



MASHAAER MUGADASSAH

METRO PROJECT STUDY

المشروع القطار للمشاعر المقدسه

Avoiding nuisance in Project management

Al Mashaaer Al Mugadassah Metro Project, Southern Line

Saudi Arabia

10th March 2016

Sharif University of Technology

Tehran



Development Commission of
Makkah Al Mukarramah,
Al Madinah Al Munawwarah and
Al Mashaaer Al Mugadassah





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- ❖ Each year, during seven days around 3.5 million pilgrims gather in Makkah to perform one of the 5 pillars of the Islam, “El Hajj”. The pilgrimages happens in Makkah city and Mashaaer area, over 18 km at East side of Makkah.



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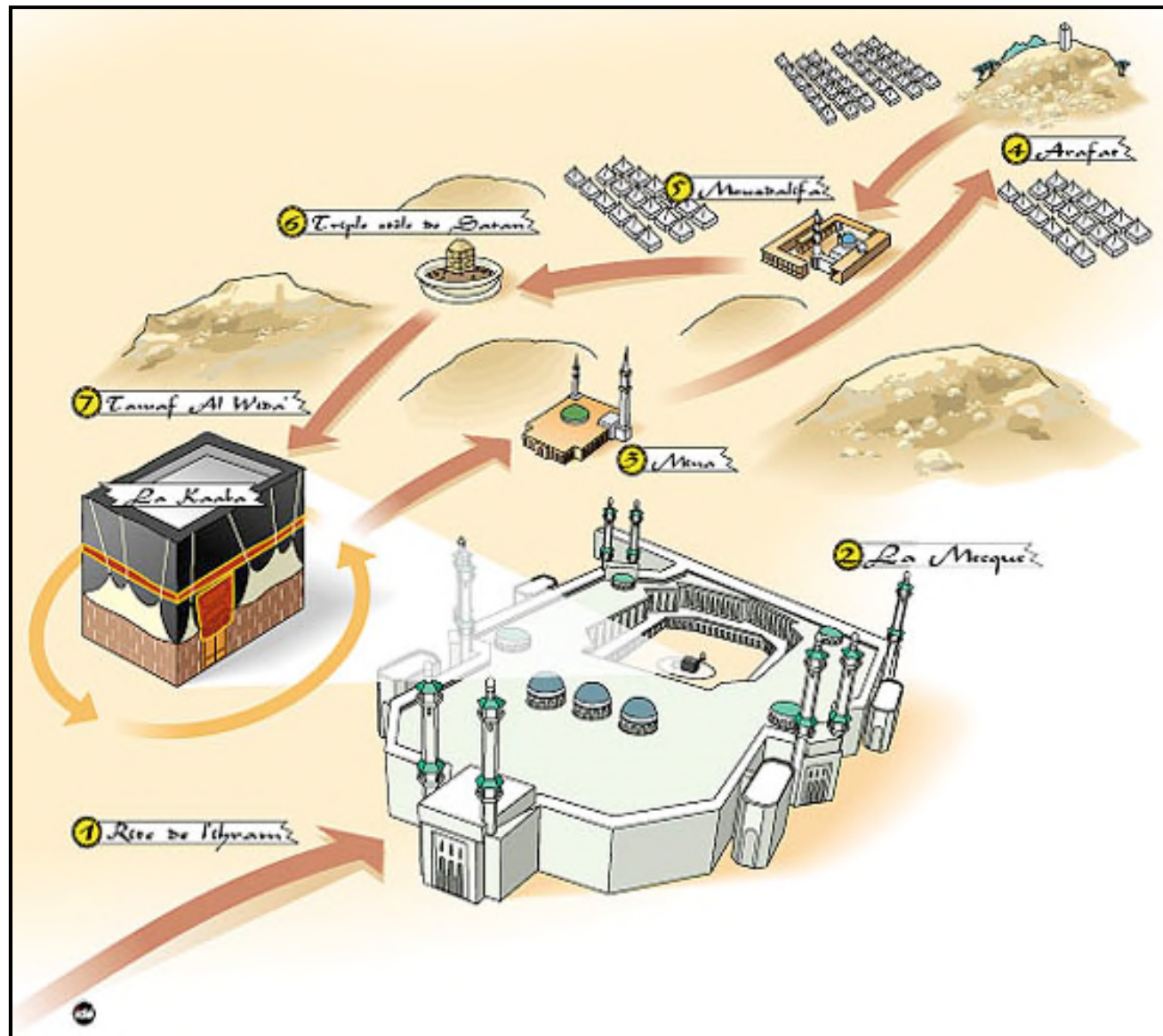




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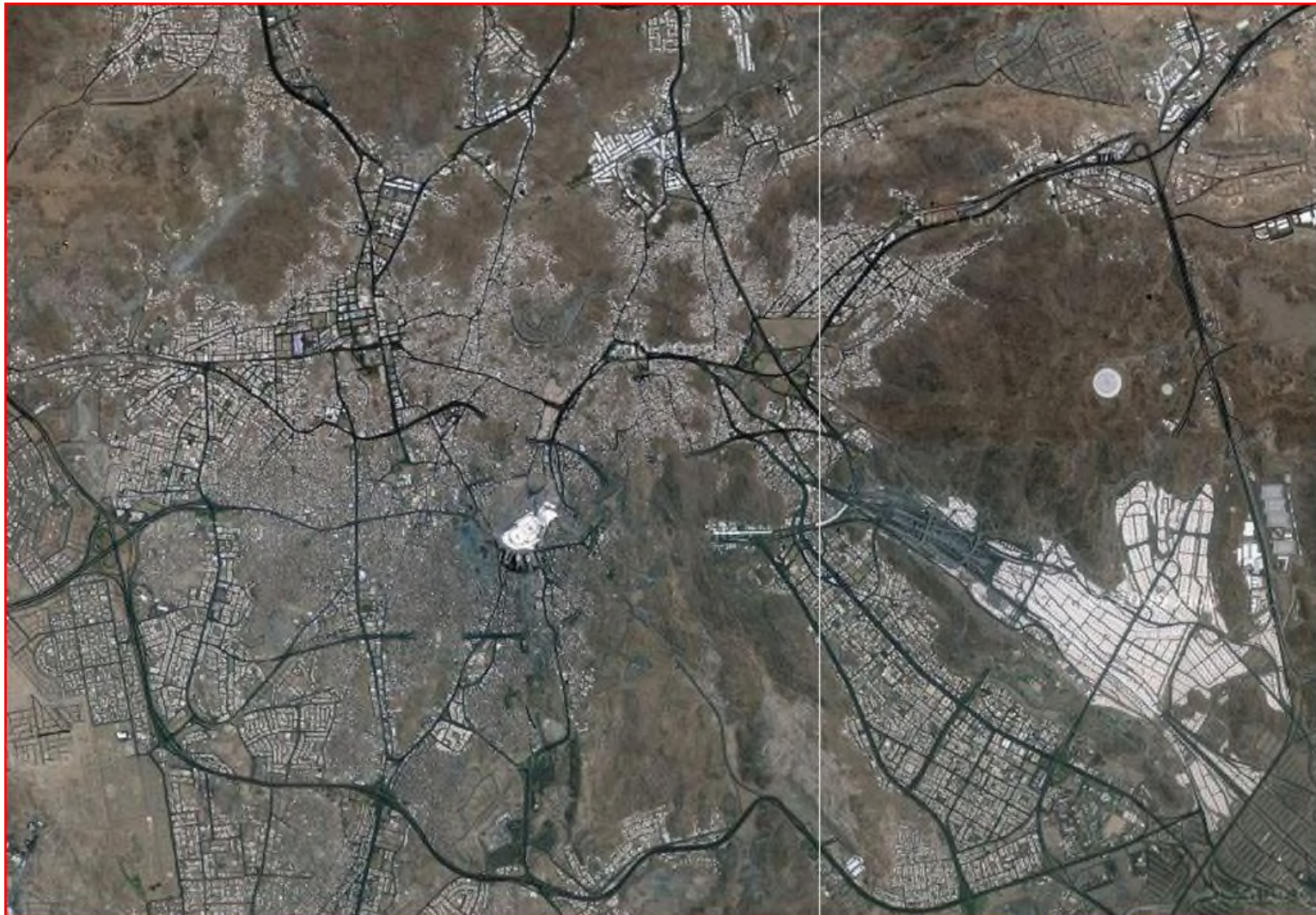




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- ❖ To reduce congestion and pollution, and to improve safety of the pilgrims , the Saudi government decided to equip the area with a metro line, called Mashaaer Southern Line,
- ❖ This line, with a capacity of 700 000 passenger/day only faces 1/5 of the needs in transportation. 4 other lines are needed to reach 3 500 000 passenger.trip /day





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PRESENTATION PLAN

- **1- TECHNICAL**
 - 1.1 Particularities of the project
 - 1.2 Movements, Alignment, Operation,
 - 1.3 Viaduct, Stations
 - 1.4 environmental insertion,
 - 1.5 Design and Construction,
- **2- MANAGERIAL**





1- TECHNICAL





1.1- PARTICULARITIES OF THE PROJECT





Particularities

- ❖ Extremely dense Crowd
- ❖ Absolute respect of pilgrimage time schedule,
- ❖ Presence of old and disable persons,
- ❖ Hostile hot climate conditions,
- ❖ Very high capacity of the line,
- ❖ Non familiarity of the passengers with metro





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Particularities



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Main characteristics

- ❖ 18 km Elevated heavy Metro Line
- ❖ 9 Stations, 300 m Length
- ❖ PPHPD 72000 (Worldwide heist)
- ❖ 20 trains of 300 m length, (13 cars of 23 m), 5 doors,
- ❖ Catenary
- ❖ 1500 DC



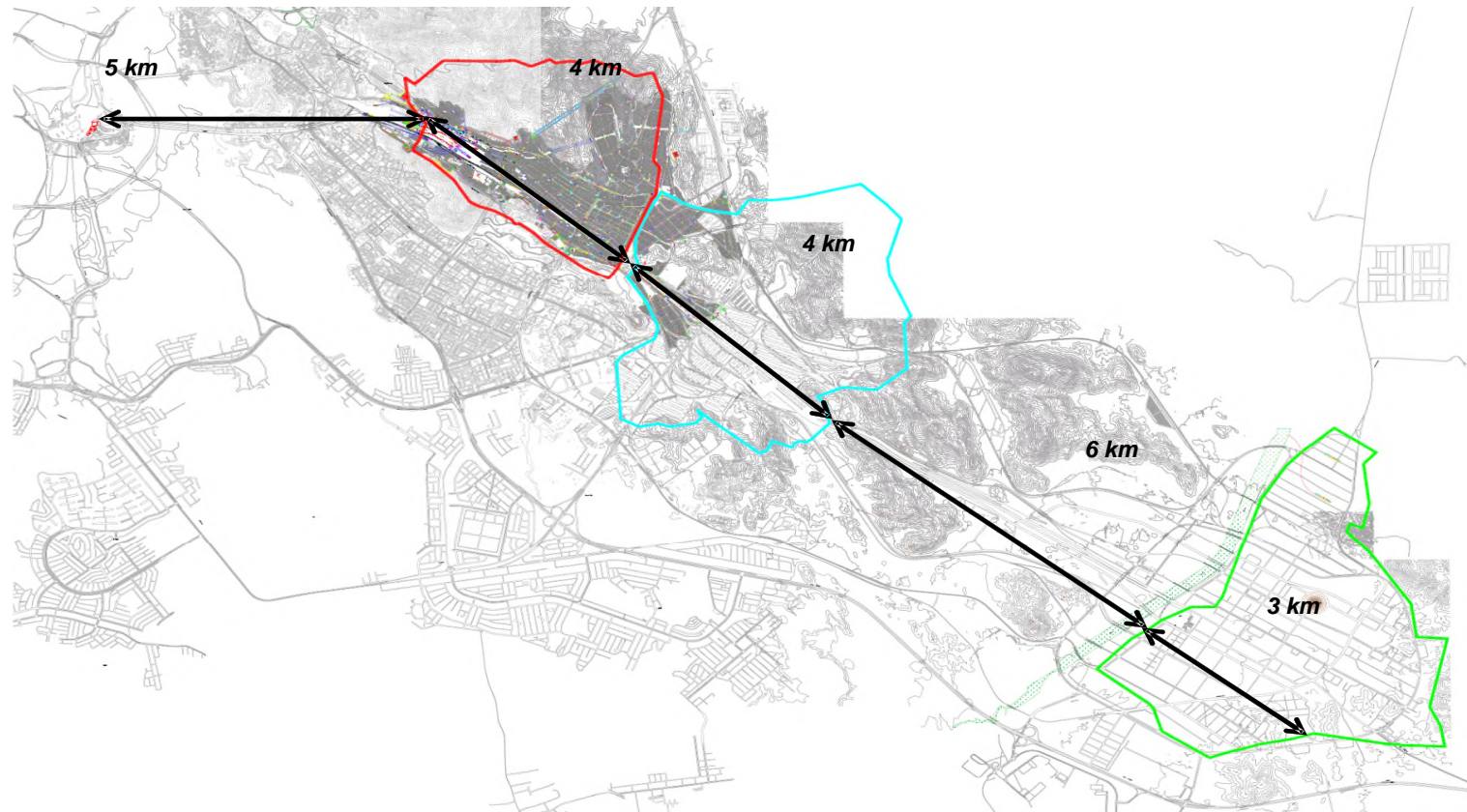


1.2: ALIGNMENT,
MOVEMENTS,
OPERATION,





Alignment



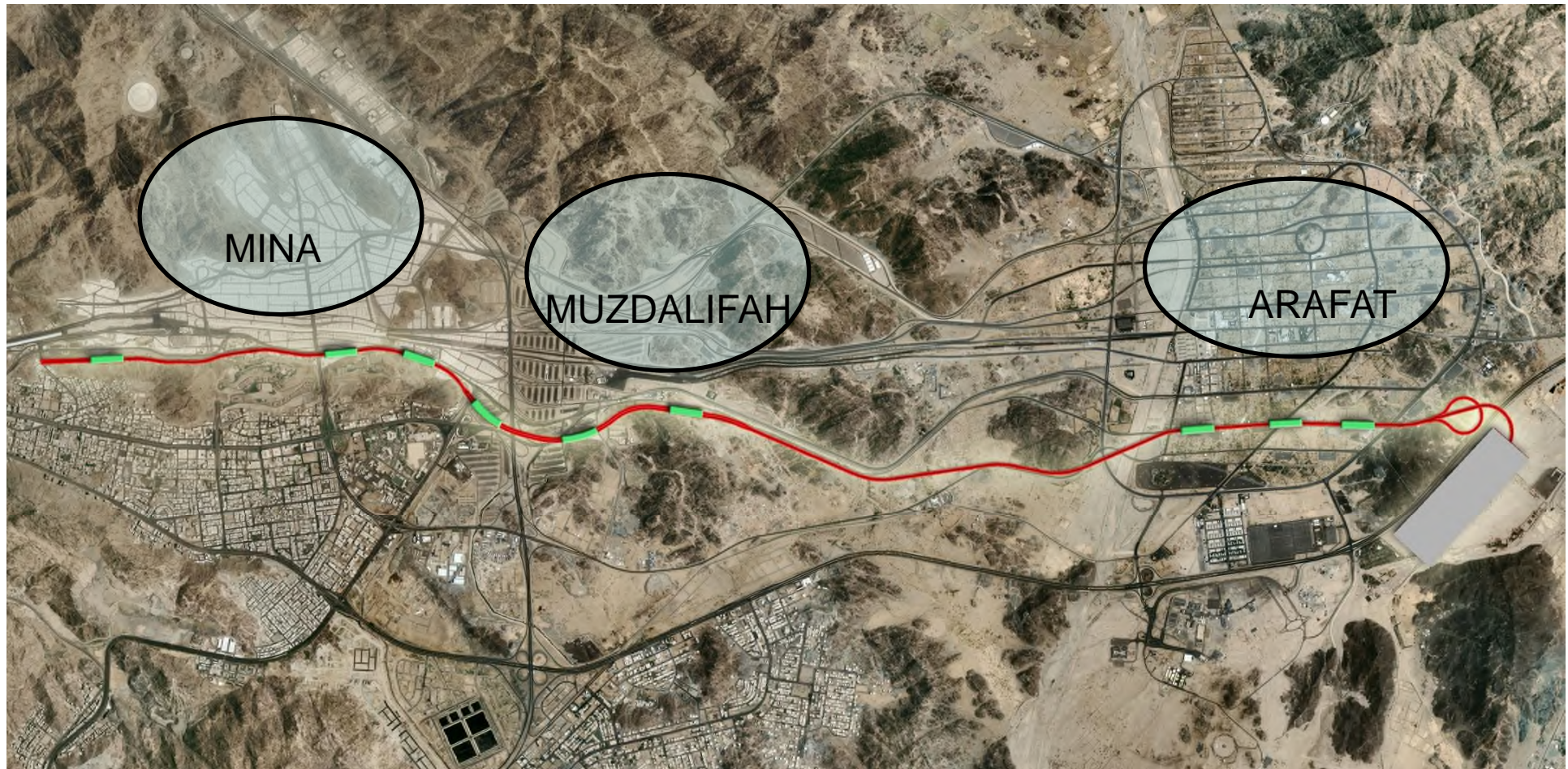


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MMMP - Southern Line Corridor



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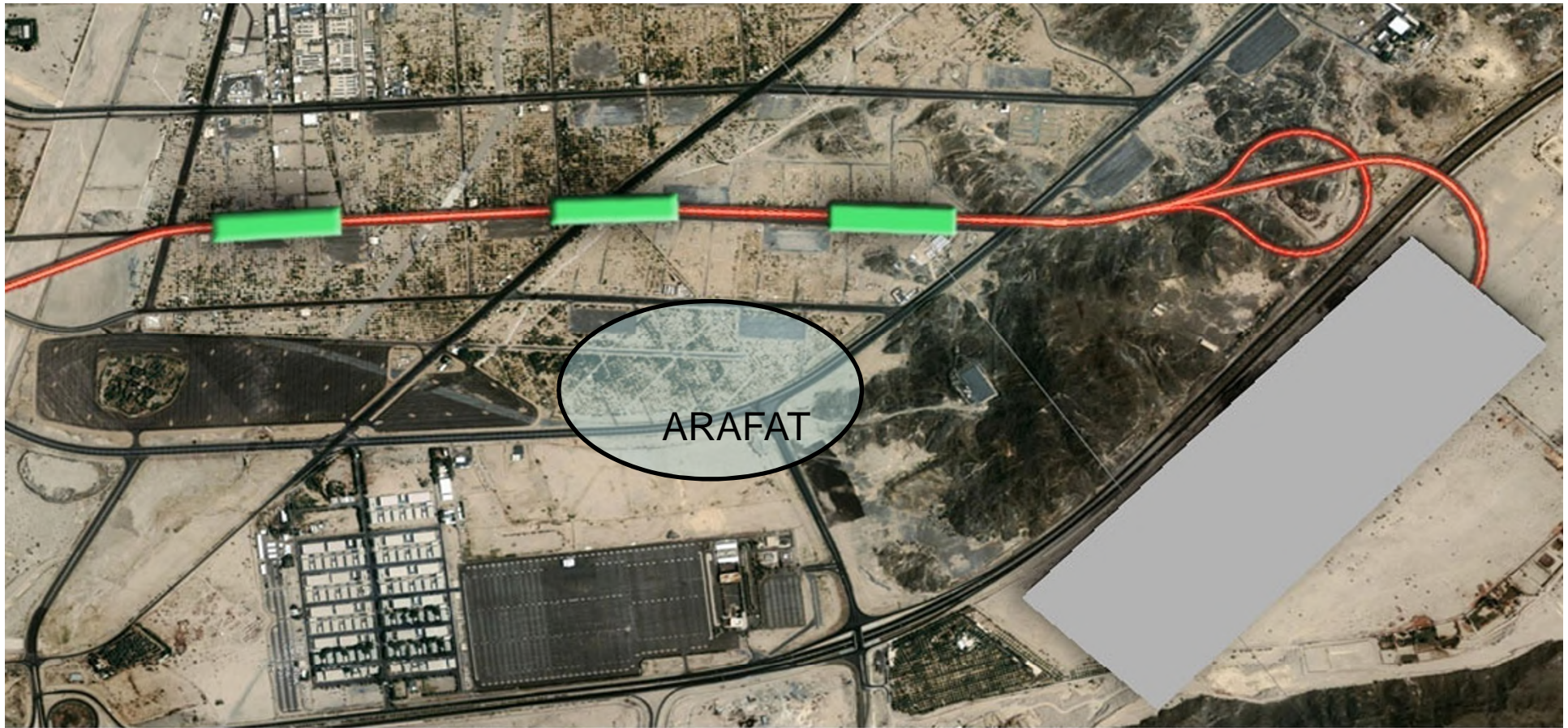




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ARAFAT



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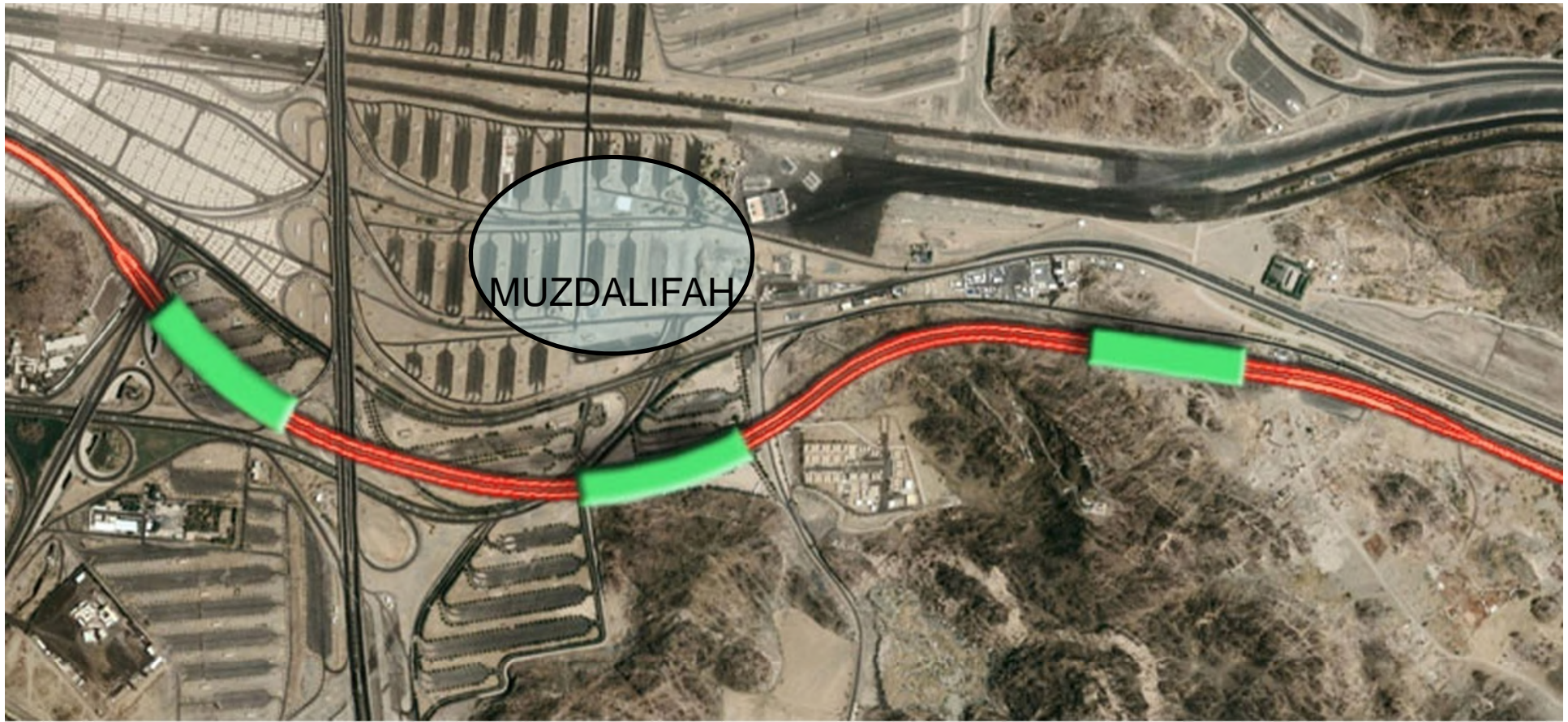




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MUZDALIFAH



MUZDALIFAH



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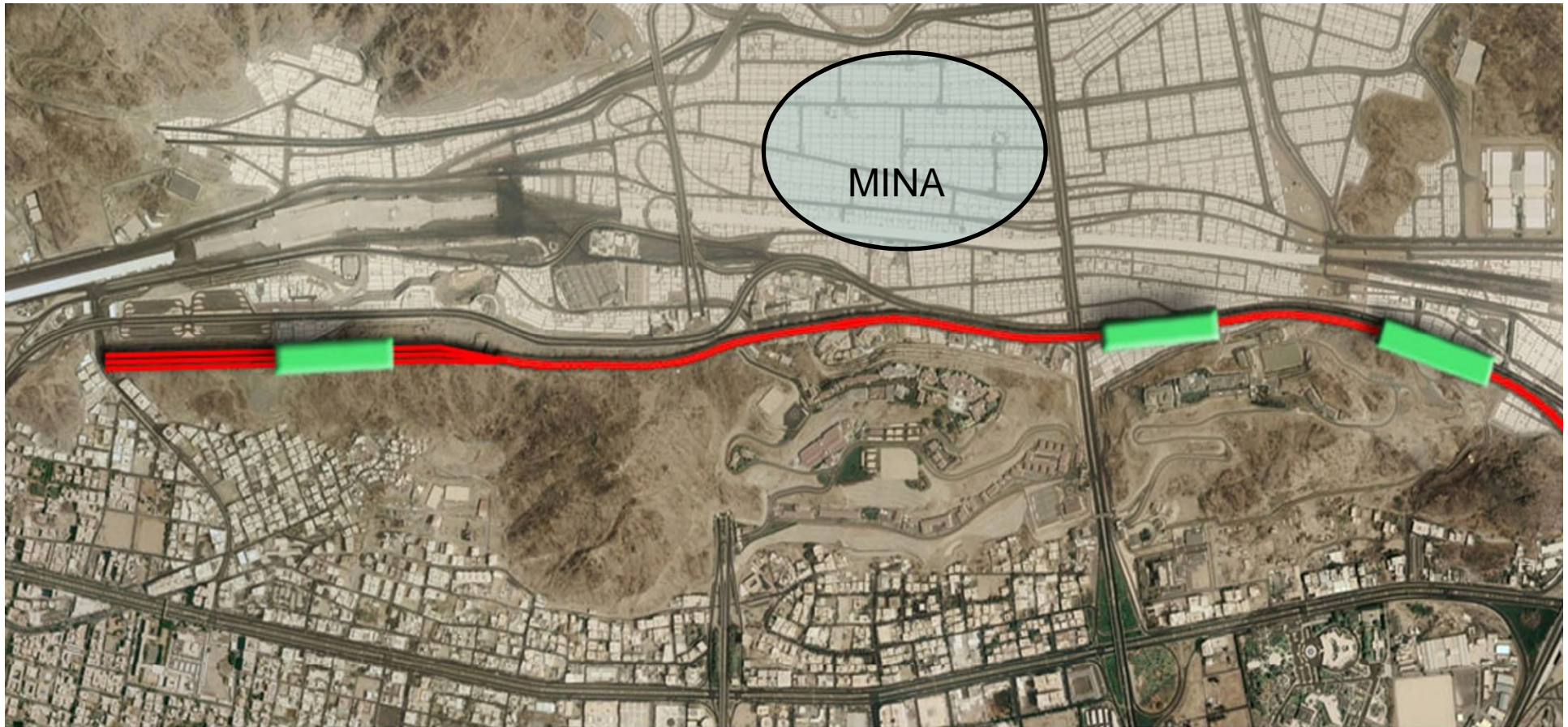




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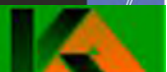
JAMMARAT & MINA



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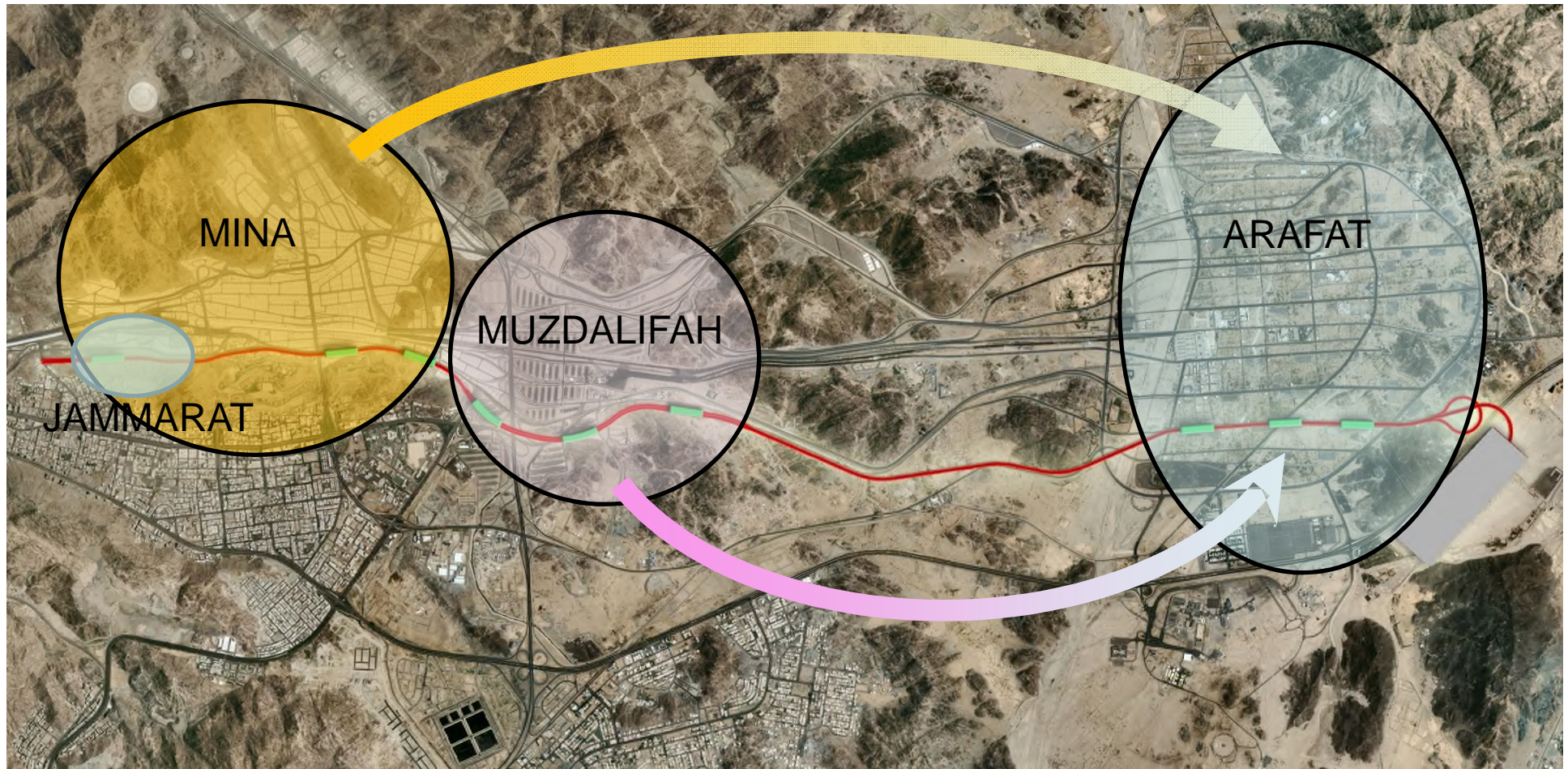


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MAIN MOVEMENT 1



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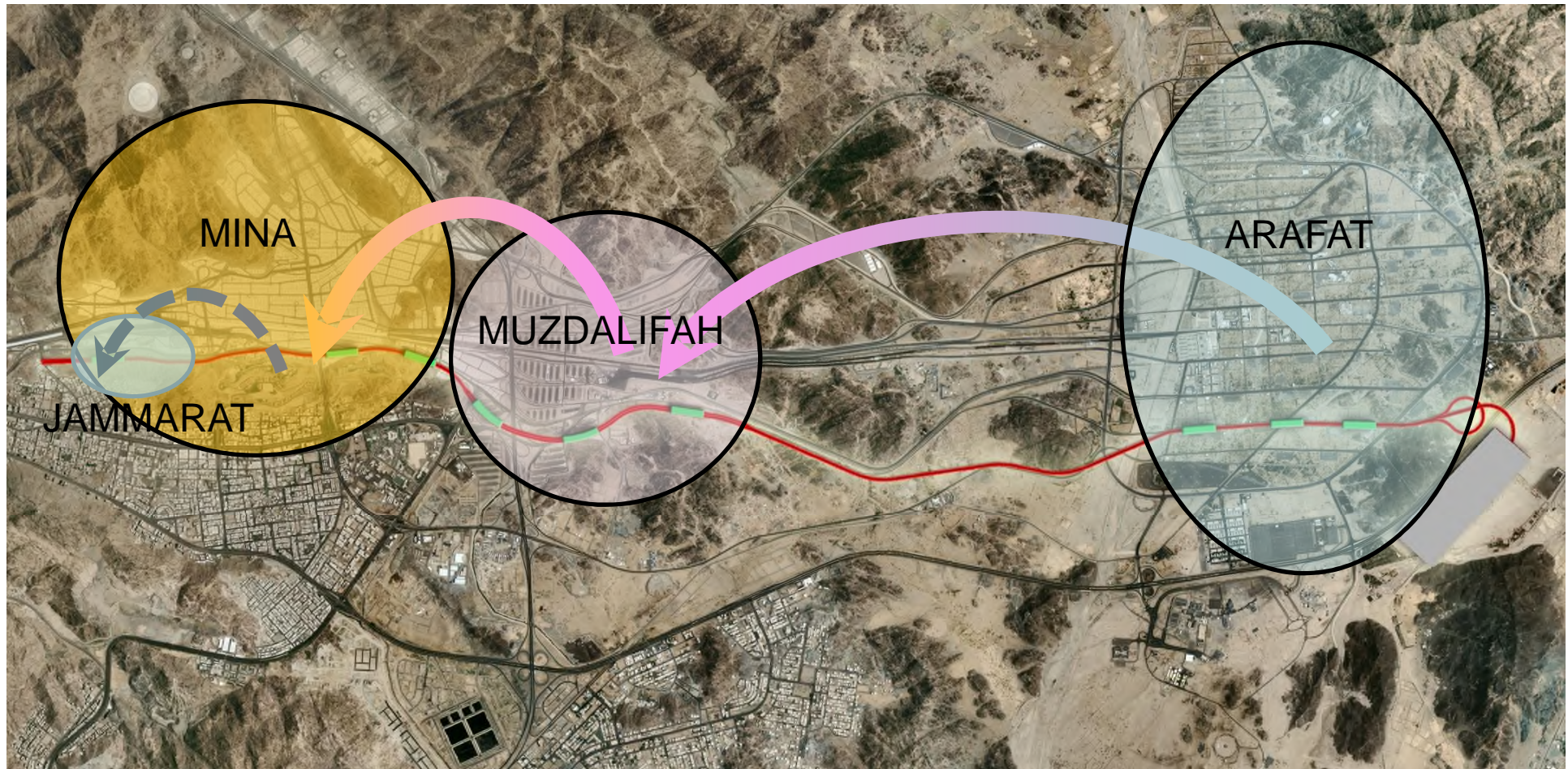


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MAIN MOVEMENT 2



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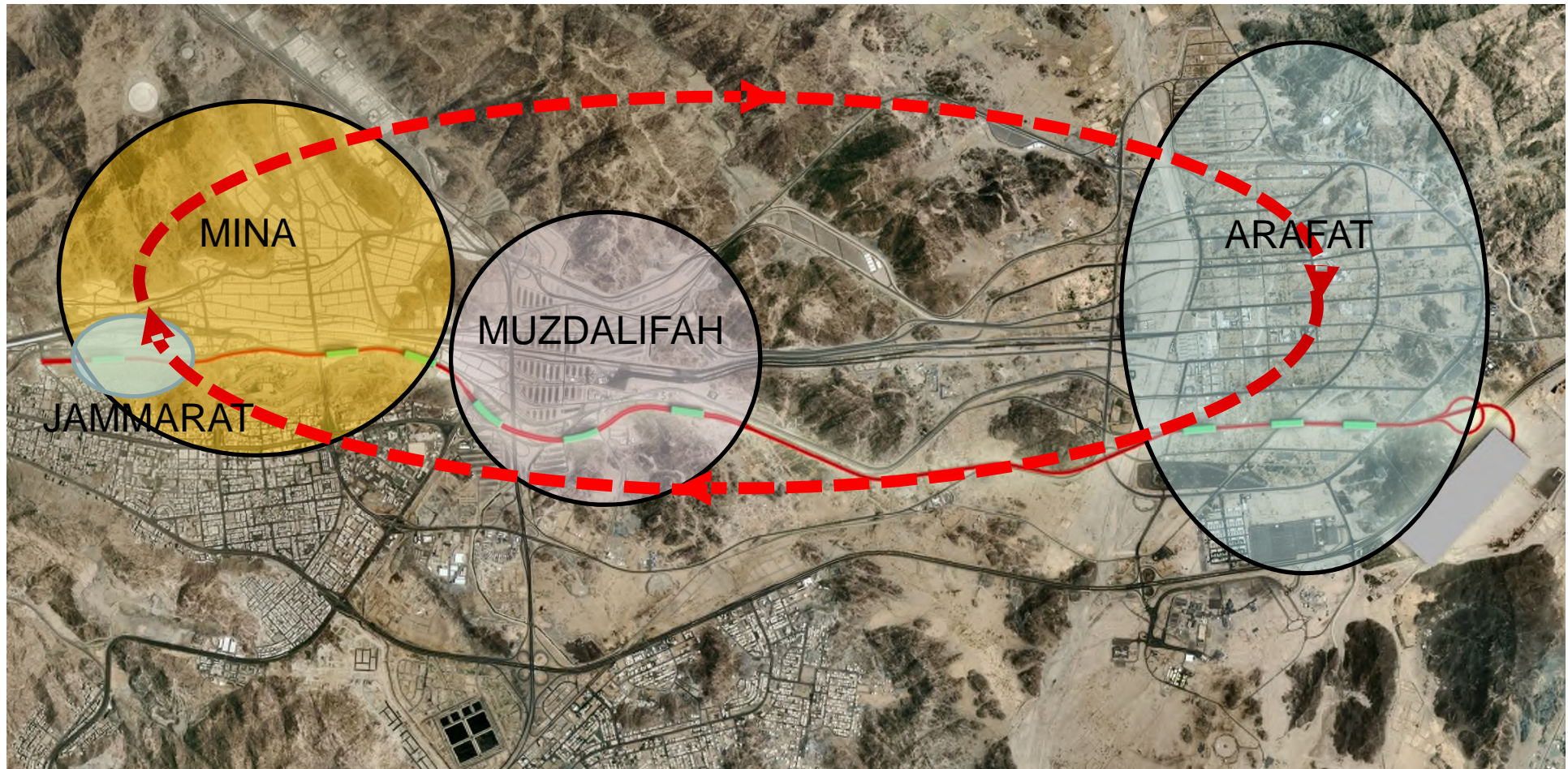


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MAIN MOVEMENTS 3



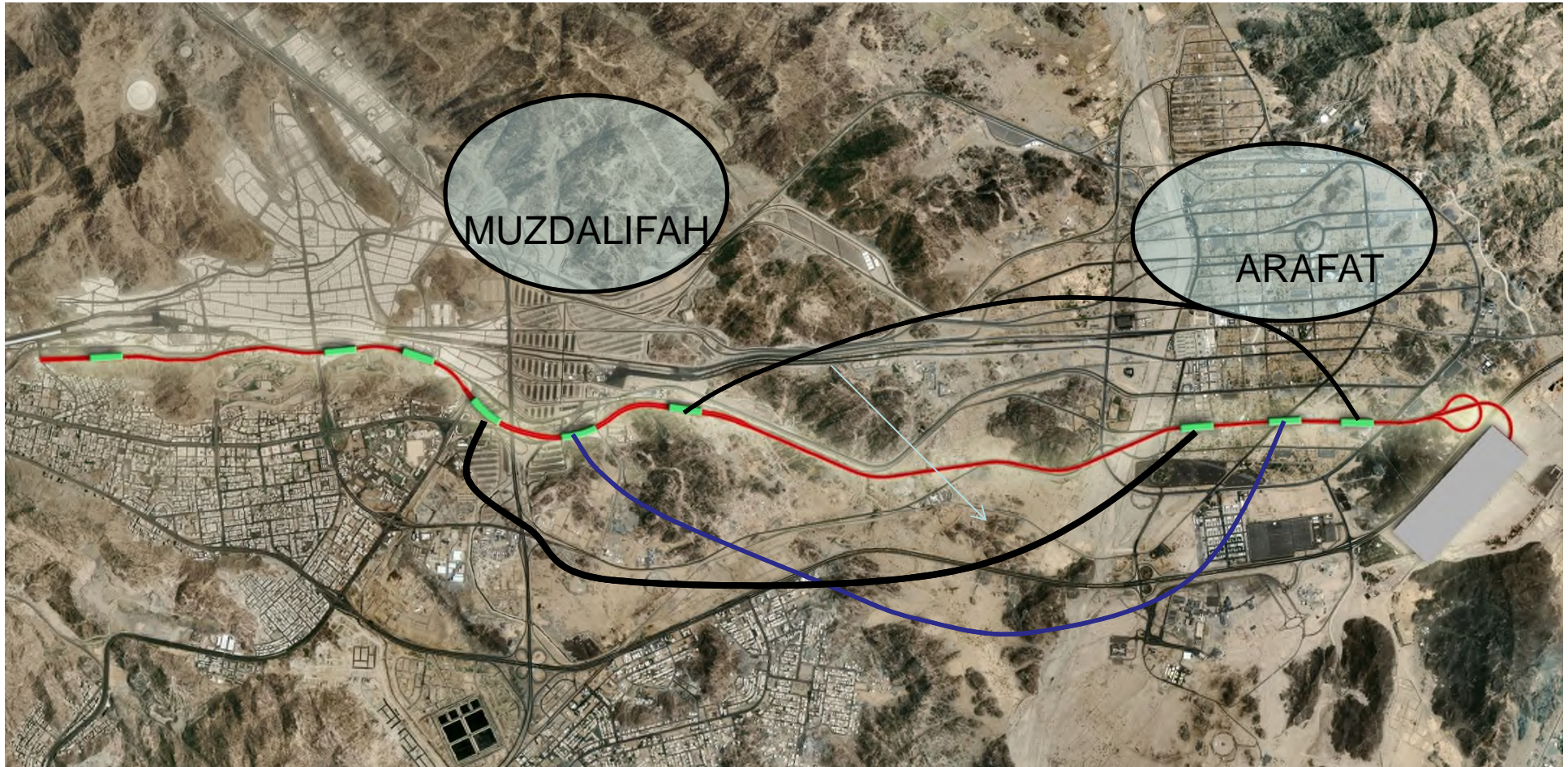


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OPERATION



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- A burst of 3 trains simultaneously arrive in each area every 5 minutes.

Headway = 300 seconds /station, 100 seconds/area,

Train capacity 3000 passengers



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1-3: Viaduct (U shape)

Stations



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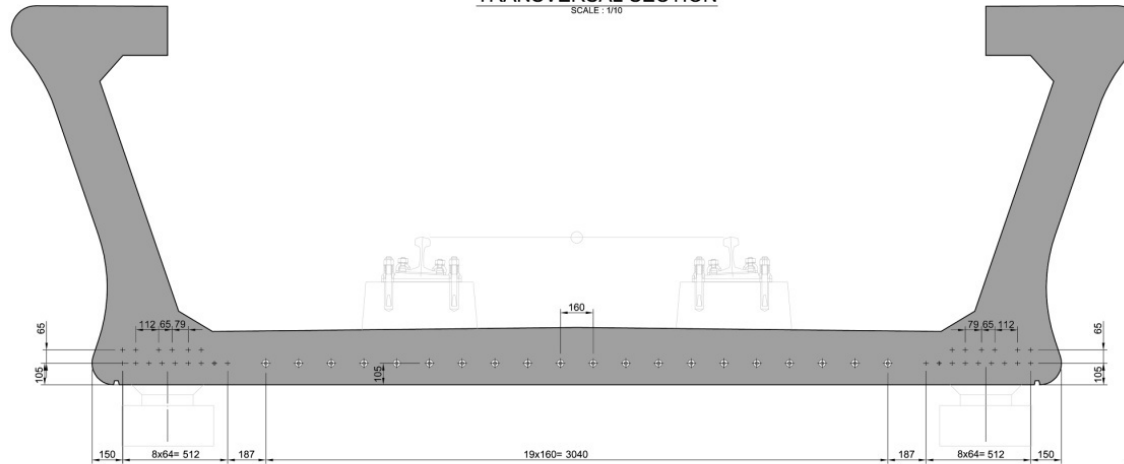
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TRANSVERSAL SECTION

SCALE: 1/10



LEGEND

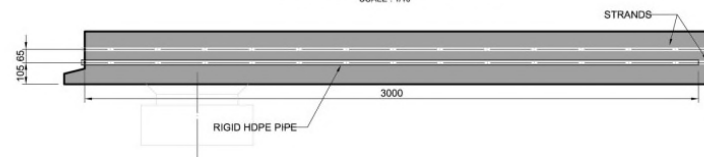
- STRAND
- STRAND WITH RIGID HDPE PIPE

SECTION

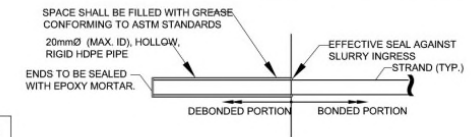
- 7 PLY STRAND OF 15.2mmØ LOW RELAXATION STRANDS.
- 20mmØ (MAX. ID), HOLLOW, RIGID HDPE PIPE. ENDS TO BE SEALED WITH EPOXY MORTAR.

LONGITUDINAL SECTION

SCALE: 1/10



TYPICAL DETAIL OF DEBONDED STRAND



NOTE :

1. MIN. CONCRETE STRENGTH AT TRANSFER TO BE 36 MPa. RELEASE OF STRANDS AT TRANSFER TO BE DONE IN GRADUAL, CONTROLLED, MANNER UNIFORMLY THROUGH OUT THE CROSS-SECTION OF U-BEAM
2. THE JACKING FORCE IN EACH STRAND SHALL 195.30 KN.

NOTE :

- CONCRETE GRADE DECK : $f_c = 45$ MPa ON CYLINDER
- REINFORCEMENT YIELD STRENGTH : $f_y = 414$ MPa
- CONCRETE COVER : $c = 50$ mm.

REVISION DATE DESCRIPTION DRAWN CHECKED APPROVED 01 5/15/2009 General Update F. Peberge J. Herguais A. Cheikh 00 4/15/2009 First Issue F. Peberge J. Herguais A. Cheikh			CLIENT: 中国铁建	CONSULTANT: SYSTRA 5, Avenue du Coq 75009 Paris TEL : 01 40 16 61 37	DRAWN : F. Peberge CHECKED : J. Herguais APPROVED : A. Cheikh PROJECT MANAGER : M. Kashari	STATUS: DETAIL DESIGN DATE: 4/15/2009 FORMAT: A1 - A3 SCALE:	PROJECT: AL MASHAAER AL MUGADDASSAH CIVIL WORK TITLE: VIADUCT SUPERSTRUCTURE TYPICAL SPAN 25m PRESTRESSING LAYOUT DRAWING NO: MMMP-DD-DWG-CWK-VDCT-SYSTRA-10-004 REV. X
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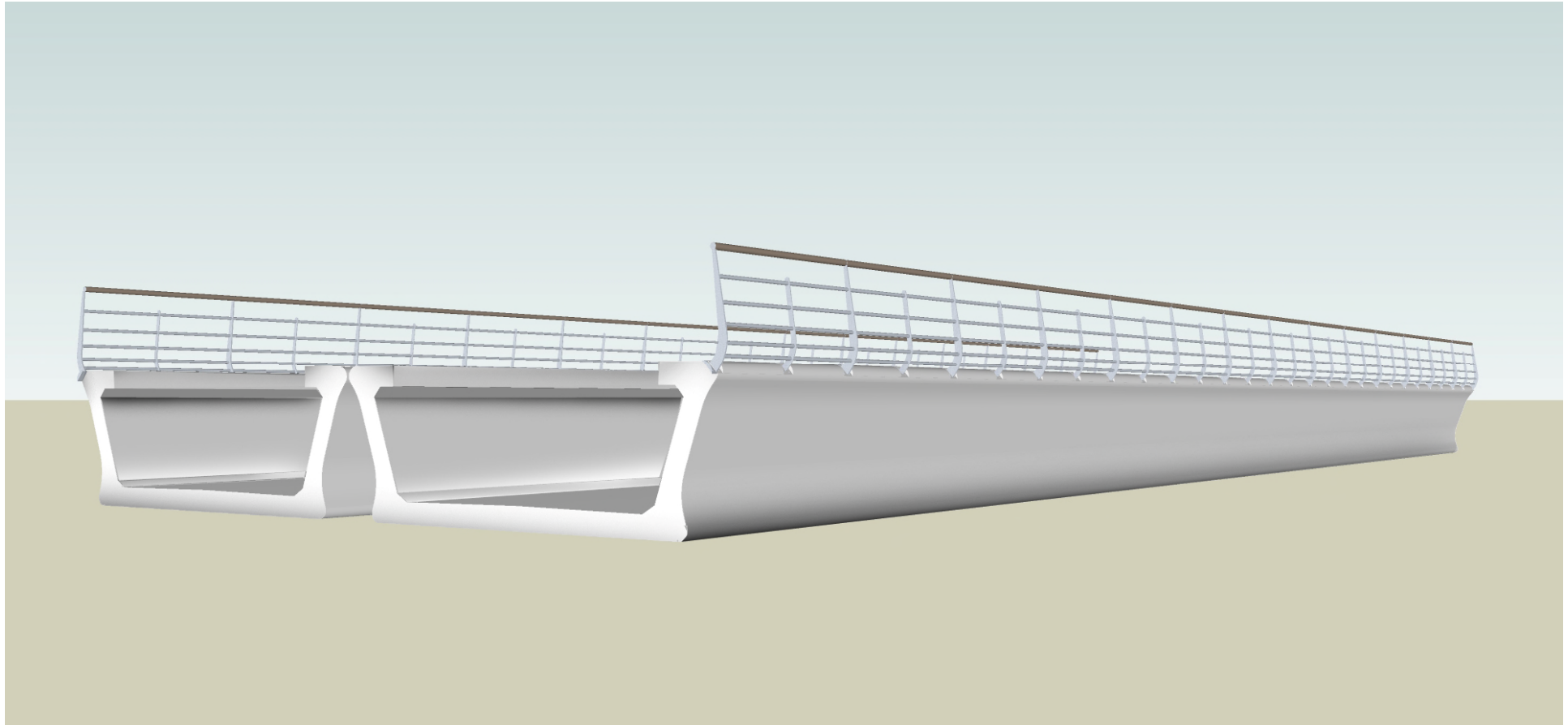




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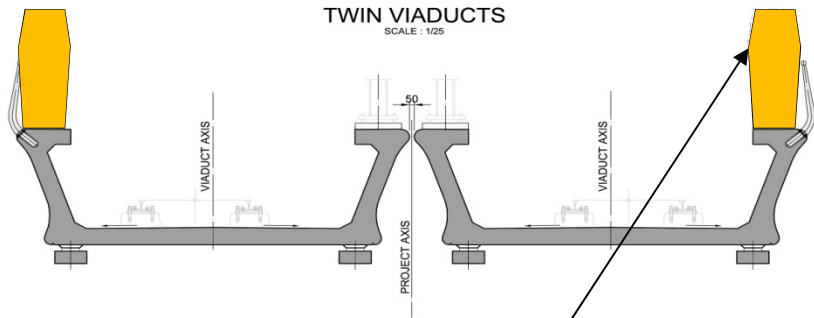


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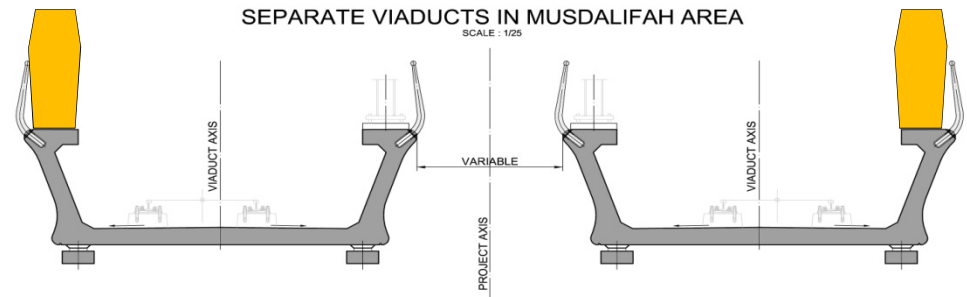
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VIADUCT EQUIPMENT



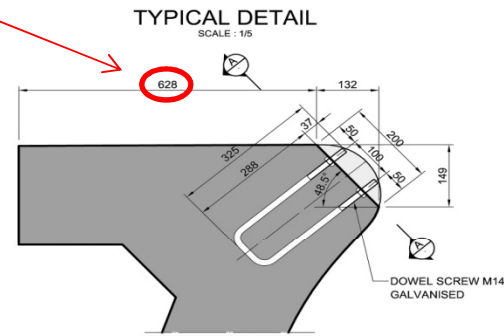
TWIN VIADUCTS
SCALE : 1/25



SEPARATE VIADUCTS IN MUSDALIFAH AREA
SCALE : 1/25

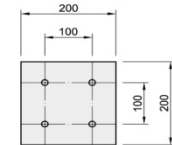
NFPA EXIT GAUGE

628 mm

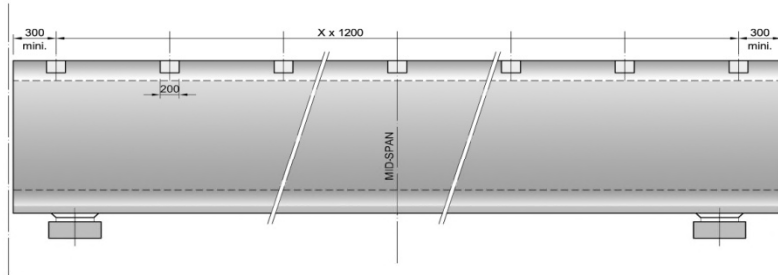


TYPICAL DETAIL
SCALE : 1/5

VIEW A-A
SCALE : 1/5



TYPICAL ELEVATION
SCALE : 1/25



NOTE :
CONCRETE GRADE DECK : $f_c = 45 \text{ MPa}$ ON CYLINDER
REINFORCEMENT YIELD STRENGTH : $f_y = 414 \text{ MPa}$
CONCRETE COVER : $c = 50 \text{ mm}$.

THE DRAWING IS THE PROPERTY OF SYSTRA AND NOT BE LOANED	REVISION	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED	CLIENT:	CONSULTANT:	DESIGNER:	DRAWN :	STATUS:	PROJECT:			
	00	5/15/2009	First Issue	F. Peberge	J. Herguais	A. Cheikh	中国铁建		5, Avenue du Coq 75009 Paris TEL : 01 40 16 61 37	F. Peberge	DETAIL DESIGN	AL MASHAER AL MUGADASSAH CIVIL WORK			
															TITLE:
															DRAWING NO. MMMP-DD-DWG-CWK-VDCT-SYSTRA-10-111
												REV. X			



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Site Pictures



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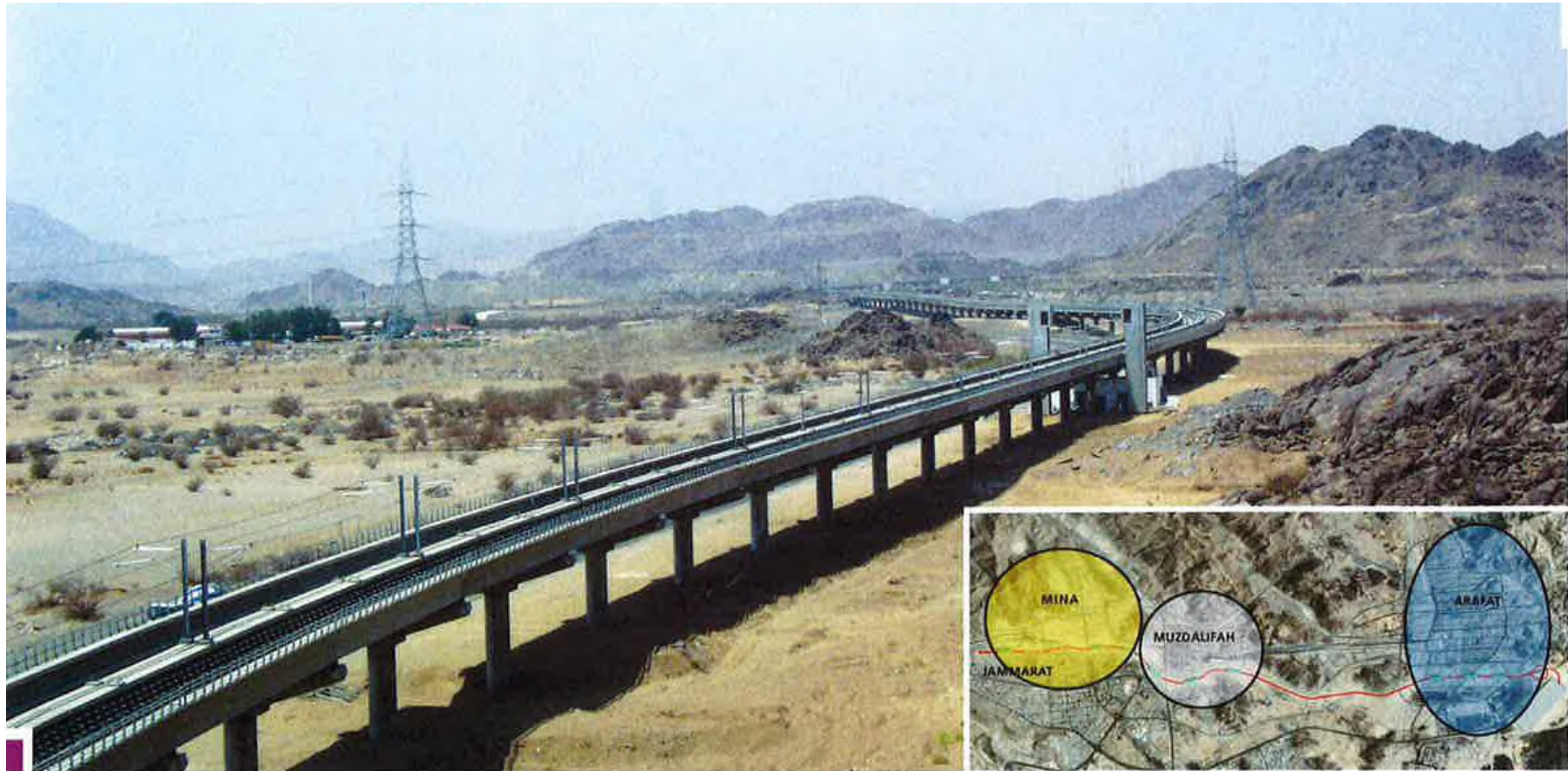


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GENERAL VIEW OF TYPICAL VIADUCT



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GENERAL VIEW OF TYPICAL VIADUCT



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SPECIAL BRIDGES



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ARAFAT1 SPECIAL BRIDGE



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30.10.2010 21:23



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STATIONS

High capacity: 3000/5 minutes

Safe:

- *Open,*
- *low occupation density,*
- *evacuation,*
- *control,*
- *Platform area, Waiting area,*
- *separate boarding and alighting platforms,*
- *Double row PSD,*
- *No opposite or crossing flow,*

Easy, for construction and use

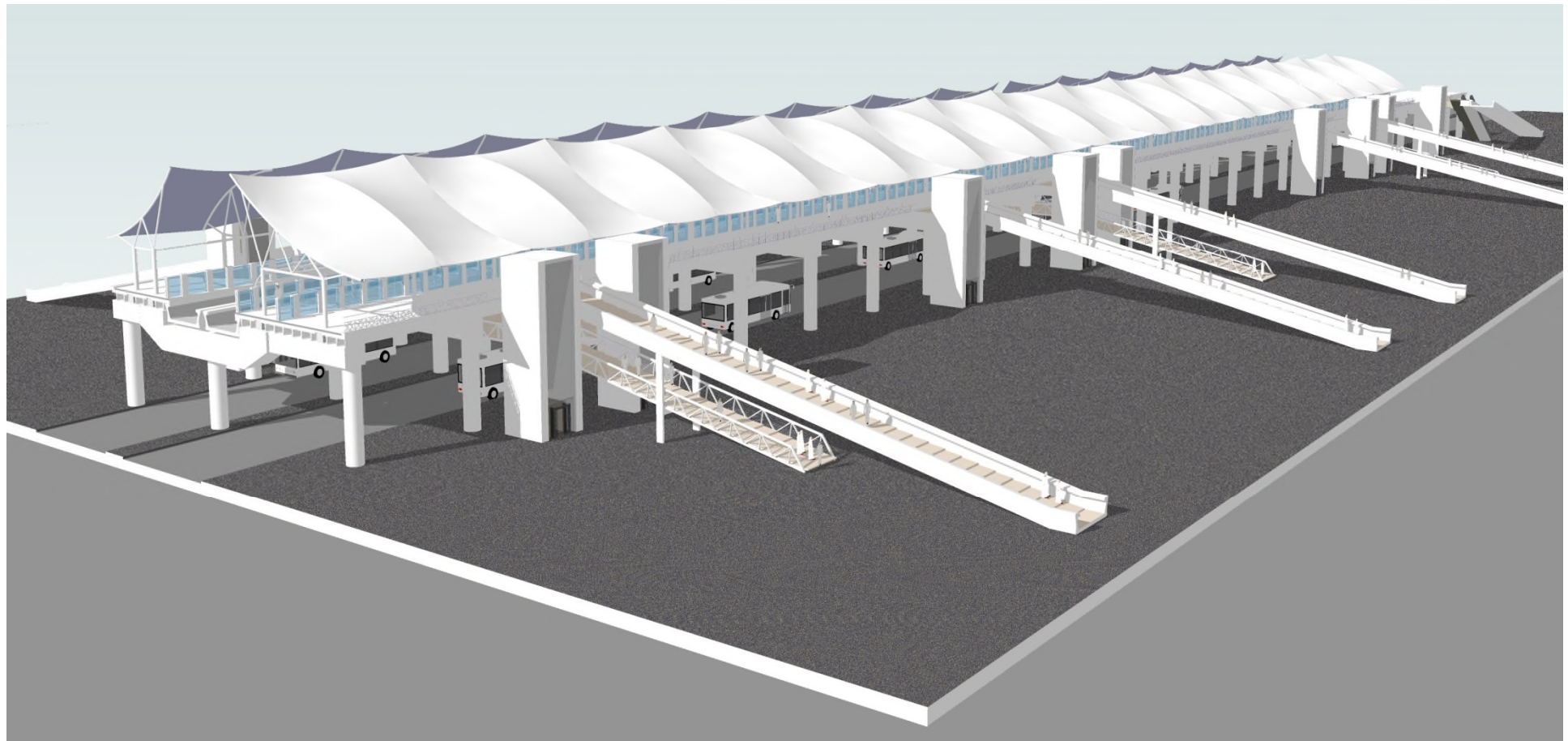




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PLATFORM LEVEL
11.00 M

PLATFORM LEVEL
15.60 M

ARAFAT 1
NORTH ELEVATION



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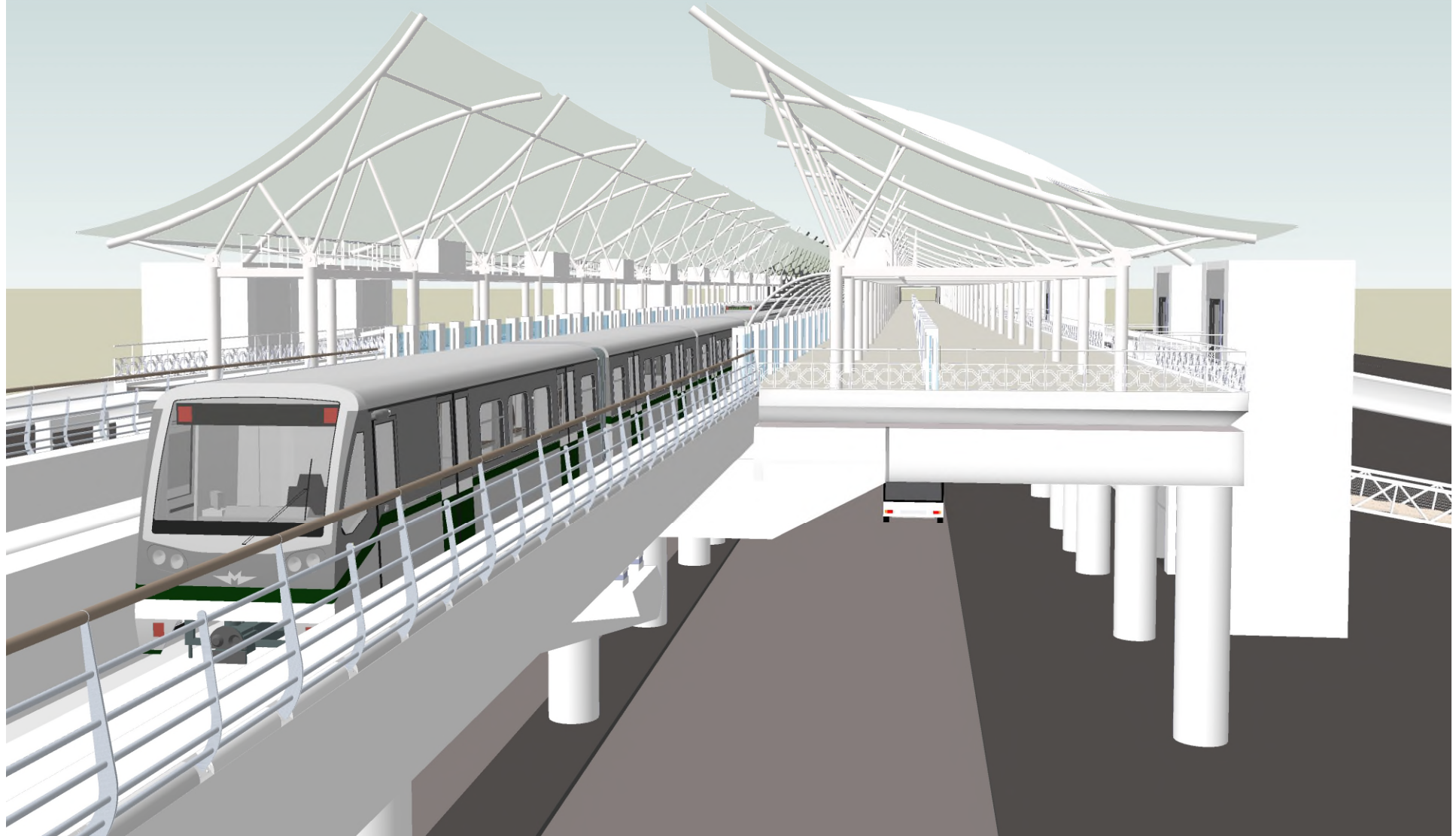




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RAMPS

Particular characteristic of the stations

Step length: 1,5 m,

Step slope : 7%

Step height: 14 cm



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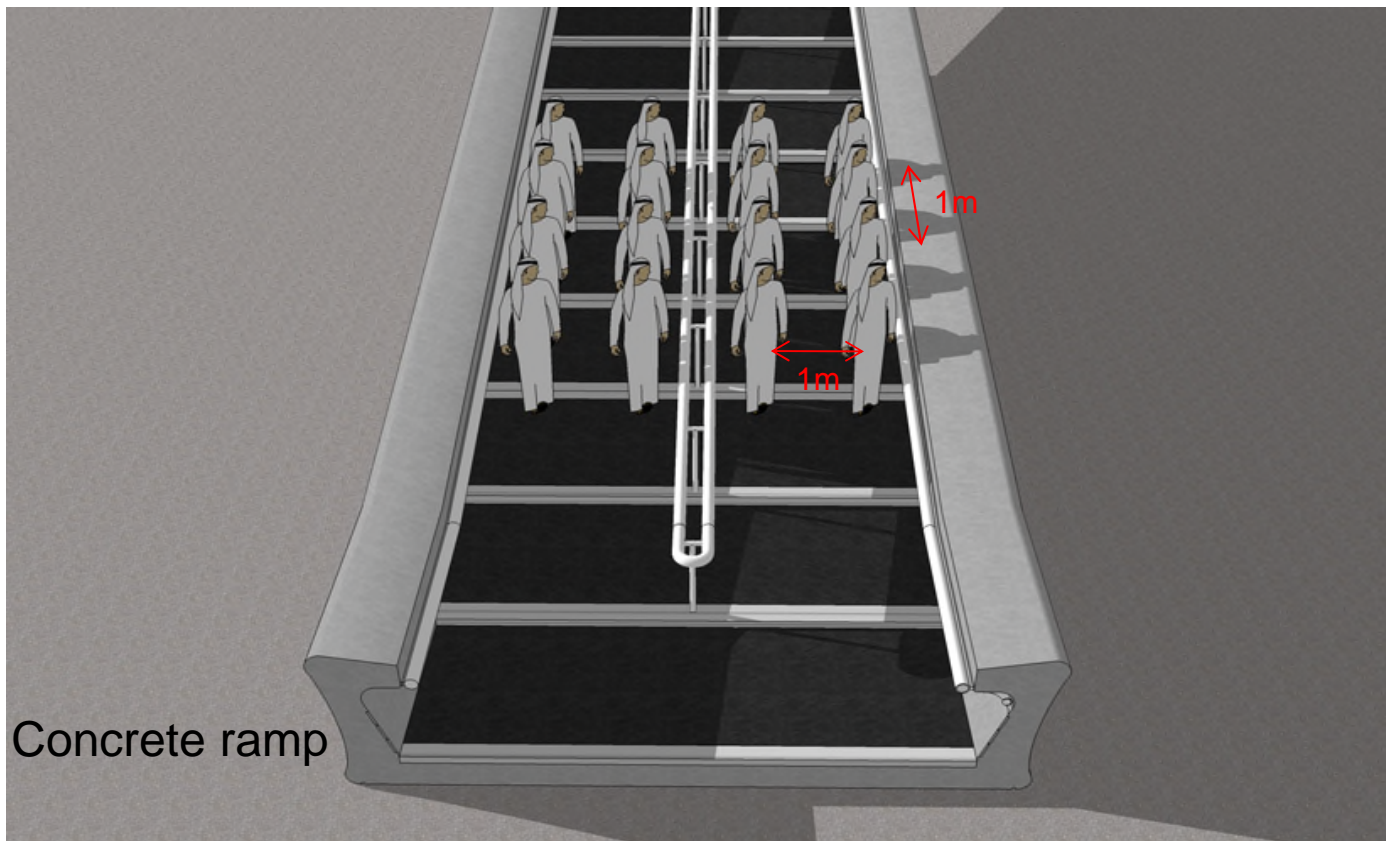


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During the progress of a group of pilgrims, the colour differentiated step nosing are always visible, limiting the risk of falling. The average density of people using the ramps, under normal operating conditions will leave an **average interval between persons of 1m**. This allows each user to move without being surprised by unexpected obstacles.



Concrete ramp











Ramps capacity

Occupation Density: 1 P/m²

3000 p / 6min by 6 ramps

--> 500 p / 6min by one ramp

Speed :

Assumption for MMMP Project : 0.5 m/s = 30 m/min

For reference and information:

- ✓ Quick walk speed : 1,5 to 2 m/s
- ✓ Normal walk speed : 1m/s (current value used in urban design)
- ✓ Disabled and old people : 0.6 m/s
- ✓ NFPA (5.5.6.3.1.4) for Metro : 0.63 m/s





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FOOTBRIDGES

Constructed under the station to avoid road crossing



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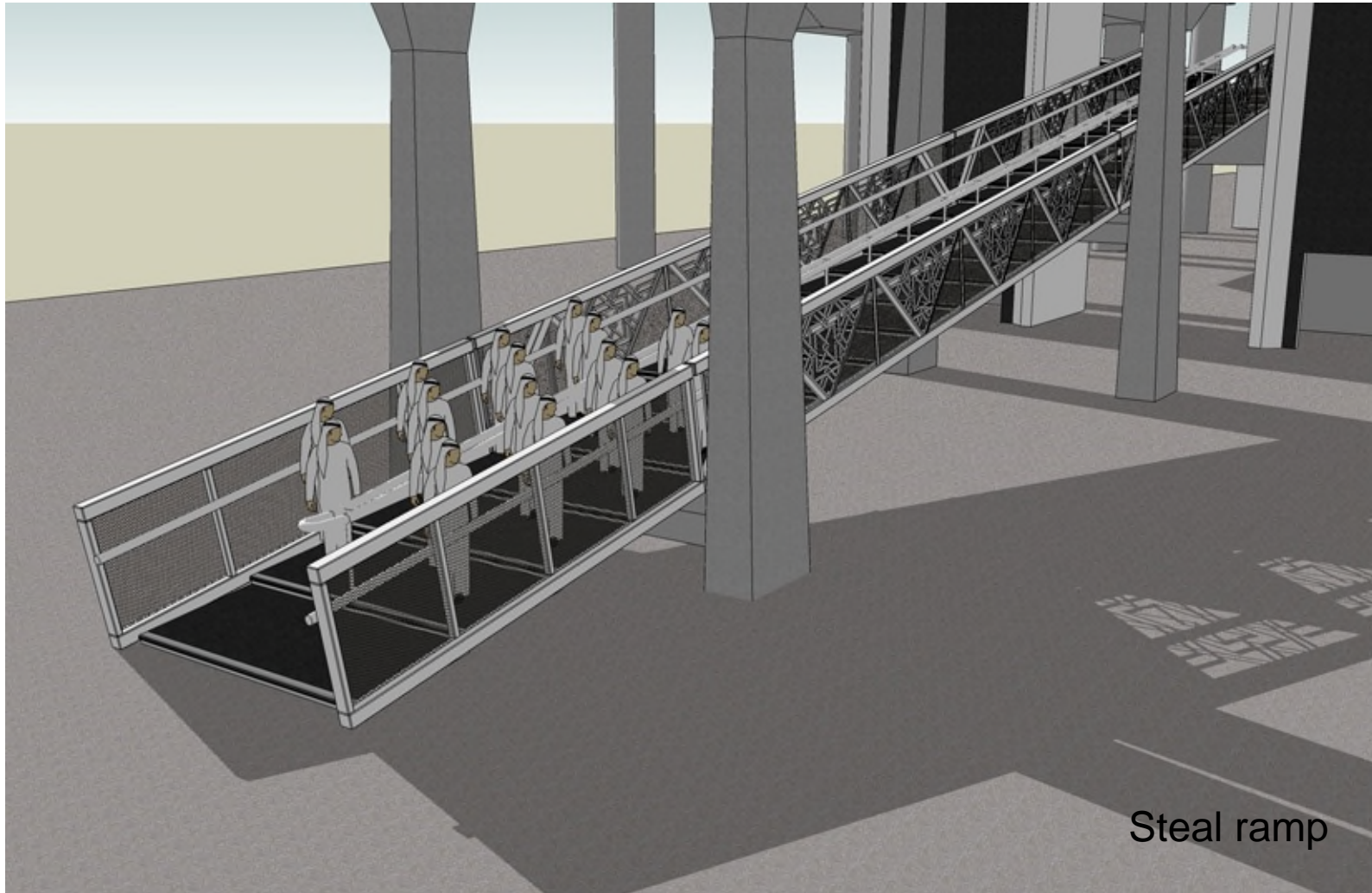




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Steel ramp



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Human flow management

2 types of flows, which have to be totally separated, to permit a safe operation:

1/. People going on the platform to board the train

- 3000 people/5 minutes
- 6 concrete ramps on each side of stations (500 people per ramp)
- 1 lift per concrete ramp (10% of disabled – 50 people per lift)

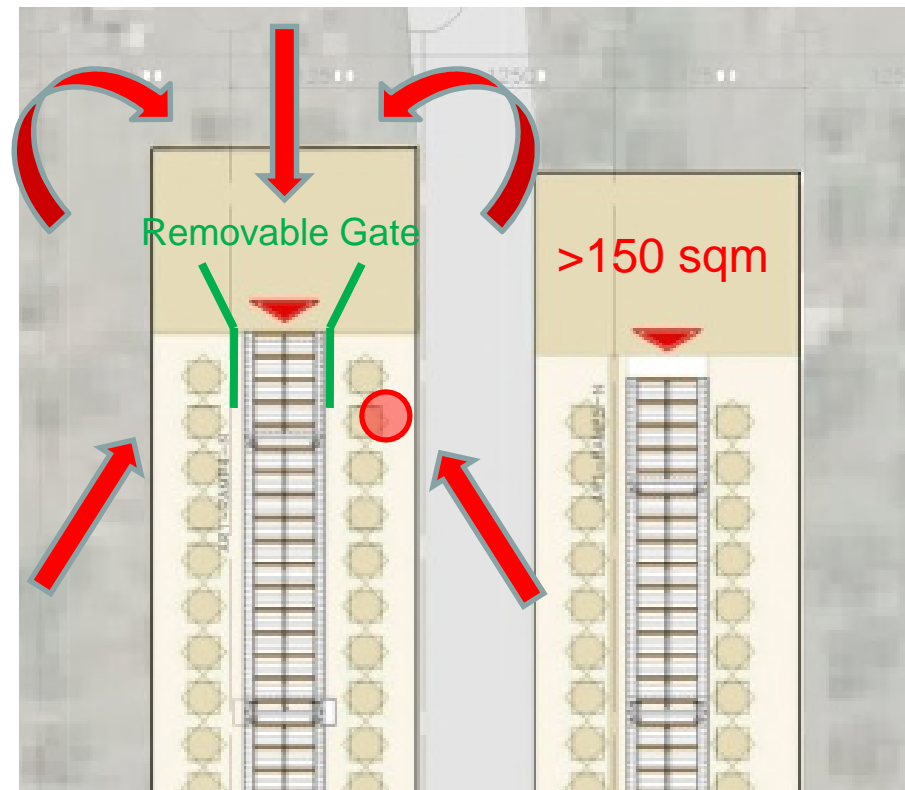
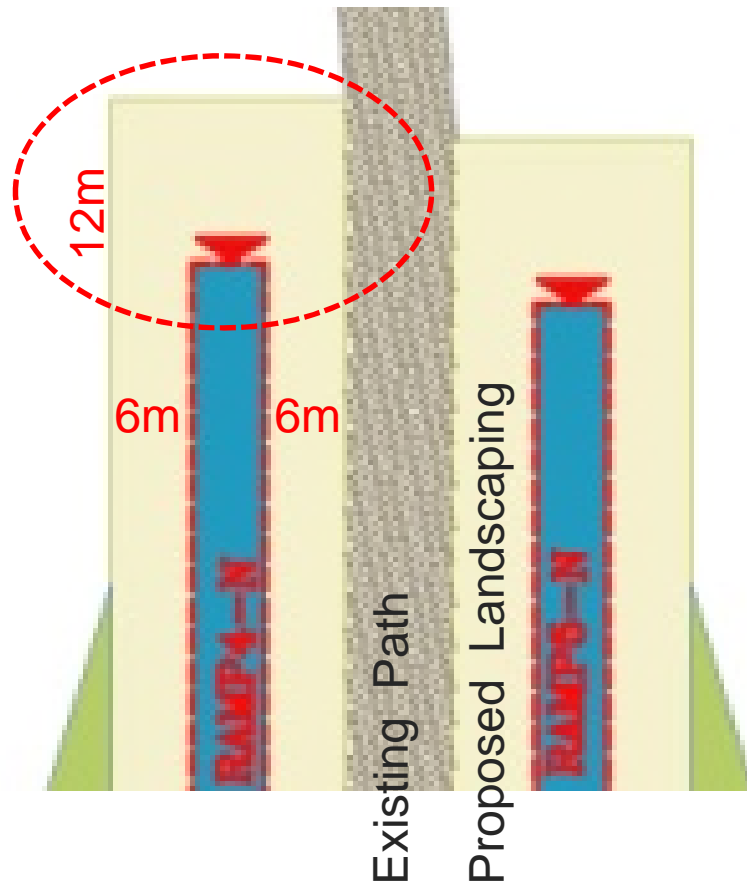
2/. People crossing under the station located above roads

- 1500 people (50% of total number)
- 3 steel footbridges per station,
- 2 lift per steel footbridge (10% of disabled – 50 people per lift)





GROUPING AREA DETAILS





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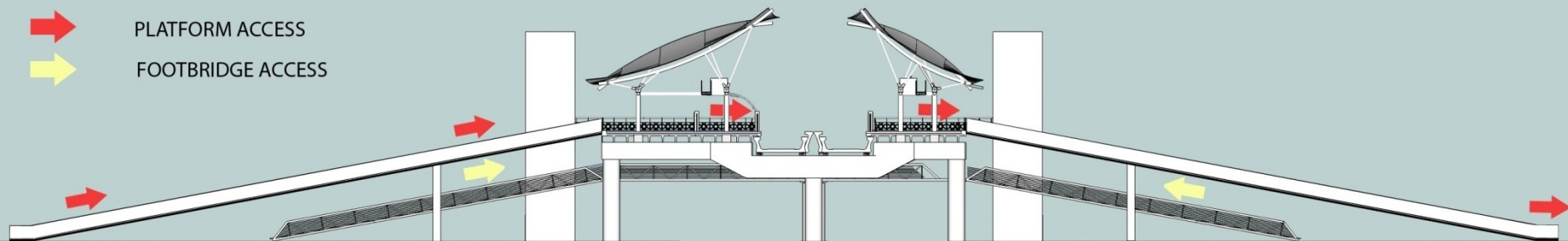
TRANSVERSE SECTION - ARAFAT



PLATFORM ACCESS



FOOTBRIDGE ACCESS



DEPARTURE PLATFORM



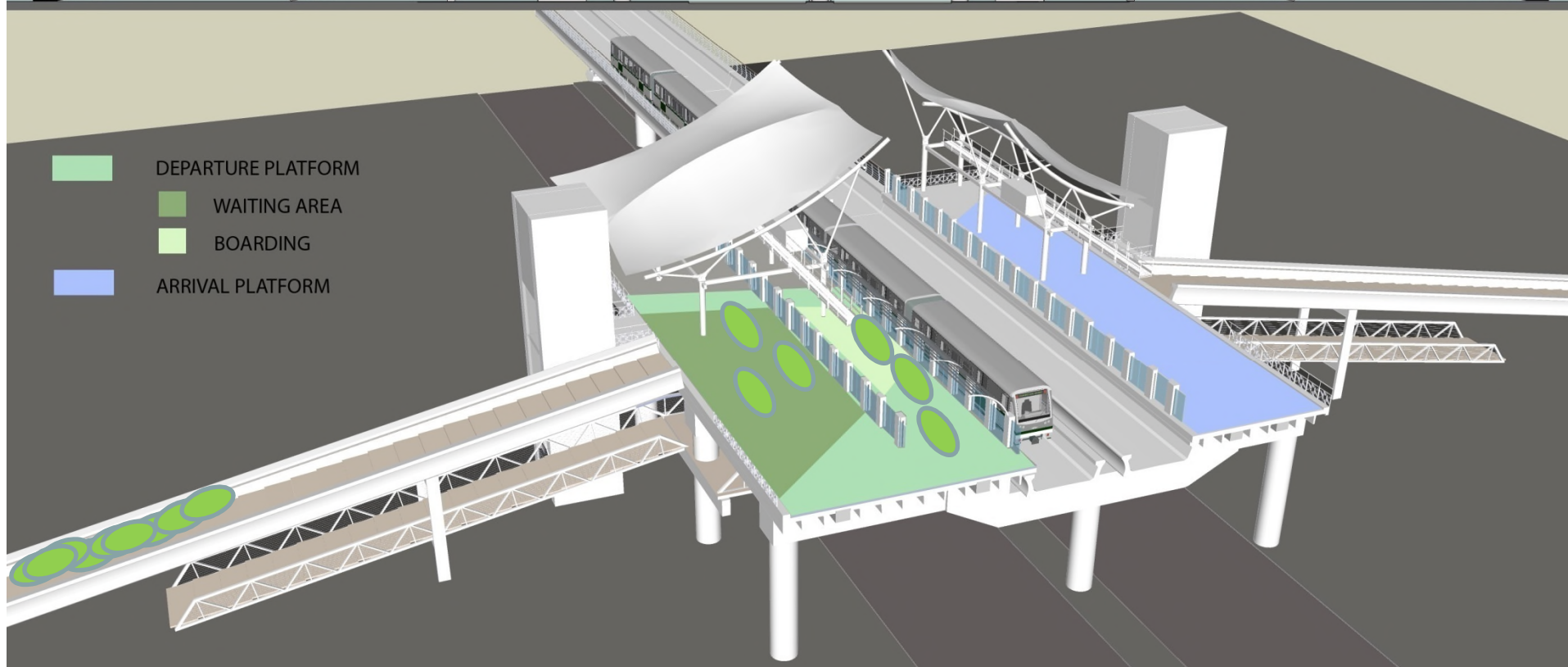
WAITING AREA



BOARDING



ARRIVAL PLATFORM



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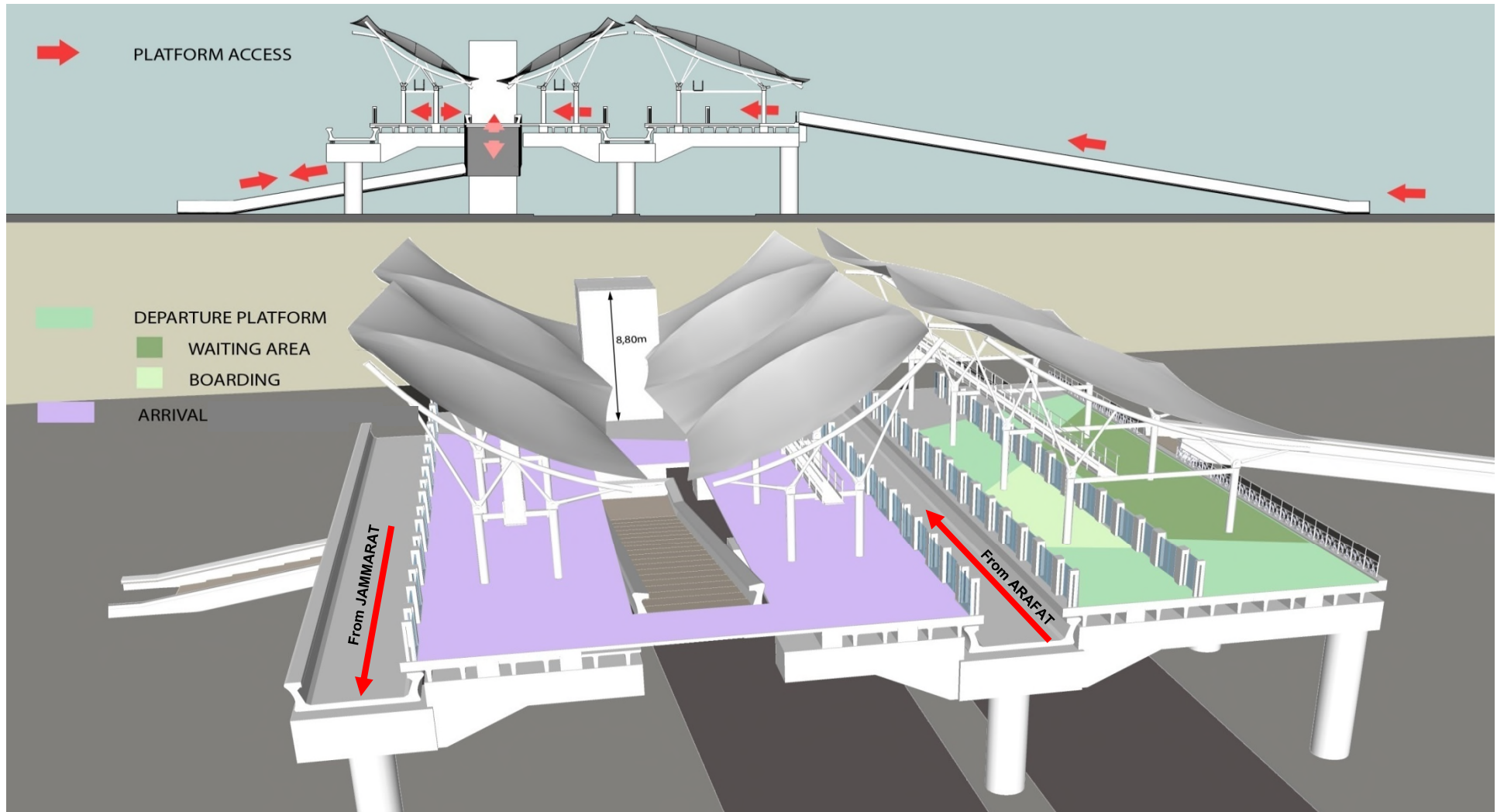


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TRANSVERSE SECTION - MUZDALIFAH



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المشروع القطار للمشاعر المقدسه



Development Commission of
Makkah Al Mukarramah,
Al Madinah Al Munawwarah and
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1-4: Environmental Insertion

- *TENTS*
- *OPEN ARCHITECTURE*
- *RAMPS*



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09.01.2011 15:22



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29.10.2010 21:01



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1-5: Design and Construction



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Designers

1-SYSTRA:

- *Preliminary Design,*
- *Specifications,*
- *Tender Documents,*
- *Civil Works Detailed Design,*
- *Track works Detailed Design*



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2-Khatib And Alami:

Building designer, site services

3-ATKINS:

System Main Consultant

4-Siemens: Power

5-Thales: Signalling

6-Westinghouse: PSD

7-Dar Al Handassah: Work supervisor



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Construction

The project was awarded as an EPC, contract to CRCC: Chinese Railway Construction Consortium (the Contractor)

COST: 1,7 mld usd,

95 M usd/kM

19 Months, Prefabrication, 24h/24 site works, Simultaneous fronts,



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Cost Break Down

- *Viaduct: 15%*
- *Track: 4%,*
- *Stations: 6,6%,*
- *Depot:14%,*
- *Rolling Stock: 27%,*
- *Power supply: 6,3%, + 2% catenary*
- *SEC Electricity works: 5%,*
- *Earth works: 5%,*
- *PSD: 2,9%*





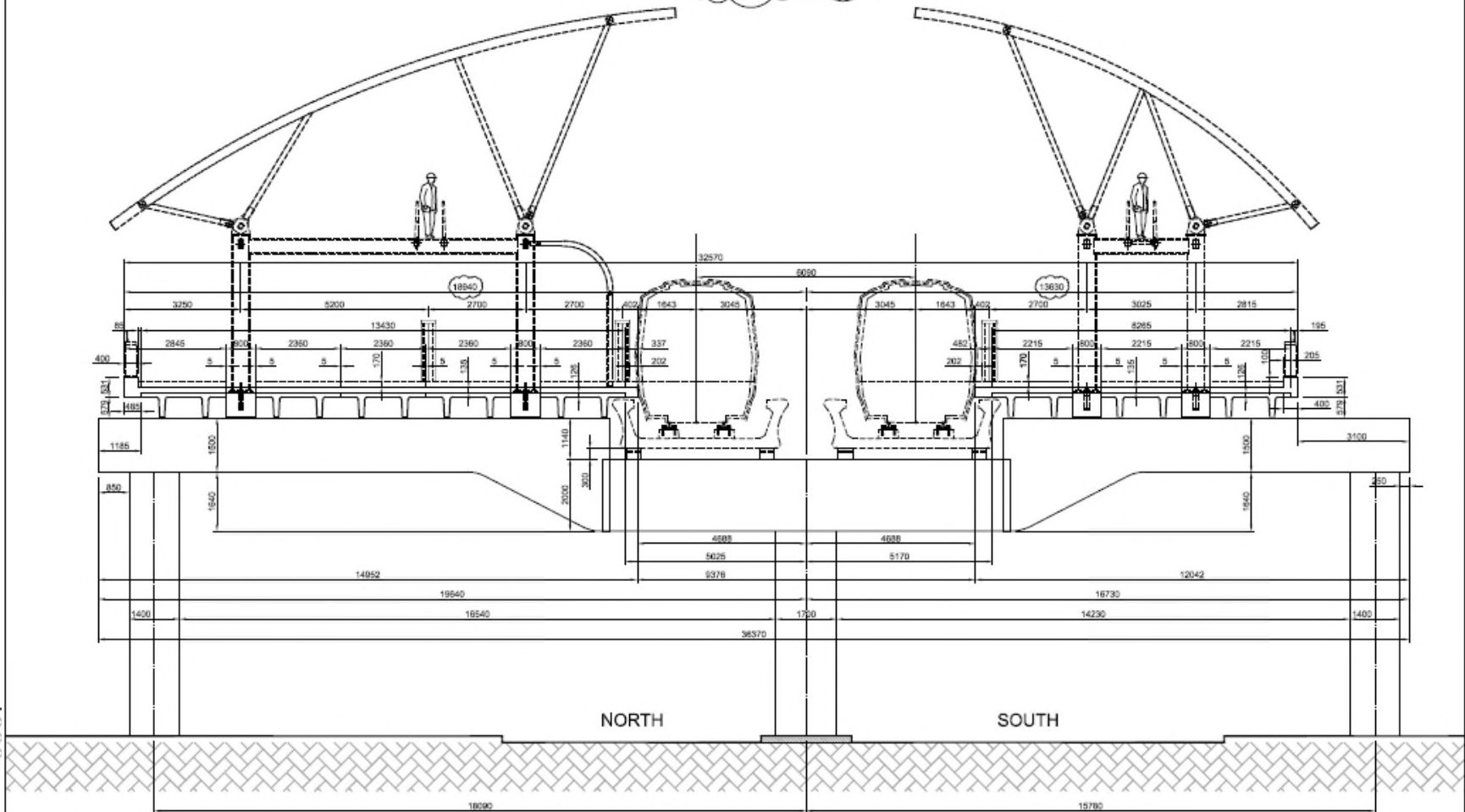
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المشروع القطار للمشاعر المقدسه

TYPICAL CROSS SECTION

SCALE: 1/50



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SYSTRA AND IRECC

REV	DATE	DESCRIPTION	BY	CHKD	APPVED
01	10/02/09	Issued	G. Bontemps	A. Chelikh	M. Kasher
02	10/02/09	Change of C level to the south of the	G. Bontemps	A. Chelikh	M. Kasher
03	10/02/09	Final Issue	G. Bontemps	A. Chelikh	M. Kasher



CLIENT:

CONSULTANT:



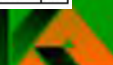

SYSTRA
5, Avenue du Coq
75009 Paris
TEL: 33 1 40 16 61 37

DRAWN: G. Bontemps	STATUS: DETAIL DESIGN
CHECKED: D. Chelikh	DATE: 4/10/2009
APPROVED: A. Chelikh	PURPAT: A1 - A3
PROJECT MANAGER: M. Kasher	SCALE: 1/50

PROJECT: AL MASHAAER AL MUGADASSAH CIVIL WORK	REV: 02
TITLE: STRUCTURAL ARAFAT 1 STATION TYPICAL TRANSVERSE SECTION	
DRAWING NO.: MMMP-DD-DWG-CWK-STAT-SYSTRA-41-010	



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METRO PROJECT STUDY

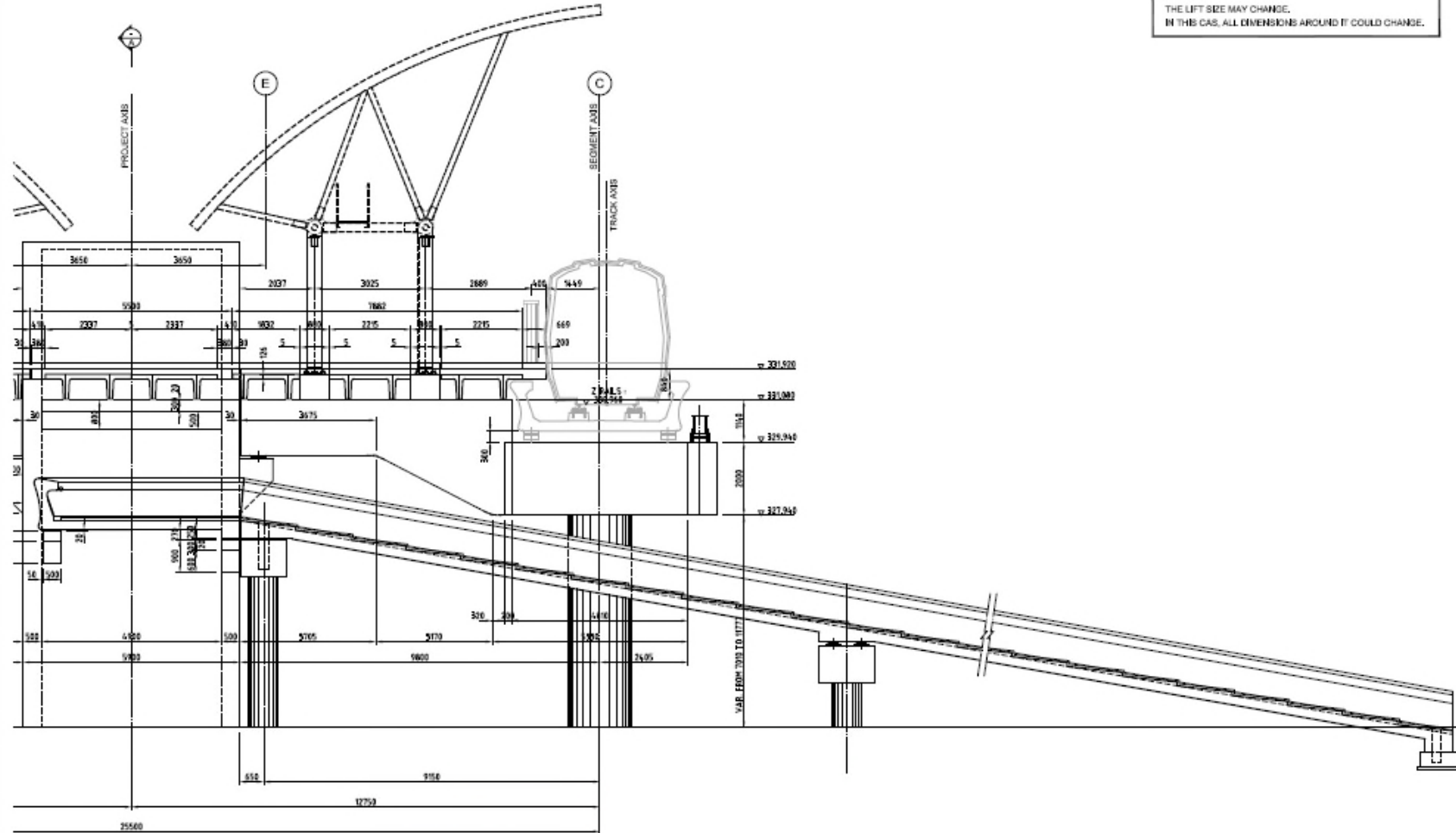
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TRANSVERSAL SECTION B-B

SCALE: 1/50

NOTE

THE LIFT SIZE MAY CHANGE.
IN THIS CAS, ALL DIMENSIONS AROUND IT COULD CHANGE.



REVISION	DATE	DESCRIPTION	DESIGNER	CHECKED	APPROVED
01	2010/02/09	General up Date	G. Georges	G. Chahant	Ph. Vahedi
02	2011/05/09	Modification	G. Georges	G. Chahant	Ph. Vahedi
03	2012/05/09	Final Issue	G. Georges	G. Chahant	Ph. Vahedi



CONSULTANT:




DESIGNER:



5, Avenue du Coq
75009 Paris
TEL : 01 40 18 61 37

DRAWN: G. Georges	STATUS: DETAIL DESIGN
CHECKED: D. Chahant	DATE: 5/7/2009
APPROVED: A. Chahant	FORMAT: A1 - A3
PROJECT MANAGER: M. Khashani	SCALE: 1/50

PROJECT: AL MASHAAER AL MUGADASSAH CIVIL WORK	TITLE: STRUCTURAL MUZDALIFAH 1 STATION TRANSVERSE SECTION B-B SOUTH PART
CDRAWING NO.: MMMP-DD-DWG-CWK-STAT-SYSTRA-44-011	
REV.: 02	



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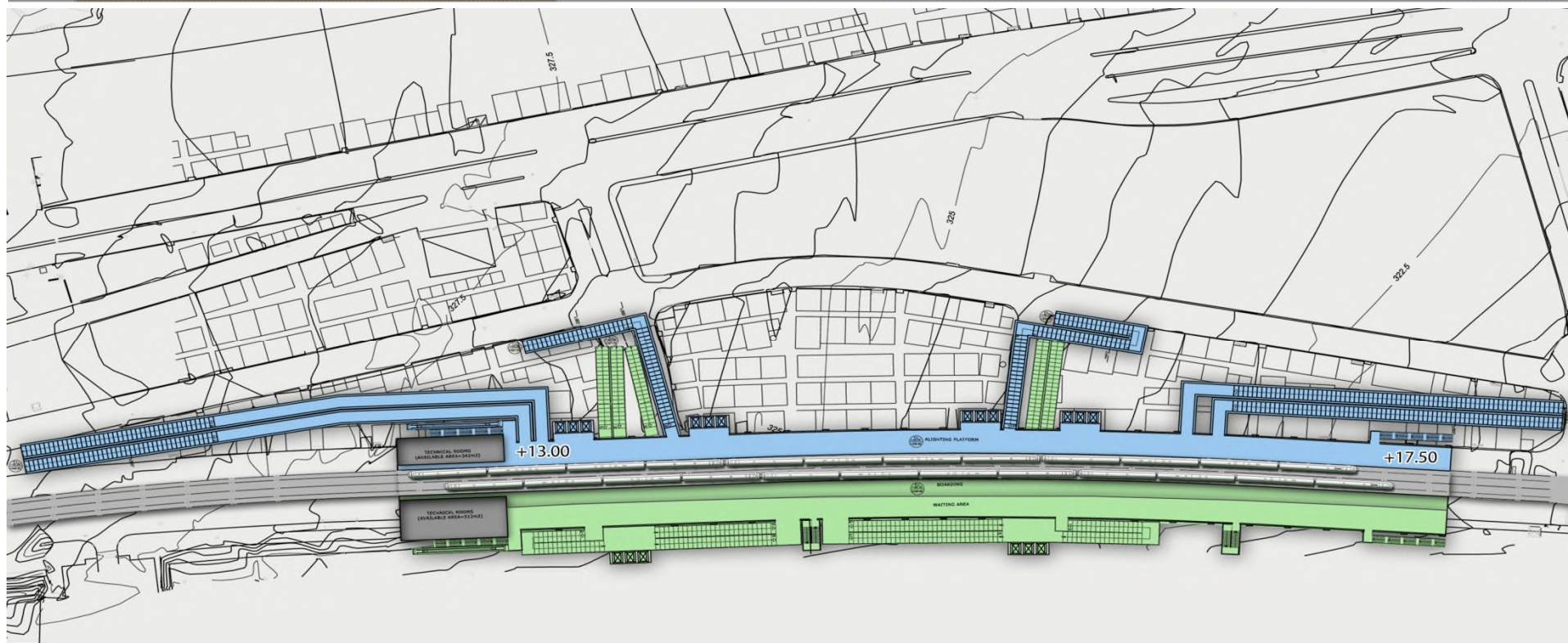




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MINA 1
PLATFORM LEVEL PLAN



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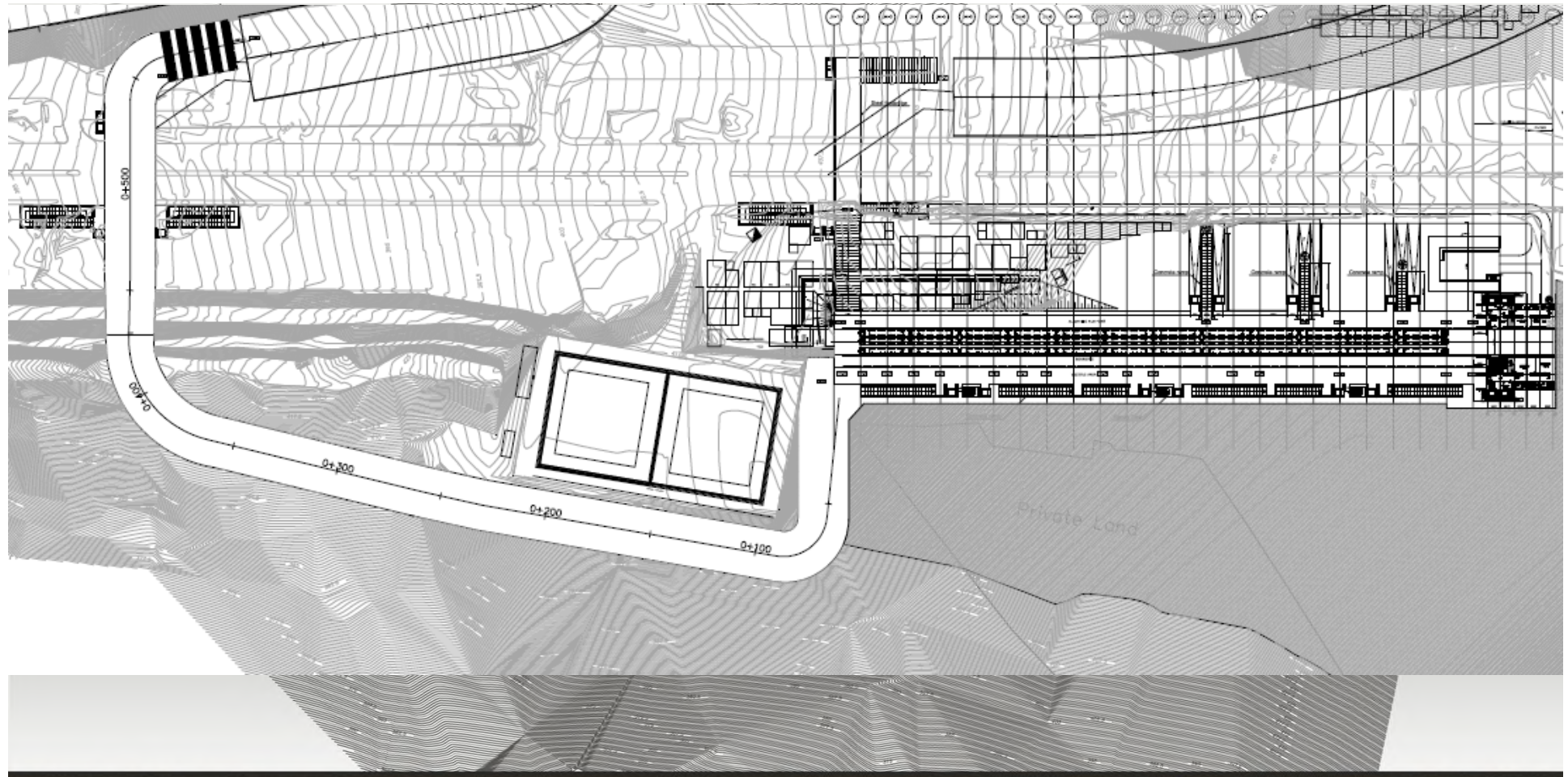




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JAMMARAT
PLATFORM LEVEL PLAN



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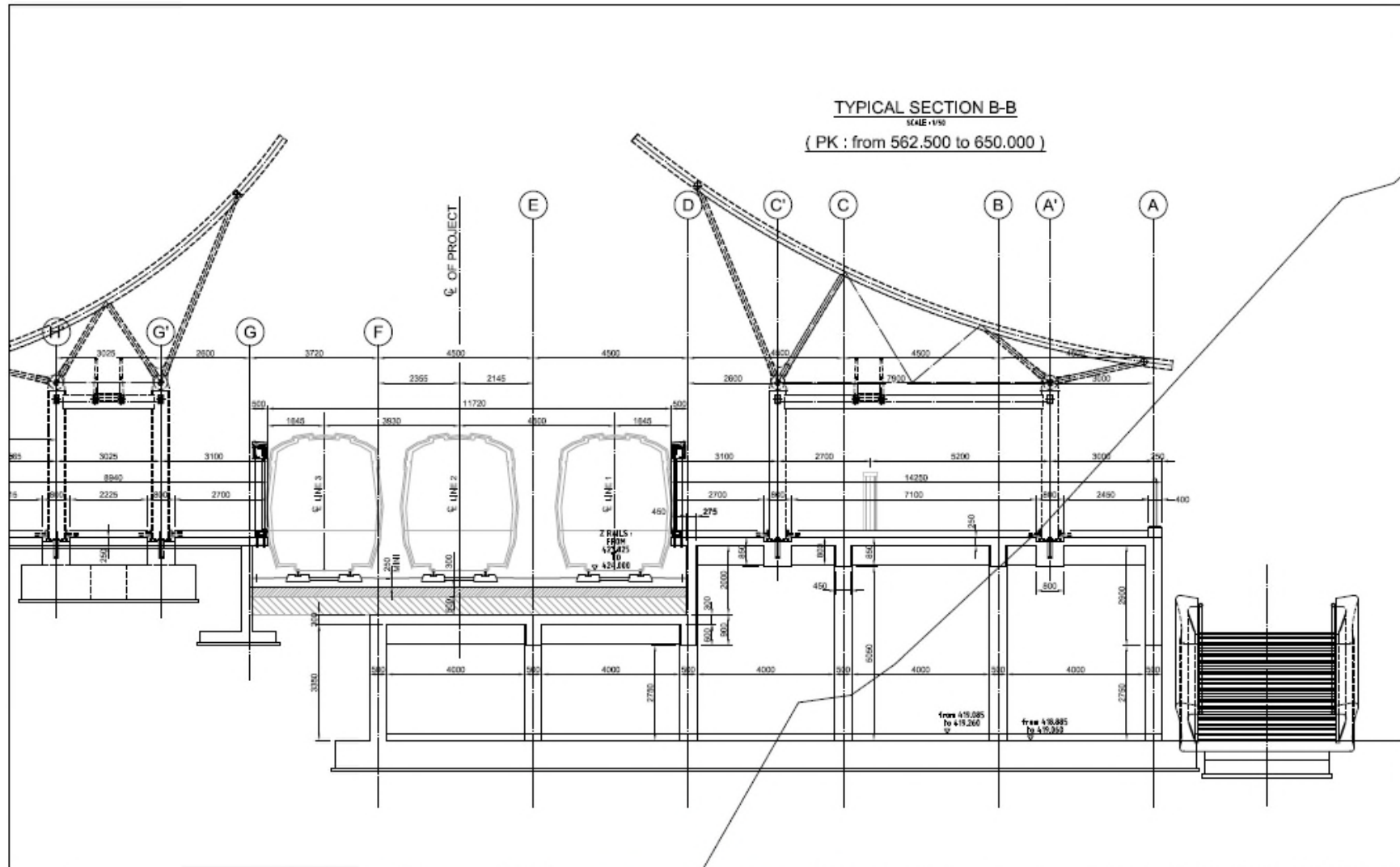




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DESIGNED: G. Georges CHECKED: D. Chaikant APPROVED: A. Cheikh	DATE: 9/18/2009	PROJECT: AL MASHAAER AL MUGADASSAH	TITLE: STRUCTURAL JAMARAT STATION TRANSVERSE SECTION B-B SOUTH PART	DRAWING NO.: MMMP-DD-DWG-CWK-STAT-SYSTRA-49-011	REV: 00	



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OPENING

6th November 2010



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STAGES and KEY DURATIONS



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3-1 STAGES

- 1-Feasibility studies: 2006-2007 Albeeah Egyptian
 - 2-Preliminary Design, Tender documents, Specifications:
Jan to July 2008 (**7 Months**)
 - 3-Tendering, Contractor selection, **3 Month**: Oct to Dec
2008
 - 3-Construction: March 2009 to Oct 2010: **20 Months**
 - 4- Detailed Design (Parallel to construction): Civil Works
+ Track Detailed Design: Main: **10 Months**, Divers and
modifications: **8 Months: Systra.**
- 14000** drawings, Averages 60 staff mobilized (up to 160)





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- Political Decision.
- Strong management (Owner, Designer, Contractor).
- Being practical
- Team Motivation.
- Planning.
- Procedures



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2- PROJECT MANAGEMENT AND **NUISANCES** TO BE AVOIDED

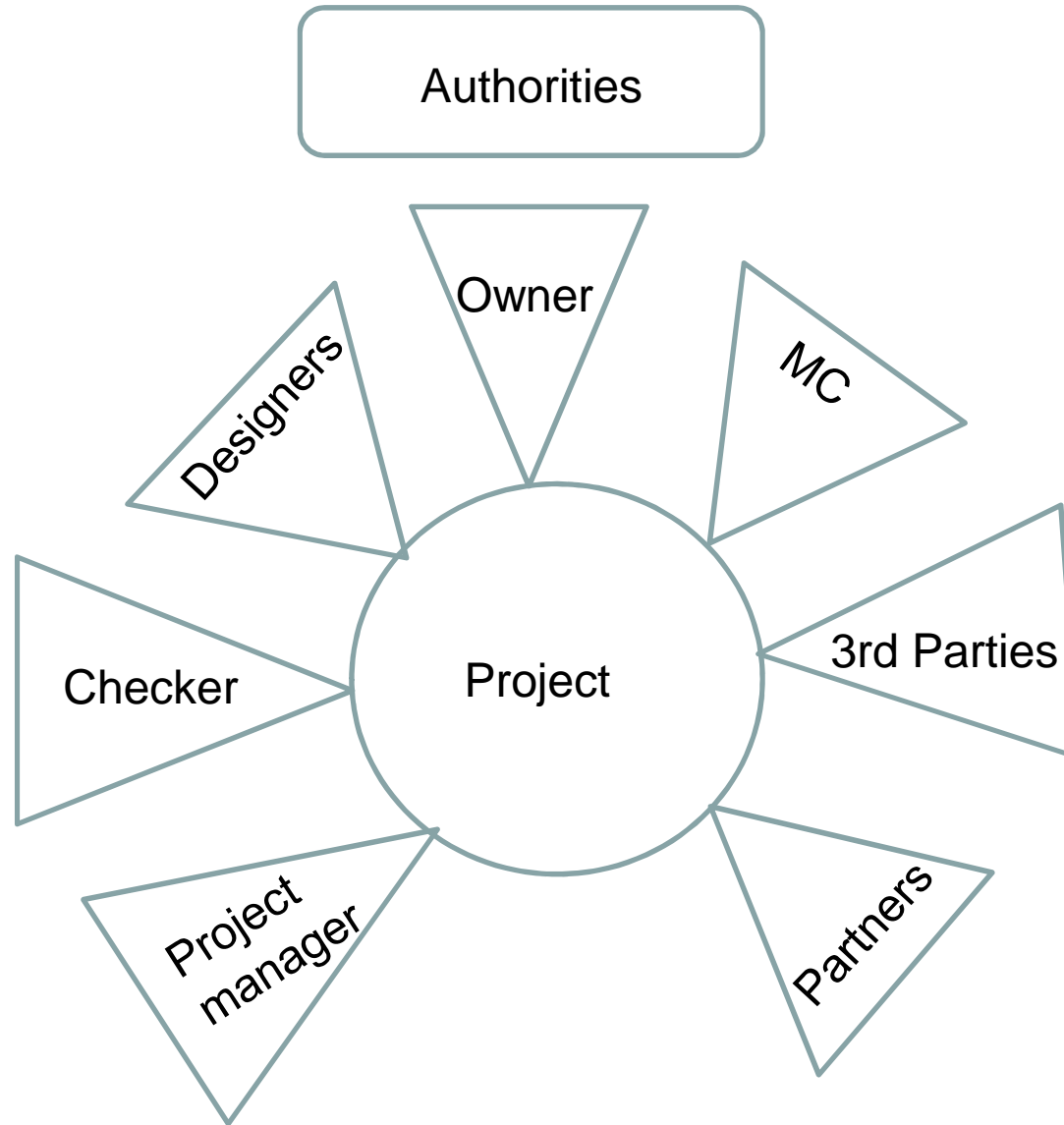


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Authorities

Relevant priorities

Budget

Attribution of power and responsibility

Owner

Being practical

Ask the needs, not less, not more

Apply authority

Feasible but TIGHT planning

Due payment

Trust the consultants

MC

Relevant Scope of Works

Comment and approval, process & Schedule

Short Deliverable list

Condensed CBS

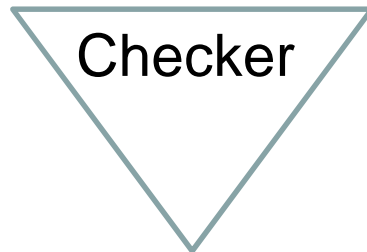
Clear planning

Do Respecting the planning





Interest of the Project



Relevant comments, in due time
Stop late enhancement

6 main points

- Sens of honesty and justice,
- We are technicians, not politicians,
- Avoid Useless works,
- Avoid Complicated DL and CBS
- Avoid Deviation from Planning
- Avoid Mixing Basic & Detailed Design



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THANK YOU



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