地理设计理论、方法与实践

GEODESIGN THEORY,TECHNOLOGY AND PRACTICE

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地理信息知识创新领导力培训

Geospatial Information, Knowledge and Innovation Leadership Training

框　架
FRAMEWORK

一、挑战 Challenge | 人地关系：人类生存与发展的永恒主题
Human Earth Relationship : The Eternal Theme of Human Survival and Development

二、应对 Countermeasures | 地理设计：应对复杂人地关系的系统性解决方案
Geodesign : A Systematic Solution to Complex Human Land Relationships

三、实践 Practice | 从方法到落地：地理设计的应用实践案例
From Method to Implementation : Application Practice Cases of Geodesign

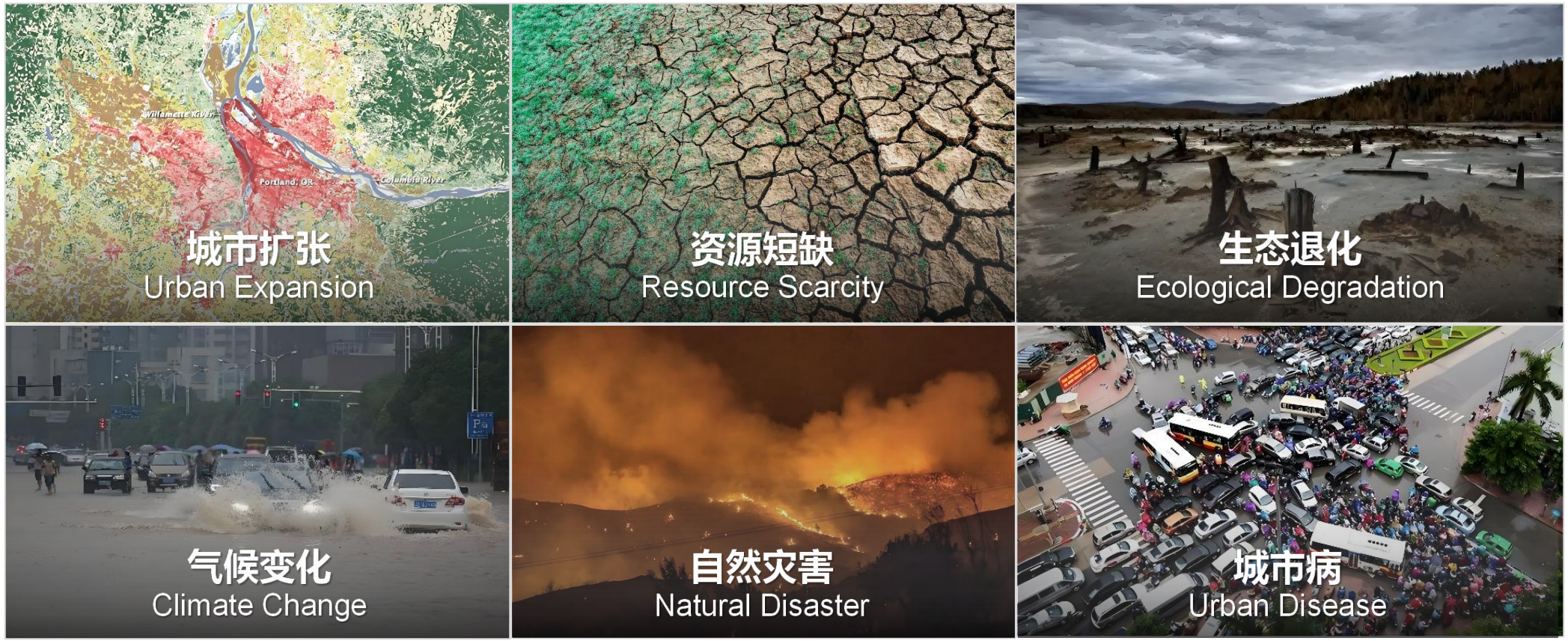
四、展望 Prospect | 地理设计的未来路径：从“人地协调”到“和谐共生”
The Future Path of Geodesign: From "Human-Environment Coordination" to "Harmonious Coexistence"

一、挑战 Challenge

人地关系：人类生存与发展的永恒主题

Human Earth Relationship：The Eternal Theme of Human Survival and Development

从全球化视角看人地关系：城市扩张、资源短缺、生态退化、灾害频发等系统性危机。
From a global perspective, the relationship between humans and the environment: systemic crises such as urban expansion, resource scarcity, ecological degradation, and frequent disasters



从全球化视角看人地关系：城市扩张、资源短缺、生态退化、灾害频发等系统性危机。
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城市化与土地占用 Urbanization and Land Occupation	2050年全球城市人口占比将达**68%，** 每年约**150万公顷**土地被城市吞噬 By 2050, the proportion of the global urban population will reach 68%, and approximately 1.5 million hectares of land will be consumed by cities each year.
资源短缺 Resource Scarcity	**40%**人口面临水资源短缺，全球约**8.28亿**人面临饥饿 Forty percent of the global population faces water scarcity, and approximately 828 million people worldwide suffer from hunger (FAO 2023).
生态退化 Ecological Degradation	近50年物种灭绝速度比自然状态快**100-1000倍**，24个重要生态系统中**15个**退化 The rate of species extinction over the past 50 years has been 100 to 1,000 times faster than in the natural state (IPBES 2019), and 15 out of 24 key ecosystem services have degraded.
气候变化与灾害 Climate change and disasters	2023年是最热年份（较工业化前高**1.45℃**），过去20年极端高温事件增加**46%** 2023 was the hottest year on record (1.45°C warmer than the pre-industrial period), and the number of extreme high-temperature events has increased by 46% over the past 20 years.

数据来源：联合国人居署《世界城市化展望2022》；联合国环境规划署（UNEP）；联合国《世界水资源开发报告2023》；联合国粮农组织（FAO）；政府间生物多样性与生态系统服务科学政策平台（IPBES）；世界气象组织（WMO）《2023年全球气候状况报告》

“人与自然和谐共生”是人类文明进步的根本遵循

The fundamental principle of human civilization progress is the harmonious coexistence between humans and nature

可持续发展
Sustainable development

1987年联合国世界环境与发展委员会（WCED）发布报告《我们共同的未来》，首次明确提出“可持续发展”概念，成为全球共识

人地协调论
Sustainable development

强调人类社会与地理环境相互依存、相互制约关系，主张通过合理调控人类活动，实现人-地动态平衡与协调发展

生态文明思想
Sustainable development

中国语境下对“可持续发展”的深化，聚焦生态系统的整体性保护与绿色转型

二、应对 Countermeasures

地理设计：应对复杂人地关系的系统性解决方案

Geodesign：A Systematic Solution to Complex Human Land Relationships

地理设计的概念
Concept of Geodesign

定义
Definition

以地理科学系统理论为指导
Guided by the theory of geographical science systems

以地理信息为基本支撑
Geographic information serves as the fundamental basis.

面向特定地理单元
Targeted at specific geographical units

集成“调查-分析-评估-模拟-设计-决策”于一体的方法论和实践框架
An integrated methodology and practical framework that incorporates investigation, analysis, assessment, simulation, design, and decision-making.

目标
Target

解决人地矛盾
Resolving the conflict between population and land

实现人地协调可持续发展
Achieving harmonious and sustainable development between people and land

提供科学、可操作的空间解决方案
Provide scientific, actionable spatial solutions

地理设计的概念
Concept of Geodesign

人本思想
Humanistic philosophy

主动协调人地关系，实现人地和谐共生与可持续发展

Actively coordinate the relationship between people and land to achieve harmonious coexistence and sustainable development.

因地制宜
Adapt to local conditions

尊重区域空间差异性和特色化发展的内在需求

Respect the inherent need for regional spatial diversity and distinctive development

信息挖掘
Information Mining

从数据中提取隐藏的时空模式、关联和知识，支撑科学决策

Extracting hidden spatio-temporal patterns, correlations and knowledge from data to support scientific decision-making

时空并重
Time and Space in Equal Measure

既关注空间格局合理性，又关注空间过程的变化与演进

It addresses both the rationality of spatial patterns and the shifts and evolution of spatial processes.

地理设计的技术体系
The Technical Framework of Geodesign

感知 Perception

地理设计数据库：地理设计的基础
Geographic Design Database: The Foundation of Geodesign

整合多源空间数据，通过标准化处理和集成，形成统一地理数据库，构成主要是地理空间数据、社会经济数据、行为地理数据
It integrates multi-source spatial data through standardized processing to establish a unified geographic database, comprising geospatial, socio-economic, and behavioral geographic data.

认知 Cognition

地理分析模型：地理设计的核心功能
Geographical Analysis Model: The Core Function of Geodesign

通过各种空间分析方法和模型，对地理环境进行分析和评估
Analysing and evaluating the geographical environment through various spatial analysis methods and models

决策 Decision

地理设计平台：地理设计的操作工具
Geographic Design Platform: Operational Tools for Geodesign

将数据和分析模型集成，提供一个直观、便捷的设计环境
Integrate data and analytical models to provide an intuitive, user-friendly design environment.

地理设计技术的演进
The Evolution of Geographical Design Techniques

AI等新技术的发展，驱动地理设计技术的演进
The advancement of new technologies such as AI is driving the evolution of geodesign techniques.

感知 Perception	**数据层** Data layer	**从静态数据库** From static databases	→	**多源时空大数据、物联网实时感知** Spatio-temporal big data, real-time IoT sensing
认知 Cognition	**模型层** Model layer	**从机理模型、统计模型** From mechanistic models, statistical models	→	**AI分析模型、时空智能体** AI models, intelligent agents
决策 Decision	**平台层** Platform layer	**从桌面工具** From the desktop tool	→	**数字孪生、云端协同** Digital Twins, Cloud Collaboration

三、实践 Practice

从方法到落地：地理设计的应用实践案例

From Method to Implementation: Application Practice Cases of Geodesign

重庆实践 Chongqing Practice

应用 Application	**国土空间规划** Territorial Spatial Planning	**生态保护修复** Ecological Conservation and Restoration	**城市治理** Urban governance	**重大基础设施全过程管理** Full Lifecycle Management of Major Infrastructure	...
平台 Digital Platform	**数字孪生系统** Digital Twin System	**云端协同设计平台** Cloud-based Collaborative Design Platform	**公众参与平台** Public Participation Platform		
模型 Model	**时空智能体** Spatio-Temporal Intelligent Agent	低空空域智能体	规划自然资源智能体	城市治理智能体	...
		工作流组装	提示词工程	知识库调优	功能调用	检索增强生成
	AI模型 AI Model	人地关系诊断模型	空间格局模拟模型	多目标优化决策模型	.....
数据 Data	**超大城市实景图** Megacity Real-View Image			**立体感知监测网** Stereoscopic Sensing and Monitoring Network	
	“天-空-地-水”集成化的时空数据库			实时/准实时的监测感知	

重庆地理设计技术演进 The Evolution of Geodesign Techniques in Chongqing

时空智能底座1.0到2.0
The spatial-temporal intelligent spatial base from version 1.0 to 2.0

从数据到信息到知识 From Data to Information to Knowledge

平台 PLATFORM

实景三维应用平台
Photorealistic 3D Modeling of Megacities

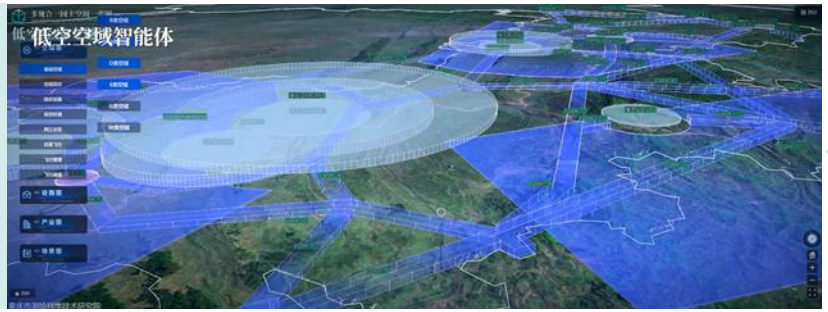
打造完整的时空信息采集、汇聚、存储、计算、服务、应用赋能链条

从“看”到“算”

模型 MODEL

时空智能模型库
Spatiotemporal Intelligent Model Repository

打造可识别-可计算-可模拟-可推演的时空智能体，涵盖低空空域、规划自然资源、城市治理等领域



可识别-可计算-可模拟-可推演时空智能体

数据 DATA

立体感知监测网
Spatial Sensing and Monitoring Network

以时空为纽带，立体感知城市脉络，构建天空地一体化感知网络，搭建“管-控-算-服”一体化感知云平台

以空间为纽带，立体感知城市脉络

1.国土空间规划领域 | 贯穿国土空间规划全过程

National spatial planning | Throughout the entire process of national spatial planning

国土空间规划阶段 National spatial planning stage	现状评估 Situation assessment	规划编制 Planning-making	实施监管 Implement supervision	调整优化 Optimization
地理设计技术赋能 Geodesign technology empowerment	➢ 整合多源数据 Integrate multi-source data ➢ “双评价” Double evaluation ➢ “三区三线”划定 Definition of "Three Zones and Three Lines"	➢ 多目标优化模型 Multi-objective optimization model ➢ 多方协同设计 Multi party collaborative design ➢ 多方案比选 Multiple options selection	➢ 遥感监测 Remote sensing monitoring ➢ 无人机巡检 Drone inspection ➢ 动态跟踪反馈 Dynamic tracking feedback	➢ 长期监测数据 Long term monitoring data ➢ 实施效果评估模型 Implementation Effect Evaluation Model ➢ 反向优化规划策略 Reverse optimization planning strategy

1.国土空间规划领域 | 重庆“两江四岸”规划设计

National spatial planning | Planning and Design of "Two Rivers and Four Banks" in Chongqing

核心挑战：如何平衡生态保护、公共活力、防洪安全与城市风貌？

Challenge: How to balance ecological protection, public vitality, flood control safety, and landscape?

- 生态空间碎片化
  Fragmentation of Ecological Space
- 空间利用低效与冲突
  Inefficiency and Conflict in Spatial Land Use
- 历史文化传承
  Weak historical and cultural continuity.
- 城市韧性风险凸显
  Rising risks to urban resilience.

重庆两江四岸核心区 Chongqing Two Rivers and Four Banks

1.国土空间规划领域 | 重庆“两江四岸”规划设计

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两江四岸规划统筹全流程管控 Two Rivers and Four Banks Planning: Coordinated Full-Process Management

地理设计方法的应用Applying Geodesign：

感知 Perception：

- 构建三维空间底座+专题数据
  Build 3D spatial base + thematic data
- 摸清现状+问题诊断
  Assess current conditions + diagnose issues

认知 Cognition：

- 统筹约束条件和要素
  Analyze constraints and factors
- 方案模拟与推演
  Simulate and test scenarios

决策 Decision：

- 方案比选 Compare and evaluate options
- 方案论证 Review and validate plans

1.国土空间规划领域 | 重庆“两江四岸”规划设计
National spatial planning | Planning and Design of "Two Rivers and Four Banks" in Chongqing

洪崖洞空间品质提升项目 Hongyadong Spatial Quality Enhancement Project Demonstration

五一期间：接待游客 **69.8 万**人次。
During the May Day Holiday: Received 698,000 tourist visits
国庆期间：接待游客 **105.9 万**人次。
During the National Day Holiday: Received 1,059,000 tourist visits

现状分析与问题诊断：
Current Issues & Analysis

- 人流车流混行导致体验感差
  Poor experience due to mixed pedestrian/vehicle flow
- 安全隐患
  Safety hazards
- 滨江路段人行道狭窄
  Narrow sidewalks along riverfront
- 桥下空间杂乱
  Cluttered space under bridge

1.国土空间规划领域 | 重庆“两江四岸”规划设计

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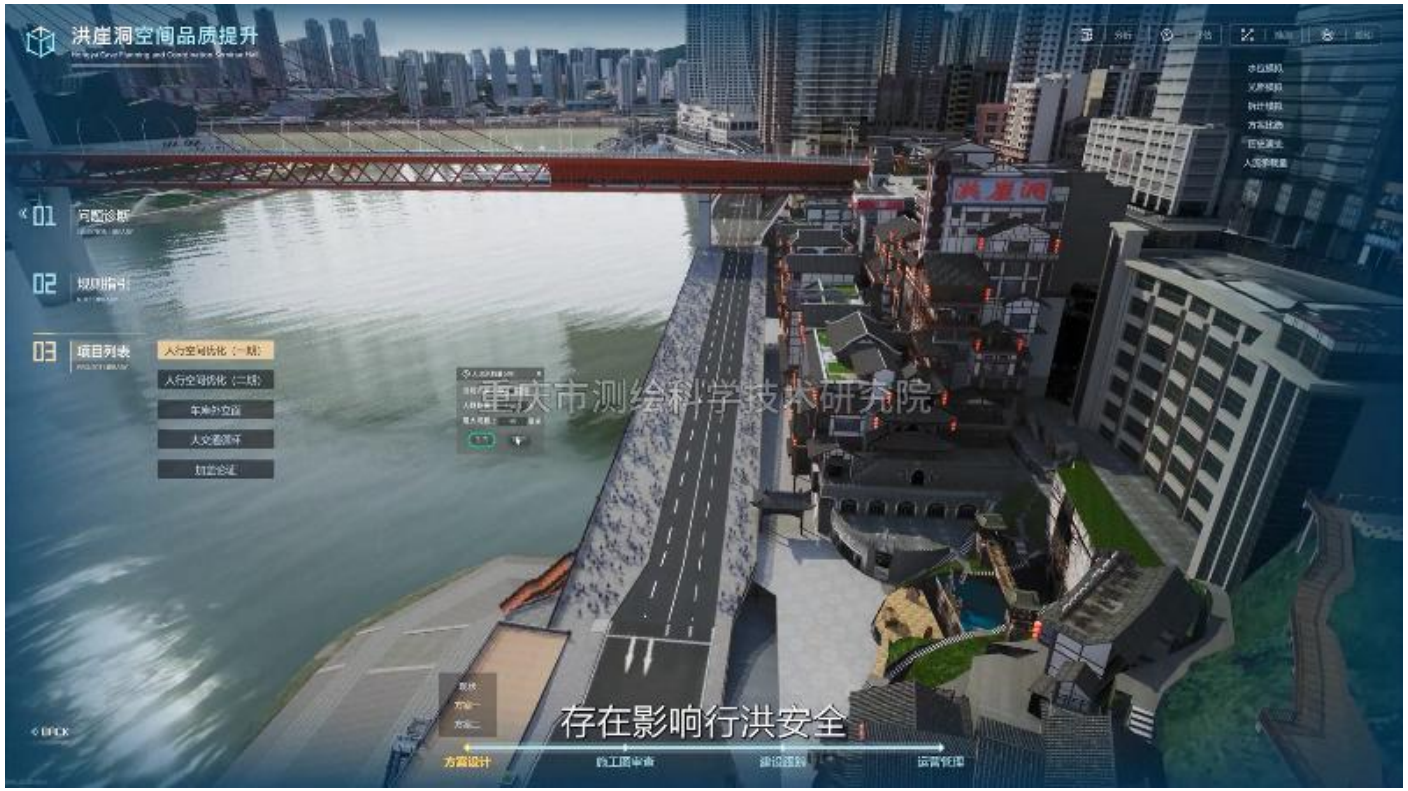

人行空间优化方案模拟：
Pedestrian Space Optimization Simulation

基于人流承载力分析，向河道方向扩展方案一：
Based on pedestrian capacity analysis, Riverfront Expansion Plan 1:

- 存在影响行洪安全
  It poses a risk to flood control safety.
- 结构安全等隐患
  structural safety hazards

1.国土空间规划领域 | 重庆“两江四岸”规划设计
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人行空间优化方案模拟：
Pedestrian Space Optimization Simulation

基于人流承载力分析，向河道方向扩展方案二：
Based on pedestrian capacity analysis, Riverfront Expansion Plan 2:

- 最终，采用将沿江一侧人行道从原来的2.5米宽增加至5.5米宽 Ultimately, the adopted measure is to widen the riverside sidewalk from the original 2.5m to 5.5m in width;
- 经测算，新增1485平方米观景空间
  Calculations show a total of 1,485 square meters of new viewing space.

1.国土空间规划领域 | 重庆“两江四岸”规划设计
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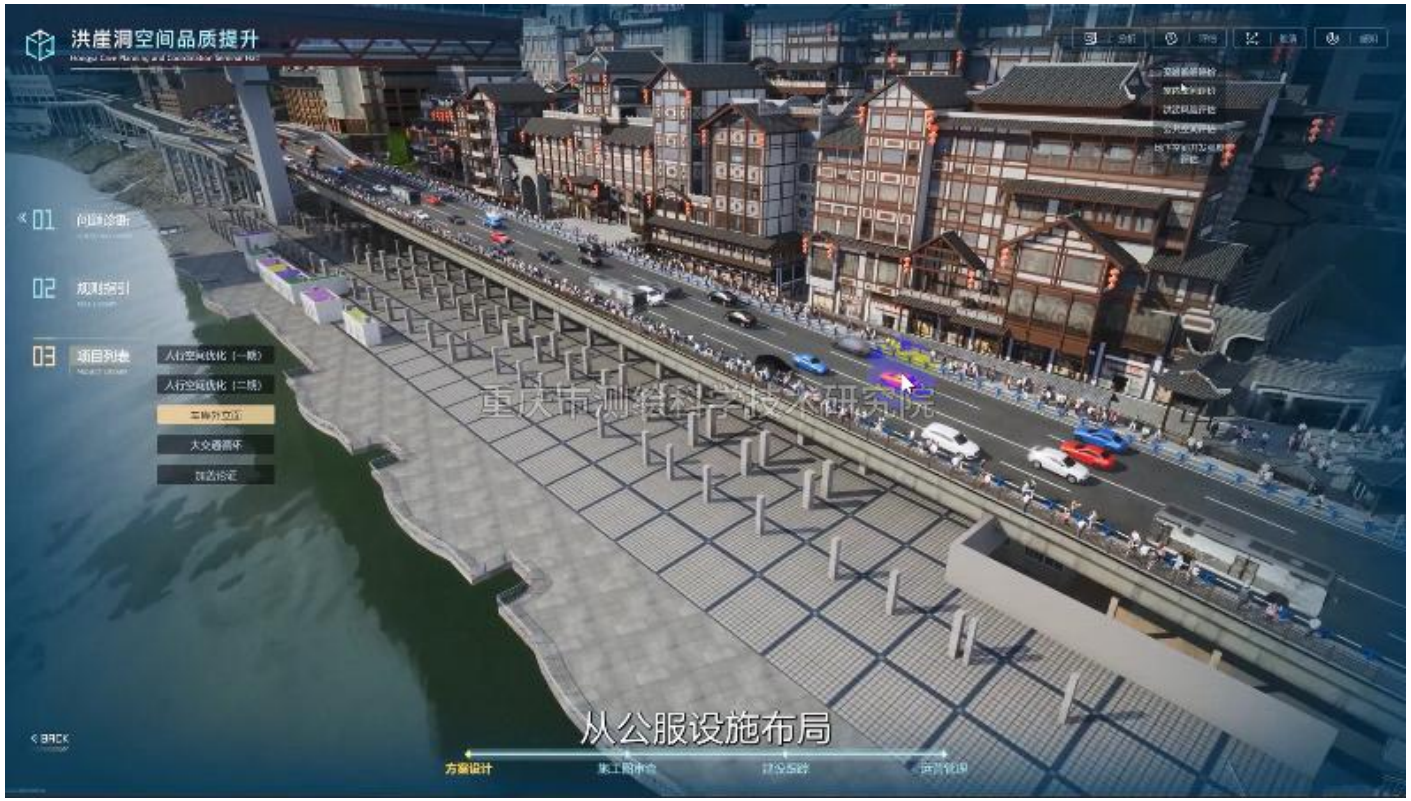


桥下空间提升方案论证：
Review of Under-Bridge Space Improvement Plan

桥下室内空间评价Evaluation of Indoor Under-Bridge Space：

- 从公共服务设施布局 Public service facility distribution
- 地上地下连通性 Above/below-ground connectivity
- 人行通道便捷度 Pedestrian passage convenience
- 风貌协调性等 Aesthetic coherence

管网布设合理性Rationality of Utility Pipeline Layout：

- 从管径、管线类型 Pipe diameter and pipeline type
- 与重点项目、公服设施衔接情况
  Connection to key projects and public facilities

1.国土空间规划领域 | 社区“一老一小”设施评估

National spatial planning | Assessment of Elderly Care Facilities & Educational Facilities for Children

需求与问题 Demand & Problems

- 公服设施配套不足、时序错位、空间错配，影响城市宜居性。
  Insufficient supporting, time sequence confusion, spatial dismatch in community facility construction.
- 与公众密切相关，但公众参规划与实施门槛较高。
  It closed to the public, but hard to participate in city’s planning and implementation.

实践思路 Practical Approach

- 践行“人民城市”理念，推动“15分钟高品质生活服务圈”建设，以“小切口” “微治理”服务“大民生” 。
  Construct People’s City need pushing forward ‘15-minute community life circles’ construction and serving the citizens through small tasks.
- 以“一老一小”设施为例，引入AI技术，构建高质量数据集，构建分析评估智能体，解决可视化呈现，推动体检评估便捷化、智慧化、动态化。
  Improt artificial intelligient technology to dynamically assess the facilities for old people and children.

1.国土空间规划领域 | 社区“一老一小”设施评估

National spatial planning | Assessment of Elderly Care Facilities & Educational Facilities for Children

主要实践内容 Research Content

①构建高质量数据集
High-quality Dataset Construction

- **汇集多源数据：**包括控规、现状设施、道路交通等。

  Based on the Five DB to aggregate multi-source data: Regulatory Planning, Facilities, Road, etc.

- **构建知识图谱：**体现行政区、小区、设施、控规之间的空间关系和社会关系。

  Construct Knowledge Graph: The Relationships Between administrative districts, residential communities, facilities, and regulatory planning.

②构建分析评估智能体
Analysis and Evaluation Agent Construction

- **构建评估知识库**：综合空间布局、覆盖范围、规划时序、供需匹配等方面的相关知识信息。

  Construct Facility Evaluation Knowledge Base: include spatial layout, coverage scope, planning timeline, supply-demand matching, etc.

- **设计智能体工作流**：从“有没有、够不够、好不好、怎么办”四个方面设计评估方法。

  Design Agent Workflow: promt focused on existence, sufficiency, quality, solution.

③研发可视化系统
Visualization System Development

- **呈现方式**：图文表联动、自然语言问答、点击交互。

  Presentation methods: map-text-table linkage, natural language question answering, click interaction.

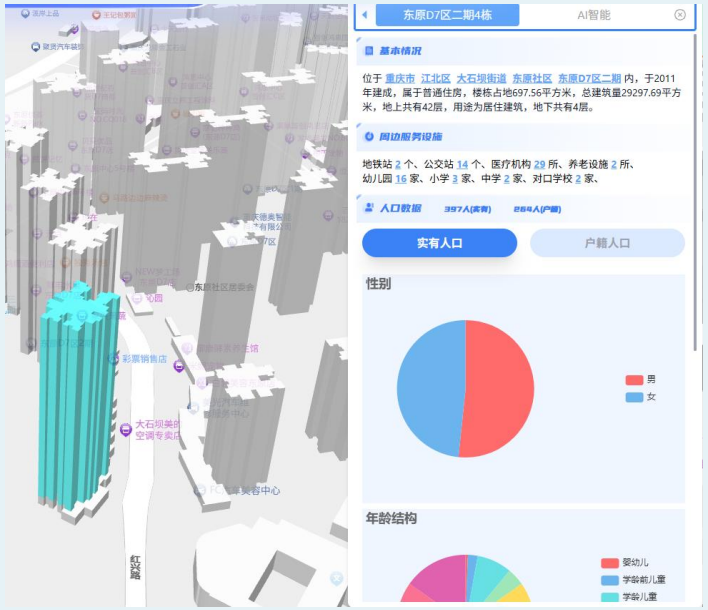
- **目的：**直观解读街道、小区、建筑楼栋三个层级的评估结果。

  Purpose: To intuitively interpret the evaluation results.

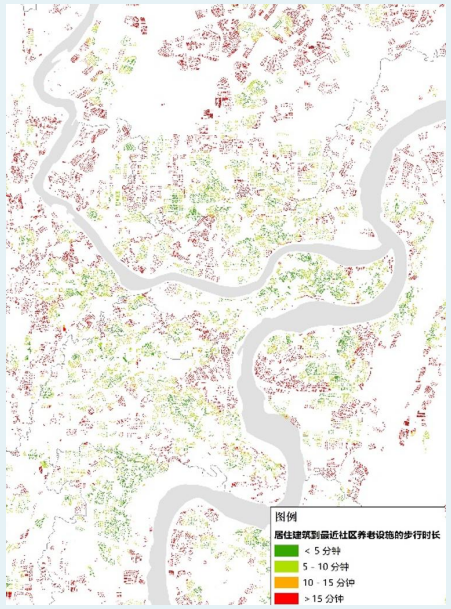
1.国土空间规划领域 | 社区“一老一小”设施评估

National spatial planning | Assessment of Elderly Care Facilities & Educational Facilities for Children

基于五库融合的高质量数据集建设 High-quality Dataset Construction Based on “Five Database Fusion”



五库融合数据
Five Database Fusion



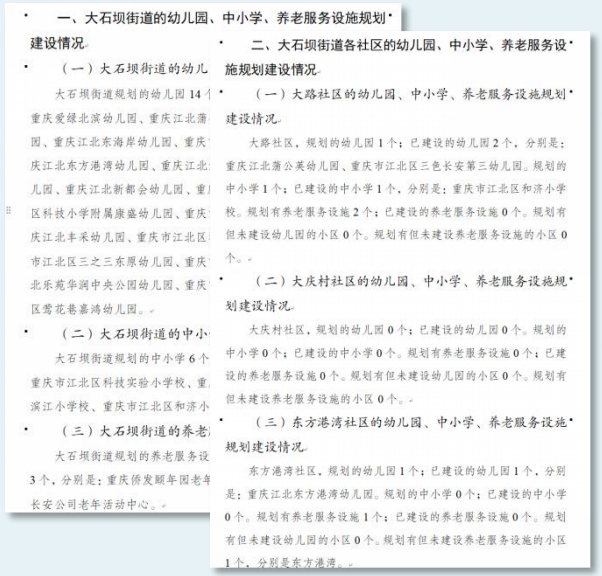
设施步行覆盖范围数据
Walking Coverage Data of Facilities

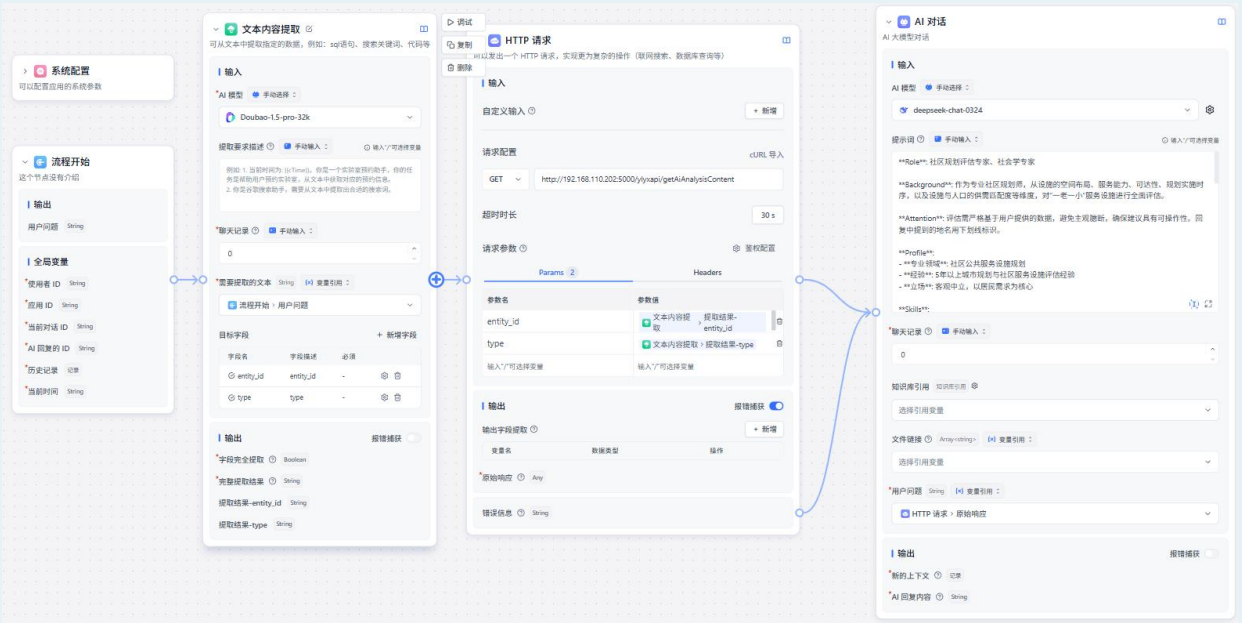
标准、政策文件
Standards and Policy Documents

1.国土空间规划领域｜社区“一老一小”设施评估

National spatial planning｜Assessment of Elderly Care Facilities & Educational Facilities for Children

构建“一老一小”评估智能体 High-quality Dataset Construction Based on “Five Fusion Database”





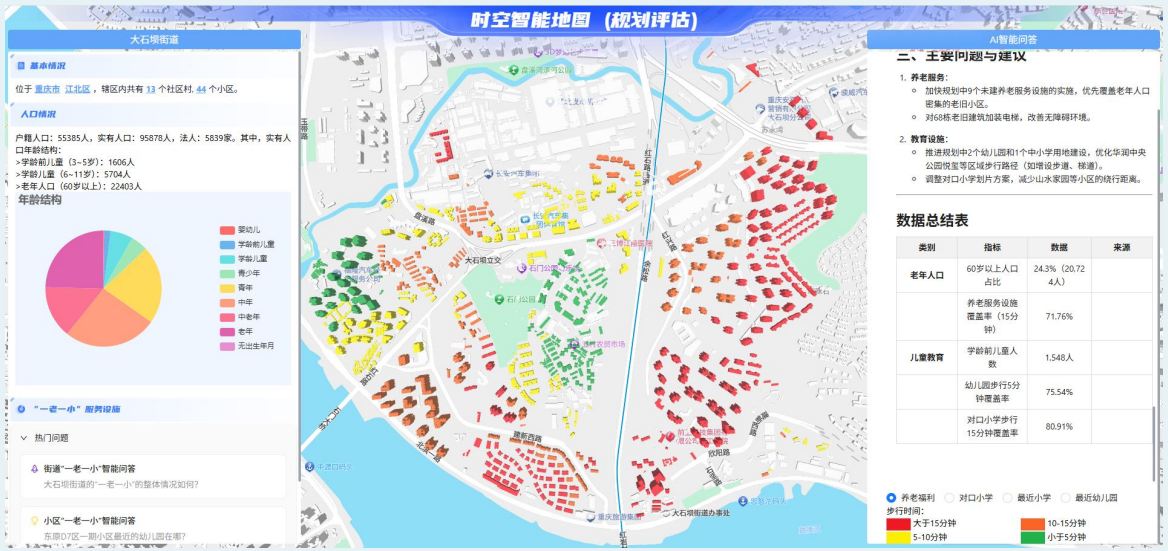
知识库 Knowledge Base　　智能体工作流设计 Workflow for Artificial Intelligent Agent

➢ **从社区“一老一小”设施“有没有、够不够、好不好、怎么办”四个方面，构架知识库，设计智能体工作流，实现语音、文字等多形式的便捷评估应用。**
When construct the knowledge base and design the workflow for Artificial Intelligent Agent，we fully focus on four aspects of the Elderly Care Facilities & Educational Facilities for Children. They are “have yet or not”,””enough or not”,”is that ok or not”,”how to improve”. After that , we could assess these facilities conveniently.

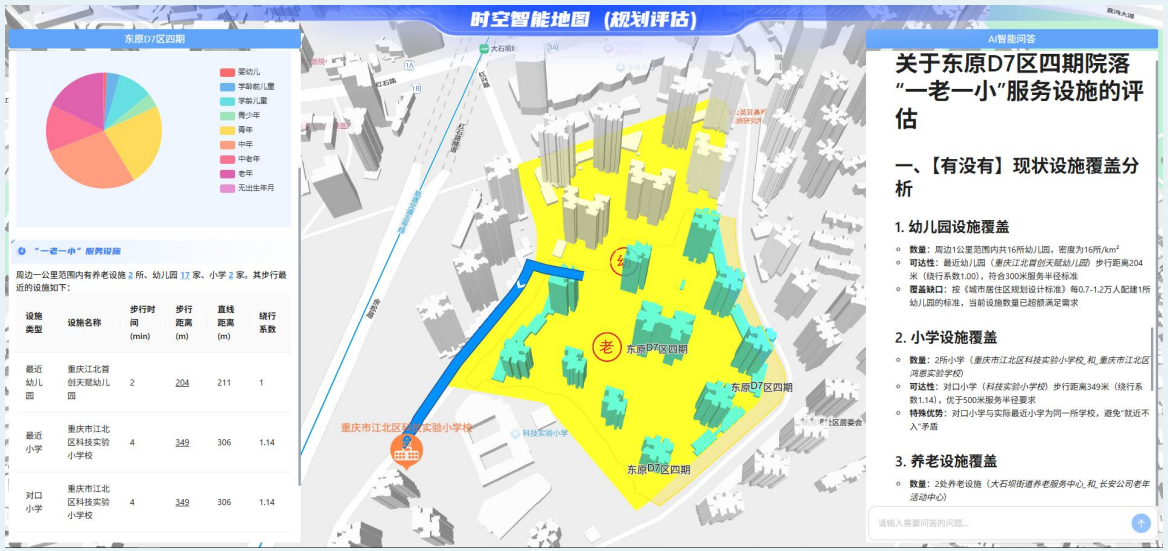
1.国土空间规划领域 | 社区“一老一小”设施评估

National spatial planning | Assessment of Elderly Care Facilities & Educational Facilities for Children

研发“一老一小”评估结果可视化系统 Visualization System for Assessment Results



街道“一老一小”服务设施的宏观分析评估结果
Results of Macro Assessment for Elderly Care Facilities & Educational Facilities for Children Base on town street



小区“一老一小”服务设施的微观分析评估结果
Results of Micro Assessment for Elderly Care Facilities & Educational Facilities for Children Base onCommunity

➢ **实现“图、文、表”动态联动，便于分析评估结果的直观性、易读性。为公众等非专业人士参与规划实施评估和社区治理提供了友好平台。**
With this visualization system, assessment results could be expressed in the form of graphics, tables and words. It is easier to understand by the non-professionals.

1.国土空间规划领域 | 巴南区精品民宿选址

National spatial planning | Site Selection for Boutique Homestay

需求与问题 Demand & Problems

- 精品民宿是乡村产业振兴的有效途径之一
  boutique homestays are a proven pathway to rural industrial revitalization.
- 适宜发展精品民宿的资源在哪里？开发利用符不符合规划和政策？
  which resources are available? where are they? and do they comply with planning policies?

实践思路 Practical Approach

- 平衡环境保护、资源（耕地、林地）保护和乡村产业振兴需求，发掘乡村自然之美，维系“人地”关系之和谐。
  Our aim is balancing environmental and resource conservation with the needs of rural industrial revitalization, to uncover rural natural beauty and sustain human-land harmony.
- 充分运用“地理信息+空间分析模型”，精准识别适宜发展高端民宿的特色资源。Leveraging geographic information and spatial analysis models to precisely identify unique resources suitable for boutique homestays.
- 坚持“底线思维”，在不破坏资源、符合规划前提下鼓励发展。
  Adhering to the bottom-line thinking,we encourage development that does not compromise resources and complies with planning requirements.

浙江经验：集群发展、新兴产业

The Zhejiang Model: Cluster-Based Development & Emerging Industries

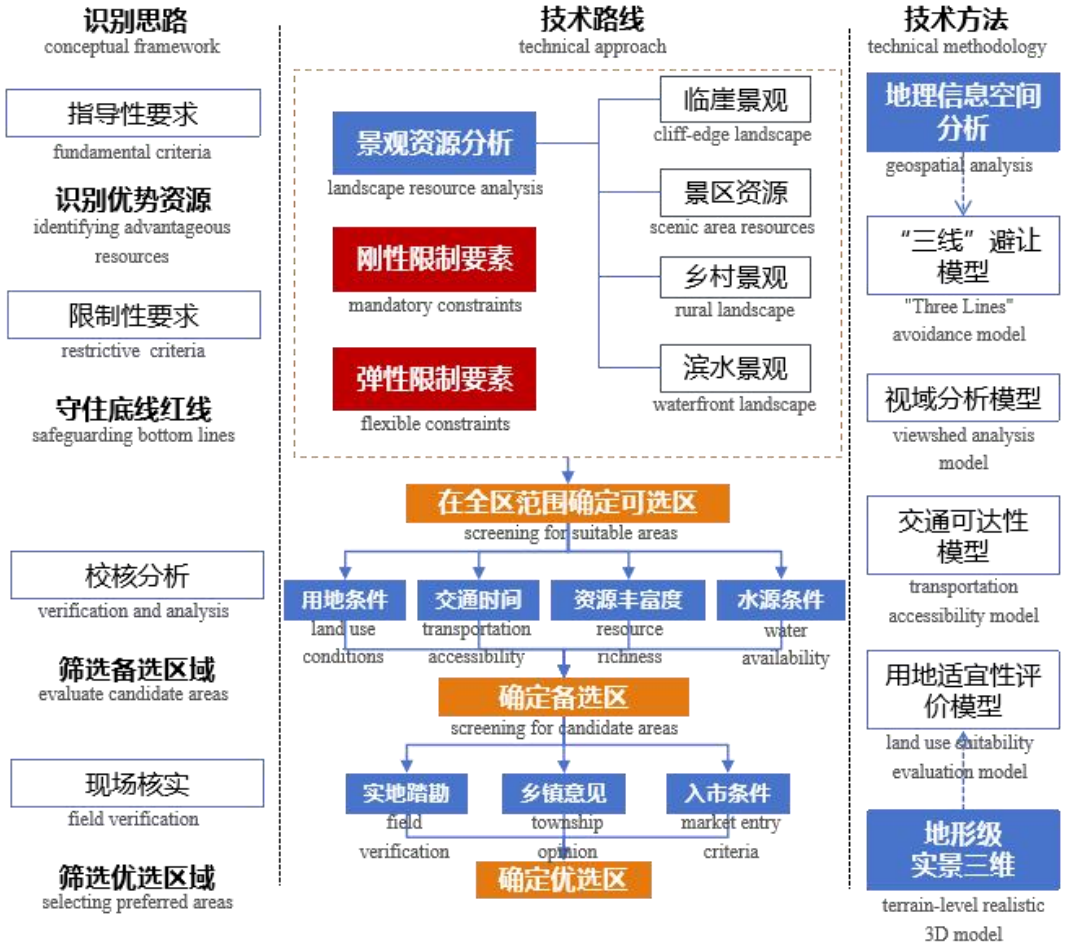
- 浙江：特色民宿遍布古镇、村落、高山和海岛
  Homestay are found across ancient towns, villages, high mountains, and coastal islands in Zhejiang.
- 德清：现有民宿近900家，直接从业人员超6000人，年接待游客890万人次，营收超30亿元。
  DeQing：Nearly 900 homestays currently available, providing 6000 jobs, annual reception 8.9million tourists and revenue exceeding 3 billion yuan.

1.国土空间规划领域 | 巴南区精品民宿选址

National spatial planning | Site Selection for Boutique Homestay

选址思路 Location selection approach

- **参考民宿选址指导性要求和发展条件，识别优势资源**
  With reference to homestay siting guidelines and core boutique development conditions, identify advantageous resources.
- **解读政策文件，确定选址限制性要求和底线要求**
  Interpret policies to determine restrictive and baseline site selection criteria.
- **分析备选区发展条件，选出资源优、条件好的地块**
  Evaluate candidate areas and select favorable areas based on development conditions.
- **结合规划，提出精品民宿发展空间格局**
  Develop spatial layout proposals for boutique homestays and integrate them with the Comprehensive Plan.
- **结合乡村用地政策，形成入市招商“一图一表”**
  Integrated with rural land-use policies, we have developed a "One Map, One Table" framework for market entry investment.



技术路线 Primary technical approach

地理信息知识创新领导力培训

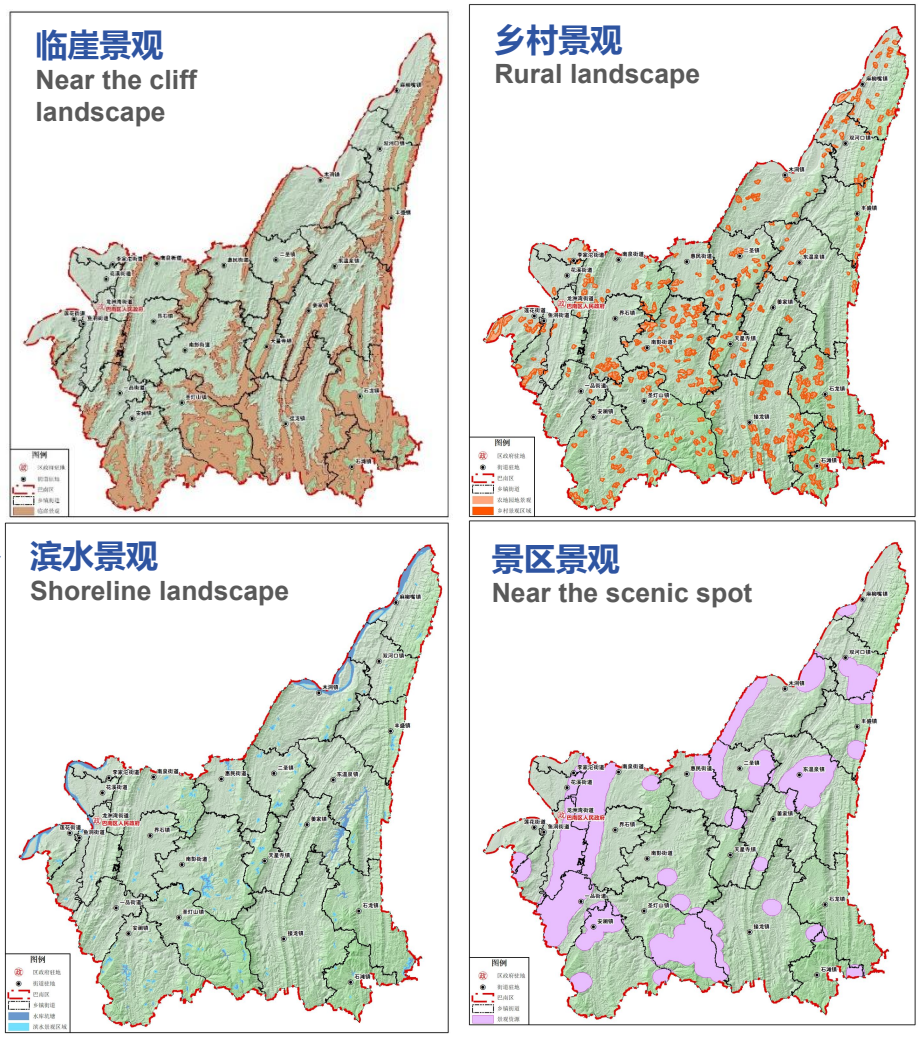
Geospatial Information, Knowledge and Innovation Leadership Training

1.国土空间规划领域 | 巴南区精品民宿选址

National spatial planning | Site Selection for Boutique Homestay

特色资源识别 Characteristic Resources Identification

类型 Type	识别因素 Analysis factor
临崖景观 Near the cliff landscape	• 视野开阔 Broad vision • 临近山崖 Near the cliff
乡村景观 Rural landscape	• 特色农田、园地（如梯田）Beautiful farmland like terraced field • 特色农房、田园生活氛围 Rural atmosphere
滨水景观 Shoreline landscape	• 临近水域 Hydrophilic space • 水质优良 Good water quality
景区资源 Near the scenic spot	• 周边有优质景区 National A or higher tourist attraction nearby • 和景区有便捷联通 Easy to arrive

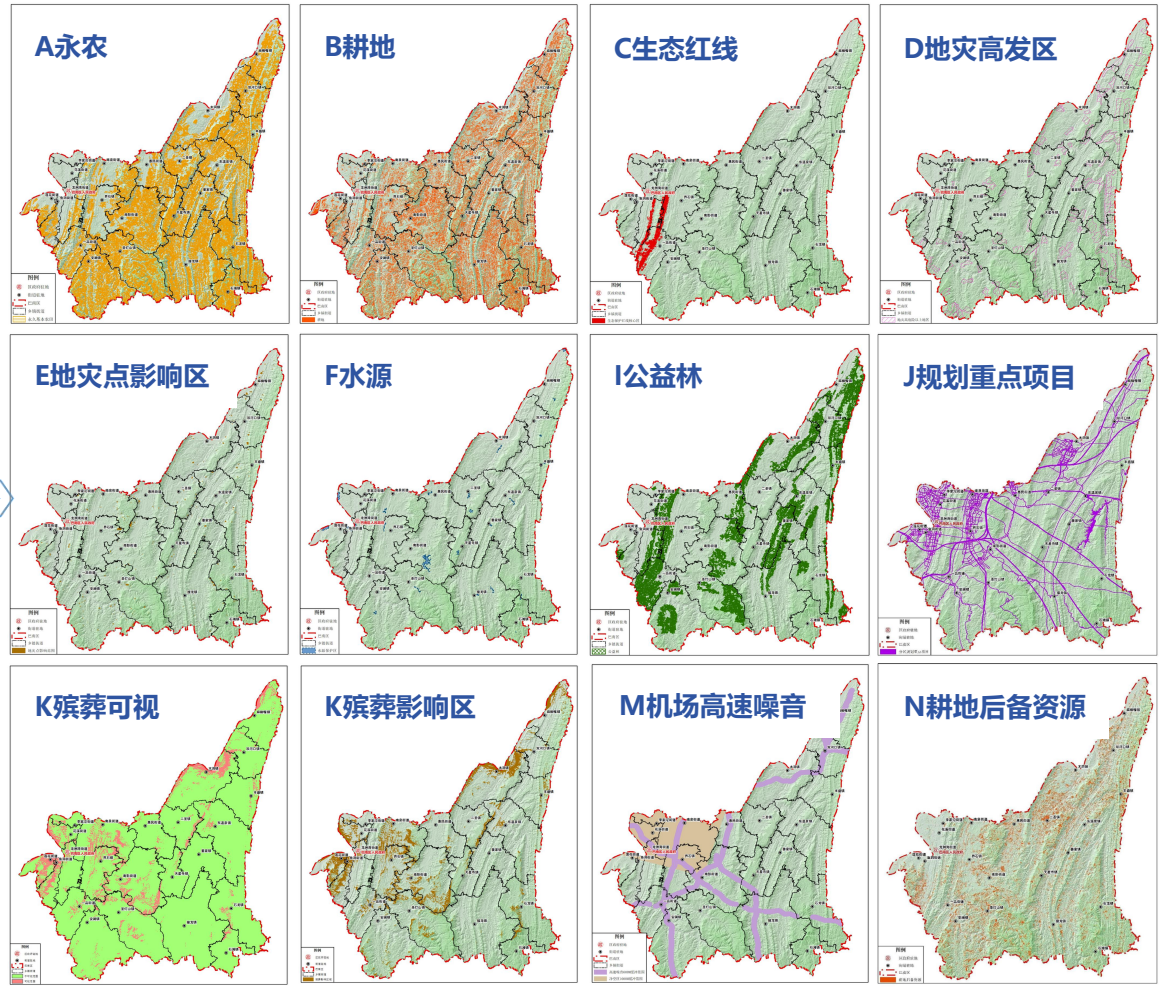


1.国土空间规划领域 | 巴南区精品民宿选址

National spatial planning | Site Selection for Boutique Homestay

限制要素分析 Restrictive Elements Analysis

类型 Type	要素内容 Analysis factor
刚性限制要素 Rigid restriction elements	A永久基本农田及补划图斑 Permanent basic farmland
	B耕地 Cultivated land
	C生态保护红线 Ecological Red Lines
	D地质灾害高危险区/极高危险区High-risk geological disaster prone areas
	E地灾点威胁范围 Threat range of geological disaster points
	F水源保护区 Water Conservation District
	G河道管理范围 River management
	H河流水库 Reservoir
	I公益林 Public welfare forest
	J分区规划重点项目 Planned Major Projects
弹性限制要素 Elastic restriction elements	K城镇开发边界 Delineated boundaries for urban development
	L墓地、殡葬等负面景观 Cemetery surrounding area
	M噪音等负面影响 Noisy area
	N耕地后备资源 Backup resources for cultivated land



1.国土空间规划领域 | 巴南区精品民宿选址

National spatial planning | Site Selection for Boutique Homestay

发展条件判别与布局 Characteristic Resources Identification & Layoout

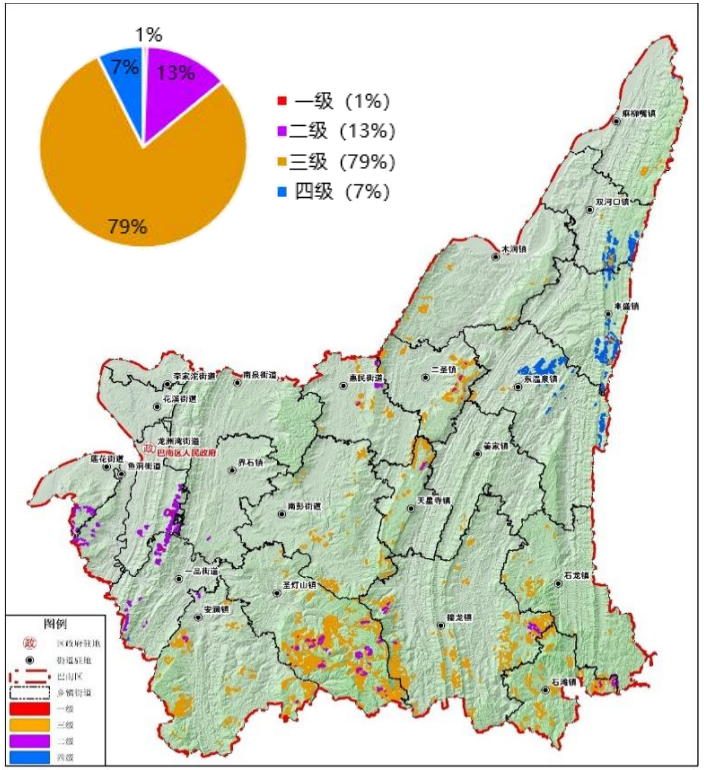
用地条件
Land use conditions

水源条件
Water source conditions

交通条件
Traffic conditions

村民意愿
Farmers' will

- 适宜发展地块398处，按条件划为四等
  Suitable development plot:398,divided to four classes.
- 兼顾集聚与民意，重点在二圣-惠民-天星寺沿线区域
  Balancing clustering and farmers'will, they are layouted in Ersheng, Huiming and Tianxingsi town.



综合发展条件
Comprehensive development conditions

发展布局
Development Layout

从方法到落地 | 地理设计的应用实践案例

From Method to Implementation | Application Practice Cases of Geodesign

1.国土空间规划领域 | 巴南区精品民宿选址

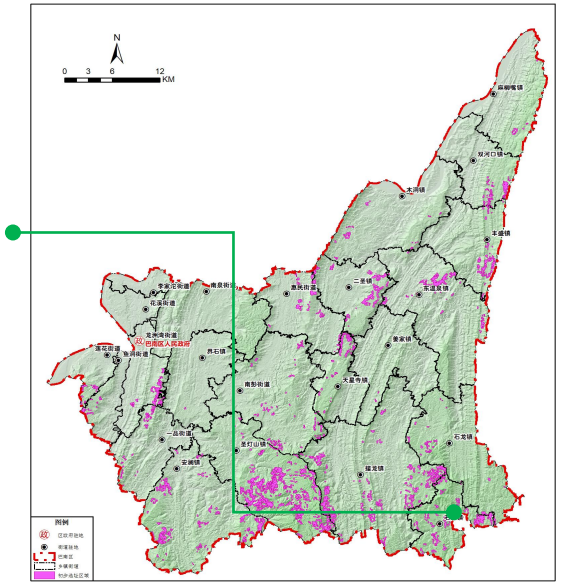
National spatial planning | Site Selection for Boutique Homestay

宣传推荐与入市 Promotion, Publicization & Enter the market

辅以地形级实景三维的地块推介信息

Recommended information expressed based on 3D real scene

地块位置：双寨村（Shuangzhai Village）
现状用地：林地（Wood Land）
交通条件：接龙互通30min、硬化村道
30-minute drive from Jielong intersection



地块位置图 Plot loction map

地块详情表 Plot detail form

类型		详情
地块区位		xx镇xx村
用地性质		商业用地
面积（公顷）		xx
容积率		1.5（根据地块条件明确容积率）
限高（米）		≤12（根据地块条件明确限高）
优势资源	交通条件	距xx互通约xx公里，地块周边有xx道路
	景观优势	位于xx山西侧，海拔约xx米，拥有临崖景观
	景区资源	距离xx景区约x公里

地块入市责任交办表 Task division form of plot entering the market

责任事项	责任单位	完成时限
论证地块规划条件	区规划自然资源局	xx年x月
地块宣传推广	区文旅委、巴洲产发集团	xx年x月
土地储备	巴洲产发集团	xx年x月
地块权属及入市意愿征集	相关镇街	xx年x月
农转用、土地流转相关手续办理	相关镇街	xx年x月

2.生态文明建设领域 | 贯穿生态保护修复全过程

Ecological civilization construction | Throughout the entire process of ecological protection and restoration

生态保护修复阶段 Ecological protection and restoration stage	现状诊断评估 Current diagnosis and evaluation	修复方案设计 Repair plan design	施工过程管控 Construction process control	后期成效监测 Post production effectiveness monitoring
地理设计技术赋能 Geodesign technology empowerment	➢ 生态本底调查 Ecological background investigation ➢ 生态退化识别 Ecological degradation identification ➢ 生态问题溯源 Tracing the origins of ecological issues	➢ 模拟不同方案生态效益、成本投入、长期稳定性 Simulate the ecological benefits, cost inputs, and long-term stability of different schemes	➢ 遥感+物联感知 Remote sensing+IoT perception ➢ 监测修复进度 Monitoring and repairing progress ➢ 动态适配调整 Dynamic adaptation adjustment	➢ 长期监测数据 Long term monitoring data ➢ 修复效果评估 Repair effect evaluation ➢ 生态价值追踪 Ecological Value Tracking

2.生态文明建设领域 | 土石方平衡

Ecological civilization construction | Earthwork balance

城市建设尤其是山地城市，深挖高切多，可用建设用地宝贵，实现土石方平衡历来是规划建设中的难题。
Urban construction, especially in mountainous cities, where there is extensive excavation and deep cutting, and available construction land is scarce, achieving earthwork balance has always been a major challenge in planning and construction.

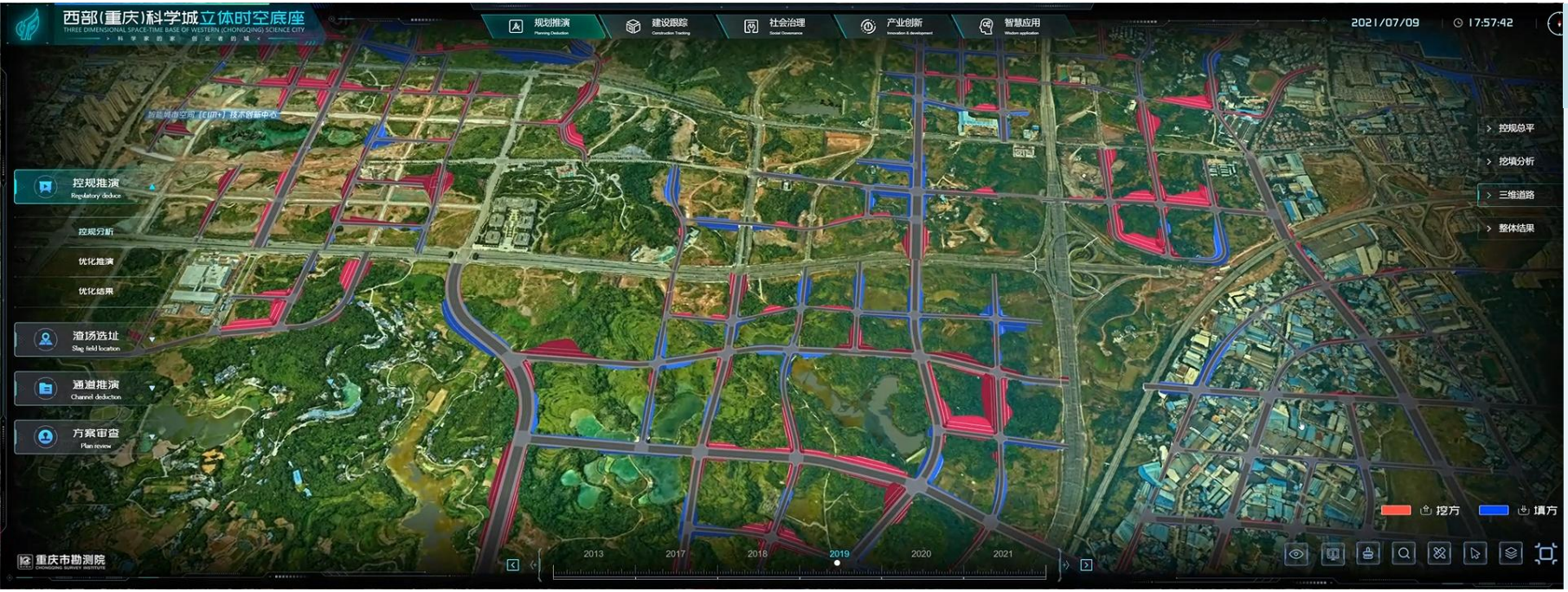
核心挑战：如何最小化开发项目中的挖填方量，减少对原地表的破坏和土方长距离运输?
Challenge: How to minimize the earthwork volume in large-scale development projects, reduce damage to the original ground surface, and cut down on long-distance transportation of earthwork?

2.生态文明建设领域 | 土石方平衡

Ecological civilization construction | Earthwork balance

高新区规划整体竖向优化：完成面积约**135.4 km²**的三维模拟，包括**492 km²** 道路和**666个**地块

Overall Vertical Optimization of High-Tech Zone Planning：Completed a 3D simulation covering approximately 135.4 km², including 492 km² of roads and 666 plots



现行控规三维模拟

Current detailed planning 3D simulation

- 路网标高自动化参数模拟

Automated parameter simulation of current detailed planning road network elevation

- 场地挖填分析

Analysis of excavation and filling of the current detailed planning site

- 三维道路土石方模拟

Current detailed planning 3D Road Earthwork Simulation

2.生态文明建设领域 | 土石方平衡
Ecological civilization construction | Earthwork balance

高新区规划整体竖向优化：完成面积约**135.4 km²**的三维模拟，包括**492 km²** 道路和**666个**地块

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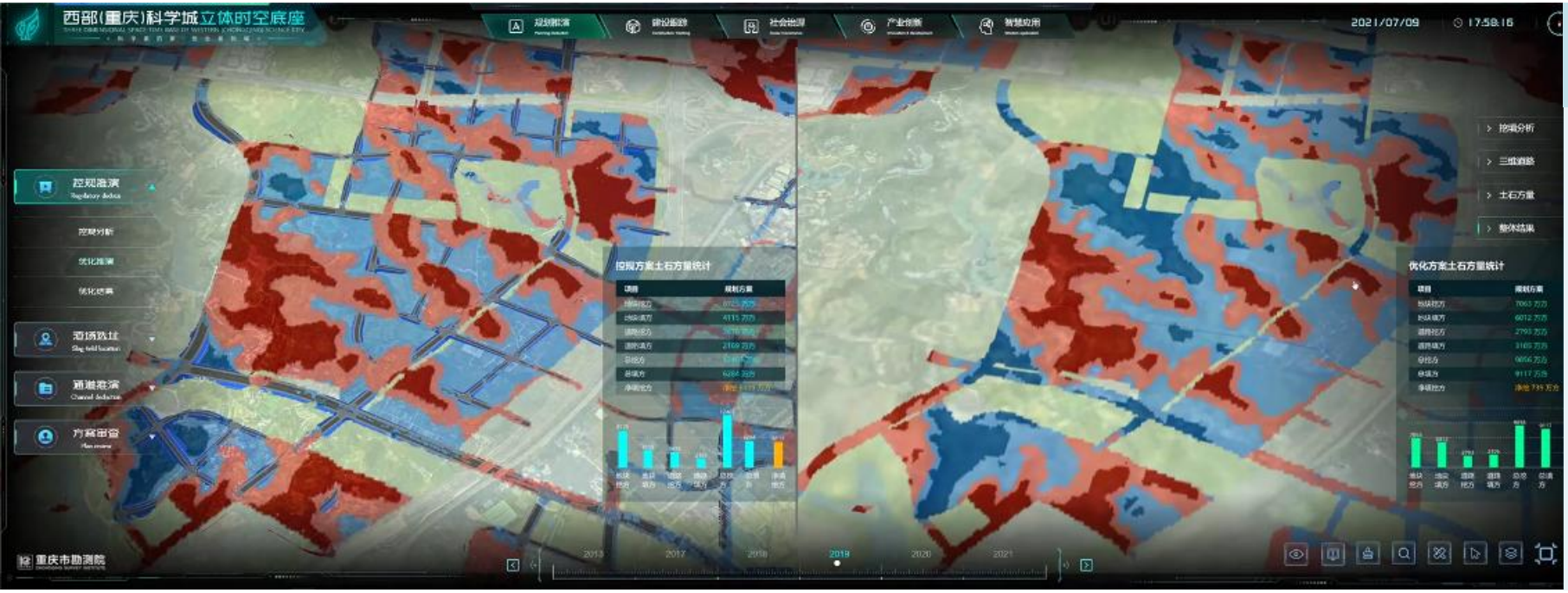


控规竖向优化推演
Current detailed planning 3D simulation

- 控规竖向标高优化调整 Detailed planning Vertical elevation optimization adjustment

298处道路竖向节点优化 | **10处**平面优化

- 优化前后土石方对比 Comparison of overall earthwork optimization

优化前：净挖**6119万方**
Before optimization: 61.19 million cubic meters

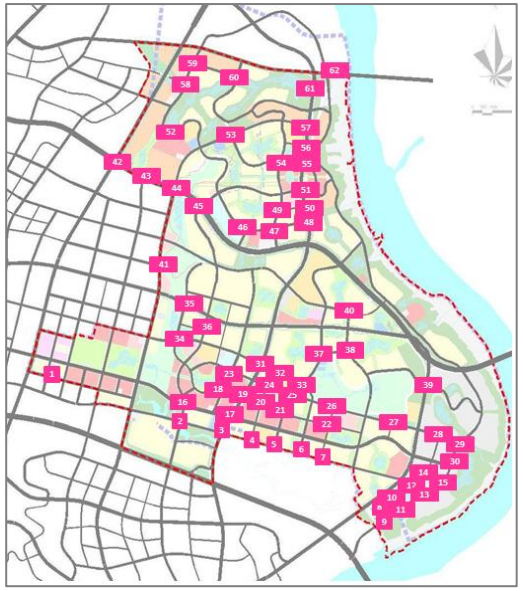
优化后：净挖: **739万方**
After optimization: 7.39 million cubic meters

2.生态文明建设领域 | 土石方平衡

Ecological civilization construction | Earthwork balance

北碚区蔡家半岛（13km²）

Caijia Peninsula, Beibei District (13km²)

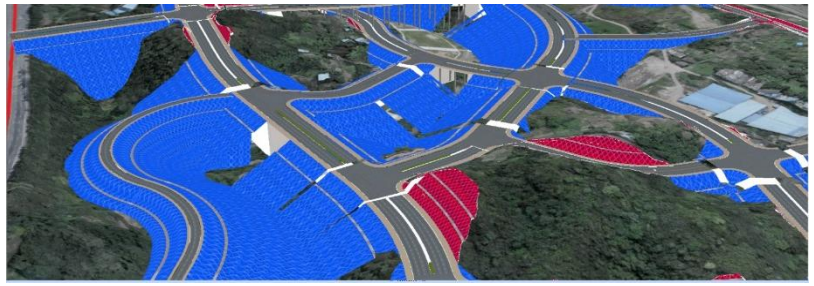


减少1000多万方土石方外运，基本实现片区土石方平衡
共计节约投资16亿元

We've cut earth and stone transportation by over 10 million cubic meters, achieving regional balance and saving 1.6 billion yuan in investment

江北区唐桂新城（8km²）

Tanggui New City, Jiangbei District (8km²)



原规划
Original planning

优化后
Optimized

节约投资总计约3亿元

The total investment saved is approximately 300 million yuan

2.生态文明建设领域 | 土石方平衡

Ecological civilization construction | Earthwork balance

在**40**多个城市片区，**20**多条交通廊道开展三维立体论证，节省造价近**200亿**元

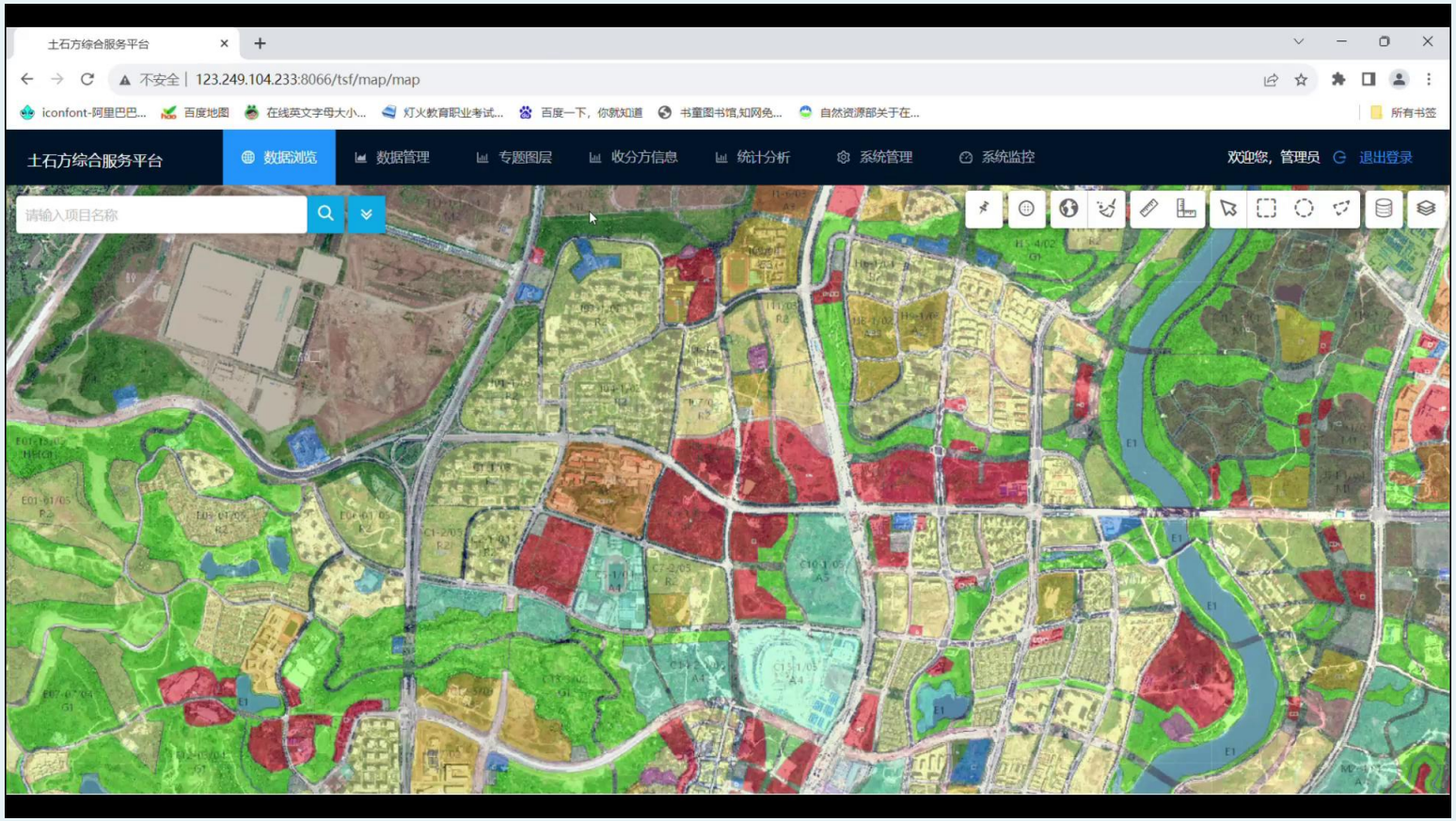
3D stereoscopic demonstrations in 40+ urban areas and 20+ transport corridors saved nearly 20 billion yuan

2.生态文明建设领域 | 土石方平衡

Ecological civilization construction | Earthwork balance

数字管理：建立土石方管理系统，服务场地管理、调运管理、信息统计等

Digital management: Establish an earthwork management system to serve site management, dispatch management, information statistics, etc



2.生态文明建设领域 | 人工智能赋能森林防火

Ecological civilization construction | AI Empower Forest Prevention

面临问题 Problems

- 重庆是长江上游重要生态屏障，森林保护任务重大
  As an important ecological barrier in the upper reaches of the Yangtze River, Chongqing faces significant forest conservation tasks.
- 重庆市林区总面积7000余万亩，森林防火压力较大
  Chongqing has a forest area of 70 million mu, facing significant pressure in forest fire prevention.

实践思路 Practices

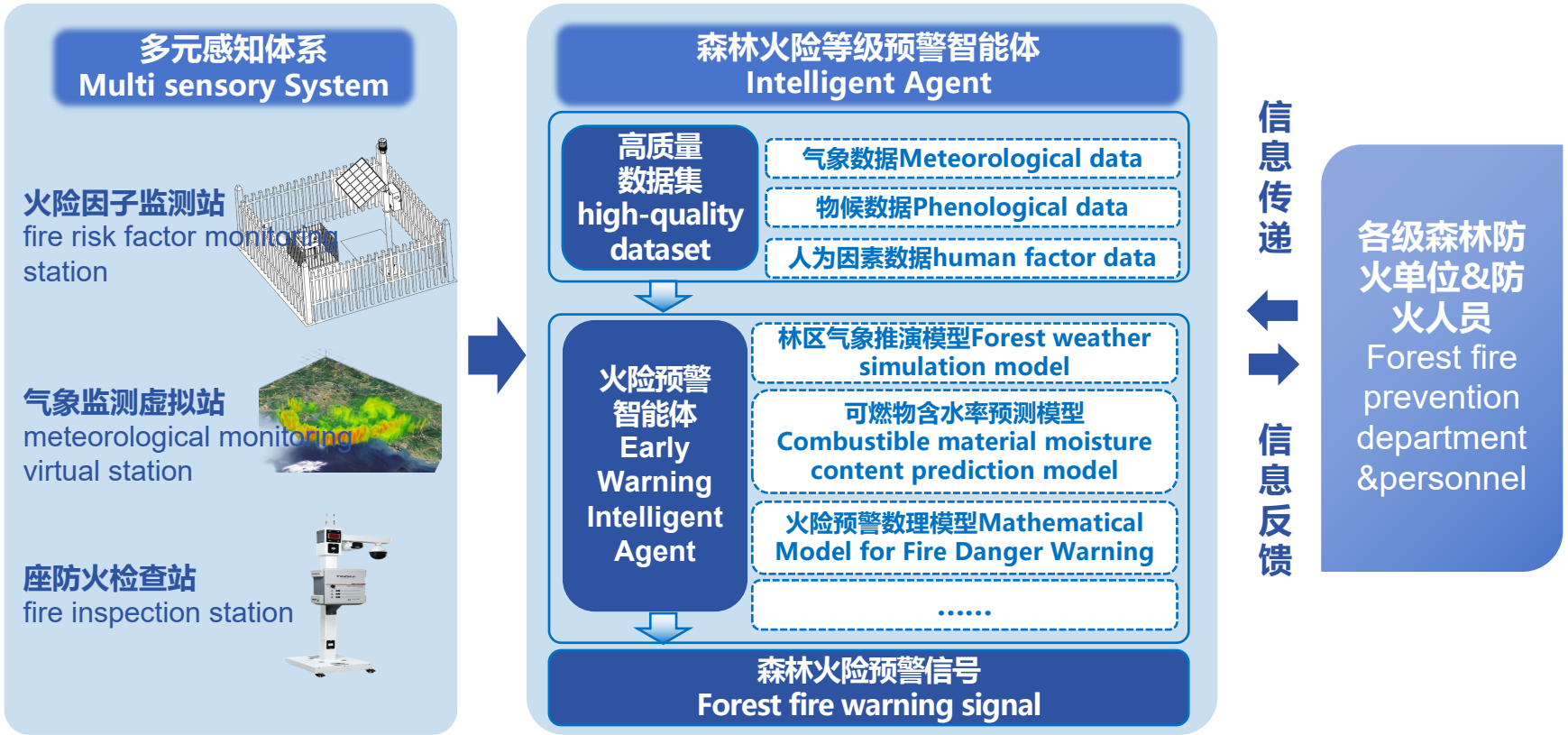
- 减少林火损失，加强森林调节气候、保持水土、维持生物多样性功能。
  Reduce forest fire losses to strengthen the multiple ecological functions of forests in regulating climate, conserving water and soil, and maintaining biodiversity.
- 运用时空地理信息+AI，综合引起森林火情的各类影响因素，形成自动识别预警能力，破解森林防火中人员投入多、预警慢、多方协同难问题。
  Using AI + spatiotemporal information, we address issues such as excessive manpower input, slow warning response, and difficulties in multi-party coordination.

2.生态文明建设领域 | 人工智能赋能森林防火

Ecological civilization construction | AI Empower Forest Prevention

契合自然地理特征的森林火险预警智能体

Forest Fire Danger Early Warning Intelligent Agent According to Geographical Features



- **通过感知设备，自动实时获取不同区域森林火情影响因素，包括气象、物候等数据**
  By sensing devices, we could retrieve influence data like Meteorological data, Phenological data autonamically, which closely related to forest fire.
- **研发契合重庆地理特征的林区气象推演模型、可燃物含水率模型等，实现火险精准预警**
  Accordint to local Geographical features, we develop forest weather simulation model, Combustible material moisture content prediction model etc. to precisely early warning forest fire.
- **协调各级单位和人员**
  Collaborative work among forest fire prevention department &personnel

2.生态文明建设领域 | 人工智能赋能森林防火

Ecological civilization construction | AI Empower Forest Prevention

赋能精准快速预警的森林火情监测智能体 Forest Fire Danger Surving Intelligent Agent

“空天地”立体化感知体系

"Space-Air-Ground" Perception System

- 林火视频监控(forest fire video surveillance devices)
- 架无人机(UAVs)
- 台林下红外(under-forest infrared devices)

AI赋能“早发现、早处置”(AI Empowers "Early Detection and Early Disposal")

森林火情监测智能体(终端) → 多模态模型

- 烟雾识别算法
- 高精度定位算法
- 智能屏蔽算法
- 自动巡航规划算法

高质量数据集 →

- 云团图像数据
- 团雾图像数据
- 监控高度数据
- 监控PTZ数据
- 林区边界数据
- 火险等级数据
- 地形数据
- 林区矢量数据
- 降雨图像数据
- 烟雾图像数据
- 地理信息数据
- 高程数据
- 人工标定数据
- 时间数据
- 地理信息数据
- 监控PTZ数据

知识库 →

- 历史预警经典案例
- 火源干扰样本
- 森林防火管理文件
- 火情处理机制文件
- 火情核实经典案例

场景赋能 →

- 全天候自动巡航 → 24小时不间断巡航
- 火情自动发现 → 月误报率 < 3次
- 火情精准定位 → 误差最优可达米级
- 火情预警推送 → 精准推送网格员
- 无人机联动核实 → 5分钟 快速到达火场

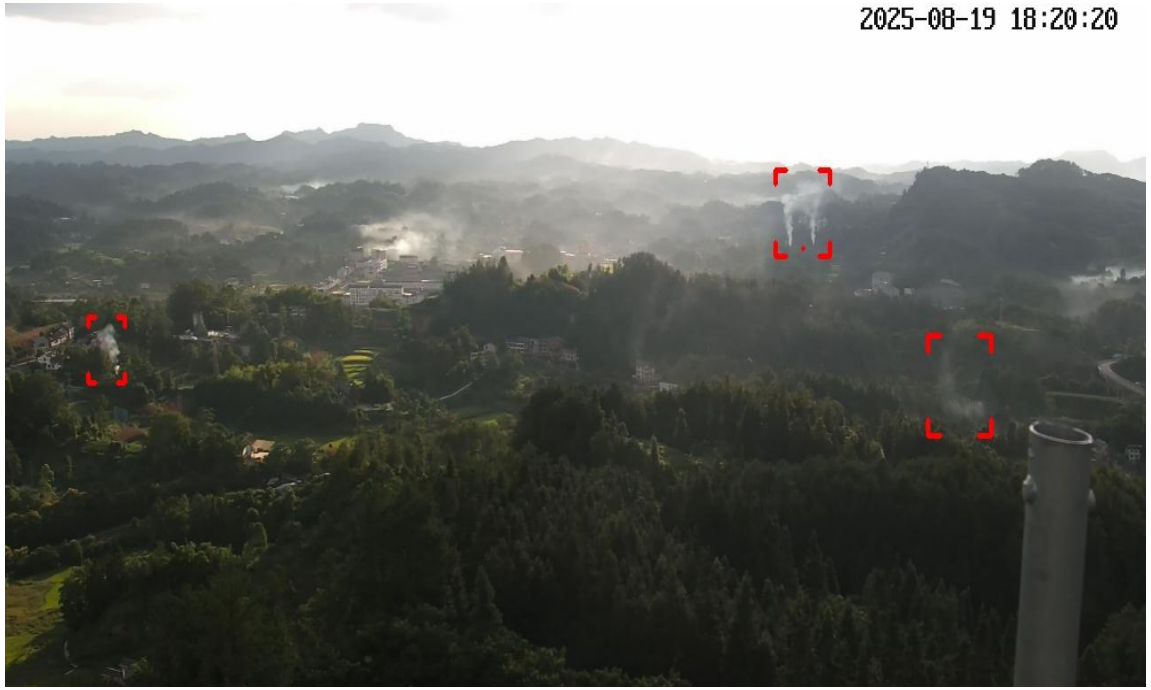
- **构建立体火情监测感知体系，辅以AI赋能，实现森林火情“早发现、早处置”**

With "Space-Air-Ground" Perception System and AI, the Forest Fire Danger Surving Intelligent Agent could early detection and early disposal of fires

2.生态文明建设领域 | 人工智能赋能森林防火

Ecological civilization construction | AI Empower Forest Prevention

森林火情监测智能体赋能火情预警快速精准（Forest Fire Danger Surving Intelligent Agent)



根据烟雾自动识别火情 Automatic discoverig fire based on smoke

时间（Date）：2025.8.19

地点（Venue）：南川区兴隆镇金星社区

无人机联动核实 Verifying fire sitution by UAV

2.生态文明建设领域 | 人工智能赋能森林防火

Ecological civilization construction | AI Empower Forest Prevention

决策处置三大智能体赋能协同作战 Three Decesion Making Intelligent Agent

①辅助决策智能体 Decision Support Intelligent Agent

感知一张图 Perception Map

作战方案智能生成 Intelligent Generation of Operational Plans

协同会商 Collaborative Consultation

指挥调度 Command Scheduling

②透明战场智能体 Transparent Battlefield Intelligent Agent

实时火情动态感知

战场信息融合

无人机标注能力

- 灭火资源可视化Visualization of Fire-fighting Resources
- 居民分布可视化Visualization of Resident Distribution
- 救援队伍可视化Visualization of Rescue Teams

③火势蔓延分析智能体 Fire Spread Analysis Intelligent Agent

高质量数据集High-Quality Dataset

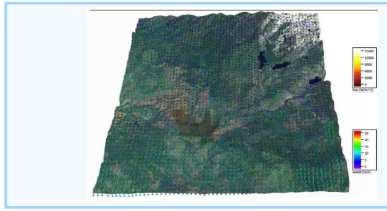
- 火场地形地貌Topography and Landform of the Fire Site
- 火场气象数据Meteorological Data of Fire Site

分析模型Analysis Models

- 火场三维建模模型（3D Modeling of Fire Scene）
- 火势蔓延推演模型（Fire Spread Prediction Models）

森林防火专家知识库Forest Fire Prevention Expert Knowledge Bases

火势蔓延模拟 Fire Spread Simulation



- **构建决策处置三大智能体，实现无人机辅助可视化作战、无人机辅助火场三维模型实时构建和火情蔓延模拟，支撑制定作战方案和快速调度指挥。** Through Three Decesion Making Intelligent Agent, we could conduct coordinated consult and command online with visually extinguish fire with UAVs, build accurate real-time 3D model of the fire site and simulate the fire spread situation.

2.生态文明建设领域 | 人工智能赋能森林防火

Ecological civilization construction | AI Empower Forest Prevention

应用成效 Application Effect

- **2024年以来，全市森林火灾起数及受害面积分别下降81.5%和97.2%。**
  From 2024，forest fire occurrence and disaster area in Chongqing decrease by 81.5% and 97.2% separately.
- **在全国林草系统秋冬季森林草原防火大会现场，向各兄弟省市展现重庆森林防灭火实战实效的能力。**
  At the Forest and Grassland Fire Prevention Conference，we introduced our practical combat capability in forest fire prevention to brother provinces and cities.

会议现场 Conference Venue 时间（Date）：2025.9.11 地点（Venue）：BeiBei Chongqing

3.城市治理方面 | 韧性城市——重庆中心城区泄洪通道专项规划

Urban governance | Resilient Cities: Specialised Plan for Flood Diversion Channels in Chongqing's Central Urban Area

城市治理阶段 National spatial planning stage	风险识别评估 Risk Identification and Assessment	风险预测预警 Risk Forecasting and Early Warning	应急处置响应 Emergency Response	长效防控优化 Long-term Prevention and Control Optimisation
地理设计技术赋能 Geodesign technology empowerment	➢ 生态本底调查 Ecological Baseline Survey ➢ 生态退化识别 Identification of Ecological Degradation ➢ 生态问题溯源 Tracing the Origins of Ecological Issues	模拟不同方案生态效益、成本投入、长期稳定性 Simulate the ecological benefits, cost inputs, and long-term stability of different schemes	➢ 遥感+物联感知 Remote sensing + IoT sensing ➢ 监测修复进度 Monitoring the progress of remediation ➢ 动态适配调整 Dynamic Adaptive Adjustment	➢ 长期监测数据 Long term monitoring data ➢ 修复效果评估 Assessment of Repair Effectiveness ➢ 生态价值追踪 Tracking Ecological Value

3.城市治理方面 | 韧性城市——重庆中心城区泄洪通道专项规划

Urban governance | Resilient Cities: Specialised Plan for Flood Diversion Channels in Chongqing's Central Urban Area

暴雨内涝已成为全球城市化进程中频发的“城市病”，其本质是“自然水循环被破坏+人工干预失序”导致的人地系统失衡。
Urban waterlogging, a prevalent challenge during globalization, is fundamentally a socio-ecological imbalance caused by a disrupted natural water cycle and disordered human intervention.

核心挑战：应对极端降雨天气，如何科学规划泄洪通道，避免内涝？Challenge: In response to extreme rainfall weather, how to scientifically plan flood discharge channels and avoid waterlogging?

3.城市治理方面 | 韧性城市——重庆中心城区泄洪通道专项规划

Urban governance | Resilient Cities: Specialised Plan for Flood Diversion Channels in Chongqing's Central Urban Area

重庆曾因地形、气候和城市发展等因素，多次遭遇暴雨内涝问题。为此，引入地理设计理念与方法，指导防洪与排水工程规划，突破了传统单一的技术性排水工程设计思路。

Chongqing has repeatedly been hit by rainstorm waterlogging in the past due to factors such as topography, climate, and urban development. To address this, geodesign concepts and methods have been introduced to guide the planning of flood control and drainage engineering, breaking through the traditional and one-sided technical-only design thinking for drainage engineering.

➢ 排查城区暴雨受灾点，分析洪涝成因与薄弱环节

Identify urban flood sites to analyze causation and key vulnerabilities

3.城市治理方面 | 韧性城市——重庆中心城区泄洪通道专项规划

Urban governance | Resilient Cities: Specialised Plan for Flood Diversion Channels in Chongqing's Central Urban Area

结合城市排水流域和规划布局，提出“城市泄洪通道”，科学确定城市泄洪通道系统和暴雨技术参数。

Informed by drainage basins and urban planning, an urban flood discharge channel system was proposed with scientific parametrization for stormwater management.

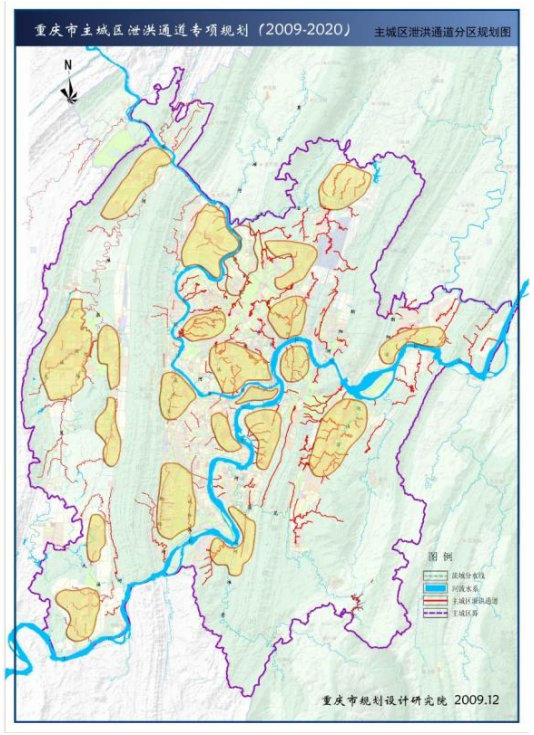
界定该通道是否为泄洪通道?	Determine whether the channel is a flood discharge channel?
参数确定（通道位置、断面、容纳能力）	Determine parameters (channel location, cross-section, capacity)
确定泄洪等级。根据不同区域分别提出 5 年、10 年、20 年泄洪标准	Determine the flood discharge level. Propose 5-year, 10-year, and 20-year flood discharge standards respectively according to different regions.
空间反馈，结合现状泄洪通道能力进行验核，不满足要求的进行整治	Spatial feedback: verify in combination with the current capacity of the flood discharge channel, and renovate if the requirements are not met.
制定技术准则，提出空间控制一般要求，将泄洪通道纳入规划管理	Formulate technical guidelines, propose general requirements for spatial control, and incorporate flood discharge channels into planning management.

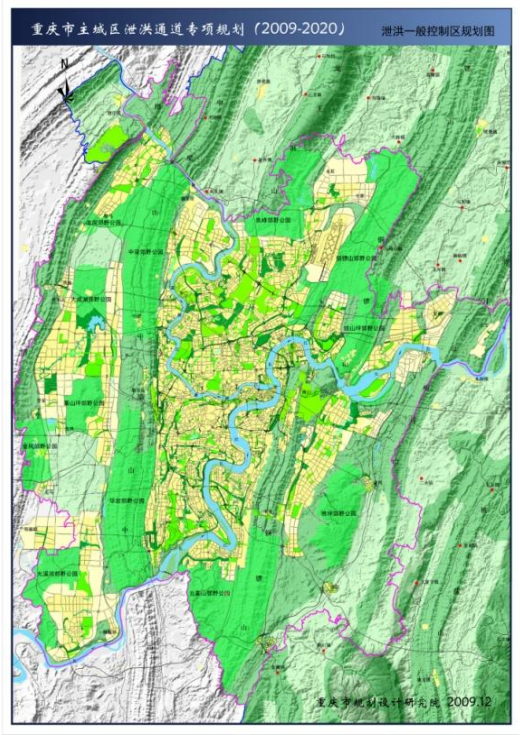
泄洪通道规划技术流程图

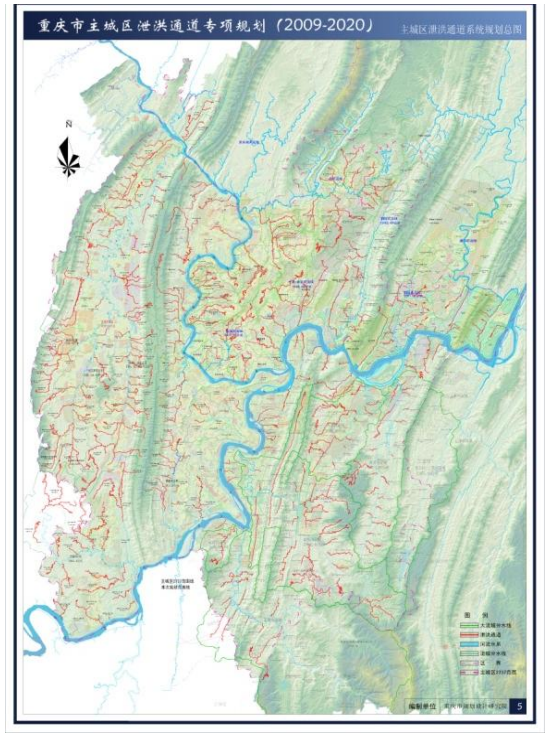
Technical flowchart for flood discharge channel planning

3.城市治理方面 | 韧性城市——重庆中心城区泄洪通道专项规划

Urban governance | Resilient Cities: Specialised Plan for Flood Diversion Channels in Chongqing's Central Urban Area







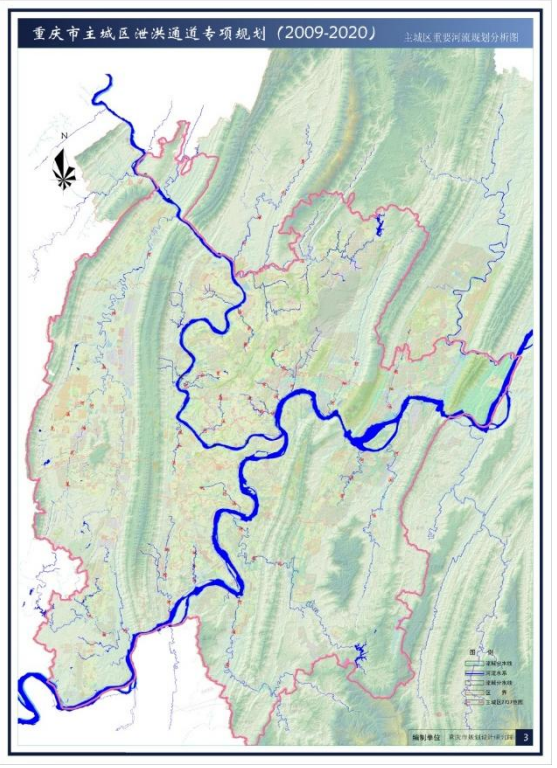
结合重庆“山水”特征，以长江、嘉陵江及四山为界，将中心城区建设用地划分为泄洪重点控制区和泄洪一般控制区，确定**83个泄洪系统**，划定**354条泄洪通道**。

Chongqing's unique topography informed the creation of a flood control system, culminating in 83 drainage systems and 354 designated discharge channels.

3.城市治理方面 | 韧性城市——重庆中心城区泄洪通道专项规划

Urban governance | Resilient Cities: Specialised Plan for Flood Diversion Channels in Chongqing's Central Urban Area

将城市防洪系统、排水系统和城市空间管控有机结合，形成更为完善的城市防洪排涝体系。
Integrate flood control, drainage systems, and spatial management to form a more robust urban flood prevention framework.



宏观层面（大流域）：与城市防洪工程规划协调一致，并加强防洪工程与城市空间管控结合

Macro Level (Major Watersheds): Coordinate with urban flood control planning and integrate it with spatial management.

中微观层面：结合城市排水工程规划，对涉“水”用地具有明确的管控和指导作用

Meso- and Micro-levels: Integrate with urban drainage planning to provide clear guidance and control over water-related land use.

3.城市治理方面 | 韧性城市——重庆中心城区泄洪通道专项规划

Urban governance | Resilient Cities: Specialised Plan for Flood Diversion Channels in Chongqing's Central Urban Area

采用技术+空间双重管制模式，系统梳理和控制住了城市泄洪通道，按不同区域和类型分别提出不同的管控要求，并将其融入城市规划管理，成为城市水系管理的有效延伸

A dual technical-spatial control approach was adopted to systematically manage urban flood channels. Tailored regulations for different zones were integrated into urban planning, effectively extending water system management.

城市泄洪通道
Urban flood discharge channel

自然溪河、湖库、明渠
Natural streams, rivers, lakes, reservoirs and open channels

地下管涵
Underground culvert

3.城市治理方面 | 韧性城市——重庆中心城区泄洪通道专项规划

Urban governance | Resilient Cities: Specialised Plan for Flood Diversion Channels in Chongqing's Central Urban Area

泄洪通道系统实例：极大增强了城市防洪泄洪安全

Example of the Flood Discharge Channel System: It has significantly enhanced urban flood prevention and safety.

在原有基础上新开辟泄洪通道
New flood discharge channels were created based on the existing system.

与自然河溪相结合
Integrated with natural rivers and streams.

与大型立体交通设施结合
Integrated with major multi-level transport infrastructure

3.城市治理方面 | 危岩地灾风险管控
Urban governance | Rockfall Preventation

天空地一体化动态监测体系 Dynamic Monitoring System

天基全域扫描 Space-based Scan

➢ 加强综合遥感，构建**卫星智能识别**体系
Strengthen comprehensive remote sensing and build a satellite intelligent recognition system

➢ 2025年新发现地表形变**1406**处，锁定隐患**331**处
In 2025, 1406 new surface deformations were discovered and 331 hidden dangers were identified

相较人工排查 InSAR效率提升 **3.6倍**
InSAR Efficiency Has Increased by 3.6 Times Compared to Manual Inspection

全域InSAR综合遥感识别 Global InSAR Integrated Remote Sensing Recognition	D-InSAR	形变识别 Deformation Recognition
	PS-InSAR	时序监测 Time Series Monitoring
	SBAS-InSAR	沉降监测 Settlement Monitoring
卫星遥感光学影像 Satellite Remote Sensing Optical Image		迹象识别 Sign Recognition

构建崩滑光学影像样本数据集示例
Example of Constructing a Landslide Aptical Image Sample Dataset

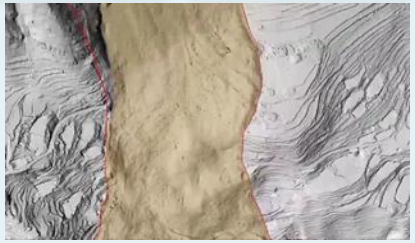
空基靶向调查 Air-based Surving

500余架 无人机巡查
Over 500 Unmanned Aerial Vehicles Patrol

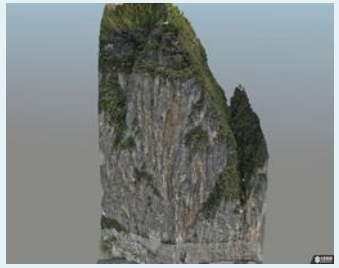
11座 无人机机场
11 Unmanned Aerial Vehicle Airports

50处危岩 全覆盖
50 Rockfall Hazards Are Fully Covered

720°全景建模
720° Panoramic Modeling



机载LiDAR地表建模
Airborne LiDAR Surface Modeling



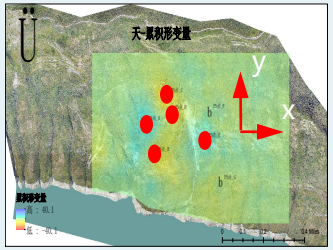
倾斜摄影建模
Oblique Photographic Modeling

无人机巡检
Unmanned Aerial Vehicles Patrol

地基精准监测 Land-based Monitoring

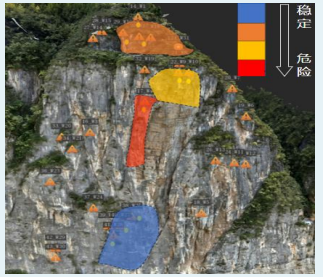
➢ 构建**AI视频识别、北斗面场景监测、激光测振**等监测体系，精准感知地面地灾隐患变化Build monitoring systems such as AI video recognition, Beidou surface scene monitoring, and laser vibration measurement to accurately perceive changes in geological hazards

AI视频监测
AI Video Recognition



北斗面场景监测
Beidou Surface Scene Monitoring

水下地形采集
Underwater Terrain Collection



激光测振
Laser Vibration Measurement

3.城市治理方面 | 危岩地灾风险管控
Urban governance | Rockfall Preventation

符合自然地理特征的预警单元 Early Warning Unit based on Physical Geography

- 根据自然地理特征、危岩地灾发生特点和应急处置组织需要，将全市划为三类预警单元：小流域**4208**个；微流域**22863**个；斜坡单元**66077**个。
According to the natural geographical features，Characteristics of geological disaster occurrence and the demand of organize emergency response, we divide the whole city into three types of early prevention unit, including 4208 small watershed, 22863 micro watershed and 66077 slop units.

- 预警单元包含各类危岩地灾风险防控的相关信息：地理信息、人口建筑信息、隐患点类型与分布、监测设备信息、风险评估信息、转移处置负责人信息等。These units have information related to rockfall preventation，including geographic information, population and building information, hazards type, monitoring equipment information, risk assessment information and evacuation supervisor

3.城市治理方面 | 危岩地灾风险管控
Urban governance | Rockfall Preventation

快速判别影响范围的分析模型 Impact Scope Analysis Model

研发涌浪分析、电子围栏等系列模型

- **涌浪分析模型 Surge Analysis Model**

模拟计算临江危岩单体崩塌引发的涌浪高度、波及路径、影响范围等。

Simulate the height, spread path and impact scope when the surge occured.

- **电子围栏模型 Electronic Fence Model**

根据涌浪分析模型分析结果，划定管控范围，发布预警信息到所有船只，与长江航道、应急等跨部门协同处置危岩崩塌。

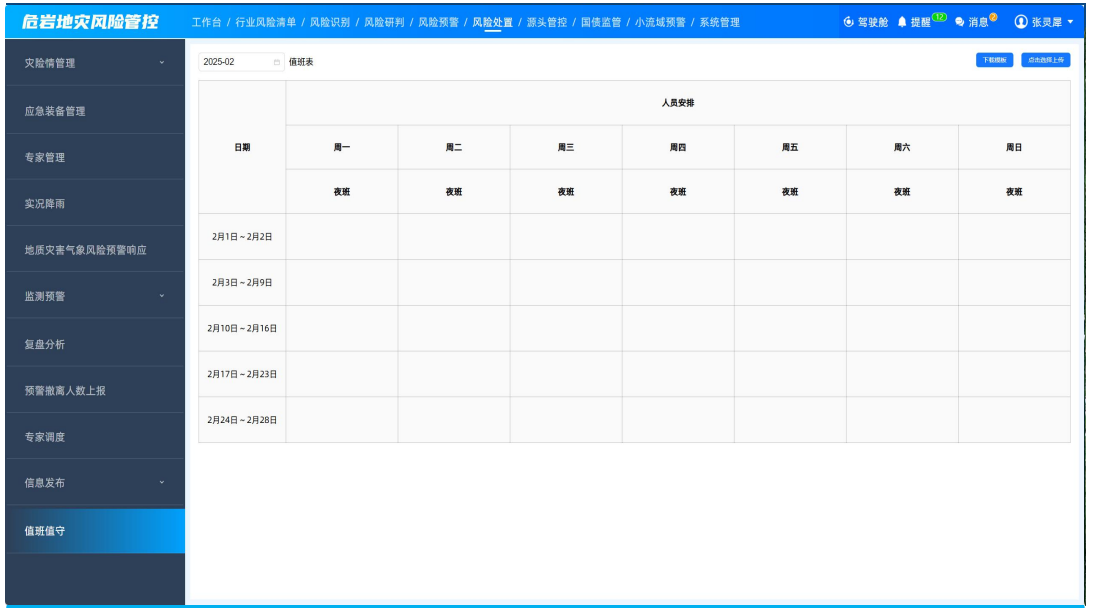
According to the result of surge analysis, we circumscribe the control scope, issue warning to ships and Collaborative response to rockfall with relevant departments.

3.城市治理方面 | 危岩地灾风险管控

Urban governance | Rockfall Prevention

多方协同应急处置平台 Cooperative Response Platform

实时查询、调度应急装备 Real-time querying&Collaborative response



值班值守情况随时掌握Momentarily get the information of duty schedules

- 危岩地灾风险管控平台，提供战时灾情总览、处置情况一屏掌控、专家在线会商、应急装备快速调度等功能，实现灾情发现、上报、分析研判、处置调度、灾情复盘等各环节主体人员的高效协同。Rockfall hazards preventation system could provide function of disaster overview, diposal status, consultation meeting among geological experts, real-time querying and collaborative response.

4.重大基础设施规划-建设-管理全过程 | 地理设计贯穿基础设施规划建设管理全过程

Major Infrastructure Planning-Construction-Management Full Process | Geographic design throughout the entire infrastructure process

重大基础设施全过程管理
End-to-end major infrastructure management

规划选址
Site selection planning

建设施工
Construction works

运营维护
Operations and Maintenance

地理设计技术赋能
Geospatial Design Technology-Empowered

- 多因素耦合
  Multi-factor coupling
- 多准则决策分析
  Multi-criteria decision analysis
- 选址优化模型
  Site Selection Optimisation Model

- 施工进度监测
  Construction Progress Monitoring
- 土石方平衡
  Earthwork balance
- 生态影响监测
  Ecological Impact Monitoring

- 设备巡检
  Equipment inspection
- 结构健康监测
  Structural Health Monitoring
- 故障预测预判
  Fault Prediction and Forecasting

4.重大基础设施规划-建设-管理全过程 | 市域（郊）铁路国土空间预研预控规划

Major Infrastructure Planning-Construction-Management Full Process | Preliminary Research and Control Planning for Metropolitan (Suburban) Railways

核心挑战：如何在项目立项前，锁定最优廊道，规避未来冲突?

Challenge: How to identify and secure the optimal corridor from an area-wide perspective before project initiation, so as to avoid future conflicts?

- **地理设计实现多约束条件下的空间博弈与最优方案生成。**

  Geographic Design enables spatial negotiation under multiple constraints and facilitates the generation of optimal solutions.

- **全面梳理梳理基本农田、生态红线、矿产压覆、地灾区域、人口、产业、旅游资源等要素。**

  Comprehensively sort out such elements as basic farmland, ecological red line, mineral resource overburden, geological disaster-prone areas, population, industries, and tourism resources..

- **科学提出线路走向，为生态保护、基本农田保护、自然资源利用，建设项目的快速推进、站场选址、发展建设用地预留等方面，提供高效、科学决策。**

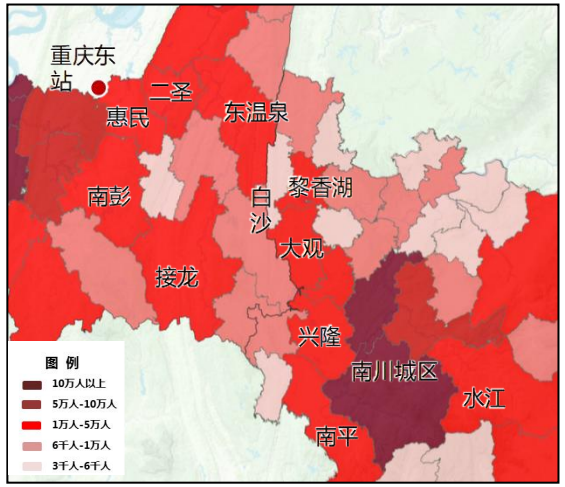
  It scientifically determines the route alignment, enabling efficient and informed decision-making in key areas such as ecological and farmland conservation, resource utilization, project implementation, station siting, and land development.

4.重大基础设施规划-建设-管理全过程 | 市域（郊）铁路国土空间预研预控规划

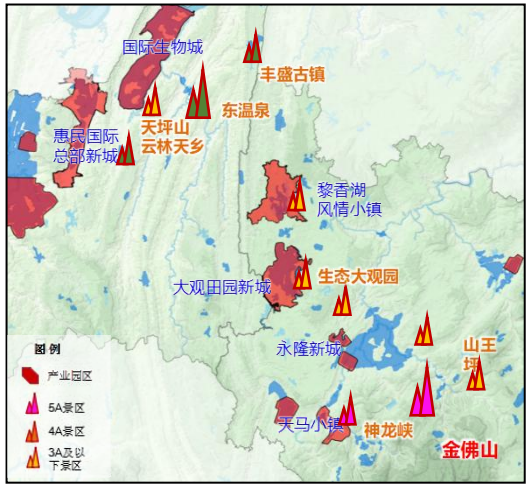
Major Infrastructure Planning-Construction-Management Full Process | Preliminary Research and Control Planning for Metropolitan (Suburban) Railways

结合要素：结合在编的市区两级国土空间规划，协调线路与沿线城镇发展关系，串联主要功能区，构建“1小时交通圈”和“1日生活圈”，以支撑和引导沿线城镇与产业发展。

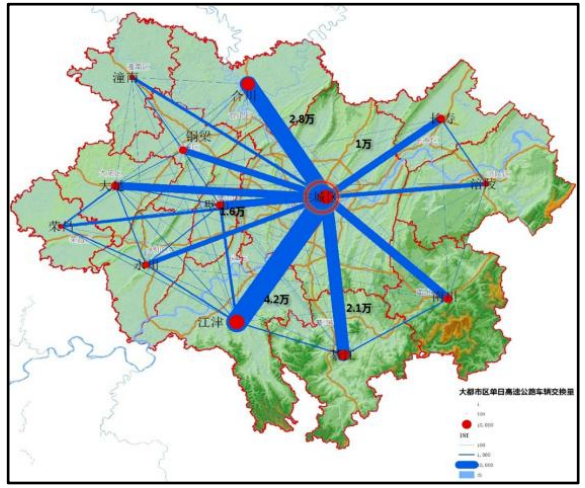
Integrating ongoing city-district territorial spatial plans, we aligned the route with urban development, linked key functional zones, and created "1-hour commute" and "daily living" circles to guide growth along the corridor.



人口分布
Population distribution



重点城镇、重要城市片区和旅游景点分布
Distribution of key towns, major urban districts and tourist attractions

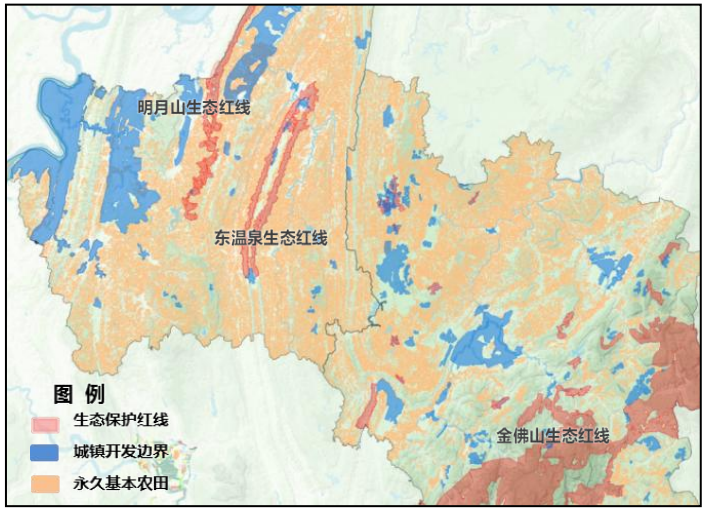


主城都市区客流分布
Passenger Flow Distribution in the Main Urban Area

4.重大基础设施规划-建设-管理全过程 | 市域（郊）铁路国土空间预研预控规划

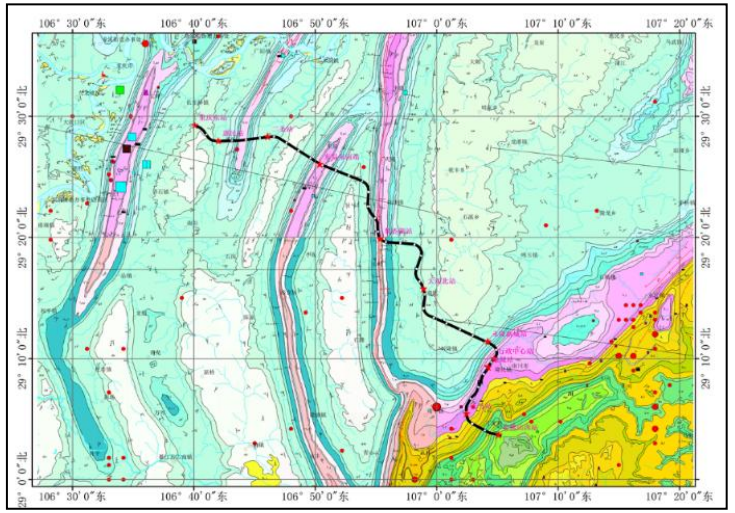
Major Infrastructure Planning-Construction-Management Full Process | Preliminary Research and Control Planning for Metropolitan (Suburban) Railways

协调避让：通过地理分析，协调线路与三条控制线关系，统筹考虑水文地质条件、矿产资源压覆和地质灾害避让等因素。Using geographic analysis to coordinate the route with the three control lines, taking into account hydrogeology, mineral resources, and geological hazards.



三条控制线分布
Distribution of three control lines

矿产资源分布
Distribution of Mineral Resources



水文地质条件
Hydrogeological conditions

4.重大基础设施规划-建设-管理全过程 | 市域（郊）铁路国土空间预研预控规划

Major Infrastructure Planning-Construction-Management Full Process | Preliminary Research and Control Planning for Metropolitan (Suburban) Railways

线路方案：以中心城区至南川线为例 —— Route Plan: Taking the Central Urban Area-Nanchuan Line as an Example

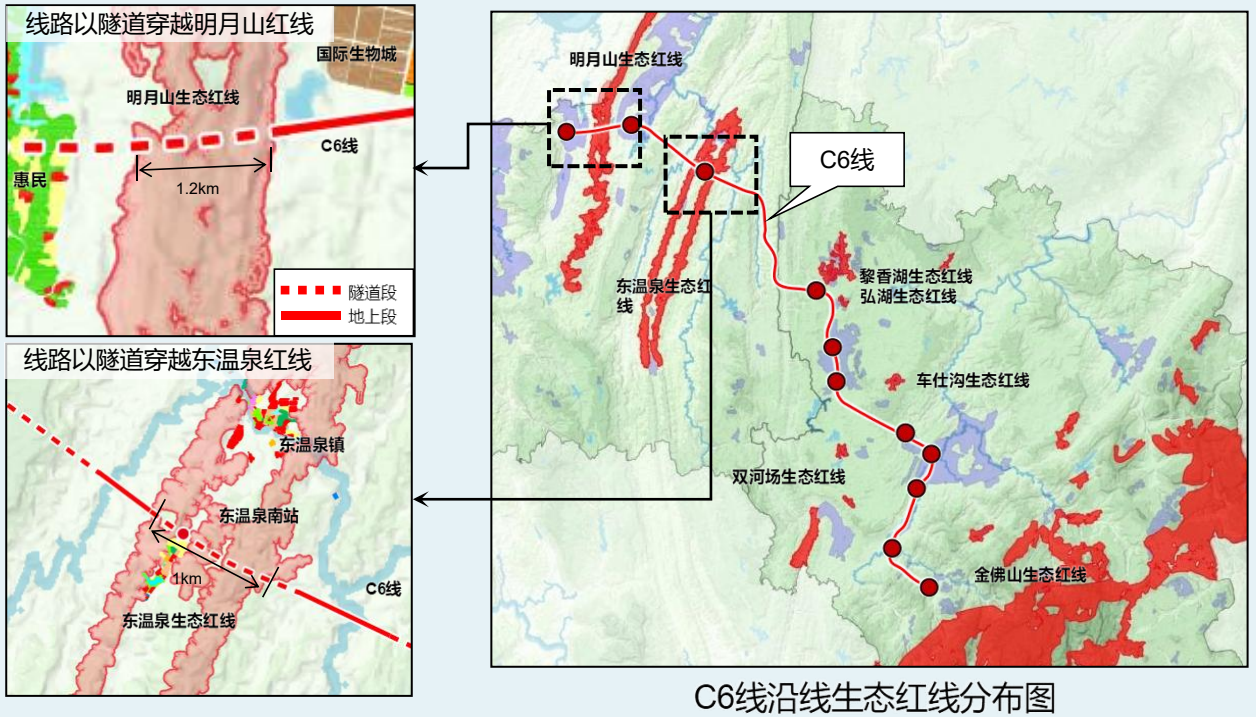
起　点： 重庆东站
终　点： 金佛山
长　度： 约76km
站　点： 8座
站间距： 10.9km

Starting Point: Chongqing East Station (Huimin)
Terminal Point: Jinfo Mountain
Length: Approximately 76km
Stations: 8
Station Spacing: 10.9km

4.重大基础设施规划-建设-管理全过程 | 市域（郊）铁路国土空间预研预控规划

Major Infrastructure Planning-Construction-Management Full Process | Preliminary Research and Control Planning for Metropolitan (Suburban) Railways

线路方案：以中心城区至南川线为例 —— Route Plan: Taking the Central Urban Area-Nanchuan Line as an Example



C6线沿线生态红线分布图

线路避让金佛山等6处生态保护红线。确实无法避让的区域，以地下隧道的形式穿越，降低对生态环境的影响。

The route avoids six ecological protection redlines, including Jinfo Mountain. Where avoidance was impossible, underground tunnels were used to minimize environmental impact.

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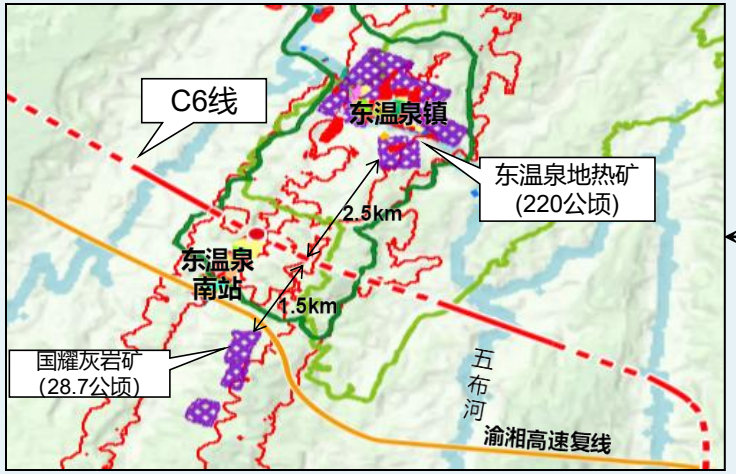
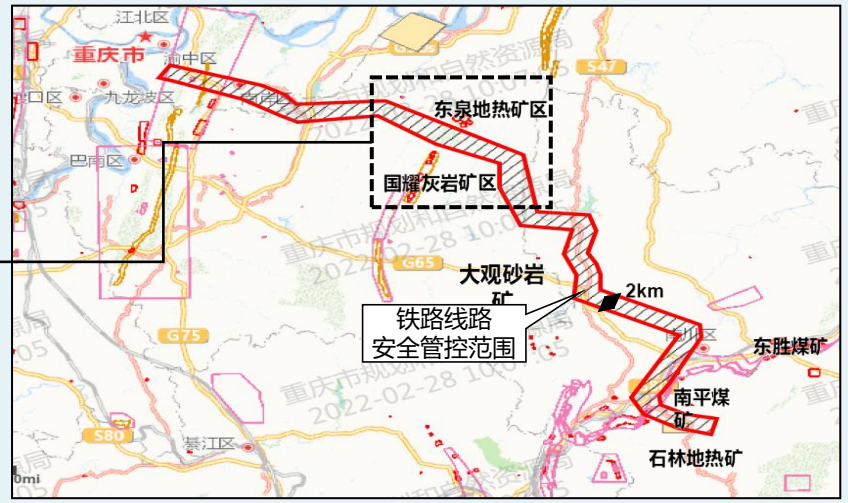


东温泉段避让现状矿产资源分布图

C6 Line: Dongwenquan Mineral Avoidance Map



线路压覆重要矿产资源预评估（线路两侧各1km）

Mineral Sterilization Risk Map (1km Buffer)

线路避让13处采矿探矿权约38.8公顷压覆面积，涵盖东温泉地热等重点矿产。对无法避让处，建议先采后建，最大限度减少影响。

The alignment avoids 13 mining claims (38.8 ha), including high-value resources. Pre-extraction is proposed for unavoidable areas to minimize mineral loss.

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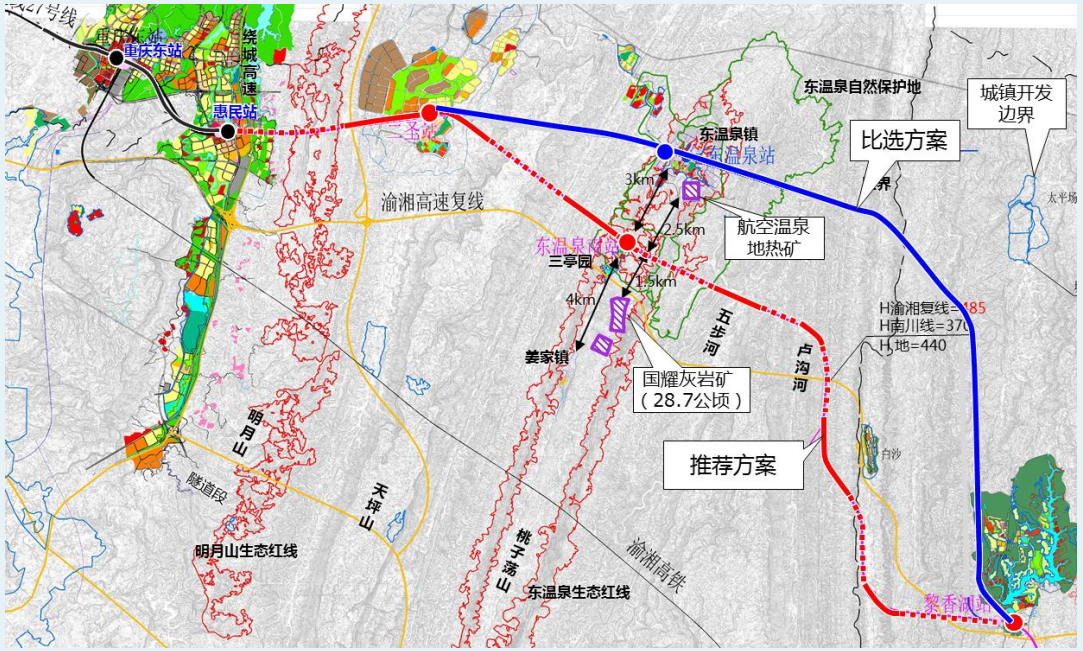

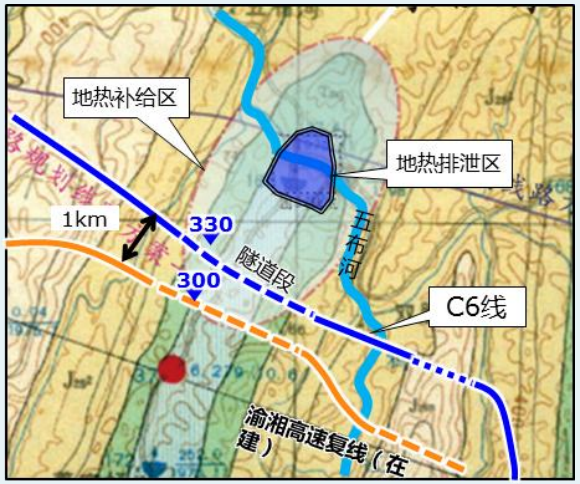

在东温泉段的线路选择上，综合考虑避让东温泉地热排泄区和地热水补给区，用对温泉地热影响较小的方式进行穿越。

The route through Dongwenquan was chosen to avoid geothermal areas, utilizing a crossing method designed to minimize impact on the hot springs.

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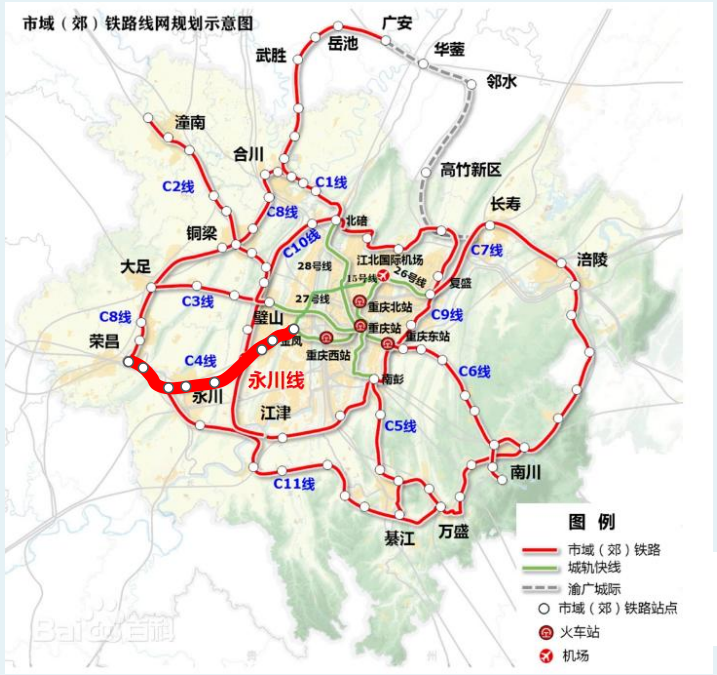

中心城区至永川线

提升土地价值，强化接驳换乘，功能分区实现，调整周边11块用地（原为产业用地）

提升土地价值，强化接驳换乘，功能分区实现，调整周边3块用地（原为工业和物流）

依据站点周边圈层（极核区、核心区、综合开发区）布局，结合片区规划与产业定位，提出规划建议。

Planning Recommendations: Based on the spatial arrangement of station-area zones (Primary Core, Core, Integrated Development Zone) and combined with the district plan and industrial positioning.

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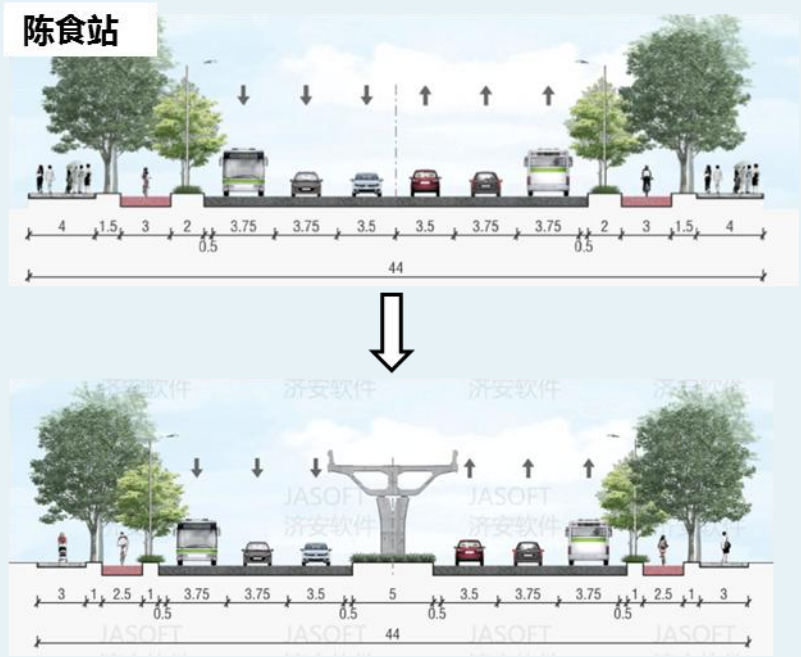

为提升站点可达性与路网密度，保障轨道铺设条件，结合用地与地形，提出路网及路幅优化建议。

Optimizing the network and road sections by integrating land use and topography to improve station access, increase road density, and secure rail construction conditions.

4.重大基础设施规划-建设-管理全过程｜市域（郊）铁路国土空间预研预控规划

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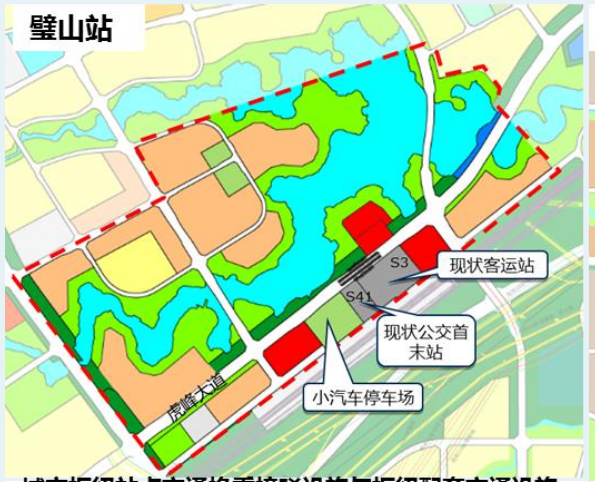
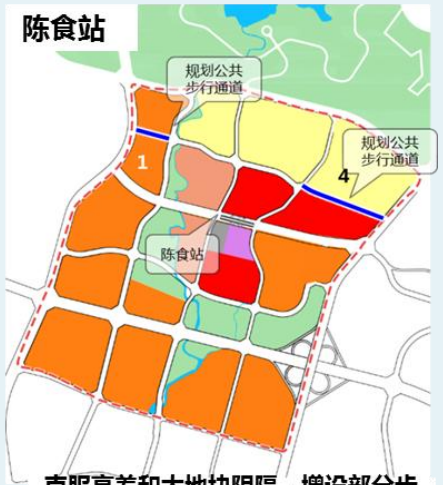


城市枢纽站点交通换乘接驳设施与枢纽配套交通设施统筹考虑。

其他站点交通换乘接驳设施，结合站点接驳距离设置。



克服高差和大地块阻隔，增设部分步行专用道。

根据指引提出不同站点交通设施配置建议，新增步行通道，提升站点可达性。

Proposed Transport Integration: Recommending station-specific facilities and adding pedestrian accessways per guidelines to improve station accessibility.

地理设计实践小结
Summary of GeoDesign Practice

1 国土空间规划
National Spatial Planning

推动从“被动适配”到“主动引领”
Promote the transition from "passive adaptation" to "active leadership"

地理设计通过整合多源时空数据与规划模型，将传统的静态蓝图转变为动态的、可模拟的战略预演

2 生态保护修复
Ecological civilization construction

推动从“末端治理”到“系统调控”
Promote the transition from "end of pipe governance" to "system regulation"

地理设计将生态本底作为规划的刚性约束，实现了对自然资源的精准管控与增值

3 城市治理
Urban governance

推动从“经验决策”到“智慧响应”
Promote the transition from "experience based decision" to "intelligent response"

面对城市这一复杂巨系统，地理设计构建了感知、分析、决策的数字化闭环

4 重大基础设施规划
Major infrastructure planning

推动从“项目孤岛”到“全域协同”
Promote the transition from "project silos" to "global collaboration"

在重大基础设施如市域（郊）铁路的规划中，地理设计打破项目本位的局限，将其置于全域国土空间格局中考量

四、展望 Prospect

地理设计的未来路径：从“人地协调”到“和谐共生”

The Future Path of Geodesign: From "Human-Environment Coordination" to "Harmonious Coexistence"

总结 | Summary

- 地理设计从被提出到发展至今，技术体系在不断演进，但其核心理念一直不变，即：**通过掌握人地关系内在规律，实现人地和谐可持续发展。**

  While its technical systems evolve, the core goal of Geographic Design is constant: guiding human-land relations toward sustainable harmony by understanding their underlying patterns.

- 作为“**融合空间思维、数据科学与协同治理的综合性方法论**”，地理设计为我们提供了一种应对复杂人地关系的系统性解决方案。

  Geographic Design offers a systematic solution to complex human-land issues by blending spatial thinking, data science, and collaborative governance.

未来展望 | Summary

- **作用进一步凸显：**通过地理设计的充分应用，让资源更好服务经济社会发展的作用进一步彰显，更精准、更高效、可持续。

  Through the full application of geodesign, the role of resources in better serving economic and social development is further demonstrated, becoming more accurate, efficient, and sustainable.

- **与新技术进一步融合：**时空智能、AIGC辅助设计、自主决策智能体、具身交互环境。

  Further integration with AI technologies will encompass areas such as AIGC-assisted design, autonomous intelligent agents, and embodied interactive environments.

- **应用领域进一步拓展：**双碳目标下的碳汇精准管理、海洋生态保护与开发协同、数字经济中的空间载体优化。

  Expanded Applications: Precise carbon sink management for dual carbon goals, coordinated marine conservation and development, and spatial optimization for the digital economy.

谢　谢

THANKS

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