



Republic of Turkey  
Ministry of Transport Maritime Affairs  
and Communications



GENERAL DIRECTORATE  
of HIGHWAYS

# Benchmarking Transport Infrastructure Construction Costs



**GENEVA**  
30 - 31 JANUARY 2018





# OUTLINE

## ROAD INFRASTRUCTURE CONSTRUCTION COSTS

- 1. REVISED TERMINOLOGY**
- 2. SUGGESTIONS AND CORRECTIONS ON QUESTIONNAIRE**
- 3. COMPARISON OF THE COLLECTED QUESTIONNAIRE FROM MEMBER STATES**





# 1. REVISED TERMINOLOGY





## ECE/TRANS/WP.5/GE.4/2017/1/Rev.2

# Revised terminology on Benchmarking Road Transport Infrastructure Construction Costs

1. The definition of **Alignments** is not included. It should be added after no. 11 **Aggregate**. (**Alignments**: Alignments refer to the geometric design elements that define the horizontal and vertical configuration of the roadways).
2. Both **Backfill** and **Base** have the same number. No. 26 is given to both.
3. In terms of alphabetical order, the order of 27. **Benefit/Cost Ratio (B/C)** and 28. **Balanced cantilever bridge** should be replaced.
4. The definition of **Bituminous base** is not included. It should be added after no. 32 **Bitumen**. (**Bituminous Base**: Main structural element of a pavement. Note 1 to entry: The base can be laid in one or more courses, described as “upper” base, “lower” base).
5. In terms of alphabetical order, 37. **Box Culvert** should be after 35. **Borrow**.

## ECE/TRANS/WP.5/GE.4/2017/1/Rev.2

# Revised terminology on Benchmarking Road Transport Infrastructure Construction Costs

6. In terms of alphabetical order, the order of 43. **Carriageway** and 44. **Capital cost** should be replaced.
7. In terms of alphabetical order, 115. **Grading** should be after 107. **Grade Separation**.
8. In terms of alphabetical order, the order of 163. **Pavement structure** and 164. **Pavement Preservation** should be replaced.
9. In terms of alphabetical order, 196. **Restoration** should be after 189. **Residual value**.



## ECE/TRANS/WP.5/GE.4/2017/1/Rev.2

# Revised terminology on Benchmarking Road Transport Infrastructure Construction Costs

- In terms of alphabetical order, 207. **Periodic maintenance** should be after 171. **Percent slope (% Slope)**. The definition of Periodic maintenance should be added. (**Periodic maintenance**: It covers activities on a section of road at regular and relatively long intervals aiming to preserve the structural integrity of the road. These operations tend to be large scale, requiring specialized equipment and skilled personnel. They cost more than routine maintenance works and require specific identification and planning for implementation and often even design. Activities can be classified as preventive, resurfacing, overlay and pavement reconstruction).
- The reference for **Periodic maintenance** should be given as; **19**. Word Bank, Transport Note No. TRN-4, June 2005, Washington D.C.

**The whole numeration should be reordered in accordance with the changes.**

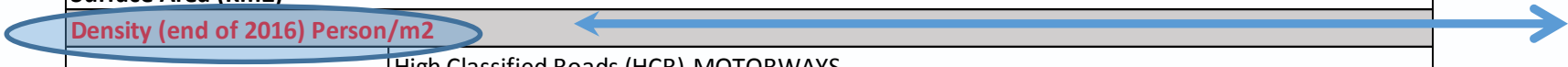


## **2. SUGGESTIONS AND CORRECTIONS ON BENCHMARKING QUESTIONNAIRE**



## Social and Economic Indicators

GNP (US \$) (end of 2016)		
POPULATION (end of 2016)		
GNP Per Capita (US \$) (end of 2016)		
Surface Area (Km2)*		
<b>Density (end of 2016) Person/m<sup>2</sup></b>		
LENGTH OF ROADS (end of 2016) (Km)	High Classified Roads (HCR)-MOTORWAYS	
	Medium Classified Roads (MCR)-PRIMARY ROADS	Singe Carriageway
		Double Carraigeway
	Medium Classified Roads (MCR)-SECONDARY ROADS	Singe Carriageway
		Double Carraigeway
OTHER ROADS	Singe Carriageway	
	Double Carraigeway	
Length of Bridges (end of 2016) (m)		
Length of Tunnels (end of 2016) (m)**		
HCR_Motorways per 1000 Km2 (end of 2016)		
MCR_Primary Roads per 1000 Km2 (end of 2016)		
MCR_Secondary Roads per 1000 Km2 (end of 2016)		
ANNUAL INVESTMENT BUDGET OF ROADS (US \$) (2016 Fiscal Year)		
ANNUAL ROAD INVESTMENT BY PPP (US \$) (Average of the last five years 2012-2016)		
Annual Investment Budget of Roads as Percentage of GNP (%) (including yearly PPP investment)		
ANNUAL CONSTRUCTED ROADS IN LENGTH (KM) (end of 2016)		
ANNUAL CONSTRUCTED DOUBLE CARRIAGEWAY ROADS IN LENGTH (KM) (Average of the last five years 2012-2016)		
ANNUAL CONSTRUCTED SINGLE CARRIAGEWAY ROADS IN LENGTH (KM) (Average of the last five years 2012-2016)		
ANNUAL CONSTRUCTED TUNNELS IN LENGTH (M) (Average of the last five years 2012-2016)**		
ANNUAL CONSTRUCTED BRIDGES IN LENGTH (M) (Average of the last five years 2012-2016)		
Design Cost as Percentage of Construction Cost (%) (end of 2016)		



**Unit for density should be changed from Person/m<sup>2</sup> to Person/Km<sup>2</sup>**

\* Lakes and dams are excluded from the surface area.

\*\* All tunnels are converted to single tube tunnels.





Motorways and Expressways are High Capacity Roads therefore they are double carriageway roads. As Turkey our suggestion is to delete Motorways-Expressways rows from all work items. In addition Expansion(Capacity Improvement) work title row should be deleted from single carriageway roads benchmarking table sheets.

**Construction Costs of Asphalt Roads**  
**SINGLE CARRIAGEWAY ASPHALT ROADS**  
**ROAD INFRASTRUCTURE CONSTRUCTION COSTS (2016 Prices) (US \$/Km) (For Asphalt Roads)**  
**COUNTRIES**

Work Title	Road Class	MAXIMUM	AVERAGE	MINIMUM	LENGTH OF REGARDED PROJECTS (Km)
Resurfacing	HCR_Motorways-Expressways				
	MCR_Primary Roads				
	MCR_Secondary Roads				
	HCR_Motorways-Expressways				
Resurfacing by Strengthening	MCR_Primary Roads				
	MCR_Secondary Roads				
Pavement Replacement	HCR_Motorways-Expressways				
	MCR_Primary Roads				
	MCR_Secondary Roads				
Reconditioning	HCR_Motorways-Expressways				
	MCR_Primary Roads				
	MCR_Secondary Roads				
Reconstruction	HCR_Motorways-Expressways				
	MCR_Primary Roads				
	MCR_Secondary Roads				
Expansion (Capacity Improvement)	HCR_Motorways-Expressways				
	MCR_Primary Roads				
	MCR_Secondary Roads				
New Construction	HCR_Motorways-Expressways				
	MCR_Primary Roads				
	MCR_Secondary Roads				



**Construction Costs of Asphalt Roads**  
**SINGLE CARRIAGEWAY ASPHALT ROADS**  
**ROAD INFRASTRUCTURE CONSTRUCTION COSTS (2016 Prices) (US \$/Km) (For Asphalt Roads)**  
**COUNTRIES**

Work Title	Road Class	MAXIMUM	AVERAGE	MINIMUM	LENGTH OF REGARDED PROJECTS (Km)
Resurfacing	MCR_Primary Roads				
	MCR_Secondary Roads				
Resurfacing by Strengthening	MCR_Primary Roads				
	MCR_Secondary Roads				
Pavement Replacement	MCR_Primary Roads				
	MCR_Secondary Roads				
Reconditioning	MCR_Primary Roads				
	MCR_Secondary Roads				
Reconstruction	MCR_Primary Roads				
	MCR_Secondary Roads				
New Construction	MCR_Primary Roads				
	MCR_Secondary Roads				



# **3. COMPARISON OF THE COLLECTED INFORMATION FROM MEMBER STATES**





# **QUESTIONNAIRE**

**I. SOCIAL AND ECONOMIC INDICATORS**

**II. TUNNEL & BRIDGE CONSTRUCTION COSTS**

**III. CONSTRUCTION COSTS OF ASPHALT ROADS**

**IV. CONSTRUCTION COSTS OF CONCRETE ROADS**





# SOCIAL AND ECONOMIC INDICATORS



		COUNTRY1	COUNTRY2		
GNP (US \$) (end of 2016)					
POPULATION (end of 2016)					
GNP Per Capita (US \$) (end of 2016)					
Surface Area (Km2)*					
Density (end of 2016) Person/Km2					
LENGTH OF ROADS (end of 2016) (Km)	High Classified Roads (HCR)-MOTORWAYS				
	Medium Classified Roads (MCR)-PRIMARY ROADS	Singe Carriageway			
		Double Carraigeway			
	Medium Classified Roads (MCR)-SECONDARY ROADS	Singe Carriageway			
		Double Carraigeway			
	OTHER ROADS	Singe Carriageway			
Double Carraigeway					
Length of Bridges (end of 2016) (m)					
Length of Tunnels (end of 2016) (m)**					
HCR_Motorways per 1000 Km2 (end of 2016)					
MCR_Primary Roads per 1000 Km2 (end of 2016)					
MCR_Secondary Roads per 1000 Km2 (end of 2016)					
ANNUAL INVESTMENT BUDGET OF ROADS (US \$) (2016 Fiscal Year)					
ANNUAL ROAD INVESTMENT BY PPP (US \$) (Average of the last five years 2012-2016)					
Annual Investment Budget of Roads as Percentage of GNP (%) (including yearly PPP investment)					
ANNUAL CONSTRUCTED ROADS IN LENGTH (KM) (end of 2016)					
ANNUAL CONSTRUCTED DOUBLE CARRIAGEWAY ROADS IN LENGTH (KM) (Average of the last five years 2012-2016)					
ANNUAL CONSTRUCTED SINGLE CARRIAGEWAY ROADS IN LENGTH (KM) (Average of the last five years 2012-2016)					
ANNUAL CONSTRUCTED TUNNELS IN LENGTH (M) (Average of the last five years 2012-2016)**					
ANNUAL CONSTRUCTED BRIDGES IN LENGTH (M) (Average of the last five years 2012-2016)					
Design Cost as Percentage of Construction Cost (%) (end of 2016)					



## TUNNEL CONSTRUCTION COSTS US\$/M)

COUNTRIES	SINGLE TUBE TUNNEL (US \$/M)			TWIN TUBE TUNNEL (US \$/M)			UNDER WATER TUNNELS (US \$/M)		
	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM



# I. BRIDGE CONSTRUCTION COSTS US\$/M<sup>2</sup>)

COUNTRIES	PRECASTED & PRESTRESSED SIMPLE BEAM (US \$/M <sup>2</sup> )			BALANCED CANTILIVER BRIDGE (US \$/M <sup>2</sup> )			CABLE STAYED BRIDGE (US \$/M <sup>2</sup> )		
	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM



## II. BRIDGE CONSTRUCTION COSTS US\$/M<sup>2</sup>)

COUNTRIES	PEDESTRIAN BRIDGES (US \$/M <sup>2</sup> )			SUSPENSION BRIDGE (US \$/M <sup>2</sup> )			SUSPENSION + CABLE STAYED BRIDGE (US \$/M <sup>2</sup> )		
	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM



# FUNCTIONAL ROAD TYPES

HCR_Motorways-Expressway	This type of roads are High Capacity Roads such as Motorways and Expressways. This class roads are full access controlled or half access controlled double carriageway highways. Full access controlled highways are generally tolled even there are free motorways in some European countries such as Germany and named as autobahn. Not only physical but also geometric capacity of this type of roads are high. The applied speed limits on this roads are also higher.
MCR-Primary Roads	This type of roads are Medium Capacity Roads such as Primary Roads. This class roads are not access controlled roads. They are free of charged roads. The financial source is taxes. They are double or single carriageway of highways. The geometric and physical capacity of this type of roads are medium. They are also main arterials and principal roads of national highways system of countries. The applied speed limits on this roads are lower than HCR.
MCR-Secondary Roads	This type of roads are Medium Capacity Roads such as Secondary Roads. This class roads are also not access controlled roads. They are also free of charged roads. The financial source is taxes. They are double or single carriageway of highways. The geometric and physical capacity of this type of roads are also medium but relatively lower than MCR_Primary Roads. They are important connectors of the national highways system to towns, connecting cities to towns also. The applied speed limits on this roads are lower than HCR.





# CONSTRUCTION COSTS OF ASPHALT ROADS

## SINGLE CARRIAGEWAY ASPHALT ROADS



ROAD INFRASTRUCTURE CONSTRUCTION COSTS (2016 Prices) (US \$/Km) (For Asphalt Roads)

1.Resurfacing, 2.Resurfacing by Strengthening 3.Pavement Replacement,  
4.Reconditioning, 5.Reconstruction, 6. New Construction

COUNTRIES	MCR_PRIMARY ROADS			MCR_SECONDARY ROADS		
	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM
1.Resurfacing						
2.Resurfacing by Strengthening						
3.Pavement Replacement						
4.Reconditioning						
5.Reconstruction						
6. New Construction						



# CONSTRUCTION COSTS OF ASPHALT ROADS



## DOUBLE CARRIAGEWAY ASPHALT ROADS

ROAD INFRASTRUCTURE CONSTRUCTION COSTS (2016 Prices) (US \$/Km) (For Asphalt Roads)

1.Resurfacing, 2.Resurfacing by Strengthening, 3.Pavement Replacement,  
4.Reconditioning, 5.Reconstruction, 6. Expansion (Capacity Improvement) 7. New Construction

COUNTRIES	HCR_MOTORWAYS&EXPRESSWAYS			MCR_PRIMARY ROADS			MCR_SECONDARY ROADS		
	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM
1.Resurfacing									
2.Resurfacing by Strengthening									
3.Pavement Replacement									
4.Reconditioning									
5.Reconstruction									
6. Expansion									
7. New Construction									



# CONSTRUCTION COSTS OF CONCRETE ROADS



## SINGLE CARRIAGEWAY CONCRETE ROADS

ROAD INFRASTRUCTURE CONSTRUCTION COSTS (2016 Prices) (US \$/Km)

1.Resurfacing, 2.Resurfacing by Strengthening 3.Pavement Replacement,  
4.Reconditioning, 5.Reconstruction, 6. New Construction

COUNTRIES	MCR_PRIMARY ROADS			MCR_SECONDARY ROADS		
	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM
1.Resurfacing						
2.Resurfacing by Strengthening						
3.Pavement Replacement						
4.Reconditioning						
5.Reconstruction						
6. New Construction						



# CONSTRUCTION COSTS OF CONCRETE ROADS



## DOUBLE CARRIAGEWAY CONCRETE ROADS

ROAD INFRASTRUCTURE CONSTRUCTION COSTS (2016 Prices) (US \$/Km)

1.Resurfacing, 2.Resurfacing by Strengthening, 3.Pavement Replacement,  
4.Reconditioning, 5.Reconstruction, 6. Expansion (Capacity Improvement) 7. New Construction

COUNTRIES	HCR_MOTORWAYS&EXPRESSWAYS			MCR_PRIMARY ROADS			MCR_SECONDARY ROADS		
	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM	MAXIMUM	AVERAGE	MINIMUM
1.Resurfacing									
2.Resurfacing by Strengthening									
3.Pavement Replacement									
4.Reconditioning									
5.Reconstruction									
6. Expansion									
7. New Construction									



# THANK YOU FOR YOUR ATTENTION!

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