FIBER OPTIC CABLE ESTABLISHMENT ON ROAD NETWORK

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Workshop on Cross-border Co-deployment of Fiber Optic Infrastructure along Road and Rail Networks

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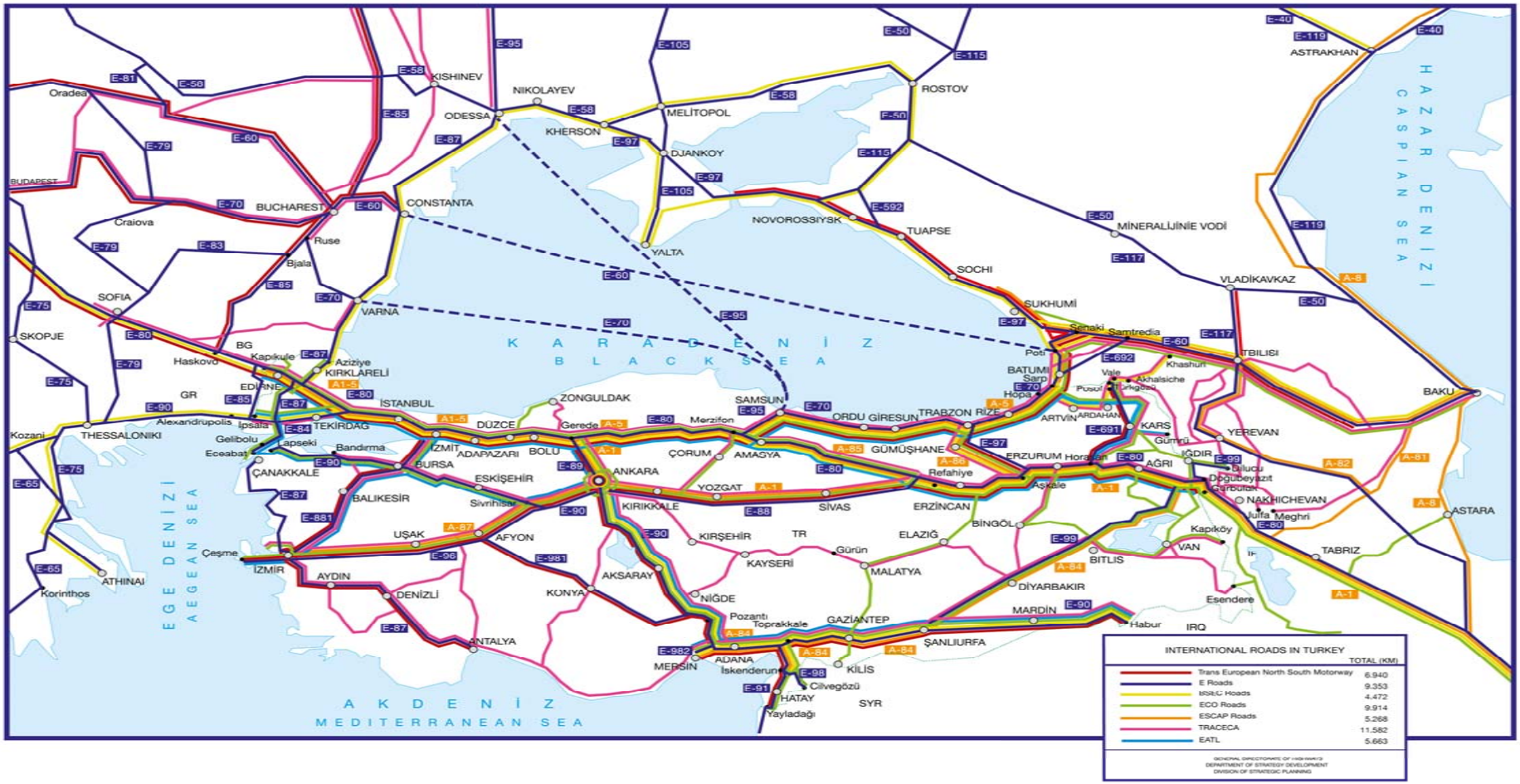
INTERNATIONAL ROADS IN TURKEY



TELECOMMUNICATION MARKET IN TURKEY

- Sector market USD 14 Billions by revenues in 2017
- Total broadband internet subscribers: 68.9 Millions
- Fiber subscribers: 2.3 Millions
- Length of fiber: 324 667 km
- Number of authorized telecom infrastructure operators: 12

NATIONAL ORGANIZATIONS FOR COMMUNICATION

- Ministry of Transport and Infrastructure
  - Information Technologies and Communications Authority
  - General Directorate of Communications
- Telecom Infrastructure Operators
- Right of Way Providers

LEGISLATION

- The Tenth Development Plan 2014-2018
- Turkey Transport and Communication Strategy, Goal 2023
- National Broadband Strategy and Action Plan (2017-2020)
- Law on Electronic Communications
- Law on Organization and Duties of General Directorate of Highways
- Regulation on the Transition of all kinds of Cables and Similar Material Used in the Fixed and Mobile Communication Infrastructure or the Networks
- Regulation on Administration of Areas and Premises in the Possession of General Directorate Highways
- Reference Document for Electronic Communication Infrastructure Facilities
- Circular on Fiber Optic Cable Installation

THE TENTH DEVELOPMENT PLAN 2014-2018

The policies regarding the Information and Communication Technologies in the 10th Development Plan:

- Communication technology infrastructure will be developed so as to allow service delivery with appropriate quality and prices; and generalization of the next-generation fixed and mobile networks that offer high-speed internet access, especially fiber infrastructure, will be ensured.

- Efficiency of the electronic communication sector regulations will be improved and competition in the sector and the development of co-operation will be ensured. Turkey will become a center of international data transmission.

TURKEY TRANSPORT AND COMMUNICATION STRATEGY, GOAL 2023

Some infrastructure objectives and proposals in the Strategic Objectives and Proposals for Information and Communication Sectors:

- Fiber to the home project: A network will be established throughout the country which will provide broadband services without capacity limit by means of the fiber infrastructure to the home.

- Hub project: Turkey will become fiber intersection point among the countries of the region due to its geographical location and become attraction and investment center in the area of information and communication. To this end, terrestrial fiber projects using railways and highways and submarine fiber project through the coasts will be realized.

BROADBAND STRATEGY

- The National Broadband Strategy, which sets the 2023 target as "Broadband Anywhere for Everyone", adopted the action of "Facilitating the Passive Infrastructure Installation with the Purpose of Developing New Generation Access Networks" within the strategic objective of "Creating Broadband Supply". The objective of the action is to ensure that the passive infrastructure investments for the new generation access networks (fiber, cable, IMT, etc.) in our country are made in a planned and rapid manner and that the increased capacity demands can be met. It is foreseen that the action, which is under the responsibility of the Ministry of Transport and Infrastructure, is to be carried out in cooperation with Ministry of Environment and Urbanization, Information Technologies and Communications Authority, General Directorate Highways, General Directorate of State Railways and some other organizations.

BROADBAND STRATEGY

- As one of the action steps, it is envisaged that institutions/organizations establishing infrastructure for public services such as municipalities, General Directorate Highways, General Directorate of State Railways, General Directorate of Petroleum Pipeline Corporation, General Directorate of Turkish Electricity Transmission Corporation and electricity distribution companies should establish a passive electronic communication infrastructure for the operators' needs and legal arrangements should be made in order to make them available to the operators with authorization-permission.

- Strategic Objective-3 of the National Broadband Strategy and Action Plan 2017-2020 prescribe “Creation of Both Broadband Supply and Demand”. In this context, it is envisaged to establish “Strong Internet Exchange Points in Turkey (IXPs)” by Action 18. This action, which is under the responsibility of Ministry of Transport and Infrastructure, provides that “the works for the establishment of international fiber optic cable infrastructure to increase the international output capacity in Turkey shall be supported”.

LAW FOR ELECTRONIC COMMUNICATION

- The Electronic Communication Law No: 5809

- The purpose of the Electronic Communication Law is to create effective competition, to ensure the protection of consumer rights, to promote the deployment of services throughout the country, to ensure efficient and effective use of the resources, to promote the new investments and technological developments in communication infrastructure, network and services through regulations and inspections in electronic communication sector and to determine relevant principles and procedures thereto.

- Rights of way supplier (GDH) means the immovable owners and/or the right owner on the immovable provided that the immovable belonging to the public or under common usage of the public regarding the rights of way is included.

- Operator means any legal entity, which has the right to provide electronic communication services and/or to provide electronic communication network and to operate the infrastructure within the framework of authorization.

AUTHORIZATION OF ELECTRONIC COMMUNICATION SERVICES

- Electronic communication services could be provided and/or electronic communication network or infrastructure could be constructed and operated by taking into consideration the strategies and policies of the Ministry, upon receiving authorization from the Authority.

- It is fundamental that the electronic communication service and/or network or infrastructure is provided primarily by the operators which are authorized by the Authority.

- Nevertheless, electronic communication service and/or network or infrastructure shall not be subject to authorization, which is;

  Within any natural person's or legal entity's property under his/its own use, which do not exceed any property's borders, which is used upon exclusively individual or organizational needs, which is not used for providing any electronic communication services to third parties, which is provided without any commercial intention and which is not publicly available.

RIGHT OF WAY

- Highways
- Urban roads
- State railways
- Pipelines
- Power lines
- Others

REGULATION ON THE TRANSITION OF ALL KINDS OF CABLES AND SIMILAR MATERIAL USED IN FIXED AND MOBILE COMMUNICATION INFRASTRUCTURE NETWORKS

- **RIGHT OF WAY PROCESS**
  - Applications made to the Ministry of Transport and Infrastructure shall be assessed within thirty days.
  - Operators are directed to right of way providers.
  - Right of way providers has to assess the right of way request within sixty days.
  - Agreement on crossing right: Within the scope of the Regulation, the operator and the crossing right provider may freely negotiate the right of passage.
  - For the request of right of ways on highways network General Directorate of Highways takes into consideration of highway conditions such as traffic safety, road works. If the conditions are not adequate, General Directorate of Highways does not provide crossing right for the operator.

REGULATION ON ADMINISTRATION OF AREAS AND PREMISES IN THE POSESSION OF GENERAL DIRECTORATE HIGHWAYS

- Crossing right submission on highways ,if possible, is subject to a mutually signed protocol at present.
- The operator has to pay utilization permit fee to General Directorate of Highways described by the regulation.
- Price= K*Current value*Area.
- K= Type of Organization: Public (0.5), State Economic Enterprise (0.5), Private (1)
- Area (m^2).

REFERENCE DOCUMENT FOR ELECTRONIC COMMUNICATION IFRASTRUCTURE FACILITIES

Information Technologies and Communications Authority issued a technical document to be taken into consideration when establishing electronic communication infrastructure; Reference Document for Electronic Communication Infrastructure Facilities. The aim of the document is to designate minimum requirements of electronic communication infrastructure facilities.

The reference document covers general standards for electronic communication infrastructure facilities, infrastructure excavation standards for underground facilities. Infrastructure channel excavation covers seven categories by ground types;

- Paved road (asphalt and so)
- Pavement-footpath
- Transverse passages
- Normal ground and other road crossings
- River, brook, swamp and wet ground crossings
- Sloping land and erosive area crossings
- Bridge crossings

The depths of the channel excavation vary between 40 cm and 120 cm by excavation category. The details are also given regarding trenching, backfilling, properties of HDPE duct and its accessories, manholes and aerial lines.

INTERNATIONAL CROSSINGS

- Turk Telekom International fiber optic network
- Leased Backbone capacity
- JADI route
- SMW-3 cable
- Iraq-Gulf route
- AMEER Middle East section
- MedTurk submarine cable system
- SMW-5 cable

Source: https://turktelekomint.com/network-map/

TASIM

- Trans-Eurasian Information Super Highway is a regional project led by Azerbaijan in 2008
- The aim of the project is to establish a transnational fiber-optic line stretching from Hong Kong to Frankfurt
- The fiber optic line covers China, Kazakhstan, Azerbaijan, Georgia, Turkey and Germany. Additionally, Russia, Ukraine and Poland are considered for redundancy
- Technical concept:
  - Integrated proprietary IP/MPLS network
  - High capacity (several Tb/s) and scalable
  - Advanced services beyond transit
  - Points of Presence in major cities along the route
  - Around 11 000 km length
  - Highly redundant in topology, core network devices and upstream interconnections

Source: http://www.tasim.net/

SEA-ME-WE 5

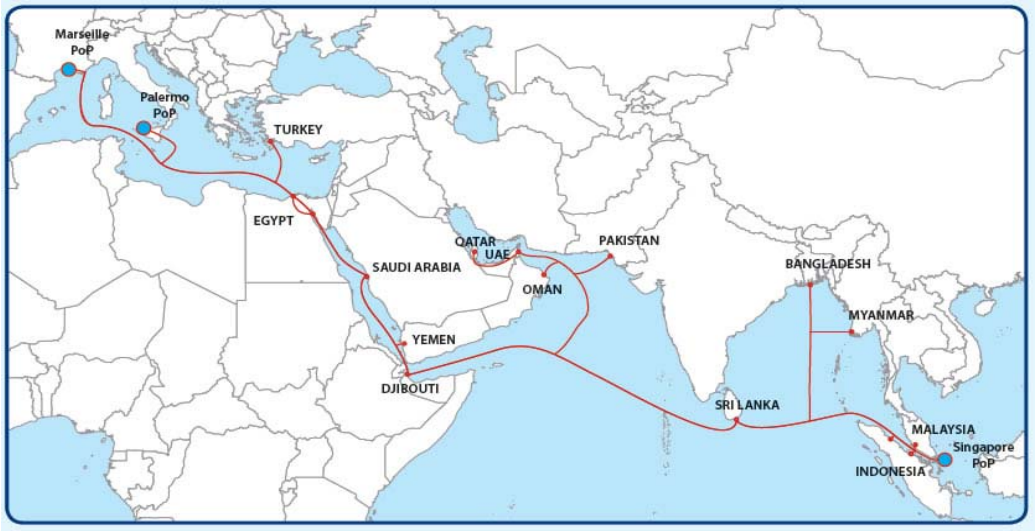
- SEA-ME-WE 5 project is a submarine fiber optic cable project connects Western Europe to Southeast Asia through the Mediterranean Sea

- 19 operators from 18 countries

- Turk Telekom International (TTI), representing Turkey

- It's a twenty-thousand km of length project with 24 Tbps initial capacity

- It's designed with the latest upgradable 100 Ghz technology. The line reaches to land in Marmaris in Turkey



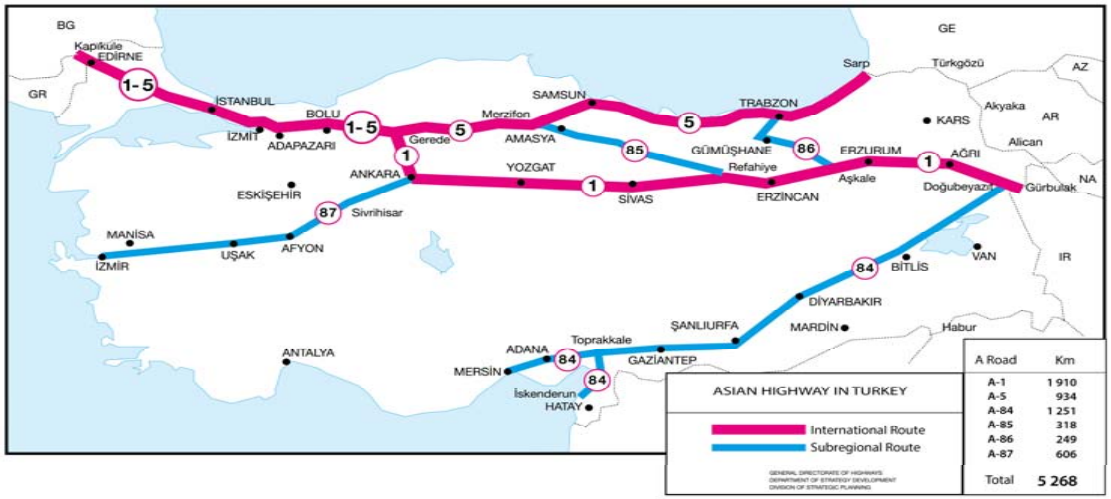
Source: http://www.seamewe5.com/route/swm5-maps/

PROTOCOLS WITH TELECOM INFRASTRUCTURE OPERATORS

- Protocols between General Directorate of Highways and Telecom Infrastructure Operators for the use of right of way on state highways and motorways
- Lateral and longitudinal passage in highways network
- Particularly with Turk Telekom, the biggest telecom operator in Turkey
- Other major operators; Superonline and Vodafone
- General Directorate of Highways have some rights arising from the protocols such as free transmission of institutional data of GDH, free allocation of fiber cores for the systems on highways.
- However, this is not enough and GDH has a project on installation of fiber optic cable on its road network for intelligent transport systems and this project is going on.

PROTOCOL WITH TURK TELEKOM FOR RIGHT OF WAY

- Protocols between General Directorate of Highways and Turk Telekom for the use of right of way.
- ~15 000 km fiber optic cable.
- Asian Highways : 5 268 km in Turkey
- Cross border connection available with
  - AH (1-5) : Bulgaria
  - AH (5) : Georgia
  - AH (1) : Islamic Republic of Iran



- Fiber optic cable on % 55 of Asian Highways network.
- Piecemeal installation, but continuous communication connection between border crossings on Asian Highways by Turk Telekom.

ADVANTAGES & DISADVANTAGES OF PROTOCOLS WITH TELECOM INFRASTRUCTURE OPERATORS

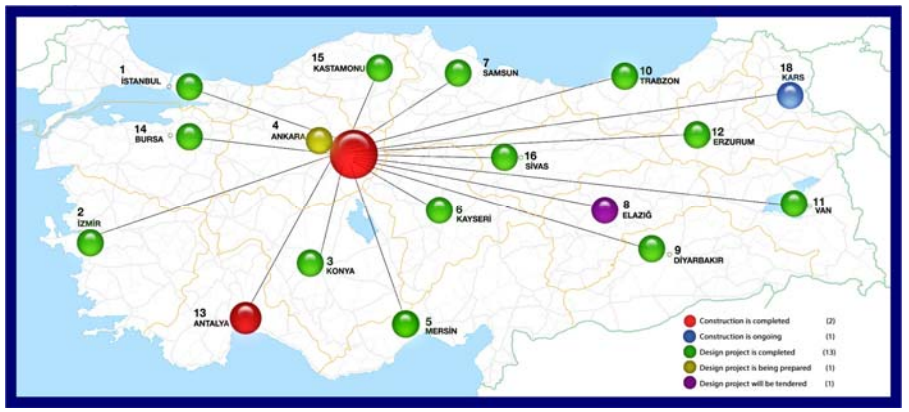
- Public interest
- Roads is reliable and ease access area for a communication cable to establish and maintain it
- Owners of roads also get benefit from fiber optic cable to provide communication for the road purpose facilities and systems along the roads
- All demands of right of way from operators are not met by right of way provider due to insufficient expropriation area, road construction and any road purpose plan for future
- Displacement of existing fiber optic cable due to road construction or enlargement
- Different right of way tariffs by right of way providers
- Legal problems

GENERAL DIRECTORATE OF HIGHWAYS (GDH)

- Inter-Urban roads (Motorways, National highways, Provincial highways)
- Planning, Designing, Construction, Maintenance and Operation of highways network
- 68 000 km highways network
- GDH is authorized to install receiver and transmitter wireless stations, and required communication networks for its own requirements

INTELLIGENT TRANSPORT SYSTEMS PROJECT

General Directorate of Highways conducts an Intelligent Transport Systems project on highways network (VMS, camera, detector, signalization, management centers…).



Communication will be provided by fiber optic cable and wireless communication systems. In this scope, installation of 505 km of fiber optic cable in pilot division has already been completed.

In the same vein, It is aimed at installation of fiber optic cable on 15 000 km of highways finally.

STANDARDIZATION WORKS OF FIBER OPTIC CABLE INFRASTRUCTURE

- Participating Departments in GDH:
  - Department of Survey, Design and Environment
  - Department of Research & Development
  - Department of Road Construction
  - Department of Traffic Safety
  - Department of Motorway Operations
  - Department of Information Technology
  - Department of Facilities and Maintenance

- Internal Circular 2017/E.6 was issued on 14 August 2017 for fiber optic cable deployment.
- Circular consists of:

Principles for fiber optic cable infrastructure

Annex-1: Technical Specification for armored type fiber optic cable
Annex-2: Trencher and Excavation Types
Annex-3: Road type cross sections
Annex-4: Technical Specification for Manholes

CIRCULAR FOR FIBER OPTIC COMMUNICATION INFRASTRUCTURE ON ROAD NETWORK

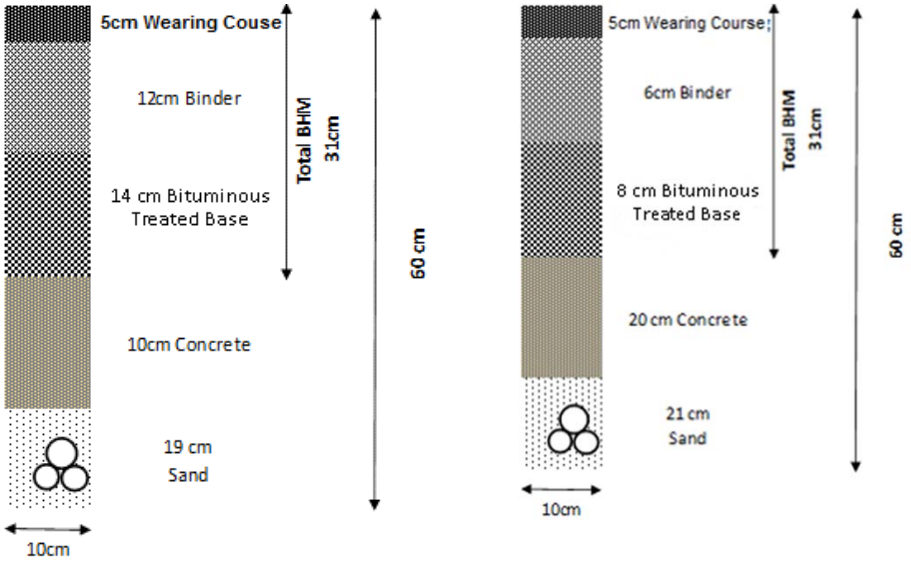
- This circular prescribes the installation of fiber optic cables on the highway network of General Directorate of Highways. It aims for the inclusion of fiber optic cable infrastructure in the road design process. In the same vein, it determines the technical rules for the installation of fiber optic cables on the roads open to traffic. This circular aims for the installation of fiber optic cable in order to fulfill the communication requirements of Intelligent Transport Systems on state roads included in the road network of General Directorate of Highways. Within this scope, it determines the installation route of fiber cable considering the road cross section. In addition, this regulation covers the information about types of excavations, backfilling, fiber cable, HDPE duct, underground warning tapes, manholes, and the required tests.

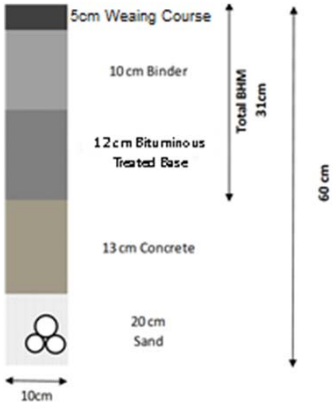
DEPLOYMENT PLACES OF FIBER OPTIC CABLE BY CIRCULAR

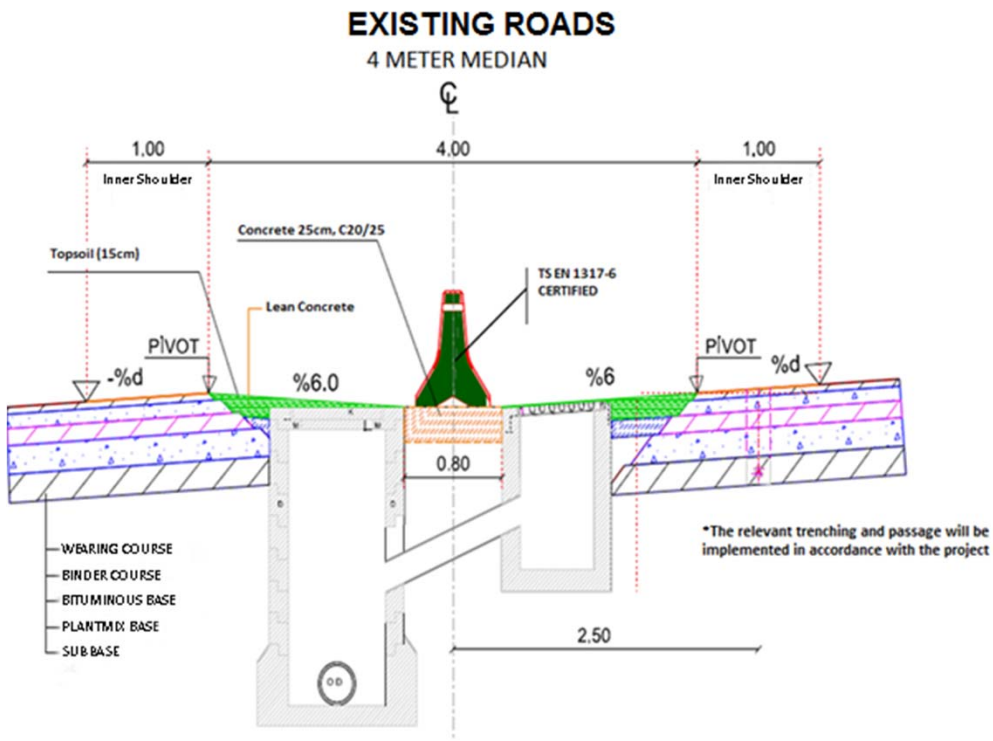
- New Roads
  - Outside road platform
  - In road platform (Obligatory situations)
- Existing Roads
  - Outside road platform
  - Median
  - In road platform (Obligatory situations)
- Special structures/Applications
  - Bridges
  - Tunnels

APPLICATIONS FOR EXISTING ROADS

Obligatory Situations – On Road Platform



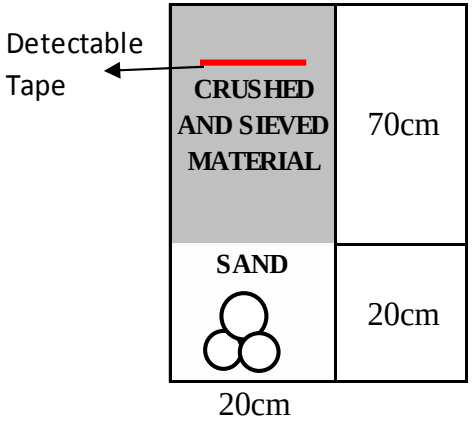




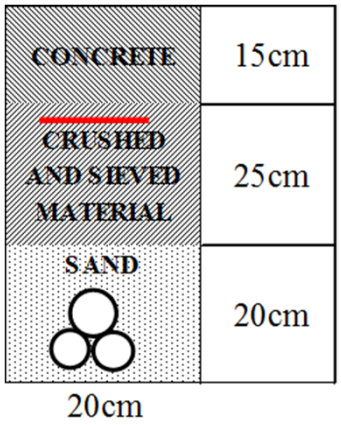
APPLICATIONS FOR NEW ROADS /EXISTING ROADS

Deployment Types – Outside Road Platform

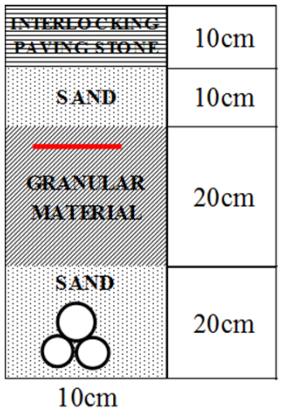
EARTH SURFACE



CONCRETE DITCH PAVING



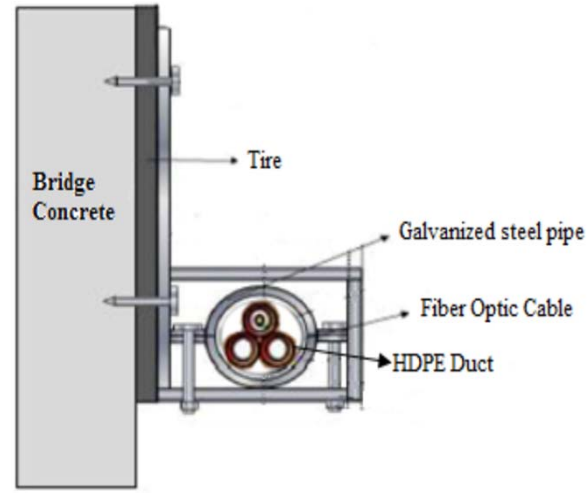
PAVEMENT-SIDEWALK SURFACE

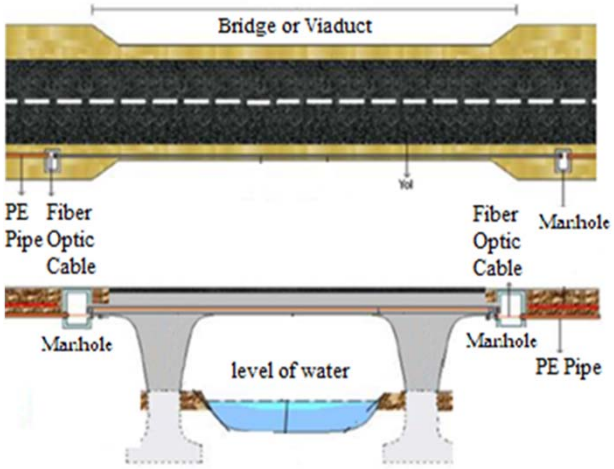


EXISTING CHANNEL

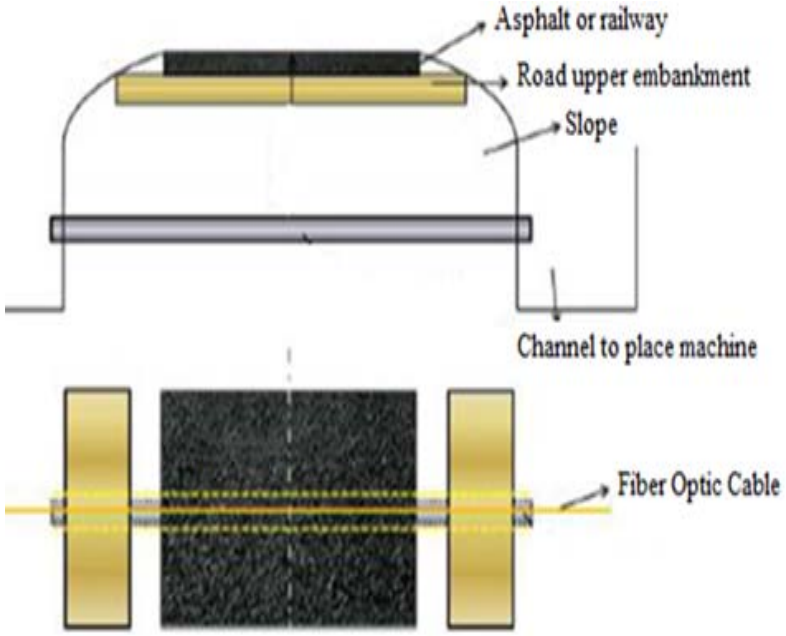
SPECIAL STRUCTURES / APPLICATIONS

BRIDGE





HORIZONTAL DRILLING/DIRECTIONAL HORIZONTAL DRILLING

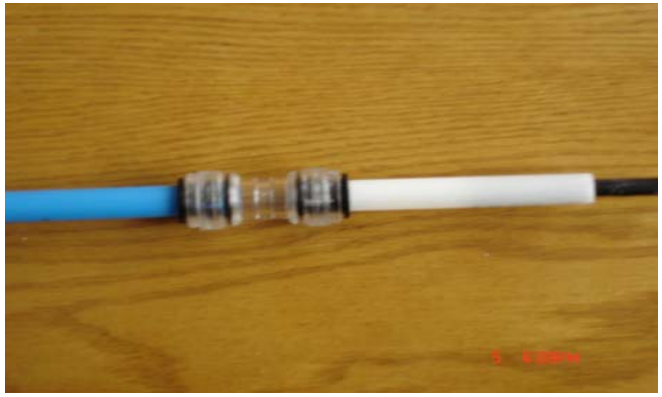


ELEMENTS OF FIBER OPTIC CABLE INFRASTRUCTURE

- **FIBER OPTIC CABLE**

ELEMENTS OF FIBER OPTIC CABLE INFRASTRUCTURE

- **DUCT / MICRODUCT**

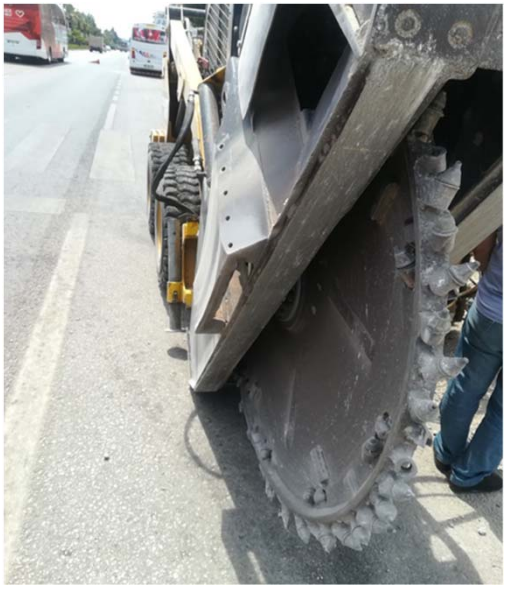


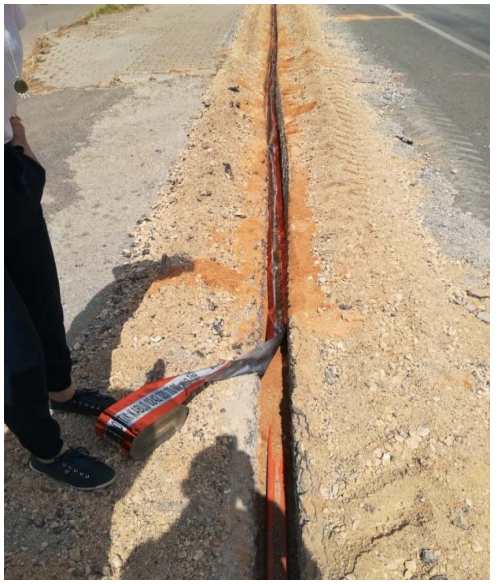
ELEMENTS OF FIBER OPTIC CABLE INFRASTRUCTURE

- **EXCAVATION & BACKFILLING**

ELEMENTS OF FIBER OPTIC CABLE INFRASTRUCTURE

- **TRENCHING & BACKFILLING**






ELEMENTS OF FIBER OPTIC CABLE INFRASTRUCTURE

- **MANHOLE**

INSTALLATION COST

- Average cost of fiber optic cable infrastructure establishment: ~12 000 USD/kilometer
- Fiber Optic Cable & supplements: % 30
- Duct: % 30
- Excavation / Trenching & Backfilling: %40

EXPECTATION OF ROAD OWNERS

- Attentive working of telecommunication operators on right way area .
- Facility sharing between operators. It is impossible to allocate right of way to every operator on roads.
- Allocation of fiber cores to the owner of the road for the purpose of Intelligent Transport Systems on roads or meeting communication services of these systems on roads.
- Uninterrupted communication along the road.
- Reasonable right of way price.

RECOMMENDATIONS

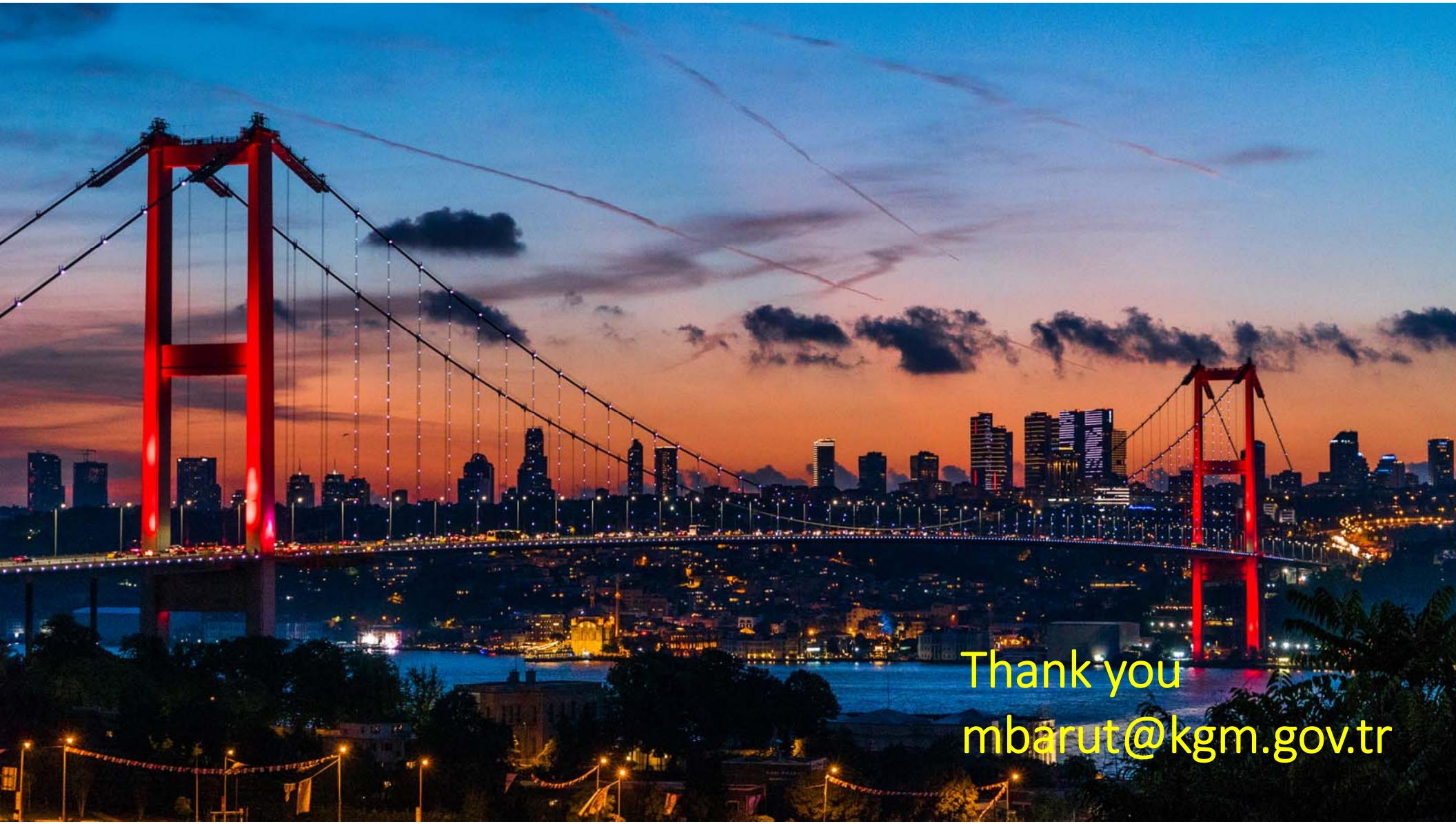
- Taking measures for traffic safety in the work zone along the roads during the establishment of fiber optic cable is of importance.
- Transverse passages of the cable are carried out under the road infrastructure by driller.
- In fact, the most proper one is to take fiber optic cable into consideration at the design stage of road and install it in the course of construction of road together with other components of road infrastructure. This is the cost effective and easy installation method.
- The proper place of roads to establish fiber optic cable is the right of way area outside carriageway or median.

RECOMMENDATIONS

- The fiber optic cable on highways network can be used for national and international communication in the case of installation by authorized telecommunication operators.
- Highways authorities can install fiber optic cable, but utilization of it will be limited to specific purpose.
- Multi-duct establishment along roads will be a proper method to make the infrastructure ready for utilization of the multi-operators and owner of the road.
- International communications through the network should be provided by the operators of fiber optic cable by means of inter-agency agreements between the operators in neighboring countries.

RECOMMENDATIONS

- Maintenance of multi-user communication infrastructure can be carried out by means of a maintenance company that chosen by all users by a common consent.
- The road should get benefit from the fiber optic cable on it. All the communication needs of the systems on the highways should be provided by the fiber optic cable on that highway.
- The closest Intelligent Transport Systems Centers of the neighboring countries on an international corridor should set a communication for information exchange regarding the road and traffic conditions of their responsibility areas to inform road users.
- A Guide should be prepared for Installation of Fiber Optic Cable on the Asian Highways. That guide should cover inclusion of fiber optic cable in the design projects of the Asian Highways.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