Where safety and quality come first

CONTENTS

INTRODUCTION

WELCOME TO FDF!

We at FDF are committed to provide integrated solutions in façade technologies, specialized in design, engineering, consultancy and management services since 2016. We are focused on and seek to meet client expectations. We work collaboratively to provide solutions that are innovative, effective and unique to the extent of delivering the client needs and implementing the essence of architecture and design.

OUR VISION

Our vision is to guide our client to enhance building technology and improve the environment. We undertake professional and ethical standards for the growth and development of our business. We believe in commitment, clear communication and we execute each project with utmost passion and dedication. We develop new generation facade systems that is designed as high value added final products.

OUR MISION

We give precedence to enrich architectural design by providing durable and sustainable project services and consultancy that include modern, effective and safe solutions. Our primary objective is make our clients and project collaborators to reach the goals which have been designated in the beginning of planning phase.

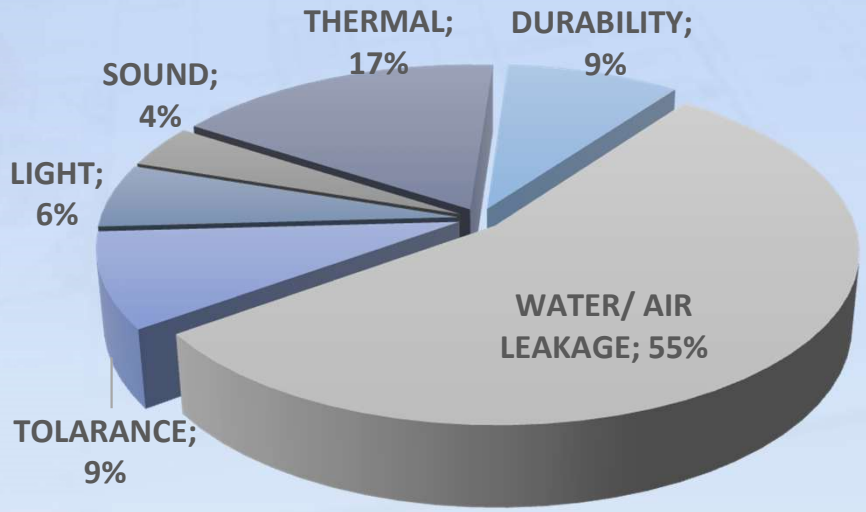
Technology at work for you
ONLY ONE RIGHT WAY OF DOING FAÇADE IS:
RIGHT FIRST TIME!

WHY OUR COMPANY?

- **SAFE DESIGN** COMPLIANCE WITH LOCAL AND INTERNATIONAL CODES, REGULATIONS (EN, DIN. ASTM, BS, TS)
- **PLANNING** THE PROJECT AT EARLY STAGE
- BETTER VALUE **ENGINEERING**
- **CONTROLLED** COSTS
- BETTER **AESTHETICS**
- BETTER AIR AND WATER **TIGHTNESS**
- **REDUCED** RUNNING COSTS
- **TIMELY** COMPLETION
- PROVIDING **SUSTAINABILITY**

MAJOR CAUSES OF FACEDE FAILURE

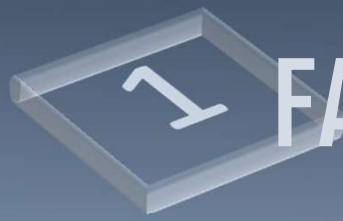
- Major façades around us have failure in terms of **Air and Water leakages** and serious **safety failures**
- System that passes the standard laboratory tests **fails to perform at site**
- The reasons behind facade failures are **poor design and poor management**



WHAT WE OFFER?

We provide none –stop service including customized design and engineering, performance testing, material procurement review, advisory services for improvements in system, review of mock-up installations, inspection of fabrication and installation, review of remedial plan before implementation.

OUR SERVICES



FAÇADE CONCEPT DESIGN

- Evaluation of alternative façades in terms of architectural, structural and building physic criteria and providing advices
- Pre-structural calculations and dimensioning of mail façade types
- Feasibility and advices regarding façade structure in architectural concept projects
- Evaluation of building energy performance and building physic criteria (Heat and energy, day light, sun protection, rain and moisture protection, fire precautions, acoustical insulation)
- Checking sustainability criteria (Durability, Structural Requirements, Natural Disaster risks)
- Producing a pre-façade budget with alternative solutions
- An evaluation report regarding façade structures and pre-façade budget are submitted at the end of this phase

FAÇADE DETAILED DESIGN

- Consultancy regarding application technics and material data of the determined façade types in the concept design stage
- Pre-structural analysis and final dimensioning of the determined façade types
- Evaluation of other related analysis (for instance, 'Wind Tunnel Test' of 'CFD Simulation' report)
- Generating façade details and principle drawings
- Value engineering
- Consultancy regarding building physic criteria, especially sun protection and thermal performance of façade structure
- Determination of thermal performance for each façade components by making analysis and calculations
- Façade principle drawing set and pre-structural analysis report are submitted at the end of this phase

TENDER DOCUMENTATION AND MANAGEMENT

TENDER DOCUMENTATION

The goal of this phase:

- Finalizing of façade detail drawings and generating of final façade shop drawing set
- Preparing of façade tender documents without contradictions and as complete
- Strategy development and management to collect right proposals and to increase competition between bidders

DOCUMENTS INSIDE TENDER PACKAGE:

- **Façade Shop Drawings:** As soon as architect and/ or client representative's approval has been taken regarding schematic design of façade construction, the shop drawing set that includes key drawings in 1:20, 1:40 or 1:50 scale, and drawing details in 1:1, 1:2,5 or 1:4 scale is prepared (all drawings are in DIN A3 format).

- **Façade Technical Specification:** This tender document provides detailed information regarding characteristics of façade structure in terms of building physic criteria, engineering calculations, national and international codes that shall be considered. Method statements and all information and descriptions regarding manufacture and installation process of each façade system are included too.

TENDER DOCUMENTATION AND MANAGEMENT

- **Bill of Quantities:** This tender document consists of lists that include short descriptions and quantities for all types of different façade works in order to collect proposals from bidders.

- **Façade Codes Drawings:** This tender documents consists of the key drawings that show all curtain wall types on elevations, sections and plan and provide possibility to crosscheck the quantities for the bidders.

TENDER MANAGEMENT

- Meetings are set with bidders in order to introduce the façade project and provide them all necessary information that helps to complete the final proposal.
- All proposals are examined. If there is inappropriateness or discrepancy, the related bidder is contacted and revision is requested immediately for the proposal.
- Detailed comparison tables are prepared and shared with the client and/or client's representatives in order to make proposals easily comparable.
- Contribution is provided to the client during negotiations, technical discussions and contracting.

FAÇADE STRUCTURAL AND PERFORMANCE ENGINEERING

Dimensioning of each façade component is done by making the following anaylsis:

- Stress and deflection analysis of:
  - curtain wall and/ or window frame system
  - anchor plates, anchor bolts and all required fixing components
  - insulated or non-insulated glass units, glass fins, glass separators or glass-balustrades
  - any kind of metal balustrade systems
  - any kind of artificial or natural cladding system components and sub- components
- Tear and capacity analysis of fixing screws
- Capacity analysis of fixing elements and examination of concrete failures
- Defining the thickness of insulation material by making thermal calculations of wall sections
- Defining heat transfer coefficient of system profiles by making thermal and condensation analysis

WIND ENGINEERING

Optional Service: Wind load and wind comfort studies through CFD analysis

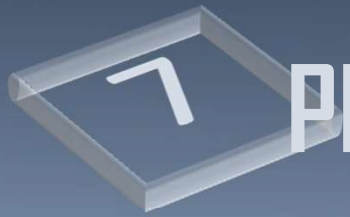
Information will be included in the technical report:

For critical wind speed reference values along the dominant wind direction in the related standard;

- Wind load distribution on the building (kN/ m^2)
- Absolute pressure distributions at desired height sections (Mpa)
- Velocity distributions at desired height sections (m/s)
- Velocity ratio distributions in desired height sections
- High density vortex areas within the settlement (café, restaurant etc. unsuitable regions)
- Regions suitable for integration of the small wind turbine, if considered in the future
- Equivalent wind velocity zones for critical values
- Particle tracing in the residential area

FAÇADE REVIEW AND EXPERTISE

- Examination and approval of the structural and energy performance analysis that will be submitted for the final products and system by the contractor before manufacture and installation
- Examination and approval of Mock-up shop drawings
- Examination and approval of application drawings (shop drawings) that will be submitted by the contractor before manufacture and installation
- Providing expertise service for specific façade failures and reporting



PROOF CHECK FOR FAÇADE APPLICATIONS

Participation to the façade performance tests which are to be performed at an accredited test center, observing the test process and examination the final test reports and certification

- Inspection of the visual Mock-up at site
- Inspection of the manufacture and installation at site/ factory and reporting (frequency can be changed depends on the project needs). Site visits start with the installation of first sample and continue until temporary submission of façade works.
- Guiding the client's representatives in the beginning of temporary submission at site in order to clarify acceptance criteria

Standard Performance Test Steps

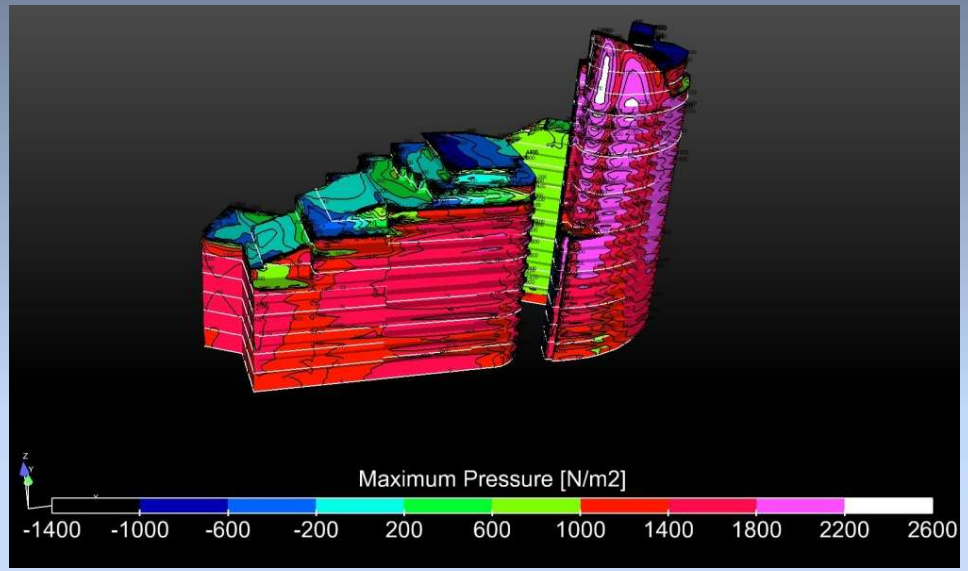
1. Air Permeability Test
2. Water tightness Test
3. Wind Resistance Test Serviceability
4. Air Permeability Test Repeat
5. Water tightness Test Repeat
6. Aging test for at least 100 cycles (depends on the project risk analysis)
7. Wind Resistant Test (safety)
8. Dismantle, Inspect and Record

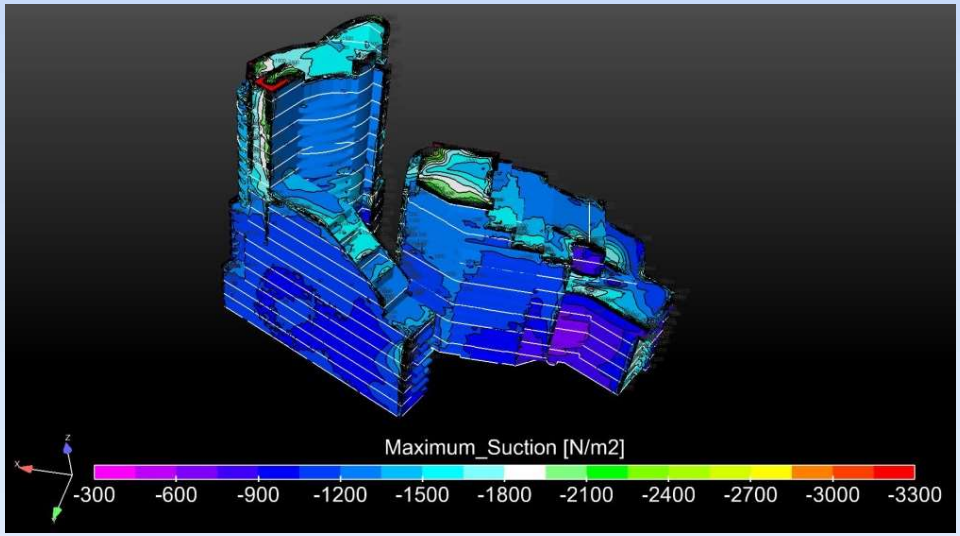
DESIGN DEVELOPMENT METHODOLOGY

DETERMINATION OF THE DESIGN WIND LOAD

METHOD 1: CFD ANALYSIS

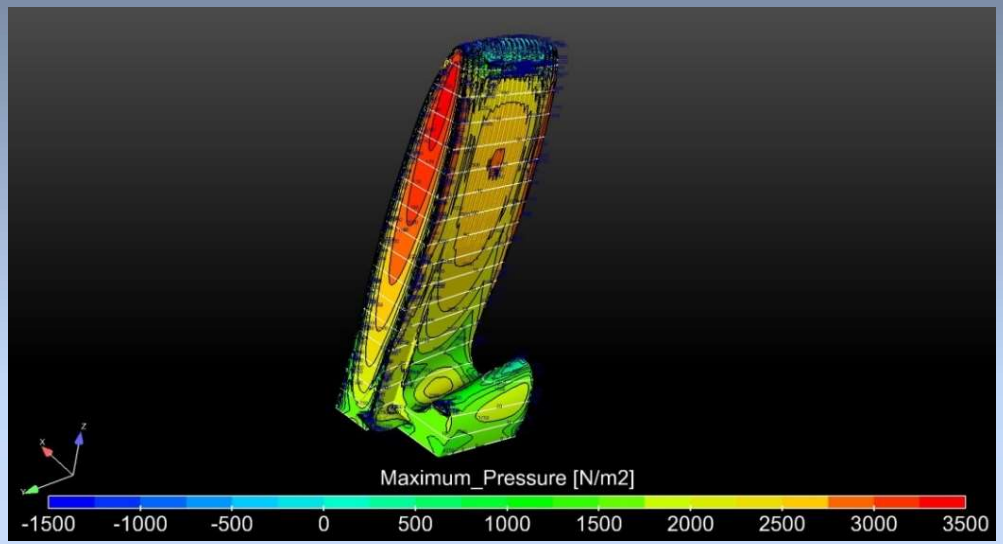
FDF REFERENCE WORK: FORTINA INVESTMENT / MALTA

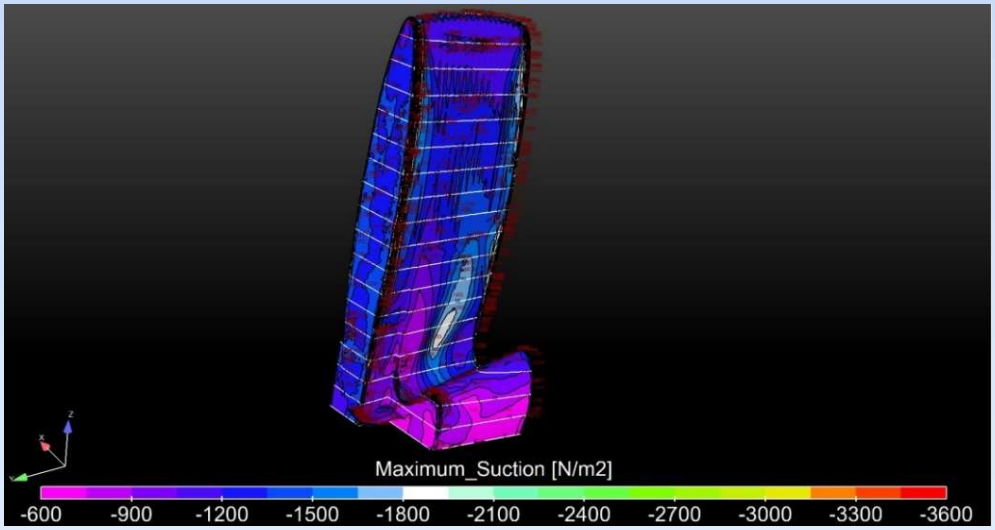




DETERMINATION OF THE DESIGN WIND LOAD

METHOD 1: CFD ANALYSIS



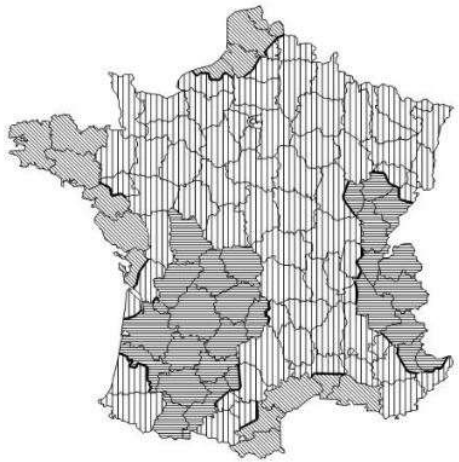


FDF REFERENCE WORK: ALLIANCE PRIVILEGE – BATUMI/GEORGIA

DETERMINATION OF THE DESIGN WIND LOAD

METHOD 2: DETERMINATION ACCORDING TO EUROCODE 1

Wind Map of the France according to NF EN 1991-1-4 -NA-2008



Régions :	1	2	3	4
Valeur de base de la vitesse de référence du vent $v_{b,0}$ [m/s]	22	24	26	28

Lyon stays in Wind Zone 2 but the city is cloed to WZ4. To stay in safe side basic wind load will be considered: 28m/sec

qb = 0.5x1.25.(28)2=490 N/m2 =0.49 kN/m2

	Terrain category	z_0 m	z_{min} m
0	Sea or coastal area exposed to the open sea	0,003	1
I	Lakes or flat and horizontal area with negligible vegetation and without obstacles	0,01	1
II	Area with low vegetation such as grass and isolated obstacles (trees, buildings) with separations of at least 20 obstacle heights	0,05	2
III	Area with regular cover of vegetation or buildings or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain, permanent forest)	0,3	5
IV	Area in which at least 15 % of the surface is covered with buildings and their average height exceeds 15 m	1,0	10
NOTE: The terrain categories are illustrated in A.1.			

Figure 1.1: Terrain category (z0) and (zmin) (EN, 1991-1-4)

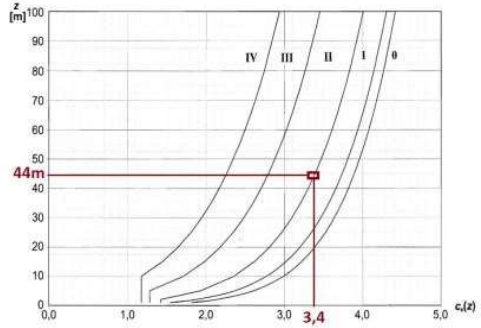


Figure 1.2: coefficient according to the building height Cqz (EN, 1991-1-4)

Considered C q (z): 3.4

qp (z)= C q (z).qb

qp (z)= 3.4 x 0.49 = **1.67 kN/m2**

External pressure coefficient considered Cp: -1.5

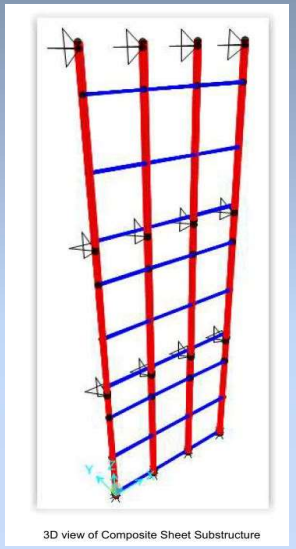
Maximum Wind Load = 1.5x1.67= +/- 2.50 kN/m2

FDF REFERENCE WORK: DUMLU OFFICE LYON/FRANCE

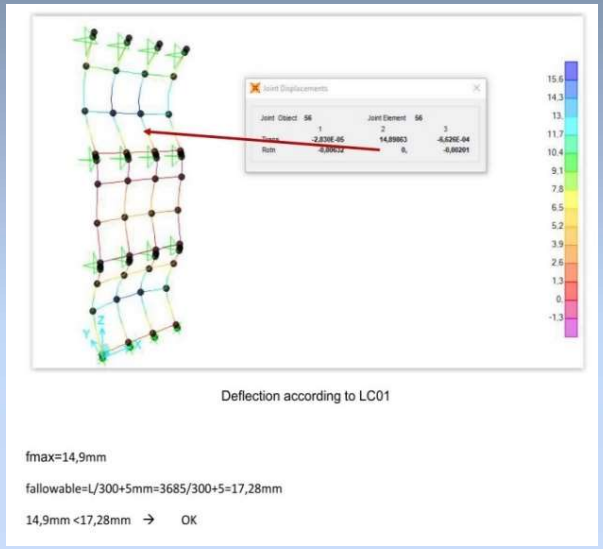
STRUCTURAL ANALYSIS AND DIMENSIONING

STRUCTURAL CALCULATIONS ARE TO BE DONE ACCORDING TO BS EN CODES

FDF REFERENCE WORK: FORTINA INVESTMENT / MALTA
ACM STRUCTURE FRAME AND FEM ANALYSIS



3D view of Composite Sheet Substructure

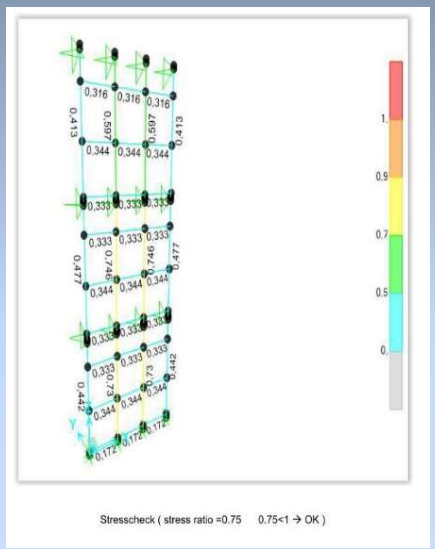


Deflection according to LC01

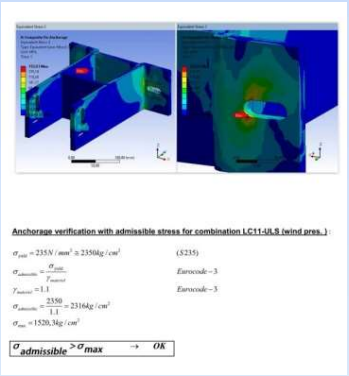
fmax=14,9mm

fallowable=L/300+5mm=3685/300+5=17,28mm

14,9mm <17,28mm → OK

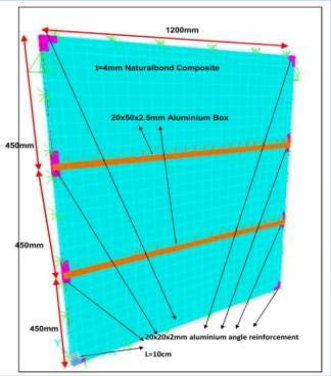


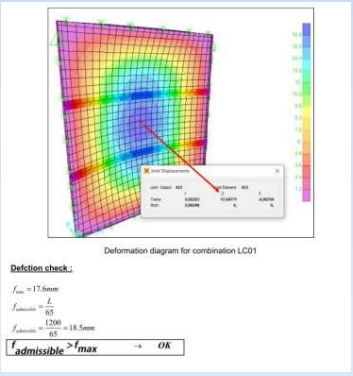
Stresscheck (stress ratio =0.75 0.75<1 → OK)



Anchorage verification with admissible stress for combination LC11-ULS (wind pres.)

$\sigma_{admissible} > \sigma_{max}$ → OK

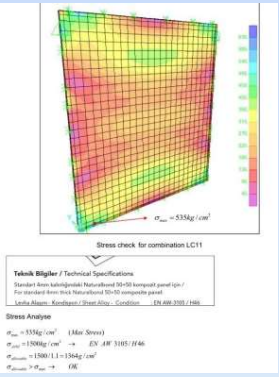




Deformation diagram for combination LC01

Defction check :

$f_{admissible} > f_{max}$ → OK



Stress check for combination LC11

Teknik Bilgiler / Technical Specifications

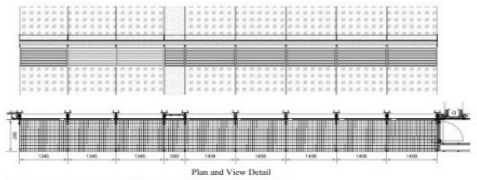
Stress Analyse

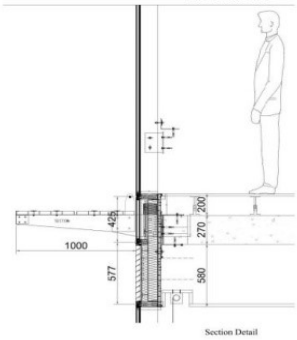
STRUCTURAL ANALYSIS AND DIMENSIONING

STRUCTURAL CALCULATIONS ARE TO BE DONE ACCORDING TO BS EN CODES

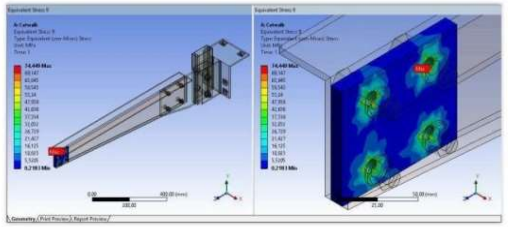
FDF REFERENCE WORK: FORTINA INVESTMENT / MALTA
STEEL WALKWAY STRUCTURE FEM ANALYSIS

CATWALK BRACKET CHECK





KY4 Stress Check Under Wind load;



KY4 with admissible stress :

$\sigma_{yield} = 235N/mm^2 \cong 2350kg/cm^2 \quad (S235) \quad \leq$

$\sigma_{admissible} = \frac{\sigma_{yield}}{\gamma_{material}} \qquad Eurocode-3$

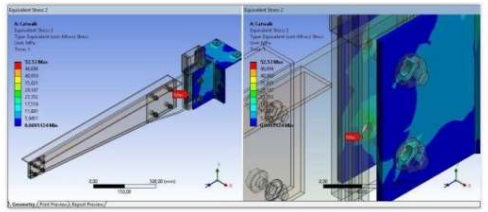
$\gamma_{material} = 1.1 \qquad Eurocode-3$

$\sigma_{admissible} = \frac{2350}{1.1} = 2127kg/cm^2$

$\sigma_{max} = 744,5kg/cm^2$

$\sigma_{admissible} > \sigma_{max} \quad \rightarrow \quad OK$

KY1 Stress Check Under Wind load;



KY1 with admissible stress :

$\sigma_{yield} = 235N/mm^2 \cong 2350kg/cm^2 \quad (S235) \quad \leq$

$\sigma_{admissible} = \frac{\sigma_{yield}}{\gamma_{material}} \qquad Eurocode-3$

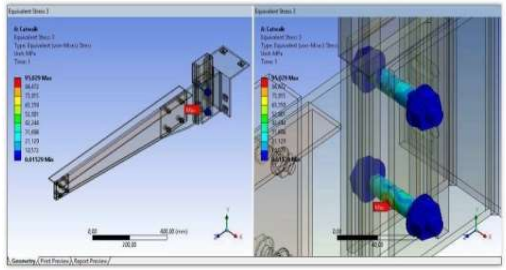
$\gamma_{material} = 1.1 \qquad Eurocode-3$

$\sigma_{admissible} = \frac{2350}{1.1} = 2127kg/cm^2$

$\sigma_{max} = 525,3kg/cm^2$

$\sigma_{admissible} > \sigma_{max} \quad \rightarrow \quad OK$

M18 Bolt Stress Check;



M18 Bolt with admissible stress :

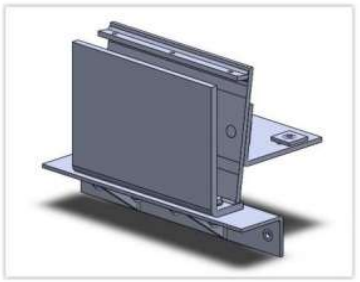
$\sigma_{yield} = 450N/mm^2 \cong 4500kg/cm^2 \quad (A2\_700)$

$\sigma_{max} = 950,3kg/cm^2$

$\sigma_{admissible} > \sigma_{max} \quad \rightarrow \quad OK$

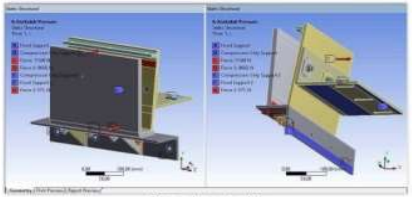
STRUCTURAL ANALYSIS AND DIMENSIONING

STRUCTURAL CALCULATIONS ARE TO BE DONE ACCORDING TO BS EN CODES

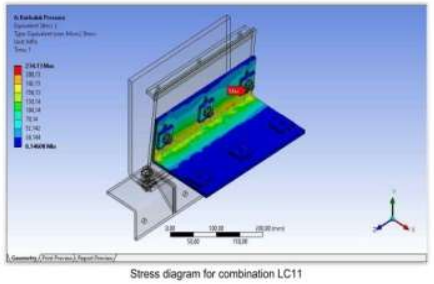


Bracket 3D model

3.3.1 BALUSTRADE ANALYSEWITH POINT LOAD REACTIONS (Pressure direction)



Pressure load on bracket



Stress diagram for combination LC11

Balustrade verification with admissible stress :

$\sigma_{yield} = 355 N/mm^2 \cong 3550 kg/cm^2$ (355) *Steel*

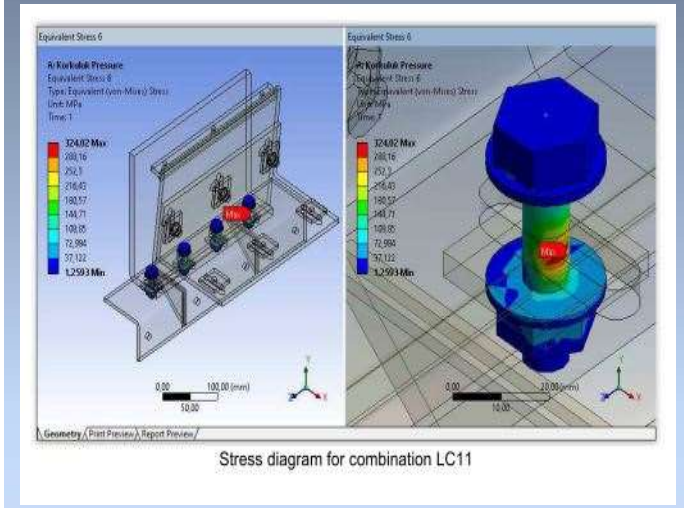
$\sigma_{admissible} = \frac{\sigma_{yield}}{\gamma_{material}}$ *Eurocode – 3*

$\gamma_{material} = 1.1$ *Eurocode – 3*

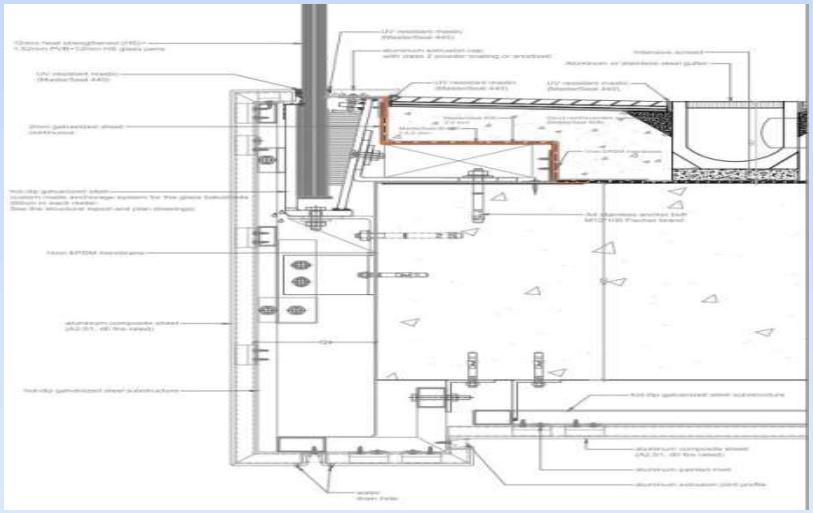
$\sigma_{admissible} = \frac{3550}{1.1} = 3227 kg/cm^2$

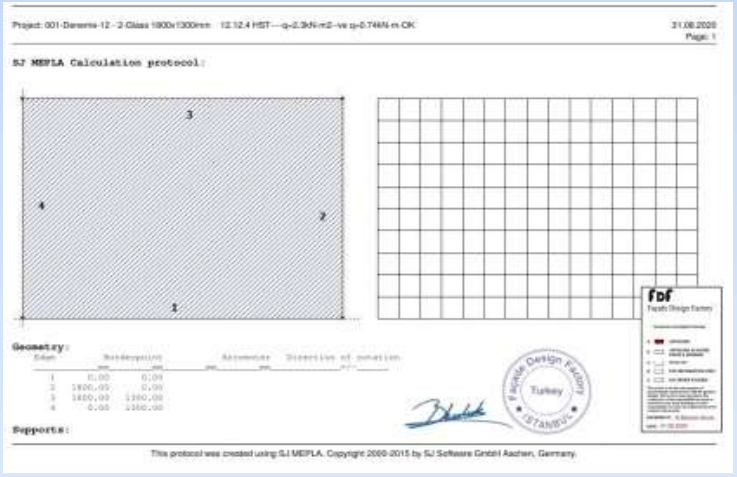
$\sigma_{max} = 2341 kg/cm^2$

$\sigma_{admissible} > \sigma_{max} \rightarrow OK$



Stress diagram for combination LC11



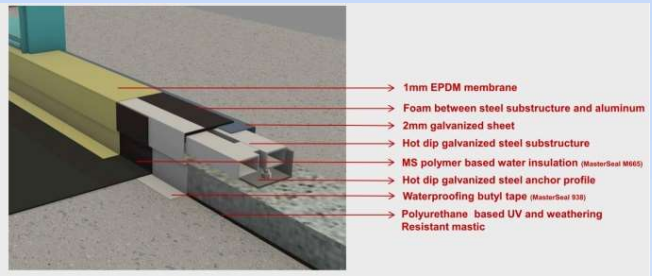


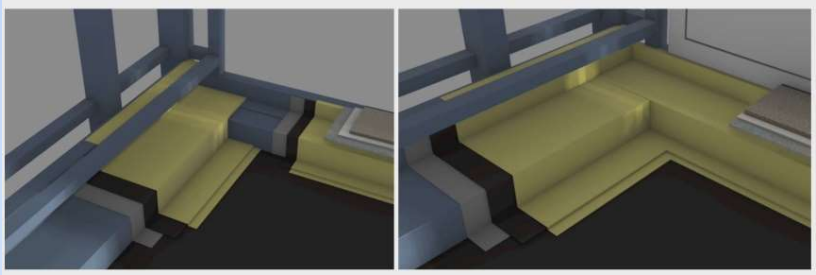
SJ MEPLA Calculation protocol:

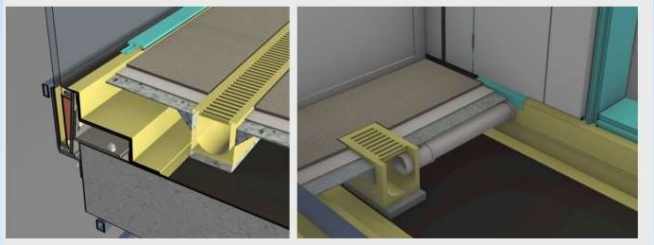
FDF REFERENCE WORK: FORTINA INVESTMENT / MALTA
GLASS BALUSTRADE STRUCTURE FEM ANALYSIS

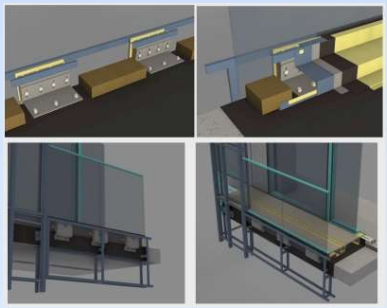
DETAIL CONSTRUCTION DRAWINGS IN 2D AND 3D

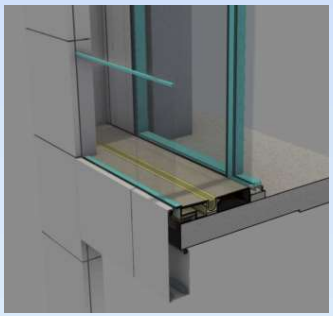
CONSTRUCTION DRAWINGS







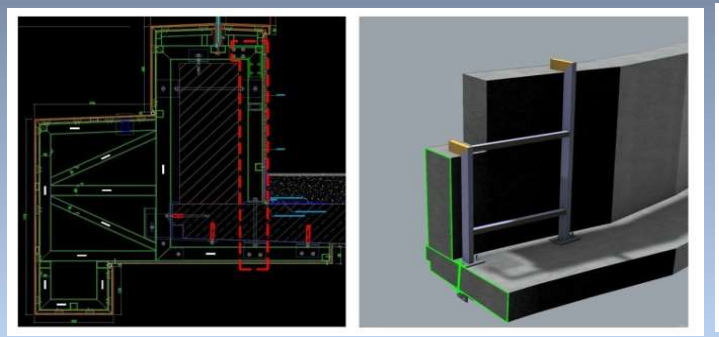


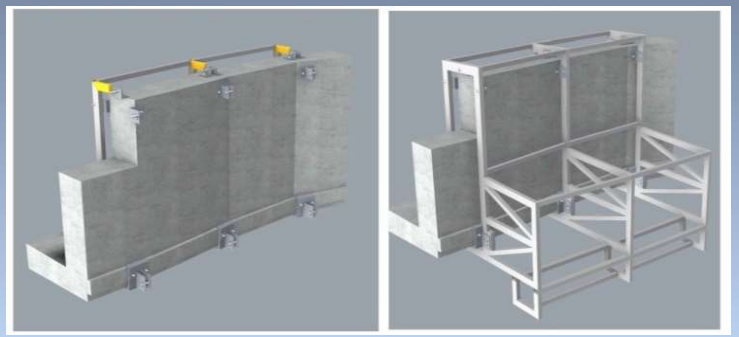


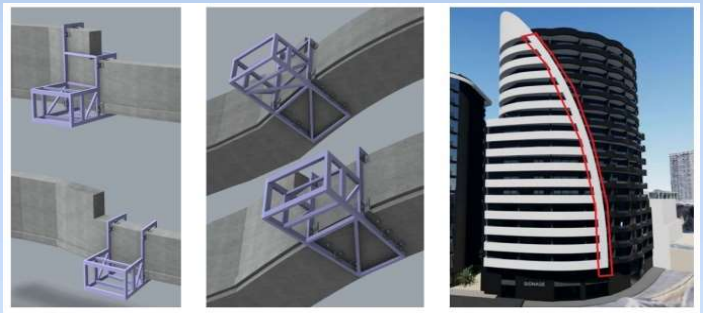
FDF REFERENCE WORK: FORTINA INVESTMENT / MALTA
BALCONY CIVIL WORKS AND FACADE CLADDINGS

DETAIL CONSTRUCTION DRAWINGS IN 2D AND 3D

CONSTRUCTION DRAWINGS



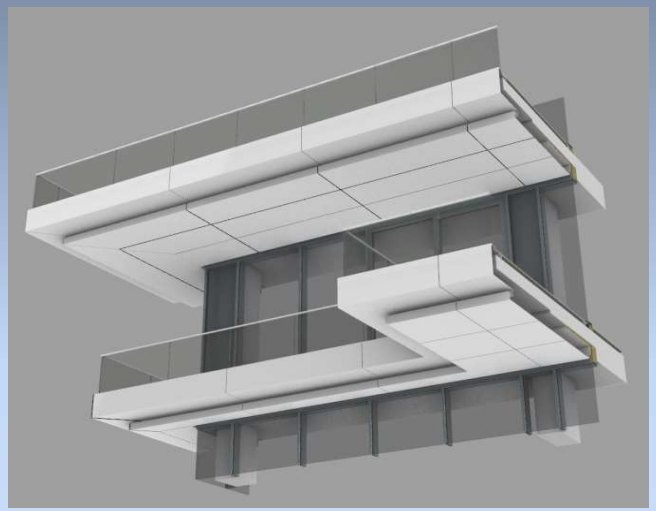


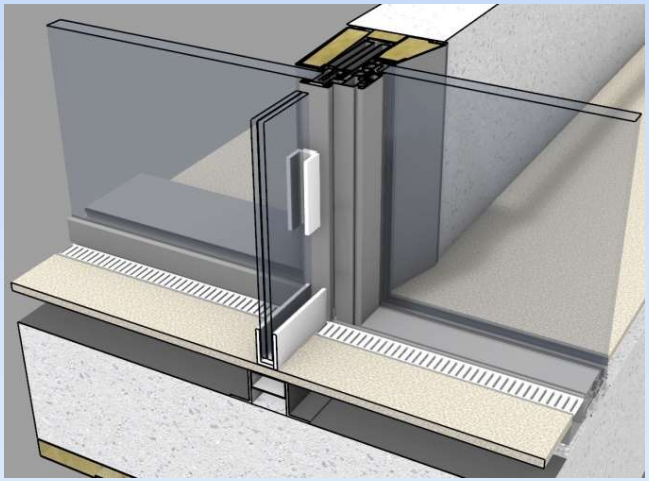


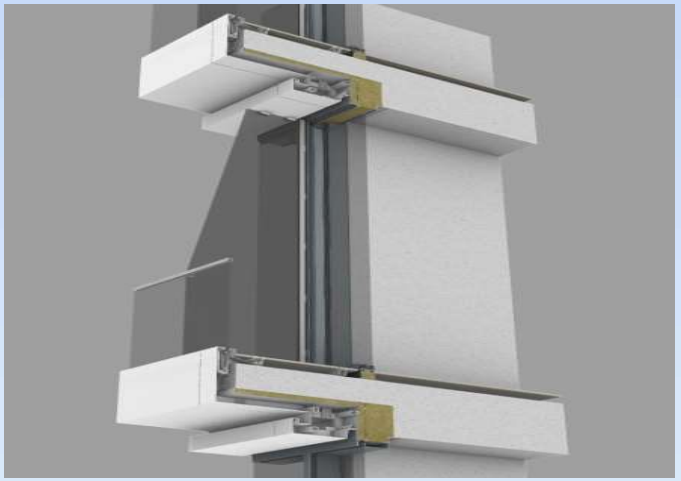
FDF REFERENCE WORK: FORTINA INVESTMENT / MALTA
TOWER ACM WORKS- REINFORCEMENT OF THE PARAPET WALL

DETAIL CONSTRUCTION DRAWINGS IN 2D AND 3D

CONSTRUCTION DRAWINGS



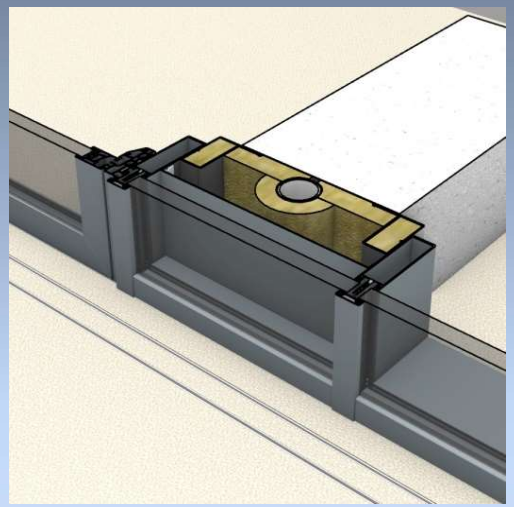


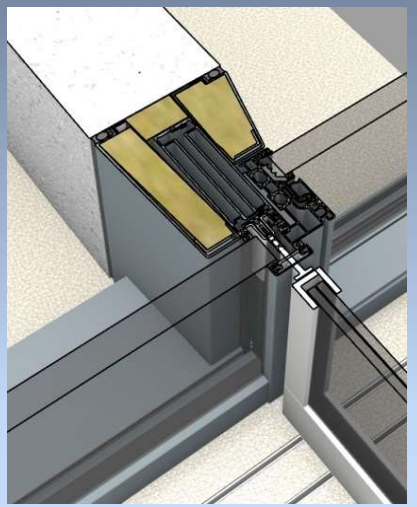


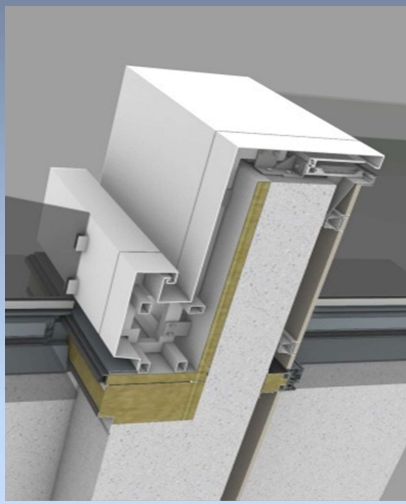
FDF REFERENCE WORK: AMBASSADORI / BATUMI
FACADE CONCEPT DETAILS

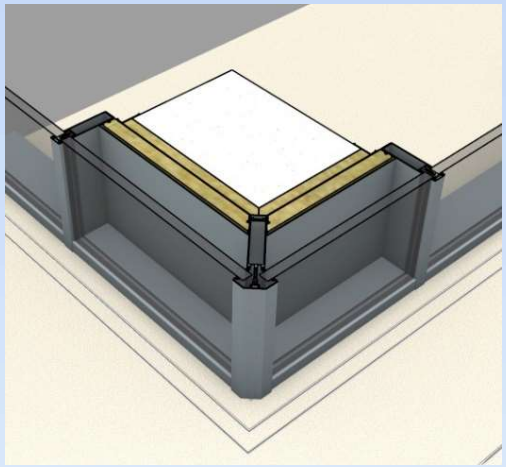
DETAIL CONSTRUCTION DRAWINGS IN 2D AND 3D

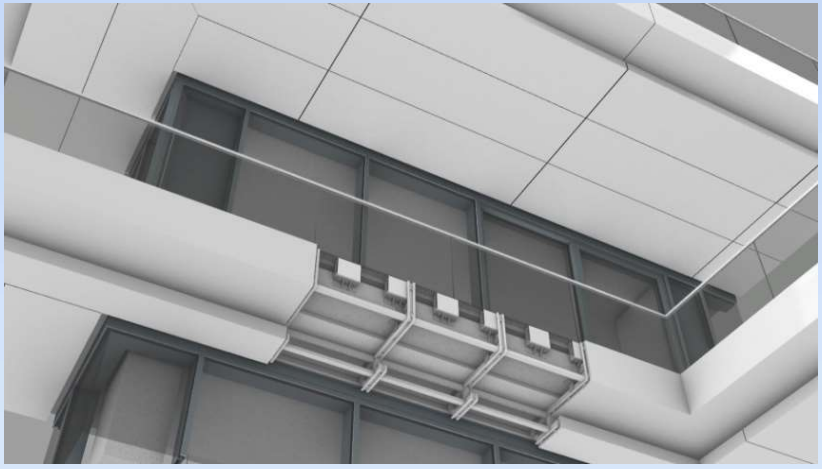
CONSTRUCTION DRAWINGS







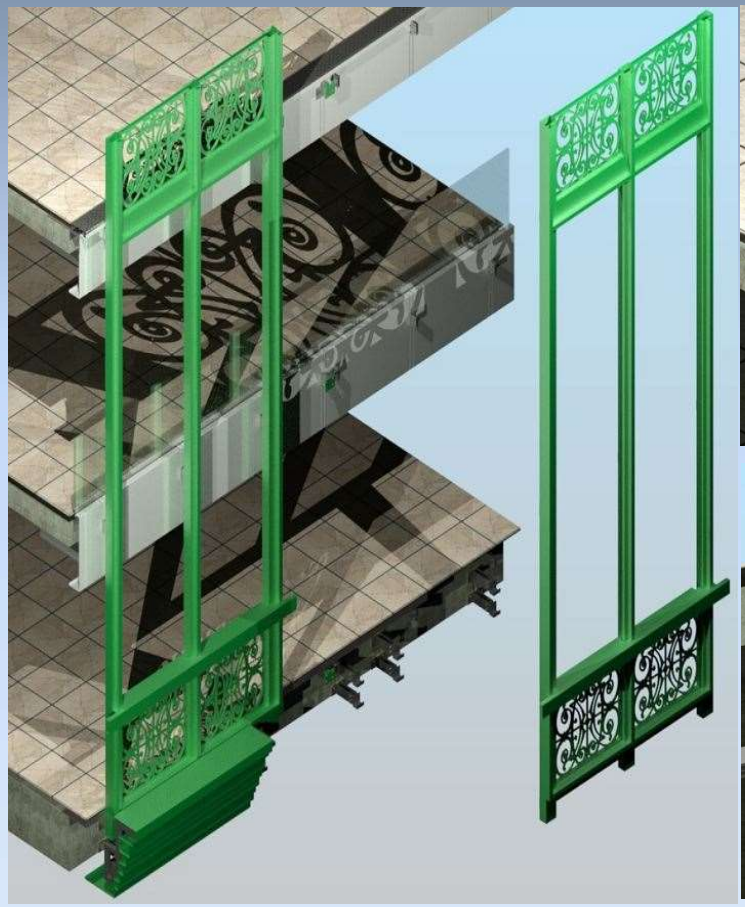


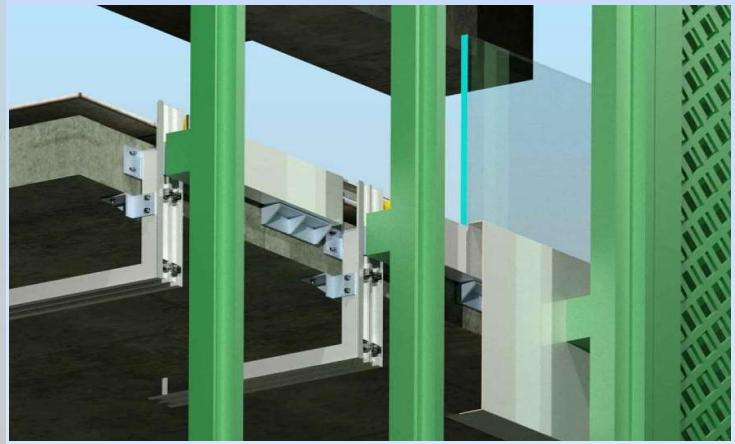


FDF REFERENCE WORK: AMBASSADORI / BATUMI
FACADE CONCEPT DETAILS

DETAIL CONSTRUCTION DRAWINGS IN 2D AND 3D

CONSTRUCTION DRAWINGS





FDF REFERENCE WORK: AMBASSADORI / BATUMI
FACADE CONCEPT DETAILS

DETAIL CONSTRUCTION DRAWINGS IN 2D AND 3D

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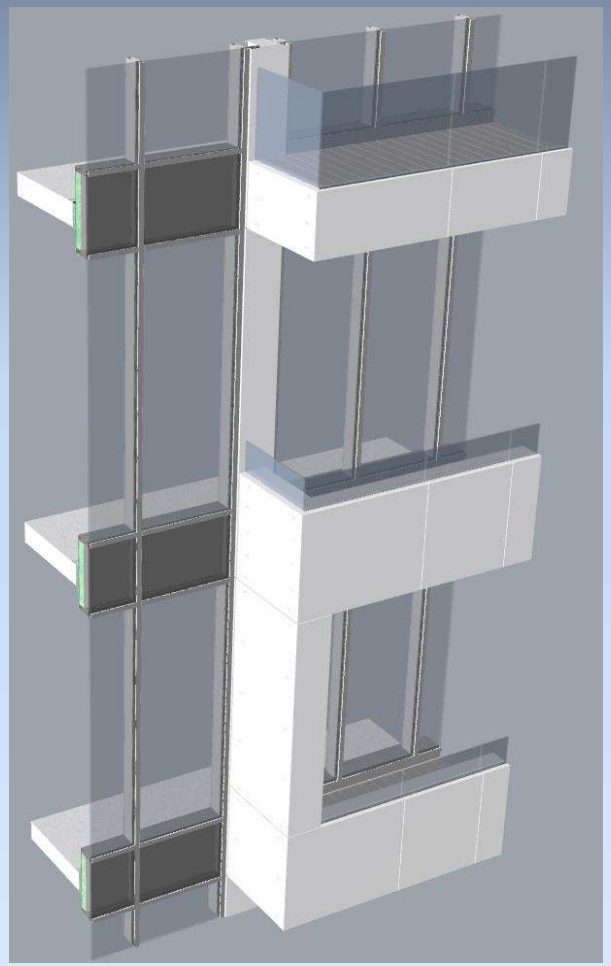
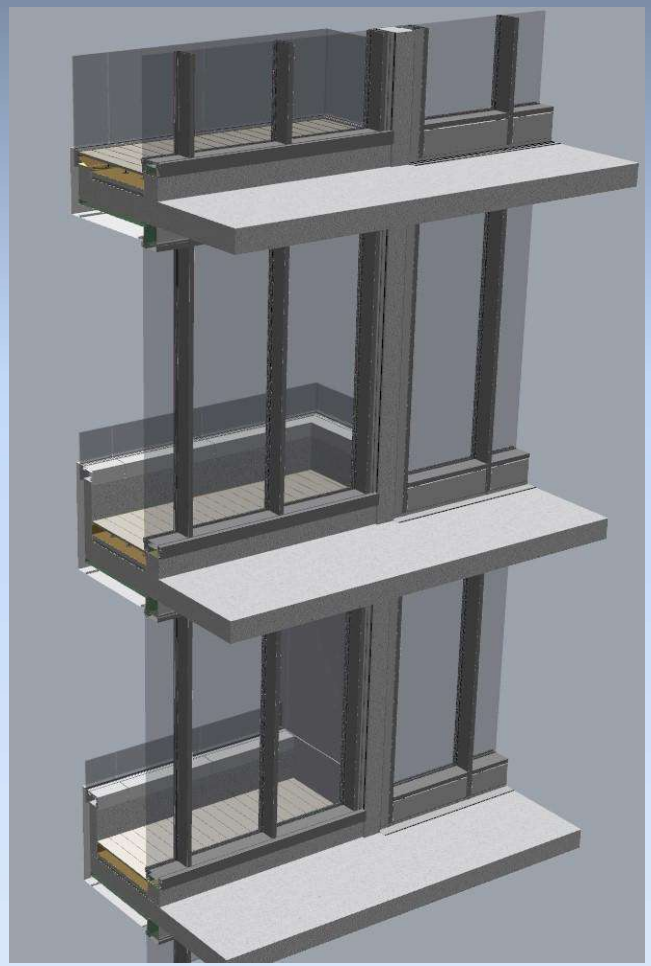
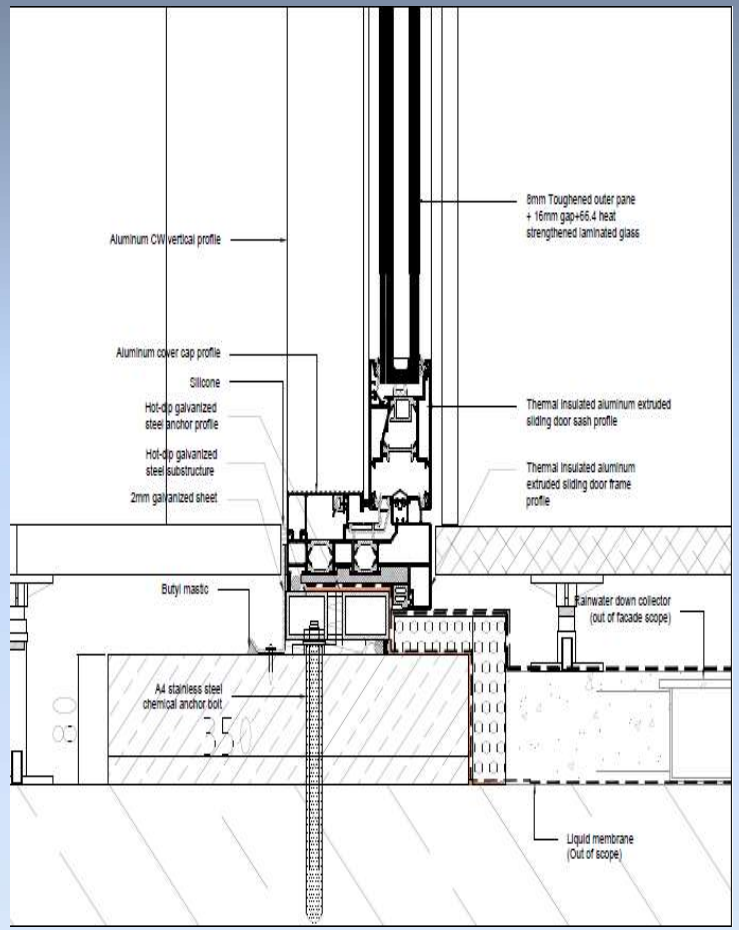


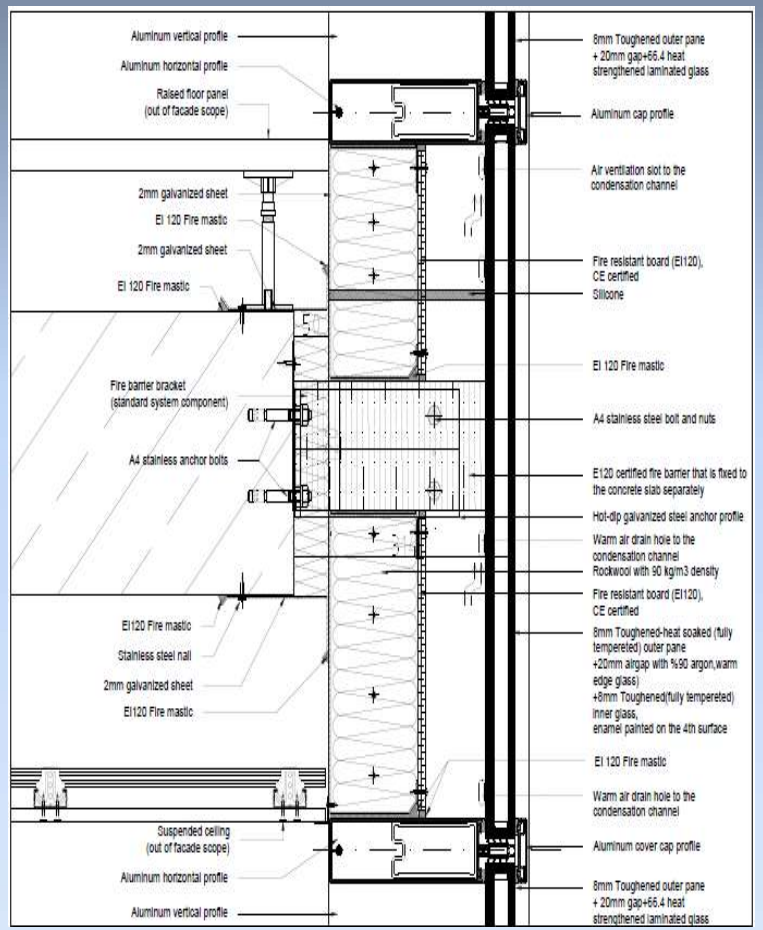


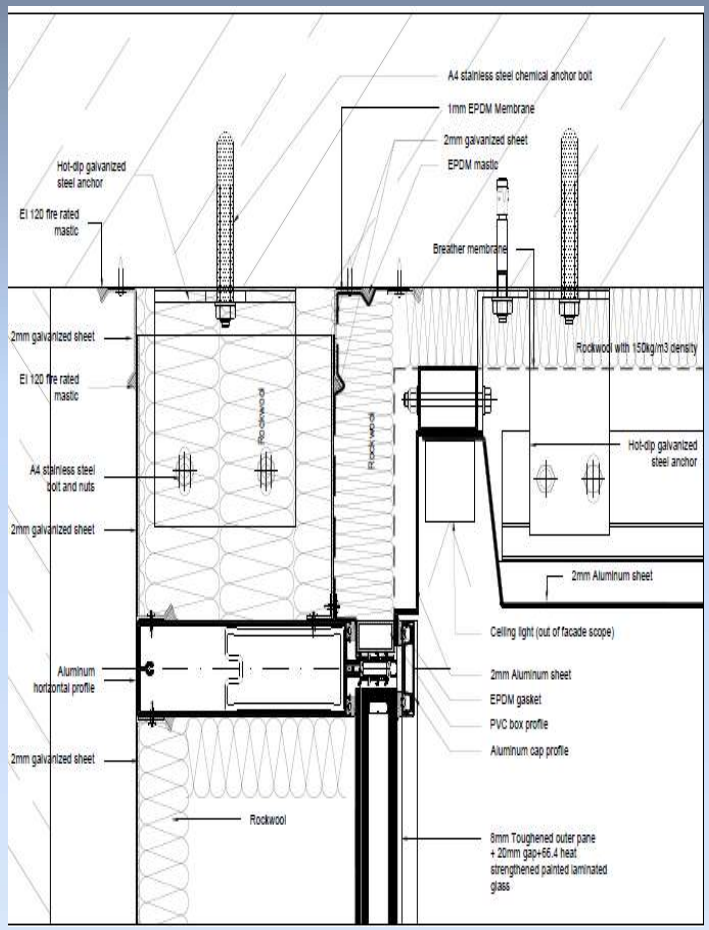
FDF REFERENCE WORK: ST TOWER / MALTA
FACADE CONCEPT DETAILS

DETAIL CONSTRUCTION DRAWINGS IN 2D AND 3D

CONSTRUCTION DRAWINGS



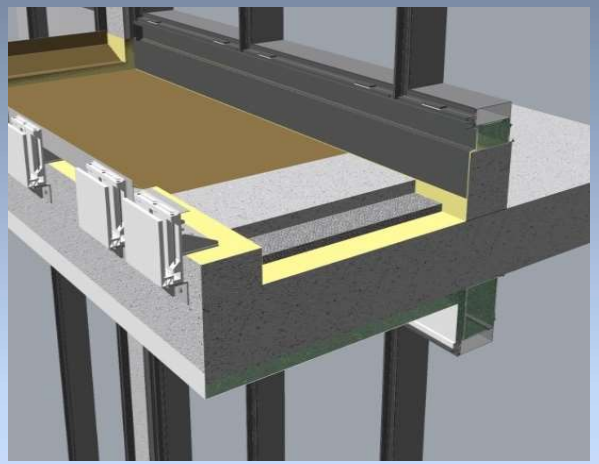


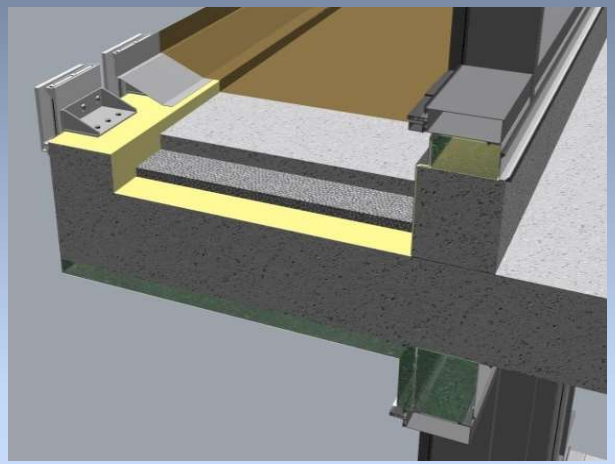


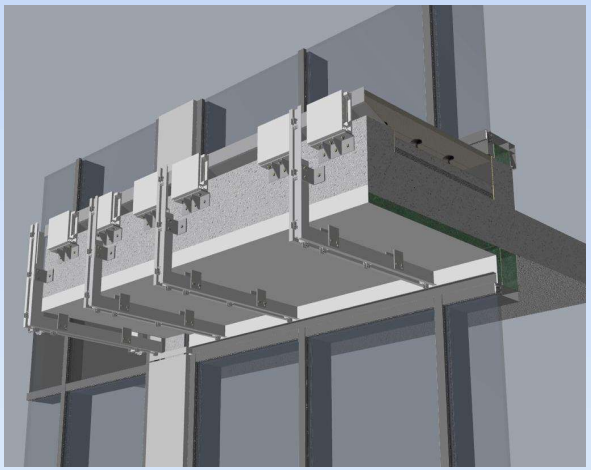
FDF REFERENCE WORK: ST TOWER / MALTA
FACADE CONCEPT DETAILS

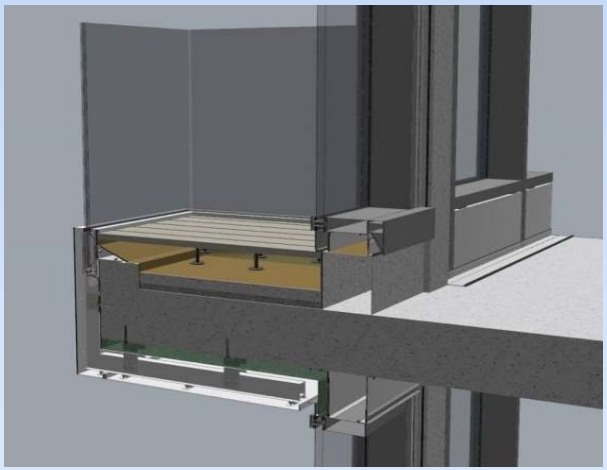
DETAIL CONSTRUCTION DRAWINGS IN 2D AND 3D

CONSTRUCTION DRAWINGS





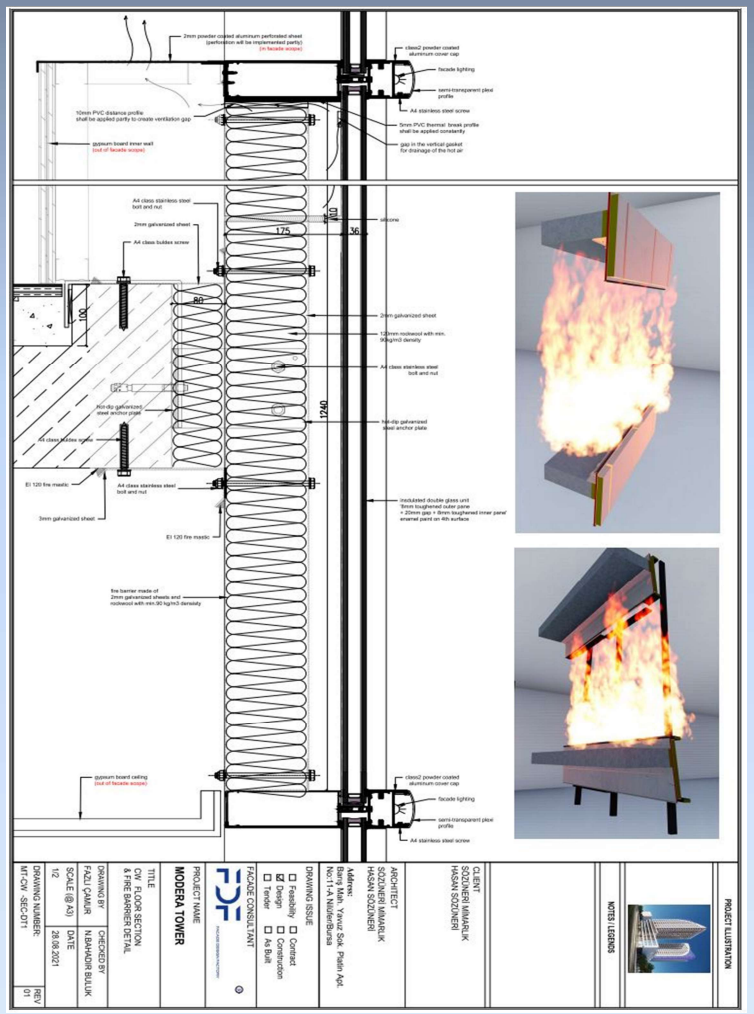


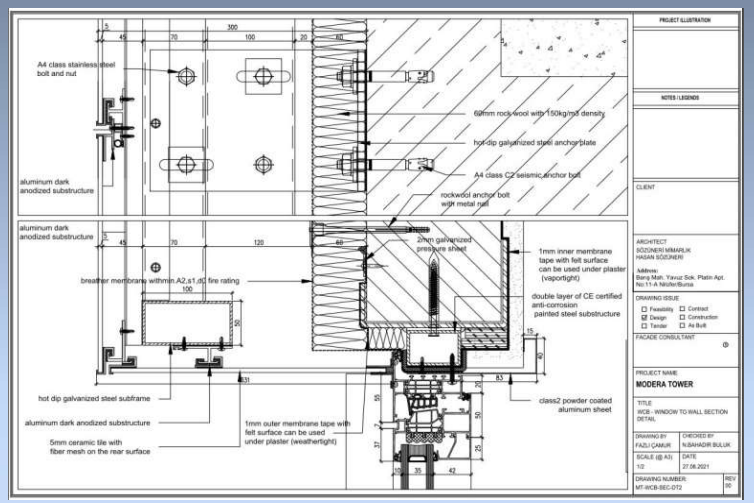


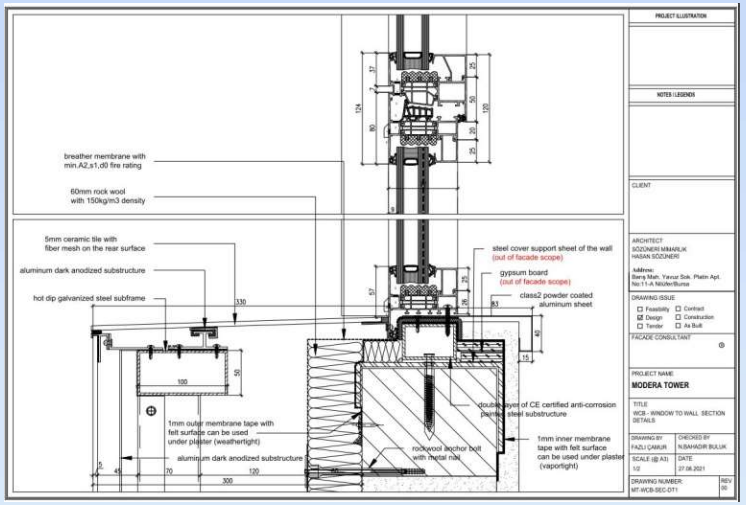
FDF REFERENCE WORK: ST TOWER / MALTA
FACADE CONCEPT DETAILS

DETAIL CONSTRUCTION DRAWINGS IN 2D AND 3D

CONSTRUCTION DRAWINGS



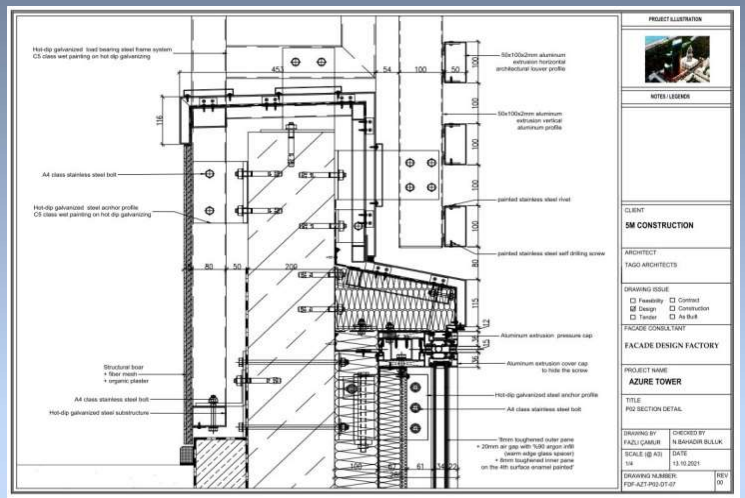


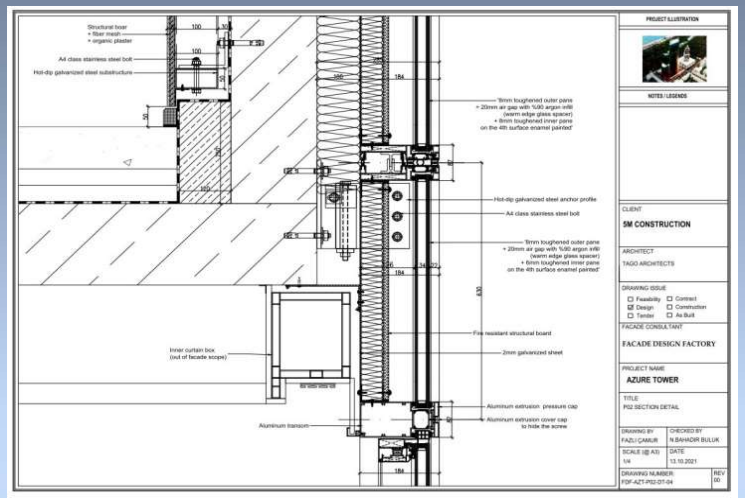


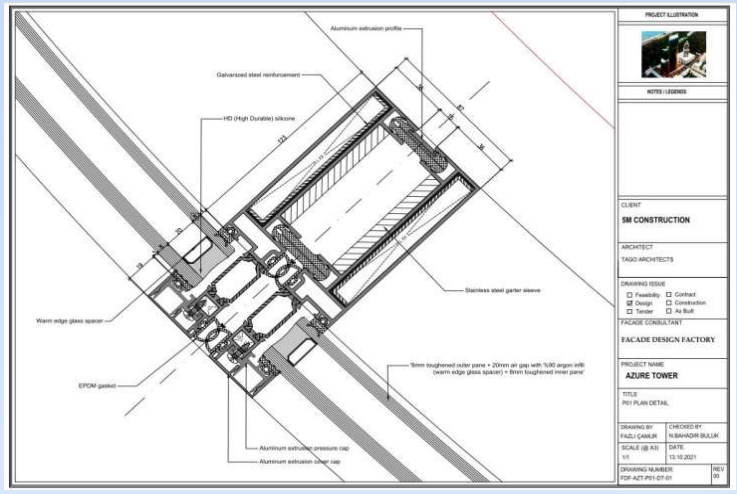
FDF REFERENCE WORK: MODERA TOWER / UZBEKISTAN
2D CONSTRUCTION DRAWINGS

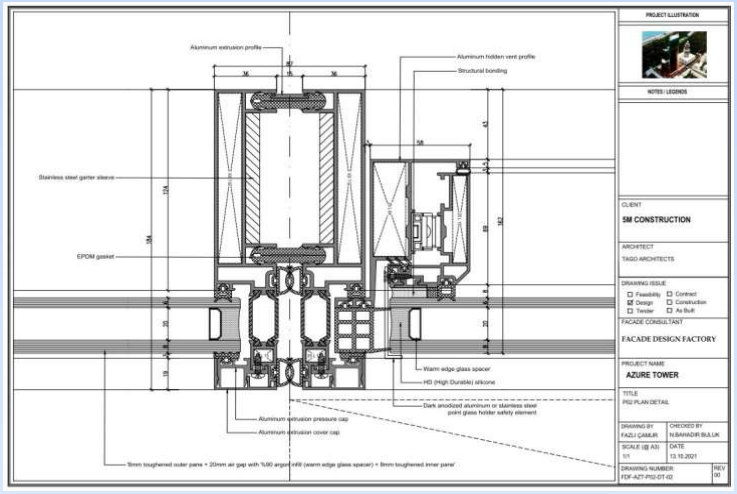
DETAIL CONSTRUCTION DRAWINGS IN 2D AND 3D

CONSTRUCTION DRAWINGS





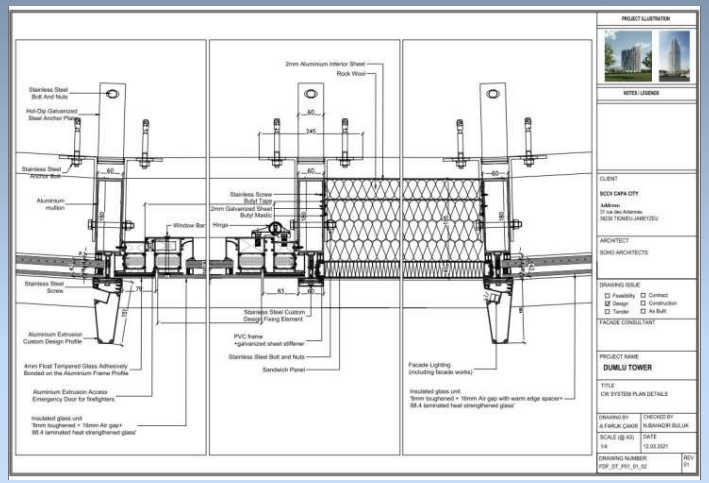


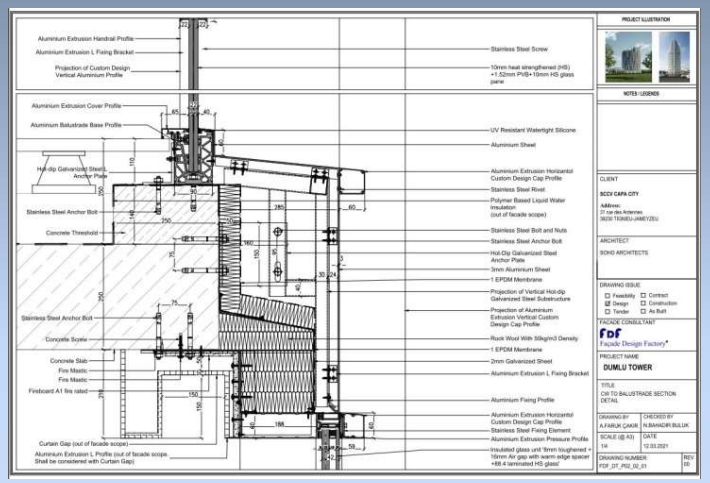


FDF REFERENCE WORK: AZURE TOWER / GEORGIA
2D CONSTRUCTION DRAWINGS

DETAIL CONSTRUCTION DRAWINGS IN 2D AND 3D

CONSTRUCTION DRAWINGS





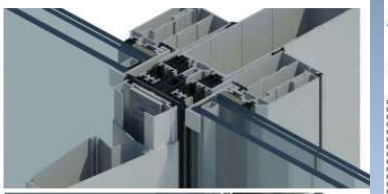
FDF REFERENCE WORK: DUMLU / FRANCE
2D CONSTRUCTION DRAWINGS

TECHNICAL SPECIFICATION AND REQUIREMENTS

TECHNICAL SPECIFICATIONS

1- GLAZED CURTAIN WALL – STICK SYSTEM

ILLUSTRATION



SYSTEM DESCRIPTION

The glazed facade system shall be a stick curtain wall construction with an aluminum frame. The width of the mullion and transoms cannot be less than 60mm.

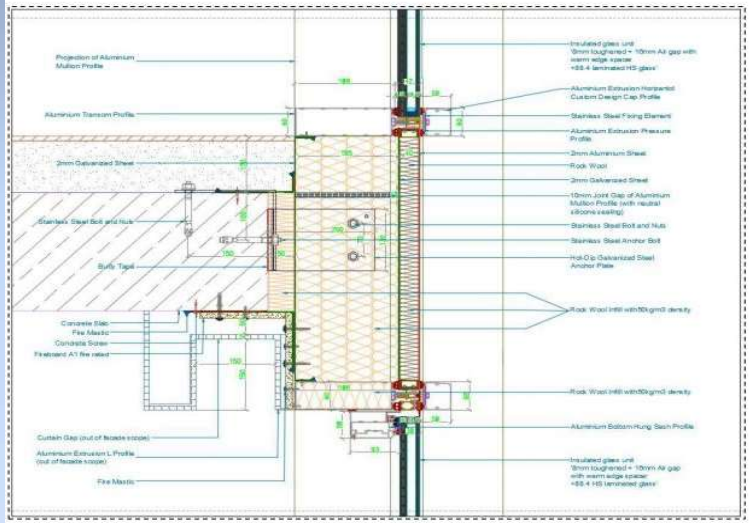
The frame of the curtain wall system is fixed to the main concrete structure by the steel anchor profilest hat are carrying vertical profiles. Functionality is ensured by making these connections with the right principles (fixed / moving points).

The anchor plate shall be fixed on the concrete slab through seismic anchor bolts made of galvanized body and A2 stainless steel clpis as dimensioned through the structural analysis.

Glass units are installed from the outside after the installation of transoms and mullions by fixing the pressure caps made of aluminum extrusion profiles through galvanized steel screws. The EPDM gaskets shall ensure a soft contact between the glass and pressure cap. The screw dimensions and distance between two screws shall be proper to system house instructions.

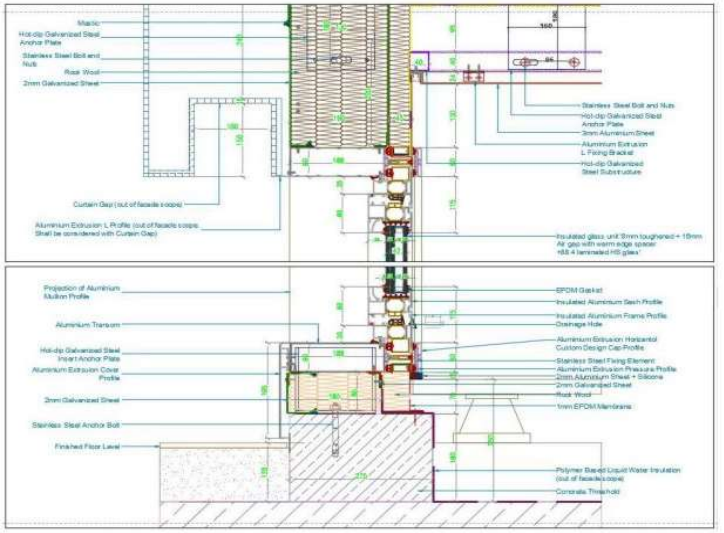
The self load of glass units shall be transferred to the transom profiles through glass holders made of aluminum extrusion profiles. These glass holders shall be located with maximum 150mm distance to vertical profiles.

Fire Spread And Smoke Barriers:



As can be seen in the section drawing above, A fire barrier that consists of 2mm galvanized sheets, rock wool infill with at least 50kg/m3 density, A1 fire rated fire boards and fire mastics with EI120 fire rating classification shall be implemented at the junction between the curtain wall and floor slabs at each level. Also, the transom profile at this level shall be filled up with a rockwool of 50kg/m3 density in order to increase the durability of the aluminum section incase of fire.

Requirement for a sprinkler system shall be considered by the fire engineer by considering the height of the fire barriers.



There should be a concrete threshold below the curtain wall in the balconies. This threshold is very functional to lock the balcont water insulation and overlap the waterproofing membrane onto the balcony insulation.

The hinged doors shall be integrated into the cw mullion and transom profiles. The door shal include an automatic closing pump as hidden at the upper edge. The handle type shall be choosen by the client and architect.

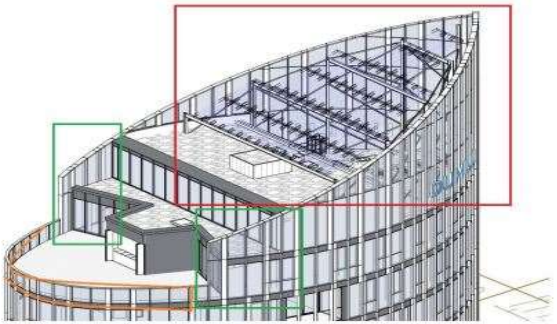
The ceiling of the balconies shall be cladded with 3mm aluminum solid sheets as class 2 powder coated with a RAL code will be provided by the Architect.

FDF REFERENCE WORK: DUMLU OFFICE LYON/FRANCE

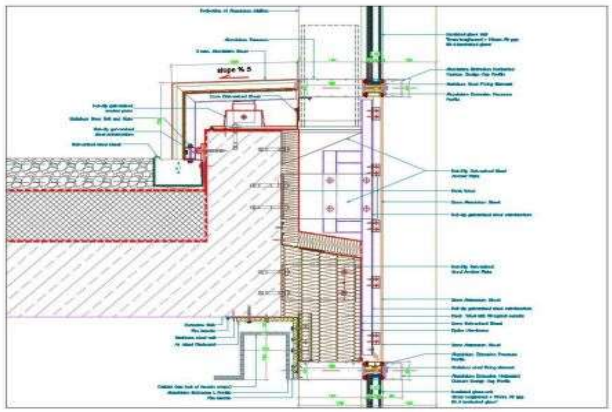
TECHNICAL SPECIFICATION AND REQUIREMENTS

TECHNICAL SPECIFICATIONS

Cold Facades – Curtain Walls On The Roof



The signed parts on the picture above have been planned as cold facade and a thermal and water insulated copper detail has been developed along the bottome edge of these parts. It is essential to have always a concrete parapet to lock the roof insulation and seal the insulated CW as shown below.



Facade System Performance Criteria:

- **Design Wind Load:**

+/- 2.5 kPa

- **Facade Total Thermal Transmittance:**

Ucw ≤ 1,6 W/m²K

- **Sound Insulation**

≥32 dB minimum (with glass)

- **Rainwater Tightness**

TS EN 12152, A4 (600Pa)

- **Air Tightness**

TS EN 12154, R7 (600Pa)

Deflection Limits (EN 13830:2015):

- d ≤ L/200, if L ≤ 3 000 mm;
- d ≤ 5 mm + L /300, if 3 000 mm < L < 7 500 mm;
- d ≤ L /250, wenn L ≥ 7 500 mm

Deflection Limit for the glass: L/100 (L is the short edge)

Aluminum Profile Surface Treatments:

The electrostatic powder coating has been choosen as surface finish by the client.
Powder coating process shall meet the requirements of QUALICOAT Class 2 and shall be "high strength" with a Project Guarantee of at least 25 years. This warrany letter shall be given by the system and/or paint manufacturer. The coating shall satisfy environmental exposure conditions.

Glass:

There are alternative solar coating types defined in the Bill of Quantites list. The client and the Architect shall decide the final product after the inspection of Visual Mock Up.

Double Glazed Units Characteristic Features:

Outer Pane:	8mm tempered float glass with solar coating (Şişecam 50/33) on surface 2
Cavity:	Air cavity with a minimum depth of 16 mm, %90 Argon infill (Black Anodized Aluminum Spacer)
Inner Pane:	88.4 (PVB thickness 1.52mm) heat strengthened laminated float glass

The characteristic features of the glass unit:

Thermal Transmittance:	Ug ≤ 1.1 W/m²K
Total Energy Transmittance:	g ≤ 0,34 (EN 410)
Visible Light Transmittance:	TL> 0,45
Reflection to Outside:	Re ≤ 35
Reflection Inside:	Ri ≤ 25

Another important element is the cover cap that shall be mounted on the glass units and provide a connection between different panes. Thanks to this element, glass plates can remain their initial positions until a secondary strong impact load even if they are broken (also the fracture form of heat strengthened glass contributes to remaining ist position). See an example picture below.

Facade System Performance Criteria:

Design Wind Load:	+/- 2.5 kPa
Design Live Load:	0.74 kN/m (BS 6180)

Glass combination:

‚10mm heat strengthened glas spane + 1.52mm PVB+ 10mm heat strengthened EXTRA CLEAR (LOW IRON) glass'

Deflection Limit for the glass: L/100 (L is the short edge)

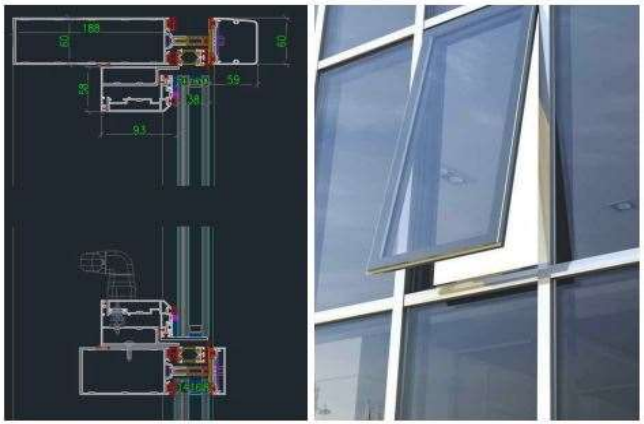
FDF REFERENCE WORK: DUMLU OFFICE LYON/FRANCE

TECHNICAL SPECIFICATION AND REQUIREMENTS

TECHNICAL SPECIFICATIONS

Top Hung Natural Ventilation Vents:

The ventilation vents are planned as top hung outer opening. There are two main advantages of this opening type by considering inner opening. First one is the high air and water tightness incase of high wind pressure as the gaskets lock the vent to the casement. The second one is the use possibility while raining.



The scissors accessory shall be the type with additional supporter bars. Also, the opening shall be limited to a clear distance of 15cm through limiters on both sides. One another important safety accessory is the safety ropes that provide fixing incase of scissors failure in case of a storm. See the examples for both accessories below.

SCISSORS

LIMITER

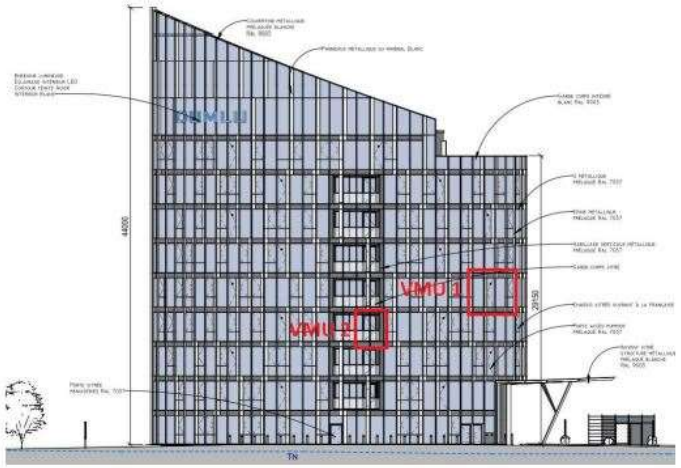
SAFETY ROPE

Architectural (Visual) Mock Up

In order to ensure that the facade implementation is proper to architectural and employer's requests and to check the final quality of manufacture and installation, samples of facade types (visual mock ups) shall be implemented by the subctractor as proper to the approved shopdrawings.

The subcontractor shall include the cost of these mock ups in the related facade work prices. If these visual mock ups are confirmed and accepted by the employer and employer's representative as proper to design drawings these elements can be used as the final product.

The spaces for the visual mock ups (VMU) have been determined as follow:



FDF REFERENCE WORK: DUMLU OFFICE LYON/FRANCE

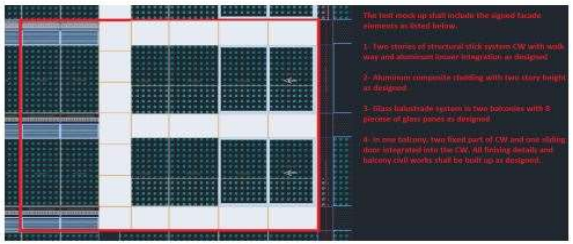
LABORATORY AND SITE TESTS AND CERTIFICATION

TEST DEFINITIONS AND REQUIREMENTS

- **Laboratory Tests**

In order to certify the required air tightness, water tightness and wind resistance performance of the typical facade systems, they shall be tested at an accredited independent facade test center according to the related EN norms. All test phases from the anchor installation to the final inspection will be observed and reported by FDF. The test result documents provided by the accredited independent test center shall be submitted to approval of the Employer and the consultant. The subcontractor candidates shall price all test expenses seperately in their final proposal.

Following space has been defined for the test mock up that shall be built up in the laboratory.



All details of the test mock up shall be the same as designed for the actual project. Only the cantilever balcony (main structure) can be simulated with steel structure since it is difficult to create it with concrete at the test space. All details of the test mock up must be prepared very clearly with material definitions and shall submit for the approval of the Employer and Employer's representative.

The following tests criteria shall be considered for the CW.

TEST NAME	TEST METOD	CLASSIFICATION /ADEQUACY
Air tightness Test	EN 12153	EN 12152 A4 (600Pa)
Water tightness Test	EN 12155	EN 12154 R7(600 Pa)
Wind Resistance Test	EN 12179	TS EN 13116, +/-2300Pa

The order of the tests shall be as follow.
1. Air Permeability Test
2. Water tightness Test
3. Wind Resistance Test Serviceability
4. Air Permeability Test – Repeat
5. Water tightness Test – Repeat
6. Mechanical Resistance of the walk way (under 1.8kPa live person load)
7. Air Permeability Test – Repeat
8. Water tightness Test – Repeat
9. Dismantle, Inspect and Record

In addition to the performance tests for the CW and Opening Units Integrated to the CW, Mechanical Resistance Test for the glass balustrade according to the design loads (BS EN 6180) and Mechanical Resistance Test for the ACM cladding under the maximum design wind load (2.3kPa) shall be done and the mechanical resistance shall be proved.

1. Mechanical Resistance Test for The Glass Balustrade (BS EN 6180): It can be made on the same mock up

2. Mechanical Resistance Test for The ACM Cladding under Design Wind Load: An additional prototype shall be provided for the resistance test under pressure difference.

3. Sound Reduction Test for the curtain wall system (CW) and sliding door as integrated into this CW according to EN ISO 10140-2.

- **Site Tests**

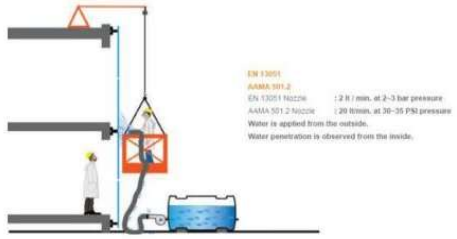
Anchor Bolt Pull Out Test:
This test shall be made for all different type of the anchor plates at site. The test shall be made and reported by the anchor bolt supplier (fischer) or another certified and accredited organization. The consultant will also attend the test physically or as online and publish an inspection report including his observations.

The test space can be any concrete surface at the site. But the border conditions (distance between the concrete border and anchor bolt) shall be exactly the same. For the existing anchor plates which have been already installed on the main structure, pull out tests can be made by selecting sample profiles randomly if possible. But these pull out tests wont be destructive. Only max. design reaction force shall be tested.

Torquing will be making with torque wrench and the required torque values shall be applied and reported for the new anchor manufacturings by the subcontractor. The anchor bolt supplier and FDF do not recommend to re-tourquing after installation for the already installed and torqued anchor bolts since it may cause an additional stress.

Water Penetration Test for the Curtain Wall (EN 13051):

Water penetration test for the finished CW systems shall be made according to EN 13051 - Curtain walling. Watertightness. Site test. This test shall be made and reported by an independent accredited organization with CE certification. The consultant will also attend the test and publish an inspection report including his observations. This test shall be applied to the entire facade system of the Office Block.



Static Water Penetration Test for the Balconies:

In order to ensure the tightness of the water insulation on the balcony floors. Static water penetration test shall be made by the facade contractor and reported to the Employer and Employer's Representatives. The consultant will also attend the test and publish an inspection report including his observations. This test shall be made for all balconies before the implementation of grout filling.

FDF REFERENCE WORK: FORTINA INVESTMENT / MALTA

LABORATORY AND SITE TESTS AND CERTIFICATION

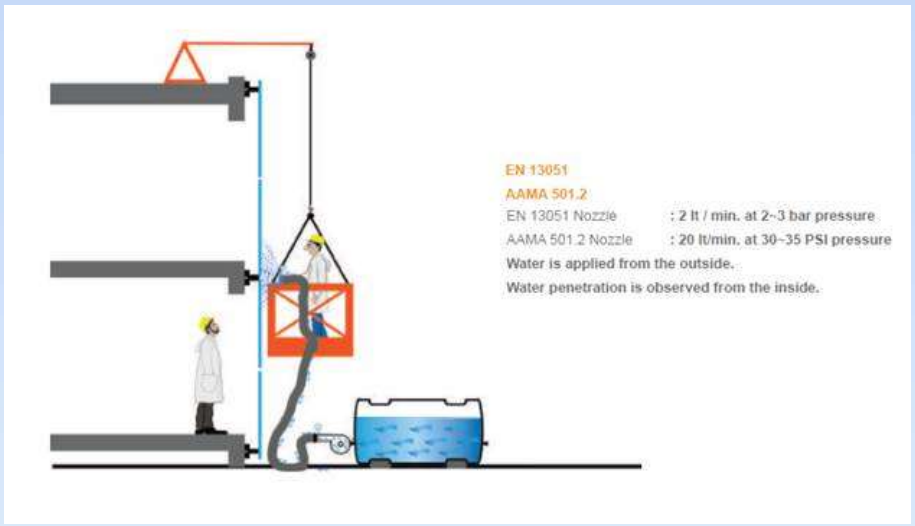
TEST DEFINITIONS AND REQUIREMENTS

FDF REFERENCE WORK: FORTINA INVESTMENT / MALTA
LABORATORY TESTS

LABORATORY AND SITE TESTS AND CERTIFICATION

SITE TESTS

SAMPLE PICTURES FOR ANCHOR BOLT PULL OUT TEST:



QUALITY ASSURANCE AND QUALITY CONTROL

MANUFACTURE INSPECTION REPORTS

FACADE DESIGN FACTORY

FORTINA MALTA – B BLOCK MANUFACTURE INSPECTION REPORT

Date : 14.01.20
Document N. : MIR-02
Page No : 17 /34
Inspect. Date: 06.01.202

FACADE DESIGN FACTORY

FORTINA MALTA – B BLOCK MANUFACTURE INSPECTION REPORT

Date : 12.12.2020
Document N. : MIR-02
Page No : 28 /74
Inspect. Date: 20.11.202

FACADE DESIGN FACTORY

FORTINA MALTA – B BLOCK MANUFACTURE INSPECTION REPORT

Date : 12.12.2020
Document N. : MIR-02
Page No : 30 /74
Inspect. Date: 20.11.202

FACADE DESIGN FACTORY

FORTINA MALTA – B BLOCK MANUFACTURE INSPECTION REPORT

Date : 12.12.2020
Document N. : MIR-02
Page No : 31 /74
Inspect. Date: 20.11.202

The main dimensions of the anchor plate and galvanizing thickness are proper to project details.

QUALITY ASSURANCE AND QUALITY CONTROL

MANUFACTURE INSPECTION REPORTS

FACADE DESIGN FACTORY

FORTINA MALTA – B BLOCK MANUFACTURE INSPECTION REPORT

Date	: 12.12.2020
Document N.	: MIR-02
Page No	: 61 /74
Inspect. Date:	20.11.202

FACADE DESIGN FACTORY

FORTINA MALTA – B BLOCK MANUFACTURE INSPECTION REPORT

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FACADE DESIGN FACTORY

FORTINA MALTA – B BLOCK MANUFACTURE INSPECTION REPORT

Date	: 14.01.2021
Document N.	: MIR-02
Page No	: 25 /34
Inspect. Date:	06.01.2021

Visual Inspection from Inside and Outside:

No visual defect has been observed in the main zone. Alsoo, the color rendering was similar on both units and of good quality.

QUALITY ASSURANCE AND QUALITY CONTROL

CONSTRUCTION INSPECTION REPORTS

FDF FACADE DESIGN FACTORY	FORTINA MALTA – B BLOCK CONSTRUCTION INSPECTION REPORT	Date : 13.10.2020 Document N. : CIR-01 Page No : 11 /56 Revision No : 0

FDF FACADE DESIGN FACTORY	FORTINA MALTA – B BLOCK CONSTRUCTION INSPECTION REPORT	Date : 13.10.2020 Document N. : CIR-01 Page No : 12 /56 Revision No : 0

FDF FACADE DESIGN FACTORY	FORTINA MALTA – B BLOCK CONSTRUCTION INSPECTION REPORT	Date : 13.10.2020 Document N. : CIR-01 Page No : 23 /56 Revision No : 0

ANC03 INSTALLED MODEL

QUALITY ASSURANCE AND QUALITY CONTROL

CONSTRUCTION INSPECTION REPORTS

FDF FACADE DESIGN FACTORY	FORTINA MALTA – B BLOCK CONSTRUCTION INSPECTION REPORT	Date : 13.10.2020 Document N. : CIR-01 Page No : 30 /56 Revision No : 0

ASSESSMENT FOR ANC05:

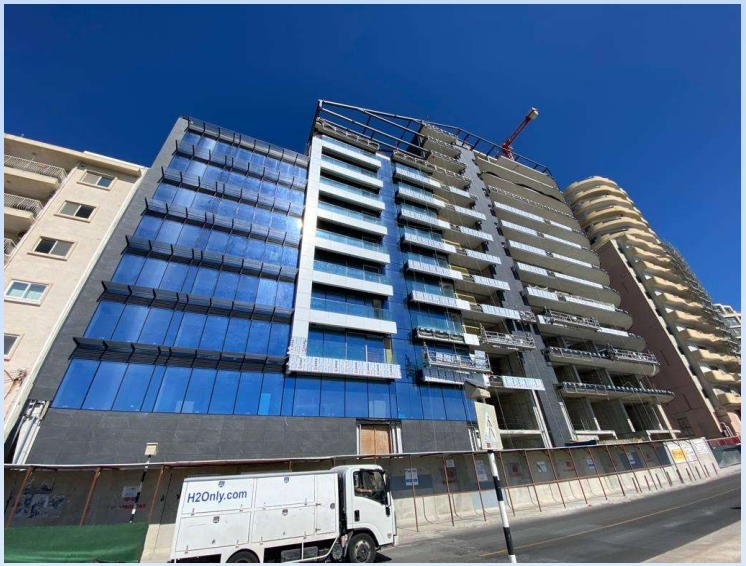
THE ANC05 SHALL BE PRODUCED IN ACCORDANCE WITH THE CONSTRUCTION DRAWINGS AND TECHNICAL DOCUMENTS AND REPLACED WITH THE EXISTING ANCHOR PROFILES.

FDF FACADE DESIGN FACTORY	FORTINA MALTA – B BLOCK CONSTRUCTION INSPECTION REPORT	Date : 13.10.2020 Document N. : CIR-01 Page No : 36 /56 Revision No : 0

SOME OF FDF REFERENCES

FORTINA MALTA – SLIEMA/ MALTA

CLENT: FORTINA CONTRACTING - MALTA



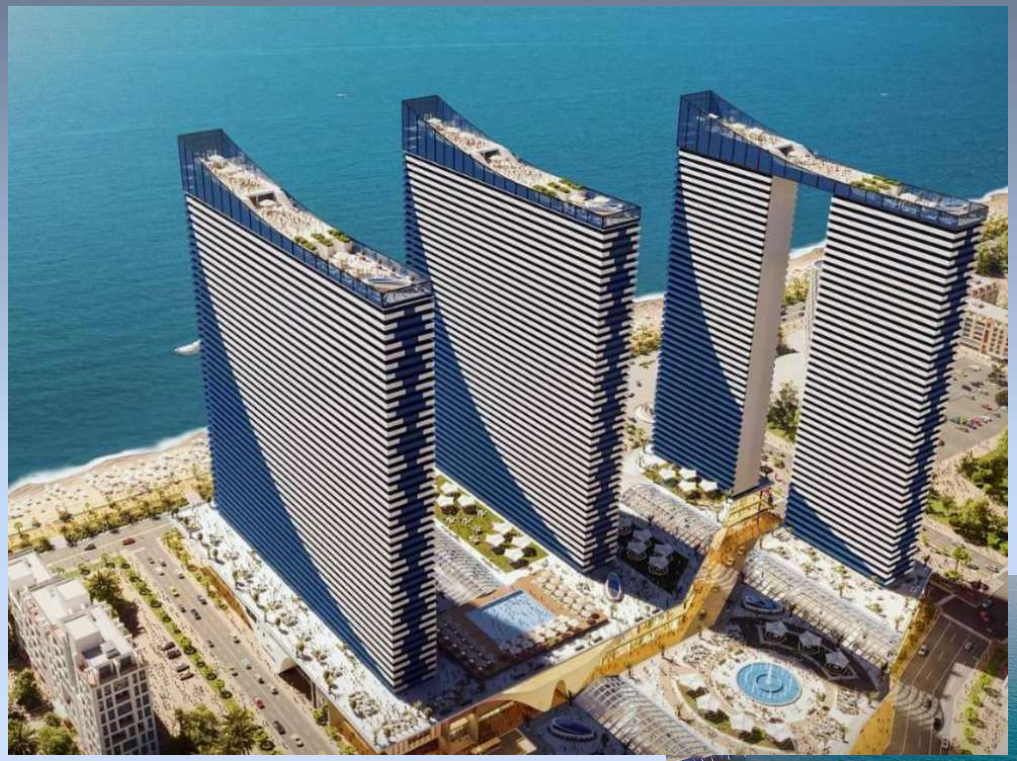
SOME OF FDF REFERENCES

CITY CENTER COMPLEX– MALTA

CLENT: DB GROUP -MALTA

SOME OF FDF REFERENCES
ST TOWER– MALTA
CLIENT: ST GROUP- MALTA

SOME OF FDF REFERENCES
ORBI CITY – BATUMI/ GEORGIA
CLIENT: ORBI GROUP - GEORGIA



SOME OF FDF REFERENCES

ORBI BAGRATIONI - BATUMI/ GEORGIA

CLIENT: ORBI GROUP - GEORGIA

SOME OF FDF REFERENCES

AZURE TOWER – BATUMI/ GEORGIA

CLIENT: MC CONSTRUCTION – GEORGIA

SOME OF FDF REFERENCES

MARRIOTT HOTEL – BATUMI GEORGIA

CLIENT: ALLIANCE GROUP - GEORGIA

SOME OF FDF REFERENCES

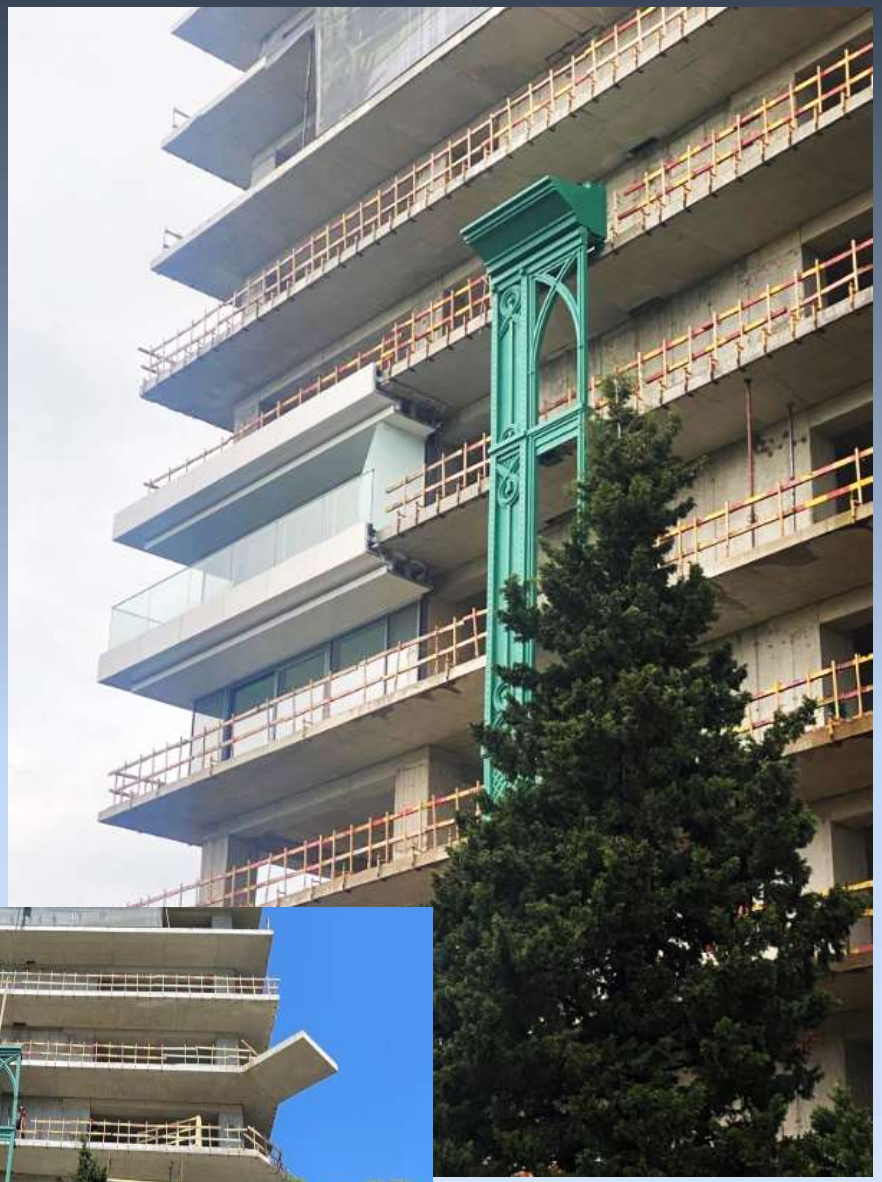
TBILISI CITY SKY RESIDENCE – GEORGIA

CLIENT: ZAKVO – GEORGIA

SOME OF FDF REFERENCES

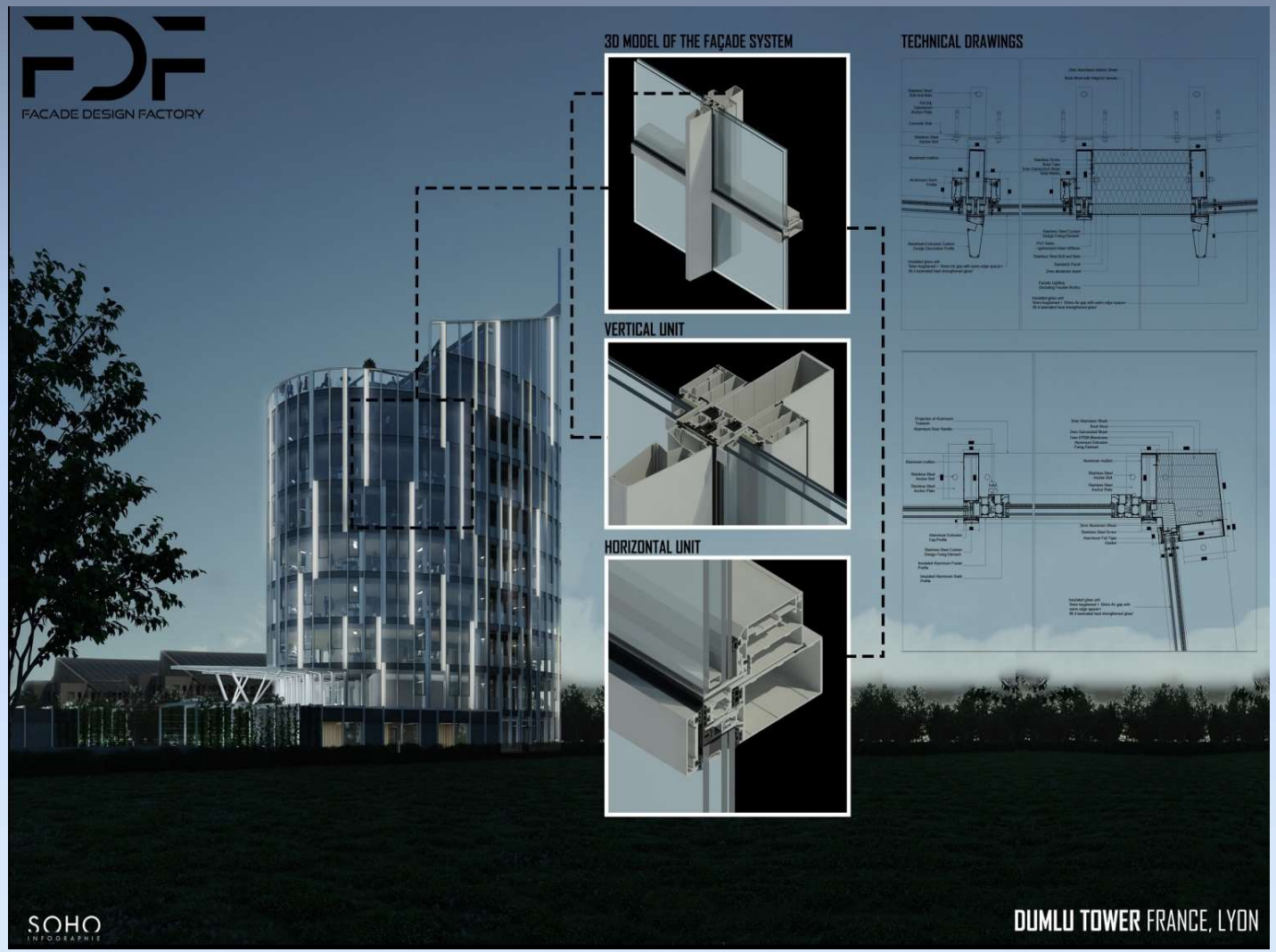
AMBASSADORI– BATUMI/ GEORGIA

CLIENT: AMBASSADORI – GEORGIA



SOME OF FDF REFERENCES
ASPAN – NUR SULTAN KHAZAKISTAN
CLIENT: DESIGN GROUP

SOME OF FDF REFERENCES
DUMLU OFFICE – LYON/ FRANCE
CLIENT: SCCV CAPA CITY - FRANCE



SOME OF FDF REFERENCES

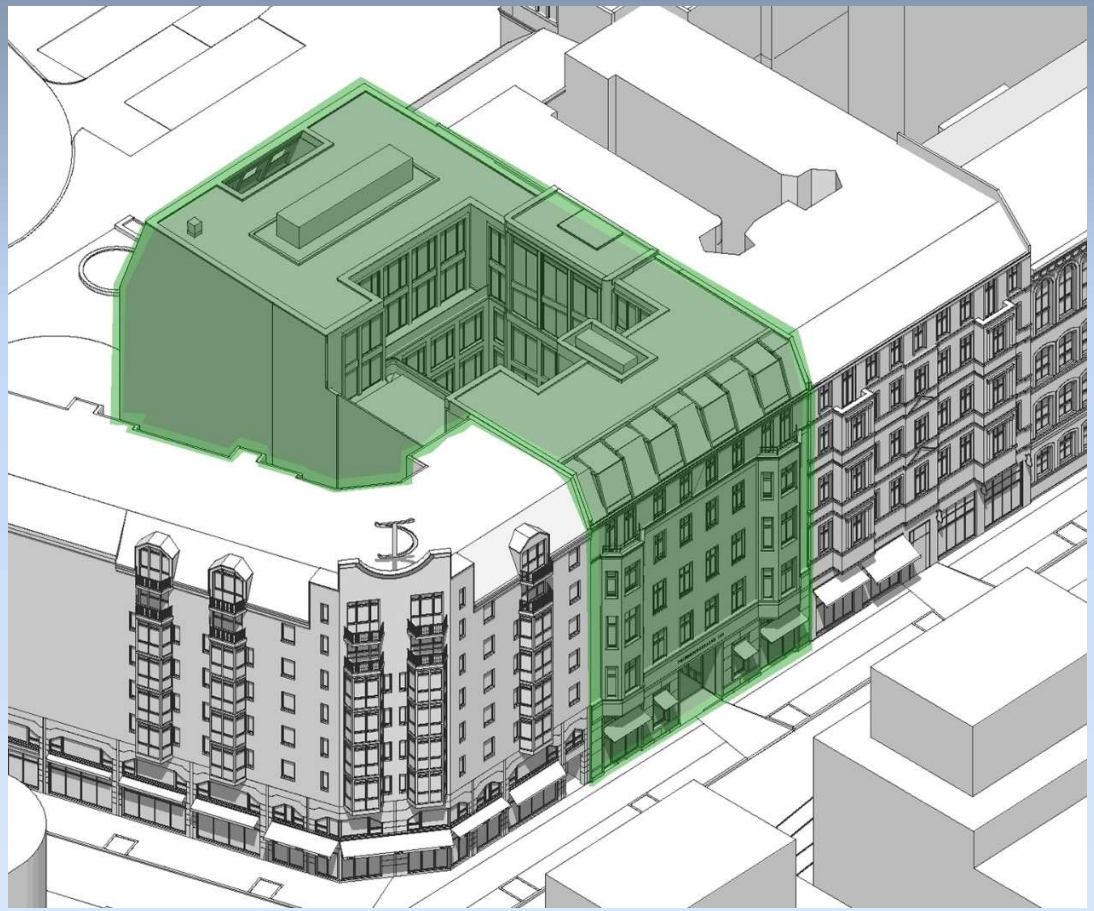
SUEDKREUZ OFFICES – BERLIN/ GERMANY

CLIENT: METAL CONSTRUCTION - TURKEY

SOME OF FDF REFERENCES

FRIEDRICHSTRASSE 128 – BERLIN/ GERMANY

CLIENT: GEA - GERMANY



SOME OF FDF REFERENCES

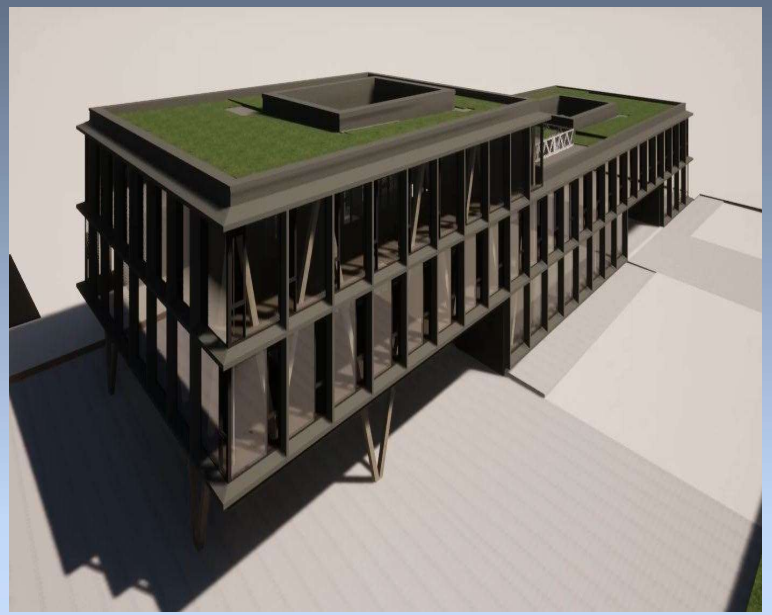
NIGERIA NATIONAL PETROLEUM CORPORETION TOWERS REFURBISHMENT– NIGERIA

CLIENT: GEA - GERMANY

SOME OF FDF REFERENCES

BGM –KÖLN/ GERMANY

CLIENT: GEA - GERMANY



SOME OF FDF REFERENCES

HOLLAND PARK GATE – LONDON/ UK

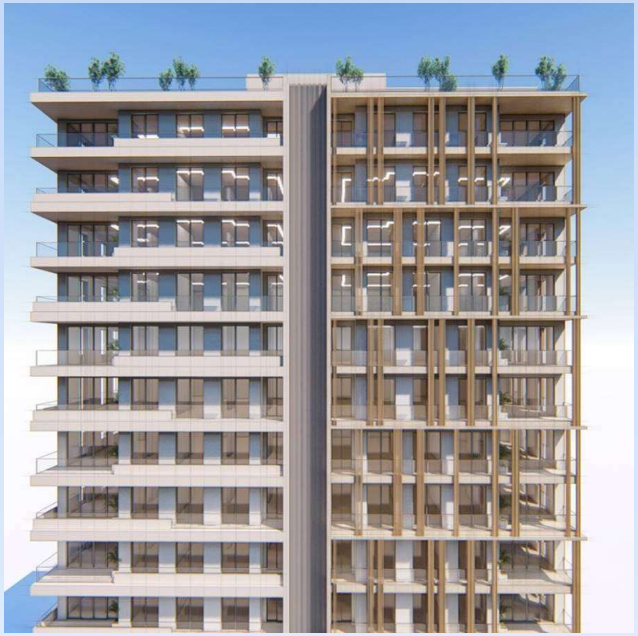
CLIENT: TUNA YAPI - TURKEY

SOME OF FDF REFERENCES
GRANDCONCOURSE – USA

SOME OF FDF REFERENCES

AL YARMOUK RESIDENCES– BAGHDAD/ IRAQ

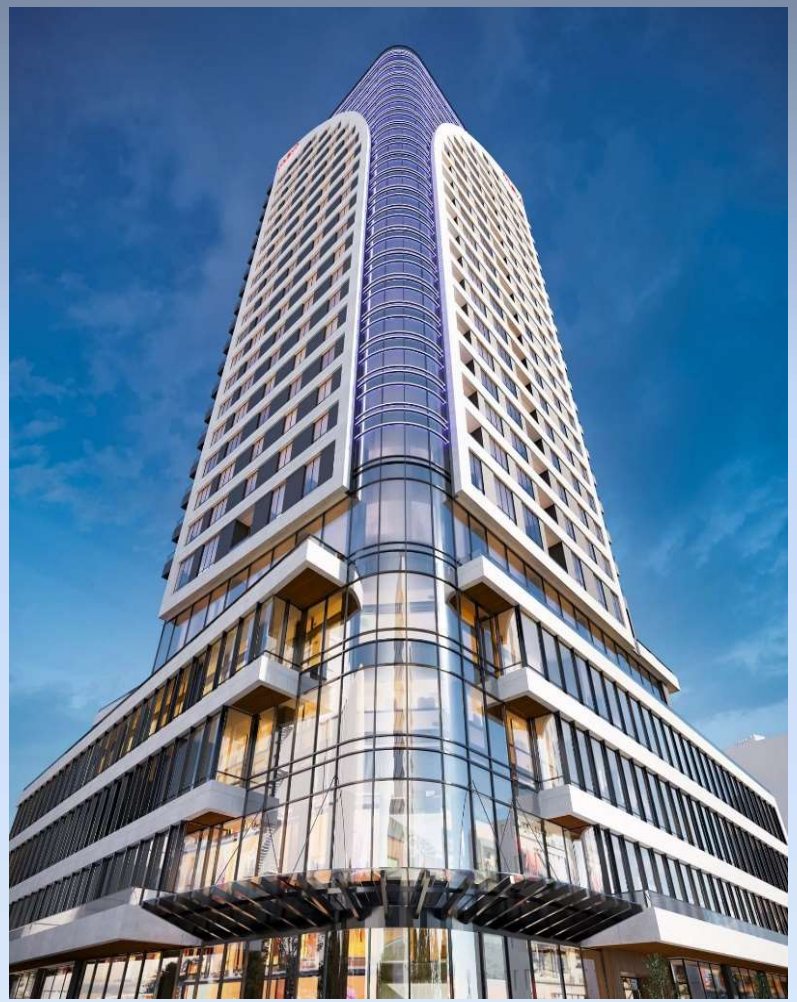
CLIENT: BACIRAQ - IRAQ



SOME OF FDF REFERENCES

MODERA TOWERS– TASHKENT/ UZBEKISTAN

CLIENT: SOZUNERI ARCHITECTS - TURKEY



SOME OF FDF REFERENCES

BENESTA DOLAPDERE –ISTANBUL/ TURKEY

CLIENT: ESTA CONSTRUCTION - TURKEY

SOME OF FDF REFERENCES

BENLEO ACIBADEM – ISTANBUL/ TURKEY

CLIENT: ESTA CONSTRUCTION - TURKEY

SOME OF FDF REFERENCES

BEN PODIO BAHCELIEVLER – ISTANBUL/ TURKEY

CLIENT: ESTA CONSTRUCTION - TURKEY

SOME OF FDF REFERENCES

FLORYA HOUSES – ISTANBUL/ TURKEY

CLIENT: MUSTAFA EKSI CONSTRUCTION- TURKEY

SOME OF FDF REFERENCES

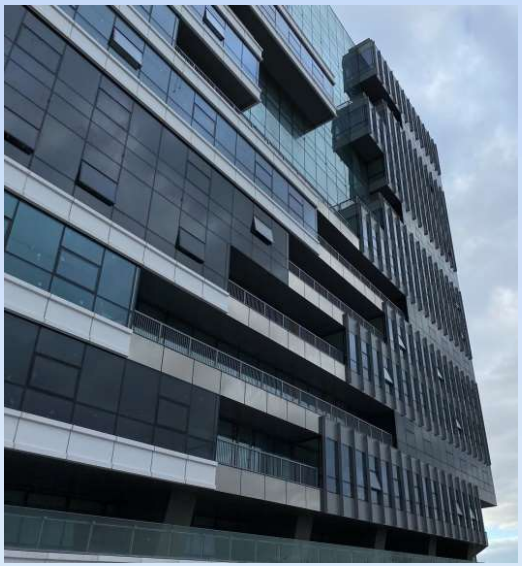
FINANCE CENTER RECREATION 1 & 13- ISTANBUL/ TURKEY

CLIENT: MUSTAFA EKSI CONSTRUCTION- TURKEY

SOME OF FDF REFERENCES

LCW HEADQUARTERS – ISTANBUL/ TURKEY

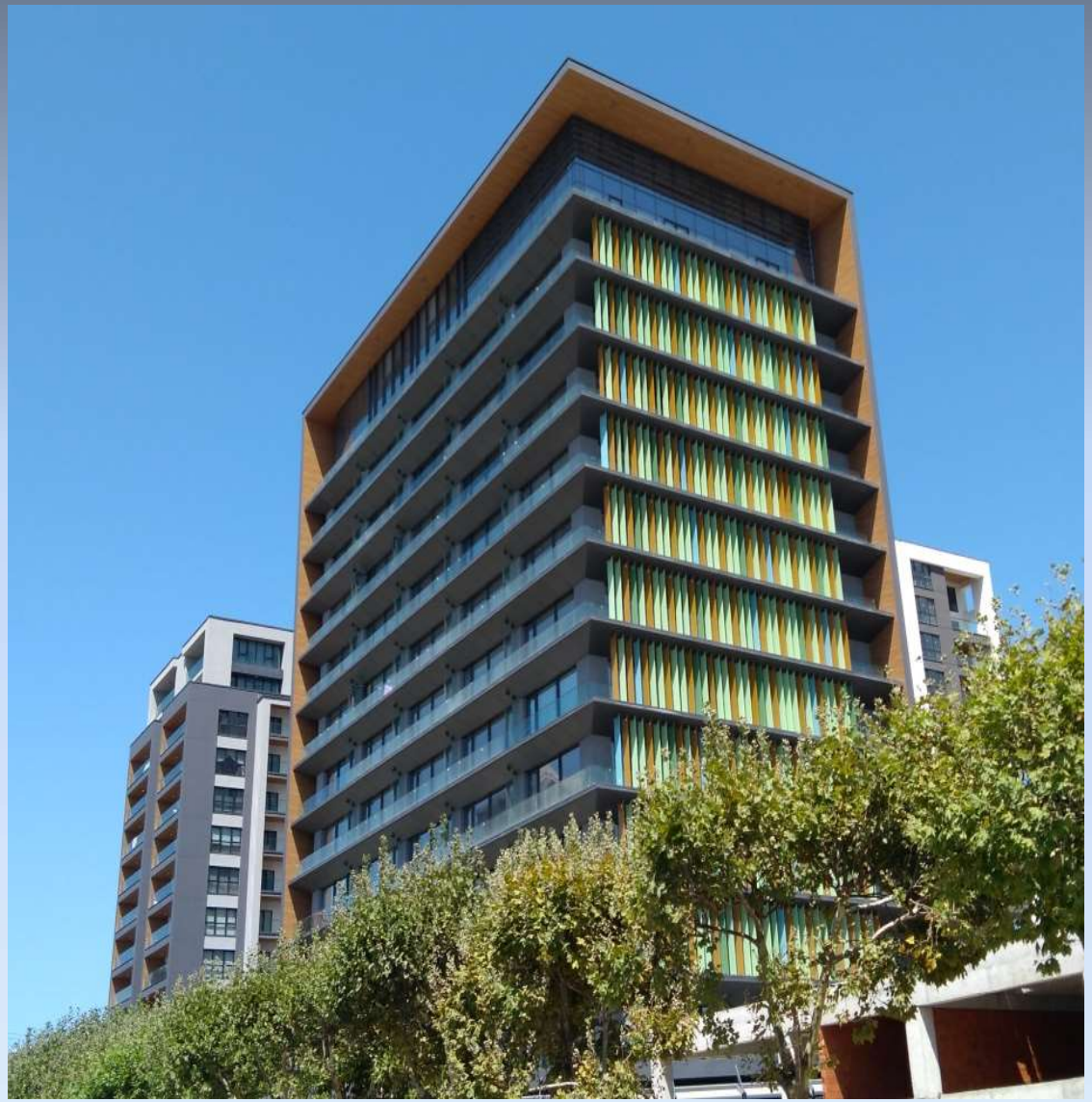
CLIENT: LCW - TURKEY

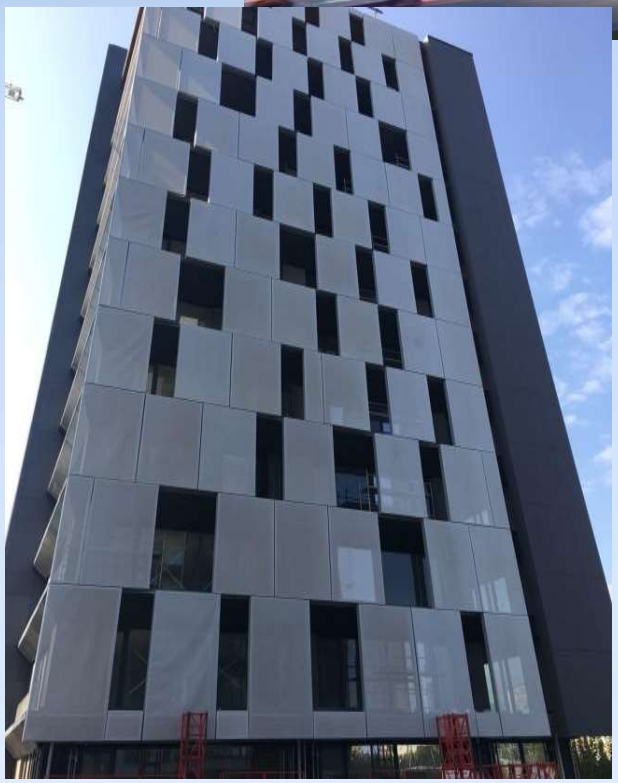


SOME OF FDF REFERENCES

PLAZA 224 – BURSA/ TURKEY

CLIENT: NILUFER PROJECT DEVELOPMENT - TURKEY





SOME OF FDF REFERENCES

ULUDAG SANATORYUM– BURSA/ TURKEY

CLIENT: BURSA CHAMBER OF COMMERCE AND INDUSTRY - TURKEY

SOME OF FDF REFERENCES

ELMAS KULE STAGE A– ISTANBUL/ TURKEY

CLIENT: GENCOGLU CONSTRUCTION - TURKEY

SOME OF FDF REFERENCES

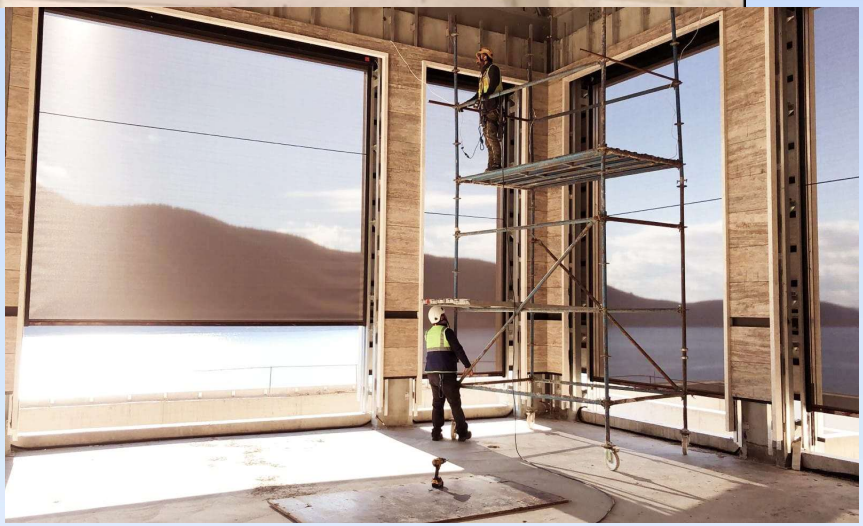
ELMAS KULE STAGE B– ISTANBUL/ TURKEY

CLIENT: GENCOGLU CONSTRUCTION - TURKEY

SOME OF FDF REFERENCES

FOUR SEASONS HOTELS AND PRIVATE VILLAS – BODRUM/ TURKEY

CLIENT: ASTAY - TURKEY



SOME OF FDF REFERENCES

FOUR SEASONS HOTELS AND PRIVATE VILLAS – ETILER TURKEY

CLIENT: ASTAY - TURKEY

SOME OF FDF REFERENCES
JURISDICTION BUILDINGS– ANKARA/ TURKEY
CLIENT: RONESANS HOLDING - TURKEY

SOME OF FDF REFERENCES

TSK AYYILDIZ CAMPUS- ISTANBUL/ TURKEY

CLIENT: RONESANS HOLDING - TURKEY

SOME OF FDF REFERENCES

TEKFEN FNN SUSTANABILITY CENTER- ADANA/ TURKEY

CLIENT: TEKFEN - TURKEY

SOME OF FDF REFERENCES

DORUK HOSPITAL – BURSA/ TURKEY

CLIENT: DORUK HEALTH GROUP - TURKEY

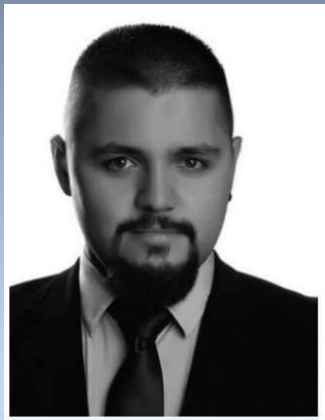
SOME OF FDF REFERENCES

BALAT HIGHLINE - BURSA/ TURKEY

CLIENT: ARTI 2000 - TURKEY

SOME OF FDF REFERENCES
NEOPORT- ISTANBUL/ TURKEY
CLIENT: NET CONSTRUCTION - TURKEY

FDF TURKEY TEAM



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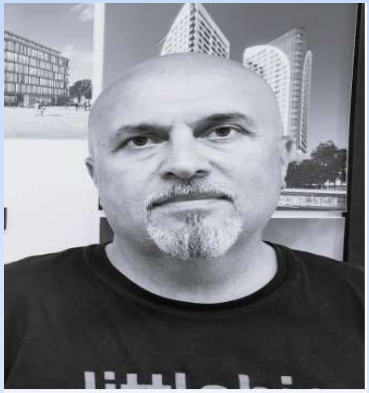

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