

印尼达瑞铅锌矿地表土建招标技术文件（一标段）

**Technical Tendering Documents for Surface Civil Engineering of
Indonesian Dairi Lead-Zinc Mine--Section I**

1 招标工程概况

Overview of the Bidding Project

1.1 工程名称

Project Name

印度尼西亚达瑞铅锌矿采选工业场地表土建工程

**Surface Civil Work at Mining and Processing Site of Dairi
Lead-Zinc Mine, Indonesia**

1.2 工程地点

Project Location

达瑞铅锌矿项目位于印度尼西亚苏门答腊岛西北部，距离印尼第三大城市 Medan 约 120 公里。从印尼 Medan 市区开车至矿区，首先经 Bitumen 国道至 Sidikalang 镇，然后通过低等级的省级公路到达 Sopokomil 村庄，路面车流量较大，车程约为 5 个小时。

Dairi lead-zinc mine is located at the northwest of Sumatra, Indonesia, about 120km away from Medan (the third largest city in Indonesia). The mine area is accessible from Medan by bitumen express way to Sidikalang, and to Sopokomil by low grade provincial standard road; Due to large traffic flow, it will take about five hours for drive.

1.3 现场条件

Site Conditions

本项目处于森林覆盖区，西北部为梯形峡谷，标高约 300~500m，西南方向为山坡，山峰标高约 1300m。

The project is located in forest covered area, trapezoid canyon is dominated in the northwest, the elevation of which is about 300-500m, and hillsides lie in the southwest, with the elevation of mountain peak around 1300m.

矿山所属的 Sopokomil 地区为热带潮湿气候，受东北季风和西南季风影响，温度无明显季节变化，白天平均气温 20~30°C，年平均气温 24~28°C，大多数月份有大量降雨，9~12 月为主要雨季，4~5 月为次要雨季，年降水量 3500~4000mm。

Sopokomil area, where the mine situates, belongs to tropical humid climate with no obvious seasonal change in temperature, and is affected by northeast monsoon and southwest monsoon. The average daily temperature is in range of 20~30°C, and the average annual temperature is 24~28°C. It rains a lot in most months, with the primary rainy season occurring in September to December, and the secondary rainy season occurring in April to May. The annual rainfall is 3500-4000mm.

苏门答腊岛是印尼地震高度活跃岛弧系统的一部分，它同时穿过地震高发的印度洋板块俯冲亚欧板块边缘和 sumatra 断层的延伸段。达瑞铅锌矿区属地震活跃带，地震加速度为 0.37g。

Sumatra, being part of the island arc system, is subject to high seismic activity, it passes through the plate boundary outboard of Indian Plate under-thrusting Eurasian Plate, as well as the extension section of Sumatra fault. Dairi lead-zinc mine area belongs to active seismic zone, and the earthquake acceleration is 0.37g.

1.4 招标工程范围

Scope of the bidding project

本次招标范围为达瑞铅锌矿项目地表土建工程，包括但不限于以下内容的：

The scope of this bid covers the surface civil work of Dairi Lead-Zinc Mine, including but not limited to the following items:

(1) 建筑、结构工程：原矿堆场、粗碎车间、中间矿堆、磨浮车间区域地表采矿、选矿、公辅设施等建构筑物。

(1) Building and structure works: buildings and structures for surface mining, mineral processing, and public and auxiliary facilities in the ROM pad, Crushing Area, Stockpile and Grinding Area, Flotation.

(2) 总图工程：永久道路、场地排水设施、防护设施、埋地管道电缆。

(2) General drawing works: permanent road, drainage facilities in the site, protection & prevention facilities, civil work and related installation of buried pipeline and cable.

(3) 桥梁工程：1~6#桥梁

(3) Bridge works: Bridges #1~6

(4) 岩土工程：卸矿平台加筋土挡墙、预应力锚索加固边坡、扶壁式挡土墙、格宾挡墙、浆砌块石护坡以及其他可能的边坡治理形式。。

(4) Geotechnical works: reinforced earth retaining wall of unloading platform, slope reinforcement using pre-stressed anchor cables, buttressed retaining wall, gabion retaining wall, masonry stone slope protection, and other possible slope treatments.

1.5 注意事项

Attentions

本次招标文件及招标工程量是基于初步设计阶段条件编制，后续施工图阶段存在调整的可能。

The bidding documents and quantities of works are prepared based on the conditions at the basic design stage, and may be adjusted at the follow-up detailed design stage.

2 建筑、结构工程技术说明

Technical specifications for buildings and structure works

2.1 工程概况

Project overview

本工程设计范围包括采矿设施、选矿工业场地等辅助设施。

The design scope includes mining facilities, mineral processing industrial site and other auxiliary facilities.

主要工程项目有：

The main works include:

选矿工程：包括粗碎车间、中间矿堆、磨矿车间、浮选车间、浮选药剂制备、石灰制备、皮带廊；

Mineral processing works: including primary crushing workshop, intermediate ore stockpile, grinding workshop, flotation workshop, flotation reagent preparation and lime preparation facilities, belt corridor;

给排水工程：循环水系统、工艺回水系统、选厂新水系统、消防水系统、污水处理系统、地表水收集系统；

Water supply and drainage works: circulating water system, process return water system, fresh water system of concentrator, fire water system, sewage treatment system, surface water collection system;

辅助设施：维修车间、综合仓库、应急发电站、油库、综合管网、选矿试验室、采矿综合楼、选矿综合楼；

Auxiliary facilities: maintenance shop, integrated warehouse, emergency power station, tank farm, integrated pipe network, mineral processing laboratory, mining complex, and mineral processing complex;

电力工程：全厂变电站、各车间变配电所等。

Electrical works: plant substation, transformation and distribution station of each workshop, etc.

本工程建（构）筑物的设计使用年限为 50 年。

The designed service life of the buildings (structures) for the project is 50 years.

本工程建筑耐火等级：除各车间变配电所为一级外，其它建构筑物均为二级。

Anti-fire rating of buildings: except Class-I for the transformation and distribution station of each workshop, the other buildings are Class II.

结构安全等级：均为二级。

Structural safety level: Level II.

地基基础设计等级：均为丙级。

Foundation design level: Class C.

地震加速度为 0.37g，相当于中国标准抗震设防烈度 8 度（0.3g），设计地震分组：第三组

The seismic acceleration is 0.37g, equivalent to seismic fortification intensity of 8 degrees (0.3g) in Chinese standards. Design seismic group: Group III.

2.2 结构工程技术要求

Technical requirements for structural works

2.2.1 规范及标准

Specifications and standards

《建筑工程设计文件编制深度规定》 2016 年版

Provisions on Depth for Preparation of Design Document for Construction Engineering (Edition 2016)

《建筑结构可靠性设计统一标准》 GB50068-2018

Uniform Standard for Reliability Design of Building Structures
GB50068-2018

《工程结构可靠性设计统一标准》 GB50153-2008

Uniform Standard for Reliability Design of Engineering Structures
GB50153-2008

《建筑结构荷载规范》 GB50009-2012

Load Code for the Design of Building Structures GB50009-2012

《钢结构设计标准》 GB50017-2017

Standard for Design of Steel Structures GB50017-2017

《混凝土结构设计规范》 GB50010-2010 (2015 年版)

Code for Design of Concrete Structures GB50010-2010 (Edition
2015)

《砌体结构设计规范》 GB50003-2011

Code for Design of Masonry Structures GB50003-2011

《建筑工程抗震设防分类标准》 GB50223-2008

Standard for Classification of Seismic Protection of Building
Constructions GB50223-2008

《建筑抗震设计规范》 GB50011-2010 (2016 年版)

Code for Seismic Design of Buildings GB50011-2010 (Edition
2016)

《建筑地基基础设计规范》 GB50007-2011

Code for Design of Building Foundation GB50007-2011

《建筑地基处理技术规范》 JGJ79-2012

Technical Code for Ground Treatment of Buildings JGJ79-2012

《建筑桩基技术规范》 JGJ94-2008

Technical Code for Building Pile Foundations JGJ94-2008

《门式刚架轻型房屋钢结构技术规范》 GB51022-2015

Technical Code for Steel Structure of Light-weight Building with Gabled Frames GB51022-2015

《轻型钢结构技术规程》 DG/T J08-2089-2012

Technical Specification for Light Steel Structures DG/T J08-2089-2012

《构筑物抗震设计规范》 GB50191-2012

Code for Seismic Design of Special Structures GB50191-2012

《非结构构件抗震设计规范》 JGJ339-2015

Code for Seismic Design of Non-structural Components JGJ339-2015

《工业建筑防腐蚀设计标准》 GB/T50046-2018

Design Standard for Corrosion Protection of Industrial Buildings GB/T50046-2018

《混凝土结构耐久性设计规范》 GB/T50476-2008

Code for Durability Design of Concrete Structures GB/T50476-2008

《钢结构工程施工质量验收规范》 GB50205-2001

Code for Construction and Acceptance of Steel Structure Engineering GB50205-2001

《有色金属工程结构荷载规范》 GB50959-2013

Code for Loads of Nonferrous Metal Engineering Structures GB50959-2013

《建筑基桩检测技术规范》 JGJ 106-2014

Technical Code for Testing of Building Foundation Piles JGJ 106-2014

《有色金属工程设备基础技术规范》 GB51084-2015

Technical Code for Equipment Foundation of Nonferrous Metals Engineering GB51084-2015

《有色金属工业厂房结构设计规范》 GB51055-2014

Code for Design of Non-Ferrous Industrial Plant Structures GB51055-2014

《有色金属工程设计防火规范》 GB50630-2010

Code for Design on Fire Protection of Nonferrous Metal Engineering GB50630-2010

《钢筋混凝土筒仓设计标准》 GB 50077-2017

Standard for Design of Reinforced Concrete Silos GB 50077-2017

《地下工程防水技术规范》 GB 50108-2008

Technical Code for Waterproofing of Underground Works GB 50108-2008

《给排水工程构筑物结构设计规范》 GB50069-2002;

Structural Design Code for Special Structures of Water Supply and Waste Water Engineering GB50069-2002;

《给水排水工程钢筋混凝土水池结构设计规程》 CECS 138:2002 ;

Specification for Structural Design of Reinforced Concrete Water Tank of Water Supply and Sewerage Engineering CECS 138:2002;

《有色金属矿山工程建设项目设计文件编制标准》 GB/T 50951-2013

Design Document Preparation Standard of Construction Project for Nonferrous Mine GB/T 50951-2013

中华人民共和国工程建设标准强制性条文(房屋建筑部分, 2013年版)

The Compulsory Provisions of Engineering Construction Standards

(Building, Edition 2013)

及其他相关现行国家标准图集。

Other current relevant national standard drawing collections

印度尼西亚相关强制性标准及规定

Relevant mandatory standards and regulations of Indonesia

2.2.2 主要设计技术要求

Main design technical requirements

a) 主要结构材料

a) Main structural materials

(1) 热轧钢筋: HPB300 级, $f_y=270 N / mm^2$

(1) Hot-rolled rebars: HRB300, $f_y=270 N / mm^2$

HRB400 级, $f_y=360 N / mm^2$

HRB400, $f_y=360 N / mm^2$

(2) 钢结构材料: 选用 Q235B 和 Q345B 钢;

(2) Steel structural materials: Q235B and Q345B;

焊条: Q235B 钢及 HPB300 钢筋选用 E43 系列, Q345B 钢选用 E50 系列, HRB400 钢筋选用 E55 系列, 不同级别材料焊接按低级别材料选用焊条;

Welding rods: E43 series for Q235B steel and HPB300 rebar, E50 series for Q345B steel, E55 series for HRB400 rebar; low-grade materials for welding of materials of different grades;

防腐材料: 所有钢结构基面先除锈, 除锈等级为 Sa2 级, 除锈后刷氯化聚乙烯漆二底一中一面, 漆膜厚度不小于 110 μ m。颜色参见标准色 B01。(用于有腐蚀性的车间区域, 所有钢结构基面先除锈, 除锈等级 Sa2.5 级, 有腐蚀性钢构件底漆采用聚氯乙烯含氟涂层配套底漆,

底漆无颜色要求，面层刷聚氯乙烯含氟面漆。做法见 08J333-145-5 大样）。

Anti-corrosive materials: All steel structure bases shall be derusted to Sa2. After rust removal, chlorosulfonated polyethylen paint shall be applied in two layers of primer, one intermediate coat, and one top coat, with a film thickness of not less than 110 μ m. For the color, see the standard color B01. (In case of corrosive workshop area, all steel structure bases shall be derusted to Sa2.5. A primer compatible with polyvinyl chloride fluorine-based coating shall be applied to corrosive steel members, and there is no color requirement. A polyvinyl chloride fluorine-based top coat shall be applied over the surface layer. For the practice, see detail drawing 08J333-145-5).

防火材料：所有钢结构部分的梁、柱、平台及钢梯等受力钢构件均须做防火涂料保护（最低耐火极限：钢柱不小于 2.5 小时，钢梁不小于 1.5 小时，钢平台及钢梯不小于 1.0 小时，屋面檩条不小于 1.0 小时）。

Fireproof materials: such stress members of steel structures as beams, columns, platforms and ladders shall be protected by applying fireproof coatings (minimum fire endurance: not less than 2.5 hours for columns, not less than 1.5 hours for beams, not less than 1.0 hour for platforms, ladders and roofing purlins).

(3) 混凝土强度等级:

(3) Concrete strength grade:

一般情况下，混凝土结构环境类别地下按“二 a”考虑，其他部分按“一”类考虑。根据工艺要求对于有气相或液相腐蚀介质的车间，须设计防腐保护，环境类别按五类。

Under normal circumstances, the concrete structure environment is considered as Category IIa, and the other parts are considered as Category I. According to the process requirements, the workshops susceptible to corrosive gas or liquid must be designed with anti-corrosion protection. The environment category is considered as

Category V.

现浇钢筋混凝土基础: C30~C40

Cast-in-situ reinforced concrete foundation: C30-C40

柱下条形基础、柱下独立基础、基础梁、梁、板、柱、楼梯: C25~C40

Strip foundations and independent foundations under column, foundation beams, girders, slabs, columns, staircases: C25-C40.

现浇钢筋混凝土池体、地坑: 根据池内腐蚀性溶液对钢筋混凝土的腐蚀性等级依次如下:

Cast-in-situ reinforced concrete ponds and pits: the concrete strength is as follows according to corrosiveness to reinforced concrete by corrosive solution in the ponds:

弱腐蚀:C30, 抗渗等级 P8;

Weak corrosion: C30, impermeability grade of P8;

中等腐蚀: C35, 抗渗等级 P8;

Moderate corrosion: C35, impermeability grade of P8;

强腐蚀: C40, 抗渗等级 P8。

Strong corrosion: C40, impermeability grade of P8

垫层: 无腐蚀环境: C10 或 C15;

Cushion layer: non-corrosive environment: C10 or C15;

弱腐蚀: C20;

Weak corrosion: C20;

中等、强腐蚀: 沥青混凝土

Moderate and strong corrosion: asphalt concrete

(4) 填充墙:

(4) Infill wall:

无腐蚀环境:

Non-corrosive environment:

▽±0.000 以下: MU15 烧结普通砖, M7.5 水泥砂浆;

Below ▽±0.000: MU15 ordinary vitrified brick and M7.5 cement mortar;

▽±0.000 以上: 框架结构: MU10 烧结多孔砖, Mb5 混合砂浆;

Above ▽±0.000: Frame structure: MU10 perforated vitrified brick, Mb5 composite mortar;

腐蚀环境:

▽±0.000 以下: MU15 烧结普通砖, M10 水泥砂浆

Below ▽±0.000: MU15 ordinary vitrified brick and M10 cement mortar;

▽±0.000 以上: 框架结构: MU10 烧结多孔砖, M10 水泥砂浆

Above ▽±0.000: Frame structure: MU10 perforated vitrified brick, M10 cement mortar;

根据本工程的实际情况, 采用的钢材主要来自中国。钢筋、水泥、木材、石材可在当地或临近国家采购, 材料要求均需满足中国及印尼当地规范及标准。

In consideration of the actual situation of the project, the steels to be used will be mainly purchased from China. Rebar, cement, wood and stones can be purchased locally or from neighboring countries. The materials must meet the specifications and standards of China and Indonesia.

b) 施工资质

b) Construction qualification

设计要求具有冶金矿山工程施工经验的单位参加工程建设,并具有进行本工程基本建设需要的施工资质及条件,验收按中国规范验收且需满足印尼相关规范要求。

According to the design requirements, contractors shall be experienced in metallurgy and mine construction and have qualification and conditions required for the project capital construction. The acceptance shall be carried out in accordance with relevant codes and regulations in China and satisfying the requirements in Indonesia.

c) 主要结构设计说明

c) Description of main structural design

(1) 建筑结构的构配件采用中国国家现行通用设计标准图集;柱网平面布置和厂房竖向布置,一般按中国现行标准的规定,符合建筑统一模数要求。

(1) Members and components designed for the building structures are subject to current general design standard drawing collections of China; the plane layout of the column grids and the vertical layout of the plant are generally in accordance with the current standards of China and meet the requirements of the buildings unified modulus.

(2) 主要厂房和建(构)筑物的主要设计方案如下:

(2) The main design schemes of main plants and buildings (structures) are as follows:

1) 粗碎车间和中间矿堆采用钢筋混凝土框架结构,粗碎车间带简易钢棚。基础采用筏板基础。

1) The primary crushing workshop and intermediate ore stockpile are made of reinforced concrete frame structure, and the primary crushing workshop is provided with a simple steel shed. Raft

foundations shall apply.

2) 磨矿车间为露天设置，结构为钢框架型式；平台、楼板根据荷载等级和跨度的不同确定采用钢平台梁柱；楼板根据工艺需要采用花纹钢板或钢格栅；柱基采用钢筋混凝土独立基础基础；设备基础采用钢筋混凝土基础。

2) The grinding workshop is unroofed, in a steel frame structure; for its platforms and floor slabs, beam columns for steel platforms are adopted as per different load levels and spans; the floor slabs consist of checker plates or steel grids as per the process requirements; the column foundations are independent reinforced concrete foundations. Equipment foundations are constructed of reinforced concrete.

3) 浮选车间为钢结构，平台、楼板根据荷载等级和跨度的不同确定采用钢平台梁柱及钢筋混凝土框架结构；楼板根据工艺需要采用花纹钢板或钢格栅；有腐蚀车间的走道板采用玻璃钢格栅；柱基采用钢筋混凝土独立基础基础；设备基础采用钢筋混凝土基础。

3) The flotation plant is made of steel structure. For its platforms and floor slabs, beam columns for steel platforms and reinforced concrete frame structure are adopted as per the different load levels and spans; the floor slabs are made of checker plates or steel grids as per the process requirements; the walkway slabs in the workshop susceptible to corrosion consist of FRP gratings; the column foundations are independent reinforced concrete foundations; equipment foundations are constructed of reinforced concrete.

4) 浮选药剂制备为钢结构。基础采用钢筋混凝土独立基础基础。

4) The flotation reagent preparation facility is of steel structure. Independent reinforced concrete foundations shall apply.

5) 石灰制备为露天设置，结构为钢框架型式；柱基采用钢筋混凝土独立基础基础；设备基础采用钢筋混凝土基础。

5) Lime preparation facilities are provided outdoors, and the structure is steel frame; the column foundations are independent reinforced

concrete foundations; equipment foundations are constructed of reinforced concrete.

6) 维修车间、综合仓库为钢结构，挖方区域子项基础采用钢筋混凝土独立基础基础；回填区域采用桩基。

6) The maintenance workshop and the integrated warehouse are of steel structures, and the foundations for sub-items in the excavation area are independent reinforced concrete foundations; pile foundations are placed in the backfill area.

7) 试验室、变配电室、总降压站为单层钢筋混凝土结构，屋面采用钢结构；柱基采用钢筋混凝土独立基础；回填区域采用桩基。

7) The lab room, transformation and distribution stations and general step-down station are of single-storey reinforced concrete structure, and the roofing is of steel structure; the column foundations are independent reinforced concrete foundations; pile foundations are placed in the backfill area.

8) 采矿综合楼、选矿综合楼为两层钢结构房屋；柱基采用桩基。

8) The mining complex and mineral processing complex are of two-story steel structure; the column foundations are pile foundations.

9) 循环水系统、地表水收集系统采用现浇钢筋混凝土结构；基础采用筏板基础。

9) The circulating water system and surface water collecting system are of cast-in-situ reinforced concrete structure; raft foundations are recommended.

10) 地下通廊和地下构筑物采用现浇钢筋混凝土结构。

10) The underground corridors and underground structures are of cast-in-situ reinforced concrete structure.

11) 吊车梁:根据使用功能,吊车跨度及起重量和厂房结构确定，采用钢吊车梁。

11) Crane girder: steel crane girders are selected as per use function, span and lifting capacity and plant structure.

12) 皮带廊、综合管网采用开敞式钢桁架结构。

12) The belt corridor and integrated pipe network are of open steel truss structure.

(3) 特殊构筑物的结构设计

(3) Structural design of special structures

1) 粗碎车间矿仓采用钢筋混凝土矿仓；

1) The ore bins in the primary crushing workshop are constructed of reinforced concrete;

2) 颚式破碎机基础采用钢筋混凝土墙式基础；

2) The jaw crushers are installed on reinforced concrete wall foundations;

3) 半自磨机、球磨机基础采用钢筋混凝土大块式基础；

3) The semi-automatic mill and ball mill are installed on reinforced concrete massive foundations;

4) 浮选机、搅拌槽支架平台采用钢支架；

4) The flotation machines and the agitation tank platform are supported by steel supports;

5) 给料机、渣浆泵基础均采用钢筋混凝土支墩基础；

5) The feeder and slurry pumps are installed on reinforced concrete pier foundations;

6) 选场循环水等采用现浇钢筋混凝土结构；

6) The circulating water facilities of the concentrator are of cast-in-situ reinforced concrete structure;

7) 浓密机支架基础采用钢筋混凝土独立基础。

7) The thickener supports are installed on independent reinforced concrete foundations.

8) 挡土墙采用钢筋混凝土结构

8) The retaining walls are of cast-in-situ reinforced concrete structure.

9) 特殊使用要求的结构：地下通廊、水池等有防水要求，采用抗渗混凝土，抗渗等级 P6、P8，内壁采用防水砂浆抹面，抹面缝与混凝土施工缝错开。

9) Structures required for special use: P6 and P8 impermeable concrete is used for underground corridors and ponds with waterproofing requirements; the inner wall is plastered with waterproof mortar; mortar joints are staggered with concrete construction joints.

2.2.3 注意事项

Attentions

(1) 钢结构施工需考虑预留设备管道等设施安装对钢结构安装的影响；

(1) Any impact caused by installation of reserved facilities such as equipment pipelines shall be considered during installation of steel structures;

(2) 桩基、承台、基础施工等均需包括防雷接地的内容；

(2) The pile foundations, bearing platforms, foundations, etc. shall be grounded to prevent lightning;

(3) 施工单位需自行评估气候环境、外接道路等外部环境对施工进度的影响；

(3) The construction company shall evaluate impact of the external environment such as the climate and external roads on the construction schedule and progress;

(4) 特殊使用要求的结构：地下通廊、水池等有防水要求，采用抗渗混凝土

(4) Structures required for special use: impermeable concrete shall be used for underground corridors and ponds with waterproofing requirements

(5) 因缺少详勘报告，结构的基础形式在施工图阶段存在调整的可能。

(5) Due to lack of detailed investigation report, forms of the foundation structures can be adjusted at the detailed design stage.

(6) 各子项的建构筑物的形式及长宽高是基于初步设计条件设计，后续施工图阶段存在调整的可能。

(6) The form, length, width and height of the buildings and structures of each sub-item are designed based on basic design conditions, and can be adjusted at the follow-up detailed design stage.

7) 因规范《低合金高强度结构钢》GB/T1591-2018 中已用 Q355 级钢材替换原 Q345 级钢材，请投标人在报价中充分考虑使用 Q355 级钢材代替原 Q345 级钢材的影响。

(7) Since Q355 grade steel has been used to replace the Q345 grade steel in GB/ T1591-2018, "High strength low alloy structural steels

", The bidders are requested to fully consider the influence of using Q355 grade steel to replace the Q345 grade steel before the submission of an offer.

2.3 建筑工程技术要求

Technical requirements for building works

2.3.1 规范及标准

Specifications and standards

《建筑工程设计文件编制深度规定》（2016 年版）

Provisions on Depth for Preparation of Design Document for Construction Engineering (Edition 2016)

《建筑设计防火规范》 GB50016-2014 (2018 修订版)

Code for Fire Protection Design of Building GB50016-2014 (Rev. 2018)

《工业建筑防腐蚀设计规范》 GB50046-2018

Standard for Anticorrosion Design of Industrial Constructions GB50046-2018

《泵站设计规范》 GB/T50265-2010

Design Code for Pumping Station GB/T50265-2010

《办公建筑设计规范》 (JGJ67-2016)

Design Code for Office Buildings (JGJ67-2016)

《民用建筑设计通则》 (GB 50352-2005)

Code for Design of Civil Buildings (GB 50352-2005)

及其他相关现行国家和当地标准图集

Other relevant current national and local standard drawings

2.3.2 设计原则

Design principles

设计遵循“技术先进，经济合理，稳妥可靠，切实可行”的设计原则。在满足各专业对建筑要求的前提下，尽量选用国家现行标准，积极采用经过实践检验的新结构，新材料，根据本工程的实际情况，采用的钢材、钢筋主要来自中国。水泥、木材、石材可在当地或临近国家采购。

The design shall be based on the principles of being technically advanced, economically rational, stable, reliable and feasible". New well-proven structures and materials meeting the current national standards shall be selected as possible, provided that requirements

of various disciplines on the construction are met. In consideration of actual conditions of the project, steel and rebars will be mainly purchased from China. Cement, wood and stone can be purchased locally or from neighboring countries.

2.3.3 建筑构造及处理

Building construction and treatment

(a) 楼地面

(a) Floor slabs

(1) C30 混凝土地面(内配双层钢筋网)用于中间矿堆堆场地面；

(1) C30 concrete ground (provided with double-layer reinforcing mesh) is recommended for the intermediate ore stockpile;

(2) C25 细石混凝土地面用于一般车间地面；

(2) C25 fine aggregate concrete ground is recommended for ordinary workshops;

(3) 防滑地砖，用于办公室、试化验室，食堂，浴室等房间。

(3) Non-slip floor tiles are laid for offices, testing rooms, labs, canteens, bathrooms, etc.

(4) 不发火地面用于应急柴油发电站

(4) Non-sparking ground is provided for the emergency diesel power station

(5) 高标号水泥砂浆用于变配电室地面

(5) High-grade cement mortar is used for the ground of the transformation and distribution rooms

地面基层做法：

Construction method of ground base course:

1) 150 厚 C15 混凝土;

1) 150 thick C15 concrete;

2) 100 厚碎石 (卵石) 灌砂夯实垫层;

2) 100 thick gravel (pebble) sand-filled compacted bedding course;

3) 素土夯实

3) Plain soil compacted

楼面基层做法:

Construction method of floor base course

1) 20 厚 1:1 水泥砂浆结合层;

1) 20-thick 1:1 cement mortar bonding course;

2) 15 厚 1:2 水泥砂浆找平层;

2) 15-thick 1:2 cement mortar leveling course;

3) 现浇钢筋混凝土板上刷水泥浆一道;

3) One layer of cement mortar applied on cast-in-situ reinforced concrete slab;

(b) 屋面防水及保温

(b) Roofing waterproofing and insulation

屋面均采用 0.6mm 厚 YX35-125-750 型 (V125) 彩色压型钢板; 内衬钢丝网夹 100 厚离心玻璃棉毡。屋面防水采用钢结构屋面自防水;

The roofing consists of 0.6mm thick YX35-125-750 (V125) color profiled steel sheets; the lined wire mesh is sandwiched with 100-thick centrifugal glass wool blanket. The roofing is of self-waterproof steel structure;

(c) 内墙面及天棚 (砖墙部分)

(c) Inner wall and ceiling (brick wall)

1:1:6 水泥石灰砂浆 15 厚，纸筋灰面 5 厚，白色涂料 2 遍，用于一般车间。

For ordinary workshops, 15-thick 1:1:6 cement lime mortar, 5-thick paper strip mixed with lime mortar, and two layers of white paint are applied.

1:2.5 水泥砂浆底 20 厚，纯水泥浆贴白色瓷板，用于卫生间等房间。

For rooms such as washrooms, a bottom layer of 20-thick 1:2.5 cement mortar is laid, and white ceramic tiles are laid with pure cement mortar.

所有内墙有阳角处，每边做 100 宽护角，护角做法为 1:3 水泥砂浆 20 厚 1800 高。

External corners at all interior walls are protected by 100-wide angle beads consisting of 20-thick and 1800-high 1:3 cement mortar.

厂区生活设施天棚采用石膏板吊顶，卫生间采用铝塑板吊顶。

The gypsum board ceilings are provided for the living facilities in the plant area, while the aluminum composite panel ceilings for washrooms.

(d) 外墙面（砖墙部分）

(d) Exterior wall (brick masonry)

墙面采用 1:3 水泥砂浆底 15 厚，1:2 水泥砂浆面 10 厚，外刷涂料。

For the walls, a bottom layer of 15-thick 1:3 cement, a surface layer of 10-thick 1:2 cement mortar and exterior paint are applied.

1) 墙体（砖墙部分）

1) Wall (brick masonry)

采用 240 厚烧结多孔砖。 ± 0.000 以下采用 MU10 砖，M5 水泥砂浆砌

筑，±0.000 以上采用 MU10 砖，M5 混合砂浆砌筑。

240-thick perforated vitrified bricks are laid. MU10 bricks and M5 cement mortar are laid below the level of ± 0.000; M10 bricks and M5 mortar are laid at above the level of ±0.000.

墙身防潮层做法采用 1:2.5 水泥砂浆（内掺 5%防水剂）20 厚，设于标高-0.060 处。

The wall damp-proof layer consists of 20-thick 1:2.5 cement mortar (added with 5% water-proof agent), and is laid at a level of -0.060.

2) 墙体（钢结构部分）

2) Wall (steel structure)

1.2 米以上为 0.6mm 厚彩色压型钢板，板型为 YX38-300-900 型，颜色为象牙白；标高正负 0.000 米以上，1.2 米以下为 MU10 烧结多孔砖，M5 混合砂浆砌筑，

YX38-300-900 0.6mm-thick ivory white profiled steel sheets are placed above the level of 1.2m; MU10 perforated vitrified bricks and M5 composite mortar are laid above the level of ± 0.000 and below the level of 1.2m.

(e) 门窗：

(e) Doors and windows:

窗采用单层玻璃塑钢窗，门采用钢门，木门，防火门。

The windows are of single-layer glass PVC-coated steel frame; steel, wooden and fire doors are recommended.

(f) 通风与采光

(f) Ventilation and day lighting

利用高侧窗组织自然通风，对通风要求较高的车间采用成品屋面自然通风器或机械通风。

The natural ventilation is provided by using clerestory windows; in case of workshops with high ventilation requirements, natural ventilation using finished roofing or mechanical ventilation is provided.

(g) 建筑消防

(g) Building fire prevention

根据《建筑设计防火规范》GB50016-2014（2018 修订版）及《有色金属工程设计防火规范》GB 50630-2010 的要求，根据建筑生产的火灾危险性分类的不同，进行建筑物的防火设计。建筑耐火等级不低于二级设计。

The fire protection of buildings shall be designed as per requirements of Code for Fire Protection Design of Building GB50016-2014 (Edition 2018) and Code for Design on Fire Prevention of Nonferrous Metals Engineering GB 50630-2010 and based on classification of building fire hazards. The fire rating of the building shall not be lower than Grade II in the design.

单层建筑平面均至少 2 个出口直接对外，便于人员疏散。

The single-storey buildings shall be provided with a minimum of 2 exits to facilitate evacuation.

各建筑物内走廊、楼梯、安全出口的位置、数量、宽度、疏散距离，除满足工艺设备布置和操作要求外，均满足设计规范规定的安全疏散要求。

The location, quantity, width and evacuation distance of corridors, staircases and emergency exits in each building shall meet the requirements not only for process equipment layout and operation but also safe evacuation stipulated by the design specifications.

对于体量较大的厂房，设有环形消防车道，均可满足消防车通行。厂区内主要道路环行，均可满足消防车通行，消防车均可达到每栋建筑物前。消防车道宽大于 4.0 m。

Circular fire lanes shall be provided for the buildings with greater dimensions and main ring roads shall be provided in the plant area to allow passage of fire trucks. Each building can be accessed by fire trucks. The width of the fire lane shall be greater than 4.0m.

(h) 安全防护:

(h) Safety protection:

1) . 所有建筑物内外平台、洞口临空处设置安全防护栏杆，距基准面高度小于 20 米的平台栏杆采用 1050 高，距基准面高度大于 20 米的平台栏杆采用 1200 高。另外悬挂安全操作标志。

1). Internal and external platforms and openings of all the buildings shall be provided with safe protection railings; 1050 -high platform railings shall be provided at less than 20m from the base level, and 1200-high platform railings shall be provided at more than 20m from the base level. Besides, the safety operation signs shall be provided.

2) . 高度超过规范要求的直爬梯均设置护笼。

2). Vertical ladders exceeding the specified height in specifications shall be provided with cages.

3) . 所有疏散门均向疏散方向开启。

3). All evacuation doors shall be opened in the evacuation direction.

4) . 所有出入口处均设置雨篷。

4). All entrances and exits shall be provided with awnings.

5) .所有厂房高侧窗、天窗处玻璃均采用安全玻璃。

5). Clerestory windows and skylights of all the workshops shall be made of shatterproof glass.

6) .大跨度、大进深车间屋面采用采光板增加车间内采光。

6). Roofing of the workshops with large span and depth shall be

provided with daylighting panels to increase daylighting.

7) .对跨度大工艺上对通风要求较高的厂房，采用挡风板天窗或自然通风器形式进行有组织自然通风。

7). For the workshops with a large span and high ventilation requirements, natural ventilation shall be provided by windshield skylights or natural ventilators.

(i) 建筑节能处理

(i) Building energy conservation

本地区全年气温相对较稳定，全年平均气温 20~30，气候温暖，变化较小，建筑物可不做节能处理

The annual temperature in the region is relatively stable with an average temperature of 20~30°C. Due to warm climate and small temperature variation, energy conservation is not required for the buildings.

2.3.4 注意事项

Attentions

(1) 地面地基的压实系数不应小于 0.9，其含水量应控制在规范的许可范围内

(1) The coefficient of compaction of the ground shall not be less than 0.9, and the water content shall be controlled within the permitted range of the specification.

(2) 碎石夯入土中的地基加固法适用于柔软地基地区，施工要求见《建筑地面工程施工及验收规范》第 3.07 条，灰土施工方法见该规范之第 4.1.1 条至第 4.1.4 条

(2) The ground reinforcement method that the macadam is tampered into the soil shall be appropriate to the soft ground area. See Article 3.07 of Code for Acceptance of Construction Quality of Building Ground for the construction requirements. See Article 4.1.1 to Article

4.1.4 of this Specification for the construction method of lime earth.

(3) 季节性冻土地地区的地面，在冻土范围内应设置防冻胀层，材料一般为中粗石，砂卵石，防冻层厚度见《建筑地面设计规范》之有关规定，防冻层应注意排水，设置防冻层的地面，纵横向缩缝均应采用平头缝，其间距不应大于 3 米

(3) As for the ground of the seasonal frozen soil region, an anti-frost heaving course shall be set in the range of frozen soils, generally with the medium coarse stone or sandy gravel. See the thickness of the frostproofing course in the relevant regulations of Code for Design of Building Ground. The drainage of the frostproofing course shall be noted. The ground of the frostproofing course shall be set. Flat joints shall be adopted as the transverse and longitudinal contraction joints, with the spacing of not more than 3m.

(4) 无论作为垫层或面层的混凝土，均须按《建筑地面设计规范》要求分仓浇筑或留缝（伸缝或缩缝）

(4) The concrete as the cushion or surface course must be placed in different silos or the joints (expansion or contraction joints) shall be reserved in accordance with the Code for Design of Building Ground.

(5) 地面混凝土垫层应在纵横向设置缩缝，纵向缩缝应采用平头缝或企口缝，其间距 3-6 米，采用企口缝时垫层不小于 150mm,拆模时混凝土强度不低于 3MPa,横向缩缝宜采用假缝，其间距为 6-12 米

(5) Longitudinal and transverse contraction joints shall be provided on the concrete cushion. Flat joints or rebate joints shall be adopted as the longitudinal contraction joints, with the spacing of 3-6m. The thickness of cushion shall not be smaller than 150mm when rebate joints are used. The concrete strength shall not be lower than 3MPa while the formwork is removed. Dummy joints should be used as the transverse contraction joints, with the spacing of 6-12m.

(6) 受液态介质作用的楼地面，应设坡向地漏或地沟的坡度，地面可用基土找坡，坡度 1-2%，楼面坡度为 1%

(6) The flooring affected by the liquid medium shall be provided with a slope to floor drain or a slope for the trench. The ground can be sloped with the foundation soil, with the slope of 1-2%. The floor slope is 1%.

(7) 块材面层之结合层，采用 1：3 干硬性水泥砂浆

(7) The 1:3 hard cement mortar shall be used for the bonding layer of the block surface layer.

(8) 防水层：材料为 1.5 厚沥青聚氨酯，沥青防水涂料等涂刷性防水层，或用其他防水材料代替，防油层用聚氨酯 2 厚，防水层，防油层在墙柱处翻起高度不小于 250mm

(8) The waterproof layer: the 1.5mm thick asphalt polyurethane and asphalt waterproofing paint shall be used, or replaced by other waterproof materials. The oil-proof layer shall adopt 2mm thick polyurethane. The turning up height of the waterproof layer and the oil-proof layer at the wall column shall not be less than 250mm.

2.4 各建（构）筑物的设计方案及主要工程量详见附表《地表建（构）筑物设施工程量表》。

See the Bill of Quantities of Surface Buildings and Structures Construction for the design scheme and main quantities of each building (structure).

3 总图工程技术说明。

Technical specifications for the general layout works

3.1 招标工程范围

Scope of bidding project

本次招标工程总图专业招标范围包括但不限于以下内容：

The scope of bidding for the discipline of general layout plan includes but is not limited to the following contents:

(1) 永久道路：施工现场已有 4m 宽现状施工便道。永久道路在现状

施工便道基础上进行拓宽和加高，施工内容包括永久道路路基、路面、排水沟等设施；

(1) Permanent road: a 4m wide existing construction road is on the construction site. The permanent road is widened and heightened on the basis of current construction road, and the construction contents include facilities such as the subgrade, pavement and drainage ditch of the permanent road;

(2) 场地排水设施：包括场地截洪沟、排水沟、排管管涵等设施；

(2) Drainage facilities on the site: including facilities such as flood detention ditch, draining ditch and draining culvert;

(3) 防护设施：包括厂区围墙、人行安全护栏等设施。

(3) Protection facilities: including the facilities such as enclosing wall of the plant, pedestrian barrier, etc.

(4) 埋地管道电缆：各区域子项间不上管架部分的管道电缆施工，工程量以实际发生为准。

(4) Buried pipeline cables: construction of those pipe cables between sections in various areas that do not lie on the pipe racks. The quantities shall be subject to the actual quantities.

3.2 工程技术要求

Technical requirements of the project

3.2.1 规范及标准

Specifications and standards

1) 优先执行印度尼西亚土石方工程相关规范及标准

1) The relevant specifications and standards of earth-stone works in Indonesia shall take priority.

2) 《厂矿道路设计规范》GB50022-1987

2) Code for Design of Roads in Plants and Mines GB50022-1987

3) 《建筑施工土石方工程安全技术规范》JGJ 180-2009

3) Technical Code for Safety in Earthwork and Stonework of Building Construction JGJ 180-2009

3.2.2 施工条件

Construction conditions

1) 项目用地已征用。投标人应充分评估风险后进行报价，除不可抗拒的因素外导致延期开工、停工、窝工、降效和增加特殊施工措施等发包人均不另行补偿相关损失及任何费用。

1) The land for the project has been requisitioned. The Bidder shall fully evaluate the risk before the submission of an offer. For the commencement delay, suspension, slowdown, efficiency reduction and addition of special construction measures which are not caused by the force majeure, the Employer will not compensate for the relevant losses or any expenses.

2) 施工现场有现状施工便道可供利用，中标人在使用过程中应对其进行维护，维护费用由中标人承担；因施工原因造成场地内管线等现有设施的损坏，由施工方出资并修复（若由发包人修复，其费用从施工方工程款中扣除）。

2) An existing construction road can be used on the site. The successful bidder shall maintain it during its use and bear the maintenance expenses; in case of any damage to the existing facilities such as pipelines on site due to the construction reasons, the constructor shall repair it at his own cost (if it is repaired by the Employer, the expenses shall be deducted from the constructor's project payment).

3) 中标人应充分考虑本工程的工期因素，加大机械、人工等资源的投入力度，充分保证施工工期。

3) The successful bidder shall fully consider the construction period of this project and increase the input in machinery, labor and other resources to guarantee the construction schedule adequately.

3.2.3 质量要求：分部、分项工程合格率 100%，单位工程优良
 Quality requirements: 100% percent of pass of segment works and sub-item works, and the high quality in the item works.

3.2.4 工程量清单
 Bill of quantities

见附表。

Refer to attached table.

4 桥梁工程技术说明 **Technical specifications for bridge works**

4.1 矿区桥梁概况 **Bridge overview in the mine site**

本项目矿区道路跨越现状沟渠水系处均需设置桥梁，根据矿区道路的总体规划及现状水系的分布情况，本次设计共布置 6 座桥梁，桥梁布置情况如下表所示：

Bridges shall be provided when roads in the Project mine site cross the present ditch drainage system. According to the general layout of mine roads and the distribution of the present drainage system, 6 bridges will be provided in this design. The layout of bridges is as shown in the following table:

表 1：矿区桥梁总体布置一览表

Table 1: General Layout of Bridges in the Mine site

序号	桥梁名称	结构形式	桥跨布置 (m)	总长 (m)	总宽 (m)	桥梁面积 (m ²)
S/N	Bridge name	Structure form	Bridge-span layout (m)	Total length (m)	Total width (m)	Bridge area (m ²)

1	1#桥 Bridge #1	钢筋砼空心板梁+重力式U型桥台+扩大基础 Reinforced concrete hollow slab girder+gravity U-type abutment+spread foundation	1跨 16m 1-span 16m	26	9	234.0
2	2#桥 Bridge #2	钢筋砼空心板梁+肋板桥台+柱式桥墩+桩基 Reinforced concrete hollow slab girder+rib abutment+column pier+pile foundation	3跨 13m 3-span 13m	46	5	231.5
3	3#桥 Bridge #3	钢筋砼空心板梁+实体桥台+柱式桥墩+桩基 Reinforced concrete hollow slab girder+solid abutment+column pier+pile	10+13+10m (3跨) 10+13+10M (3-span)	40	9	360.0

		foundation				
4	4#桥 Bridge #4	钢筋砼空心板梁+柱 式桥台+柱式桥墩+ 桩基 Reinforced concrete hollow slab girder+column abutment+column pier+pile foundation	3跨 16m 3-span 16m	52	9	468.0
5	5#桥 Bridge #5	钢筋砼空心板梁+扶 壁式桥台+扩大基础 Reinforced concrete hollow slab girder+ buttressed abutment+spread foundation	1跨 13m 1-span 13m	17	17	289.0
6	6#桥 Bridge #6	钢筋砼空心板梁+肋 板桥台+柱式桥墩+ 桩基 Reinforced concrete hollow slab girder+rib abutment+column	3跨 13m 3-Span 13m	46	7	230.0

		pier+pile foundation				
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4.2 设计采用的主要规范和标准

Main specifications and standards used in design

本项目桥梁设计采用中华人民共和国国内现行相关规范和标准，设计采用和依据的主要相关规范和标准如下：

The existing specifications and standards of the People's Republic of China are adopted in the design of bridges in this Project. Main specifications and standards used in the design are as below:

(1) 《厂矿道路设计规范》(BGJ 22-87)

(1) Code for Design of Roads in Plant and Mine (BGJ 22-87);

(2) 《公路桥涵设计通用规范》(JTG D60-2015);

(2) General Specifications for Design of Highway Bridges and Culverts (JTG D60-2015);

(3) 《公路钢筋混凝土及预应力混凝土桥涵设计规范》(JTG 3362-2018);

(3) Specifications for Design of Highway Reinforced Concrete and Prestressed Concrete Bridges and Culverts (JTG 3362-2018);

(4) 《公路桥涵地基与基础设计规范》(JTG D63-2007);

(4) Code for Design of Ground Base and Foundation of Highway Bridges and Culverts (JTG D63-2007);

(5) 《公路桥梁抗震设计细则》(JTG/T B02-01-2008);

(5) Guidelines for Seismic Design of Highway Bridges (JTG/T B02-01-2008);

(6) 《公路涵洞设计细则》(JTG/T D65-04-2007);

(6) Guidelines for Design of Highway Culvert (JTG/T D65-04-2007);

(7) 《公路圬工桥涵设计规范》(JTG D61-2005);

(7) Code for Design of Highway Masonry Bridges and Culverts (JTG D61-2005);

(8) 《公路桥涵施工技术规范》(JTG/T F50-2011);

(8) Technical Specifications for Construction of Highway Bridges and Culverts (JTG/T F50-2011);

(9) 《混凝土结构设计规范》(GB50010-2010);

(9) Code for Design of Concrete Structures (GB50010-2010);

4.3 主要设计技术标准

Main technical standards of design

(1) 所在道路等级：二级露天矿山道路；

(1) Road grade: second-grade opencast mine road;

(2) 设计汽车荷载等级：按国内规范“公路-I级”荷载控制设计；

(2) Class of design car load: controlled and designed as per the load of Class I Highway in the domestic specification;

(3) 桥涵结构设计基准期：100年。

(3) Baseline design period of bridge and culvert structures: 100 years.

(4) 桥涵主体结构设计使用年限：中小桥 50 年；

(4) Design service life of main structure of bridge and culvert: 50 years for middle and small sized bridges

(5) 桥涵结构设计安全等级：二级。

(5) Design safety level of bridge and culvert structures: Level II.

(6) 设计洪水频率：五十年一遇。

(6) Designed flood frequency: fifty years return period.

(7) 混凝土耐久性基本要求：按桥涵所处 I 类环境进行设计。

(7) Basic requirements of concrete durability: designed according to the environment of Class I for the bridge and culvert.

(8) 桥梁所处区域地震基本烈度：8 度。

(8) Basic seismic intensity of the bridge: 8 degree.

4.4 主要工程材料

Main construction materials

(1) 混凝土

(1) Concrete

各桥上部主梁结构采用 C40 钢筋混凝土；

C40 reinforced concrete shall be adopted by the main girder of the superstructure of each bridge;

桥面铺装采用 C40 防水砼；

C40 waterproof concrete shall be used in the bridge deck paving;

桥梁墩台及其基础均采用 C30 砼；

C30 concrete shall be used by the bridge pier and abutment and the foundation;

伸缩缝局部加强混凝土：C50 钢纤维砼。

Locally reinforced concrete for the expansion joint: C50 steel fiber concrete.

结构混凝土最大水灰比为 0.45，最小水泥用量为 300kg/m³，最大氯离子含量不超过水泥用量的 0.3%，宜使用非碱活性集料。

The maximum water cement ratio of the structural concrete shall be 0.45, the minimum cement content shall be 300kg/m³, the maximum

chloride ion content shall not exceed 0.3% of the cement content, and non-alkali active aggregates should be used.

(2) 普通钢筋

(2) Plain rebar

普通钢筋采用 HPB300 和 HRB400 钢筋，其质量必须符合国家标准《钢筋混凝土用钢第一部分：热轧光圆钢筋》(GB 1499.1—2008) 和《钢筋混凝土用钢第二部分：热轧带肋钢筋》(GB 1499.2—2007) 的有关规定。

HPB300 and HRB400 rebar shall be used as plain rebar, and the quality must comply with the relevant regulations of national standards including Steel for the Reinforcement of Concrete-Part 1: Hot Rolled Plain Bars (GB 1499.1 — 2008) and Steel for the Reinforcement of Concrete-Part 2: Hot Rolled Ribbed Bars (GB 1499.2—2007).

(3) 其它

(3) Others

进场钢材、水泥除必须具有厂方的质量合格证外，还应在工地分批抽样送检合格。其它材料砂、石、水的质量要求按《公路桥涵施工技术规范》(JTG/T F50-2011) 有关要求办理。

Steel products and cements on the site shall also pass the site sampling inspection in different batches, besides provided with the manufacturer's quality certificate. The quality of other materials such as sands, stones and water shall comply with the relevant requirements of the Technical Specifications for Construction of Highway Bridges and Culverts (JTG/T F50-2011).

4.5 桥型方案及各桥工程数量表

Bridge type scheme and bill of quantities of each bridge

各桥暂定桥型方案详见附件 1 (各桥桥型方案布置图，电子版)

See Annex 1 for the temporary bridge type scheme of each bridge (Each Bridge Type Scheme Layout, electronic copy)

各桥主要工程数量详见附件 2（各桥主要工程数量表，电子版）

See Annex 2 for the main bill of quantities of each bridge (Main Bill of Quantities of Each Bridge, electronic copy)

4.6 存在问题及建议

Existing problems and suggestions

（1）因本项目各桥桥位处尚无工程地质勘察资料，附件 1 中各桥桥型方案（尤其桥梁下部结构形式及尺寸）仅为暂定，并且暂定的各桥桥型方案尚未获得当地水务部门批复，后续阶段需根据补充的工程地质勘察资料与当地水务部门批复的相关意见对各桥桥型方案进行深化设计或方案调整，目前暂定桥型方案仅供施工招标参考使用，桥梁施工须依据调整后的施工图设计成果。

(1) Since there is no engineering geological investigation data for the locations of various bridges of this Project, the bridge type scheme of each bridge in Annex 1 is provisional provided and it has not yet been approved by the local water supply authority. At later stages, the bridge type schemes shall be further designed or adjusted according to the supplementary engineering geological survey data and the local water supply authority's relevant opinions. The present temporary bridge type scheme is only used for the reference of construction bidding. The bridge construction must be based on the design results of the adjusted detailed design.

（2）本项目目前尚处于初步设计阶段，附件 2 中所提工程数量仅为概算工程量，仅作为施工招标参考使用，不可作为施工结算的依据。

(2) As this Project is currently at the basic design stage, the quantities in Annex 2 are estimated and only used for the reference of construction bidding, which cannot be used as the basis of the construction settlement.

（3）附件 2 中工程量依据暂定的各桥桥型方案进行统计，本次统计工

程量将随桥型方案的后续调整而调整。

(3) The statistics of quantities in Annex 2 shall be made according to the provisional bridge type scheme of each bridge, and the statistics of quantities will be adjusted subsequently with the adjustment of the bridge type scheme.

(4) 各桥方案中下部结构基础为桩基的，均按暂定 25m 桩长统计工程数量，桩基类型均暂按钻孔灌注桩考虑。

(4) If the substructure foundation in each bridge scheme is the pile foundation, the statistics of quantities is temporarily made according to the 25m pile length and the type of pile foundation shall be considered in accordance with the bored piles.

(5) 部分桥梁两侧与上下游河岸及场地衔接处需设置挡土墙，此部分挡土墙工程量见岩土专业部分，不在附件 2 统计范围。

(5) Retaining walls shall be built on both sides of some bridges, at the upstream and downstream banks, and the connection places of the site. The quantities of retaining wall in this part shall be shown in the part of geotechnical discipline, and not included in the statistics scope of Annex 2.

(6) 附件 2 中工程量均未统计桥梁施工过程中可能发生的临时排水、临时改沟、施工围堰等临时工程及施工措施工程量，临时工程及施工措施工程量建议以现场按实核计。

(6) Statistics of quantities of possible temporary works and construction quantities such as temporary drainage, temporary ditch diversion and construction cofferdam during the construction of the bridge are not made in the quantities in Annex 2. It is suggested that statistics of quantities of temporary works and construction quantities be checked and calculated on the site according to the practical quantities.

5 岩土工程技术说明

Technical specifications for geotechnical works

5.1 卸矿平台加筋土挡墙 Reinforced retaining wall of ore unloading platform

5.1.1 工程量统计 Statistics of quantities

见附表。

Refer to attached table.

5.1.2 技术说明 Technical specifications

加筋土挡土墙相对于重力式挡土墙和混凝土挡土墙来说,其具有较大经济优势,尤其当挡土墙墙高越高,其经济优势就越明显。相对于重力式或混凝土挡土墙来说其圬工数量也少,减少了对材料的浪费。挡土墙中墙体、拉筋和填土为挡土墙主要的三组结构,所以在设计时需对这三组材料进行设计和计算。拉筋是加筋土挡土墙主要的结构,它将土压力转化为对墙体的拉力,以此来稳定墙体,这也是加筋土挡土墙支挡土压力的主要原理。

Compared with the gravity retaining wall and the concrete retaining wall, the reinforced earth retaining wall has great economic advantages, and the higher the retaining wall, the more obvious the economic advantage; what's more, the reinforced earth retaining wall features less quantities of masonry and waste of materials. The main three structures of the retaining wall are the wall, tie bar and earth fill, so these materials shall be designed and calculated in design. The tie bar is the main structure of the reinforced earth retaining wall. It converts the earth pressure to the tensile force against the wall to stabilize the wall. This is also the main principle of retaining pressure supported by the reinforced earth retaining wall.

加筋土挡土墙的优点就是可以作为一种柔性材料来吸收地震荷载并且能较好地适应地基变形,而加筋土挡土墙正好能适应这些地震发生频繁地区的挡土墙形式。

The reinforced earth retaining wall can be taken as a kind of flexible

material to absorb the seismic load and be able to adapt to the deformation of ground, and it is just right for those types of retaining walls in areas where earthquakes occur frequently.

5.1.3 注意事项

Attentions

(1) 按设计及规范要求平整场地，并对平整好的场地进行碾压，要求碾压后的填土压实度不小于 0.94；严格按设计文件，就地选取符合要求的填料；也可采用渗水性强的砂性土、砂砾、碎（砾）石、粉煤灰等材料，严禁采用淤泥、腐质土；当采用粘性土作为填料时，应在最佳含水量时施工；当采用弱膨胀土作为填料时，膨胀土宜改良使用。填料不得含有冻块、有机料及生活垃圾；填料粒径不宜大于填料压实厚度的 2/3，且最大粒径不得大于 15cm 含有尖锐棱角的粗粒料应避免摊铺在铺设筋材的表层；

(1) The site shall be leveled according to the design and specification, and the leveled site shall be compacted, and the compaction degree of the fill shall not be less than 0.94 upon the compaction; acceptable fillings shall be selected strictly in accordance with the design documents; also materials such as sandy soils of strong water permeability, gravels, crushed (gravel) stones and fly ash may be used, but the sludge or humus soil is forbidden; when the cohesive soil is used as the filling, the construction shall be carried out with the optimum moisture content; when the weak swelling soil is used as the filling, the swelling soil should be improved. The filling shall not contain any frozen piece, organic material or domestic garbage; the particle size of the filling should not be greater than 2/3 of the compaction thickness of the filling, the maximum particle size shall not be greater than 15cm, and coarse aggregates with sharp edges and corners shall be avoided from spreading on the surface layer of the reinforced material;

(2) 土工格栅必须按断面图要求的位置、长度及方向进行铺设。裁剪

时，沿格栅横向必须保留一整排至少 60mm 长的格栅纵向肋条；

(2) The geogrid must be laid in accordance with the position, length and direction of the cross-section diagram. During tailoring, a whole row of at least 60mm long longitudinal rib of the grid must be retained along the grid transversely;

(3) 用诸如斗式挖掘机或是带有铲斗的推土机等机械设备来进行填土施工，保证填土通过倾倒的方式摊铺在格栅上。为避免格栅受施工机械损伤，机械履带与格栅之间应至少保留 60mm 厚的填土，禁止机械直接在格栅上行进；

(3) The filling shall be conducted by use of machineries such as bucket excavator or bulldozer with a bucket to ensure that the fillings are spread on the grid through dumping. In order to prevent the grid from mechanical damage during construction, the 60mm thick filling shall be retained at least between the mechanical track and the grid, and the machinery cannot move on the grid directly;

(4) 在坡面处的格栅上摆放装土料的土袋，土袋的尺寸应适中，可铺填上一定量的回填料，通过格栅的另一自由端用张拉梁对格栅施加张拉力，使格栅绷紧，保证格栅平顺紧贴地面；

(4) The earth bag shall be placed on the grid at the slope and its size shall be medium, a certain quantity of backfill may be filled. A tensioning force shall be exerted on the grid by tensioned beam through the other free end of the grid to make the grid tightened and keep the grid close to the ground smoothly.

(5) 边坡施工过程中，应保证每一层格栅位于相同高程，故在施工过程中边坡底应注意采用阶梯式上升方案，单级阶梯高度应为格栅间 0.4m；

(5) During the slope construction, each layer of geogrid shall be at the same elevation. Therefore, the benches shall be made from the toe of each slope during the construction, and the height of a single bench shall be 0.4m between the geogrids.

(6) 在保持张拉格栅绷紧的同时，进行回填料的回填摊铺，以保证张拉设备移去后格栅不会回缩，或者张拉格栅后采用销钉固定格栅，固定格栅的销钉数量根据实际铺设长度而定；

(6) Backfilling shall be carried out while keeping the geogrid tensioned tightly, to ensure that the geogrid will not retract after the tensioning device is removed. Alternatively, the tensioned geogrid may be fixed with the pins, the number of which depends on the actual laying length of the geogrid.

(7) 在邻近结构面 1m 范围内，用轻型压实机械压实填土，对其他部位的回填料用大型压实设备进行充分碾压，使该层回填料的压实度达到设计及规范的要求，碾压时先格栅中部，再后部，最后前部依次进行碾压；

(7) Within 1m range near the structural surface, the backfills shall be compacted with the light compaction machinery. Those at other parts shall be fully compacted with the large-scale compaction equipment, so that the compaction degree of each backfill layer meets the design requirements and the requirements of specifications. The geogrid shall be compacted by rolling from the middle to the rear part, and finally to the front part.

(8) 按照设计要求，分层回填、碾压直至下一层底标高；

(8) According to the design requirements, the materials shall be backfilled in layers and compacted to the bottom elevation of the next layer.

(9) 裁剪出下一层土工格栅，并按规定位置铺设，将此层格栅与底层格栅反包段采用连接棒连接，并预留反包格栅的长度，反包长度翔.&n，格栅拉紧并固定，放置装砂砾料的麻袋；

(9) Then the next layer of geogrid shall be cut out and laid at the specified position. The overlap section of this layer of geogrid and the lower layer of geogrid shall be connected with the connecting rods, and the overlap length shall be reserved. Then the geogrid shall be

tightened and fixed, and the sacks filled with sand and gravel shall be placed.

(10) 最顶层土工格栅应足够长并埋在填土面下，保证填土可提供足够的约束力以永久性地锚固格栅。

(10) The top layer of geogrid shall be long enough and buried under the backfills to ensure that the backfills provide sufficient constraining force and anchor the geogrid permanently.

5.2 预应力锚索加固边坡

Slope improvement with prestressed anchor cables

5.2.1 工程量统计

Statistics of quantities

见附表。

Refer to attached table.

5.2.2 技术说明

Technical specifications

预应力锚索是指采取预应力方法把锚索锚固在岩体内部的索状支架，用于加固边坡。锚索靠锚头通过岩体软弱结构面的孔锚入岩体内，把滑体与稳固岩层联在一起，从而改变边坡岩体的应力状态，提高边坡不稳定岩体的整体性和强度。

The prestressed anchor cables refer to the cable support consisting of the cables anchored inside the rock mass by prestressing for the purpose of slope improvement. An anchor cable is anchored into the rock mass at the anchor head through the hole on the weak structural surface of the rock mass, to connect the sliding mass with the stable rock stratum, so that the stress state of the rock mass of a slope is changed and the integrity and strength of the unstable rock mass of the slope are improved.

5.2.3 注意事项

Attentions

边坡施工边挖边加固，即开挖一级，防护一级，不得一次开挖到底。根据各工点工程立面图，按设计要求，将锚孔位置准确测放在坡面上，孔位误差不得超过 $\pm 50\text{mm}$ 。如遇既有刷方坡面不平顺或特殊困难场地时，需经设计监理单位认可，在确保坡体稳定和结构安全的前提下，适当放宽定位精度或调整锚孔定位。

During the slope construction, improvement shall be carried out along with excavation, which means a bench shall be protected and improved once it is excavated. It is not allowed to complete the slope excavation all at once. According to the elevation view of each work point and the design requirements, the anchor holes shall be accurately set out on the slope surface, with the hole position error not exceeding $\pm 50\text{mm}$. If an existing slope is uneven or the special site makes the construction difficult, subject to the approval of the Designer and the supervision company, lower positioning accuracy may be used or the positions of the anchor holes may be adjusted provided that the stability and structural safety are ensured.

钻孔机具的选择，根据锚固地层的类别、锚孔孔径、锚孔深度、以及施工场地条件等来选择钻孔设备。岩层中采用潜孔冲击成孔；在岩层破碎或松软饱水等易于塌缩孔和卡钻埋钻的地层中采用跟管钻进技术。

The drilling equipment shall be selected according to the type of stratum to be anchored against, anchor hole diameter, anchor hole depth, and construction site conditions. For the rock strata, the down-the-hole drilling shall be used. For the fractured or soft and saturated rock strata where the hole collapse, hole shrinkage and drill sticking and burying are likely to occur, the drilling with casing technology shall be adopted.

锚孔钻进施工，搭设满足相应承载能力和稳固条件的脚手架，根据坡面测放孔位，准确安装固定钻机，并严格认真进行机位调整，确保锚孔开钻就位纵横误差不得超过 $\pm 50\text{mm}$ ，高程误差不得超过 $\pm 100\text{mm}$ ，钻孔倾角和方向符合设计要求，倾角允许误差位 $\pm 1.0^\circ$ ，方位允许误差 $\pm 2.0^\circ$ 。

During the anchor hole drilling, the scaffolding with the corresponding bearing capacity and stability conditions shall be erected. According to the slope surface conditions, the holes shall be set out and the stationary drilling machine shall be accurately installed. The machine position shall be adjusted strictly to ensure that the vertical and horizontal errors of the anchor holes do not exceed $\pm 50\text{mm}$, the elevation error doesn't exceed $\pm 100\text{mm}$ and the dip angles and orientations of the holes meet the design requirements. The allowable error is $\pm 1.0^\circ$ for the dip angle and $\pm 2.0^\circ$ for the orientation.

钻孔要求干钻，禁止采用水钻，以确保锚索施工不至于恶化边坡岩体的工程地质条件和保证孔壁的粘结性能。钻孔速度根据使用钻机性能和锚固地层严格控制，防止钻孔扭曲和变径，造成下锚困难或其它意外事故。

Dry drilling shall be adopted. It is prohibited to use wet drilling, so as to ensure that the anchor cable construction will not lead to deterioration of the engineering geological conditions of the slope rock mass and to ensure the bonding performance of the hole walls. The drilling speed shall be strictly controlled according to the performance of the drilling machine and the stratum to be anchored against, so as to prevent the boreholes from twisting and reducing, which will hinder the anchoring or result in other accidents.

钻进过程中对每个孔的地层变化，钻进状态（钻压、钻速）、地下水及一些特殊情况作好现场施工记录。如遇塌孔缩孔等不良钻进现象时，须立即停钻，及时进行固壁灌浆处理（灌浆压力 $0.1\sim 0.2\text{MPa}$ ），待水泥砂浆初凝后，重新扫孔钻进。

In the drilling process, the stratum changes at each hole, the drilling status (bit pressure, drilling speed), groundwater information and other special conditions shall be recorded well on the site. In case of a poor drilling phenomenon, such as hole collapse or shrinkage, drilling shall be stopped immediately and the hole wall shall be improved by grouting (grouting pressure $0.1\sim 0.2\text{MPa}$). After the cement mortar has initially set, the hole shall be cleaned and re-drilled.

钻孔孔径、孔深要求不得小于设计值。为确保锚孔直径，要求实际使用钻头直径不得小于设计孔径。为确保锚孔深度，要求实际钻孔深度大于设计深度 0.2m 以上。

The borehole diameter and depth shall not be less than the design values. In order to ensure the diameter of an anchor hole, the actual diameter of the drill bit used shall be not less than the design diameter. In order to ensure the depth of an anchor hole, the actual drilling depth shall be greater than the design depth by over 0.2m.

钻进达到设计深度后，不能立即停钻，要求稳钻 1~2 分钟，防止孔底尖灭、达不到设计孔径。钻孔孔壁不得有沉渣及水体粘滞，必须清理干净，在钻孔完成后，使用高压空气（风压 0.2~0.4MPa）将孔内岩粉及水体全部清除出孔外，以免降低水泥砂浆与孔壁岩土体的粘结强度。除相对坚硬完整之岩体锚固外，不得采用高压水冲洗。若遇锚孔中有承压水流出，待水压、水量变小后方可下锚筋与注浆，必要时在周围适当部位设置排水孔处理。如果设计要求处理锚孔内部积聚水体，一般采用灌浆封堵二次钻进等方法处理。

After the design depth is achieved, drilling shall not be stopped immediately. It is required to drill stably for another 1 to 2 minutes to prevent pinch-out of the bottom of the hole, in which case the design diameter will not be reached. The wall of each borehole shall be free from drilling slag and viscous liquid and must be cleaned. After a hole is drilled, the stone dust and liquid shall be fully removed out of the hole by using high-pressure air (air pressure of 0.2~0.4MPa), so as to avoid reducing the bonding strength between the cement mortar and the rock-soil mass of the hole wall. Except for the anchoring in the relatively hard and complete rock mass, flushing with high pressure water shall not be adopted. If any confined groundwater flows out of an anchor hole, the anchor rebar placement and grouting shall not be conducted until the water pressure and water volume are reduced. If necessary, the drain holes shall be provided around the hole as appropriate. If the built-up water inside an anchor hole is required to be removed as specified in the design requirements, grouting for

plugging and secondary drilling shall be generally carried out.

锚孔钻造结束后,须经现场监理检验合格后,方可进行下道工序。孔径、孔深检查一般采用设计孔径、钻头和标准钻杆在现场监理旁站的条件下验孔,要求验孔过程中钻头平顺推进,不产生冲击或抖动,钻具验送长度满足设计锚孔深度,退钻要求顺畅,用高压风吹验不存明显飞溅尘碴及水体现象。同时要求复查锚孔孔位、倾角和方位,全部锚孔施工分项工作合格后,即可认为锚孔钻造检验合格。

After the anchor hole drilling is completed, the next process shall not be carried out until the holes pass the inspection conducted by the on-site Supervisor. During the hole diameter and depth inspection, generally hole inspection is conducted by using the design hole diameter, drill bit and standard drill pipe under the witness of the on-site Supervisor. During the inspection, the drill bit shall advance smoothly without impacts or vibrations. The drilling length during the hole inspection shall reach the design anchor hole depth. The drill bit shall be retreated smoothly. When checking with the high-pressure air, there shall be no obvious splashing dust and water. At the same time, the positions, dip angles and orientations of the anchor holes shall also be checked. After all the subdivisional works of anchor hole construction are checked to be qualified, the anchor hole drilling inspection may be deemed as qualified.

预应力锚索体由锚梁、自由段、锚固段和安全段四部分组成。采用压力分散型锚索,由三个单元锚索组成,每个单元锚索分别由两根无粘结钢绞线内锚于钢质承载体组成,钢绞线通过特制的挤压簧和挤压套对称地锚固于钢质承载体上,要求单根的连接强度大于 200KN。钢质承载体要求采用 45 号钢材加工制作,其厚度不小于 2cm。

The prestressed anchor cable system consists of four parts: the anchor beam, the free section, the anchoring section and the safety section. The pressure-dispersed anchor cables composed of three unit anchor cables are adopted. Each of the unit anchor cables is composed of two unbonded steel strands internally anchored onto a steel supporting body symmetrically with the special compressed

springs and sleeves. The connection strength of a single strand shall be greater than 200KN. The steel supporting body shall be made of steel #45, with the thickness being not less than 2cm.

钢绞线采用 $\phi 15.24\text{mm}$ 高强度低松弛无粘结预应力钢绞线。安装前，要确保每根钢绞线顺直，不扭不叉，排列均匀，除锈、除油污，对有死弯、机械损伤及锈坑处剔出。钢绞线沿锚索体轴线方向每 2.0m 设置一架线环，保证锚索体保护层厚度不小于 20mm。

The $\phi 15.24\text{mm}$ high-strength low-relaxation unbonded prestressed steel strands shall be adopted. Before installation, make sure that each steel strand is straight and evenly arranged without twisting and crossing, and is derusted and degreased. The fast knots, mechanical damage and rust pits shall be removed. The steel strands shall be provided with a wire loop every 2.0m along the axial direction of the anchor cable system to ensure that the protective layer thickness of the anchor cable system is not less than 20mm.

安装锚索体前再次认真核对锚孔编号，确认无误后再用高压风吹孔，人工缓缓将锚索体放入孔内，用钢尺量出孔外露出的钢绞线长度，计算孔内锚索长度（误差控制在 50mm 范围内），确保锚固长度。

Before installing the anchor cable system, carefully check the anchor hole number again. After it is confirmed to be correct, the high-pressure air shall be used to blow the hole and the anchor cable system shall be manually inserted into the hole slowly. Then a steel ruler shall be used to measure the length of the steel strands exposed outside the hole and the anchor cable length inside the hole shall be calculated (with the error being controlled within 50 mm) to ensure the anchoring length.

注浆采用纯水浆，经试验比选后确定施工配合比。实际注浆量一般要大于理论的注浆量，或以锚具排气孔不再排气且孔口浆液溢出浓浆作为注浆结束的标准。如一次注不满或注浆后产生沉降，要补充注浆，直至注满为止。注浆结束后，将注浆管、注浆枪和注浆套管清洗干净，同时做好注浆记录。

The neat cement grout shall be used for grouting. The mix ratio for construction shall be determined after testing and comparison. The actual grouting volume is generally larger than the theoretical grouting volume. Alternatively, grouting shall be stopped when no air is exhausted from the vent hole of the anchorage device anymore and the thick grout begins to overflow from the orifice. If the hole is not fully filled with the grout or settlement occurs after grouting, the grout shall be replenished until the hole is filled. After the grouting is completed, the grouting pipe, grouting gun and grouting sleeve shall be cleaned, and the grouting records shall be made.

地梁采用 C30 混凝土整体浇注。基础先铺垫 2cm 砂浆调平层，再进行钢筋制作安装，钢筋接头需错开，同一截面钢筋接头数不得超过钢筋总根数的 1/2，且有焊接接头的截面之间的距离不得小于 1m。如锚索与竖梁箍筋相干扰，可局部调整箍筋的间距。砼浇注，尤其在锚孔周围，钢筋较密集，一定要仔细振捣，保证质量。

The ground beams shall be cast in one piece with C30 concrete. Firstly, a 2cm mortar leveling layer of the foundation shall be paved, and then the rebars shall be processed and installed. The rebar joints shall be arranged in a staggered manner. The number of joints in the same section shall not exceed 1/2 of the total rebar number, and the distance between the sections containing welded joints shall not be less than 1m. If the anchor cable interferes with the vertical beam stirrups, the spacing of the stirrups may be adjusted locally. During the concrete pouring, the concrete must be carefully vibrated to ensure the quality, especially around the anchor hole where the rebars are densely arranged.

通过现场张拉试验，确定张拉锁定工艺。锚索的张拉及锁定分级进行，严格按照操作规程执行。在设计张拉完成 6~10d 后再进行一次补偿张拉，然后加以锁定。

The tensioning and locking process shall be determined through a field tensile test. The anchor cable tensioning and locking shall be carried out in stages in accordance with the operating procedures.

Compensating tension and locking shall be performed 6~10d after the design tensioning is completed.

补偿张拉后，从锚具量起，留出长 5~10cm 钢绞线，其余部分截去，须用机械切割，严禁电弧烧割。最后用水泥净浆注满锚垫板及锚头各部分空隙，然后对锚头采用不低于 35MPa 的混凝土进行封锚，防止锈蚀和兼顾美观。

After the compensating tensioning, 5-10 cm steel strands shall be reserved from the anchorage device, and the rest part shall be cut off mechanically. Arc cutting is strictly prohibited. Finally, the neat cement grout shall be used to fill the gaps at the anchor backing plate and anchor head. The anchor head shall be sealed with the concrete with the strength being not less than 35 MPa, to prevent corrosion and ensure the good appearance.

5.3 扶壁式挡土墙

Buttressed retaining wall

扶壁式挡土墙包括：消防泵房与汽修车间临水挡土墙、中间矿堆临水挡土墙、20/11KV 总降周边临水挡墙。

The buttressed retaining walls include: the water retaining walls at the firefighting pump house and vehicle repair workshop, the water retaining walls at the intermediate ore stockpile and the water retaining walls around the 20/11KV main step-down substation.

5.3.1 工程量统计

Statistics of work quantities

见附表。

Refer to attached table.

5.3.2 技术说明

Technical specifications

扶壁式挡土墙是一种钢筋混凝土薄壁式挡土墙，其主要特点是构造简单、施工方便，墙身断面较小，自身质量轻，可以较好的发挥材料的强度性能，能适应承载力较低的地基。适用于缺乏石料及地震地区。一般在较高的填方路段采用来稳定路堤，以减少土石方工程量和占地面积。扶壁式挡土墙，断面尺寸较小，踵板上的土体重力可有效地抵抗倾覆和滑移，竖板和扶壁共同承受土压力产生的弯矩和剪力，适用 6~12m 高的填方边坡，可有效地防止填方边坡的滑动。

The buttressed retaining wall is a reinforced concrete thin-walled retaining wall which features a simple structure, convenience in construction, a small wall section and a light weight. It can better exert the strength performance of the materials and adapt to the ground with a low bearing capacity. It is suitable for the areas lacking stone and the earthquake regions. It is generally used at the fill sections with high elevations to stabilize the embankments and reduce the quantities of earth and stone works and the floor area. The buttressed retaining wall has a small section size. The weight of the soil mass on the heel slab can effectively resist overturning and sliding. The vertical slab and the buttress can jointly withstand the bending moment and shear force generated by the soil pressure. It is suitable for the 6~12m high filling slopes, and can effectively prevent the filling slopes from sliding.

扶壁式挡土墙的主要特点是构造简单、施工方便，墙身断面较小，自身质量轻，可以较好地发挥材料的强度性能，能适应承载力较低的地基。但是需耗用一定数量的钢材和水泥，特别是墙高较大时，钢材用量急剧增加，影响其经济性能。

The main features of the buttressed retaining wall include a simple structure, convenience in construction, a small wall section and a light weight. It can better exert the strength performance of the materials and adapt to the ground with a low bearing capacity. However, it needs a large amount of steel and cement. Especially in case of a large height, the amount of steel required increases sharply, which

affects its economic performance.

5.3.3 注意事项

Attentions

(1) 挡土墙墙底垫层为C15素砼，厚100mm，四周扩出基础底边各100mm。基槽开挖过程中不得超挖或扰动基底原状土，在基槽开挖后须请地质勘察部门进行现场踏勘，确认地基承载力后方可进行施工。

(1) The cushion at the bottom of a retaining wall shall adopt 100mm thick C15 plain concrete, and shall extend beyond the bottom edges of the foundation by 100mm respectively. During the excavation of a foundation trench, over-excavation or disturbance to subsoil shall not occur. After the excavation, the construction shall not proceed until a site survey is carried out by the geological survey department to confirm the bearing capacity of the ground.

(2) 钢筋的混凝土保护层厚度均为50mm，按设计要求设置宽20~30mm的变形缝(伸缩缝)，自墙顶做到基底，钢筋和混凝土均断开，缝中填塞沥青麻筋，填塞深度不应小于150mm。

(2) The thickness of the concrete protective layer the rebars shall be 50mm. According to the design requirements, the deformation joints (expansion joints) with a width of 20~30mm shall be made from the top of the wall to the base, where the rebars and concrete shall both be disconnected, and the asphalt jute shall be filled, with the filling depth being not less than 150mm.

(3) 挡土墙背回填应待墙身混凝土强度达到100%的设计强度方可进行，挡土墙背填料选用抗剪性能好的碎石土，要求回填碎石土容重 $\gamma \leq 18 \text{KN/m}^3$ ，内摩擦角 $\geq 35^\circ$ ，每层松铺回填厚度 $\geq 300 \text{mm}$ ，碾压夯实，压实系数 ≤ 0.90 ，填料含水量应接近最佳含水量，当含水量过高时应采取晾晒或掺入水泥等材料进行处理。

(3) Backfilling at the back of the retaining wall shall not be carried out until the concrete strength of the wall body reaches 100% of the design strength. The gravelly soil with good shear resistance shall be

used for backfilling. The backfilled gravelly soil shall have a volume weight of $\gamma \leq 18 \text{KN/m}^3$ and an internal friction angle of $\geq 35^\circ$. The thickness of each uncompacted layer shall be $\geq 300 \text{mm}$. The materials shall be rolled and compacted with a compaction coefficient of ≤ 0.90 . The water content of the materials shall be close to the optimal water content. If it is too high, the materials shall be dried or mixed with cement or other materials.

(4) 为排出墙体后积水，减少静水压力，沿墙体纵横两向设泄水孔，泄水孔的尺寸为100mm的PVC圆管，网度2.5X2.5m，外斜坡度5%，泄水孔应保持直通无阻，管口铺盖300g/m²/土工布用作反滤层，每片土工布面积600X600mm²，明显出水点重点设置，最低处泄水孔应高出地面300mm。

(4) In order to discharge the built-up water behind the wall and reduce the hydrostatic pressure, the drain holes shall be provided along the longitudinal and transverse directions of the wall. The drain holes shall adopt 100mm PVC circular pipes and 2.5x2.5m meshes, with the outward slope being 5%. The drain holes shall be kept smooth and unobstructed. The orifices shall be covered with the 300g/m² geotextiles as the filter layer. The area of each piece of geotextile shall be 600x600mm². The outlets with a large water amount shall be carefully constructed. The lowest drain hole shall be located at 300mm above the ground.

(5) 墙身砌出地面后，应及时回填夯实，并做成不小于5%的向外流水坡，以免积水下渗，影响墙身稳定。

(5) Once the height of the built wall exceeds the ground elevation, the materials shall be backfilled and compacted in time and an outward slope of not less than 5% shall be made to prevent the built-up water from seeping and affecting the stability of the wall.

(6) 钢筋连接均采用帮条双面焊接、搭接双面焊接等，焊接接头应相互错开，焊接接头连接区段的长度不小于45d（d为受力钢筋的较大直径）且不小于500mm。

(6) The rebars shall be connected by double-sided rod welding, double-sided lap welding, etc. The welded joints shall be staggered from each other. The length of a section connected by the welded joints shall be not less than 45d (d refers to the larger diameter among the stressed rebars) and not less than 500mm.

(7) 挡土墙顶部处应通长设置安全栏杆，栏杆形式根据建设单位要求确定，安全栏杆净高要求大于1.30m。

(7) A safety railing shall be set at the top of the retaining wall. The form of the railing shall be determined according to the requirements of the Employer. The net height of the safety railing shall be greater than 1.30m.

(8) 工程施工期间和使用期间均应加强边坡和挡墙的变形监测，挡土墙监测应由建设单位委托有资质的监测单位编制监测方案，经建设、设计和监理单位共同认可后方可实施。

(8) Deformation monitoring of the slopes and retaining walls shall be strengthened during both the construction and service periods. The monitoring of the retaining walls shall be consigned by the Employer to a qualified monitoring company, which shall prepare the monitoring plan. The plan shall not be implemented after it is approved by the Employer, the Designer and the supervision company.

5.3.4 补充说明:

Supplementary notes:

因未进行勘察，地层和参数不清楚，所有的支护形式可能会依据勘察结果进行相应调整和修改。

As the reconnaissance hasn't been carried out, the strata information and relevant parameters are not available. The supporting forms may be adjusted and modified according to the reconnaissance results.