Arup in Macau
Introduction

From world-class resorts to strategic infrastructure and city planning projects, for the past 20 years Arup has contributed design, engineering and consulting expertise to transforming the cityscape of Macau.

Shaping a global tourist destination
Our journey in Macau began in 2002 with Sands Macao, the first foreign entertainment development to open in the city. Since then, we have successfully delivered further large-scale entertainment resort projects, including Venetian Macao, Four Seasons Hotel Macau and Galaxy Macau.

Fuelling growth in the Greater Bay Area
In support of Macau’s economic diversification, our portfolio has expanded to a wide range of planning and infrastructure projects. Through our involvement in the LRT Hengqin Extension Line, Hong Kong-Zhuhai-Macau Bridge Macau Section and the Hengqin New Area urban design, we facilitated Macau’s integration into the Greater Bay Area, unlocking opportunities for regional synergy and cooperation. We also strengthened transport connectivity within the city, with major works including Tai Tam Hill Tunnel, 4th Macau-Taipa Bridge, and Light Rail Transit East Line.

Envisioning a sustainable Macau
We are a driving force behind Macau’s sustainable urban development. Entrusted by the Macau Government, we formulated a masterplan for the whole Macau in line with the United Nations’ Sustainable Development Goals. Our visionary strategy will help develop Macau into a happy, smart, sustainable and resilient city over the next decades, maximising value for our clients, the community and the environment.
We have provided infrastructure design and transport planning services to enhance urban mobility and foster social and economic connections.

LRT Seac Pai Van Line
The LRT Seac Pai Van Line, which consists of 1.3km viaducts and two elevated stations, will connect the LRT Taipa Line at Rotunda Flor de Lotus to the northern part of Coloane Island via Estrada Do Istmo – the extension of the Cotai Strip to the South. Following successful delivery of a feasibility study, we are working on the detailed design of this strategic link. Our total design services include rail alignment, architecture, station planning, civil, structural, geotechnical, constructability, programme and project management, drainage, MEP, fire, system safety, transport consulting environmental consulting, landscape design and cost estimation.
Transport

Project showcase

LRT East Line pre-feasibility study

Arup was commissioned to conduct transportation pre-feasibility studies for the LRT East Line which will connect the Macau Peninsula and Taipa Island in the East via reclaimed land. We constructed a cross-regional transport model and comprehensive LRT model to forecast the travel pattern and passenger volume for the selection of appropriate routes. We also studied and developed alignment options and began preliminary concept design.

LRT Hengqin Extension Line

Arup, in a JV with China Railway Siyuan Survey and Design Group, carried out a multidisciplinary detailed design consultancy for the 3.3km Hengqin extension which will link Macau’s light rail network to the Guangzhou-Zhuhai Intercity Railway via the Hengqin Checkpoint. Our scope covers an elevated station at the Lotus Border and two underground stations at the Hengqin Border. The stations will be connected with sections of viaduct and tunnels, constructed by cut-and-cover and tunnel boring machine.

3.3km long
Transport

Project showcase

Rotunda do Istmo Underpass
As part of the short-term improvement scheme at the ‘Rotunda do Istmo’, the underpass provides a by-passing route for the existing roundabout, accommodating future demand of increased traffic in the rapidly developing Cotai area. The construction works include a dual-two lane, 170m long cut-and-cover tunnel, a 470m long approaching ramps at two ends, modification of existing roads and its associated civil, electrical and mechanical works. Arup conducted detailed design for this underpass including transport consulting, civil, structural, geotechnical and MEP engineering.

Olympic Roundabout improvement Phase 1
The Olympic Swimming Pool Roundabout is one of the busiest junctions in the Cotai area. To ease the situation, the Macau Government proposed a flyover to connect the East-West bound traffic to bypass the roundabout while restructuring the at-grade road junction to enhance traffic circulation capacity.

Arup carried out a feasibility study and provided detailed design for two one-lane-one-way vehicular viaducts, at-grade road improvement, drainage, traffic, geotechnical, landscape, and MEP. This project will provide more capacity to cater for the traffic within Macau and additional crossboundary traffic.

640m total length
Transport Project showcase

Transport

Coloane – Ka-Ho Tunnel – The North Link Road design

The Macau Government proposed building the Ka-Ho Tunnel through Taipa Grande to improve the road network of East Taipa and tackle the increasing traffic flow in the Cotai area. The North Link Road is one of the East Taipa traffic improvement plans, connecting the Ka-Ho Tunnel north entrance to the Macau International Airport.

Our scope of service comprised a feasibility study and detailed design for two of the two-lane-one-way vehicular viaducts, at-grade road improvement, drainage, traffic, geotechnics, landscape, underground utility, and MEP.

Tai Tam Hill Tunnel and associated infrastructure

Our multidisciplinary consultancy involves the 800m dual two-lane drill and blast Tai Tam Hill Tunnel, a 1.2km cut-and-cover underpass and a network of viaducts and road works. Our scope of service covers a wide range of skills including tunnelling design and constructability, traffic planning, traffic control and surveillance, environmental impact assessment, tunnel ventilation and MEP provision and the fire and evacuation strategy.

A3 Connection Bridge between Macau New Urban Zone A and Macau Peninsula

In Macau’s new urban masterplan, the Land, Public Works and Transport Bureau recommended building four bridges to connect the land reclamation Zone A to the Macau Peninsula. Arup was commissioned to conduct a feasibility study and preliminary design for the A3 bridge, which is next to the Outer Harbour Ferry Terminal and serves as the southeast link to Macau Peninsula. We are also helping improve the road connection and traffic from the eastern side from Outer Harbour Ferry Terminal to the north end of Avenida da Ponte de Amizade.
Arup carried out MEP and sustainability services after reviewing the on-site traffic conditions and relevant information of the existing underground public transport interchange serving over 20 bus lines. Computational fluid dynamics was applied to ensure the indoor air quality would achieve the desired level after implementation. To provide a better thermal comfort environment and improve resilience and energy performance of the facility, the entire variable refrigerant volume system has been replaced by an energy-efficient water-cooled chiller plant system which serves five air-conditioned waiting areas.
Our design and engineering expertise has enhanced Macau’s liveability and driven its rapid progress from national to international tourist destination.

**Property, science and technology**

**Venetian Macau**

One of the largest single-span hotel structures in Asia, this multipurpose entertainment complex boasts casino, a 3,000-room hotel and a retail mall with canals and gondolas, and performance facilities which include a multi-purpose event centre and a Las Vegas style theatre. The architecture is a replica of the Venetian® Las Vegas and inspired by iconic buildings in Venice, Italy. Arup demonstrated modern engineering on a grand scale with the design and fast-track construction of this mega structure.

3,000 rooms
Four Seasons Hotel Macau
Completed in 2007, this hotel development comprises a 400-room high-end hotel, a serviced apartment tower, a casino and luxury retail facilities.

Arup provided structural, geotechnical, civil drainage and traffic consultancy to facilitate this fast-track project. We designed transfer plates to support the hotel and serviced apartment tower while providing a 20m column grid podium area for hotel and retail operations.

250,000m²
GFA

Sands Cotai Central
Arup reviewed fire safety design documents for the Sands Cotai Central holiday complex which includes hotels, casinos, retail and residential facilities. We further developed a detailed life safety system and fire prevention as well as reviewed architectural drawings for compliance with applicable regulations and for life safety system coordination, including flue gas management systems, automatic fire extinguishing systems and fire-resistant structures test.

557,000m²
GFA

The Londoner Macao
Featuring iconic British style, The Londoner Macao is an extensive re-modelling of the Sands Cotai Central. The rebranded first phase was unveiled in February 2021.

Arup’s structural and fire teams were involved in various project areas including the stunning Crystal Palace, the western façade, the 96m high Elizabeth Tower and the 6,000-seat Londoner Arena. Our scope of service included designing a new 300m long façade and providing fire safety consultancy.

30*
packages of alteration and addition works
Galaxy Macau
Galaxy’s mega resort is being developed in phases with Arup providing services including structural, geotechnical and civil drainage engineering, traffic consulting, transport planning, third party fire checker and technical studies such as air ventilation assessment and environmental impact assessment. Lot 1 boasts a hotel tower on top of the existing bus depot; Lot 2 is designed to be a family entertainment hub; and Lot 3 comprises a hotel, convention, arena, exhibition and gaming complex.

Broadway Macau
Arup was engaged to provide multidisciplinary services including structural, MEP, IT and extra low voltage system designs, security and fire engineering for the mega renovation of the former Grand Waldo Complex in Cotai. The mixed-use development features the first hawker-style street market in Macau, together with a wide range of facilities including a 5-star hotel, a casino, a live entertainment auditorium, retail stores, offices, staff training facilities and a carpark block.
Property, science and technology

Wynn Palace Phase 2

Wynn Palace is a luxury integrated resort located in Cotai. As part of its expansion study currently undergoing, the expansion will incorporate an array of non-gaming amenities such as event space, interactive entertainment installations, food and beverage offerings, and additional hotel rooms.

Arup has been engaged to provide total engineering services including structural, mechanical, electrical and public health consultancy for the project.
Located in the City of Dreams complex, Morpheus is a flagship luxury hotel designed by renowned architects Zaha Hadid. It adopts ‘water’ as the theme of design, with external water features on the west side and an aquarium inside, coupled with water shows. Arup developed a total fire engineering strategy to address the challenges posed by the building’s unique architectural form and its very tall atrium.

Our services helped the project attain Category Winner and Award of Excellence Winners of the Fire & Risk Engineering Category at the CTBUH Awards for Excellence 2019.

MGM Grand is a 35-storey resort consisting of a 3-storey podium that houses casino areas, a Grande Praça conservatory which is a 25m high attraction rising up to the glass ceiling, restaurants, retail, car park and recreational facilities and a 600-room hotel tower.

Arup delivered specialist services including development of a comprehensive fire safety strategy and providing advice to the design team for smoke control, means of egress and fire safety system designs based on our expertise on International Building Code.

MGM Grand Macau

130m tall atrium

© Ivan Dupont
SJM Lisboa Palace
Boasting a Sino-Western style design concept, the development features a casino hall, restaurants, retail area, car parking spaces, landscape area and a 2000-key hotel tower.

Arup offered a holistic design approach to construct the foundation and basement on the soft ground of the site, located at the waterfront of a reclaimed area in Cotai.

SJM Lisboeta
Lisboeta Macau is the first Macau themed integrated resort comprises a 4-star hotel, a low-rise boutique chateau hotel, a summer palace and a central hub. Arup was appointed to provide fire engineering consultancy service on the fire safety design, enabling the basement and podium floors of the 4-star hotel to comply with International Building Code edition 2012.
Project showcase

Property, science and technology

Macau public housing Lot A4
This design & build project comprises six 30-storey residential towers with 1,566 flats, a shared 4-storey retail podium and a 3-storey basement carpark. Commissioned by the Macau Government, Arup will help incorporate the use of BIM technology and precast concrete elements including floor slab, façade and staircase system into the project.

MEP consultancy
The demand for MEP and extra low-voltage (ELV) consulting services has increased over the past 20 years. From base build provision and detail design to inspection and upgrade of a building system, Arup contributed its MEP and ELV expertise to helping optimise government infrastructure such as roads and light rail projects, as well as hotels, shops and restaurants.

Our comprehensive scope of service covers electricity, air conditioning, ventilation, smoke exhaust, kitchen ventilation, fire protection, water supply and drainage, ANSUL, gas, electronic access control, and weak current systems.

17+ major projects completed
Advisory services

As integrators and connectors, we help clients find the best solution with our tailored package of services.

4th Macau-Taipa Bridge
Arup is providing project management, cost management and site supervision consultancy services for the 4th Macau-Taipa Bridge – another vehicular crossing linking the Macau Peninsula and Taipa. The bridge will be mostly marine viaduct, about 3km long, crossing two navigation channels and located on the east side of Ponte de Amizade. The project will relieve the increasing traffic flow between Macau and Taipa and help cope with the demand from the Hong Kong-Zhuhai-Macau Bridge and the future development of new reclamation areas.

3km long bridge
Advisory services

Project showcase

AB Tunnel
As the longest ever cross-harbour tunnel in Macau, this 2.9km long dual-two lane tunnel will be a major link between the new Reclamation Zone A and Zona de Aterros do Porto Exterior. Arup was appointed to review the local design institutes’ reference designs, prepare full tender documentation and support technical tender assessment.

Upon completion, the AB Tunnel will strengthen the public road network within the Macau central zone and divert part of the traffic arising from the Macau Boundary Crossing Facilities of Hong Kong-Zhuhai-Macau Bridge, the new housing developments in Reclamation Zone A and the 4th Macau-Taipa bridge.
We combine our pioneering vision and multidisciplinary skills to empower Macau’s urban development and shape a more sustainable future.

Macau masterplan and public engagement

Arup was appointed by the Macau Government to formulate a strategic masterplan for Macau as a whole. By adopting a ‘Happy, Smart, Sustainable, Resilient’ approach, we proposed an integrated masterplanning framework in keeping with United Nations’ Sustainable Development Goals (SDGs).

The masterplan will optimise development potential while addressing the concerns and aspirations of the local populace regarding land use, transport, environment, infrastructure resilience and social enhancement. This pioneering planning approach will also set an example for other cities in the Greater Bay Area.
Cities planning & design

Macau East planning study
Arup was engaged to revamp Macau’s eastern edge, an area expected to form the Pearl River Delta’s (PRD) future western gateway. Our comprehensive planning approach included assessment of a variety of technical issues such as hydrodynamic impacts, air ventilation and traffic. We also provided advice on the disposition of open space and civic amenities to improve existing residential and commercial areas and seamlessly bind together the existing and new into a new vision for the future of urban Macau and the PRD.

Hengqin urban design competition
Arup provided consultancy services for Hengqin’s urban design and proposed a new paradigm for its development that helps to enhance Macau’s economic diversification and create a more livable space for Macau’s residents. Drawing on Arup’s expertise and experience in infrastructure and urban development, the plan focused on the design of a strategic cross-border transportation network, as well as the interaction between various industries, ecology, tourism space and Macau’s overall development.
To help fulfil the Environmental Impact Assessment (EIA) guidelines in Macau, Arup provided EIA services for a diverse range of developments covering infrastructure, hotels and buildings. By conducting EIA studies, we evaluated the environmental performance of the construction and operation of projects, including air quality, noise, water quality, waste management, ecology, land contamination, as well as environmental monitoring and audit. Mitigation measures were recommended to minimise potential environmental impact and enhance sustainability.

Feasibility study for DSAMA Taipa Pequena Sink
With a capacity of 30,000m³, the Taipa Pequena Hill Sink can adjust water volume during emergency conditions such as typhoons and provide tap water supply for Taipa residents to improve disaster prevention. Arup conducted a feasibility study for this project covering ground investigation, environmental, landscape, civil and geotechnical consultancy. Our study focused on identifying a suitable sink type and volume based on the water supply and water demand forecast data provided by the client. We also recommended a construction method that delivers the best economic benefits.
<table>
<thead>
<tr>
<th>Our businesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Property, Science and Industry</strong></td>
</tr>
<tr>
<td><strong>Transport</strong></td>
</tr>
<tr>
<td><strong>Energy, Water &amp; Resources</strong></td>
</tr>
<tr>
<td><strong>Advisory Services</strong></td>
</tr>
<tr>
<td><strong>Cities Planning &amp; Design</strong></td>
</tr>
<tr>
<td><strong>Technical Specialist Services</strong></td>
</tr>
<tr>
<td><strong>Digital Services</strong></td>
</tr>
<tr>
<td><strong>Climate &amp; Sustainability Services</strong></td>
</tr>
<tr>
<td><strong>Regional incubators &amp; Not For Profit</strong></td>
</tr>
</tbody>
</table>
About Arup

Dedicated to sustainable development, Arup is a collective of designers, consultants and experts working globally. Founded to be humane and excellent, we collaborate with our clients and partners using imagination, technology, and rigour to shape a better world.