



Republic of Turkey
Ministry of Transport Maritime Affairs
and Communications



GENERAL DIRECTORATE
of HIGHWAYS

TEM / HEEP AREA V 2018 ANNUAL MEETING

Ayönkarahisar
↑
Ankara
Istanbul



27 -30 May 2018

Prague - CZECH REPUBLIC



OUTLINE

General Overview of Highway Network

Road Maintenance Works

Asset Management

Image - Based Information Management System

Conclusion





General Overview of Highway Network

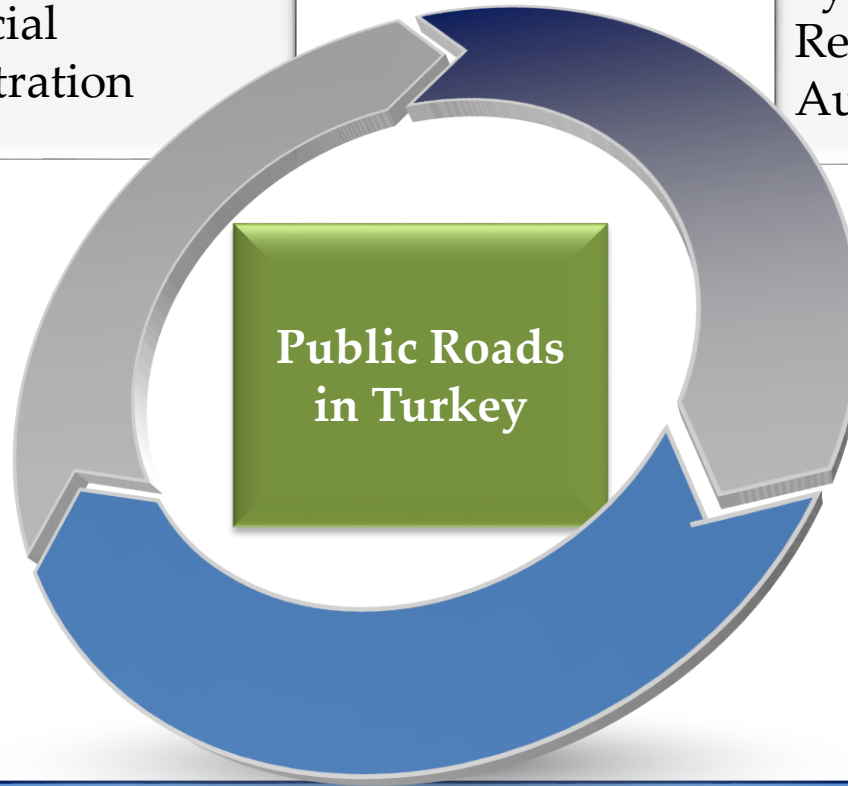




ROAD NETWORK IN TURKEY

Type: Village and Forest roads
Responsibility: Special
Provincial Administration

Type: Urban roads
Responsibility: Municipal
Authorities



Type: Motorways, State & Provincial roads
Responsibility: General Directorate of Turkish Highways

The road network excluding urban roads is about 385.000 km in length

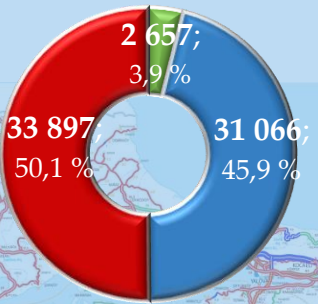


DG TURKISH HIGHWAYS

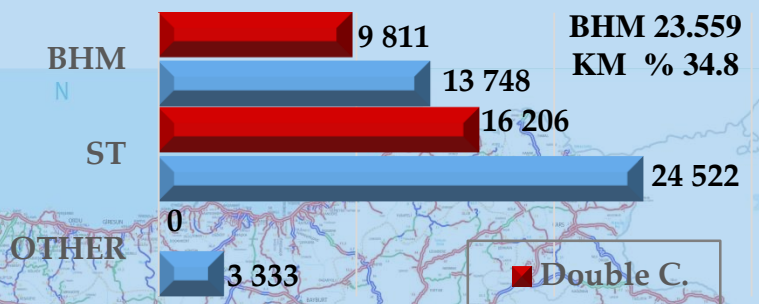
(31.12.2017)

Road network(67.620 km)

Divided roads
26.017 km (% 38,5)



Surface type (67.620 km)



Motorway State road Provincial road



127,997 Billion vehicle x km

75-80 Billion \$ (Asset Value of Highways)

(This value is higher than the GDP of 130 countries)

Bridges

Number 8.441

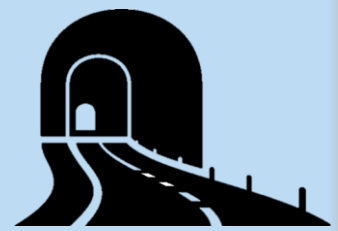
Km 556



Tunnels

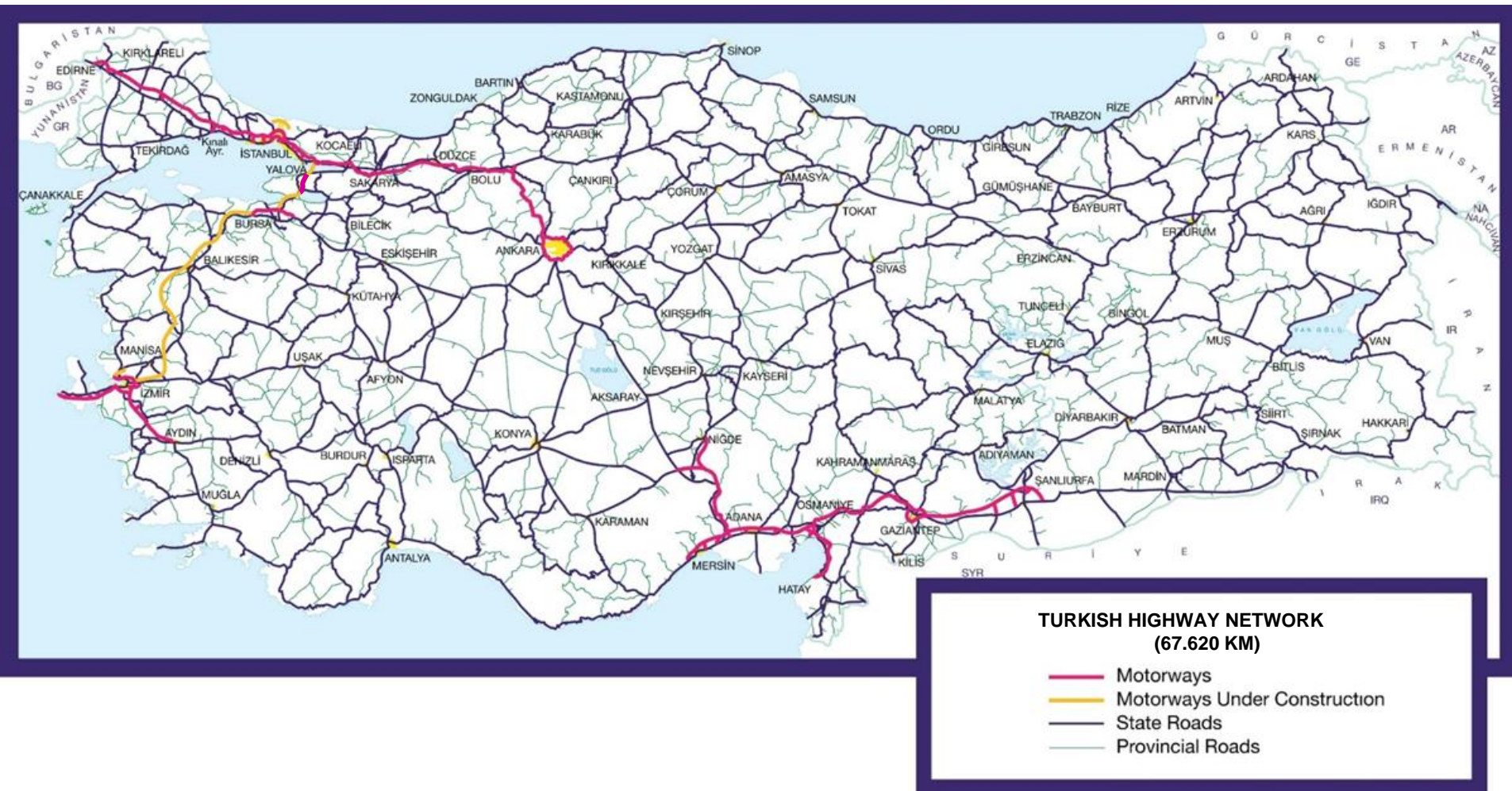
Number 341

Km 433



NATIONAL HIGHWAY NETWORK (67.620 km)

➤ Turkish Road Network under General Directorate of Turkish Highways' responsibility.





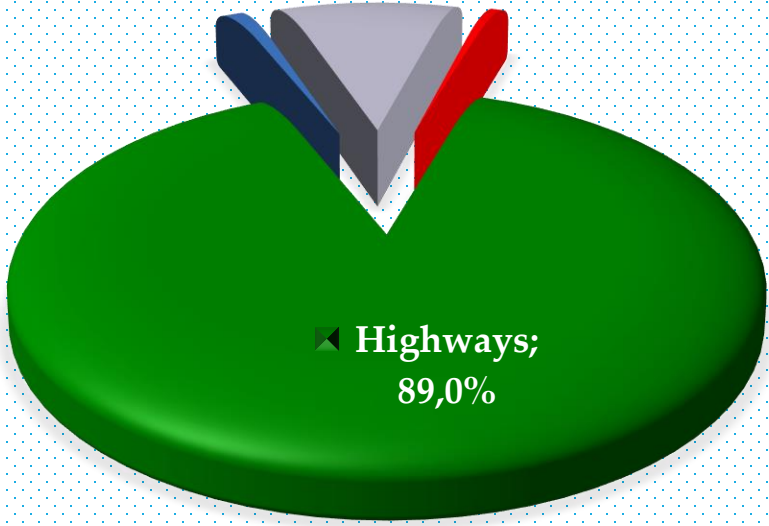
DOMESTIC PASSENGER & FREIGHT TRANSPORT

PASSENGER TRANSPORT

■ Railways;
1,0%

■ Airlines;
9,4%

■ Highways;
89,0%



Passenger Transport
Highways: 89 %

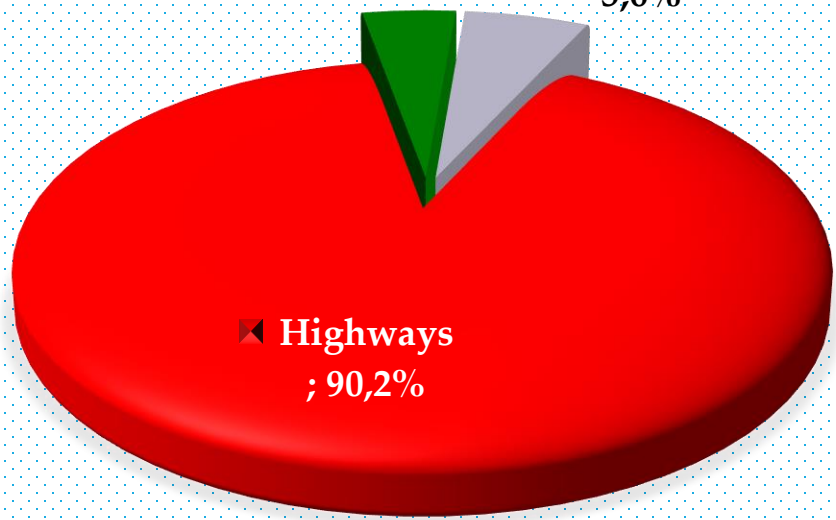
FREIGHT TRANSPORT

■ Sea Route
0,6%

■ Railways;
4,2%

■ Sea Routes;
5,6%

■ Highways
; 90,2%

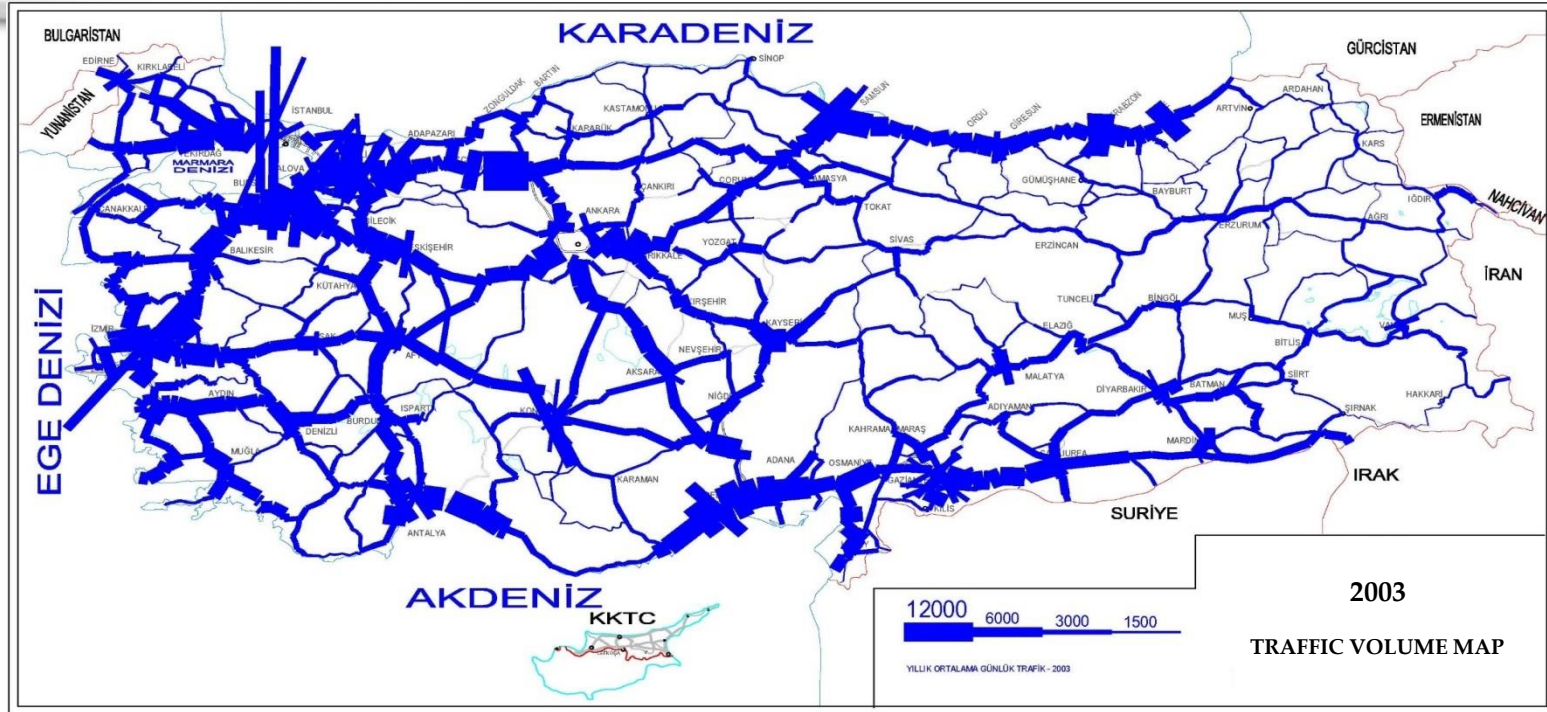


Freight Transport
Highways: 90,2 %

TRAFFIC VOLUME
Million Km (2003)

52.349

Total Vehicle-Km

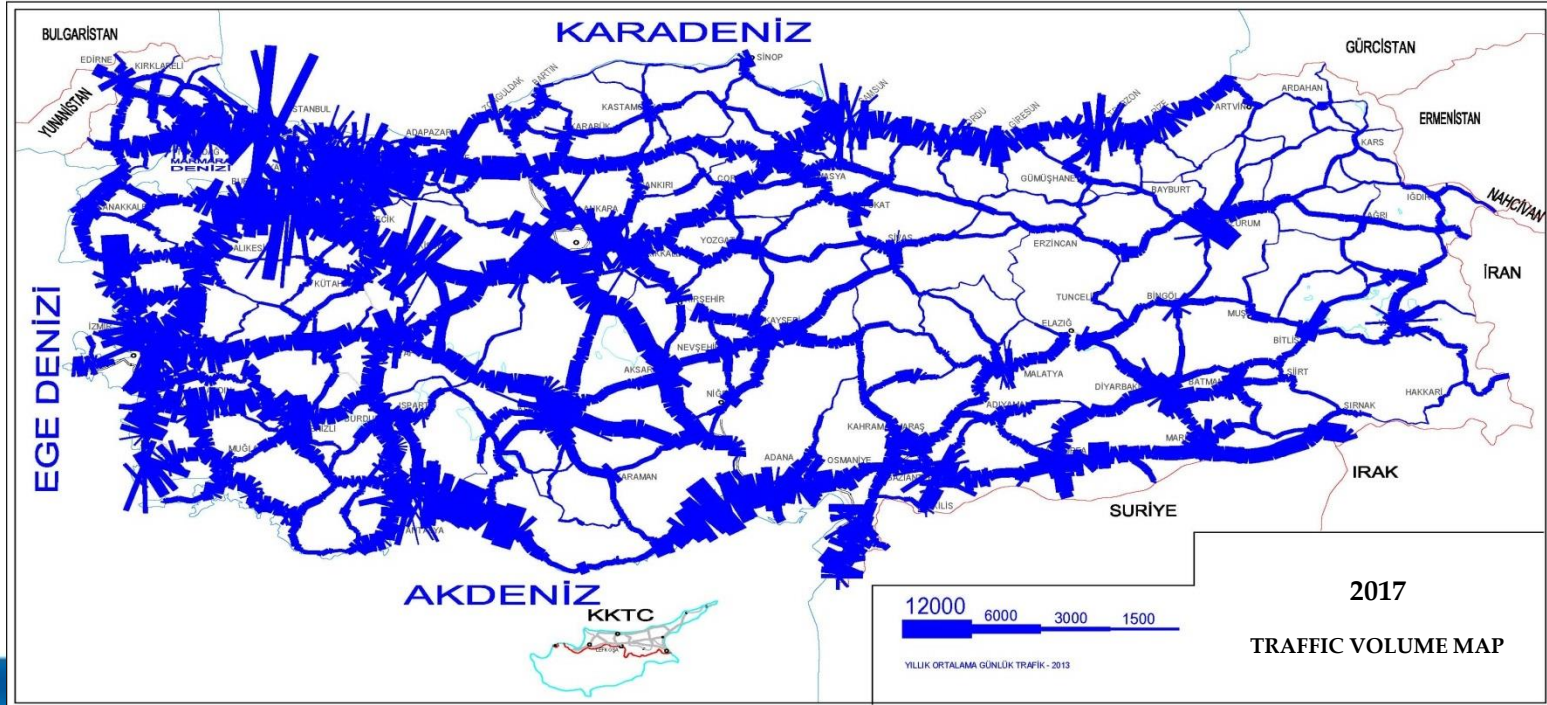


TRAFFIC VOLUME
Million Km (2017)

127.997

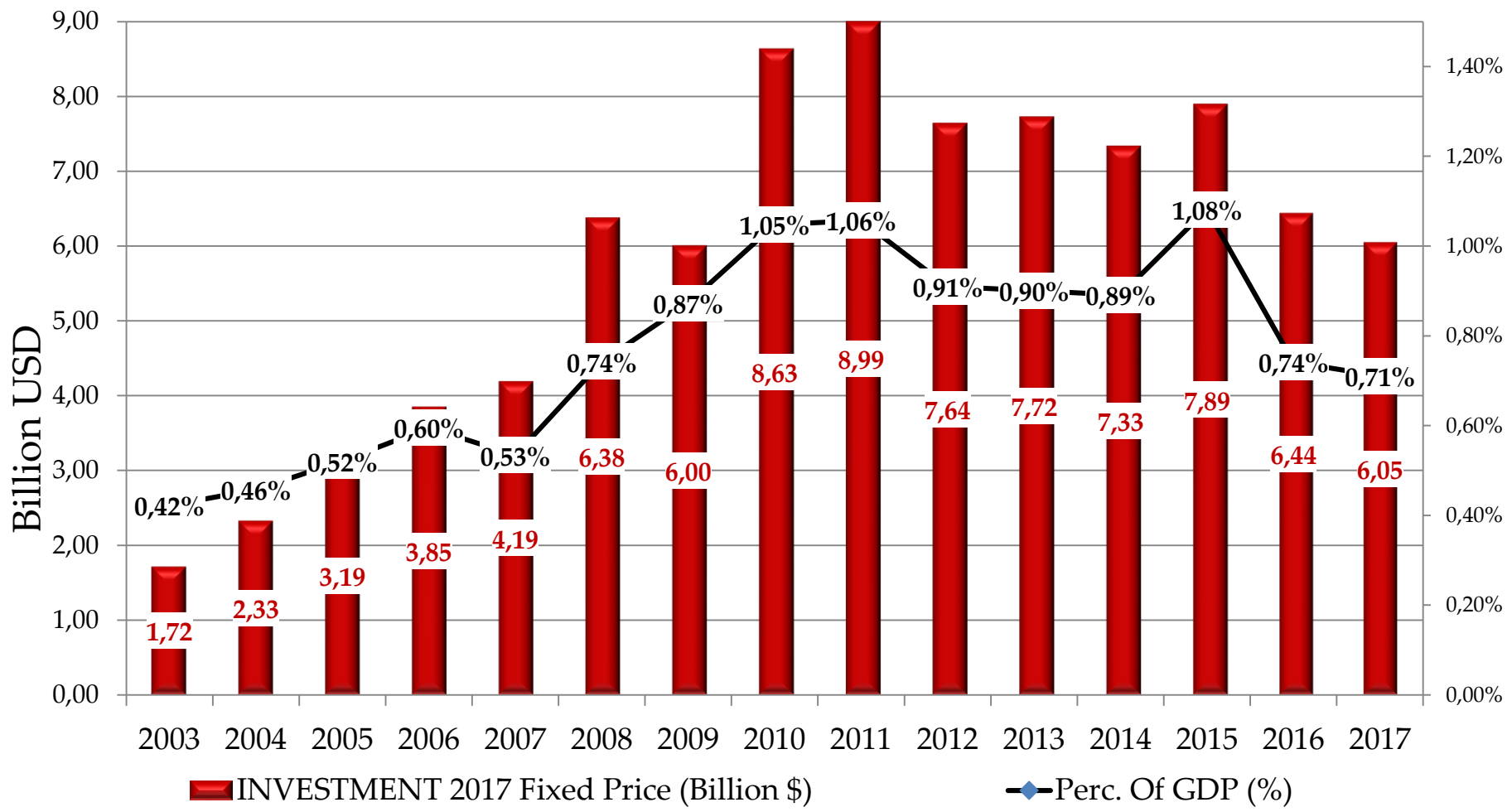
Total Vehicle-Km

144 % increase in
vehicle-km





PERCENTAGE OF GDP USED FOR HIGHWAY INFRASTRUCTURE INVESTMENT





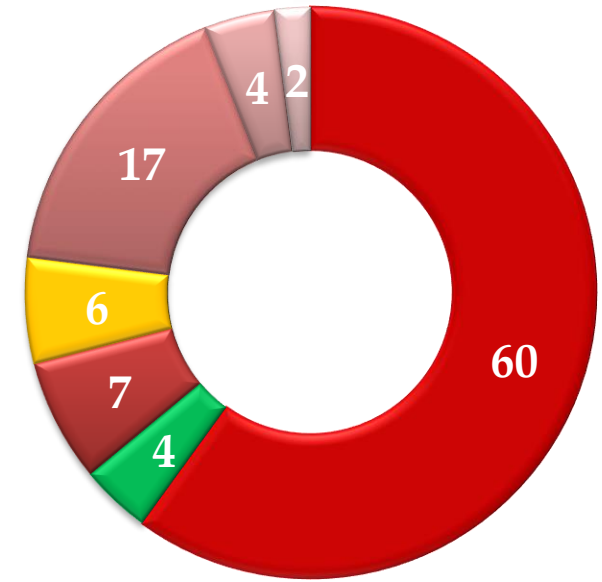
THE BREAKDOWN OF GDH's TOTAL BUDGET

In 2017, Total budget of Turkish Highway amounted to **6,05 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 2017 total expenditures is about 0.71 % of Gross Domestic Product (GDP)



- State & Provincial Road Cons. & Upgrading
- Motorway Rehab. & Oper.
- Routine Maintenance
- Personnel Expenditure
- Expropriation
- Road Safety Works
- Other Current Expenditures



Road Maintenance Works



REGIONAL DIVISIONS OF GDH



- 18 Regional Divisions
- 118 Subdivisions
- 288 Maintenance Houses
- 25 Motorway Maintenance and Operation Offices
- 2 Equipment and Supply Directories



ROAD MAINTENANCE WORKS



ROUTINE MAINTENANCE

Removing surface deformation on asphalt roads, corrugation and rutting on surface of stabilized road, repairing structures, such as, bridge, culvert, structures, clearing drainage systems, ditch and culverts as well as vegetation, etc.



SNOW AND ICE REMOVAL

Snow and ice removal has a considerable place in maintenance works. Removing snow and ice on roads during winter and providing a secure and smooth traffic flow are among these works.



EMERGENCY REPAIR

Maintenance in case of emergency and disasters



PERIODIC MAINTENANCE

To preserve the structural integrity of the road, or to enable the road to carry increased axle loadings.

ROUTINE MAINTENANCE



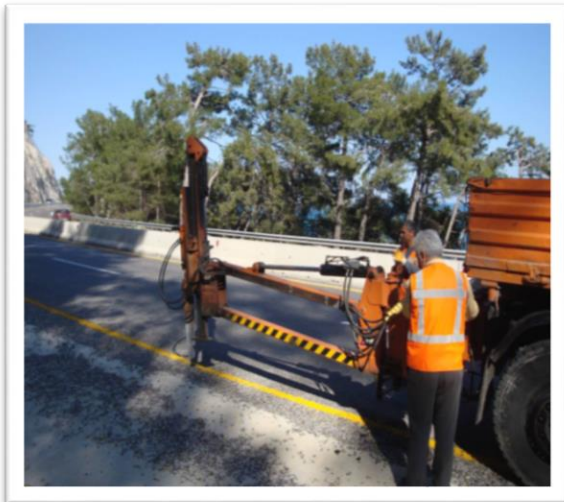
Patching



Surface Treatment



Ditch Cleaning



Maintenance of traffic signs and engineering structures



Verge Cutting



ROUTINE MAINTENANCE WORKS IN 2017

Maintenance Works carried out by	406 (118 Subdivision, 288 Maintenance Houses)
Maintenance Crew	9.392
Machinery & Equipment	7.703
Aggregates used for asphalt patching	1.528.318 m ³
Bitumen used for asphalt patching	169.670 Tonnes
Number of Planted Seedling (yearly average)	1.681.481
Number of GRP (Glass Reinforced Plastic) plates	969.419





SNOW & ICE REMOVAL WORKS IN 2017-2018 WINTER



Network In Operation

54.514 Km

Network In Operation (If Possible)

8 904 Km

Maintenance Works carried out by

412 (118 Subdivision, 270 Maint. Houses, 24 Motorway Maint. Houses)

Maintenance Crew

11 288

Machinery & Equipment

7 994

Aggregates used

383 637 m³

Salt Used

481 340 Tonnes

Length of snow fence

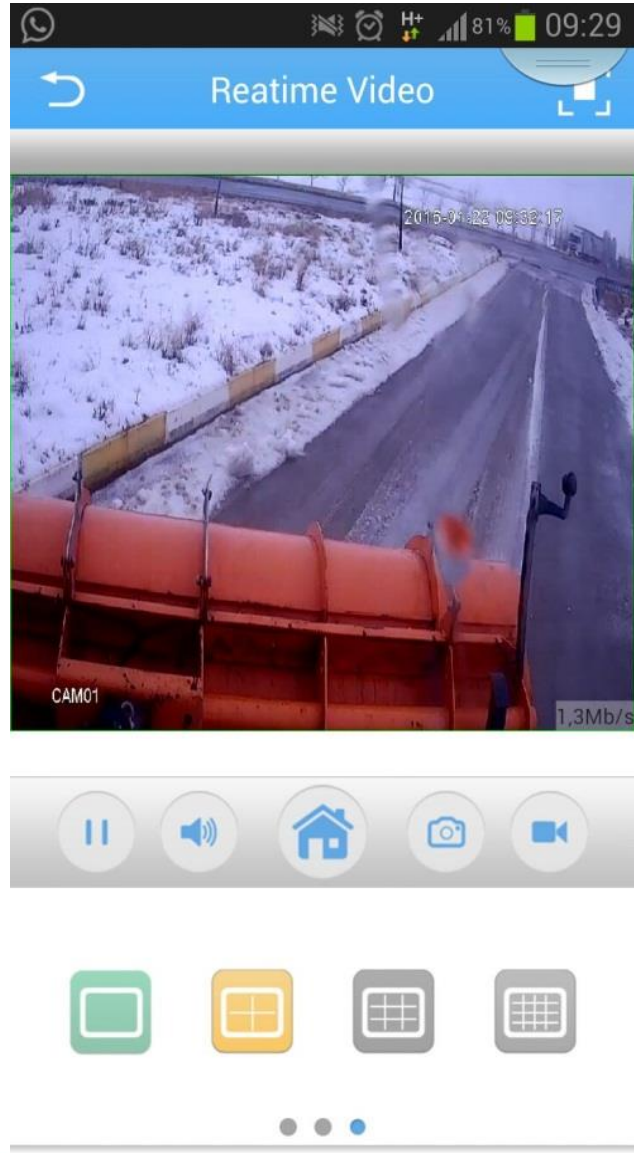
613 Km

Chemicals used for anti icing

562 Ton



SNOW & ICE REMOVAL WORKS



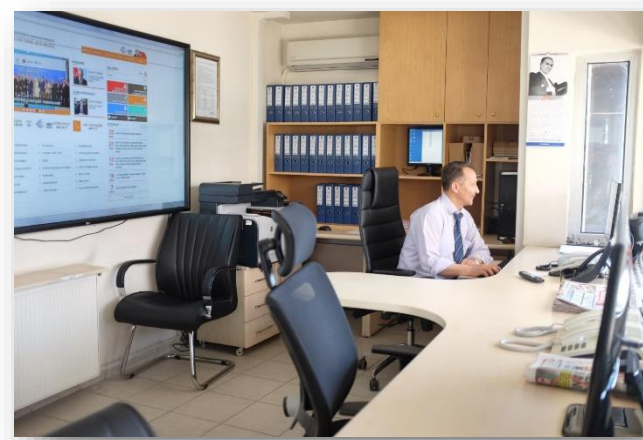
MAINTENANCE IN CASE OF EMERGENCY AND DISASTERS



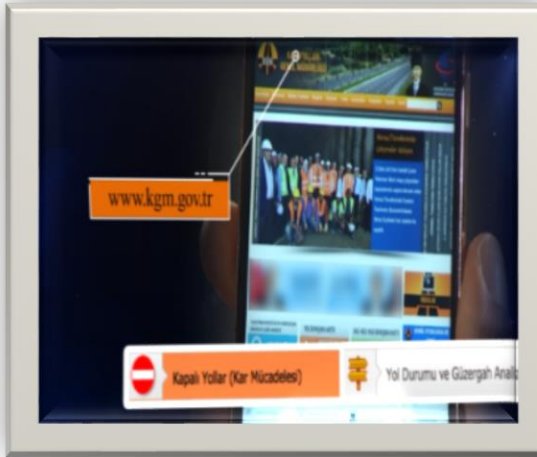


HIGHWAY INFORMATION & PUBLIC RELATIONS

7/24 HIGHWAY INFO LINE



Public Service Announcements



Educational Publications



**KGM
SERVICE
LINE
ALO 159**

**HIGHWAY
INFORMATION
LINE
0-312-415 88 00**

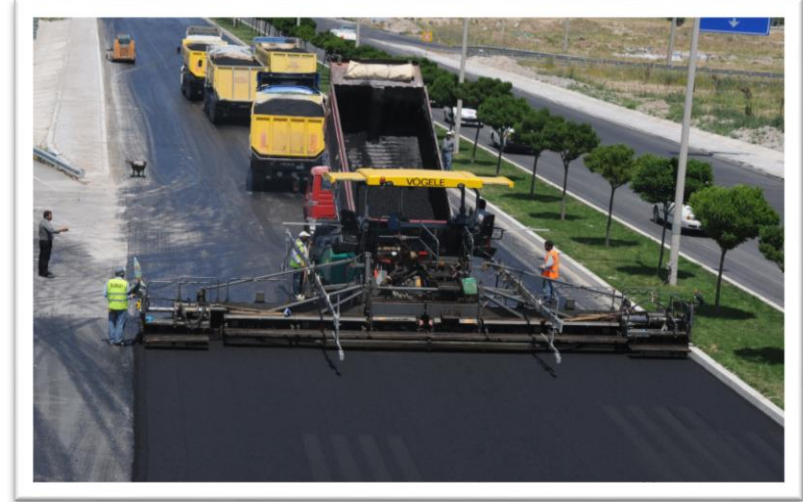
Online Surveys



KGM KAMU SPOTU



PERIODIC MAINTENANCE





DEFINITIONS OF ROAD INVESTMENTS

Resurfacing	Placing a new surface of an existing road in order to service in good condition, to increase skid resistance, to seal by aiming to preserve road from negative atmospheric conditions, to increase driver comfort, to extend pavement life, etc. The aim is not to increase the bearing capacity of pavement however to extend lifetime by preserving the road from bad weather conditions.
Resurfacing by Strengthening	Renewing of road surface with reinstalling bituminous layer either by directly or by removing determined depth of pavement by milling in order to increase bearing capacity of road and to eliminate road defects.
Pavement Replacement	Renewing of the pavement either by removing the total thickness of all paving layers, existing asphalt layers from an existing roadway or not, and providing a new paved surface without changing capacity or geometry of the road, i.e. without changing subgrade.
Reconditioning	Reconditioning includes improvement of grades, curves, intersections or sight distances in order to improve traffic safety or changing the subgrade to widen shoulders or to correct structural problems in addition to resurfacing or pavement replacement.
Reconstruction	Total rebuilding of both pavement and subgrade of an existing highway. Work which either changes the location of the existing subgrade shoulder points or removes all of the existing pavement and base course for at least 50% of the length of the project. In other words it is the rebuilding of an existing roads' pavement and subgrade to correct road geometry, to increase road safety, to ease maintenance works and to increase preservation.
Expansion (Capacity Improvement)	Same as reconstruction and also involves the construction of additional through travel lanes beyond the work associated with reconstruction.
New Construction	There is not any existing road for this kind of project. It is totally new building of a road with all parts; subgrade, pavement, structures, etc.



Asset Management System





ORGANIZATION CHART of MANAGEMENT SYSTEMS

Implementation Units

- Department of Maintenance
- Department of R&D
- Department of Structures
- Department of Traffic Safety

Standards Setting

- Department of Maintenance
- Department of R&D
- Department of Structures
- Department of Traffic Safety

Traffic & Transportation Statistics

- Department of Traffic Safety

Budget

- Department of Strategy Development

Technological Background

- Department of Information Technologies



PAVEMENT ASSET MANAGEMENT SYSTEM FLOW CHART

Database Creation

- Inventory data
- Structural condition data
- Functional condition data
- Visual distress evaluations

Pavement Current Condition Analysis

- Structural condition analysis
- Functional condition analysis

Pavement Condition Modeling

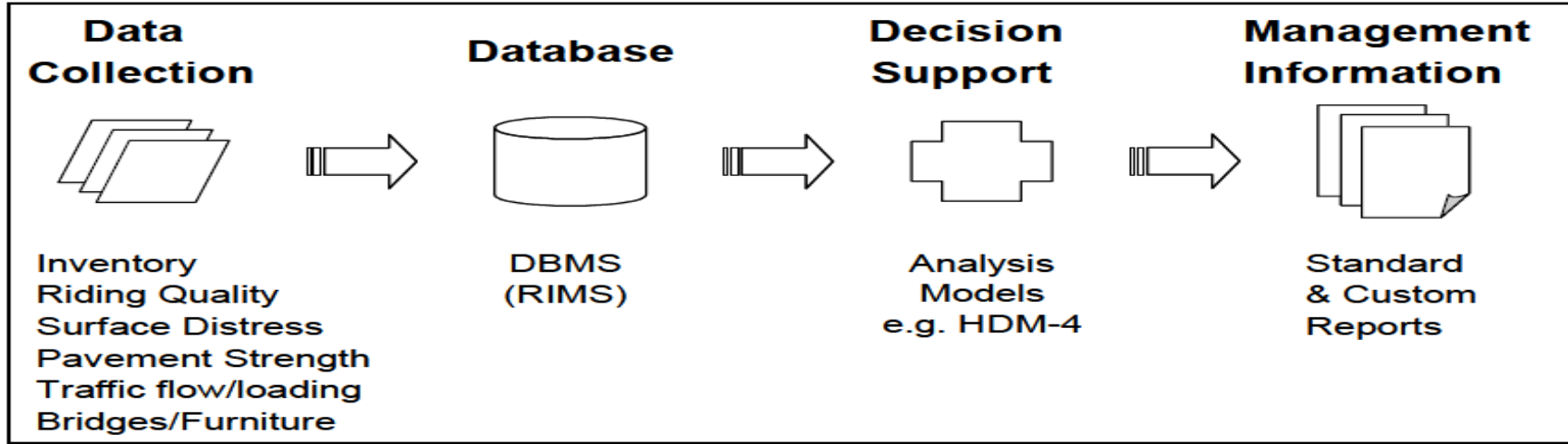
- IRI modeling
- FWD modeling
- Skid Resistance modeling
- Surface distress modeling

Determination of Maintenance – Repair Alternatives

Benefit / Cost Analyses and Feasibility Analyses

Optimum Budget Management

ASSET MANAGEMENT SYSTEMS





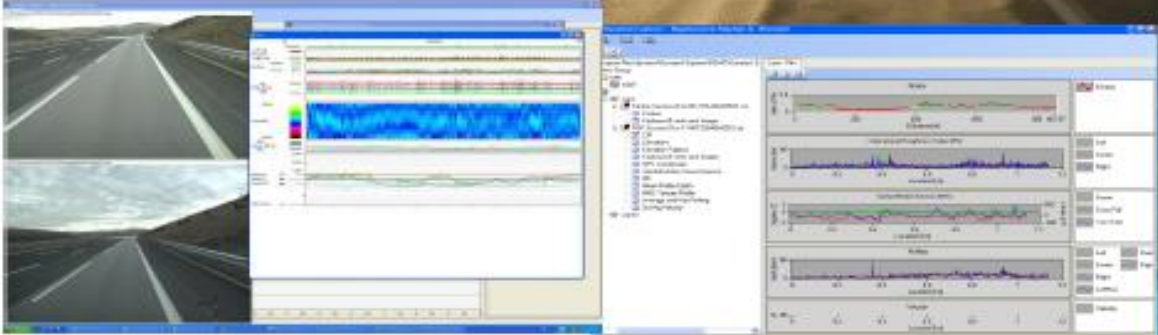
PAVEMENT ASSET MANAGEMENT SYSTEM



- ROAD INVENTORY
- PAVEMENT INVENTORY
- PAVEMENT PERFORMANCE
- TRAFFIC COUNTS
- CLIMATE
- COST

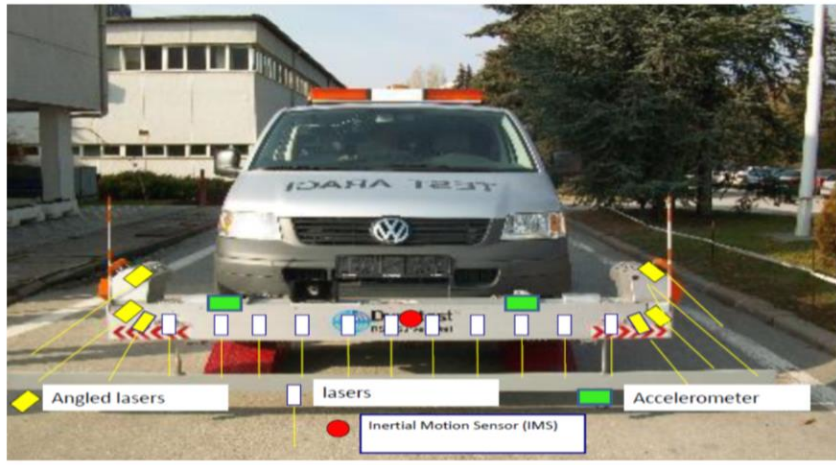
DATABASE

ANALYSES



PAVEMENT ASSET MANAGEMENT SYSTEM

ROAD PERFORMANCE TESTS

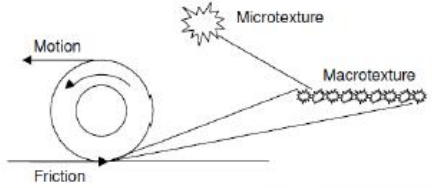
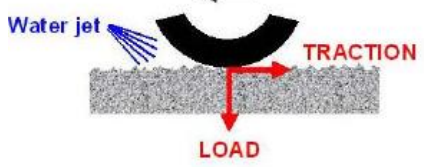
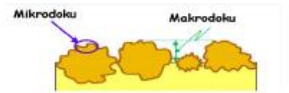


FALLING WEIGHT DEFLECTOMETER



SKID RESISTANCE TESTER

- 2 dual Transducer
- Wet and dry measurement
- Pavement temperature
- DGPS
- 1-5 sn Wheel breaking

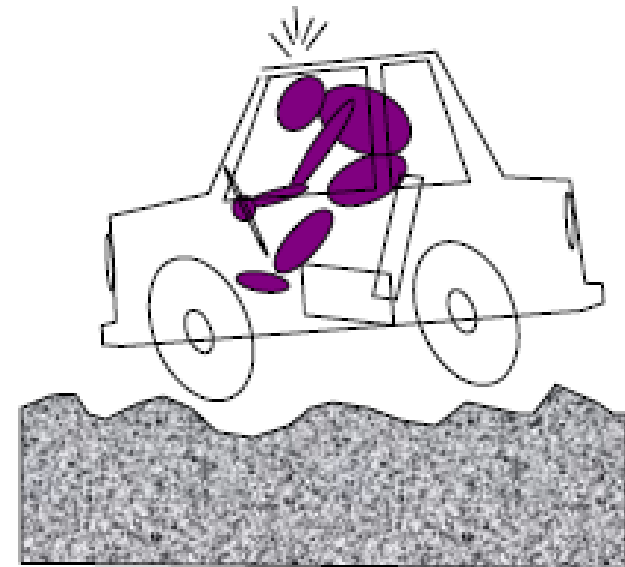


PAVEMENT ASSET MANAGEMENT SYSTEM

IRI ANALYSES

IRI data collected by profilometer measuring device are classified according to the criteria established by General Directorate of Highways.

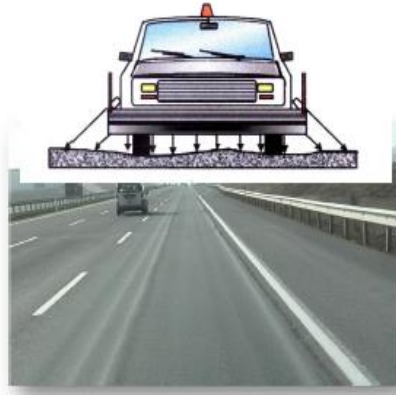
Roughness Value (IRI - m/km)	Roughness Classification	Priority Class
0	Absolute Perfect	
0 - 0.71	Very Good	6
0.72 - 1.11	Good	5
1.12 - 1.58	Average - Good	4
1.59 - 1.80	Average	3
1.81 - 2.13	Bad	2
> 2.13	Very Bad	1





RUTTING ANALYSES

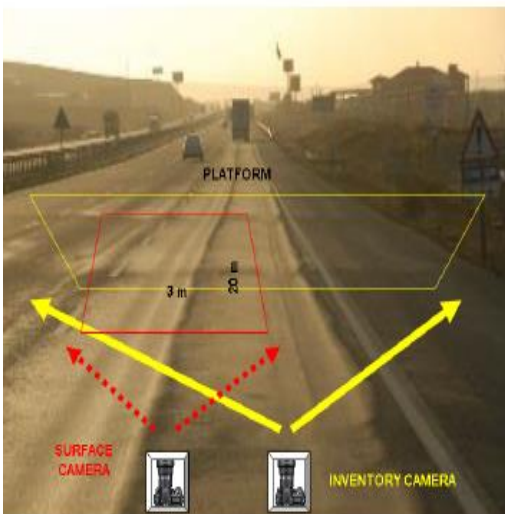
Rutting classification used in General Directorate of Highways.



Rutting Value (TIO - mm)	Rutting Classification	Priority Class
≤ 5	Good	4
5 - 15	Average	3
15 - 30	Bad	2
> 30	Very Bad	1

SURFACE DISTRESS ANALYSES

Surface and inventory images shot in every 20 m with high-resolution cameras of Profilometer are evaluated one by one.



Item No	Surface Distress Type	Surface Distress Symbol
1	Rutting - Right	TIO-R
2	Rutting - Left	TIO-L
3	Alligator Crack	TSÇ
4	Edge Crack	KÇ
5	Transverse Crack	EÇ
6	Longitudinal Crack	BÇ
7	Block Cracking	BLÇ
8	Undulation	ON
9	Settlements	OTR
10	Slippage cracks	ÖTL
11	Patch	Y
12	Pothole	ÇK
13	Bleeding	TR
14	Stripping	SY

SURFACE DISTRESS ANALYSES





PAVEMENT MANAGEMENT SYSTEM

Road Performance Tests

Structural Condition Tests

- Deflection Tests (FWD)
- PCI via Visual Inspection

Functional Condition Tests

- Roughness (IRI)
- Rutting (TIO)
- Skid resistance
- On-board sound intensity



PAVEMENT ASSET MANAGEMENT SYSTEM

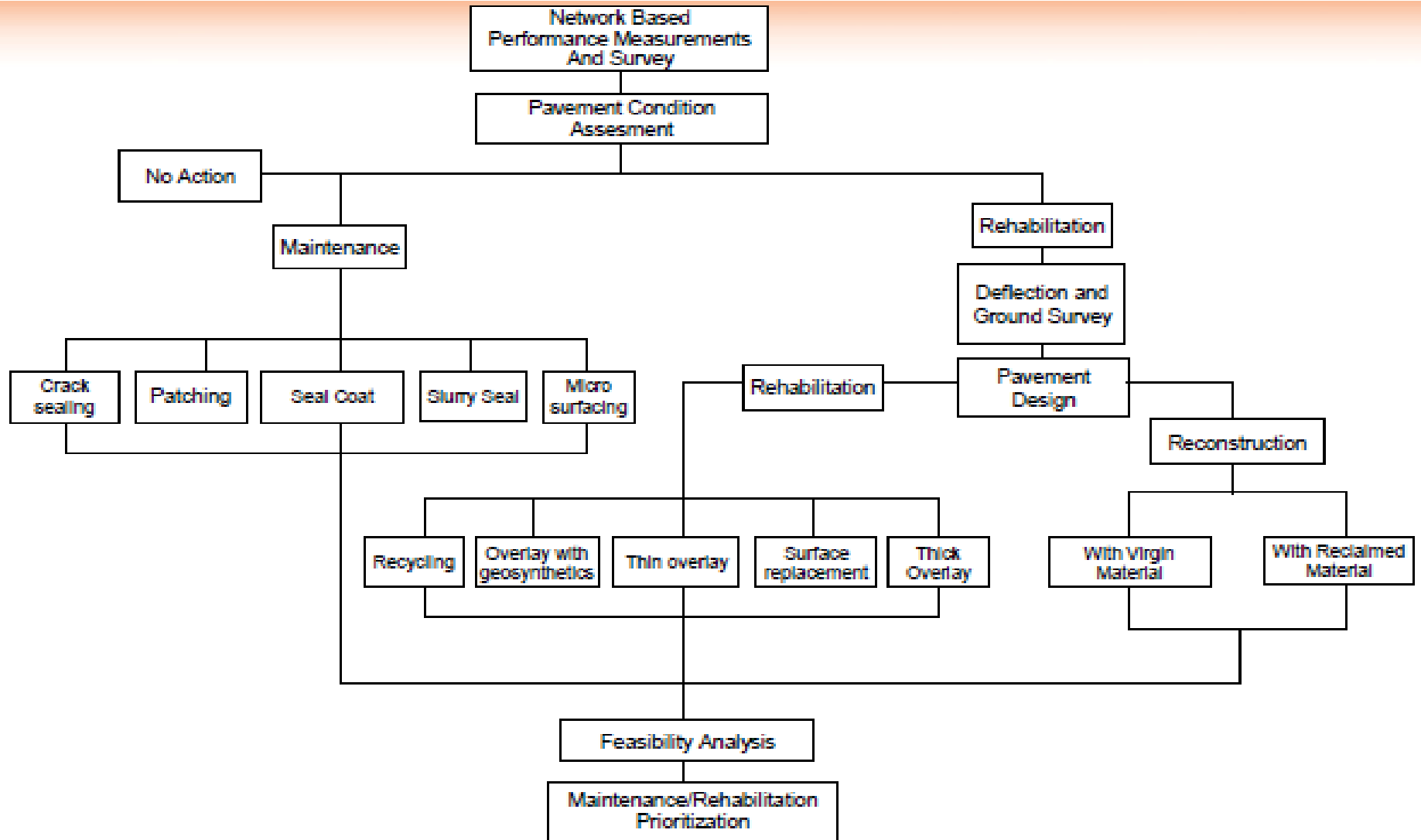
Pavement Pointing Table										
ROAD NAME:		PERSONAL INFORMATION								
ROAD NUMBER:		NAME - SURNAME:								
DRIVING WAY:		POSITION:								
STARTING KM:										
END KM:										
ÜSTYAPI BOZULMA TİPİ	POINTS (A)	DISTRESS SEVERITY (A)			DISTRESS DENSITY (C)					DAMAGE D=AxBxC
		LOW (0,4)	MEDIUM (0,7)	HIGH (1)	VERY LOW (0,6)	LOW (0,7)	MEDIUM (0,8)	HIGH (0,9)	VERY HIGH (1)	
Alligator Crack ✓	10	X				X				2,8
Edge Cracing ✓	5		X				X			2,8
Transverse Crack ✓	10	X					X			3,2
Longitudinal Crack ✓	15	X					X			4,8
Block Cracing	10			X				X		9
Rutting ✓	10			X					X	10
Waves	5		X			X		X		2,45
Local Settlement	5		X			X				2,45
Patch	5	X			X					1,2
Pathole	10	X			X					2,4
Bleeding	5			X			X			4
Stripping	10			X			X			8
Total Damage=										53,1
Total Structural Damage=										23,6
100 - Total Structural Damage = PSP=										76,4
100 - Total Damage =PP=										46,9
Pavement Condition=										Low

Roughness Value (IRI - m/km)	Roughness Classification	Priority Class
0	Absolute Perfect	
0 - 0.71	Very Good	6
0.72 - 1.11	Good	5
1.12 - 1.58	Average - Good	4
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Rutting Value (TIO - mm)	Rutting Classification	Priority Class
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> 30	Very Bad	1

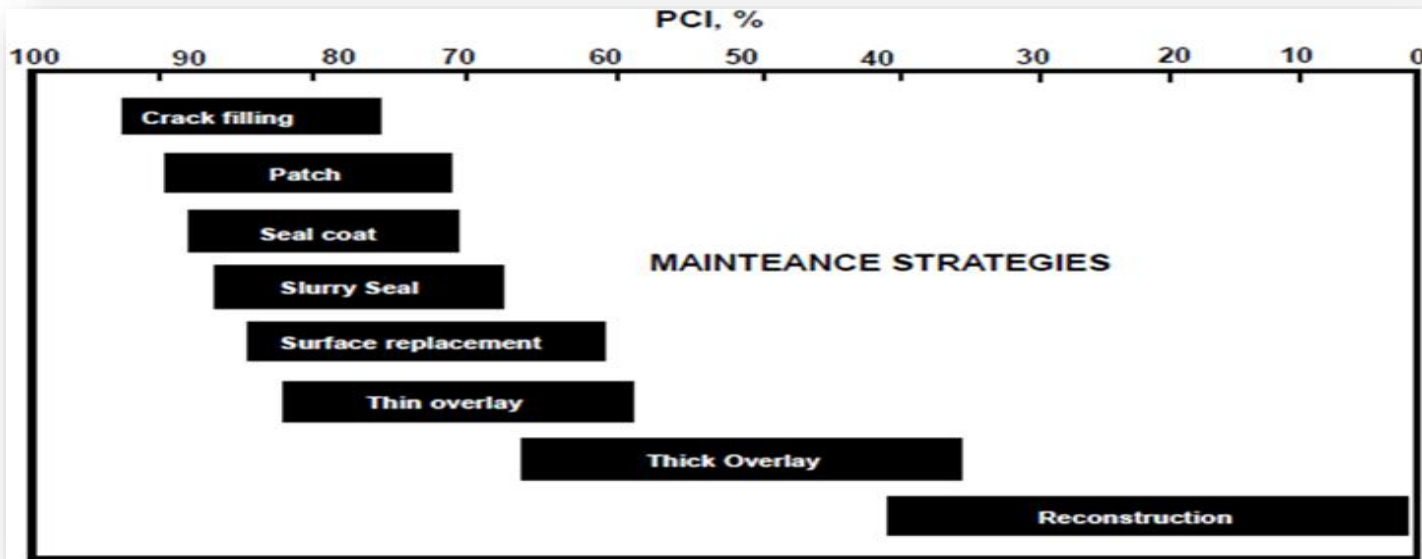


PAVEMENT ASSET MANAGEMENT SYSTEM DECISION TREE FOR ASPHALT CONCRETE ROADS



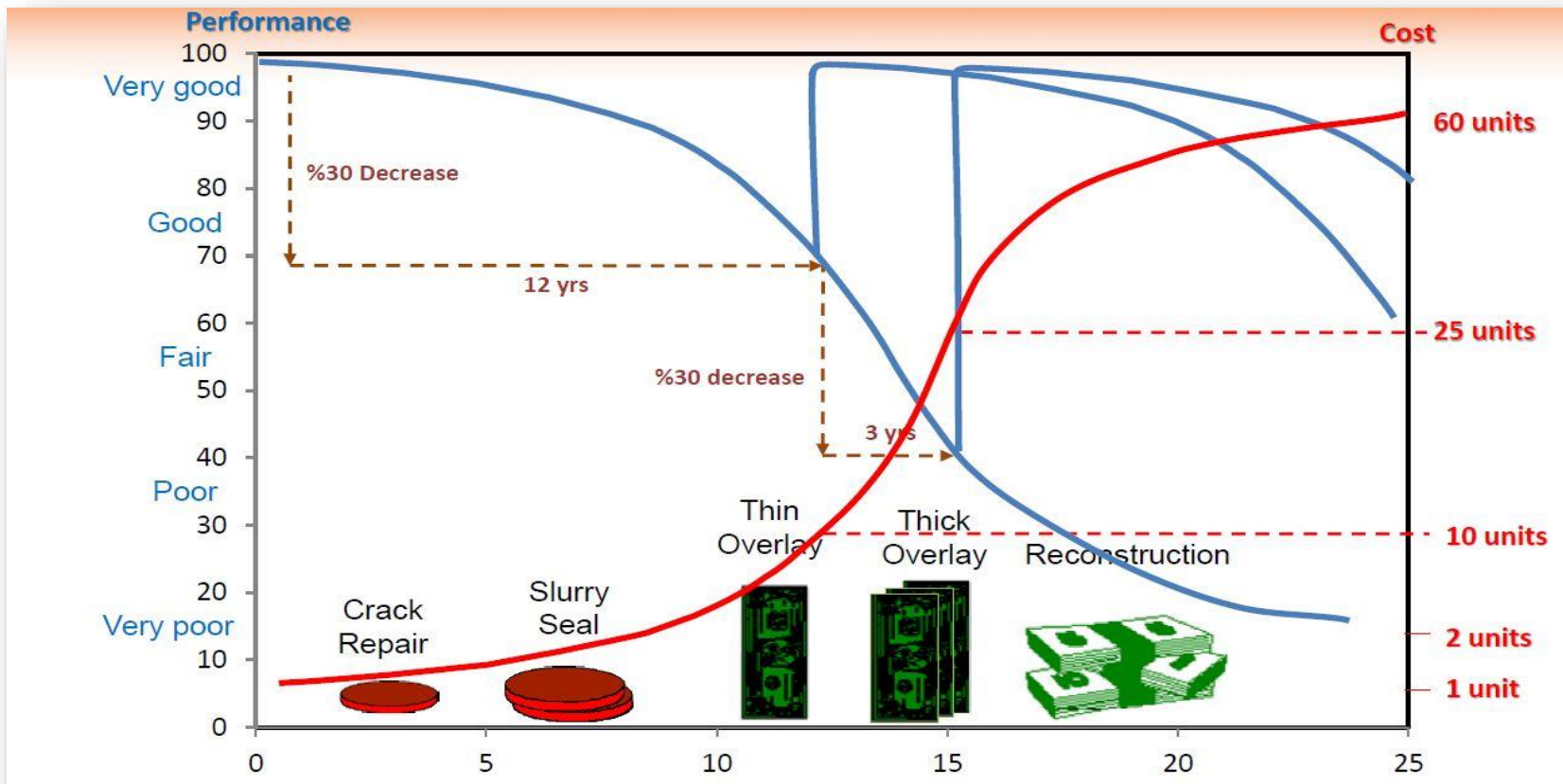


PAVEMENT ASSET MANAGEMENT SYSTEM



PCI	Pavement Condition	Strategy
100 - 90	Very good	No action
90 - 75	Good	Routine maintenance
75 - 65	Fair	Maintenance/Overlay
65 - 40	Poor	Thick Overlay
< 40	Very poor	Reconstruction

PAVEMENT ASSET MANAGEMENT SYSTEM



PMS provides a tool to select **the right road for the right treatment at the right time** and a road network operation with high performance pavement can be made with minimum cost.



Service Levels and KPIs for Maintenance Works

Image-Based Information Management System



PURPOSE OF IMAGE-BASED INFORMATION MANAGEMENT SYSTEM PROJECT

The purpose of the project is

- to establish an image-based information management system with fast, reliable, efficient, highly accurate dynamic data acquisition,
- to meet the needs of 67.620 km road network.





WHY DO WE NEED THIS SYSTEM ?

Road inventory data have been collected manually using GNSS and tablet PC since 2007.

Difficulties

- Costly and time consuming
- Vehicles must stop during data collection and production.
- Laser meters or classical hand meters are used
- If images are needed vehicles should be stopped





Image-Based Information Management System

In the scope of Pilot Project

- Data collected,
- Suitable technologies were determined
- Similar applications and technologies observed.
 - State of Utah 'Roadway imaging/Inventory Program,
 - Wien Mobile Mapping System,
 - Switzerland The Federal Roads Office (FEDRO) infra3d system etc..

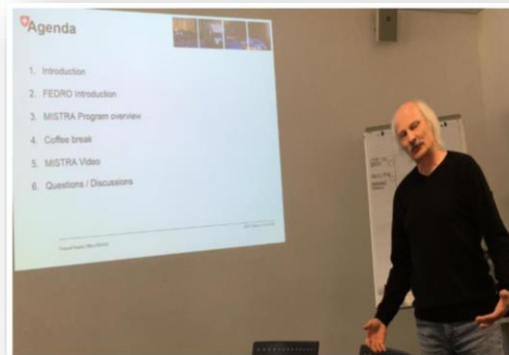




Image-Based Information Management System

New Project; lidar, image based technologies, automated data collection.

Pilot Project was made;

- Mobil Lidar Technology and Stereo Imaging Technology,
- 1000 km sample road section within Ankara provincial borders.



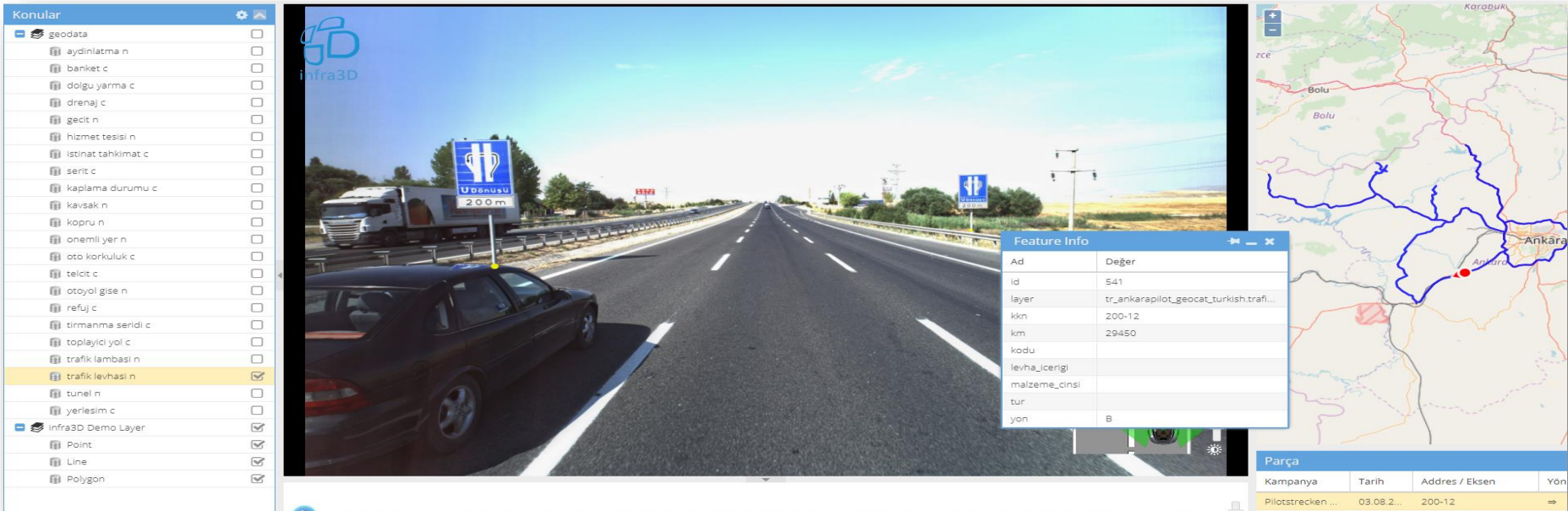
Image-Based Information Management System

Current situation

- The existing situation was analyzed
- Data production was carried out by collecting different technological systems and road inventory information.

Future plans

- Tender for the contract on June 2018 (technical provisions completed)



Ad	Değer
id	541
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kkn	200-12
km	29450
kodu	
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CONCLUSION

- It is important that road maintenance works are made on time to avoid negative effects on economic life of infrastructure
- Proper road maintenance contributes to reliable transport at reduced cost, as there is a direct link between road condition and vehicle operating costs and travel time
- Establishing and developing Road maintenance/Pavement management systems are crucial in order to use the limited budget more efficiently.
- Combining all asset management systems is important to give better decisions for the investments considering all of the assets of our road network



Service Levels and KPIs for Maintenance Works

Thank you for your attention

Mücahit ARMAN

Deputy Director General

marman@kgm.gov.tr

Kenan KAYACI

Director of Strategic Planning Division

kkayaci@kgm.gov.tr

