适应港区内外部交通衔接的需求,并为分流 S20 外环及外环隧道,有效整合区域集疏运通道资源发挥积极作用。

收稿日期:2011-05-31

### 1.3 工程可实施性

沿江通道浦东段长约 20 km, 所经区域限制条件众多, 工程可实施性势必成为选线工作的一大重点因素。此外, 可实施性对该工程交通功能的发挥同样起着互相牵制的作用。所以, 在进行选线的时候, 结合一定深度的可实施性研究是非常必要的。

#### 1.4 沿线敏感点

外高桥区域内有外高桥电厂、竹园污水处理厂、保税物流园区、外高桥烈士陵园等重要设施及建筑,另有河流污水箱涵、高压电力走廊、航油管道等重要管线、电缆等,亦是需要在选线时进行重点考虑的因素。其中,对部分重要设施及管线的搬迁或保护,应结合一定深度的可行性研究予以初步明确,以便研判选线方案的可实施性。

### 1.5 环境影响、社会稳定风险

外高桥地区主要分布有高桥镇、高东镇等生活社区,为避免日后环境影响、社会稳定风险等方面的矛盾,在选线阶段应当先期开展社会稳定风险评估的初步工作,结合风险源的识别,优化线路走向,尽量避免周边矛盾对日后工程实施的影响。

总体上看,采用 S20 外环线位具有服务港区便利的优势,但与电力、合流污水等控制因素存在大量的协调工作;采用与沪通铁路并线的线位具有通道资源集约的特点,但由于距港区相对较远,服务功能较弱,并且存在与铁路部门协调建设周期、运营管理等方面的问题。为此,在以上方案的基础上,选线工作进一步拓宽思路,对华东路、杨高北路线位亦做了比选研究。通过多方案比选,以期形成一个能够兼顾满足沿江通道功能、沿线控制条件、区域协调发展的线位。(各比选方案路线走向参见图 1)



图 1 上海市沿江通道工程浦东段总体选线方案比选图

## 2 选线方案

### 2.1 方案一：沪通铁路线位方案、方案二：S20 线位（南侧）方案

规划沪通铁路在浦东外高桥地区主要沿 S20 南侧—高桥港西侧—五洲大道北侧—G1501 东环东侧走线。为避让 S20 沿线外高桥发电厂、高压走廊、合流污水箱涵等众多制约因素,本工程方案一采用部分与沪通铁路并线的线位方案。越江段隧道~欧高路走线于 S20 外环南侧,自欧高路向南与沪通铁路并线。公铁并线段中的铁路敷设形式自北向南为 2.7 km 桥梁+4.16 km 地面+2.84 km 桥梁,沿江通道则以均以高架形式叠合于铁路上方,桥梁下部结构为公铁共用。公铁并线段至华东路西侧分离,沿江通道向南与五号沟立交顺接。

方案二则为了使沿江通道与外高桥地区各重要港区的紧密衔接,同时发挥沿江通道与 S20 的集疏运作用,选择采用 S20 线位。从交通功能角度看,该线位方案是较为理想的选择之一。该方案沿现状 S20 外环线南侧敷设高架或地面高速。为避让外高桥电厂出厂线,杨高北路~航津路段平行于现状 S20 南侧采用地面敷设形式。线位至五洲大道后转向东,同样与五号沟立交衔接。

方案比选:

方案一虽能避让 S20 沿线众多控制因素,但存在高架投影面局部侵入高桥保税区、高架主线距高东镇居住社区较近等问题,存在一定的社会稳定风险。且由于线位距离港区较远(约 1 km),因此其对港区的集疏运功能相对较弱。同时,方案一与沪通铁路并线虽能节省部分通道资源,但由于其路面标高较高,立交匝道放坡需占用相对较多的用地,因此其用地上的优势并不十分明显。方案二由于更靠近港区,因此其在立交出入口设置方面相对较优,但主要存在与沿线高压走廊间距过近的问题,局部路段平均间距仅 3~5 m,后经征询电力部门,该方案不具备可行性。

## 2.2 方案三:华东路线位方案、方案四:杨高北路线位方案

鉴于方案一、方案二均存在一定的不足之处,同时结合浦东新区相关部门的设想,又针对华东路线位、杨高北路线位方案展开了论证。

方案三主要沿 S20 外侧敷设线位,其中江东路~浦东北一路沿 S20 北侧新建主线高架,至张杨北路线位转入港华路走行并进入盾构隧道段,并向南依次下



穿高桥港、合流污水箱涵、高压走廊、竹园污水处理厂后转入华东路隧道接地,此后以高架形式走线于华东路并转接入五号沟立交。

方案四考虑利用杨高北路—五洲大道。为避让轨交6号线高架区间及其车站,该方案利用杨高北路东侧与保税区围墙间绿带敷设沿江通道主线高架,后向东转入五洲大道线位,并最终接入五号沟立交。

方案比选:

方案三为避让外高桥电厂、高压走廊、竹园污水厂等,需新建一段总长约6 km的盾构隧道,投资相对较大。其次,该线位为了避让外高桥发电厂、竹园污水处理厂,需两次往返于S20、港华路、华东路线位间,形成2段小半径S形曲线,对地块形成切割的同时,也造成了总体线形指标较差,不利于大型货运车辆的行驶安全。

方案四沿杨高北路基本穿越现有建成区,沿线东侧为外高桥保税区,其保税区域具有严格的封关要求;西侧为高桥镇区,沿路分布有大量居民住宅、酒店等建筑,对噪声环境的要求较高;杨高北路(港华路~洲海路)路中则敷设有轨道交通六号线高架及外高桥保税区北站、航津路站、外高桥保税区南站3个车站。该方案高架投影面已进入保税区封关区域,不能满足保税区方面的要求。同时,该线位距外高桥港区约1.5 km,无法设置直接服务港区,尤其是外高桥四~六期码头的出入口,这将制约沿江通道对港区及外环线货运压力的分流功能。此外,该线位距西侧居民区较近,相对其它选线方案将产生更为不利的环境、社会稳定等方面的影响,协调难度较大。

方案三、方案四为沿江通道工程外高桥地区的线位比选提供了更多参考,但受到功能发挥、工程可实施性、环境、社会稳定及用地等方面的制约,较S20外环线位、沪通铁路线位而言不具优势,现阶段尚不足以作为沿江通道工程浦东段理想的线位方案。

### 2.3 方案五:S20线位(中央)方案

经过前期大量的方案比选,以及进一步深入了解高压电力走廊、外高桥发电厂、合流污水箱涵等方面的详细控制条件后,我们又将浦东段方案深化聚焦于S20线位。

根据电力部门意见,高压线缆、铁塔包括出厂线均具备抬升的可行性。同时,根据上海市排水有限公司意见,新建结构物需与合流污水箱涵边缘保持3 m以上的净距,另据合流污水箱涵原设计单位意见,在技术上具备对现状合流污水透气井进行改建的可能。因

此,结合S20中央分隔带布置沿江通道主线高架,形成“高架+地面”复合型道路,在技术上具有可行性。

方案五总体线位为:自越江隧道接地点向南,沿江通道浦东段道路采用于S20中央分隔带及南侧辅道分幅布置高架的形式,其中外高桥发电厂~竹园污水处理厂段(沿S20方向长约1.5 km),沿江通道采用高架形式敷设于S20宽约28 m的中央分隔带中,本区段桥梁标准桥宽31.5 m,高架承台及桩基避让合流污水箱涵并与之保持3 m以上的净距,并对合流污水透气井进行改建或保护。外高桥发电厂4条220 kV高压出厂线、外高桥第二发电厂2条500 kV高压出厂线、外高桥第三发电厂1条500 kV高压出厂线及所涉及的高压铁塔需做升高,高架道路与高压走廊的间距能够满足相关电力规范的要求。经征询排水、电力相关部门的专业意见,该方案具备技术可行性。

此外,根据电力部门意见,为配合出厂高压线升高,建议涉及外高桥电厂段的主线高架采用节段桥梁技术,即采用架桥机施工,以准确控制施工高度。结合我国大陆、港台地区及国外大量的工程经验,以及节段桥梁技术的进一步大力推广应用,该方案的可行性能够得到进一步巩固。

综合集约用地、工程可实施性、交通功能保障、敏感点保护等多方面因素,方案一和方案五在总体上相对较优,具备在下阶段进行进一步深化比选的条件,应在可行性研究阶段重点聚焦。

### 3 结语

目前,上海市沿江通道工程已由市发改委批复立项,其浦东段工程中的公铁合建方案仍有待上海市与铁道部明确意见。受此因素制约,浦东段工程暂未形成推荐方案。但鉴于沪通铁路线位方案与S20线位方案在技术上均可行,且不影响浦西段、越江段的实施与衔接,可作为主要比选方案在工可编制阶段进一步深化研究。

随着城市经济及交通的进一步发展,现有路网设施逐渐不能满足需求,对现有路网进行立体化改善的需求将日益强烈。同时,伴随着城市化地区用地稀缺的加剧以及桥梁节段等工程技术的逐渐成熟,使“高架+地面”这类复合型、集约型道路受到越来越多的关注,具有广泛的应用前景。沿江通道工程浦东段的选线思路及方案,能够为其它相似工程的研究提供有价值的参考。

# SHANGHAI HIGHWAYS

No. 3. 2011(serial No. 121)

## CONTENTS

**Introduction to Mechanistic-Empirical Pavement Design Guide** ..... **CHEN Xingwei** (1)

**Abstract:** This paper introduces the Mechanistic-Empirical Pavement Design Guide (MEPDG) developed by the National Cooperative Highway Research Program (NCHRP) in the United States. The topics include: background of MEPDG, design procedure and inputs, material characteristics, flexible pavement analysis and performance prediction, and implementation of MEPDG. The information provided in this paper could be a reference for pavement engineers.

**Key words:** MEPDG; design inputs; material characteristics; Pavement performance

**Low Carbon Road in Shanghai Jiading New District** ..... **ZHENG Xiaoguang, HE Changxuan, CHEN Hongying** (8)

**Abstract:** According to implement low carbon city planning in Jiading new district, warm-mixing asphalt and drainage pavement, porous footway using steel slag, roadside greening carbon storage technique and automatic irrigation are designed and built in LINZE Road firstly, which can be as a demo project for further extensive popularization in Jiading new district.

**Key words:** Jiading New District; Low Carbon Road; Design; Building

**Key Technologies of High Performance Novachip Ultra-thin Wearing Layer** ..... **DING Wuyang, NI Wei, LIU Qiang** (13)

**Abstract:** As a representative high-performance ultra-thin wearing layer, Novachip is suitable for preventive maintenance of asphalt pavement due to good skid resistance, drainage, rapid construction and so on. Based on Nanjing Airport Expressway pavement repairing engineering, the requirements of raw materials including aggregate, asphalt binder and tack coat were described. The key procedure of Novachip design was researched which included grading, optimum asphalt content and the verification of performance, and the construction technology was discussed. The research results would provide reference for related engineering.

**Key words:** Ultra-thin wearing layer; Novachip; materials standard; mix design

**Application of Micro-surfacing on Xinfengjin Expressway Asphalt Pavement Treatment** ..... **FAN Qun, SUN Guangjun** (17)

**Abstract:** Micro-surfacing is widely used in Europe and America. Nowadays, it started to be applied in China and achieved success. This paper introduced the Micro-surfacing treatment project on Fengxinjin expressway and discussed its application condition and effect.

**Key words:** Micro-surfacing; blacktop treatment; highway

**Asphalt Pavement Initial Failure Analysis of One Heavy-loaded Municipal Express Road** ..... **CONG Lin, TAN Le, QIU Meng** (19)

**Abstract:** In view of the failure condition and structural characteristic of asphalt pavement of heavy-loaded express road in one city, measurement of thickness and compactness of asphalt surface layer, lab rutting test on field samples, uniaxial penetration test of asphalt core samples, compression strength test of lime-fly ash concrete were carried out. Some testing index results didn't satisfy the requirements of specification and design. Field investigation and test analysis show that lack of construction control in municipal road, low-temperature paving and poor compaction of asphalt concrete is the main cause of asphalt pavement serious initial failure under heavy-load traffic, which was a costly lesson to similar municipal road engineering.

**Key words:** Heavy-loaded express road; Asphalt pavement; Initial failure; Uniaxial penetration test

**Summary of Routine Selection for Shanghai Yanjiang (Pudong Section) Expressway** ..... **YU Zhenqing** (23)

**Abstract:** Shanghai Yanjiang Expressway has positive and strategic meanings for Pudong Area as an external transport corridor. It will optimize road transportation system, support the construction for the international shipping center of Shanghai, which is an important project of Shanghai Road construction in the "twelfth 5- year" planning. Yanjiang Expressway (Pudong section) connects

most of the ports, bonded area and logistic warehouse in Waigaoqiao area; it plays as one of the critical roles to integrate the function of the whole road system. But on the other hand, the complex of the construction and the sensitive elements involved forms the hardest part of the construction of the whole project. In order to solve above problems, Pudong Section project made lots of researches and comparison for different routines, the research focused on site selection, function of transportation, the possibility of the implementation of the project, how to solve the sensitive elements, environmental impact and the risk to society stability. Finally, we worked out Shanghai-Nantong Railway bond routine scheme and S20 South bond routine scheme, which were taken as the basis for the whole project.

**Key words:**Yanjiang Expressway; Pudong Section; Waigaoqiao Area; Routine selection

**Technical Characters of Continuous Composite Girder Structure ofShanghai Yangtze River Bridge ..... LU Yongcheng (26)**

**Abstract:**Composite Structure Bridge can extend the merits and make up the defect of steel and concrete, hich makes the design, construction and maintenance of the structure more reasonable and economical in the whole life cycle. These structures must play the important role for domestic bridge construction in the future. This article introduced the design and construction technical characters of the non-navigation 105m span continuous steel-concrete composite girder bridges.

**Key words:**composite structure; steel structure; concrete structure; pre-bending steel girder; support lift method

**Jacking-up Supporting Frame Design and Structural Safety Analysis for ExistingBridge of Hangshen Line ..... PENG Wei (29)**

**Abstract:**The jacking-up method is adopted to elevate the height of the bridge deck of the existing bridge of Hangshen Line in order to meet the need of waterway upgrading. The most complicated span combination unit was selected as an example in this paper, and the brief key points of design and construction for jacking-up supporting frame was introduced, especially focused on the loading conditions which needed to take into account, key construction stages, and analysis scope for structural safety analysis of the supporting frame. The comments and suggestion from analysis results can be technical supports for the design of this project and can aa reference for the similar projects.

**Key words:**bridge jacking-up; jacking-up frame; multi-purpose members; structural safety

**Analysis onArch-girder Combination Bridge with Concrete-filled Steel tube with ANSYS ..... YAN Yuwen (33)**

**Abstract:**To study the mechanical character of the arch-girder combination bridge with concrete-filled steel tube, including the overall bridge model, the partial model of arch and bending model of arch, finite-element hree finite element models are built for this type bridgeintroduced This paper introduced the mechanical behaviors of girder and arch,connectedthe stress of the steel connect slab and steel anchor box, and analyzed the buckling of arch. the bridge satisfiedspecifications,e strength of bridge satisfy the s cifications and the structure is safe. The instability of the arch will not happen.

**Key words:**ANSYS; concrete-filled steel tube; arch-girder combination bridge; finite element

**Key technology of disaster prevention and reduction for Shanghai Yangtze river highway tunnel project ..... HUANG Shaowen (37)**

**Abstract:**The technology of disaster prevention and reduction for Shanghai Yangtze river tunnel are introduced in this paper, which is the largest diameter with the longest distance one time tunneling by shield machine under water in the world. The seven key technologies include the disaster prevention technology during shield tunneling period, water supply and drainage, he system design about fire control, evacuation and rescue, energy conservation and emission reduction in lighting, hhigh-pressure water sure water cooling, passive fire prevention to building. All technologies are a linkage system during tunnel design, operation period and verification, which can be a reference for the similar projects.

**Key words:**Shanghai Yangtze river tunnel; disaster prevention and reduction technology; safety system

**Measuring control technology for 190m high pylon of a cable-stayed bridge in V-shape valley ..... BU Dongping , LI Yuhong (43)**

**Abstract:**The 190m high pylon of the cable-stayed bridge is the highest pylon located in the mountainous area in China, which is the main pylon of the Luo Ping cable-stayed bridge of the Shanghai-Chengdu Expressway. The site in the V-shape valley has a large temperature difference between day and night, which affect on the main pylon construction. he construction control survey is one of the key ttechnologiesfor the tower construction quality. ensure the construction for this high pylon, referred to the domestic research on the high pylon construction measurement technology, considered the specific situation, this paper summed up the measurement technology for cable-stayed bridge with high pylons in mothe mountainous rea , especially for the GPS differential positioning technology for cable theter. It can be a reference for the same type of bridge construction.

**Key words:**Measuring control; Three-dimensional coordinates; GPS differential positioning technology; Automatic laser collimator

**Practice on Cement Emulsification Asphalt Mixture ..... ZHANG Li (46)**

**Abstract:**Cement emulsification asphalt mixture is a new semi-flexible material between cement concrete and asphalt concrete. This