ÜSKÜDAR-ÜMRANİYE-ÇEKMEKÖY METRO
CIVIL AND ELECTROMECHANICAL WORKS

TBM Entry Works Under Sea Level Near Istanbul Bosphorus
TURKEY

7th of Nov. 2018
Barış Özcan - Coordinator of Design & Engineering
1. DOĞUŞ CONSTRUCTION
DOĞUŞ CONSTRUCTION AND TRADE INC.

- Doğuş Construction ranks among the most reputable construction companies with mega-infrastructure projects since its establishment in 1951

- Doğuş Construction, which has been listed since year 2003 in the “The Top 250 International Contractors” list that is determined every year by Engineering News Record (ENR) based on the previous year’s foreign project revenues of the world's leading contracting firms, rose to 124th place in 2017 and carried its position to the 14th place within Turkish firms.

- “Best Place to Work” and “Occupational Health and Occupational Safety” awards in 2014 and 2017.

- More than 208 ongoing and completed projects amounting up to USD 20,6 bn in value,

  - 21 Dams and HEPPs capable of producing 3350 MW of electricity
  - 1.515 km Roads
  - 200 km Subways and Tunnels
  - 43 km Bridges and Viaducts
  - 3.000,000 m² Buildings
  - Environmental Projects, Ports, Marinas, Irrigation Projects, Sewage Systems, Office Buildings, Shopping and Leisure Centres, Residential and Industrial Buildings

- 12.078 Employees (by the end of August 2018 including subcontractors)
REGIONAL COVERAGE

- Active offices in Qatar, Oman, Bulgaria, Ukraine, Morocco, Kazakhstan, Libya, Saudi Arabia, India, Dubai and Kyrgyzstan.

1. DOĞUŞ Construction & Trade Inc. Head Office (TURKEY)
2. DOĞUŞ Construction & Trade Inc. (BULGARIA)
3. DOĞUŞ Construction & Trade Inc. (DUBAI)
4. DOĞUŞ - Soma L.L.P. (INDIA)
5. DOĞUŞ Construction & Trade Inc. (KAZAKHSTAN)
6. DOĞUŞ Construction & Trade Inc. (KYRGYZSTAN)
7. DOĞUŞ Construction & Trade Inc. (LIBYA)
8. DOĞUŞ Construction & Trade Inc. (MOROCCO)
9. DOĞUŞ Construction L.L.C. (OMAN)
10. DOĞUŞ Construction L.L.C. (QATAR)
11. DOĞUŞ Construction & Trade Inc. (SAUDI ARABIA)
12. DOĞUŞ Construction & Trade Inc. (UKRAINE)

7th of Nov. 2018

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COMPLETED AND ONGOING PROJECTS

NORTHEAST EUROPE
538 Million $
Metro, Road, Motorway, Bridge and Viaduct Projects

NORTH AFRICA
2.242 Million $
Road, Motorway, Bridge, Viaduct and Building Projects

TURKEY
14.797 Million $
Metro, Railway, Road, Motorway, Bridge, Viaduct, Dam and Energy, Port, Building and other Projects

CIS, UKRAINE & INDIA
1.356 Million $
Metro, Road, Motorway, Bridge, Viaduct and Airport Projects

MIDDLE EAST
1.977 Million $
Motorway, Bridge and Viaduct Projects

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MAJOR PROJECTS IN THE LAST 10 YEARS

- Railway, Metro and Tunnels: 48%
- Road and Motorways: 24%
- Dams and Energy: 12%
- Port and Airports: 7%
- Buildings: 7%
- Treatment Plants and Other: 2%
2. ÜSKÜDAR-ÜMRANİYE-ÇEKMEKÖY METRO
ÜSKÜDAR-ÜMRANİYE-ÇEKMEKÖY METRO CIVIL & ELECTROMECHANICAL WORKS

EMPLOYER
İSTANBUL METROPOLITAN MUNICIPALITY (IBB) DEPARTMENT OF RAIL SYSTEMS ANATOLIAN SIDE RAIL SYSTEMS DIRECTORATE

ENGINEER
YUKSEL PROJECT INTERNATIONAL INC. - EMAY INTERNATIONAL ENGINEERING AND CONSULTANCY J.V.

CONTRACTOR
DOĞUŞ CONSTRUCTION AND TRADE INC.

CONTRACT VALUE
676,621,046,64 EURO

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SITE HANDOVER DATE
20 March 2012 (Under Operation Since December 2017)

FEATURES
20 km double tube tunnel (Including 2,7 kms of connection tunnels to metro car depot area, maintenance and control center

NUMBER OF STATIONS
16 stations + 1 depot area (serving for 68 trains)

NUMBER OF METRO CARS
21 trains and each has 6 cars (total 126 cars)

MAX. SPEED
80km/hour

PASSENGER CAPACITY OF THE TRAIN
AW3 Load (AW3 = 6 pas/m2) 1620 pass./train

HEADWAY
90 seconds
WHAT MAKES THE PROJECT DISTINCTIVE?

- The largest metro line awarded to sole contractor in Turkey. (Design and build, civil, track and E&M works)
- The first ever UTO metro line (unmanned train operation-GoA Level 4) in Turkey
- The first to have Platform Screen Gates System in the stations in Turkey
3. ÜSKÜDAR AREA
HISTORICAL BUILDINGS WITHIN IMPACT AREA OF THE TUNNEL

Selmanağa Mosque

Valide-i Cedid Mosque

Mihrimah Sultan Mosque

Historical Almshouse

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GEOLOGICAL LAYOUT OF ÜSKÜDAR AREA

USKUDAR STATION

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INTERFACE BETWEEN MARMARAY STATION AND ÜÜÇ ÜSKÜDAR STATION

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ÜSKÜDAR STATION - TBM ENTRY
ÜSKÜDAR STATION - TBM ENTRY

MARMARAY STATION

ÜSKÜDAR STATION

ALMSHOUSE

LINE-1

LINE-2

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PILE AND GROUTING LAYOUT
### SOIL IMPROVEMENT WORKS - ALMSHOUSE LOCATION

<table>
<thead>
<tr>
<th>Units of Drill</th>
<th>LG of Drills (m)</th>
<th>WT of Cement (kg)</th>
<th>WT of Sodium Silicate (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LINE 1</strong></td>
<td>2.325</td>
<td>366.735</td>
<td>10.323</td>
</tr>
<tr>
<td><strong>LINE 2</strong></td>
<td>2.561</td>
<td>1,056.757</td>
<td>10.567</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>4.886</td>
<td>1,423.492</td>
<td>20.890</td>
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</tbody>
</table>

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<tr>
<th>Units of Drill</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>LINE 1</strong></td>
<td>110</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LINE 2</strong></td>
<td>122</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>232</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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GROUT CORE AFTER CEMENT INJECTION
CHEMICAL POLYURETHANE INJECTION FROM INSIDE OF THE SEGMENTS
CHEMICAL POLYURETHANE INJECTION FROM INSIDE OF THE SEGMENTS
GROUTING WORKS THROUGH THE STATION PILES

LINE 1

UE-1
l=5.0m.
Aış Yok

UE-2
l=5.0m.
500 kg

UE-3
l=5.0m.
500 kg

UE-4
700 kg

UE-5
l=5.0m.
1000 kg

UE-6
l=5.0m.

UE-7
l=5.0m.
800 kg

UE-8
l=5.0m.
500 kg

UE-9
l=5.0m.
Aış Yok

UE-10
l=5.0m.
Aış Yok

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ADDITIONAL PRECAUTION - RC POOL IN THE STATION
ADDITIONAL PRECAUTION - RC POOL IN THE STATION
GROUND CONDITION AFTER BREAKTHROUGH

Cement Injection Zone

-12m.

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DRIVING THE TBM INTO THE STATION
THANKS & BEST REGARDS