• Introduction
  - How Istanbul became a global leader in rail construction
  - Our main takeaways

• Cases
  - M4 Kadikoy – Kartal
  - Marmaray
  - M9 Ataköy- İkitelli

• Challenges to building rail in Istanbul
ISTANBUL

M1A (LRT)

Year: 2000
1 line, 16km (10 miles)
ISTANBUL

M1A-M1B
M2
M3
BC1
M4

Year: 2014
5 lines, 100km (62 miles)
ISTANBUL

M1A-M1B + extension
M2
M3 + extensions
BC1
M4 + extensions
M5
M6
M7
M8
M9
M10
M11
M12
M13

Year: 2029

14 lines, 345km (214 miles)
ISTANBUL

Global Weighted Average cost/km : $210 M
Istanbul’s Weighted Average cost/km : $127 M
HOW SO FAST?

How Istanbul became a global leader in rail construction

• Background
  - Rapid growth
  - Policies encouraging public + private involvement
  - The construction sector
HOW SO CHEAP?

Our main takeaways

• Learning from the world

• Steady stream of projects

• Competition in the market
  - Cultivation of a rail construction eco-system

• Improvement of the procurement and preliminary design process
  - Procurement of the preliminary design
  - Establishment of the Rail Systems Projects Directorate
  - Evolution of Design-Bid-Build to Design-Build

• Flexibility on the agency and contractor’s side

• Adoption of technology
  - Equipment pools
  - University collaboration in innovation
  - BIM (3D models)
CASES
M4 KADIKOY – KARTAL
“flexibility”

Owner Agency: Rail Systems Directorate, Istanbul Metropolitan Municipality (IMM)
Cost: $170 M/km
Length: 21.7 km  16 stations
Speed: 3 km/year (2005-(2008)-2012)

Issues/Highlights
- Complicated timeline:
  - Major design changes and re-tendering
- Collaboration between the agency and contractors
  - Blast drilling/NATM vs. TBMs

Lessons Learned
- Better planning is essential
  - Internal re-organization of the agency
  - New procurement method
- Flexibility on the agency and the contractor’s side makes a difference
CASES
M4 KADIKOY - KARTAL

* Image by Osman Uygun from wowturkey.com
CASES
MARMARAY - BC1
“the perfect storm”

Owner Agency: Railways, Harbors and Airports Construction General Directorate (DLH)
Cost: $228 M/km
Length: 13.6km 4 stations
Speed: 1.3km/year (2004-2014)

Issues/Highlights
- EPC Turnkey contract
- Technological challenges and innovation
- Archeology
- Doubling of the time span and costs
- Extensive mitigation requirements

Lessons Learned
- Timeline should be more thoroughly considered
- Archeology requires a systematic, streamlined approach to ease communication between parties.
- Contractors should be selected based on experience in the specific contracting method and archeology
CASES
MARMARAY - BC1

* Images: courtesy of Nurettin Demir
* F. E. Strom, F. T. Lindman and J. A. Hilliker, 1902
CASES
MARMARAY - BC1

* Image: courtesy of Nurettin Demir
- The new third track - >
  - Mainline intercity and HS trains: ERTMS Level 1 system
    7 trains/dd Ankara & 3 t/dd Konya, the rest stop on the Asian side
  - Double track - >
    - Freight: ERTMS Level 1 system (12:00 am-6:00am)
    - Commuter: CBTC system
      8-15 minute headways, 142 trips/dd-285 trips in total
  - 3 tracks merge into 2 in the BC tunnel section
CASES

M9 ATAKOY – IKITELLI

“building capacity”

Owner Agency: Rail Systems Directorate, Istanbul Metropolitan Municipality (IMM)
Cost: $98/km
Length: 13.4 km  12 stations
Speed: 1.9km/year (2016-2023)

Issues/Highlights

- Financial challenges
- Inexperienced contractor
- 4 TBMs single launch box

Lessons Learned

- Financing should be secured before the construction tender
- Cultivating the rail construction ecosystem pays off
CASES
M9 ATAKOY - IKITELLI
CASES
M9 ATAKOY - IKITELLI

Total Costs (w.o Rolling Stock)
81% Contractor's Costs
16% Financing Costs
(Expense based on feasibility study)
Interest, commissions, commitment fees,
3% PM/CM Costs
72% Direct Costs
Labor, material, equipment
15% Contingency and Profit
2% Third Party Costs
Utility Relocations
0.5% General Costs
White and blue collar wages, site utilities,
accommodation, food, security
0.5% Design Costs
Construction documents

Sources: Preliminary design and feasibility studies, contract costs, interviews.
CHALLENGES

- Health, safety and environmental mitigation measures
- Political meddling
- Labor conditions
Thank you!