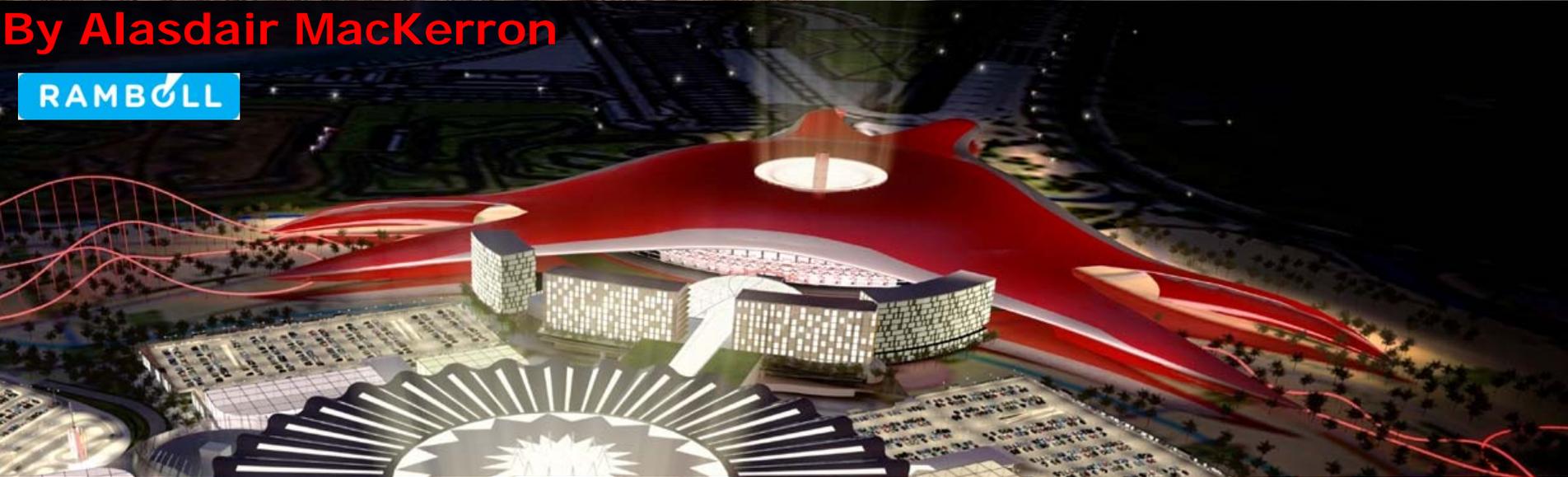


DELIVERING THE FERRARI WORLD

By Alasdair MacKerron

RAMBOLL





01
General Overview

02
Scope and
Programme

03
Delivery Strategy

04
Foundations

05
Slabs

06
Stability

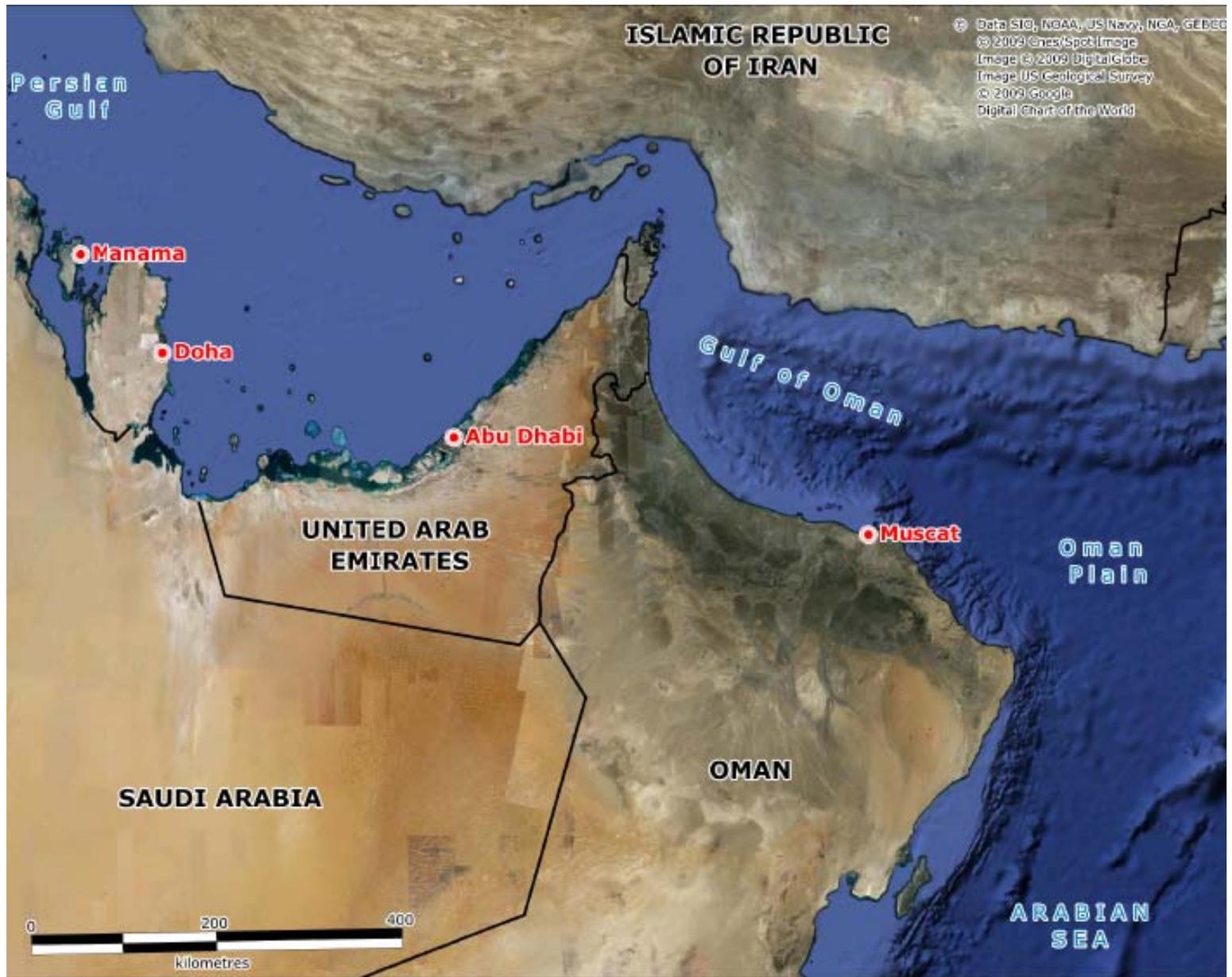
07
Roof

08
Enclosures

09
Roller-coasters

10
Lessons Learned









Yas Island - *Leisure Destination*

- 01**
Ferrari Experience
- 02**
Retail Centre
- 03**
Formula 1 Track
- 04**
Marina
- 05**
Warner Bros Theme Park
- 06**
Leisure Resorts
- 07**
Al Raha Beach Development (11km long)



WHAT IS THE FERRARI WORLD?



01

25 major rides and attractions

02

2 roller-coasters including the world's fastest

03

Roof of 201,000m²

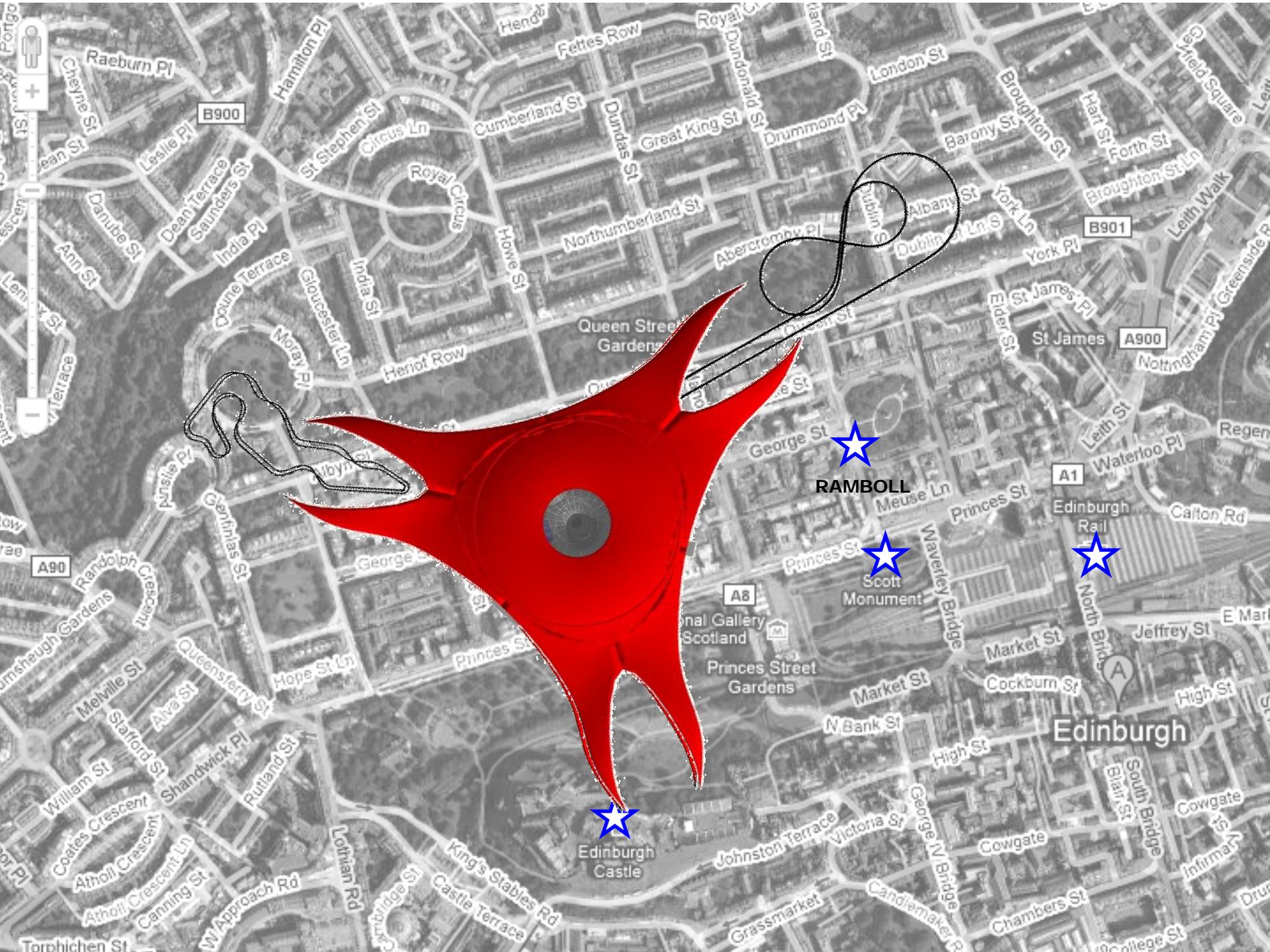
04

Indoor conditioned space at 24°C

05

Fast track design and construction





RAMBOLL

Scott Monument

Edinburgh

Edinburgh Castle

Edinburgh Rail

B900

B901

A900

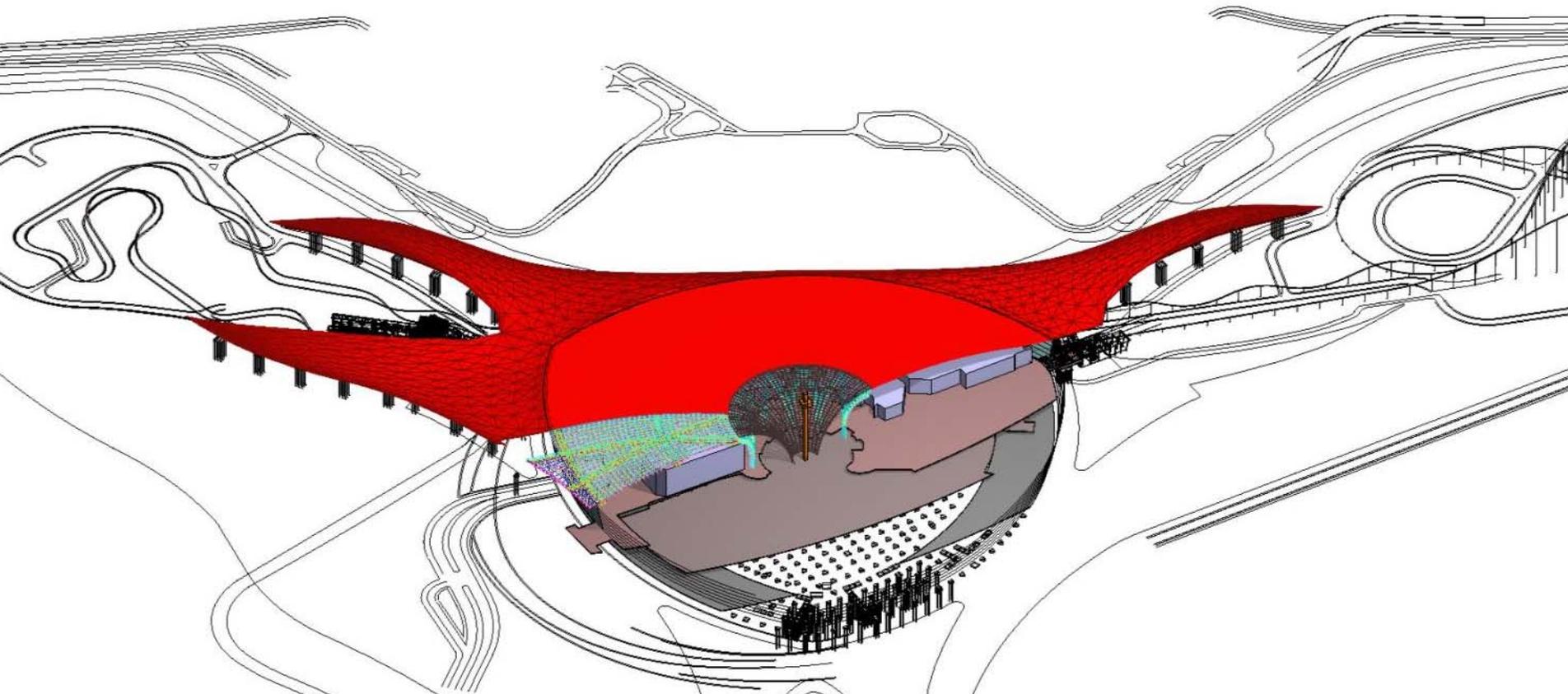
A1

A8

A90



RAMBOLL SCOPE



- 01**
All Foundations
- 02**
Shell & Core Structures
- 03**
Roof Concept & Scheme

- 04**
Building Services
Concept & Scheme
- 05**
Fire Engineering
- 06**
Facade Concept &
Scheme

- 07**
Coaster Foundations & Buildings
- 08**
Roads and Drainage
- 09**
Ride Enclosures & Attractions
- 10**
Area Development

GLOBAL ASSEMBLY LINE



A TYPICAL DAY

GMT

04:00

09:00

13:00

18:00

22:00



01

Multiple time zones mean communications are not simple

02

Only 3.5 hours between UK & UAE
1.5 hours during Ramadan

03

Staggered working week only leaves 14hrs between UK & UAE



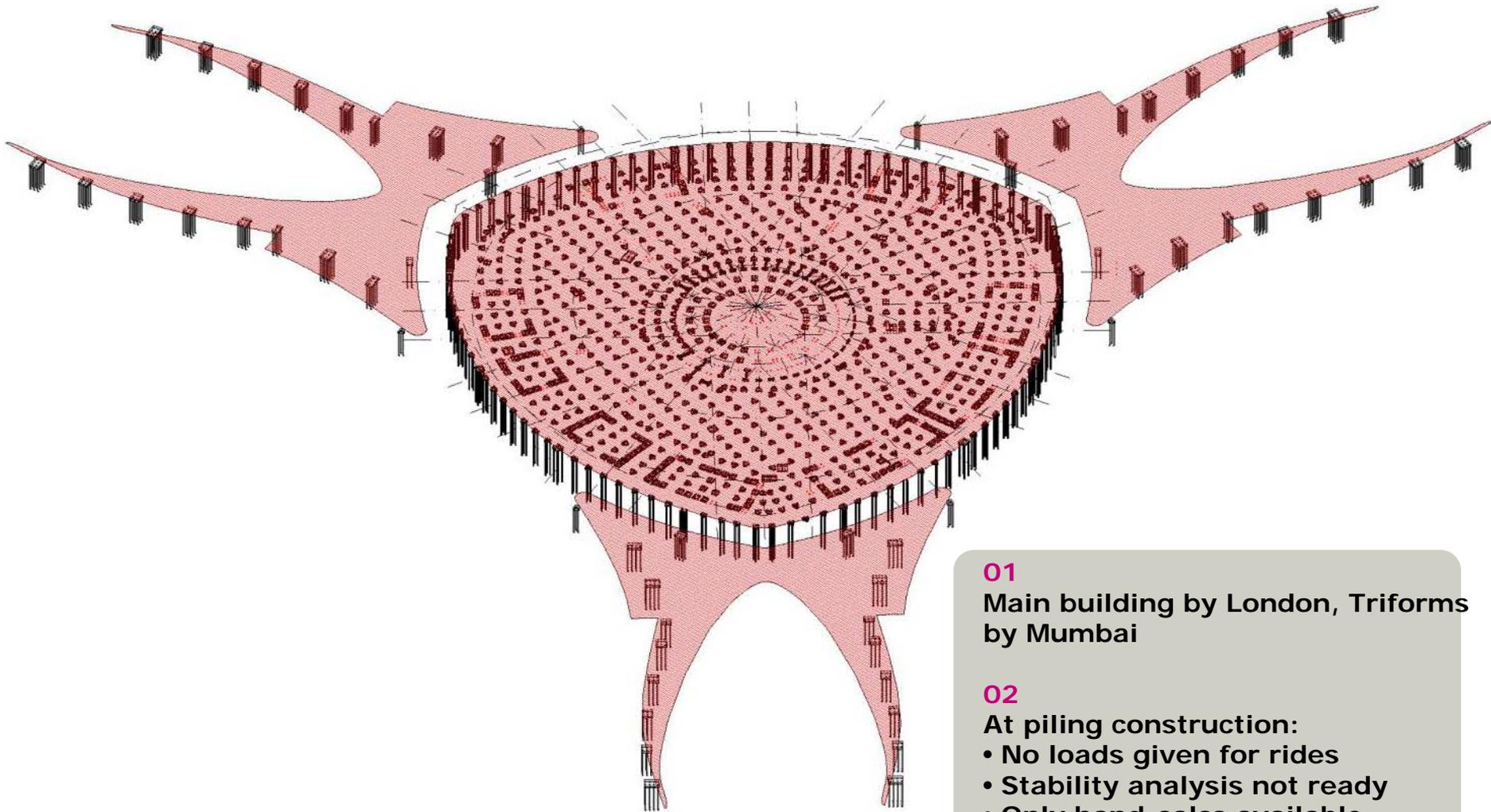
PROGRAMME

- Fast track programme

Construction starts before design concepts complete

- First meeting Nov 06
- Piling package May 07
- First pile August 07
- Loads from rides Jan 08
- Formula 1 race date 1 Nov 09 – roof finished
- Soft opening November 10

FOUNDATIONS



01

Main building by London, Triforms by Mumbai

02

At piling construction:

- No loads given for rides
- Stability analysis not ready
- Only hand-calcs available

03

Agree to allow 25% contingency in pile design to get piling going

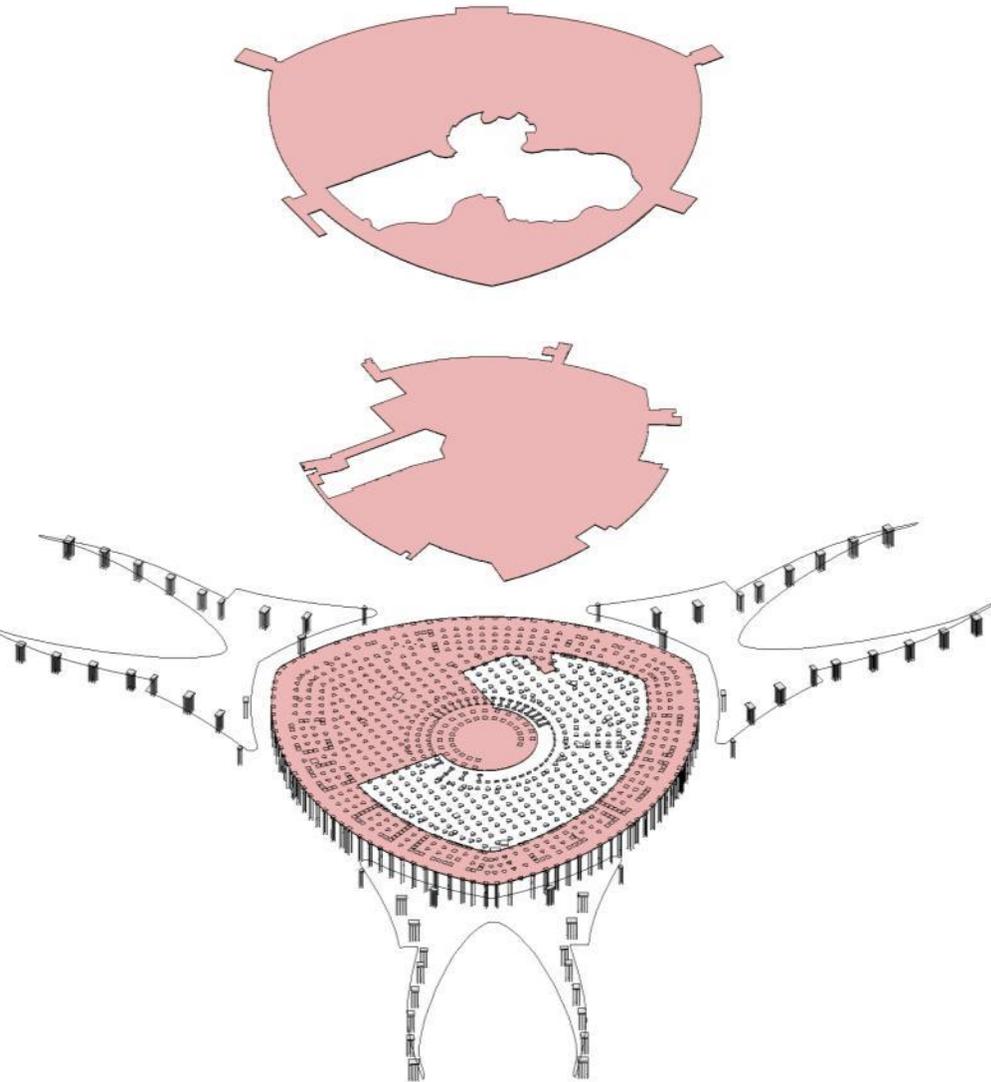
FOUNDATION DESIGN



London Geotechnical & Structures

- Static pile testing to 3 x working load
- Load test of 2,400 tonnes using kentledge
- Tests allowed savings in pile lengths totalling some 33km
- Almost 7,000 individual piles with a total length of 130km

INTERNAL SLABS



01

Plaza Level

- Designed by Edinburgh
- 600mm RC transfer structure
- Supports ride enclosures
- Designed twice due to load changes

02

Mezzanine Level

- Designed by Birmingham
- 500mm slab
- Offices, Italian Piazza, Lake & area development

03

Undercroft Level

- Designed by Edinburgh
- 500mm slab
- Car park, plant rooms & maintenance areas

04

- 3 grid systems
- Flat slab construction
- Shear wall stabilised

FIRST UNDERCROFT POUR



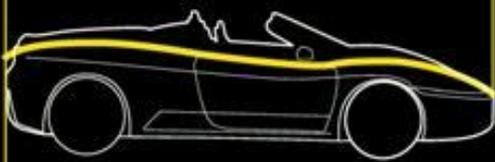
FIRST SLAB POUR

- 1,200mm thick x 79m diameter
- 5,800m³ or 900 trucks of concrete poured over 27 hours
- Used all concrete supply in Abu Dhabi for 3 days

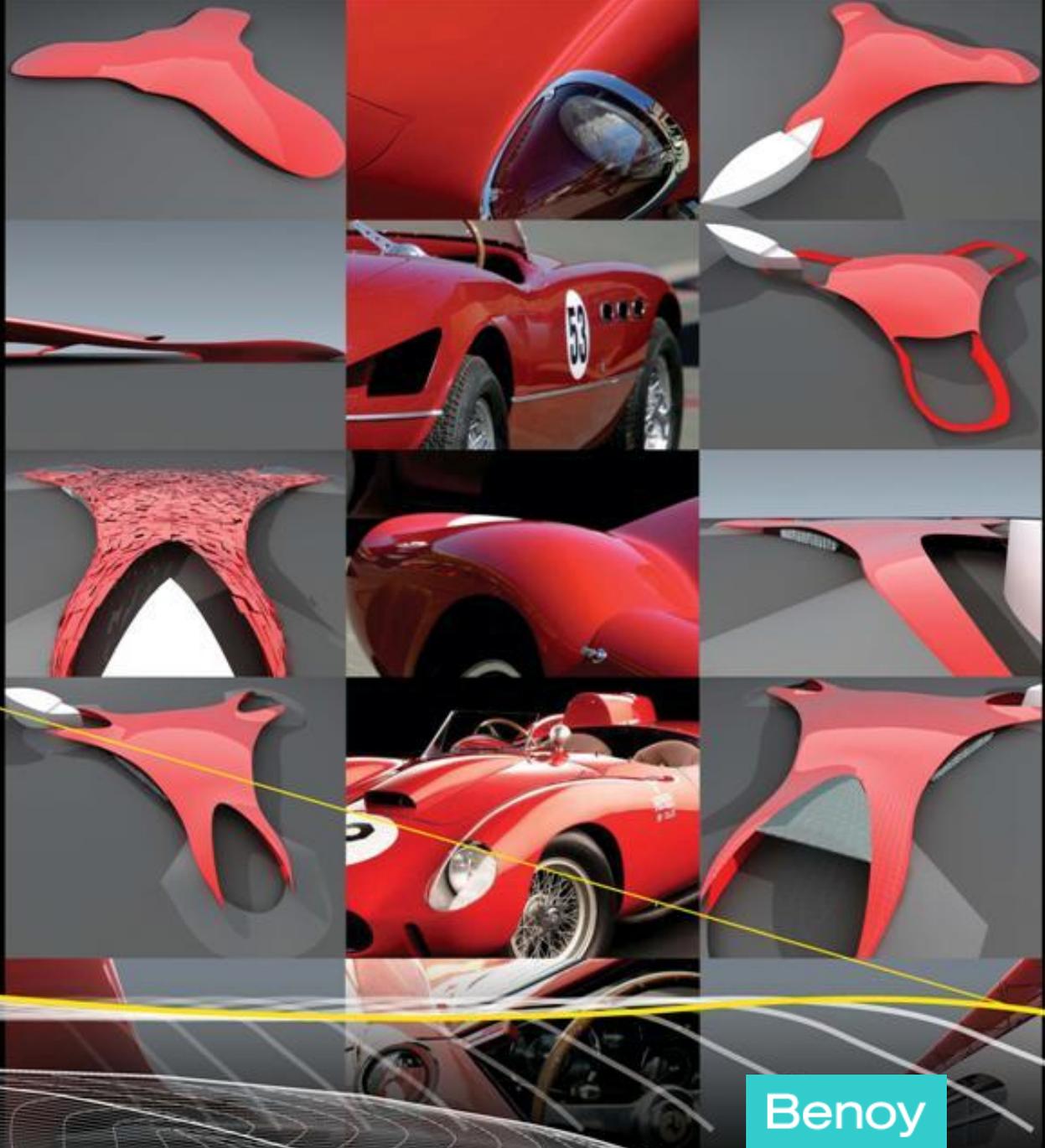
AN IDEA IS BORN



Ferrari F430 Spider

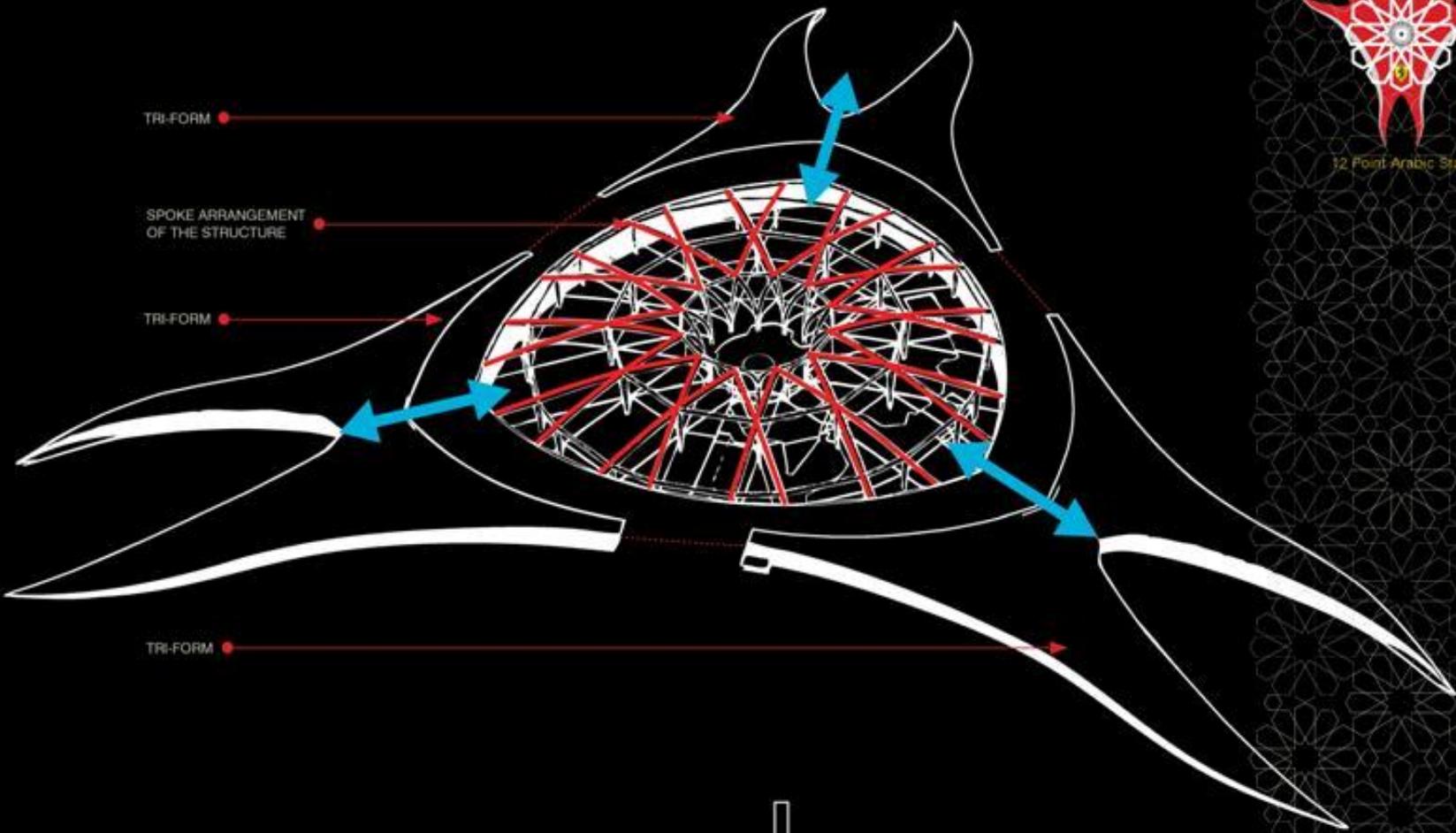


LANGUAGE OF PRIMARY DOUBLE CURVE





12 Point Arabic Star



TRI-FORM

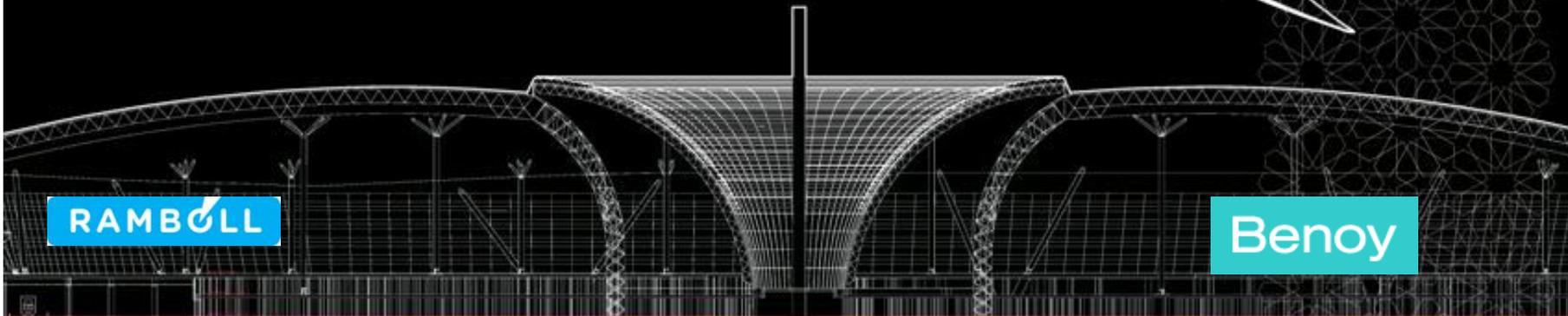
SPOKE ARRANGEMENT OF THE STRUCTURE

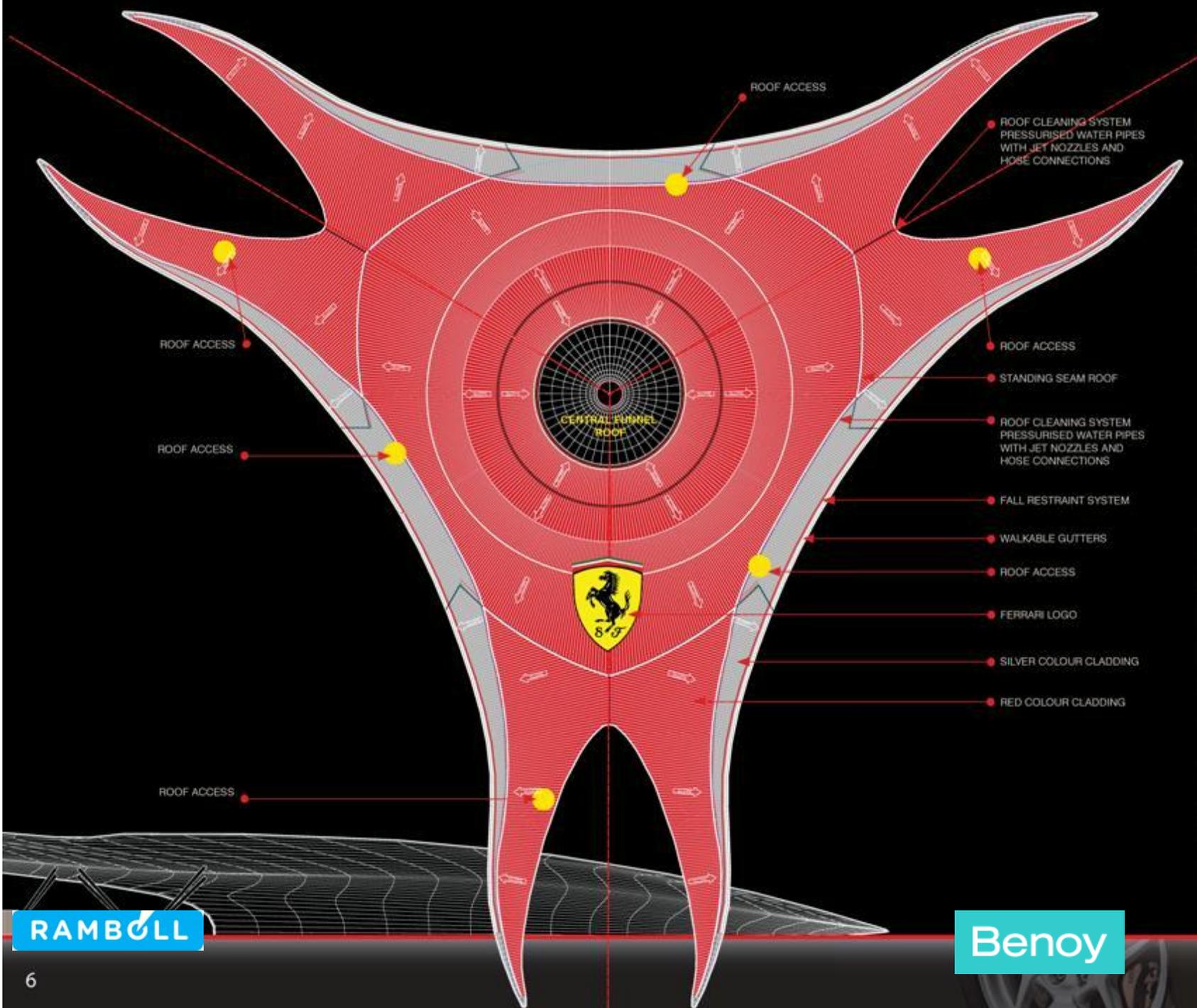
TRI-FORM

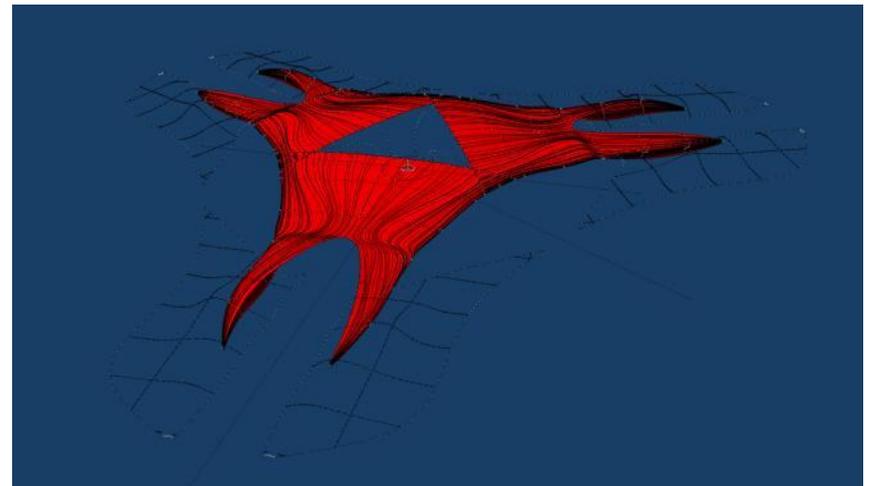
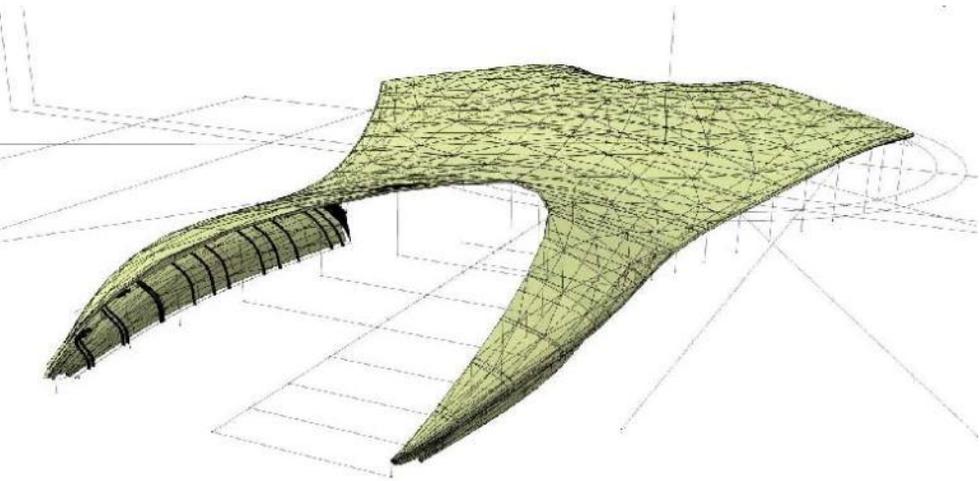
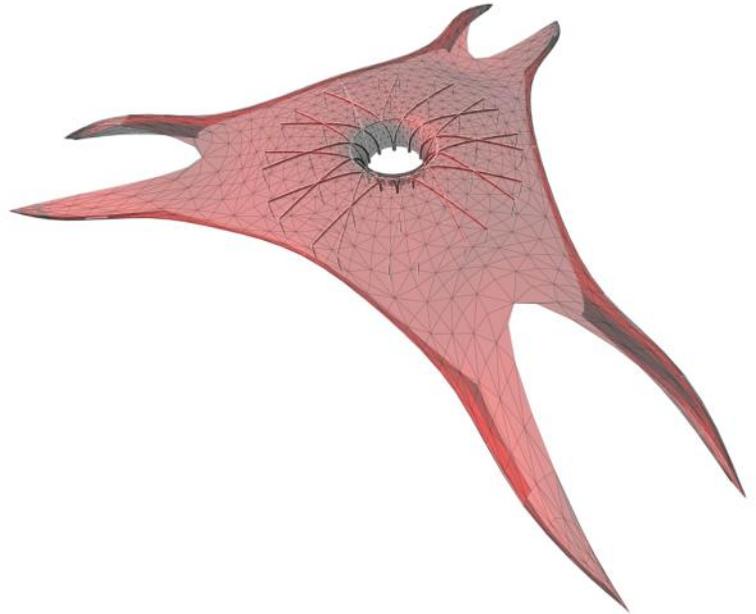
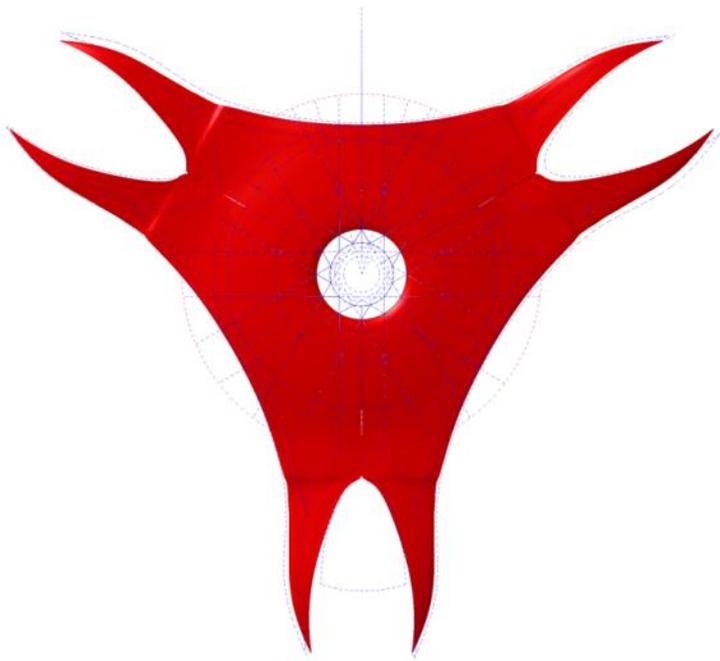
TRI-FORM

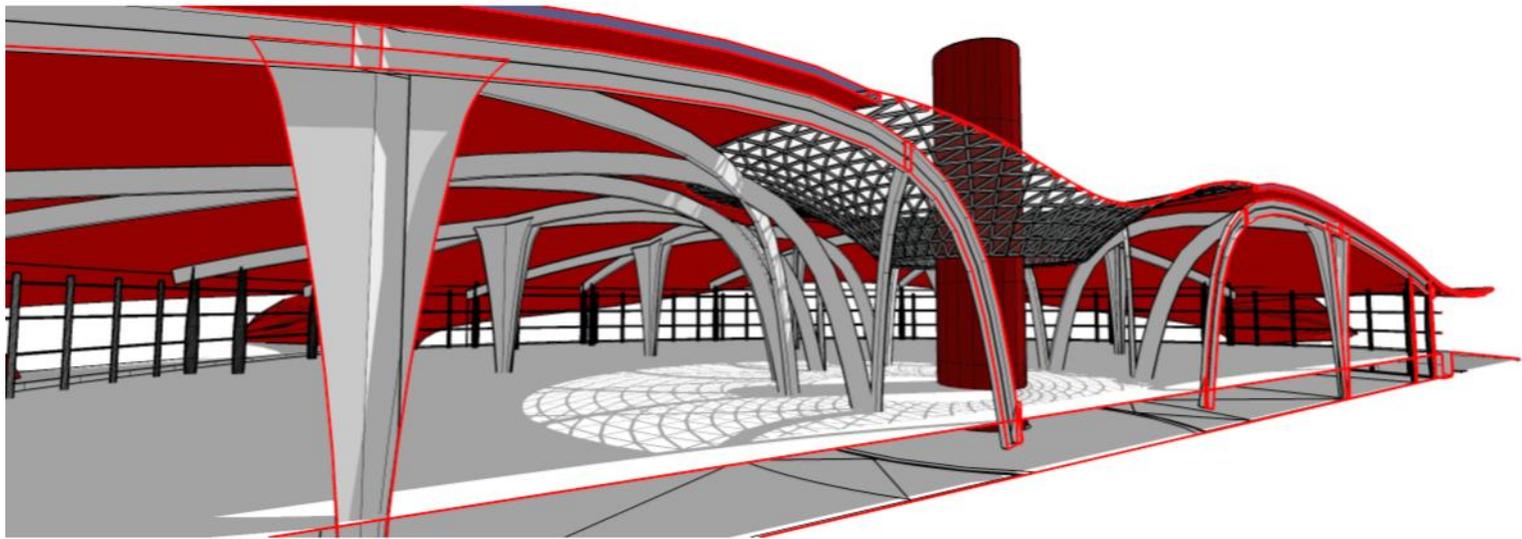
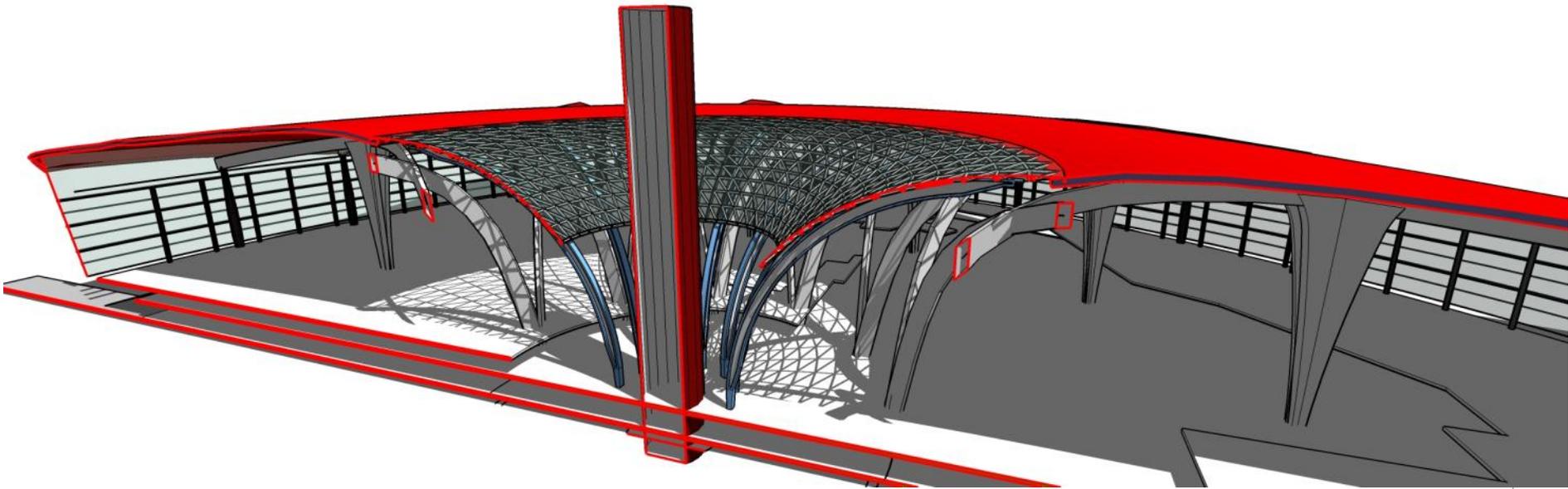
RAMBOLL

Benoy

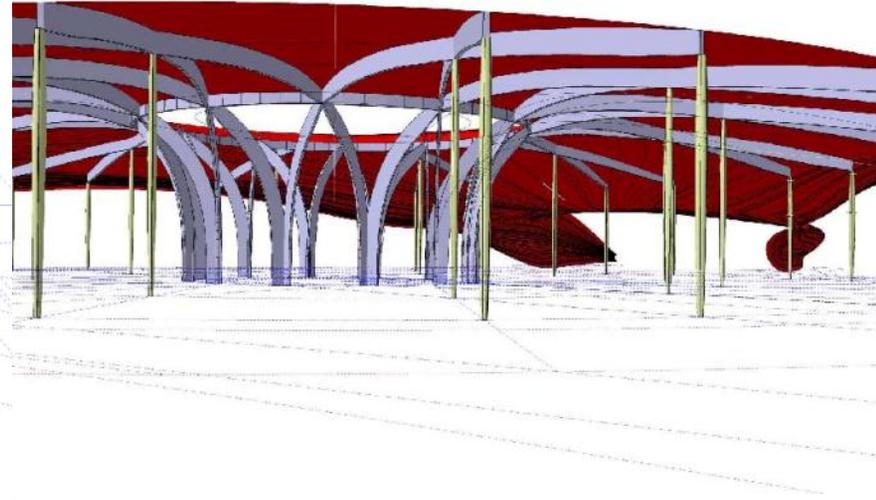
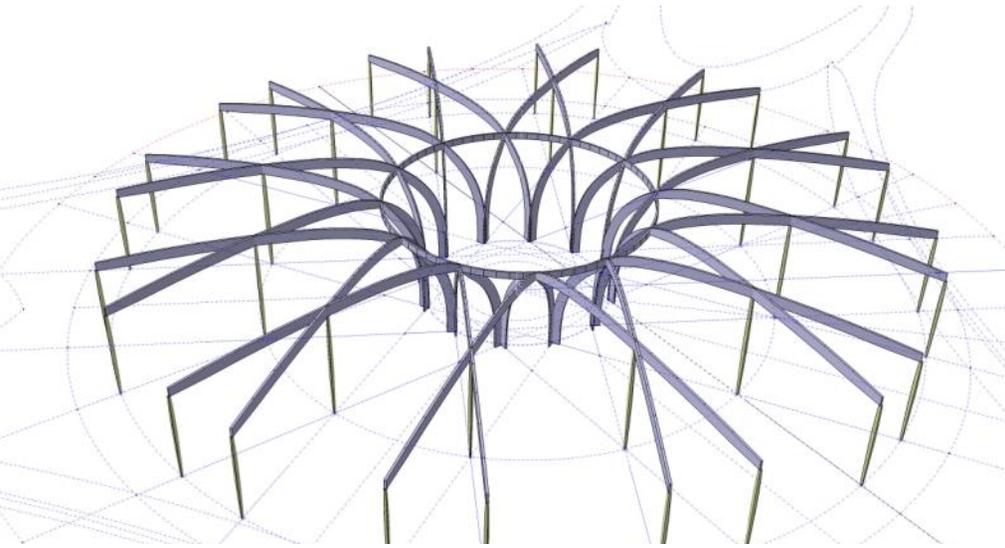




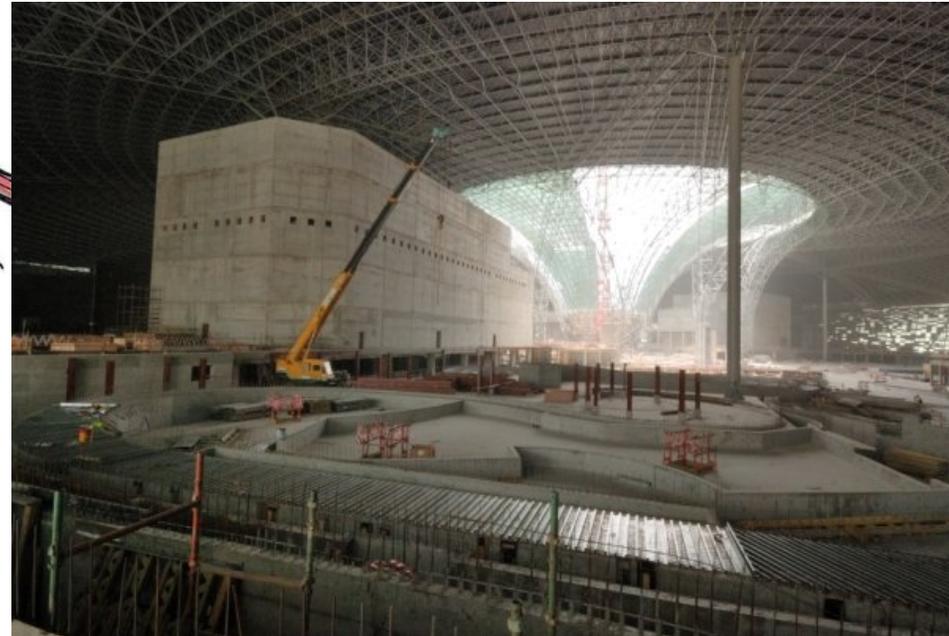


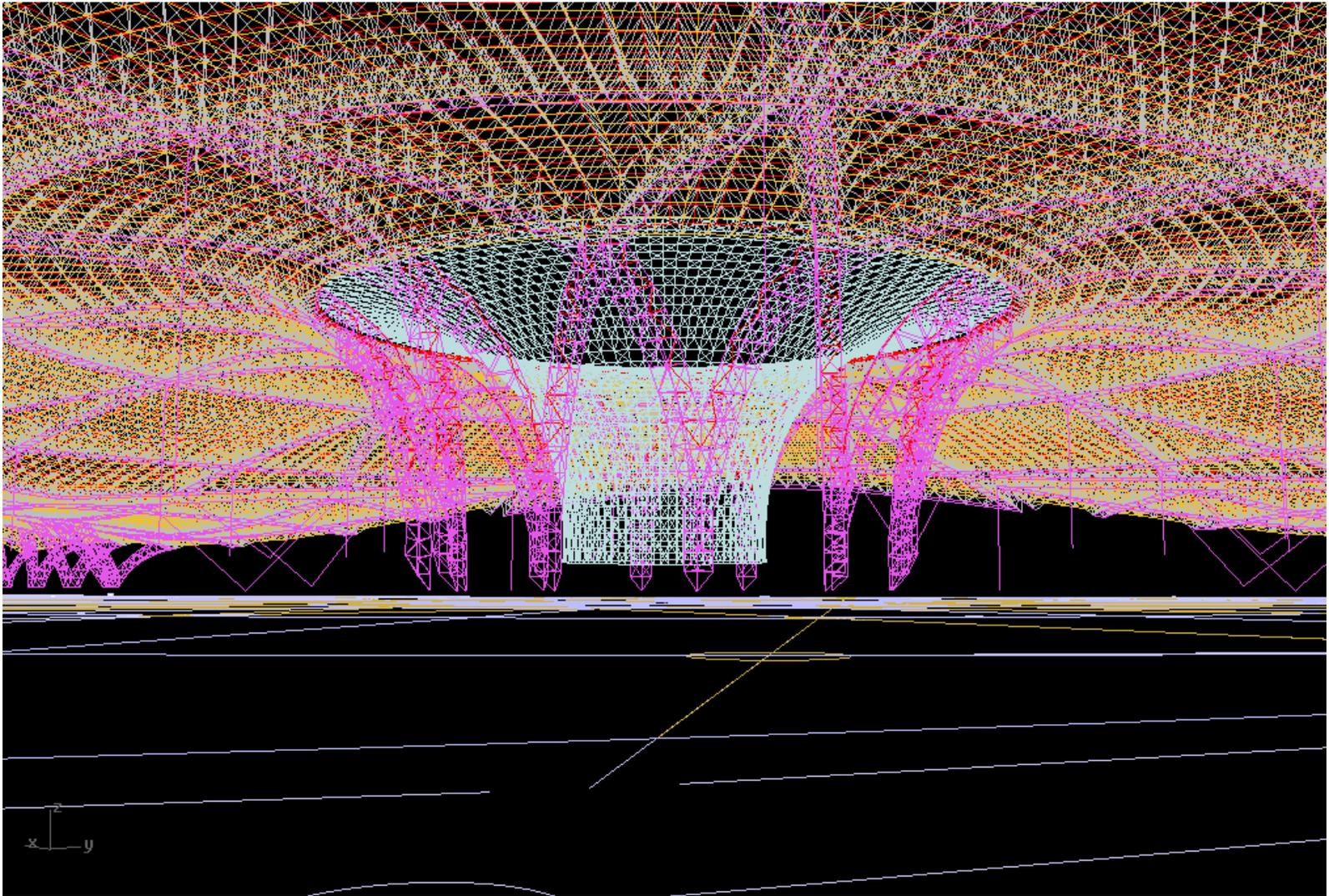


ROOF INTERNAL PERSPECTIVE



RAMBOLL

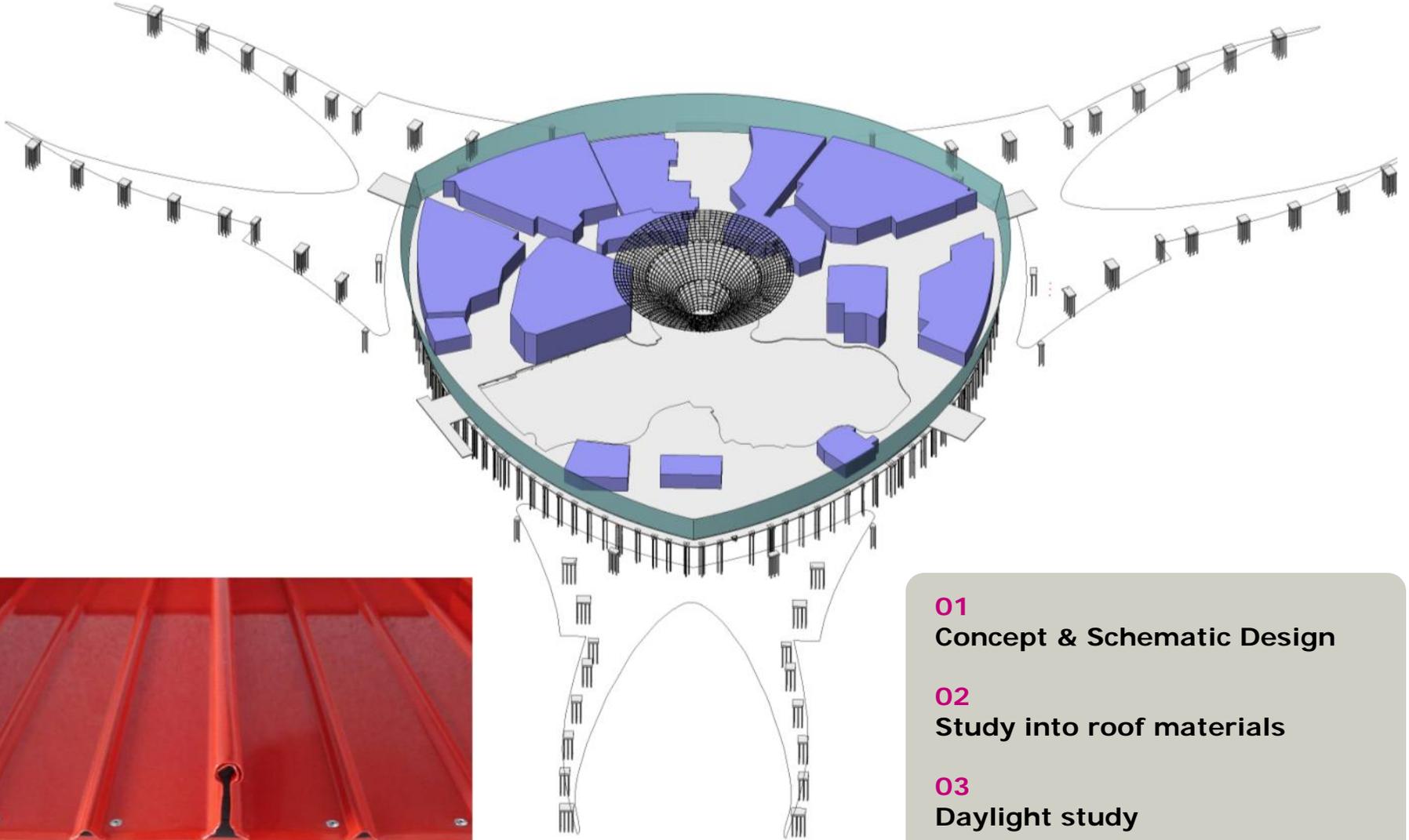




TEMPORARY WORKS



FACADE & FUNNEL



01
Concept & Schematic Design

02
Study into roof materials

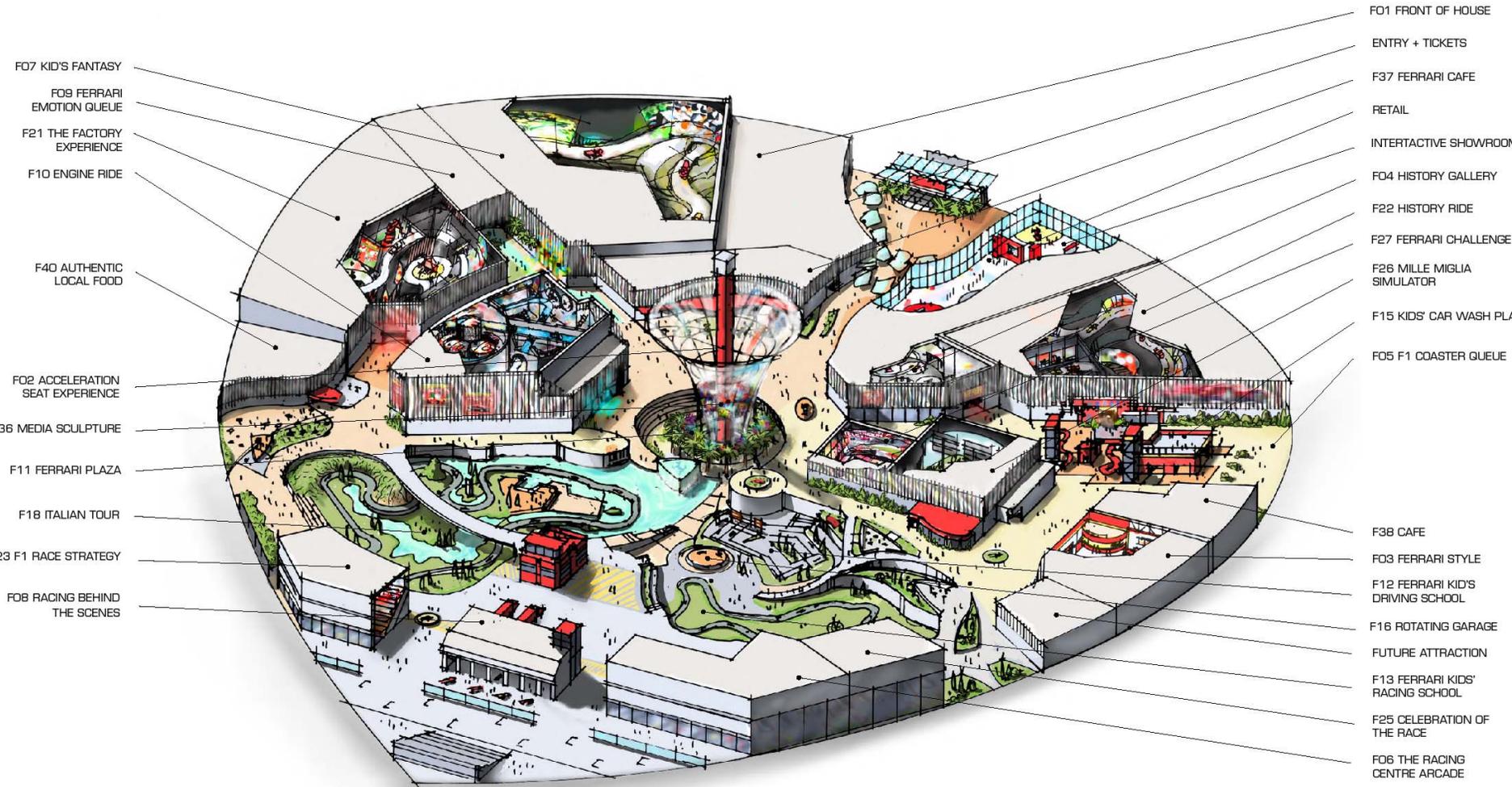
03
Daylight study

04
Insulated roof and facades

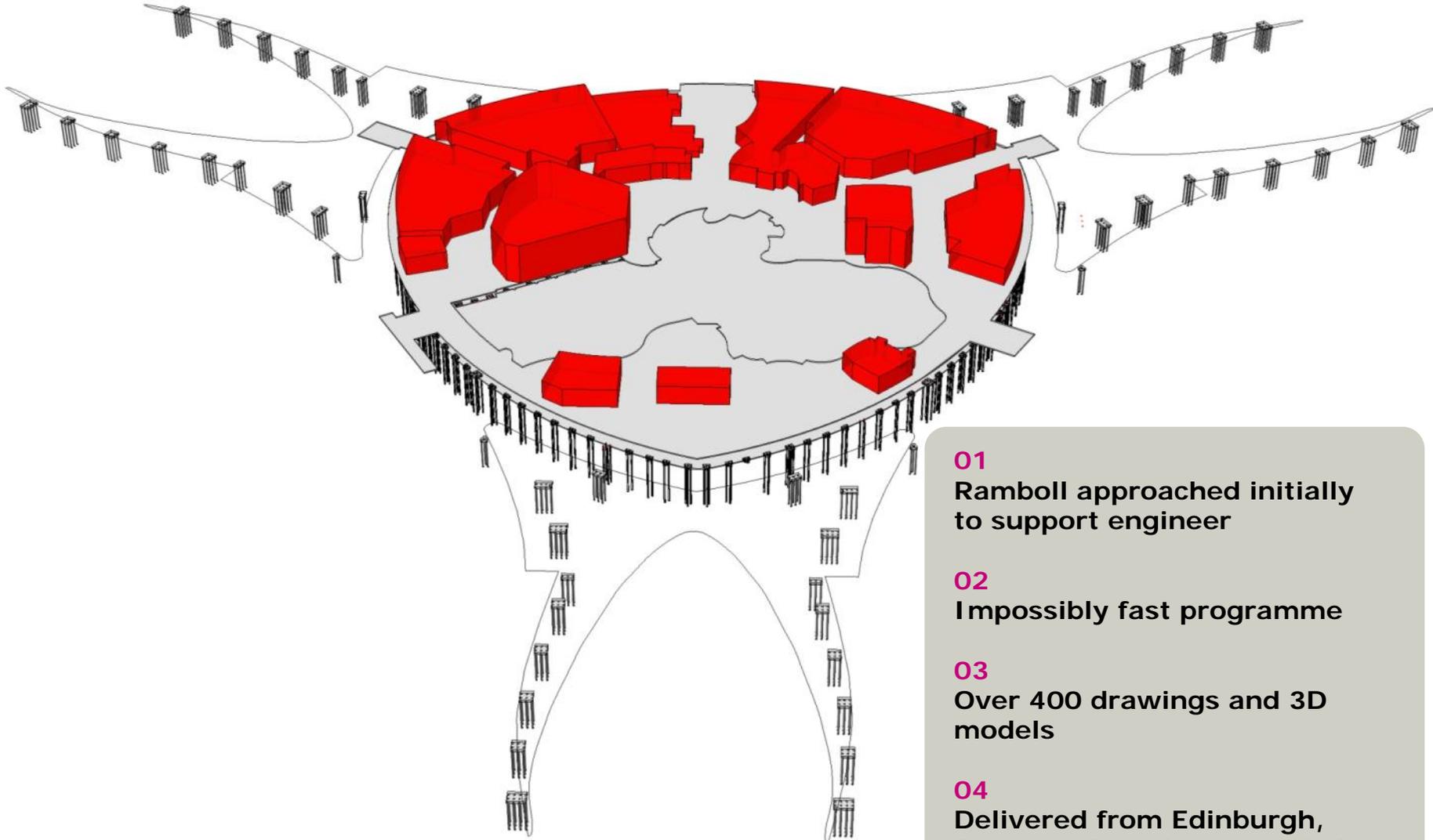
MAXIMISING NATURAL DAYLIGHT



RIDE ENCLOSURES & AREA DEVELOPMENT



RIDE ENCLOSURES



- 01** Ramboll approached initially to support engineer
- 02** Impossibly fast programme
- 03** Over 400 drawings and 3D models
- 04** Delivered from Edinburgh, Glasgow, Manchester and site

RIDE ENCLOSURES



01

Client : JRA

02

Initially a CAD and co-ordination exercise only to support original engineer

03

Brief changed immediately we were appointed – full design, original engineer no longer involved

04

Redesign of all buildings with 3 new architects from USA, UK and UAE

05

Programme to be unaffected

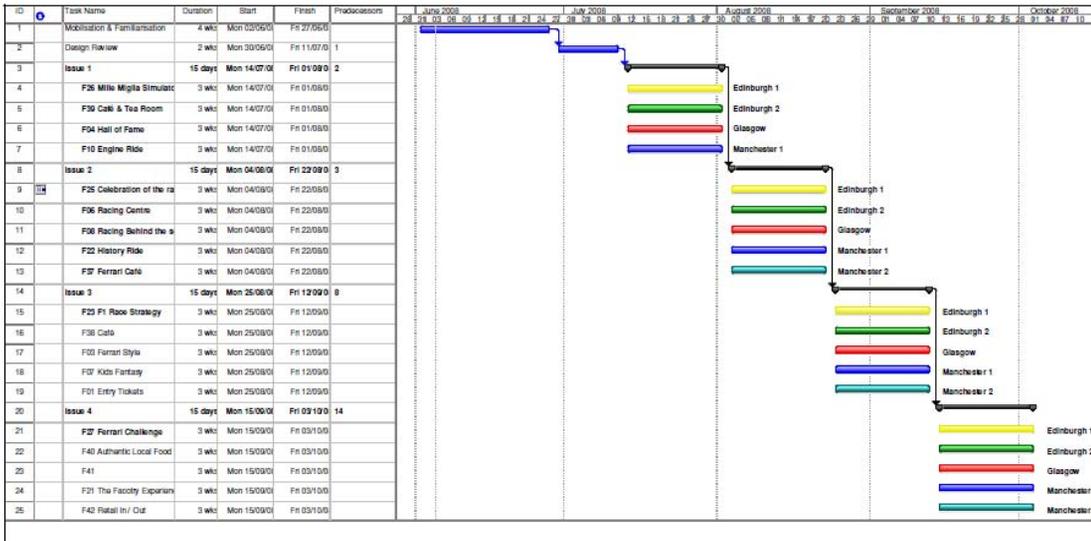
06

19 buildings in 16 weeks, over 400 drawings and 3d models

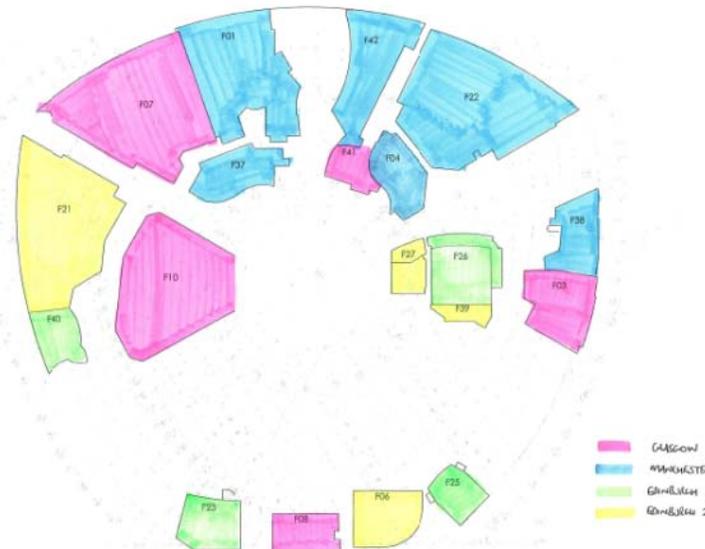
07

Full steel connection design and detailing, RC intent drawings

PROGRAMME

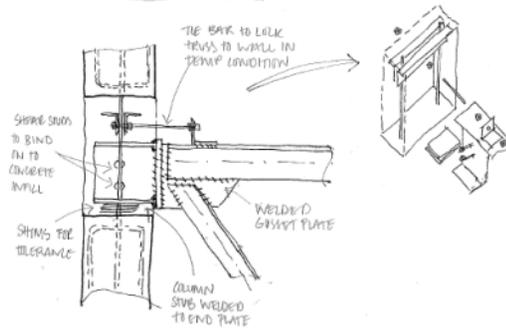


- 01** Initially a CAD exercise then turned into a redesign and CAD
- 02** Initial 38 week programme rejected, cut to 16 weeks and scope increased
- 03** Redesign and CAD of 19 buildings sitting on suspended slab
- 04** Managed across 3 UK offices (Edinburgh, Glasgow, Manchester) with additional CAD support from London, Cambridge and site team
- 05** Ramboll led the design process



PROGRAMME DELIVERY

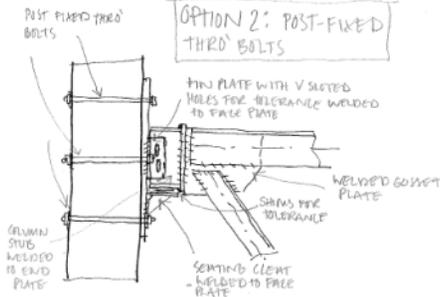
OPTION 1: CAST-IN POCKET



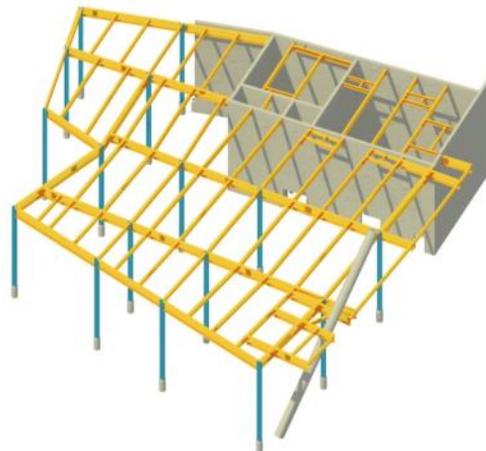
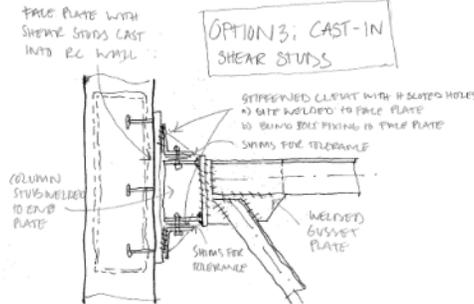
ALTERNATE TRUSS/WALL CONNECTION DETAILS

RAMBOLL WHITEBIRD
5485/GA/SK/001
24 JUNE 08 MR

OPTION 2: POST-FIXED THRU' BOLTS

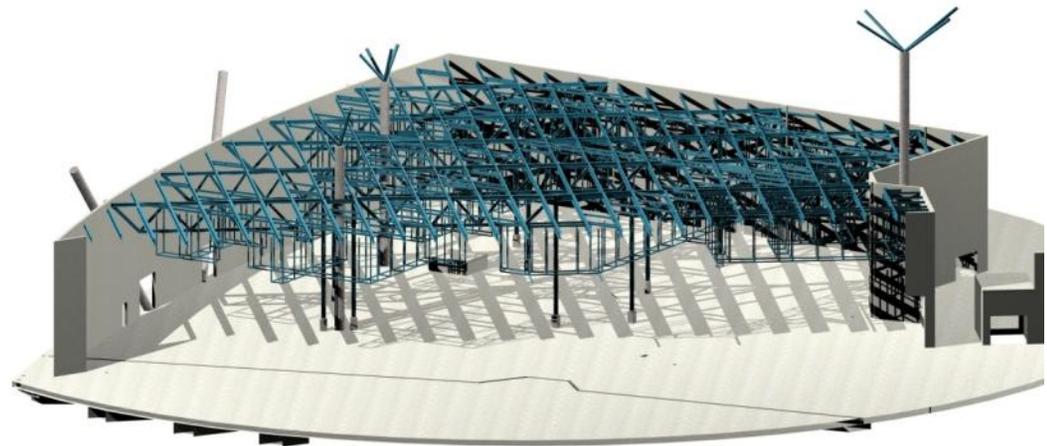
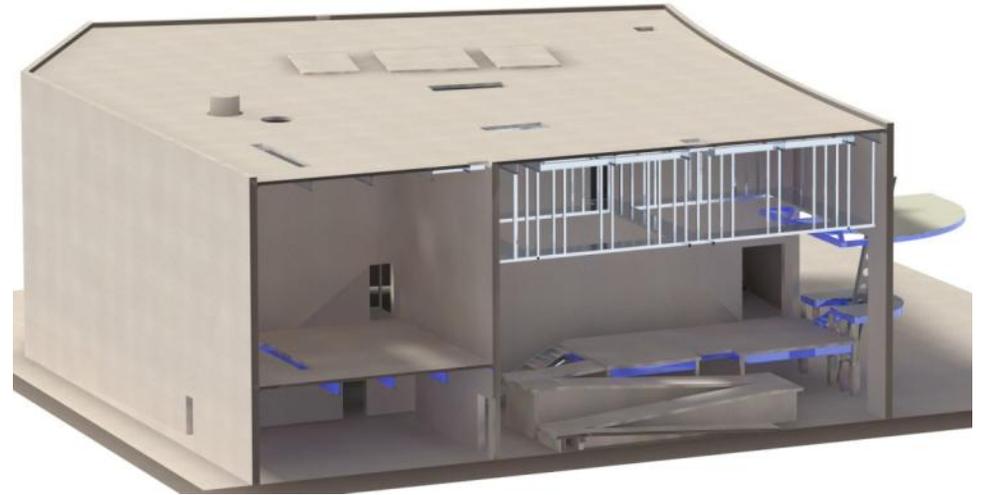


OPTION 3: CAST-IN SHEAR STUDS

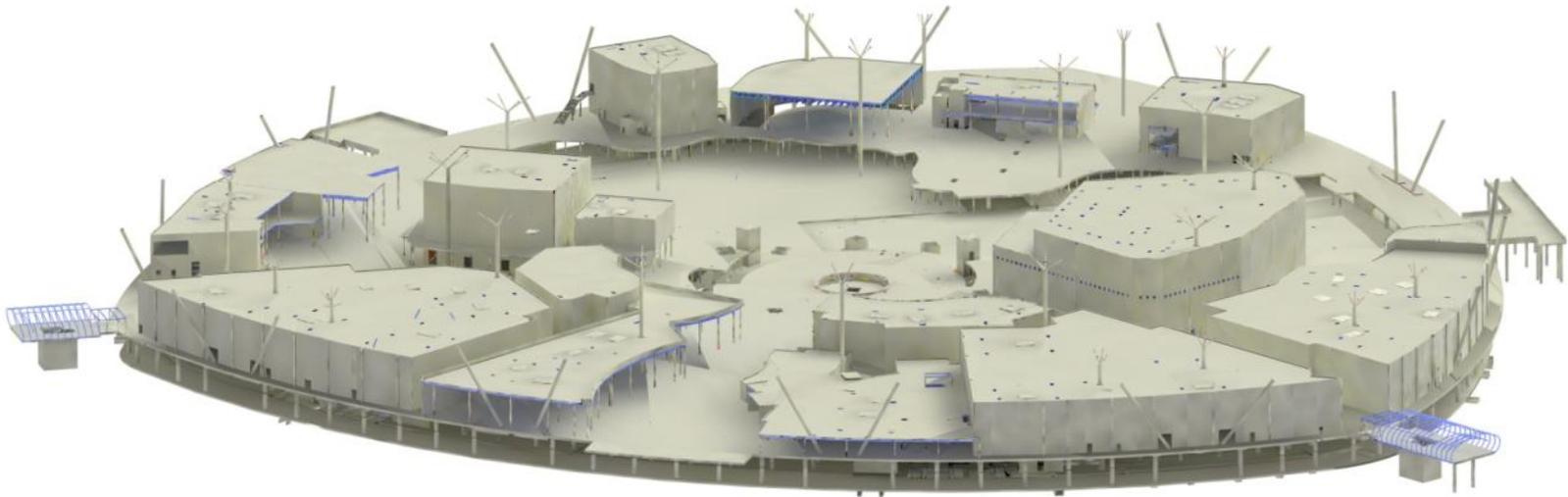


- 01** Initial familiarisation then five buildings delivered every three weeks
- 02** A clear master programme and detailed programme
- 03** Establish construction principles early
- 04** Co-ordination and strategy workshops UK and Abu Dhabi
- 05** Clear protocols for reviewing and checking
- 06** Work in progress sketches and 3D models
- 07** Formal reviews 1 week before issue date
- 08** Site based presence

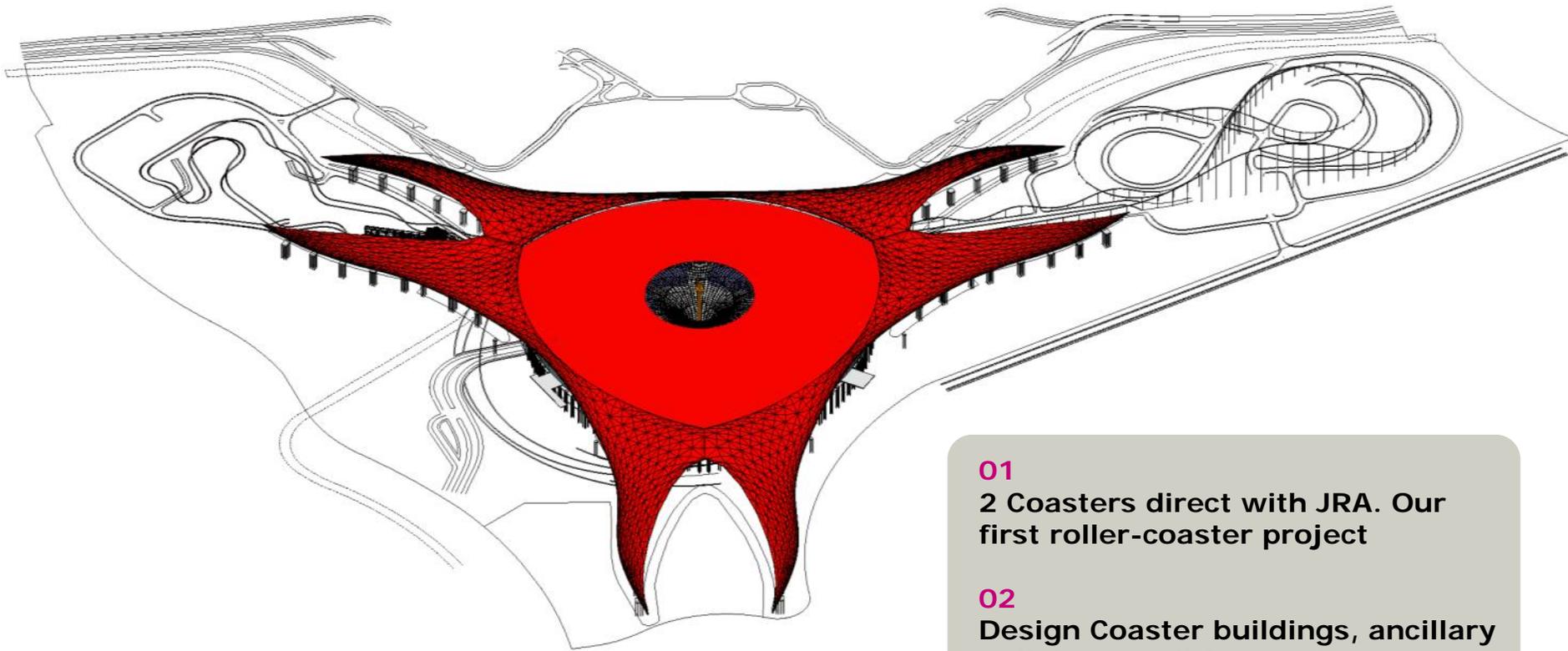
3D MODELS – CLEAR OUTPUT



3D MODELS – THE CO-ORDINATED PRODUCT



ROLLER-COASTERS



01

2 Coasters direct with JRA. Our first roller-coaster project

02

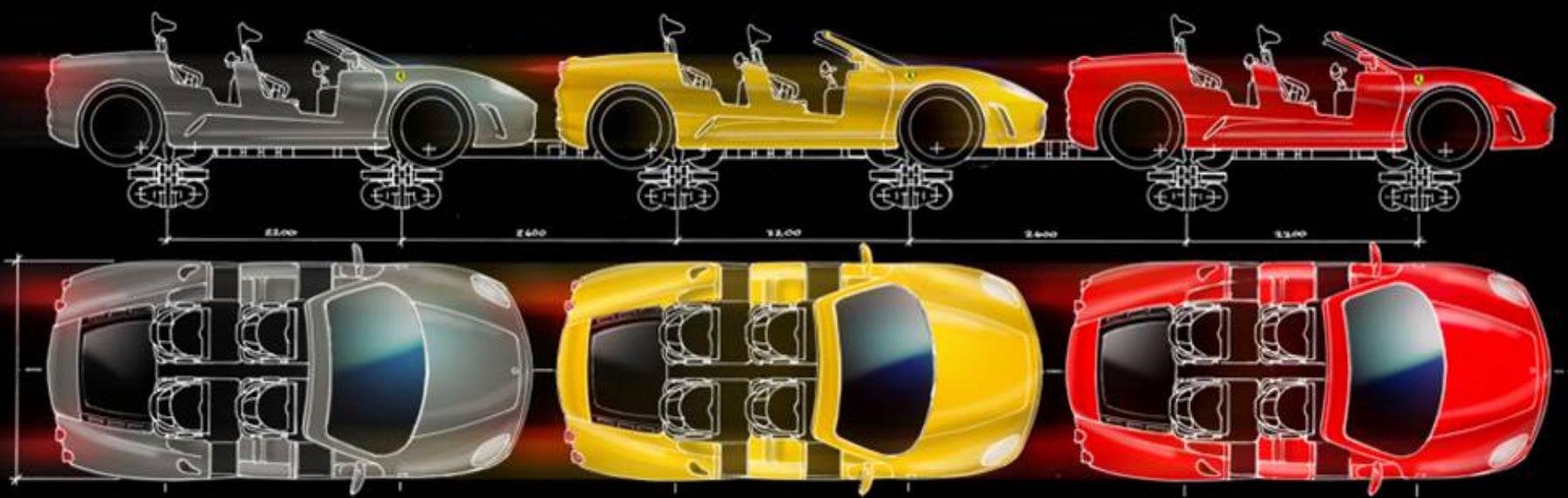
Design Coaster buildings, ancillary buildings & all foundations

03

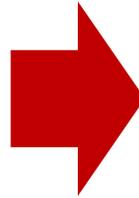
Structural, Building Services, Geotechnical & Civils

04

Delivered from Edinburgh, London & Abu Dhabi



DUELLING GT COASTER

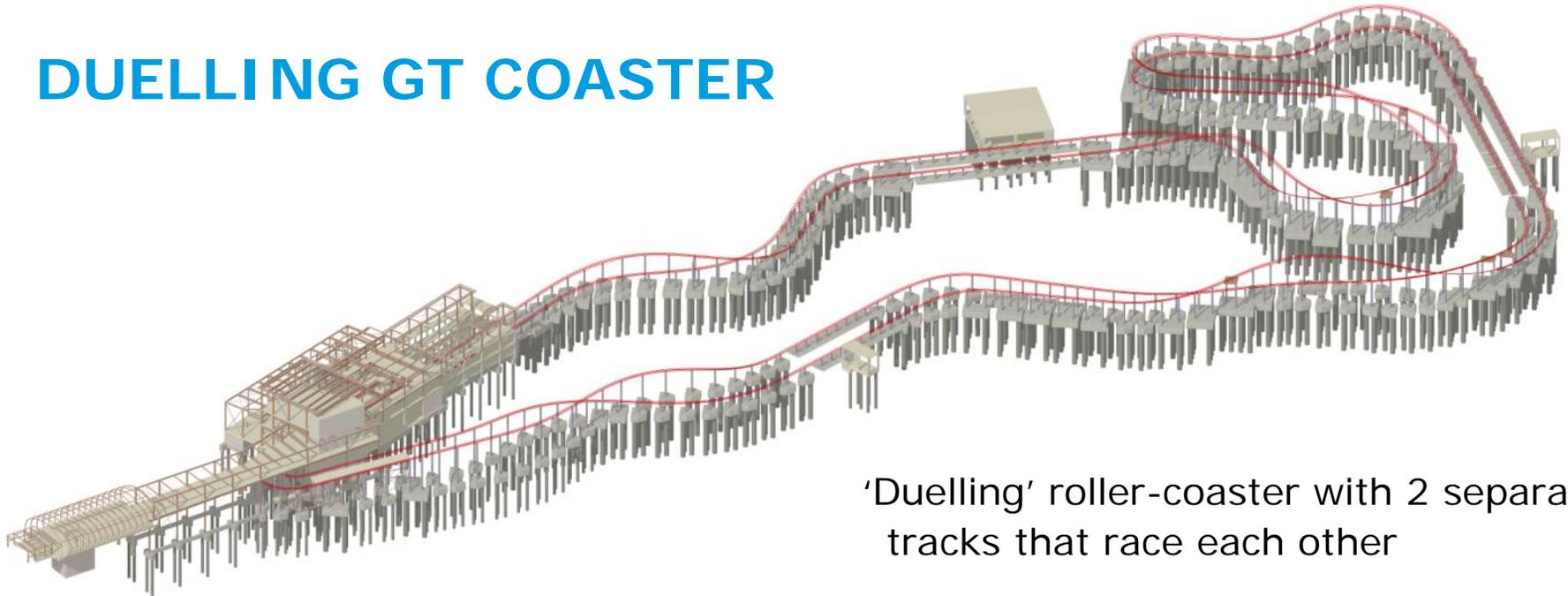


RAMBOLL

'Duelling' roller-coaster with 2 separate tracks that race each other

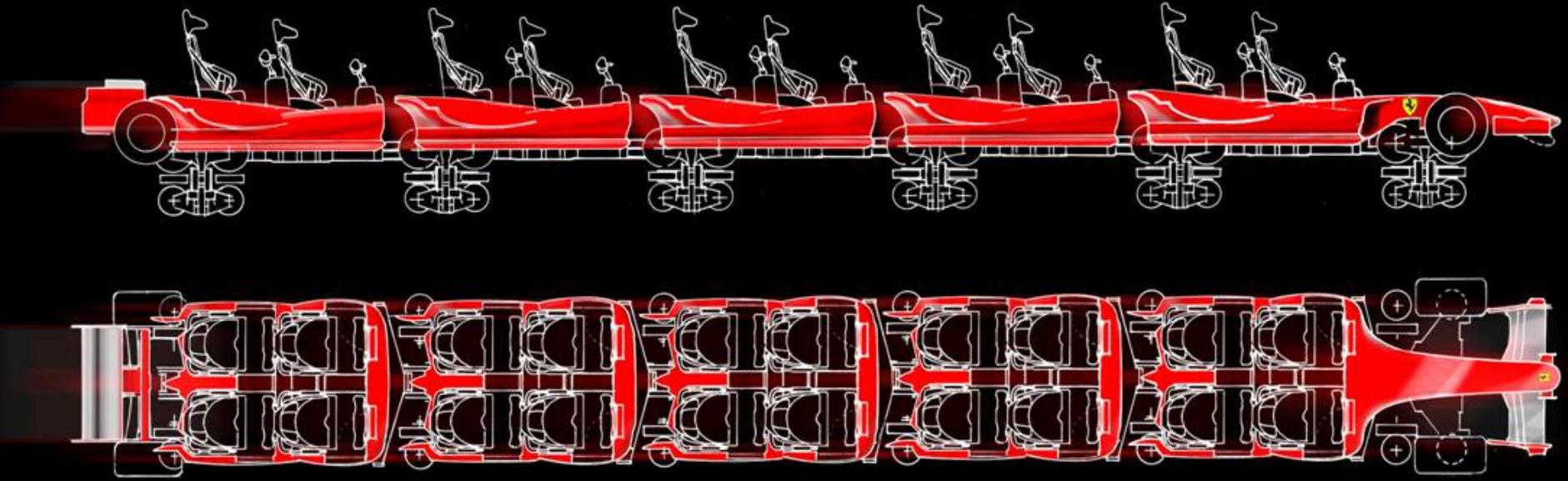


DUELLING GT COASTER



'Duelling' roller-coaster with 2 separate tracks that race each other

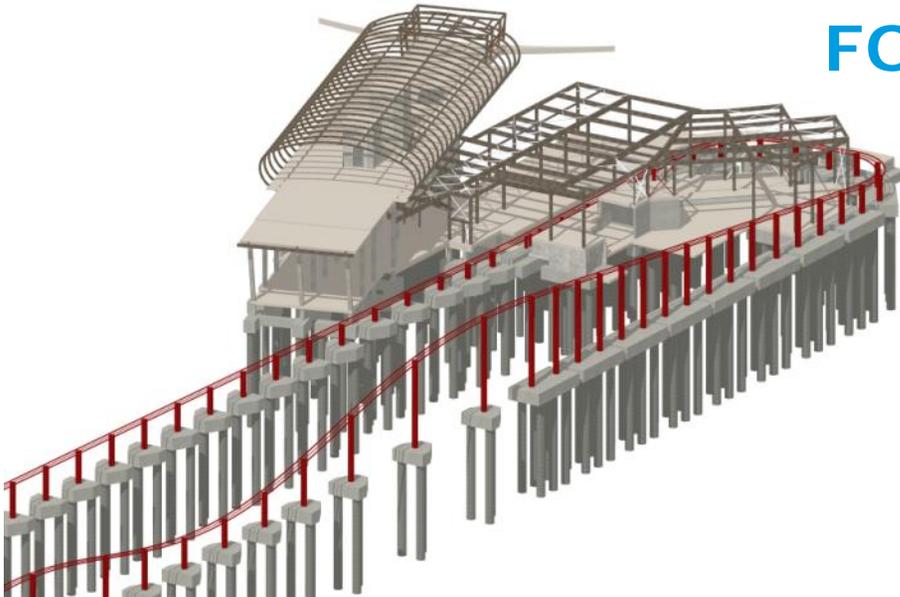
Multiple accelerations & decelerations, straights & hairpins



FORMULA ROSSA COASTER

Formula 1 inspired coaster

Accelerated by a cable and winch
300m away



FORMULA ROSSA COASTER

01

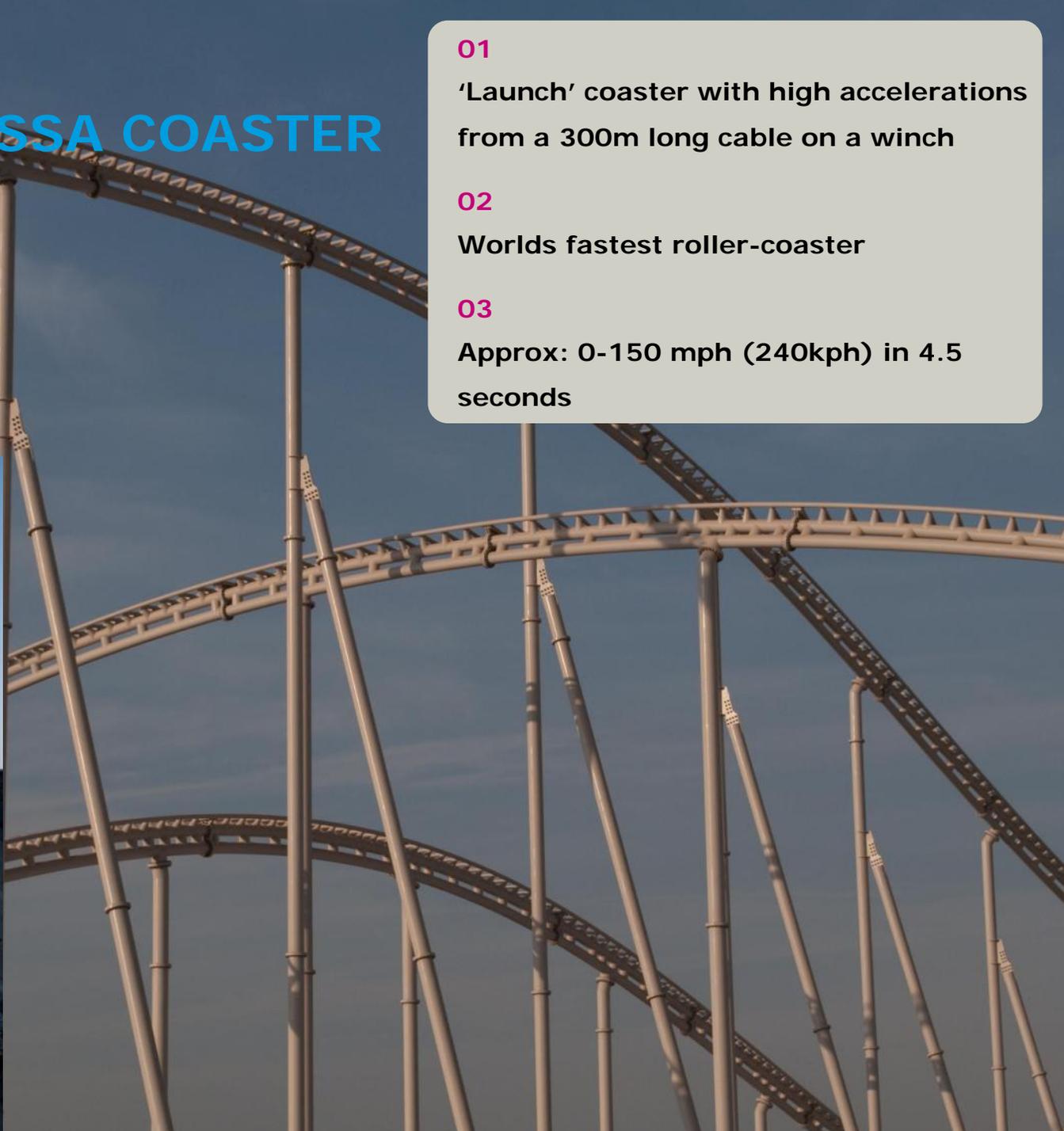
'Launch' coaster with high accelerations from a 300m long cable on a winch

02

Worlds fastest roller-coaster

03

Approx: 0-150 mph (240kph) in 4.5 seconds





The idea



highway

southwest car park

retail destination

southeast car park

ring road

lake

ferrari experience

f1 track

Nov 2007



YAS ISLAND

site progress 071102

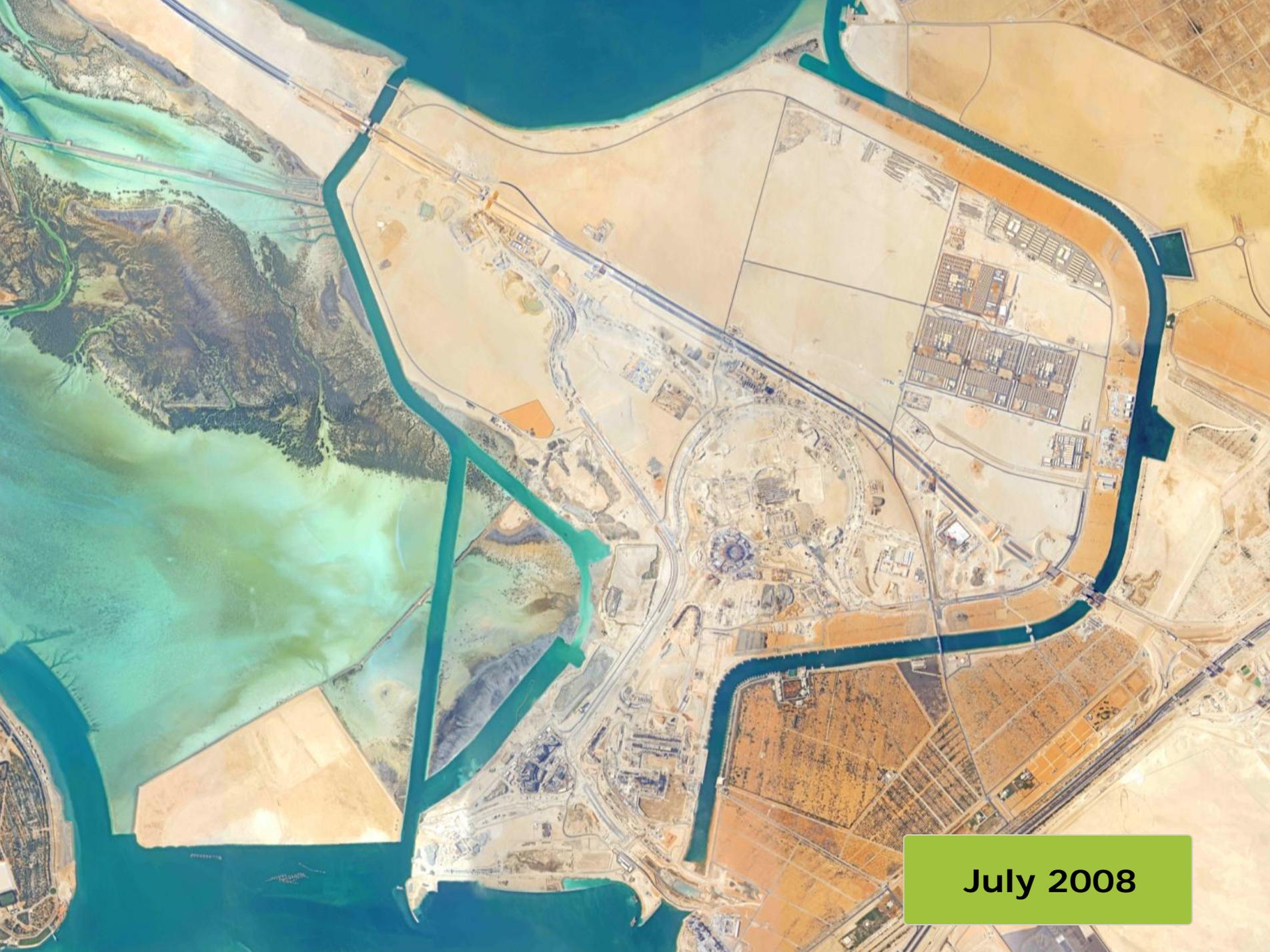


Benoy Architects

www.benoy.com



Feb 2008



July 2008



July 2008



October 2008



Jan 2009



Mar 2009



Apr 2009



Apr 2009



June 2009



October 2009



November 2009



November 2010



TOP 5 LESSONS LEARNED

01

Documenting your design philosophies comprehensively

02

Ensure financial systems are robust enough to deal with multiple currencies

03

Ensure that site staff are fully supported, they have a tough job

04

Be aware of country-specific construction methodologies and materials

05

Deploy senior presence on site from the start.



RAMBOLL

TOP 5 THINGS TO CELEBRATE

01

we **CAN DELIVER** from multiple regional & international offices together

02

Use of 3D CAD & existence of CAD standard practices were invaluable

03

Managing expectation of others (i.e. deliverables & scope)

04

Focused workshops to coordinate

05

Dedicated site team and use of document controllers were invaluable



Top 5 Quick Facts

- 128,120 m³ of concrete or 21,353 concrete trucks which would stretch 228 miles if parked bumper to bumper.
- 172,000 steel members in the roof
- There are over 7km of gutters around the roof
- 65,298 design documents (drawings, reports, submittals) to date
- > 1 man working year lost flying and 21 weeks in airport lounges!



THANK YOU

