RESILIENT ROAD TRANSPORT INFRASTRUCTURE DEVELOPMENT IN TURKEY

UNECE and EUSDR PA 1b WORKSHOP
How to develop resilient Infrastructure (Global SDG 9)

Thursday and Friday, 16-17 November 2017 Ljubljana. Slovenia
1. GENERAL OVERVIEW of HIGHWAY NETWORK
2. ROAD FINANCING IN TURKEY
3. ROAD INFRASTRUCTURE DEVELOPMENT
4. MOTORWAYS AND PPP MOTORWAY PROJECTS
GENERAL OVERVIEW of HIGHWAY NETWORK
The lands of Turkey are located at a point where the three continents; Asia, Africa and Europe are closest to each other. Turkey has 13000 km of international road network. Within 4 hours flying time, about 1.5 billion people from 56 countries can reach Turkey.
The road network excluding urban roads is about 385,000 km in length.
GDH is responsible for planning, design, construction, maintenance, repair and operation of roads, bridges and structures within the network of motorways, state and provincial roads and keep all the network safely in operation in all weather conditions.

GDH was established on March 1, 1950

GDH is an affiliated institution of the Ministry of Transport, Maritime Affairs and Communications.
REGIONAL DIVISIONS OF GDH

- 18 Regional Divisions
- 118 Subdivisions
- 285 Maintenance Houses
- 25 Motorway Maintenance and Operation Offices
- 2 Equipment and Supply Directories
• Total road network is 67,498 km.
• 38% of total road network (25,757 km) is dual carriageway

- Total Replacement Value: 67 Billion $
- Road Density: 50 km / 100 km² (Excl. Urban Roads)
- Motorway Density: 3.34 km/ 1000 km²
NATIONAL HIGHWAY NETWORK (67.498 km)

- Turkish Road Network under General Directorate of Turkish Highways’ responsibility.
By the end of August 2017

- Number of Vehicles: 21,863,854
- Number of Passenger Cars: 11,802,713 (54% of Vehicle Fleet)
DOMESTIC PASSENGER & FREIGHT TRANSPORT

**PASSENGER TRANSPORT**
- Railways, 1.0%
- Airlines, 9.4%
- Highways, 89.0%

**FREIGHT TRANSPORT**
- Railways, 4.2%
- Sea Routes, 5.6%
- Highways, 90.2%

Passenger Transport
Highways: 89 %

Freight Transport
Highways: 90.2 %
129% increase in vehicle-km, in the period of 2003 & 2016

Despite only accounting for 3.8% of the road network as a whole, our motorway network is carrying 18% of all road transport.
TRAFFIC VOLUME
Million Km (2003)

52,349
Total Vehicle-Km

TRAFFIC VOLUME
Million Km (2016)

119,671
Total Vehicle-Km

129 % increase in vehicle-km
ROAD SAFETY IN TURKEY

SAFETY & ROAD INFRASTRUCTURE

- Road safety impact assessments as part of the new road design
- Upgrading of single carriageway roads into dual carriageway
- Road safety audits and inspections to be carried out at the planning, design and operation

Measures to improve the Safety of Road Infrastructure

- Black spot eradication on the determined high risk road sections, remedial measures are ranked according to their cost-benefit analysis.
- Comprehensive road maintenance works: • installation of road sign & signals and guardrail, routine and preventive maintenance
ROAD SAFETY IN TURKEY

Improvement of Black Spots

- Curve improvement
- Rearrangement of Junction Layout
- Construction of climbing lane
- Underpass and overpass for pedestrians
- Signalization
- Guardrail etc.
Truck escape ramps are constructed for accommodating out-of-control trucks on long steep downgrades.
ROAD SAFETY IN TURKEY

Rumble Strips

To warn the drowsy, fatigued or careless drivers who go out their lane by noise and vibration

Centerline Rumble Strips

Shoulder Rumble Strips

GOAL

To decrease the number of run-off and head on collisions

GOAL

To reduce the number of fatalities caused by run-off and head on collisions by 40-50 percent
National Budget
- financing approximately 95% of road investment budget
- Road used related taxes and excise taxes on vehicle purchasing taxes directly go to the consolidated budget. Ministry of Finance collects all taxes and allocates those taxes to all public expenditures.

Toll Motorway Revenues
- 400 Million USD, covering 5% of total road investment budget
- Istanbul-Ankara toll rate is about 6 USD for 380 km (1.5 US Cents/km)
- Two intercontinental suspended bridges over Istanbul Strait 2 US$ for two way

PPP concessions for the construction of BOT motorways
- İstanbul-İzmir Motorway (Inc. İzmit Bay Crossing)
- Northern Marmara Motorway, Odayeri-Paşaköy Section (Inc. Yavuz Sultan Selim Cable Stayed Suspension Bridge) Project
In 2016, Total budget of Turkish Highway amounted to 7.5 Billion US $.

Out of total budget,

- 60 % on state and provincial road construction & upgrading
- 4 % on motorway rehabilitation and operation,
- 7 % on routine maintenance,
- 4 % on routine road safety works,
- 6 % on personnel expenditure,
- 17 % on expropriation
- the remaining 2 % on other current expenditures.

KGM's 2016 total expenditures is about 0.90 % of Gross Domestic Product (GDP)
OUR NATIONAL ROAD PROGRAM:
The road infrastructure investments are planned to ensure;

1. Staying competitive by reducing travel times and transport costs

2. Providing uninterrupted and safe road transportation

3. The improvement of mobility and road user comfort

4. Facilitating the distribution of economic prosperity to all regions of the country
ROAD INFRASTRUCTURE DEVELOPMENT

1. Upgrading of Single Carriageways to Dual Carriageways
2. Conversion of Surface Treated Roads into Asphalt Concrete
3. Upgrading of Single Carriageway Roads
4. Superstructures (Bridges, Viaducts, Tunnels)
5. PPP Motorway Projects
The length of dual carriageway roads opened to traffic has reached 19.656 km including motorways since 2003.

The primary objectives of dual carriageway road construction:
• to reduce traffic accident fatalities and serious injuries due to head-on collision,
• to improve the level of service affected by inadequate capacity.

General Directorate of Highways started the implementation of a highway upgrading program in 2003 involving the upgrading of existing single carriageway into dual carriageway.
<table>
<thead>
<tr>
<th>Corridor</th>
<th>LENGTH (KM)</th>
<th>In Operation</th>
<th>Under Construction</th>
<th>Will be Tendered</th>
</tr>
</thead>
<tbody>
<tr>
<td>D010</td>
<td>1.552</td>
<td>1.201</td>
<td>108</td>
<td>243</td>
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<tr>
<td>D100</td>
<td>1.852</td>
<td>1.852</td>
<td>0</td>
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<tr>
<td>D200</td>
<td>1.235</td>
<td>1.235</td>
<td>0</td>
<td>0</td>
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<tr>
<td>D300</td>
<td>1.925</td>
<td>1.898</td>
<td>0</td>
<td>28</td>
</tr>
<tr>
<td>D400</td>
<td>1.960</td>
<td>1.403</td>
<td>145</td>
<td>412</td>
</tr>
<tr>
<td>TOTAL</td>
<td>8.524 (100%)</td>
<td>7.589 (% 89)</td>
<td>253 (3%)</td>
<td>683 (8%)</td>
</tr>
</tbody>
</table>

**EAST-WEST CORRIDORS (8.524 KM)**
### NORTH-SOUTH CORRIDORS (12.146 KM)

<table>
<thead>
<tr>
<th>Status</th>
<th>Dual Carriageway (km)</th>
<th>Single Carriageway (km)</th>
<th>Total (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Operation</td>
<td>9.380 (87%)</td>
<td>651 (49%)</td>
<td>10.031 (82%)</td>
</tr>
<tr>
<td>Under Construction</td>
<td>890 (8%)</td>
<td>288 (21%)</td>
<td>1.178 (10%)</td>
</tr>
<tr>
<td>Will be Tendered</td>
<td>543 (5%)</td>
<td>394 (30%)</td>
<td>937 (8%)</td>
</tr>
<tr>
<td><strong>TOTAL LENGTH</strong></td>
<td>10.813 (89%)</td>
<td>1.333 (11%)</td>
<td>12.146 (100%)</td>
</tr>
</tbody>
</table>
CONVERSION OF SURFACE TREATED ROADS INTO ASPHALT CONCRETE

**2003 – 2015**
- 1,500 km (Ann.Avr.)

**2016**
- 2,086 km

**2017 Target**
- 2,017 km
UPGRADING OF SINGLE CARRIAGEWAY ROADS

- **2003 – 2015**: 776 km (Ann. Avr.)
- **2016**: 921 km
- **2017 Target**: 860 km
# ROAD STRUCTURES – TUNNELS, BRIDGES & VIADUCTS

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Tunnels</th>
<th>Length of Tunnels</th>
<th>Year</th>
<th>Number of Tunnels</th>
<th>Length of Tunnels</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>83</td>
<td>50 km</td>
<td>2017</td>
<td>315</td>
<td>372 km</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Under Construction</td>
<td>184</td>
<td>482 km</td>
</tr>
<tr>
<td>2003</td>
<td>5.967</td>
<td>311 km</td>
<td>2017</td>
<td>8.193</td>
<td>541 km</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Under Construction</td>
<td>483</td>
<td>62 km</td>
</tr>
</tbody>
</table>
MOTORWAYS & PPP MOTORWAY PROJECTS
An ambitious motorway construction program was started in early 1980s. With regard to this expedited motorway construction program, up to 2010, a motorway network with a length of 2.289 km has been opened to traffic. This program was financed by mainly national budget and loans from IFI.
OBJECTIVE: to expand and improve our Motorway Network to meet the transport demand of the economic growth.

PROBLEM: financing new motorway projects

SOLUTION: financing mechanism on the basis of PPP
PPP MOTORWAY PROJECTS AFTER 2010

- NORTHERN MARMARA MOTORWAY (405 km)
  - Odayeri–Paşaköy Section (148 km)
  - Kınalı–Odayeri section (88 km)
  - Paşaköy–Akyazı section (169 km)

- İSTANBUL-İZMİR MOTORWAY (433 km)
  - 105 Km in operation
  - 80 Km finished (not opened to traffic)
  - 248 Km under construction

- KINALI-TEKİRDAĞ-ÇANAKKALE-BALIKESİR MOTORWAY (101 km)

- MENEMEN-ALİAĞA-ÇANDARLI MOTORWAY (76 km)

- ANKARA - NİĞDE MOTORWAY PROJECT (330 km)
GENERAL FEATURES OF BOT MOTORWAY CONTRACTS:

- Design specifications and standard are determined by GDH. (Project start-end points, corridor, technical requirements for special structures like suspension bridges)
- Traffic Guaranty will be provided to secure the pay back of the debt and equity if the generated revenue is not enough.
- Expropriation costs are mainly covered by Administration.
- In case of the termination of Agreement, used loans will be paid by the Treasury.
- The Tolls are updated every year based on the guidelines of United Nations Statistics Office.
- Financing of project will be covered by the contractor as equity (at least 20%) and loan (80% at most).
PPP PROJECT CYCLE

PROJECT DEFINITION

PREPARATION OF BASIC DESIGN
(DETAILED DESIGN IF NECESSARY)

ECONOMICAL & FINANCIAL FEASIBILITY & EIA STUDIES

APPLICATION TO HIGH PLANNING COUNCIL TO RECEIVE AUTHORISATION

PREPARING TENDER DOCUMENTS

APPROVAL OF TENDER DOCUMENTS BY MINISTER OF TRANSPORT MARITIME AFFAIRS AND COMMUNICATIONS
PPP PROJECT CYCLE

ANNOUNCEMENT OF TENDER NOTICE

THE BEST BID IS CHOSEN BY TENDER COMMITTEE AND APPROVED BY MINISTER

SIGNING OF CONTRACT

ADMINISTRATION CONTROLS THE PROJECT IN BOTH CONSTRUCTION AND OPERATION PERIOD
NORTHERN MARMARA MOTORWAY
NORTHERN MARMARA RING MOTORWAY (405 Km) Including Cable Stayed Suspended Bridge YSS

Odayeri- Paşaköy Section including Yavuz Sultan Selim Bridge put into operation on 26 August 2016

- **Odayeri- Paşaköy Section including Yavuz Sultan Selim Bridge**
  - **KINALI-ODAYERİ SECTION 88 KM (European Side)**
  - **PAŞAKÖY-AKYAZI SECTION 169 KM (Asian Side)**
  - **NORTHERN MARMARA RING MOTORWAY (405 Km)** Including Cable Stayed Suspended Bridge YSS
  - **TEM Motorway**

- **ODAYERİ-PAŞAKÖY SECTION INCLUDING** Cable Stayed Suspended Bridge YSS
  - 148 KM

UNECE and EUSDRA PA 1b WORKSHOP
NORTH MARMARA MOTORWAY
(including 3rd suspension bridge, Yavuz Sultan Selim Bridge)
NORTH MARMARA MOTORWAY (Odayeri-Paşaköy) (including cable stayed suspension bridge, Yavuz Sultan Selim Bridge)

- **TOTAL LENGTH**: 148 Km
  - Cable Stayed Suspension Bridge with a length of 1875 meter

- **NUMBER OF VIADUCTS**: 35
  - **LENGTH OF VIADUCTS**: 13.5 km

- **NUMBER OF TUNNELS**: 2+2 (Railways)
  - **LENGTH OF TUNNELS**: 2389+536 m

- **NUMBER OF BRIDGES**: 97
  - **LENGTH OF BRIDGES**: 7.6 Km

- **NUMBERS OF INTERCHANGES**: 20
NORTHERN MARMARA MOTORWAY, ODAYERİ-PAŞAKÖY SECTION PROJECT

- Investment Cost is 3.5 Billion US $
- 148 Km Length
- 3 Years 2 Months Construction Period
- 9 Years 11 Months 6 Days Motorway Operation Period
- 13 Years 1 Months 6 Days Contract Period
- Consortium: ICA IC İçTAŞ ASTALDİ

Timeline:

- TENDER: Apr 20
- CONTRACT SIGNED: May 28
- GROUND DELIVERY: Jun 26
- BUILDING PHASE: 165.3 wks (Jun 26 - Aug 26)
- OPERATING PHASE: 509.9 wks (Aug 26 - Jun 4)
- TRANSFER: Jun 4

Year:
- 2012  2014  2016  2018  2020  2022  2024  2026  2027
- Today
Yavuz Sultan Selim Bridge

- 1408 m main span (The Bridge will be the longest suspension bridge in the world which has a rail system on it, 2x4 lanes of motorway and 2 lanes of railway on the same deck.
- Northern part of the bridge is Black Sea, southern part of the bridge is Marmara Sea.
Yavuz Sultan Selim Bridge

- The width of the deck is 59 meters, the largest in the world.
- Also it has got the highest tower in the world with a height of 322 meters.
Some Key Figures Of YSS Bridge

- 2x4 motorway lanes, 2 railway tracks
- **2,164 metre** length, **1,408 metre** span, **58.50 metre** deck width
- 2 towers with a height of **322 metres**
- 59 segments, 176 stay cables,
- Cable stay tensile strength: **1960 MPa**
- **597 metre** length of longest cable
- **7,800 tonnes** of steel for the stay cables
- Anchor units, **75 to 151**
- Maximum height of dampers: **7.2 metres** above the deck
- 2 suspension cables, each **2,420 metres** long
- 34 pairs of vertical hangers
NORTHERN MARMARA MOTORWAY, KINALI – ODAYERİ SECTION PROJECT

- Investment Cost is 950 million US $
- 88 Km Length
- 3 Year Construction Period
- 4 Years 9 Months 12 Days Motorway Operation Period
- 7 Years 9 months 12 days Contract Period
- Consortium: KOLİN-KALYON JOINT VENTURE

PPP MOTORWAY PROJECTS UNDER CONSTRUCTION

<table>
<thead>
<tr>
<th>Phase</th>
<th>Duration (Wks)</th>
<th>Start/End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILDING PHASE</td>
<td>156.4</td>
<td>Jul 11-Jul 11</td>
</tr>
<tr>
<td>TENDER</td>
<td>May 4</td>
<td></td>
</tr>
<tr>
<td>CONTRACT SIGNED</td>
<td>Jul 1</td>
<td></td>
</tr>
<tr>
<td>GROUND DELIVERY</td>
<td>Jul 11</td>
<td></td>
</tr>
<tr>
<td>OPERATING PHASE</td>
<td>249.6</td>
<td>Jul 12-Apr 23</td>
</tr>
<tr>
<td>TRANSFER</td>
<td>Apr 23</td>
<td></td>
</tr>
</tbody>
</table>

PPP MOTORWAY PROJECTS UNDER CONSTRUCTION

NORTHERN MARMARA RING MOTORWAY, PAŞAKÖY – AKYAZI SECTION PROJECT

• Investment Cost is 1.6 Billion US $
• 169 Km Length
• 3 Years Construction Period
• 3 Years 9 Months 12 Days Operation Period
• 6 Years 9 Months 12 Days Contract Period
• Consortium: LİMAY-CENGİZ JOINT VENTURE

TENDER
May 4

CONTRACT SIGNED
Jul 1

GROUND DELIVERY
Jul 11

BUILDING PHASE
156.4 wks
Jul 11 - Jul 11

OPERATING PHASE
197.3 wks
Jul 12 - Apr 23

TRANSFER
Apr 23


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Uninterrupted interurban and urban railway transportation from Edirne to İzmit will be conducted via the railway passing from the the 3rd Bridge, and this railway system will be integrated with Marmaray and İstanbul Metro, and the Atatürk Airport, Sabiha Gökçen Airport and the 3rd Airport.

Following the establishment of connection of the Northern Marmara Motorway which includes the the 3rd Bridge, as well – with the İstanbul (Kınalı) – Çanakkale – Savaştepe motorway and İstanbul – İzmir motorway, travel time to the neighboring cities will be reduced.

Fuel saving will be enabled by decreasing the traffic density within the city and the current bosphorus bridges. Vehicles will be able to make transit pass uninterruptedly, safely and comfortably.

The effect of air pollutants related to the transportation within the city will be reduced following the redirection of the transit traffic to the 3rd Bridge.

Time cost in our import and export will be reduced following the removal of the transportation restriction for loaded vehicles.
İSTANBUL-İZMİR MOTORWAY
ISTANBUL-IZMİR MOTORWAY (INCLUDING İZMİT BAY CROSSING AND CONNECTION ROADS)

- Investment Cost is 8.5 Billion US $
- 433 Km Length
- 105 Km in operation, the construction of 80 km was finished, but not opened to traffic.
- 7 Year Construction Period
- 15 Years 4 Months Motorway Operation Period
- 22 Years 4 months Contract Period
- Consortium: OTOYOL YATIRIM VE İŞLETME A.Ş.

PPP MOTORWAY PROJECTS UNDER CONSTRUCTION

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- 433 Km Length
- 105 Km in operation, the construction of 80 km was finished, but not opened to traffic.
- 7 Year Construction Period
- 15 Years 4 Months Motorway Operation Period
- 22 Years 4 months Contract Period
- Consortium: OTOYOL YATIRIM VE İŞLETME A.Ş.
• Project’s route is one of the main axes of Turkey.
• The Project will connect İzmir to İstanbul, Yalova, Bursa, Balıkesir, Manisa and Kütahya and serve directly to a geographic area with 25 million inhabitants.
• Length of the road between İstanbul-İzmir will be shorten by 95 km.
• Travel time from İstanbul to İzmir will decrease from 8-10 hours to 3-3.5 hours.
TOTAL LENGTH : 433 km
(384 km motorway, 49 km connecting roads, 2.682 m suspension bridge)

NUMBER OF VIADUCTS : 40
LENGTH OF VIADUCTS : 22.3 Km

NUMBER OF TUNNELS : 3
LENGTH OF TUNNELS : 6.45 Km

NUMBER OF BRIDGES : 364
LENGTH OF BRIDGES : 20.8 Km

NUMBERS OF INTERCHANGES : 25
İZMİT BAY SUSPENSION BRIDGE

İzmit Bay Crossing comprise of; North Approach Viaduct, Suspension Bridge Main and Side Spans and South Approach Viaduct.

Midspan Length (m)

- AKASHI KAIKYO (JAPAN)
- XIHOUMEN (CHINA)
- GREAT BELT (DENMARK)
- İZMİT BAY CROSSING (TURKEY)

Navgation Clearance: 64.30m x 1000m
İzmit Bay Bridge with a length of 2680 m and 1550 m center span (4th longest in the world)
KINALI-TEKİRDağ-ÇANAKKALE-BALIKESİR MOTORWAY
PPP MOTORWAY PROJECTS UNDER CONSTRUCTION

KINALI-TEKİRDağ-ÇANAKKALE-BALIKESİR MOTORWAY, MALKARA-ÇANAKKALE SECTION (INCLUDING 1915 ÇANAKKALE BRIDGE)

- Investment Cost is 2.7 Billion US $
- 101 km Length
- Longest midspan length of 2023 m in the World
- 5.5 years Construction Period
- 10 years 8 months 12 days Motorway Operation Period
- 16 Years 2 months 12 days Contract Period
- Consortium: DAElim (KORE)-LİMAK - SK (KORE) - YAPI MERKEZİ JOINT VENTURE GROUP

338.9 wks BUILDING PHASE Mar 21 - Sep 18
505.9 wks OPERATING PHASE Sep 19 - May 30

TENDER Jan 26
GROUND DELIVERY Mar 21
CONTRACT SIGNED Mar 21

2016 2018 2020 2022 2024 2026 2028 2030 2032

Today
MENEMEN-ALİAĞA-ÇANDARLI MOTORWAY
MENEMEN-ALİAĞA-ÇANDARLI MOTORWAY PROJECT

- Investment Cost is 394 Million US $
- 76 km Length
- 3 Years Construction Period
- 6 Years 10 Months 11 Days Operation Period
- 9 Years 10 Months 11 Days Contract Period
- Consortium: İÇTAŞ-ASTALDI-KALYON JOINT VENTURE GROUP

PPP MOTORWAY PROJECTS UNDER CONSTRUCTION

156.6 wks BUILDING PHASE
Apr 5 - Apr 5

358.1 wks OPERATING PHASE
Apr 6 - Feb 16

TENDER
Feb 15

CONTRACT SIGNED
Apr 4

GROUND DELIVERY
Apr 5

Today
2017
2018 2019 2020 2021 2022 2023 2024 2025 2026 2027
2027

TRANSFER
Feb 17

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ANKARA-NİĞDE MOTORWAY
ANKARA - NİĞDE MOTORWAY PROJECT

- Investment Cost is 1.1 Billion US $
- 330 km Length
- 3 years Construction Period
- 8 years 10 months 17 days Motorway Operation Period
- 11 Years 10 months 17 days Contract Period
- Tender Date: 14 th of April, 2017
- Consortium: ERG İNŞAAT- SEZA İNŞAAT JOINT VENTURE GROUP
TARGET MOTORWAY NETWORK until 2035

TOTAL: 8.199 KM

- Motorways in operation (2.285+44 Km BOT): 2.622 km
- BOT projects (under construction): 1.012 km
- BOT projects (in tendering process): 257 km
- Future BOT projects: 2.023 km

5.914 KM

UNECE and EUSDRA PA 1b WORKSHOP
INTELLIGENT TRANSPORT SYSTEMS

- ITS focus on mainly;
  - Electronic Toll Collection Systems
  - Traffic Management Systems
  - Traveller Information Systems
  - Tunnel Operating Systems
TOLL COLLECTION

OGS (DSRC-ACTIVE)
- 1,954,845 Subscribers
- 30,40 % of Payment

HGS (RFID-PASSIVE)
- 11,126,849 Subscribers
- 69,60 % of Payment

TOTAL
- 13,081,694 Subscribers
- 400 Million Dollar collected
- 323 Million Vehicles Passed
TOLL COLLECTION

SSG

- Removal of tolboth
- No need for lane preference
- Improvement in traffic flow
THANK YOU FOR YOUR ATTENTION!

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Ministry of Transport, Maritime Affairs and Communications