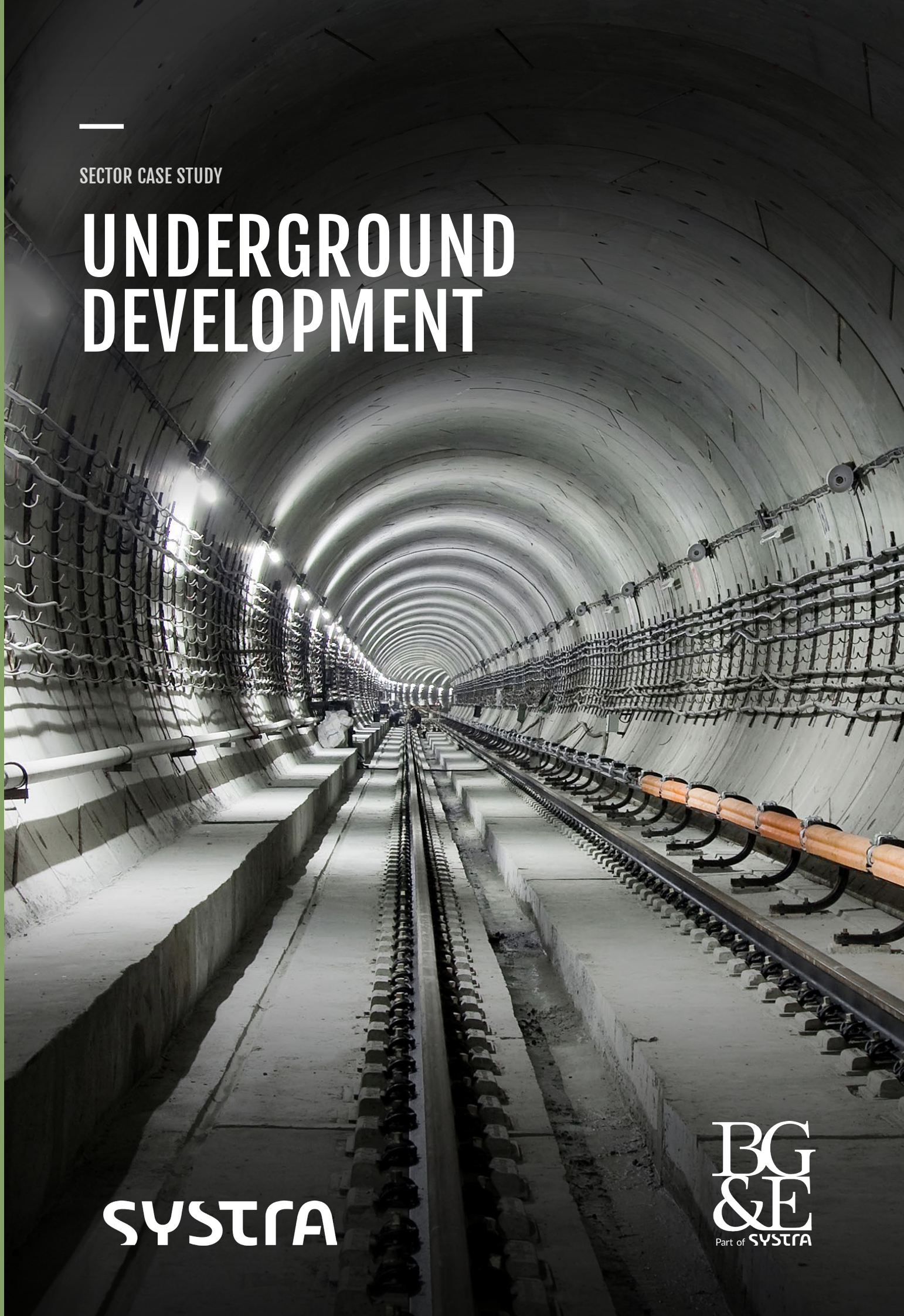
SECTOR CASE STUDY

UNDERGROUND DEVELOPMENT



SYSTRA

BG&E Part of SYSTRA

SYDNEY METRO

SYDNEY, NSW, AUSTRALIA
CLIENT: SYDNEY METRO & TRANSPORT FOR NEW SOUTH WALES

Delivered by SYSTRA

Sydney Metro is Australia's largest public transport project. By 2030, Sydney is planned to have a network of four metro lines, 46 stations and 113 kilometres of new metro rail.

The SYSTRA team has contributed across all four active Sydney Metro projects and throughout the project lifecycle.

- Sydney Metro Northwest: part of the integrated team that developed the tunnelling constructability solution.
- Sydney Metro City & Southwest: led complex concrete lining operations, including formwork design and construction-method development.
- Sydney Metro — Western Sydney Airport: developed the tunnel boring machine strategy, including machine selection for the Bringelly Shale conditions.
- Sydney Metro West: supported design and construction outcomes, leading the technical solution through concept design, transaction and delivery.





SYDNEY METRO — WESTERN SYDNEY AIRPORT STATION

SYDNEY, NSW, AUSTRALIA
CLIENT: CPB CONTRACTORS GHELLA JV (CPBG)

Delivered by BG&E Part of SYSTRA

The Sydney Metro — Western Sydney Airport railway will become a transport spine for Greater Western Sydney, connecting communities and travellers with Western Sydney International (Nancy-Bird Walton) Airport and the growing region.

BG&E provided geotechnical services to CPBG for slope stability and designed stabilisation measures for the proposed cutting. The team also designed the 300 metre long Orchard Hills station box and dive structure, together with the bridge crossing above the dive structure.

The project includes six new metro stations: St Marys, with interchange to the existing suburban railway; Orchard Hills, serving a future commercial and mixed-use precinct; Luddenham, serving a future education, innovation and commercial precinct; Bradfield, connecting with the future CBD of the Western Parkland City; and two stations within the airport site.

The 23 kilometre railway will connect residential areas with employment hubs, including Bradfield Metro Station, and link airport travellers with the wider Sydney public transport network. The project is expected to support more than 14,000 jobs during construction.



SYDNEY METRO CITY & SOUTHWEST

SYDNEY, NSW, AUSTRALIA
CLIENT: JOHN HOLLAND, CPB CONTRACTORS & GHELLA JV

Delivered by BG&E Part of SYSTRA

Sydney Metro City & Southwest is a 15.5 kilometre metro rail line spanning Chatswood and Marrickville and includes a new tunnel beneath Sydney Harbour.

Arcadis and BG&E, working in joint venture as ABJV, were engaged for tunnel and station excavations, surface civil works, and selected permanent and temporary works structures.

Design included temporary and permanent civil works, structures for open boxes, shafts and dive sites, building-effects and durability assessments, earthing and electrolysis, project-wide flooding assessment and CAD and BIM management.

We also provided construction engineering and temporary works design which included tunnel boring machine running tunnels, mined cross-passages, a crossover cavern at Barangaroo, tunnelling below Central Station and mined station caverns and adits at Victoria Cross, Martin Place and Pitt Street.

The scope also covered demolition, excavation and concrete structures for dives and new stations, permanent concrete lining, the primary concrete structure at Barangaroo station, temporary access and support services and removal of temporary works not required for handover.

SYDNEY METRO NORTHWEST

SYDNEY, NSW, AUSTRALIA
CLIENT: SMEC

Delivered by Part of SYSTRA

Sydney Metro Northwest was developed as Australia's first fully automated metro rail system, delivering eight new railway stations, 4,000 commuter parking spaces and a high-frequency single-deck train service for Sydney's growing north-west.

BG&E's materials team was engaged by SMEC to provide investigation and assessment services supporting certification of the four kilometre viaduct structure after failures occurred in some spans during post-tension strand stressing.

Materials and structural engineers assessed installed spans, precast segments awaiting installation, constructed piers and crossheads. The team worked with other consultants and the construction consortium to coordinate access, testing and inspections.

The elements were inspected and reported on within six weeks, enabling certification by Transport for New South Wales and allowing required rectification works to proceed.

BG&E was subsequently re-engaged for a broader program of testing and durability services. This included supervision and inspection of key structural works, concrete testing in tunnel inverts, optimisation of precast-element design, inspection of precast production, shop-drawing support and materials advice during construction.



WESTCONNEX

SYDNEY, NSW, AUSTRALIA
CLIENT: TRANSPORT FOR NEW SOUTH WALES & TRANSURBAN

Delivered by SYSTRA



WestConnex is a 33 kilometre road project comprising more than 19 kilometres of twin tunnels. The project was designed to ease traffic congestion and improve connections to Sydney's port and airport precincts.

Because of its scale, the scheme was divided into three stages and five major contracts. Excavation was undertaken using 86 roadheaders.

SYSTRA provided specialist tunnel engineering services to the client-side team across the entire program of works. The integrated project-delivery support included tunnelling construction directors, mechanical and electrical construction directors, commissioning directors and a substantial team of underground professionals.

WEST GATE TUNNEL

MELBOURNE, VIC, AUSTRALIA
CLIENT: CPB CONTRACTORS & JOHN HOLLAND JV (FOR TRANSURBAN)

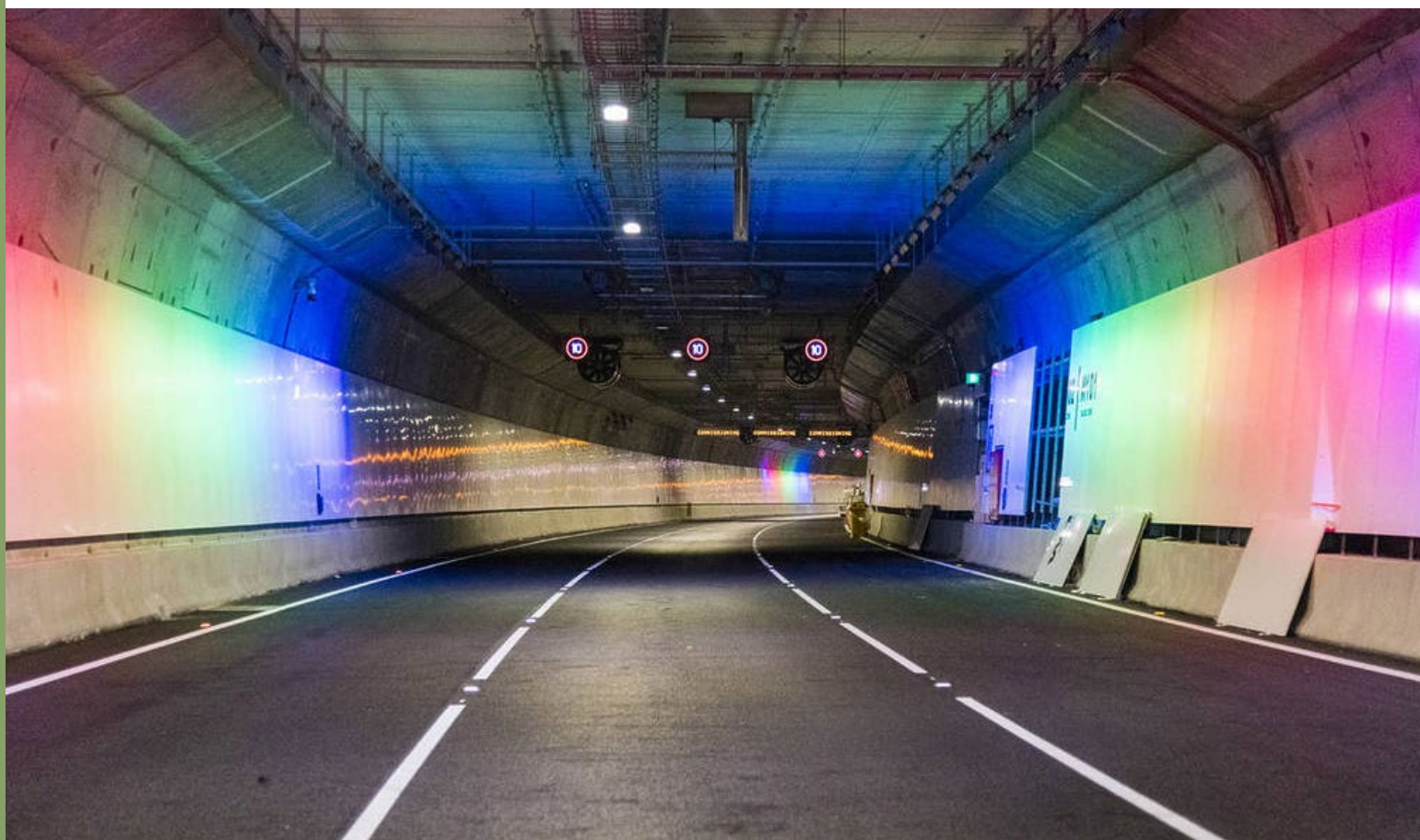
Delivered by SYSTRA

The West Gate Tunnel project is intended to reduce Melbourne's reliance on the West Gate Bridge and provide new links to the Port of Melbourne, CityLink and the CBD.

SYSTRA is providing tunnel design and construction-delivery support as part of the integrated client team delivering the project.

The scope includes twin three lane tunnels, a second crossing of the Maribyrnong River, upgrades to the West Gate Freeway and a new cycling connection.

Perceived contaminated soil associated with past industrial use brought many activities, including tunnelling, to a halt in late 2019 while a waste-disposal solution was developed and tunnelling resumed in early 2022. The highly variable geological conditions required the use of closed-face earth pressure balance tunnel boring machines. Excavation on both tunnel drives was completed by May 2023.



LEGACY WAY

BRISBANE, QLD, AUSTRALIA
CLIENT: TRANSCITY JV COMPRISING ACCIONA, GHELLA & BMD CONSTRUCTIONS

Delivered by SYSTRA



Legacy Way is a motorway link connecting Brisbane's western suburbs with the CBD. The 4.6 kilometre twin-bore tunnel received international recognition when it was named the ITA Major Tunnel Project of the Year in 2013.

SYSTRA provided delivery services to the Transcity JV for all tunnel fit-out elements following excavation.

The work included the innovative reuse of more than 125,000 tonnes of tunnel boring machine waste through a reconfigured conveyor system, removing an estimated 10,000 heavy-vehicle movements from local streets.

The team also contributed to the development and implementation of an innovative precast smoke-duct solution.

WESTERN HARBOUR TUNNEL

SYDNEY, NSW, AUSTRALIA
CLIENT: JOHN HOLLAND & CPB CONTRACTORS JV

Delivered by BG&E Part of SYSTRA



Delivered in two stages, the Western Harbour Tunnel is a new motorway beneath Sydney Harbour connecting North Sydney and Rozelle while bypassing the CBD.

BG&E provided structural, civil and geotechnical engineering services for Stage 2. Stage 2 connects the Stage 1 works at Cove Street, Birchgrove, with the Warringah Freeway near North Sydney and includes tunnelling beneath Sydney Harbour and the complete tunnel fit-out.

The team designed the Cammeray Ventilation Building and associated ventilation shaft, as well as several alternative foundation solutions for mechanical and electrical equipment at Rozelle Interchange.

A key outcome of the project was tailored ground modelling and analysis supported tunnelling beneath Sydney Harbour — complex geotechnical risks were managed for excavation under dense urban areas, and foundation solutions for mechanical and electrical infrastructure at Rozelle Interchange were optimised.

On completion, the twin three lane tunnels are expected to reduce traffic on the Western Distributor by 35%, the Harbour Tunnel by 20% and the Harbour Bridge by 17%.



SUBURBAN RAIL LOOP

MELBOURNE, VIC, AUSTRALIA
CLIENT: CPB CONTRACTORS

Delivered by BG&E Part of SYSTRA

The Suburban Rail Loop was announced by the Victorian Government as a city- and state-shaping program of investment and policy initiatives intended to transform Victoria's public transport system, increase productivity and support urban renewal across metropolitan Melbourne.

The program comprises a 90 kilometre orbital rail line linking every major railway line from the Frankston line to the Werribee line, with a connection to Melbourne Airport. It also includes new stations, transport super-hubs at Clayton, Broadmeadows and Sunshine and integrated precinct developments.

BG&E was engaged to deliver Work Package C — Tunnels and Civil — from Cheltenham to Glen Waverley.

The BG&E materials team assessed concrete and steel deterioration mechanisms, evaluated risks and opportunities across the design life, analysed material performance in atmospheric and below-ground environments, and assessed compliance with relevant standards and project requirements.

The team prepared a comprehensive durability report informed by geological and hydraulic assessments, documenting design decisions and durability assessments. A value-for-money report also identified key opportunities, risks and recommended maintenance regimes.

BG&E and SYSTRA joined forces in 2025, combining BG&E's civil and structural engineering expertise with SYSTRA's global capability in public transport, mobility and infrastructure.

With more than 1,000 people across Australia and New Zealand, the partnership strengthens our reach and position in one of the world's most dynamic infrastructure markets.

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SYSTRA

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