

**1st Japan Construction
International Award**
Quality Infrastructure by Japanese
Technology

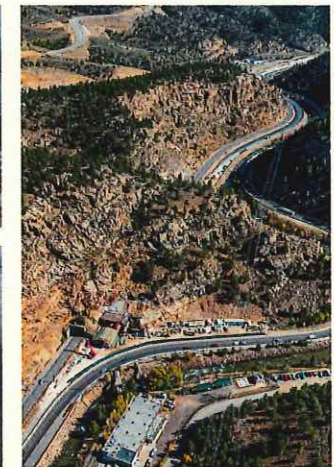
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はじめに

Introduction

我が国企業は、世界各国で様々なインフラの設計、施工等に携わり、我が国の優れたノウハウや技術力を存分に発揮することにより、「質の高いインフラ」を実現するとともに、技術移転や人材育成等を通じて、建設産業の育成にも貢献し、信頼を勝ち取ってまいりました。

本書では、「質の高いインフラ」が具体的にどのようなものなのか、そこで日本の強みがどのように発揮されたかを分かり易く示すため、「第1回JAPANコンストラクション国際賞」を受賞したプロジェクトを紹介しています。本書が、我が国の「質の高いインフラ」の理解促進と、我が国企業の更なる海外進出の一助となることを期待しています。

Japanese companies have engaged in designing, construction, and other business activities associated with various infrastructure around the world. In their business activities, they made full use of excellent know-hows and technical strength which are unique to Japan, achieving high-quality infrastructure. At the same time, they contributed to the development of the construction industry through technical transfer, personnel training, and other support measures. Such efforts allowed them to achieve solid worldwide trust.

This pamphlet introduces projects which were awarded with the first Japan Construction International Award to easily and specifically understand what high-quality infrastructure is and how Japanese companies made use of their strength in such infrastructure projects. We hope this pamphlet will help to raise awareness on high-quality infrastructure and to support Japanese companies' further overseas advance.

「質の高いインフラ」とは “High quality infrastructure”

インフラは、ただ整備すれば良いというものではありません。我が国は、「質の高いインフラ投資の推進のためのG7伊勢志摩原則」等を通じて、インフラ投資にあたって重視すべき5つの考え方を提唱しています。

For good services, infrastructure should not only be constructed. Through the G7 Ise-Shima Principles for Promoting Quality Infrastructure Investment and other initiatives, Japan proposes five principles that should be valued in infrastructure investment.

原則2. 「質の高いインフラ」は、現地人材を広く雇用し、工事の施工を通じて技術・ノウハウを積極的に移転します。

Principle 2. High-quality infrastructure promotes hiring of the locals in a wide scale and active technical and know-how transfer through construction.



原則2 Principle 2

2. Ensuring job creation, capacity building and transfer of expertise and know-how for local communities

原則3. 「質の高いインフラ」は、周辺への影響を最小限にする工法の採用やバリアフリーの実現など、社会・環境面に十分な配慮を行います。

Principle 3. High-quality infrastructure adequately considers social and environmental aspects including adoption of construction methods which minimize negative effects on surroundings and introduction of barrier-free design.



原則3 Principle 3

3. Addressing social and environmental impacts

原則1 Principle 1

1. Ensuring effective governance, reliable operation and economic efficiency in view of life-cycle costs as well as safety and resilience

原則1. 「質の高いインフラ」は、独自の構造や耐久性の高い資材を採用すること等により、低廉な維持管理コストと優れた安全性を実現します。

Principle 1. High-quality infrastructure achieves economical maintenance costs and excellent safety environments through adoption of special structures, highly durable materials and other efforts.



原則5 Principle 5

5. Enhancing effective resource mobilization

原則5. 「質の高いインフラ」は、インフラ整備に当たり、政府だけでなく、民間部門からの資金も効果的に活用します。

Principle 5. High-quality infrastructure effectively makes use of funds not only from governments but from private sectors in infrastructure development.



原則4 Principle 4

4. Ensuring alignment with economic and development strategies at the national and regional levels

原則4. 「質の高いインフラ」は、経路の国家プロジェクトの実現から地域の生活環境の改善に至るまで、幅広く貢献します。

Principle 4. High-quality infrastructure contributes to society in a wide scale ranging from achievement of long-awaited national projects to improvement of living environment for the locals.



我が国は、これらの考え方に基づく「質の高いインフラ投資」を今後も推進していきます。

Japan, based on these principles, will continue to promote investment on high-quality infrastructure.

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太陽の架け橋一日出づる国から
極寒の大地へ

A Bridge of the Sun - From a
Country of the Rising Sun to a
Country to Frigid Earth

02 | 03

ウランバートル市高架橋建設計画
(モンゴル)

市内を南北に分断するウランバートル鉄道線を跨ぐ
262mの鋼製橋梁と362mのアプローチ道路を建設。
老朽化した既存の二つの跨線橋では15tであった
南北方向通行車両の重量制限が40tに緩和されるとともに、
市内と国際空港を結ぶ距離が約3km短縮された。
これにより、市内南北の物流アクセスが大幅に向上し、
経済成長に大きく寄与しているほか、
市民の生活環境も改善。

工期: 2009年11月~2012年10月
発注者: モンゴル国道路・運輸・建設及び都市開発省
応募者: JFEエンジニアリング株式会社
(共同応募者: 株式会社建設技研インターナショナル)

関係者
設計者: 建設技研インターナショナル
施工者: JFEエンジニアリング

Ulan Bator Elevated-Bridge
Construction Project (Mongolia)

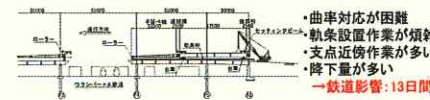
In the project, a 262 m steel bridge and a 362 m approach
road straddling Ulan Bator Railway Line, which separates
the city into the Southern and Northern parts were
constructed.
For vehicles driving in the south-north direction, the weight
limit of the two aged existing bridges was 15 t. After the
construction completion, the limit was increased to 40 t.
At the same time, the distance between the city and the
International Airport was shortened by approximately 3 km.
The new bridge and road shortened the logistic access
time between the southern and northern parts of the city,
largely contributed to economic growth and citizens' living
environments improvement.

Construction period: Between November 2009
and October 2012
Orderer: Ministry of Road, Transportation, Construction
and Urban Development of Mongolia
Applicant: JFE Engineering Corp.
(Co-applicant: CTI Engineering International Co., Ltd.)

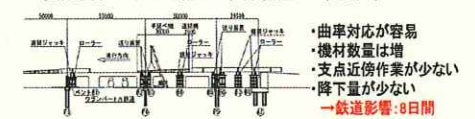
Relevant companies:
Design: CTI Engineering International Co., Ltd.
Construction: JFE Engineering Corp.



■発注時(架設完了桁上で組立→軌条、台車にて送出し)



■変更後(ペント上で組立→送り装置にて送出し)



少数桁構造や耐久性の高い鋼コンクリート合床版の採用により、維持
管理コストが小さく、トータルでのライフサイクルコストが低い、質の高いイ
ンフラを実現。

コンクリート打設のできない冬季に材料・部材の輸送・架設を行うなど適切
な工程管理と、日本製の機材を活用した急速施工など高い技術・ノウハウ
の活用により、-30℃にもなる長く厳しい冬季にも関わらず完全無災害かつ
約1ヶ月の工期短縮で施工を完了。

施工中も、排出土・振動の少ない工法の採用や、急速施工が可能な特
殊工法の採用により、隣接した商業地・住宅地・学校や鉄道・基幹道路
等、周辺交通への影響を最小化。

完成後、本橋は「日出づる国日本からのプレゼント」として「太陽橋」と命名
され、日モンゴルの友好関係を象徴するインフラ事業となっている。



High-quality infrastructure with minimal maintenance costs
and reduced total life-cycle costs was achieved by adopting a
structure with fewer bridge beams and durable steel-concrete
composite floors.

Optimal process management including material/member
transportation and construction conducted during winter, when
concrete cannot be placed, and use of high-level technology
and know-hows including rapid construction which utilizes
Japanese-made equipment and other strategies allowed
shortening of the construction period by approximately one
month without any accidents despite a harsh winter period, in
which the temperature drops to -30°C.

In addition, during the construction, a construction method
with fewer discharged soil and oscillation and a specialized
construction method, which allows rapid construction were
adopted. Through the adoption, effects on the neighboring
commercial areas, residential areas and schools and on the
surrounding traffic including railroads and main roads were
minimized.

After the completion, the bridge was named as "Taiyo-bashi"
based on an idea that the bridge was presented by Japan, a
country of the rising sun. The infrastructure project works as a
symbol for the Japanese-Mongolian friendship.

A Town in a City-Created with Collective Strength (Expertise)

**「スナヤン・スクエア」プロジェクト
(インドネシア)**

ジャカルタ特別州中心部の約20万㎡の敷地におけるショッピングモール、オフィス、高級コンドミニアム、ホテルからなる都心型大規模複合開発。
1989年にインドネシア政府から40年間の事業権(BOT契約)を取得。民間資金を効果的に活用しながら、BOT期間が終了する2036年まで運営中のプロジェクト。
1997年のアジア通貨危機など数々の困難を乗り越え、現地コミュニティに質の高い暮らしの場を提供し続けるとともに、海外からの人と資金をジャカルタに惹きつける拠点であり続けている。

工期

ホテル複合棟新築工事:
2011年12月～2015年8月
「スナヤン・スクエア」プロジェクト開発フェーズ:
1992年1月～2015年8月
プロジェクトBOT期間: 1996年4月～2036年4月
発注者: スナヤン・トリカリア・スンパナ
応募者: 鹿島建設株式会社

関係者

設計: 鹿島建設建築設計本部、カジマ・デザイン・アジア
施工: カジマ・インドネシア

**Senayan Square Project
(Indonesia)**

Senayan Square is an urban, large-scale multi-purpose development comprising shopping mall, office buildings, high-end condominiums and hotel on a site of approximately 200,000 m² located in the center of the capital city, Jakarta.
In 1989, Kajima Corp. was awarded a 40-year BOT Agreement by the Indonesian Government. The project will be operated until 2036, the end of the BOT period, using private funds. Senayan Square has overcome a number of difficulties including the Asian financial crisis in 1997 and continues to be one of Jakarta's most significant developments, attracting international tenants and visitors.

Construction period:

Hotel construction: December 2011 to August 2015
Senayan Square project development in phases:
January 1992 to August 2015
Project BOT period: April 1996 to April 2036
Developer: PT Senayan Trikarya Sempana
Applicant: Kajima Corp.

Related companies:

Design: Kajima Architectural Design Division, Kajima Design Asia Pte. Ltd.
Construction: PT Kajima Indonesia



プラザスナヤン正面 / Plaza Senayan front



スナヤン・スクエア全景 / Panoramic view

日本における開発ノウハウを全面的に活用し、低層部屋上をはじめとした敷地全体の緑化や、熱線吸収ガラスの活用による日射抑制対策などを施し、環境に優しい開発事業を実現。車椅子対応のスロープ、トイレ、客室を設置するなどバリアフリー化にも配慮。

全施設への自家発電機設置、大容量給水タンクの導入、防爆設備の整備、長期修繕計画の策定など、インフラとしての高い強靱性・経済性を確保。

商業施設で約5,150人、オフィスには約70社のテナントで約9,200人、施設運営管理会社で約750人の雇用を創出。外注社員約1,050人、ホテル従業員約560人と併せて、プロジェクト全体で実に約16,700人以上の雇用を創出している。

Accumulated Japanese know-how was fully utilized to achieve an ecologically friendly development, the green design of the whole site, including roofs of low-rise buildings, and measures to reduce irradiance with heat absorbing glass being examples. The design considered barrier free access for wheelchairs, incorporating slopes and disabled toilets and guest rooms.

Senayan Square's sustainability and investment viability were enhanced by the provision of back-up power generators at all buildings, high capacity water supply tanks, bomb-blast protection features and long-term maintenance plans among other measures.

Retail tenants employed some 5,150 people and office tower tenants, 70 or so in number, employed another 9,200. The management company operating the facilities employed 750 people directly and 1,050 indirectly by outsourcing work. 560 jobs were created at the hotel. Overall, more than 16,700 people were employed at Senayan Square.

ミャンマー初の経済特区開発

Development of Myanmar's First Special Economic Zone (SEZ)

06 | 07

ティラワ経済特別区ゾーンA開発工事 (ミャンマー)

「ティラワ経済特区」は、日ミャンマー両国が官民を挙げて取り組む大規模な工業団地開発事業。計画総面積2,400 haのうち、初期開発エリア「ゾーンA」として400 haを開発。本プロジェクトは、このうち326 haの工業団地エリアの開発を設計施工で実施するもの。第1期エリアが2015年9月に開業し、多くの日系企業の進出を後押しするとともに、ミャンマーの経済発展に大きく貢献している。

工期：2014年2月～2016年10月
発注者：Myanmar Japan Thilawa Development Ltd.
応募者：五洋建設株式会社(設計施工)

関係者
発注者：Myanmar Japan Thilawa Development Ltd.
(出資比率：日系民間39%、JICA10%、ミャンマー民間41%、ミャンマー政府10%)
施工：五洋建設-Suntacパートナーシップ

Thilawa SEZ Zone A Development Project (Myanmar)

Thilawa SEZ is a large-scale industrial park development project under the collaboration between private sectors and public sectors of both Japan and Myanmar. Out of total planned area 2,400 ha, the early development area 400 ha was developed as Zone A. In this project, PENTA-OCEAN CONSTRUCTION CO., LTD. constructed 326 ha industrial park area under EPC/Turnkey contract. Phase 1 area was opened in September 2015. The opening supports many Japanese companies expanding business into Myanmar also greatly contributes to the economic growth in Myanmar.

Construction period: Between February 2014 and October 2016
Client: Myanmar Japan Thilawa Development Ltd.
Applicant: Penta-Ocean Construction Co., Ltd. (Design-Build)

Relevant companies
Developer: Myanmar Japan Thilawa Development Ltd. (Shares: Japanese private sector 39%, JICA 10%, Myanmar private sector 41%, Myanmar government 10%)
Contractor: Penta-Suntac Partnership



ティラワ経済特別区全景

日系民間企業の39%、JICAの10%の出資を含め、日ミャンマーの官民が一体となって推進した両国官民協力の象徴的プロジェクト。

耐震設計や水害対策、ランニングコストの低い浄水場・下水処理施設など、日本の設計基準による高品質で環境にも配慮されたインフラ整備を実現。

一年の約半分を占め、月間降雨量が800mmを超える月もある雨季の影響等、困難な条件下にもかかわらず、仮排水路・仮設道路などの雨季対策や現地エンジニア、協力業者も含めた厳しい工程管理により、工期遵守を達成。進出予定企業のビジネスプランにも影響を与える工期の延長を回避したことは高く評価。

施工中は最大1,300人/日の作業員を雇用したほか、完成後も工場・物流施設・商業施設の経済特別区進出により現地に大きな雇用を創出。現地で実施したコンプライアンス研修や賄賂禁止を掲げたワンストップサービス窓口などの取組みにより、現地における法令順守精神の浸透にも寄与。



日緬両政府の要人が多数出席し開催された開業式の様子

This project is a symbolic project, which was promoted under close cooperation between public and private sectors both from Japan and Myanmar including 39% of its funding came from Japanese private companies and 10% of its funding came from JICA.

High quality and environment friendly infrastructures were developed, adopting Japanese standard such as seismic design, flood prevention measures and low-running-cost plants for water purification and sewage treatment.

The construction was substantially completed on time, in spite of severe natural conditions, such as maximum rainfall of 800 mm/month in a half-year rainy season, with well planned countermeasures including temporary drainage and access road and strict construction schedule management among local engineers and subcontractors. On-time delivery of the project contributes to timely set up of investors' business planning.

During the construction, maximum 1,300 workers were employed daily. Other than that, factories, logistics facilities, and commercial facilities located in Thilawa SEZ created large number of job opportunities for locals. Also, the project enhanced legal compliance in Myanmar by conducting compliance training sessions by the Contractor, as well as the Anti-bribery policy initiated by the One-Stop Service Center in Thilawa SEZ Management Committee.



東南アジアの大動脈をつなぐ
日本の技術

ネアックルン橋梁建設計画
(カンボジア)

ベトナムから首都プノンベンを経由しタイに至るアジアハイウェイの一部であり、南部経済回廊を構成する国道1号線がメコン河と交わる地点に位置する2.2kmの橋梁。

これまで有料フェリーでしか渡河できず、混雑時には数時間の特線を強いられていたが、この橋の建設により、短時間で、しかも夜間を含め常時無料で渡河できるようになった。これによってボトルネックとなっていたメコン河を短時間で安全に渡ることが可能となり、東南アジアのみならずアジア全体の経済発展に大きく寄与。

工期：2011年1月～2015年3月
発注者：カンボジア国公共事業・運輸省
応募者：株式会社長大(設計、施工監理等)

関係者
設計：長大、株式会社オリエンタルコンサルタンツグローバル
施工：三井住友建設株式会社



プロジェクト位置図、国道1号線がメコン川と交わる位置

Japanese Technology Connecting
the Main Artery of Southeast Asia

Neak Loeung Bridge Construction
Project (Cambodia)

Neak Loeung Bridge is a 2.2 km bridge over Mekong River, and a part of National Road No.1, which is a part of Asian Highway and the 2nd East-West Economic Corridor that connects Vietnam and Thailand via Phnom Penh, the capital of Cambodia.

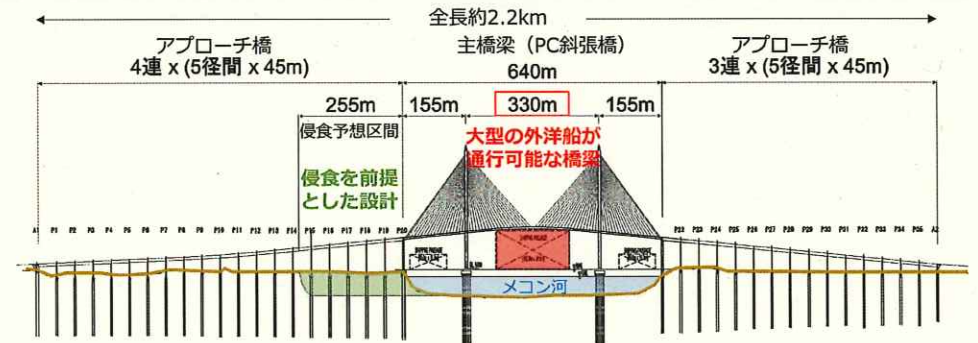
Before the construction, the river could only be crossed by toll ferries, forcing the passengers to stand by for several hours during rush hours. However, the completion of the bridge made it possible to cross the river fast, free of charge, regardless of time including night time. Therefore, the bridge made it possible to cross Mekong River, which used to be the logistic bottleneck of the road, fast and safe which lead to economic development of not only Southeast Asia but also Asia overall.

Construction period : From January 2011 to March 2015
Client : The Ministry of Public Works and Transport, Cambodia
Applicant : Chodai Co., Ltd.
(Design, construction supervision, etc.)

Relevant companies
Design : Chodai Co., Ltd. , Oriental Consultants Global Co., Ltd.
Construction : Sumitomo Mitsui Construction Co., Ltd.



本橋のデザインを取り入れたカンボジアの500リエル紙幣。カンボジア国民にとって身近な橋梁として親しまれている。



橋梁全体完成写真および構成。航行船舶の安全性、自然災害への強靱性に配慮した計画

日本企業の高い技術力により、5,000tの外洋船が通過可能な支間を持つ長大橋を設計・施工。

中洲上のアプローチ橋の設計において、コストの高い護岸建設を避け、侵食が生じることを前提として基礎設計を行うことで、コストの増大を抑えながら、将来の耐久性、自然環境の変化に対する強靱性を確保。

不発弾爆発に伴う工事中断にも関わらず、片持桁架設用作業車の大型化および鉄筋プレハブ化等により当初工期内に完工。

最盛期には1,000人/日の現地人雇用を創出。現地大学新卒等をエンジニアとして積極的に採用し、将来の現地技術者育成に寄与。

「つばさ橋(Spien Tsubasa)」と命名され、現地紙幣のデザインにも取り入れられるなど、日カンボジア友好の象徴的プロジェクト。

The long span bridge, which vessels as large as 5,000 t could pass under, was designed and constructed by using sophisticated technology of Japanese companies.

In designing the approach bridge on the sandbank, revetment construction was avoided due to high cost. But instead, the foundation was designed taking future erosion of the sandbank into account, as well as ensuring durability and resilience against changes in natural environment.

In spite of suspension on the construction due to an explosion of unexploded ordnance, it completed within the original construction period through efforts including use of larger Form Traveler for main girder and prefabrication of Re-bar cage. The project created employment of up to 1,000 locals per day. Among them were new graduates from local universities, contributing to raising local engineers.

The bridge was named "Tsubasa Bashi (Spien Tsubasa)", and was also adopted to the design of Cambodian riel notes. The project is now recognized as the symbol of Japan-Cambodia friendship.

都市を潤す東南アジア最長の
高品質トンネル

パハン・セランゴール導水トンネル
(マレーシア)

マレーシアの首都クアラルンプールおよびセランゴール州の人口は年6.1%の割合で増加しており、2020年には約1,000万人に達するといわれるが、生活・工業用水の確保が大きな課題。この喫緊の課題に対処するため、隣接するパハン州からマレー半島を縦断するティティワンサ山脈を貫く直径5.2m、導水能力189万m³/日の導水トンネルを建設。トンネル延長は東南アジア最長44.6km、最大土被りは世界8番目となる1,246mで、世界的にも稀な長距離トンネル。

工期: 2009年6月~2015年3月
発注者: マレーシア政府エネルギー・環境技術・水資源省
応募者: 清水建設株式会社(施工)

関係者
設計者: 東電設計・SMEC・SMHB
施工者: 清水建設・西松建設・UEMB・IJM JV



The Longest High-Quality Tunnel in
Southeast Asia - A Tunnel Hydrating
Cities

Pahang Selangor Raw Water
Transfer Tunnel Project (Malaysia)

The population of the Malaysian capital Kuala Lumpur and the Selangor state has been increasing year by year. The population is said to reach approximately 10 million in 2020. However, the cities has a big challenge in securing daily-life/industrial-use water. To address this urgent issue, this tunnel-construction project was implemented. The tunnel transverses the Malay Peninsula, spanning between the neighboring Pahang and Selangor and piercing the Titiwangsa Mountain Range. The tunnel has a diameter of 5.2 m and a raw water transfer capacity of 1.89 million m³ per day. The tunnel is a rare long tunnel worldwide; the length of the tunnel is 44.6 km, which is the longest in Southeast Asia; the maximum earth-covering depth is 1,246 m.

Construction period: Between June 2009 and March 2015
Orderer: The Ministry of Energy, Green Technology and Water
Applicant: Shimizu Corp. (Construction)

Relevant companies
Design: Tokyo Electric Power Services Co., Ltd., SMEC, SMHB Sdn. Bhd.
Construction: JV of Shimizu Corp., Nishimatsu Construction Co., Ltd., UEMB and IJM

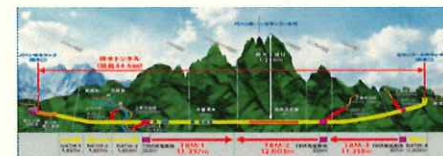


標高1,500mを超える山脈に緩い下り勾配のトンネルを掘削することで下流側揚水設備を不要とし、運営コストまで十分に考慮に入れたライフサイクル重視の質の高いインフラを実現。

全長44.6kmの長距離トンネル掘削であったが、GPS・精密測量等を使った高精度の測量と日本企業の技術力により高いレベルの貫通精度を確保。

本プロジェクトで採用された日本独自の施工技術は、世界トンネル会議等で発表され高い評価を得た。本プロジェクトの施工事例がマレーシアのトンネル施工標準にも採用された。

最大12ヶ国、約1,000名のスタッフと作業員が従事し、その後クアラルンプールや東南アジアでの地下鉄工事でも活躍。また、現地企業とのJVで工事を実施し、日本企業のもつトンネル工事の技術とノウハウをパートナーに移転。



In the project, a tunnel with a mild falling gradient in a mountain range of 1500 m in height was excavated, making pumping installations on the downstream side unnecessary. At the same time, the project took operational costs into account, achieving high-quality infrastructure which focuses on its life-cycle.

Although the overall length of tunnel excavation was long, 44.6 km, high-level piercing system was secured thanks to highly precise measurement, which uses GPS, precision measurement, and others as well as technical strengths of Japanese companies.

This project adopted construction techniques, which are unique to Japan. These techniques were introduced at international meetings including the World Tunnel Congress and other conferences, and these techniques were highly evaluated. Malaysian construction standards for tunnels adopted construction cases of the project.

Approximately 1,000 staffs and workers from up to 12 countries engaged in this project. After the completion of the project, many of them are now actively working in subway-construction projects in Kuala Lumpur and Southeast Asia. In addition, the construction was conducted by a JV with a local company. Through the JV, tunnel-construction technology and know-hows, which are owned by Japanese companies, were transferred to the partners.

世界最大を誇る中東の ハブ空港

ハマド国際空港 (カタール)

カタール政府の国家プロジェクトでもある、「中東におけるハブ空港」を目指す世界最大級の新空港の建設プロジェクト。このうち、本プロジェクトは年間旅客2,400万人対応の旅客ターミナル部分の建設が対象範囲となる。メインターミナル・ビルディングの構造は、ウェーブ形状柱を支える地上5階建て、延床面積約49万㎡の巨大プロジェクト。「ベスト・エアポート・イン・ザ・ミッドイースト」(2016)、「5スター空港」(2017)に輝く。本空港の建設により、石油依存経済から脱却し、「観光・研究開発などを取り入れた経済構造への転換」というカタールの国家目標の実現に貢献した。

工期: 2006年3月～2013年3月
発注者: 新ドーハ国際空港運営委員会 (NDIA)
応募者: 大成建設株式会社 (施工)

関係者
施工: 大成建設-TAV スカイオリックス
共同企業体 (SOJV)
CM: オーバーシーズベクテル設計コンサルタント:HOK



カタールの象徴となる世界最大規模のハブ空港「ハマド国際空港」

A Hub Airport in Middle East - the World's Largest Class

Hamad International Airport (Qatari)

The construction of the world's largest class new airport is a national project of Qatari government, aiming to make the airport "a hub airport in Middle East". Of the whole construction, this project covers the construction of passenger-terminal area, which accommodates 24 million passengers annually. The structure of the main terminal building is a state of the art construction, which is supported by wave-shaped columns. A behemoth project which constructs a passenger-terminal with 5 floors above ground and with total floor area of approximately 0.49 million m². The project was awarded with "Best Airport in the Middle East" (2016) and "5-star Airport" (2017). Qatari government aimed to grow out of oil-dependent economy to achieve "economic-structure transformation which incorporates tourism and research and development". Construction of the airport contributed to achievement of that goal.

Construction period: Between March 2006 and March 2013
Orderer: New Doha International Airport Steering Committee (NDIA)
Applicant: Taisei Corp. (Construction)

Relevant companies
Construction: Taisei Corp.-TAV Sky Oryx joint venture (SOJV)
CM: Overseas Bechtel, Inc.
Design consultant: HOK



施工中全景



出発ロビー(チェックインカウンター)



施設全体俯瞰図

国内外で培った日本企業のノウハウを活かして、RC造からCFT構造柱への変更提案を行い、コストを低減しながら、施工性の大幅な向上を図り、大空間を構成する160mのアーチを実現した。

施工に際しては、高度かつ緻密な応力解析や、日本製3次元測量機を用いた高い精度管理により、巨大かつ特殊な形状の部材を用いた難しい工事を安全に遂行した。

ラウンジ面積の変更等を含む施設全体の大幅な見直しに、日本のゼネコンとして設計部門からの応援を含めた対応で、空港建設経験と高い施工管理技術を活かして、工事を止めることなく対応し、求められた工期を遵守。

夏季の40度を超える過酷な環境の中、40ヶ国・22,000人以上の多国籍の作業員を動員。大規模かつ難易度の高い本プロジェクトにおいて、労働環境に配慮した様々な取組みを実施。

Know-hows that Japanese companies had accumulated in Japan and overseas were utilized to propose changes in column structure from RC to CFT. With the change, workability was significantly improved while cutting costs, to achieve a 160 m arch which constitutes a large space.

Regarding construction, challenging works, which use specifically shaped huge members, were safely completed with the use of high-level and precise stress analyses and high-level precision management with the use of 3-D measuring equipment, which had been made in Japan.

Although significant facility-wide design revisions including changes in lounge areas had been made, Taisei as a Japanese general contractor, utilized experiences in airport building and high-level construction-control technology to address such revisions without stopping construction thanks to countermeasures including support from its design department.

Under a challenging environment, where temperature is over 40°C during summer, the project attracted at least 22,000 multinational workers from 40 countries. In this highly challenging large-scale project, various attempts were incorporated to consider working environments.

トルコ150年の夢
— ボスボラス海峡横断
鉄道プロジェクト

ボスボラス海峡横断地下鉄整備事業
(トルコ)

「トルコ150年の夢」とされた、イスタンブール市を「アジアとヨーロッパの結合点」とするための一大国家事業。ボスボラス海峡を横断するトンネルを敷設し、ヨーロッパ側とアジア側を地下鉄で結ぶ。海峡を横断する約1.4kmの沈埋トンネル、約9.5kmのシールドトンネル、さらに3つの地下駅とひとつの地上駅を建設する総延長13.6kmにわたる巨大プロジェクト。地下鉄の開通により、フェリーで30分かけて渡っていた海峡の横断に要する時間が約4分に短縮され、市内の接続性が飛躍的に向上した。

工期：2004年8月～2014年10月
発注者：トルコ共和国運輸省
応募者：株式会社オリエンタルコンサルタンツグローバル(プロジェクト・マネジメント)
大成建設株式会社(EPC)

関係者
プロジェクト・マネジメント：AVRASYA
(オリエンタルコンサルタンツグローバル・Yüksel Proje・日本コンサルタンツ株式会社)
EPC：大成建設・ガマ・ヌロールJV

A Dream of the Turkish People
Spanning 150 Years

Bosphorus Rail Tube Crossing
Project (Turkey)

Bosphorus Rail Tube Crossing Project is a Turkish national project of great importance realizing a dream of the Turkish people spanning 150 years, which aimed to make Istanbul "a junction connecting Asia to Europe." In this project, tunnels, which transverse the Bosphorus, were constructed to connect the European- and Asian-sides with subways. In this large project with a total length of 13.6 km, the following constructions were completed: a submerged tunnel of approximately 1.4 km, which transverse the strait; a shield tunnel of approximately 9.5 km; in addition, 3 subway stations and one ground station. Thanks to the opening of the subways, the travel time which had been required 30 minutes to cross the Bosphorus by a ferry was shortened to approximately 4 minutes by the subway, resulting in dramatically improved connectivity within the city.

Construction period: Between August 2004 and October 2014
Orderer: Republic of Turkey Ministry of Transport, Maritime and Communications
Applicant: Oriental Consultants Global Co., Ltd. (project management) Taisei Corp. (EPC)

Relevant companies
Project management: AVRASYA (Oriental Consultants Global Co., Ltd., Yüksel Proje, Japan International Consultants for Transportation Co., Ltd.)
EPC: JV of Taisei, Gama, And Nuroi



プロジェクト概略図

世界最深となる水深60mにおける沈埋トンネル施工。黒海とマルマラ海の水位差や風向等によって流れが激しく変化し、上層と下層で潮流の向きが異なる状況下での沈埋面の沈設工事は難問を極めたが、日本企業の高い技術力によってこれを実現。

シールドトンネルと沈埋面を海中で直接接合するという試みも世界初であったが、高水圧下でも確実な止水性を保てる新工法を開発し、安全かつ精度の高い接合部の施工を実現。

地中には遺跡層、地上には歴史的建造物がひしめく2000年以上の歴史都市において、埋蔵文化財をきめ細やかに発掘・保護しながら地下駅を建設するという困難な状況での契約工期、海峡横断部開業を達成。

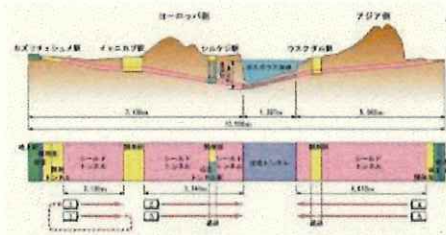
沈埋トンネル工事で最大600人、駅部開削工事で最大1,000人におよぶ多くの労働者を現地雇用。加えて現地エンジニアを常時30人程度雇用することにより、トルコ初となる沈埋工法等に係る技術を移転。

A submerged tunnel was constructed at a water depth of 60 m, which is the world's deepest construction point. The water level difference between the Black Sea and the Sea of Marmara, wind direction, and other factors result in drastically transforming ocean currents. And, due to the drastically transforming currents, directions of upper- and lower-currents become different. Although the submerged tunnel construction of sunken tunnel elements under such conditions was extremely challenging, this project was achieved with the use of high-level techniques of Japanese companies.

The attempt to directly connect a shield tunnel with sunken tunnel elements was the world's first. However, a new construction method, which maintains robust cut off performance under high water pressure, was developed to achieve highly safe and precise construction of the junction.

In Istanbul, a city with a history of at least 2000 years, there is an antiquity layer under the ground and clusters of historical buildings on the ground. In such city, subway-station construction had to be preceded while paying sensitive cares in excavation and protection of the buried cultural properties. Under such difficult conditions, the construction was completed within the contract construction period and the Bosphorus-traversing part was opened.

In the project, a large number of locals were employed: in the submerged tunnel construction, up to 600 locals, in the drilling works for the station areas, up to 1000 locals were employed. In addition, this project regularly employed approximately 30 local engineers to transfer technologies associated with the submerged tunneling method, which had been incorporated for the first time in Turkey, and other methods.



沈埋トンネルの施工

シンガポール初の海底トンネル

The first-ever underground tunnel in Singapore

16 | 17

マリーナ地区高速道路 485 工事 (シンガポール)

将来予想される交通量の増大に対するための陸上ネットワークの改善と既設高速道路を撤去した跡地の再開発を目的とした全長 5.3km のマリーナ高速道路建設計画の一部。

本プロジェクト (485 区) は、片側 5 車線の地下トンネル高速道路であり、全長 700m、幅約 55m のシンガポール国内最大の高速道路である。700m のうち約 420m はシンガポール初の海底トンネルを構築する工区であった。

本プロジェクトは次の方法を採用して行われた。

1. 構築するトンネルの高側に鋼管矢板を設置し海上部を仮締め切りした。
2. 鋼管矢板の内側は砂で埋め立て、地盤改良を行うための作業場を構築した。
3. トンネルの構築は開削工法を採用した。

工期：2008年10月～2013年6月

発注者：シンガポール陸上交通省 (LTA)

応募者：五洋建設株式会社 (設計施工)

採用施工方法

●本プロジェクトでは、海上部を鋼管矢板で仮締め切り、その内側を砂で埋め立てることにより陸上と同じ状態を作り、その上で開削工法にて構築する工法を採用。

●この際、当工区近傍にマリーナバレッジ (河口堰) が設置されており、マリーナバレッジの放流を妨げないようにする必要があるので、河口部を約半分に分けてステージ1とステージ2の2段階に分けて施工 (差図参照)。

Marina Coastal Expressway Contract 485 (Singapore)

Marina Coastal Expressway Contract 485 was a part of a construction project for Marina Coastal Expressway (MCE), a highway of approximately 5.3 km in total length.

The project aimed to improve ground networking to address projected future increases in traffic and to re-develop a vacant area after the removal of the existing highway.

This project (Contract 485) covered an underground tunnel highway with 5 lanes in each direction, a total length of 700 m and a total width of approximately 55 m, which was the widest highway in Singapore.

The first-ever undersea tunnel in Singapore was constructed in a zone of approximately 420 m of the total construction zone of 700 m.

In this project, the following method was adopted:

1. Temporally cofferdam, which was made of steel pipe piles, installed along both sides of the planned tunnel line in the sea.
2. A The space between the two pipe pile walls was reclaimed with sand to make the working platform for ground improvement.
3. Cut and cover excavation method was used for tunnel construction.

Construction period: October 2008 to June 2013

Owner: Land Transport Authority of Singapore (LTA)

Applicant: PENTA-OCEAN CONSTRUCTION CO., LTD (Design and Construction)

Adopted Construction Method

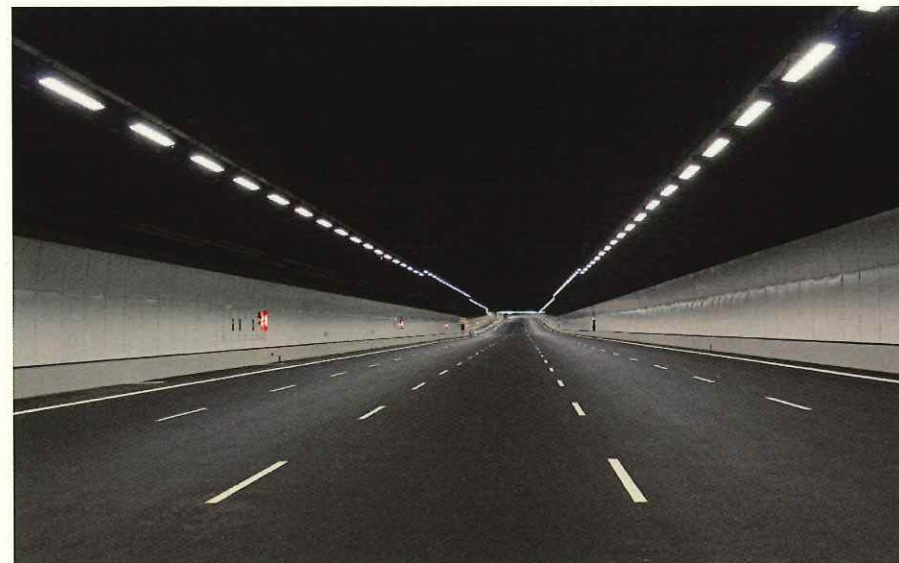
●In this project, the following method was adopted: 1. Temporary cofferdam, which was made of steel pipe piles, were installed along the both sides of the planned tunnel line in the sea. 2. A The space between the two pipe pile walls was reclaimed with sand to make the working platform for ground improvement. 3. Cut and cover excavation method was used for tunnel construction.

●The marina barrage exists near this construction area. Therefore, during the construction, care was taken not to inhibit the discharge from the marina barrage. To ensure the above is achieved, construction process was divided into 2 stages, Stage 1 and 2.

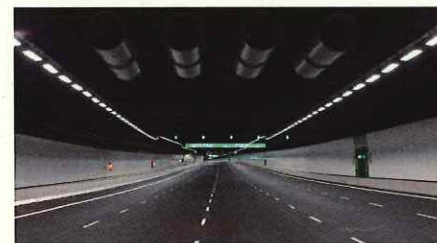


海上仮締め切り説明図 (Stage-1)

海上仮締め切り説明図 (Stage-2)



上り車線



下り車線



トンネル開通後

海上部施工時の鋼管矢板の継ぎ手部は、品質の高い日本製の資材を使用し止水性を確保。躯体についても、正確な温度応力解析や水密性の高いコンクリートの使用など、五洋建設の豊富なノウハウと高い技術を駆使して求められた漏水防止基準を達成。

ステージ1の作業終了後、直径 1.4m の鋼管矢板は世界最大のパイロハンマーを使用して無事に引抜くことが出来た。ステージ1で2年以上使用したこれらの鋼管矢板を引抜き後にステージ2で再利用する方法は世界的に例のない作業であった。

隣接する貯水池への汚濁水侵入を防ぐため、信頼性の高い日本製の汚濁防止枠を設置し、水質汚染を防止。貯水池を管理する政府機関 (シンガポール公益事業庁) のホームページにモデル工事として紹介され高い評価を得た。

At the joint between steel pipe piles of the cofferdam, high-quality, Japanese-made material was used to ensure excellent watertight performance. For the tunnel structure, Penta-Ocean's rich know-hows and high-level technologies were actively utilized. For example, accurate temperature stress analyses and highly watertight concrete were used. With the tunnel structure, high standards to prevent leaking were achieved.

After the completion of Stage 1, 1.4 m diameter steel pipes were successfully removed using the world's biggest vibration hammer. These steel pipes, after over 2 years of use during Stage 1, were re-used for Stage-2. Such removal and reuse method was the first-ever work in the world.

To prevent silty water from flowing into the neighboring reservoirs, highly reliable Japanese-made silt curtain for silt containment were placed and water contamination by silt was prevented. A Singaporean government agency (Public Utilities Board), which manages reservoirs, promoted this method as a model construction site; the construction method was highly evaluated.

東南アジア最大級の アウトレットモール開発

三井アウトレットパーク クアラルンプール 国際空港 セバン (マレーシア)

クアラルンプール国際空港敷地内に、東南アジア最大級のアウトレットモールとして2015年に開業。第1期に130店舗、2018年2月に第2期として約70店舗が開業。最終的には全体店舗面積約44,000㎡、店舗数約250店舗となる大型開発。東南アジアのハブ空港として、レジャー・ショッピング・エンターテインメント・物流・ホテルなど空港施設と親和性の高い施設を一体的に整備するというマレーシア政府の「エアロポリス計画」における最初の開発プロジェクト。

工期

1期: 2014年1月～2015年2月

2期: 2016年11月～2017年11月

発注者: MFMA DEVELOPMENT SDN.BHD.
(三井不動産株式会社70%、Malaysia Airports Holdings Bhd.30%)

関係者

設計者: Nakano Construction SDN.BHD.
施工者: Nakano Construction SDN.BHD.



広域図

Where Luxuries Always Become Affordable

Mitsui Outlet Park in Kuala Lumpur International Airport (Sepang, Malaysia)

Mitsui Real Estate Development opened the first authentic outlet mall in Malaysia within the site of Kuala Lumpur International Airport. In the first phase, 130 stores moved in the outlet mall and in the second phase, approximately 70 stores moved in there in February 2018. Ultimately, it will become the largest outlet mall in Southeast Asia with about 250 stores in an overall retail area of approximately 44,000 m². Malaysian government devised Aeropolis Project, which sets Kuala Lumpur International Airport as a hub airport in Southeast Asia and which organizes facilities which have high affinity to airport facilities including leisure/shopping/entertainment spots, logistics centers, and hotels in a comprehensive manner. This project is the first project among the Aeropolis Project.

Construction period:

1st Phase: Between January 2014 and February 2015

2nd Phase: Between November 2016 and November 2017

Orderer: MFMA DEVELOPMENT SDN.BHD.

(Stake: Mitsui Real Estate Development Co., Ltd. =70%, Malaysia Airports Holdings Bhd. =30%)

Applicant: Mitsui Real Estate Development Co., Ltd. (Orderer)

Relevant companies

Design: Nakano Construction SDN.BHD.

Construction: Nakano Construction SDN.BHD.



詳細図



〔三井アウトレットパークKLIA セバン〕メインエントランス外観



サンシャインスクエア

商業施設開発・運営・リーシングに関する日本企業の優れた実績が評価され、多くの競合他社が参加する中で落札。日本で培ったノウハウを存分に活かし、現地コミュニティから高い評価。

テナント従業員や建物管理を含め約3,000人の雇用を継続的に創出し、民間の資金を活用しながら地域経済の活性化に貢献しているプロジェクト。

運営会社には日本人材を志向させ、商業施設運営・リーシングのノウハウを継続的にローカルスタッフに転移するなど、現地産業の成長にも寄与。

車椅子用駐車場の確保やスロープ、点字ブロック等の設置など、施設全体のバリアフリー化にも配慮。国内外問わず幅広い層に対して豊かな消費生活を提供する場として機能している。

Since Mitsui's excellent track records as a Japanese company in commercial-facility development/operation/leasing were highly evaluated, Mitsui was awarded the contract beating many competitors. Mitsui fully utilized its know-hows, which the company accumulated in Japan, in the project, resulting in a high evaluation from local communities.

The project created approximately 3,000 employment including staff members working at tenants and those who engage in building management on a continuous basis, contributing to local-economy activation with the use of private funds.

Japanese staff members were dispatched to the operator to transfer know-hows on operation/leasing for commercial facilities to local staff, contributing to local-business development.

Barrier-free design for overall facilities was also introduced. For example, parking space dedicated for persons using wheelchairs, slopes, Braille blocks, and other facilities were introduced. Mitsui Outlet Park functions as a place which offers excellent consumer life for a wide range of Malaysian and non-Malaysian customers.

CM/GCのメリットを活かし 技術力を発揮

I-70 ツイントネル拡幅工事 (米国コロラド州)

事業目的は、コロラド州最大の都市デンバーとロッキー山脈のスキーリゾートを結ぶ幹線高速道路を、片側2車線から3車線に拡幅することによる交通渋滞緩和。本プロジェクトは、第一期工事として、延長約240mの山岳トンネル区間を含む、総延長約4kmの道路を拡幅するもの。

標高2,500mの山中に位置し1年のうち8ヶ月にわたり積雪がある厳しい自然条件に加え、スキーリゾートの閑散期にあたる4月から12月の間のトンネルを封鎖可能というステークホルダーからの強い要望のもとで、短期間での工事完了を求められた困難なプロジェクト。

工期: 2012年4月~2016年9月
(プレコンサービスを含む)
発注者: コロラド州道路局
応募者: 株式会社大林組 (CM/GC*)

設計: アトキンス
施工: クラマー・大林組JV
(クラマー社は大林組の米国子会社)

※CM/GC契約方式
施工者を設計段階から事業に参画させ、その施工ノウハウにもとづき、施工性(施工リスク)の観点から、設計に対する助言や工期・コストに関する情報を得ることで、設計手戻りの減少、コストの早期把握、部分的な工事の開始、施工中のトラブル回避などを期待できる契約方式。



鉄筋坑内運搬

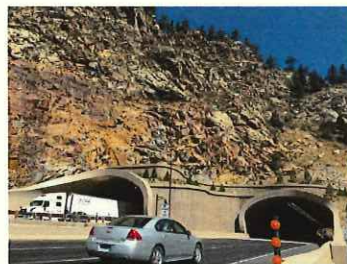
Exertion of Technological Strengths with the Use of Advantages of CM/GC

I-70 Twin Tunnels Widening Project (Colorado, U.S.)

This project aims to alleviate traffic jam by expanding the arterial expressway, which connects Denver, the largest city of Colorado, to Rocky Mountain ski resorts, from a 2-lane road to a 3 lane road in each direction. This project, as the 1st phase of I-70 Twin Tunnels Widening Construction, widened a road of approximately 4 km in total length including mountain-tunnel sections of approximately 240 m in total length. The construction area was located at an altitude of 2,500 m and had severe natural conditions, in which snow fell for 8 months in one year. In addition to such geographical conditions, stakeholders strongly requested that the tunnels would be allowed to close only during the off-season for the ski resorts between April and December. Under such conditions, this project was required to be completed in a short duration, making this project further very challenging.

Construction period: Between April 2012 and September 2016 (including a period of pre-construction service)
Client: Colorado Department of Transportation (Including pre-control service)
Applicant: Obayashi Corp. (CM/GC*)
Design: WS Atkins plc
Construction: Kraemer-Obayashi JV (Kraemer North America, LLC is a subsidiary of Obayashi Corp. in the U.S.)

CM/GC* contract method
CM/GC is a contract method which proceeds with in the following manner: A contractor participates in a project from the designing stage and provides design advices and construction-period/cost information in terms of constructability (construction risks) to an client. Through the participation, the contractor's know-hows are incorporated into the project. Therefore, reductions in the frequencies of design reworkings, early cost recognition, partial construction initiation, and avoidance of troubles during construction are expected.



施工完了(西側坑口)



東行き施工状況

CM/GC方式のメリットを最大限に活かし、プレコンストラクション段階で提案した施工性向上策により、品質向上とともに、工事費削減、工期短縮に成功。

子会社でありJVパートナーである地元企業の動員力とノウハウに、日本企業の高いトンネル技術が融合して高いレベルのパフォーマンスを発揮。

作業員の大半は地元の労働組合を通じて雇用。また、舗装工事や土砂運搬等の工事は、地元の中小企業と下請契約し現地労働者の雇用創出に貢献。工事経験の浅い作業員が多かったが、教育・訓練を徹底し、事故防止に努めた結果、全工期を通じて休業災害なしで完了。

プレコンストラクション段階で地元関係者との会合にCM/GC業者として出席し、把握した懸案事項や要求事項を施工計画に反映することで、現地の期待に応え、高評価を獲得。

Obayashi maximally utilized advantages of the CM/GC method to succeed in construction-cost reduction, construction-period shortening, as well as quality improvement through a method to improve constructability, which was proposed on the pre-construction stage.

The high standard of performance was provided by the synergy of Kraemer, having the ability to attract local workers and know-hows as a local company as well as JV partner, with Obayashi having advanced tunneling technologies of Japan.

Most workers were employed via local labor unions. In addition, construction works including pavement and hauling operations were done by local small and medium sized companies, contributing to employment creation for local workers. Although many workers had only limited experience in construction, education and training were offered and accident prevention was eagerly pursued. As a result, the construction was completed without any accidents requiring time off from work throughout the construction period.

Obayashi, as a CM/GC provider, participated in various meetings with local communities during the pre-construction stage. The company recognized stakeholders' concerns and requests at the meeting. Then, the company reflected such concerns and requests in the construction plans to meet locals' expectations, resulting in a high appreciation from locals.