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# 高速公路环境评价与发展

ENVIRONMENTAL ASSESSMENT  
AND DEVELOPMENT OF  
EXPRESSWAY

程胜高 编著

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## 中文摘要

高速公路是现代化交通的重要组成部分，是衡量国民经济发展水平的重要标志。高速公路的建设不仅改善了我国公路网结构，提高了公路运输服务水平，改变了人们的思想观念，而且每建成一条高速公路都产生了巨大的经济和社会效益，促进了沿线地区的经济发展，以高速公路为依托的经济产业带正悄然形成。

我国第一批高速公路都是最需解决的交通“瓶颈”路段，因而带来的效益十分显著，加快高速公路建设的呼声很高。笔者从可持续发展的角度关注高速公路的建设，冷静分析高速公路建设如何走可持续发展之路？研究如何评价已建高速公路的社会经济效益与环境效益？系统、全面研究我国高速公路发展历程及其存在的诸多问题，探讨了高速公路建设项目的主要环境影响因素与评价技术与方法，及其应采取的环境保护措施与对策。本书以宜黄等高速公路建设对社会经济与环境的影响的研究为实例，充分运用实例调研分析及计算模拟法，采用定性与定量相结合的技术方法就以下几个问题作了深入探讨：（1）我国目前已通车的高速公路对环境的影响程度如何？（2）高速公路对区域经济可持续发展的贡献与作用如何？（3）高速公路自身持续性发展的影响因素如何？（4）如何建立高速公路项目的环境影响评价指标体系。

### 1. 高速公路生态环境评价的研究

目前，在高速公路的设计、施工和管理中越来越重视高速公路沿线的水土保持、绿化等生态环境保护措施，世界各国均在高速公路的设计、施工、使用、管理的各个过程中以不同形式加强了对生态环境影响的预防和保护。

（1）高速公路生态环境影响预测的内容与指标：①项目对区

域生态环境（主要包括对土地、生物、水资源等生态因子）的影响；②三级评价要对关键评价因子（如绿地、珍稀濒危物种、荒漠等）进行评价，二级评价要对所有重要评价因子均进行单项评价预测；一级评价除进行单项预测外，还要对区域性全方位的影响进行预测；③生态影响划分为：有利影响和不利影响，可逆影响和不可逆影响，近期影响和长期影响，一次影响与长期影响，明显影响与潜在影响，局部影响与区域影响；④要根据不同因子受开发建设影响在时间和空间上的表现和积累情况进行预测评估。

（2）高速公路建设项目的生态环境评价要点：高速公路生态评价范围按路线中轴线向外延 300~500m；评价重点包括线路施工和建成后使区域土地利用格局和地表土壤使用现状的改变，及因此而引发的生态环境问题；路线对动植物的迁移的阻断影响及由此而引发的生物多样性问题，以及水土流失、滑坡、塌方、泥石流、崩塌、地面沉降等不良地质地段对周边生态环境的影响；场站类由于人工建筑出现及人类活动强度加大对土地生产能力、绿地调节控制能力以及生物种群数量，内部异质化程度等的影响。

（3）高速公路生态环境保护措施有：土地利用的环境保护措施；生态系统的环境保护措施；因地制宜建设立体生态经济带。

## 2. 高速公路环境污染研究与评价

（1）高速公路环境污染及污染源分析：高速公路污染源的界定及主要污染类型；高速公路施工期与运营期环境污染分析。

（2）声环境影响评价：宜黄高速公路环境敏感点白天达标率为 82.4%，但夜间超标严重，噪声达标率仅为 33%，超标值达 1.2~11.6dB(A)。声环境预测结果表明：2000 年时全线白天在公路两侧 30m 范围以外达标，夜间在公路 50m 范围以外达标；2010 年时全线白天在 40m 范围以外达标，夜间在 70m 范围以外达标；2020 年时，全线白天在 50m 范围以外达标，夜间在 90m 范围以外达标。

（3）京津塘高速公路大气环境影响评价结论为：目前该高速公路大气环境质量良好，公路所经过地区大部分为农田，公路在施工及运营后需要注意重点采取环保措施的地点是城镇及居民稠密区，

只要切实落实各项环保措施,施工影响可以控制在较小的范围内,公路运营后距路边 100m 处,汽车尾气与扬尘对周围环境的影响已很小,从大气角度来考虑该项目建设是可行的。经过近 10 年高速公路的运营结果表明,该项目尚未对周围大气环境造成不良影响。

(4) 高速公路生活服务区废水采用环境保护措施后可以达标排放,不会造成水污染。

### 3. 高速公路环境地质评价

(1) 环境地质灾害的产生与防治:在高速公路建设中,由于土石方的大量开挖,破坏了岩土体的稳定性,以及高速公路两侧植被的分布,导致一系列的环境地质问题的产生,如崩塌、滑坡、泥石流、土壤侵蚀等,对公路环境质量造成一定程度的影响。因此,在高速公路的设计及施工过程中应作出相应的预防及治理措施。

(2) 土壤侵蚀对道路建设的影响分析:高速公路道路施工过程中的路基施工区,采石、取土及弃土堆放区是最易产生土壤侵蚀的地段。因此,道路建设必须重视水土保持。

(3) 高速公路建设的环境地质灾害及工程对策:公路工程建设及公路工程建筑物会以各种方式影响水陆生态环境,引发环境地质问题,导致环境地质灾害。因此在高速公路建设中,不仅要论证工程设施的可靠性和工程建设的经济效益,而且必须考虑和合理利用地质环境的问题,做到既能使公路工程建筑安全、经济、稳定,又能合理开发和保护地质环境。

(4) 高速公路地质灾害危险性的评估:其目的就是对拟建高速公路沿线,可能诱发地质灾害和工程建设本身可能遭受地质灾害的程度进行评估,对土地的适宜性作出评价,确保高速公路建成后安全、畅通运行,以最小的投资获得经济、社会及生态环境的最大效益。

### 4. 高速公路社会经济评价的研究

(1) 在区域经济-交通发展因果关系分析的基础上将宜黄高速公路的建设对区域社会经济的发展的作用分为:直接交通投资引入的直接投入效益、开发效益和产出效益,并建立系统动力学模型,

采用“有无”评价法分析了宜黄高速公路对区域发展所带来的社会经济效益。结果表明：宜黄高速公路社会经济效益显著，从通车到2005年，其社会经济效益将达到240亿元。

(2) 运用投入产出分析法对宜黄高速公路建设资金的投入效益分析表明：宜黄高速公路的建设直接带动了沿线建筑业、建筑材料生产、公路运输业等相关行业的增长，具有明显的拉动效益。

(3) 高速公路可使所连接的地区之间的运输时间大大缩短，从而节约旅客旅行时间，可以有更多的时间为社会创造更多的经济效益。

### 5. 高速公路建设与公众参与

(1) 公众参与的形式和调查原则：国际上通用的公众参与的两种类型是协商和参与；公众参与的调查原则一是调查对象构成要多样性，二是调查对象要有代表性，三是对调查区域总体实行随机调查。

(2) 高速公路建设公众参与的方式有两种：①建设单位和环保部门直接听取项目所在地人民代表、政协委员、群众、社会组织、学术团体或会代表的意见和建议；②项目所在地人大、政协或群众团体征询受影响地区公众的意见。

### 6. 高速公路的环境保护及环境监督管理

(1) 道路交通环境管理的任务与工作要求：道路交通部门环境管理以建设项目环境管理为主。其主要任务是执行国家有关的环境管理、环境保护的法规和制度，制定道路交通行业相应的规范、规定和实施细则，对因道路建设、营运给周围环境造成的污染、损害和影响采取环保对策，使道路交通建设与环境保护实现可持续发展。

(2) 高速公路建设的环境保护与设计：高速公路的设计应针对路线方案、设计和施工环节对环境的影响，注意保护和改善公路沿线的自然和社会环境。因高速公路建设与营运对沿线环境造成的破坏或污染，设计时应考虑采取措施加以防护。



## Abstract

### **ENVIRONMENTAL ASSESSMENT AND DEVELOPMENT OF EXPRESSWAY**

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Expressway, as an essential constitution of modern traffic, is an important symbol of the GDP level. The development of expressway has improved traffic net construction as well as enhanced efficiency of traffic. The existent expressway has accelerated the regional economy and brought great economical and social benefits. The industrial zones relying on the expressway are gradually formed.

The earliest expressway has been constructed to resolve the bottle neck problems of transportation, which brought a great benefit to regional soci-economy. So many people called for a fast development of expressway with great passion. Anyway, I'd like to consider this problem calmly with the thought of sustainable development, and try to resolve the problems such as how to get the expressway construction on the way of sustainable development and analysis the environmental benefit and soci-economic benefit. The development of expressway is researched in our country and the shortages of them is found systematically and synthetically. It is discussed that the appraisal technology and technique and the main factors that influence the



environment. In the book, study on what degree did the Yi-huang expressway and so on affect the soci-economic and environment is taken for example. By analyzing the example and using the computer simulation, the following problems will be discussed fully by qualitative and quantitative means: (1) What degree did the expressway construction impact on the environment? (2) What degree did the expressway contribute to the sustainable development to the regional soci-economic development? (3) Which factors affect the sustainable development of expressway itself, and how did them affect it? (4) How to establish the assessment index system of expressway construction sustainable development?

### **1. Study on eco-environmental assessment**

Nowadays, eco-environmental protection measures such as soil and water conserve, afforestation etc have been paid more and more concentration during the expressway designing, constructing and running time. Many countries have taken various ways to protect the eco-environment during different course of the expressway.

1) The contents and indexes of expressway environment assessment:

The first, how the project affect the regional ecological factors (such as green surface, species and water resource etc included)? The second, tertiary assessment must evaluate key assessment factors (such as green surface, race and endangered species, deserts etc); secondary assessment must evaluate all the important factors specially; primal assessment not only must evaluate all the important factors specially but also must forecast the regional influence wholly. The third, the impact on eco-environment can divide into: positive and negative effect; reversible and irreversible effect; short-term and long-term effect, one-off and extended effect; obvious and potential effect, local and regional effect. The forth, the changing and accumulating of various factor with the

expressway must be forecast and assessed.

2) The eco-environment assessment stress:

Form the axes to the extended forward 300—500m must be assessed in the expressway eco-environment assessment. the stress include: changing the pattern of the land using during the constructing and running time together some new problems brought by these, the biodiversity problem that caused by the freeway preventing the plant and animal from moving, the impact on the environment around the freeway because of solid and water loss, landslide, soil slip, debris flow, dilapidation and the impact caused by land subsidence, the land capacity production, the green surface capacity adjusting, the population of the species and the degree of inner transferring of the environment because of the construction and the running.

3) The measures are as followed; expressway eco-environment protection measures:

Those are the measures: protecting land utilization and ecosystem, and founding three-dimensional soci-economic zone by adjusting measures to local conditions.

## **2. The study and appraisal of expressway environment pollution**

1) Analyzing the pollution and pollution source of expressway environment:

This includes the identification of pollution sources and the type of dominating sources, analyzing the pollution during the constructing and running periods.

2) The evaluation of noise pollution:

The result of Yi-huang freeway site monitoring indicate that 82.4 percent of the sensitive receptors can meet the standard noise level, but at night only 33 percent can meet the standard noise level and exceed the standard by 1.2—11.6 dB(A). the model prediction results shows that

beyond 30 meters from the freeway can meet the daytime standard noise level, and 50 meter to meet night standard noise level in the year of 2000; in 2010, the critical distance of daytime is 40 meters and 70 meters at night; in 2020, the critical distance is 50 meters in daytime and 90 meters at night.

3) The evaluation of Jing-jin-tang freeway air pollution:

The site monitoring results indicated that the present air quality is very good. The freeway mostly is through croplands, so more attention must be paid to the towns and the great population areas. If the measures to protect the environment are carried out, the influence during the way constituting will be controlled within a smaller range. The exhaust air and dust caused by the cars impact less on the air beyond 100 meters. After 10-year transporting time, it can be concluded that the way has not do harm to the air environment.

4) The wastewater will meet the standard and not bring to water pollution on condition that protecting measures are taken in the expressway service areas.

### **3. Geo-environment assessment of expressway**

1) Why the geological disaster come into being and how to prevent and remedy it

The stability of rock-soil media and the distribution of vegetation in freeway both sides during the constructing period because much soil and rock has been moved, so many geo-environment problems such as dilapidation, land-slide, debris flow and soil erosion come into being. Those can affect the freeway environment to some degree. So relevant prevention and cure measures must been taken during the expressway designing and construction.

2) How the soil erosion impact on the freeway construction

The soil erosion can take place easily in those regions: the places we build the roadbed; the place we take the stone and soil and the place

we pile up the soil discarded. So, protection of water and soil must be focused on.

3) The geological disaster caused by freeway construction and countermeasure to prevent the disaster

The freeway construction and the timbering needed can affect the terraqueous ecosystem and cause some geological problems and bring to disasters. Hence, only the reliability and economic benefit of the project and the geo-environment are all taken into consideration during the construction period, can we insure that the geo-environment be protected and used reasonably with the building road safely, economically and steadily.

4) Evaluation of geological disaster criticality

The disaster、potential geological disaster and land applicability along the freeway must be evaluation before the freeway built to make sure that the way running smoothly and safely with minimum investment and maximum society and ecology benefit. That is the aim of the evaluation of geological disaster.

#### **4. Study of soci-economic assessment on expressway**

On the base of causality analysis of regional economy and transporting, the Yi-huang expressway's effect on regional economic development is divided into three parts, which are input benefit, out benefit and development benefit. We set the systematic dynamic model and use "yes or no" method to appraisal the Yi-huang freeway soc-economic. We can include that Yi-huang expressway has a signification soc-economic benefit, which goes sharply to 24 billion yuan from the expressway opening to the years of 2005 by means of "yes or no" assessment.

2) An analyzing results on input benefit of construction indicated that the construction of Yi.-huang expressway greatly derived the development of construction industry, construction material industry and transportation.

3) Expressway can shorten the transporting time between the cities to save the passenger, which can share more time to create other economic benefit for the society.

## **5. The construction of expressway and public participation**

1) The means and ways and principle of public participation

Consulting and participating in are used more by mostly countries in public participation. There are three principles we must abide by. The first, the informants must be various. The second, the informants must be representative, the last one, stochastic investigation must be taken in the area optionally.

2) There are two means of public participation: firstly, the building and the environment protect department accept directly the attitude and advice from local people present, office-bearer, public, social and academic organization and. Secondly, local office-bear or fork organization consult the people's opinion of the people those are affected by the expressway.

## **6. Environment protecting and monitoring**

1) The task and rule of traffic environment management

The traffic department's duty and rule on environment management: enforcing the relative national regulates on environment managing, protecting; establishing corresponding criterion, rule and detailed rules, giving some remediation measures to reduce the pollution, harm and influence caused by constructing the way.

2) The protection and design of expressway construction.

Pay attention to preserve and improve the nature and society environment along the road according to the blue print、 design and construction. Moreover the measures that is taken to prevent the society environment along the road from damaging and pollution must be taken into consideration.

## 内 容 简 介

本书以宜黄等高速公路建设对社会经济与环境影响的研究为实例,运用可持续发展的理论和方法,通过研究我国高速公路发展历程及其存在的诸多环境问题,提出了有利于高速公路可持续发展的建议。它是一部系统而简明地阐述高速公路的环境评价与可持续发展的专著。

全书共分八章,以丰富的高速公路环境监测数据与大量的国内外调查研究资料为基础,全面、系统、多层次地论述了高速公路的各种环境评价方法与技术,以及高速公路对区域经济可持续发展的贡献与作用。其内容涉及高速公路的发展概况、环境评价与可持续发展的理论及研究方法、高速公路的生态环境评价、高速公路环境污染研究与评价、高速公路环境地质评价、高速公路社会影响与可持续发展、高速公路建设与公众参与、高速公路的环境保护及环境管理等诸多方面。

本书内容广泛,资料丰富,方法先进,论述深入,既适合交通与环境专业工作者参考阅读,也适合本科生及研究生不同层次之需求,同时还可供公路建设项目管理与科技人员参考和应用。



**程胜高** 湖北人，1954年生，教授，博士。现为中国地质大学(武汉)环境评价研究所所长。编著有《环境统计学》《固定污染源排气实用监测方法与技术》《环境影响评价与环境规划》等专著与教材共6本。以第一作者公开发表学术论文40余篇，其中1篇被国际三大检索ISTP录入，在《地球科学》《上海环境科学》《环境保护》等核心期刊发表论文17篇，其中多篇被美国《化学文摘》录入。主持完成或正在进行的国家计委、交通部、国际合作等科研项目共29项。作为项目负责人主持完成的研究项目25项。其中有：(1)主持完成与美国斯坦福大学国际合作项目：湖北电力发展对温室气体排放的影响研究；(2)主持完成国家计委项目：石油化工设备与环境污染调研；(3)主持交通部西部交通建设重点科技攻关项目：公路施工场所污水排放标准的研究；(4)主持湖北省教育厅高校社科项目：创建生态环保型城市发展战略研究。所完成的项目获湖北省人民政府二等奖1项(排名第二)；获湖北省科技进步三等奖1项(排名第一)。独立指导硕士生或合作指导硕士生数十名。20多年来为本科生和研究生讲授《环境学导论》、《环境影响评价》《环境与健康》《环境保护与可持续发展》与《全球环境变化》等7门课程。现兼任国家环境保护总局环境影响评价技术评审专家库成员、中国环境科学学会高级会员、湖北省环保产业协会常务理事、湖北省环境学会环境评价专业委员会委员、《中国设备工程》杂志编委、《安全与环境工程》杂志编委等。



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