

**E U R O P E A N U N I O N - T A C I S**

**Technical Assistance to the Southern Republics of the CIS  
and Georgia - TRACECA**

**TRADE AND TRANSPORT SECTORS**

**IMPLEMENTATION OF PAVEMENT MANAGEMENT SYSTEMS**

**PROJECT NO.: TELREG 9305**

**DRAFT FINAL REPORT**

**STUDY OF THE COST AND FINANCING OF ROAD USAGE**

**VOLUME 2, ANNEX**

**DECEMBER 1996**

**KOCKS CONSULT GMBH  
Consulting Engineers  
Koblenz / Germany**

**in association with**

**TECNECON, Economic  
and Transport Consultants  
London / U. K.**

**PHØNIX  
Pavement Consultants  
Vejen / Denmark**



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Koblenz  
19.12.1996

Dear Sir,

***TRACECA Project: Implementation of Pavement Management Systems  
Project Number: TELREG 9305  
Study of the Cost and Finance of Road Usage***

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We take pleasure in submitting to you the draft final report of the above study comprising Volume 1 Main Report and Volume 2 Annex for your review and comment.

The report is submitted in six copies, five bound and one loose leaf. A copy of Volume 1 has been forwarded by E-Mail to the Tacis Coordinating Units in the eight recipient states as well as to the Tacis Monitoring & Evaluation Central Asia in Almaty.

The Russian version is presently under translation and will be submitted together with the diskette as soon as completed.

Yours faithfully

KOCKS CONSULT GMBH  
Consulting Engineers



Ulrich Sprick



Ulrich Willems

**Copies to:** Tacis CU, all 8 recipient states

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**ANNEX 1**





Design guidelines and codes relating to road signage, and to geometric design of rural highways, including rural road intersections, are to be reviewed in detail with local experts and compared to current Western practice. Suggestions for revision are to be made. They should recommend the most suitable Western design guidelines for adoption, noting any adaptations, if considered necessary.

Work in this section should be closely coordinated with the road safety seminars, to promote a maximum of local input.

### 3.6 Study Tour and Seminars

A study tour to Western Europe is to be provided for twenty persons, to be nominated by the Consultant and approved by the Recipient States. The tour is to focus on routine maintenance practice, bitumen bound materials technology and road safety.

The Consultant is to arrange site visits and demonstrations, such as to

- working road and bridge maintenance units
- bituminous bound materials production plants
- in-situ surface recycling operations
- on-site expositions and explanations of road safety dispositions

About five full working days is to be foreseen, plus appropriate acclimatisation/briefing and debriefing periods. Participants should meet West European counterparts, and be able to question them on all aspects of the activities they are shown. Russian language interpreters are to be in attendance.

Short seminars are to be organised in each of the Recipient States to present overviews, explanations of state-of-the-art PMS, bituminous bound products technology, bridge maintenance techniques and concepts of road safety, to Roads Directorate senior staff. Seminar manuals are to be prepared in the Russian language.

Road safety presentations should cover the most recent and ongoing work in the West concerned with the prediction of accidents and implementation of safety measures (eg. conflict techniques of safety situation analysis, the economic analysis of safety measures, recent case studies and risk analysis findings). It may be assumed that the basic principles and established standards of road safety design are already known by the local authorities.

Bridge maintenance presentations should include the most recent Western practice for treatment of cracking, concrete removal, patch repairs, sprayed concrete, external reinforcement, supplementary prestress, corrosion countermeasures, surface treatments, coating of reinforcement, cathodic protection, desalination and realkalisation.

### 3.7 Cost and Financing of Road Usage

3.7.1 The present system of taxes is neither effective in financing road maintenance, nor in allocating the incremental cost of road usage within the economy. Furthermore, it could provoke

distortion of demand within the transport sector. The general problem has been reviewed in previous reports by Western consultants.

This study is to present a rigorous, authoritative analysis embracing:

- the cost of road usage
  - the elements comprising vehicle operating costs and their dependency on road condition
  - the dependency of condition on maintenance practice
  - the eventual reconstruction costs under scenarios such as do-nothing, minimum maintenance and optimised scenarios
  - the incremental deterioration of pavements under the effect of axle loads
- the advantages and disadvantages of the present collection systems, including for example
  - a comparison with marginal cost pricing
  - the impact of transit fees across the region
  - distortions to competition between modes
  - distortions to vehicle and fuel demand
- external costs of road transport
- foreign exchange components in overall cost of road transport, for the different states

Recommendations are to be made for workable, balanced, systems of levying taxes on road use, and the equitable allocation of funds to road maintenance. The cost inputs are to be considered separately for each State.

A full analysis of tolling of roads and bridges is beyond the scope of this study. However any obvious candidate projects may be cited and used as an example.

The order of magnitude of time and safety costs and savings are to be estimated and presented, but separately from direct costs. The effects of congestion may be included qualitatively.

Full collaboration with the Ministries of Economy and Finance in the preparation of this analysis and recommendations, will be essential for the output to have any impact.

Serious price distortions (eg through subsidies) have been encountered. Shadow pricing is to be applied as appropriate, but applications should then be clearly explained.

The cost and financing analysis described in this section is to be issued as a separate report dealing with this single issue. It should be clear and concise, to address a readership of Officials in the TRACECA states, foreign consultants (eg to Ministries of Economy and Finance), as well as other decision makers, who may be presumed unfamiliar with transport economics. It should be strictly objective, and applicable as a reference document for negotiations between Ministries of Transport and Ministries of Economy and Finance in the Region. It should emphasise the local consequences and obligations of road maintenance policies, rather than seeking to justify IFI intervention.

**ANNEX 3**



Table A.3.1 Representative Vehicle Models Selected for Vehicle Operating Cost Analysis

Country	Car	Utility vehicle	Large Bus	Representative Vehicle Types/Models			Heavy Truck + Trailer 5-axes
				Medium 2-axle Truck	Heavy 3-axle Truck		
Armenia	Lada 124	Eraz 762vgp	Ikarus 256	Zil 130-80	Kamaz 5320	Kamaz 5410	
Azerbaijan	Lada 124	GAZ 52	Ikarus 25058	Zil 130 431410	Kamaz 53212	Kamaz 54112	
Georgia	Lada 124	Raf 2203	Ikarus 25058	Zil 130-80	Kamaz 53212	Kamaz 54112	
Kazakhstan	Lada 2106	Raf 2203	Ikarus 25058	GAZ-SAZ 53B	Kamaz 53212	Kamaz 5410	
Kyrgyzstan	Lada 2107	Raf 2203	Ikarus 250	Zil 130	Kamaz 5320	Kamaz 54112	
Tajikistan	Lada 124	Raf 2203	Ikarus 256	Zil 130	Kamaz 5320	Kamaz 54112	
Turkmenistan	Lada 124	Eraz 762vgp	Ikarus 256	Zil 130-80	Kamaz 5320	Kamaz 54112	
Uzbekistan	Lada 1600	Raf 2203	Ikarus 256	Zil 130-80	Kamaz 5320	Kamaz 54112	

Source: Consultant's estimate

TABLEA32.XLS

Table A.3.2 DATA INPUTS FOR VEHICLE OPERATING COST ANALYSIS							
Vehicle Operating Cost Model Inputs	Unit	ARMENIA					
		1 Car	4 Utility Vehicle	5 Large Bus	8 Medium (2-axle) Truck	9 Heavy (3-axle) Truck	10 Articulated (>3-axle) Truck
<b>Roadway Characteristics</b>							
Surface type		Paved	Paved	Paved	Paved	Paved	Paved
Average roughness (IRI)	m/km	5	5	5	5	5	5
Average positive gradient	%	5	5	5	5	5	5
Average negative gradient	%	5	5	5	5	5	5
Proportion of uphill travel	%	50	50	50	50	50	50
Average horizontal curvature	deg/km	5	5	5	5	5	5
Average superelevation	fraction	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C
Altitude of terrain	m.	1,000	1,000	1,000	1,000	1,000	1,000
Effective number of lanes		>1	>1	>1	>1	>1	>1
<b>Vehicle Characteristics</b>							
Tare (unladen) weight	kg	960	1,320	10,400	4,525	7,500	12,130
Load carried	kg	400	900	3,500	3,500	6,000	15,000
Maximum used driving power	metric HP	41	40	138	67	147	147
Maximum used braking power	metric HP	20	32	208	147	217	436
Desired speed	km/hour	98.3	94.9	93.4	88.8	88.8	84.1
Aerodynamic drag coefficient	dimensionless	0.45	0.48	0.65	0.85	0.85	0.63
Projected frontal area	m <sup>2</sup>	1.80	2.72	6.30	5.20	5.20	5.75
Calibrated engine speed	rpm	3,500	3,300	2,300	1,800	1,800	1,700
Energy efficiency factor	dimensionless	0.95	0.90	0.95	1.00	1.00	1.00
Fuel adjustment factor (alpha 2)	dimensionless	1.16	1.16	1.15	1.15	1.15	1.15
<b>Tyre Wear Data</b>							
Number of tyres per vehicle		4	4	6	6	10	18
Wearable volume of rubber per tyre	dm <sup>3</sup>			6.85	7.60	7.30	8.39
Retreading cost per new tyre	Fraction	0.3	0.3	0.3	0.3	0.3	0.3
Maximum number of recaps		1	1	1	1	1	1
Constant term of tread wear model	dm <sup>3</sup> /m			0.164	0.164	0.164	0.164
Wear coefficient for tread wear model	10-3 dm <sup>3</sup> /kj			12.780	12.780	12.780	12.780
<b>Vehicle Utilisation Data</b>							
Average annual utilisation	km	25,000	40,000	120,000	60,000	90,000	90,000
Average annual utilisation	hours	500	875	2,000	1,430	1,370	1,500
Hourly utilisation ratio (HURATIO)	Fraction	0.4	0.5	0.6	0.6	0.6	0.65
Average service life	Years	15	12	10	15	10	10
Use constant service life ?		No	No	No	No	No	No
Age of vehicle in km	km	131,250	156,000	281,250	262,500	218,750	300,000
Passengers per vehicle		2	5	45			
<b>Unit Costs</b>							
New vehicle price	US\$	7,000	6,000	50,000	15,000	45,000	60,000
Fuel cost	US\$/litre	0.35	0.35	0.3	0.3	0.3	0.3
Lubricants cost	US\$/litre	1.4	1.4	1.4	1.4	1.4	1.4
New tyre cost	US\$	45	50	200	150	200	250
Crew time cost	US\$/hour		0.26	0.39	0.39	0.39	0.52
Passenger delay cost	US\$/hour						
Maintenance labour cost	US\$/hour	0.31	0.31	0.31	0.31	0.31	0.31
Cargo delay cost	US\$/hour						
Annual interest rate (%)	%	12	12	12	12	12	12
Overhead per vehicle km	US\$		0.01	0.02	0.025	0.025	0.025
<b>Additional Coefficients</b>							
KP - Maintenance parts		0.308	0.308	0.483	0.371	0.371	0.371
CPo - Maintenance parts	10E-6	32.490	32.490	1.770	1.490	8.610	13.940
CPq - Maintenance parts	10E-3	13.700	13.700	3.560	251.790	35.310	15.650
QIPo - Maintenance parts		120.000	120.000	190.000	0.000	0.000	0.000
CLo - Maintenance parts		77.140	77.140	293.440	242.030	301.480	652.510
CLp - Maintenance parts		0.547	0.547	0.517	0.519	0.519	0.519
CLq - Maintenance parts		0.000	0.000	0.006	0.000	0.000	0.000
COo - Lubricants		1.550	1.550	3.070	3.070	3.070	5.150
FRATIO0 - VCURVE		0.268	0.221	0.233	0.292	0.292	0.179
FRATIO1 - VCURVE	10E-4	0	0	0	0.094	0.094	0.023
ARVMAX - VROUGH		259.7	239.7	212.8	177.7	177.7	130.9
BW - VDESIR		1	1	1	1	1	1
BETA - Speed		0.274	0.308	0.273	0.310	0.310	0.244
EO - Speed		1.003	1.004	1.012	1.013	1.013	1.018
A0 - Fuel		-8201	6014	-7276	-22955	-22955	-30559
A1 - Fuel		33.4	37.6	63.5	95.0	95.0	156.1
A2 - Fuel		0	0	0	0	0	0
A3 - Fuel		5630	3846	4323	3758	3758	4002
A4 - Fuel		0	1.398	0	0	0	0
A5 - Fuel		0	0	8.64	19.12	19.12	4.41
A6 - Fuel		4460	3604	2479	2394	2394	4435
A7 - Fuel		0	0	11.50	13.76	13.76	26.08
NHO - Fuel		-10	-12	-50	-85	-85	-85
Alpha1		0.7	1	1	1	1	1

TABLEA32.XLS

Table A.3.2 DATA INPUTS FOR VEHICLE OPERATING COST ANALYSIS							
Vehicle Operating Cost Model Inputs	Unit	AZERBAIJAN					
		1 Car	4 Utility Vehicle	5 Large Bus	8 Medium (2-axle) Truck	9 Heavy (3-axle) Truck	10 Articulated (>3-axle) Truck
<b>Roadway Characteristics</b>							
Surface type		Paved	Paved	Paved	Paved	Paved	Paved
Average roughness (IRI)	m/km	5	5	5	5	5	5
Average positive gradient	%	5	5	5	5	5	5
Average negative gradient	%	5	5	5	5	5	5
Proportion of uphill travel	%	50	50	50	50	50	50
Average horizontal curvature	deg/km	5	5	5	5	5	5
Average superelevation	fraction	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C
Altitude of terrain	m.	100	100	100	100	100	100
Effective number of lanes		>1	>1	>1	>1	>1	>1
<b>Vehicle Characteristics</b>							
Tare (unladen) weight	kg	960	1,300	11,100	4,525	8,200	12,800
Load carried	kg	300	400	3,000	2,400	6,000	15,000
Maximum used driving power	metric HP	41	39	100	67	147	147
Maximum used braking power	metric HP	20	29	197	147	255	467
Desired speed	km/hour	98.30	94.90	93.40	88.80	88.80	84.10
Aerodynamic drag coefficient	dimensionless	0.45	0.46	0.65	0.85	0.85	0.63
Projected frontal area	m <sup>2</sup>	1.80	2.72	6.30	5.20	5.20	5.75
Calibrated engine speed	rpm	3,500	3,300	2,300	1,800	1,800	1,700
Energy efficiency factor	dimensionless	0.95	0.95	0.95	1	1	1
Fuel adjustment factor (alpha 2)	dimensionless	1.16	1.16	1.15	1.15	1.15	1.15
<b>Tyre Wear Data</b>							
Number of tyres per vehicle		4	4	6	6	10	18
Wearable volume of rubber per tyre	dm <sup>3</sup>			6.85	7.60	7.30	8.39
Retreading cost per new tyre	Fraction	0.3	0.3	0.3	0.3	0.3	0.3
Maximum number of recaps		1	1	1	1	1	1
Constant term of tread wear model	dm <sup>3</sup> /m			0.164	0.164	0.164	0.164
Wear coefficient for tread wear model	10 <sup>-3</sup> dm <sup>3</sup> /kj			12.780	12.780	12.780	12.780
<b>Vehicle Utilisation Data</b>							
Average annual utilisation	km	17,500	29,250	62,500	40,000	40,000	56,250
Average annual utilisation	hours	350	650	1,250	1,000	1,000	1,250
Hourly utilisation ratio (HURATIO)	Fraction	0.40	0.50	0.60	0.50	0.60	0.65
Average service life	Years	15	8	7	8	8	10
Use constant service life ?		No	No	No	No	No	No
Age of vehicle in km	km	131,250	175,500	218,750	240,000	200,000	281,250
Passengers per vehicle		2	5	32			
<b>Unit Costs</b>							
New vehicle price	US\$	7,800	7,020	38,500	15,438	40,300	50,000
Fuel cost	US\$/litre	0.35	0.35	0.14	0.14	0.14	0.14
Lubricants cost	US\$/litre	1.32	1.32	1.32	1.32	1.32	1.32
New tyre cost	US\$	57	57	200	150	250	250
Crew time cost	US\$/hour		0.28	0.43	0.43	0.43	0.57
Passenger delay cost	US\$/hour						
Maintenance labour cost	US\$/hour	0.34	0.34	0.34	0.34	0.34	0.34
Cargo delay cost	US\$/hour						
Annual interest rate (%)	%	12	12	12	12	12	12
Overhead per vehicle km	US\$		0.010	0.020	0.025	0.025	0.025
<b>Additional Coefficients</b>							
KP - Maintenance parts		0.308	0.308	0.483	0.371	0.371	0.371
CPo - Maintenance parts	10E-6	32.490	32.490	1.770	1.490	8.610	13.940
CPq - Maintenance parts	10E-3	13.700	13.700	3.560	251.790	35.310	15.650
QIPo - Maintenance parts		120.000	120.000	190.000	0.000	0.000	0.000
CLo - Maintenance parts		77.140	77.140	293.440	242.030	301.460	652.510
CLp - Maintenance parts		0.547	0.547	0.517	0.519	0.519	0.519
CLq - Maintenance parts		0.000	0.000	0.006	0.000	0.000	0.000
COo - Lubricants		1.550	1.550	3.070	3.070	3.070	5.150
FRATIOO - VCURVE		0.268	0.220	0.233	0.292	0.292	0.179
FRATIO1 - VCURVE	10E-4	0	0	0	0.094	0.094	0.023
ARVMAX - VROUGH		259.7	239.7	212.8	177.7	177.7	130.9
BW - VDESIR		1	1	1	1	1	1
BETA - Speed		0.274	0.310	0.273	0.310	0.310	0.244
EO - Speed		1.003	1.004	1.012	1.013	1.013	1.018
A0 - Fuel		-8.201	6.014	-7.276	-22.955	-22.955	-30.559
A1 - Fuel		33.4	37.6	63.5	95.0	95.0	156.1
A2 - Fuel		0	0	0	0	0	0
A3 - Fuel		5,630	3,846	4,323	3,758	3,758	4,002
A4 - Fuel		0	1,398	0	0	0	0
A5 - Fuel		0	0	8.64	19.12	19.12	4.41
A6 - Fuel		4,460	3,604	2,479	2,394	2,394	4,435
A7 - Fuel		0	0	11.50	13.76	13.76	26.08
NHO - Fuel		-10	-12	-50	-85	-85	-85
Alpha1		0.7	1	1	1	1	1

TABLEA32.XLS

Table A.3.2 DATA INPUTS FOR VEHICLE OPERATING COST ANALYSIS							
Vehicle Operating Cost Model Inputs	Unit	GEORGIA					
		1 Car	4 Utility Vehicle	5 Large Bus	8 Medium (2-axle) Truck	9 Heavy (3-axle) Truck	10 Articulated (>3-axle) Truck
<b>Roadway Characteristics</b>							
Surface type		Paved	Paved	Paved	Paved	Paved	Paved
Average roughness (IRI)	m/km	7	7	7	7	7	7
Average positive gradient	%	5	5	5	5	5	5
Average negative gradient	%	5	5	5	5	5	5
Proportion of uphill travel	%	50	50	50	50	50	50
Average horizontal curvature	deg/km	5	5	5	5	5	5
Average superelevation	fraction	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C
Altitude of terrain	m.	500	500	500	500	500	500
Effective number of lanes		>1	>1	>1	>1	>1	>1
<b>Vehicle Characteristics</b>							
Tare (unladen) weight	kg	960	1,815	11,100	4,525	8,200	12,400
Load carried	kg	300	400	3,000	2,400	6,000	15,000
Maximum used driving power	metric HP	41	39	100	67	147	147
Maximum used braking power	metric HP	20	29	197	147	255	467
Desired speed	km/hour	98.30	94.90	93.40	88.80	88.80	84.10
Aerodynamic drag coefficient	dimensionless	0.45	0.46	0.65	0.85	0.85	0.63
Projected frontal area	m <sup>2</sup>	1.80	2.72	6.30	5.20	5.20	5.75
Calibrated engine speed	rpm	3,500	3,300	2,300	1,800	1,800	1,700
Energy efficiency factor	dimensionless	0.95	0.95	0.95	1	1	1
Fuel adjustment factor (alpha 2)	dimensionless	1.16	1.16	1.15	1.15	1.15	1.15
<b>Tyre Wear Data</b>							
Number of tyres per vehicle		4	4	6	6	10	18
Wearable volume of rubber per tyre	dm <sup>3</sup>			6.85	7.60	7.30	8.39
Retreading cost per new tyre	Fraction	0.3	0.3	0.3	0.3	0.3	0.3
Maximum number of recaps		1	1	1	1	1	1
Constant term of tread wear model	dm <sup>3</sup> /m			0.164	0.164	0.164	0.164
Wear coefficient for tread wear model	10 <sup>-3</sup> dm <sup>3</sup> /kj			12.780	12.780	12.780	12.780
<b>Vehicle Utilisation Data</b>							
Average annual utilisation	km	17,000	30,000	60,000	40,000	40,000	50,000
Average annual utilisation	hours	350	750	1,250	1,150	1,000	1,250
Hourly utilisation ratio (HURATIO)	Fraction	0.40	0.50	0.50	0.50	0.60	0.65
Average service life	Years	17	12	10	15	12	10
Use constant service life ?		No	No	No	No	No	No
Age of vehicle in km	km	135,000	200,000	350,000	400,000	250,000	325,000
Passengers per vehicle		2	5	32			
<b>Unit Costs</b>							
New vehicle price	US\$	7,000	9,750	45,000	18,000	40,000	48,000
Fuel cost	US\$/litre	0.28	0.28	0.21	0.21	0.21	0.21
Lubricants cost	US\$/litre	1.35	1.35	1.35	1.35	1.35	1.35
New tyre cost	US\$	50	80	200	150	200	250
Crew time cost	US\$/hour		0.20	0.30	0.30	0.30	0.30
Passenger delay cost	US\$/hour						
Maintenance labour cost	US\$/hour	0.24	0.24	0.24	0.24	0.24	0.24
Cargo delay cost	US\$/hour						
Annual interest rate (%)	%	12	12	12	12	12	12
Overhead per vehicle km	US\$		0.010	0.020	0.025	0.025	0.025
<b>Additional Coefficients</b>							
KP - Maintenance parts		0.308	0.308	0.483	0.371	0.371	0.371
CPo - Maintenance parts	10E-6	32.490	32.490	1.770	1.490	8.610	13.940
CPq - Maintenance parts	10E-3	13.700	13.700	3.560	251.790	35.310	15.650
QIPo - Maintenance parts		120.000	120.000	190.000	0.000	0.000	0.000
CLo - Maintenance parts		77.140	77.140	293.440	242.030	301.460	652.510
CLp - Maintenance parts		0.547	0.547	0.517	0.519	0.519	0.519
CLq - Maintenance parts		0.000	0.000	0.006	0.000	0.000	0.000
COo - Lubricants		1.550	1.550	3.070	3.070	3.070	5.150
FRATIO0 - VCURVE		0.268	0.220	0.233	0.292	0.292	0.179
FRATIO1 - VCURVE	10E-4	0	0	0	0.094	0.094	0.023
ARVMAX - VROUGH		259.7	239.7	212.8	177.7	177.7	130.9
BW - VDESIR		1	1	1	1	1	1
BETA - Speed		0.274	0.310	0.273	0.310	0.310	0.244
EO - Speed		1.003	1.004	1.012	1.013	1.013	1.018
A0 - Fuel		-8.201	6.014	-7.276	-22.955	-22.955	-30.559
A1 - Fuel		33.4	37.6	63.5	95.0	95.0	156.1
A2 - Fuel		0	0	0	0	0	0
A3 - Fuel		5.630	3.846	4.323	3.758	3.758	4.002
A4 - Fuel		0	1.398	0	0	0	0
A5 - Fuel		0	0	8.64	19.12	19.12	4.41
A6 - Fuel		4.460	3.604	2.479	2.394	2.394	4.435
A7 - Fuel		0	0	11.50	13.76	13.76	26.08
NHO - Fuel		-10	-12	-50	-85	-85	-85
Alpha1		0.7	1	1	1	1	1



TABLEA32.XLS

Table A.3.2 DATA INPUTS FOR VEHICLE OPERATING COST ANALYSIS							
Vehicle Operating Cost Model Inputs	Unit	KAZAKHSTAN					
		1 Car	4 Utility Vehicle	5 Large Bus	6 Medium (2-axle) Truck	9 Heavy (3-axle) Truck	10 Articulated (>3-axle) Truck
<b>Roadway Characteristics</b>							
Surface type		Paved	Paved	Paved	Paved	Paved	Paved
Average roughness (IRI)	m/km	5	5	5	5	5	5
Average positive gradient	%	5	5	5	5	5	5
Average negative gradient	%	5	5	5	5	5	5
Proportion of uphill travel	%	50	50	50	50	50	50
Average horizontal curvature	deg/km	5	5	5	5	5	5
Average superelevation	fraction	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C
Altitude of terrain	m.	300	300	300	300	300	300
Effective number of lanes		>1	>1	>1	>1	>1	>1
<b>Vehicle Characteristics</b>							
Tare (unladen) weight	kg	1,200	1,815	11,100	3,700	8,200	12,400
Load carried	kg	400	600	3,200	3,500	7,500	15,000
Maximum used driving power	metric HP	43	48	100	100	147	147
Maximum used braking power	metric HP	20	38	200	200	255	436
Desired speed	km/hour	98.30	94.90	93.40	88.80	88.80	84.10
Aerodynamic drag coefficient	dimensionless	0.45	0.46	0.65	0.85	0.85	0.63
Projected frontal area	m <sup>2</sup>	1.80	2.72	6.30	5.20	5.20	5.75
Calibrated engine speed	rpm	3,500	3,300	2,300	1,800	1,800	1,700
Energy efficiency factor	dimensionless	0.9	0.9	0.95	1	1	1
Fuel adjustment factor (alpha 2)	dimensionless	1.16	1.16	1.15	1.15	1.15	1.15
<b>Tyre Wear Data</b>							
Number of tyres per vehicle		4	4	6	6	10	18
Wearable volume of rubber per tyre	dm <sup>3</sup>			6.85	7.60	7.30	8.39
Retreading cost per new tyre	Fraction	0.3	0.3	0.3	0.3	0.3	0.3
Maximum number of recaps		1	1	1	1	1	1
Constant term of tread wear model	dm <sup>3</sup> /m			0.164	0.164	0.164	0.164
Wear coefficient for tread wear model	10 <sup>-3</sup> dm <sup>3</sup> /kj			12.780	12.780	12.780	12.780
<b>Vehicle Utilisation Data</b>							
Average annual utilisation	km	22,000	40,000	75,000	60,000	60,000	67,500
Average annual utilisation	hours	400	800	1,500	1,500	1,500	1,500
Hourly utilisation ratio (HURATIO)	Fraction	0.40	0.50	0.65	0.55	0.65	0.65
Average service life	Years	15	12	10	15	10	10
Use constant service life ?		No	No	No	No	No	No
Age of vehicle in km	km	165,000	240,000	375,000	450,000	300,000	337,500
Passengers per vehicle		2	5	32			
<b>Unit Costs</b>							
New vehicle price	US\$	8,525	9,500	37,115	18,000	37,293	47,541
Fuel cost	US\$/litre	0.29	0.29	0.20	0.20	0.20	0.20
Lubricants cost	US\$/litre	1.32	1.32	1.32	1.32	1.32	1.32
New tyre cost	US\$	53	80	265	146	225	225
Crew time cost	US\$/hour		1.53	3.05	2.29	2.59	2.59
Passenger delay cost	US\$/hour						
Maintenance labour cost	US\$/hour	1.83	1.83	1.83	1.83	1.83	1.83
Cargo delay cost	US\$/hour						
Annual interest rate (%)	%	10	10	10	10	10	10
Overhead per vehicle km	US\$		0.010	0.025	0.025	0.025	0.025
<b>Additional Coefficients</b>							
KP - Maintenance parts		0.308	0.308	0.483	0.371	0.371	0.371
CPo - Maintenance parts	10E-6	32.490	32.490	1.770	1.490	8.610	13.940
CPq - Maintenance parts	10E-3	13.700	13.700	3.560	251.790	35.310	15.650
QIPo - Maintenance parts		120.000	120.000	190.000	0.000	0.000	0.000
CLo - Maintenance parts		77.140	77.140	293.440	242.030	301.460	652.510
CLp - Maintenance parts		0.547	0.547	0.517	0.519	0.519	0.519
CLq - Maintenance parts		0.000	0.000	0.006	0.000	0.000	0.000
COo - Lubricants		1.550	1.550	3.070	3.070	3.070	5.150
FRATIO0 - VCURVE		0.268	0.220	0.233	0.292	0.292	0.179
FRATIO1 - VCURVE	10E-4	0	0	0	0.094	0.094	0.023
ARVMAX - VROUGH		259.7	239.7	212.8	177.7	177.7	130.9
BW - VDESIR		1	1	1	1	1	1
BETA - Speed		0.274	0.310	0.273	0.310	0.310	0.244
EO - Speed		1.003	1.004	1.012	1.013	1.013	1.018
A0 - Fuel		-8,201	6,014	-7,276	-22,955	-22,955	-30,559
A1 - Fuel		33.4	37.6	63.5	95.0	95.0	156.1
A2 - Fuel		0	0	0	0	0	0
A3 - Fuel		5,630	3,846	4,323	3,758	3,758	4,002
A4 - Fuel		0	1,398	0	0	0	0
A5 - Fuel		0	0	8.64	19.12	19.12	4.41
A6 - Fuel		4,460	3,604	2,479	2,394	2,394	4,435
A7 - Fuel		0	0	11.50	13.76	13.76	26.08
NHO - Fuel		-10	-12	-50	-85	-85	-85
Alpha1		0.7	1	1	1	1	1

TABLEA32.XLS

Table A.3.2 DATA INPUTS FOR VEHICLE OPERATING COST ANALYSIS							
Vehicle Operating Cost Model Inputs	Unit	KYRGVZ REPUBLIC					
		1 Car	4 Utility Vehicle	5 Large Bus	8 Medium (2-axle) Truck	9 Heavy (3-axle) Truck	10 Articulated (>3-axle) Truck
<b>Roadway Characteristics</b>							
Surface type		Paved	Paved	Paved	Paved	Paved	Paved
Average roughness (IRI)	m/km	5	5	5	5	5	5
Average positive gradient	%	5	5	5	5	5	5
Average negative gradient	%	5	5	5	5	5	5
Proportion of uphill travel	%	50	50	50	50	50	50
Average horizontal curvature	deg/km	5	5	5	5	5	5
Average superelevation	fraction	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C
Altitude of terrain	m.	1,250	1,250	1,250	1,250	1,250	1,250
Effective number of lanes		>1	>1	>1	>1	>1	>1
<b>Vehicle Characteristics</b>							
Tare (unladen) weight	kg	1,045	1,815	11,000	4,175	7,080	12,400
Load carried	kg	350	600	4,000	3,200	4,200	12,500
Maximum used driving power	metric HP	43	48	138	67	147	147
Maximum used braking power	metric HP	20	38	200	147	217	467
Desired speed	km/hour	98.30	94.90	93.40	88.80	88.80	84.10
Aerodynamic drag coefficient	dimensionless	0.45	0.46	0.65	0.85	0.85	0.63
Projected frontal area	m <sup>2</sup>	1.80	2.72	6.30	5.20	5.20	5.75
Calibrated engine speed	rpm	3,500	3,300	2,300	1,800	1,800	1,700
Energy efficiency factor	dimensionless	0.95	0.9	0.95	1	1	1
Fuel adjustment factor (alpha 2)	dimensionless	1.16	1.16	1.15	1.15	1.15	1.15
<b>Tyre Wear Data</b>							
Number of tyres per vehicle		4	4	6	6	10	18
Wearable volume of rubber per tyre	dm <sup>3</sup>			6.85	7.60	7.30	8.39
Retreading cost per new tyre	Fraction	0.4	0.4	0.4	0.4	0.4	0.4
Maximum number of recaps		0.1	0.1	0.1	0.1	0.1	0.1
Constant term of tread wear model	dm <sup>3</sup> /m			0.164	0.164	0.164	0.164
Wear coefficient for tread wear model	10 <sup>-3</sup> dm <sup>3</sup> /kj			12.780	12.780	12.780	12.780
<b>Vehicle Utilisation Data</b>							
Average annual utilisation	km	13,500	33,750	67,500	26,250	43,750	60,000
Average annual utilisation	hours	300	750	1,500	750	1,250	1,500
Hourly utilisation ratio (HURATIO)	Fraction	0.40	0.50	0.50	0.50	0.50	0.55
Average service life	Years	20	15	12	17	15	15
Use constant service life ?		No	No	No	No	No	No
Age of vehicle in km	km	135,000	253,125	405,000	223,125	328,125	450,000
Passengers per vehicle		2	5	32			
<b>Unit Costs</b>							
New vehicle price	US\$	7,000	10,000	50,000	17,000	37,500	48,500
Fuel cost	US\$/litre	0.22	0.22	0.20	0.20	0.20	0.20
Lubricants cost	US\$/litre	1.50	1.50	1.50	1.50	1.50	1.50
New tyre cost	US\$	57	85	200	150	200	250
Crew time cost	US\$/hour		0.65	0.97	0.97	0.97	1.30
Passenger delay cost	US\$/hour						
Maintenance labour cost	US\$/hour	0.78	0.78	0.78	0.78	0.78	0.78
Cargo delay cost	US\$/hour						
Annual interest rate (%)	%	12	12	12	12	12	12
Overhead per vehicle km	US\$		0.010	0.022	0.022	0.022	0.022
<b>Additional Coefficients</b>							
KP - Maintenance parts		0.308	0.308	0.483	0.371	0.371	0.371
CPo - Maintenance parts	10E-6	32.490	32.490	1.770	1.490	8.610	13.940
CPq - Maintenance parts	10E-3	13.700	13.700	3.560	251.790	35.310	15.650
QIPo - Maintenance parts		120.000	120.000	190.000	0.000	0.000	0.000
CLo - Maintenance parts		77.140	77.140	293.440	242.030	301.460	652.510
CLp - Maintenance parts		0.547	0.547	0.517	0.519	0.519	0.519
CLq - Maintenance parts		0.000	0.000	0.006	0.000	0.000	0.000
COo - Lubricants		1.550	1.550	3.070	3.070	3.070	5.150
FRATIO0 - VCURVE		0.268	0.220	0.233	0.292	0.292	0.179
FRATIO1 - VCURVE	10E-4	0	0	0	0.094	0.094	0.023
ARVMAX - VROUGH		259.7	239.7	212.8	177.7	177.7	130.9
BW - VDESIR		1	1	1	1	1	1
BETA - Speed		0.274	0.310	0.273	0.310	0.310	0.244
EO - Speed		1.003	1.004	1.012	1.013	1.013	1.018
A0 - Fuel		-8,201	6,014	-7,276	-22,955	-22,955	-30,559
A1 - Fuel		33.4	37.6	63.5	95.0	95.0	156.1
A2 - Fuel		0	0	0	0	0	0
A3 - Fuel		5,630	3,846	4,323	3,758	3,758	4,002
A4 - Fuel		0	1.398	0	0	0	0
A5 - Fuel		0	0	8.64	19.12	19.12	4.41
A6 - Fuel		4,460	3,604	2,479	2,394	2,394	4,435
A7 - Fuel		0	0	11.50	13.76	13.76	26.08
NHO - Fuel		-10	-12	-50	-85	-85	-85
Alpha1		0.7	1	1	1	1	1

TABLEA32.XLS

Table A.3.2 DATA INPUTS FOR VEHICLE OPERATING COST ANALYSIS							
Vehicle Operating Cost Model Inputs	Unit	TAJKISTAN					
		1 Car	4 Utility Vehicle	5 Large Bus	8 Medium (2-axle) Truck	9 Heavy (3-axle) Truck	10 Articulated (>3-axle) Truck
<b>Roadway Characteristics</b>							
Surface type		Paved	Paved	Paved	Paved	Paved	Paved
Average roughness (IRI)	m/km	5	5	5	5	5	5
Average positive gradient	%	5	5	5	5	5	5
Average negative gradient	%	5	5	5	5	5	5
Proportion of uphill travel	%	50	50	50	50	50	50
Average horizontal curvature	deg/km	5	5	5	5	5	5
Average superelevation	fraction	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C
Altitude of terrain	m.	1,500	1,500	1,500	1,500	1,500	1,500
Effective number of lanes		>1	>1	>1	>1	>1	>1
<b>Vehicle Characteristics</b>							
Tare (unladen) weight	kg	1,000	1,815	10,500	4,250	7,250	12,400
Load carried	kg	375	600	3,750	3,250	5,000	14,000
Maximum used driving power	metric HP	41	40	138	67	147	147
Maximum used braking power	metric HP	20	32	208	147	217	467
Desired speed	km/hour	98.30	94.90	93.40	88.80	88.80	84.10
Aerodynamic drag coefficient	dimensionless	0.45	0.46	0.65	0.85	0.85	0.63
Projected frontal area	m <sup>2</sup>	1.80	2.72	6.30	5.20	5.20	5.75
Calibrated engine speed	rpm	3,500	3,300	2,300	1,800	1,800	1,700
Energy efficiency factor	dimensionless	0.95	0.9	0.95	1	1	1
Fuel adjustment factor (alpha 2)	dimensionless	1.16	1.16	1.15	1.15	1.15	1.15
<b>Tyre Wear Data</b>							
Number of tyres per vehicle		4	4	6	6	10	18
Wearable volume of rubber per tyre	dm <sup>3</sup>			6.85	7.60	7.30	8.39
Retreading cost per new tyre	Fraction	0.3	0.3	0.3	0.3	0.3	0.3
Maximum number of recaps		1	1	1	1	1	1
Constant term of tread wear model	dm <sup>3</sup> /m			0.164	0.164	0.164	0.164
Wear coefficient for tread wear model	10-3 dm <sup>3</sup> /kj			12.780	12.780	12.780	12.780
<b>Vehicle Utilisation Data</b>							
Average annual utilisation	km	15,000	35,000	65,000	35,000	50,000	65,000
Average annual utilisation	hours	325	750	1,500	1,000	1,400	1,500
Hourly utilisation ratio (HURATIO)	Fraction	0.40	0.50	0.60	0.50	0.50	0.60
Average service life	Years	20	15	12	17	15	15
Use constant service life ?		No	No	No	No	No	No
Age of vehicle in km	km	150,000	250,000	400,000	300,000	325,000	400,000
Passengers per vehicle		2	5	40			
<b>Unit Costs</b>							
New vehicle price	US\$	7,500	10,000	50,000	17,000	40,000	48,000
Fuel cost	US\$/litre	0.43	0.43	0.40	0.40	0.40	0.40
Lubricants cost	US\$/litre	1.50	1.50	1.50	1.50	1.50	1.50
New tyre cost	US\$	55	80	200	200	200	250
Crew time cost	US\$/hour		0.90	0.90	0.90	1.30	1.30
Passenger delay cost	US\$/hour			0.70	0.70	0.70	0.70
Maintenance labour cost	US\$/hour	0.70	0.70	0.70	0.70	0.70	0.70
Cargo delay cost	US\$/hour						
Annual interest rate (%)	%	10	10	10	10	10	10
Overhead per vehicle km	US\$		0.010	0.022	0.025	0.025	0.025
<b>Additional Coefficients</b>							
KP - Maintenance parts		0.308	0.308	0.483	0.371	0.371	0.371
CPo - Maintenance parts	10E-6	32.490	32.490	1.770	1.490	8.610	13.940
CPq - Maintenance parts	10E-3	13.700	13.700	3.560	251.790	35.310	15.650
QIPo - Maintenance parts		120.000	120.000	190.000	0.000	0.000	0.000
CLo - Maintenance parts		77.140	77.140	293.440	242.030	301.460	652.510
CLp - Maintenance parts		0.547	0.547	0.517	0.519	0.519	0.519
CLq - Maintenance parts		0.000	0.000	0.006	0.000	0.000	0.000
COo - Lubricants		1.550	1.550	3.070	3.070	3.070	5.150
FRATIO0 - VCURVE		0.268	0.220	0.233	0.292	0.292	0.179
FRATIO1 - VCURVE	10E-4	0	0	0	0.094	0.094	0.023
ARVMAX - VROUGH		259.7	239.7	212.8	177.7	177.7	130.9
BW - VDESIR		1	1	1	1	1	1
BETA - Speed		0.274	0.310	0.273	0.310	0.310	0.244
EO - Speed		1.003	1.004	1.012	1.013	1.013	1.018
A0 - Fuel		-8,201	6,014	-7,276	-22,955	-22,955	-30,559
A1 - Fuel		33.4	37.6	63.5	95.0	95.0	156.1
A2 - Fuel		0	0	0	0	0	0
A3 - Fuel		5,630	3,846	4,323	3,758	3,758	4,002
A4 - Fuel		0	1,398	0	0	0	0
A5 - Fuel		0	0	8.64	19.12	19.12	4.41
A6 - Fuel		4,460	3,604	2,479	2,394	2,394	4,435
A7 - Fuel		0	0	11.50	13.76	13.76	26.08
NHO - Fuel		-10	-12	-50	-85	-85	-85
Alpha1		0.7	1	1	1	1	1

TABLEA32.XLS

Table A.3.2 DATA INPUTS FOR VEHICLE OPERATING COST ANALYSIS							
Vehicle Operating Cost Model Inputs	Unit	TURKMENISTAN					
		1 Car	4 Utility Vehicle	5 Large Bus	8 Medium (2-axle) Truck	9 Heavy (3-axle) Truck	10 Articulated (> 3-axle) Truck
<b>Roadway Characteristics</b>							
Surface type		Paved	Paved	Paved	Paved	Paved	Paved
Average roughness (IRI)	m/km	5	5	5	5	5	5
Average positive gradient	%	5	5	5	5	5	5
Average negative gradient	%	5	5	5	5	5	5
Proportion of uphill travel	%	50	50	50	50	50	50
Average horizontal curvature	deg/km	5	5	5	5	5	5
Average superelevation	fraction	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C
Altitude of terrain	m.	500	500	500	500	500	500
Effective number of lanes		>1	>1	>1	>1	>1	>1
<b>Vehicle Characteristics</b>							
Tare (unladen) weight	kg	960	1,320	10,400	4,525	7,500	12,400
Load carried	kg	400	1,400	3,500	4,000	6,000	15,000
Maximum used driving power	metric HP	41	40	138	67	147	147
Maximum used braking power	metric HP	20	32	208	147	217	467
Desired speed	km/hour	98.30	94.90	93.40	88.80	88.80	84.10
Aerodynamic drag coefficient	dimensionless	0.45	0.46	0.65	0.85	0.85	0.63
Projected frontal area	m <sup>2</sup>	1.80	2.72	6.30	5.20	5.20	5.75
Calibrated engine speed	rpm	3,500	3,300	2,300	1,800	1,800	1,700
Energy efficiency factor	dimensionless	0.95	0.9	0.95	1	1	1
Fuel adjustment factor (alpha 2)	dimensionless	1.16	1.16	1.15	1.15	1.15	1.15
<b>Tyre Wear Data</b>							
Number of tyres per vehicle		4	4	6	6	10	18
Wearable volume of rubber per tyre	dm <sup>3</sup>			6.85	7.60	7.30	8.39
Retreading cost per new tyre	Fraction	0.3	0.3	0.3	0.3	0.3	0.3
Maximum number of recaps		1	1	1	1	1	1
Constant term of tread wear model	dm <sup>3</sup> /m			0.164	0.164	0.164	0.164
Wear coefficient for tread wear model	10 <sup>-3</sup> dm <sup>3</sup> /kj			12.780	12.780	12.780	12.780
<b>Vehicle Utilisation Data</b>							
Average annual utilisation	km	17,500	37,500	62,500	50,000	60,000	67,500
Average annual utilisation	hours	350	750	1,250	1,250	1,500	1,500
Hourly utilisation ratio (HURATIO)	Fraction	0.40	0.50	0.65	0.50	0.60	0.65
Average service life	Years	15	12	10	15	10	10
Use constant service life ?		No	No	No	No	No	No
Age of vehicle in km	km	131,250	225,000	312,500	375,000	300,000	337,500
Passengers per vehicle		2	5	45			
<b>Unit Costs</b>							
New vehicle price	US\$	7,000	7,500	46,500	20,000	42,000	49,000
Fuel cost	US\$/litre	0.10	0.10	0.07	0.07	0.07	0.07
Lubricants cost	US\$/litre	0.50	0.50	0.50	0.50	0.50	0.50
New tyre cost	US\$	60	60	200	200	200	275
Crew time cost	US\$/hour		0.49	0.74	0.74	0.74	0.98
Passenger delay cost	US\$/hour						
Maintenance labour cost	US\$/hour	0.59	0.59	0.59	0.59	0.59	0.59
Cargo delay cost	US\$/hour						
Annual interest rate (%)	%	10	10	10	10	10	10
Overhead per vehicle km	US\$		0.010	0.022	0.025	0.025	0.025
<b>Additional Coefficients</b>							
KP - Maintenance parts		0.308	0.308	0.483	0.371	0.371	0.371
CPo - Maintenance parts	10E-6	32.490	32.490	1.770	1.490	8.610	13.940
CPq - Maintenance parts	10E-3	13.700	13.700	3.560	251.790	35.310	15.650
QIPo - Maintenance parts		120.000	120.000	190.000	0.000	0.000	0.000
CLo - Maintenance parts		77.140	77.140	293.440	242.030	301.460	652.510
CLp - Maintenance parts		0.547	0.547	0.517	0.519	0.519	0.519
CLq - Maintenance parts		0.000	0.000	0.006	0.000	0.000	0.000
COo - Lubricants		1.550	1.550	3.070	3.070	3.070	5.150
FRATIO0 - VCURVE		0.268	0.220	0.233	0.292	0.292	0.179
FRATIO1 - VCURVE	10E-4	0	0	0	0.094	0.094	0.023
ARVMAX - VROUGH		259.7	239.7	212.8	177.7	177.7	130.9
BW - VDESIR		1	1	1	1	1	1
BETA - Speed		0.274	0.310	0.273	0.310	0.310	0.244
EO - Speed		1.003	1.004	1.012	1.013	1.013	1.018
A0 - Fuel		-8,201	6,014	-7,276	-22,955	-22,955	-30,559
A1 - Fuel		33.4	37.6	63.5	95.0	95.0	156.1
A2 - Fuel		0	0	0	0	0	0
A3 - Fuel		5,630	3,846	4,323	3,758	3,758	4,002
A4 - Fuel		0	1,398	0	0	0	0
A5 - Fuel		0	0	8.64	19.12	19.12	4.41
A6 - Fuel		4,460	3,604	2,479	2,394	2,394	4,435
A7 - Fuel		0	0	11.50	13.76	13.76	26.08
NHO - Fuel		-10	-12	-50	-85	-85	-85
Alpha1		0.7	1	1	1	1	1

TABLEA32.XLS

Table A.3.2 DATA INPUTS FOR VEHICLE OPERATING COST ANALYSIS							
Vehicle Operating Cost Model Inputs	Unit	UZBEKISTAN					
		1 Car	4 Utility Vehicle	5 Large Bus	6 Medium (2-axle) Truck	9 Heavy (3-axle) Truck	10 Articulated (>3-axle) Truck
<b>Roadway Characteristics</b>							
Surface type		Paved	Paved	Paved	Paved	Paved	Paved
Average roughness (IRI)	m/km	5	5	5	5	5	5
Average positive gradient	%	5	5	5	5	5	5
Average negative gradient	%	5	5	5	5	5	5
Proportion of uphill travel	%	50	50	50	50	50	50
Average horizontal curvature	deg/km	5	5	5	5	5	5
Average superelevation	fraction	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C	0.00012C
Altitude of terrain	m.	500	500	500	500	500	500
Effective number of lanes		>1	>1	>1	>1	>1	>1
<b>Vehicle Characteristics</b>							
Tare (unladen) weight	kg	960	1,815	10,400	4,525	7,500	12,400
Load carried	kg	400	600	3,500	3,500	6,000	15,000
Maximum used driving power	metric HP	41	48	138	67	147	147
Maximum used braking power	metric HP	20	38	208	147	217	467
Desired speed	km/hour	98.30	94.90	93.40	88.80	88.80	84.10
Aerodynamic drag coefficient	dimensionless	0.45	0.46	0.65	0.85	0.85	0.63
Projected frontal area	m <sup>2</sup>	1.80	2.72	6.30	5.20	5.20	5.75
Calibrated engine speed	rpm	3,500	3,300	2,300	1,800	1,800	1,700
Energy efficiency factor	dimensionless	0.95	0.95	0.95	1	1	1
Fuel adjustment factor (alpha 2)	dimensionless	1.16	1.16	1.15	1.15	1.15	1.15
<b>Tyre Wear Data</b>							
Number of tyres per vehicle		4	4	6	6	10	18
Wearable volume of rubber per tyre	dm <sup>3</sup>			6.85	7.60	7.30	8.39
Retreading cost per new tyre	Fraction	0.3	0.3	0.3	0.3	0.3	0.3
Maximum number of recaps		1	1	1	1	1	1
Constant term of tread wear model	dm <sup>3</sup> /m			0.164	0.164	0.164	0.164
Wear coefficient for tread wear model	10 <sup>-3</sup> dm <sup>3</sup> /kj			12.780	12.780	12.780	12.780
<b>Vehicle Utilisation Data</b>							
Average annual utilisation	km	17,500	37,500	62,500	50,000	60,000	67,500
Average annual utilisation	hours	350	750	1,250	1,250	1,500	1,500
Hourly utilisation ratio (HURATIO)	Fraction	0.40	0.50	0.65	0.50	0.60	0.65
Average service life	Years	15	12	10	15	10	10
Use constant service life ?		No	No	No	No	No	No
Age of vehicle in km	km	150,000	250,000	320,000	350,000	325,000	350,000
Passengers per vehicle		2	5	45			
<b>Unit Costs</b>							
New vehicle price	US\$	8,000	9,750	45,000	18,000	40,000	48,000
Fuel cost	US\$/litre	0.38	0.38	0.30	0.30	0.30	0.30
Lubricants cost	US\$/litre	1.40	1.40	1.40	1.40	1.40	1.40
New tyre cost	US\$	55	80	200	200	200	250
Crew time cost	US\$/hour		0.44	0.66	0.66	0.66	0.87
Passenger delay cost	US\$/hour						
Maintenance labour cost	US\$/hour	0.52	0.52	0.52	0.52	0.52	0.52
Cargo delay cost	US\$/hour						
Annual interest rate (%)	%	10	10	10	10	10	10
Overhead per vehicle km	US\$		0.010	0.022	0.025	0.025	0.025
<b>Additional Coefficients</b>							
KP - Maintenance parts		0.308	0.308	0.483	0.371	0.371	0.371
CPo - Maintenance parts	10E-6	32.490	32.490	1.770	1.490	8.610	13.940
CPq - Maintenance parts	10E-3	13.700	13.700	3.560	251.790	35.310	15.650
QIPo - Maintenance parts		120.000	120.000	190.000	0.000	0.000	0.000
CLo - Maintenance parts		77.140	77.140	293.440	242.030	301.460	652.510
CLp - Maintenance parts		0.547	0.547	0.517	0.519	0.519	0.519
CLq - Maintenance parts		0.000	0.000	0.006	0.000	0.000	0.000
COo - Lubricants		1.550	1.550	3.070	3.070	3.070	5.150
FRATIO0 - VCURVE		0.268	0.220	0.233	0.292	0.292	0.179
FRATIO1 - VCURVE	10E-4	0	0	0	0.094	0.094	0.023
ARVMAX - VROUGH		259.7	239.7	212.8	177.7	177.7	130.9
BW - VDESIR		1	1	1	1	1	1
BETA - Speed		0.274	0.310	0.273	0.310	0.310	0.244
EO - Speed		1.003	1.004	1.012	1.013	1.013	1.018
A0 - Fuel		-8,201	6,014	-7,276	-22,955	-22,955	-30,559
A1 - Fuel		33.4	37.6	63.5	95.0	95.0	156.1
A2 - Fuel		0	0	0	0	0	0
A3 - Fuel		5,630	3,846	4,323	3,758	3,758	4,002
A4 - Fuel		0	1,398	0	0	0	0
A5 - Fuel		0	0	8.64	19.12	19.12	4.41
A6 - Fuel		4,460	3,604	2,479	2,394	2,394	4,435
A7 - Fuel		0	0	11.50	13.76	13.76	26.08
NHO - Fuel		-10	-12	-50	-85	-85	-85
Alpha 1		0.7	1	1	1	1	1

Table A.3.3 PERCENTAGE BREAKDOWN OF VEHICLE OPERATING COSTS

Vehicle Operating Cost Component	% of Total Vehicle Operating Costs					
	Car	Utility	Large Bus	Truck 2 axle	Truck 3 axle	Truck >3 axle
<b>ARMENIA</b>						
Fuel	31.66	50.69	33.34	36.86	30.05	28.60
Lubricants	3.61	2.63	1.31	2.05	0.99	0.91
Tyres	4.08	3.30	28.99	20.00	23.30	29.51
Crew time	0.00	3.23	1.79	3.27	1.35	1.68
Maintenance labour	1.11	0.83	0.87	1.32	0.81	1.10
Maintenance parts	23.36	15.37	11.69	15.22	22.71	20.08
Depreciation	20.26	9.60	10.53	6.24	9.81	8.77
Interest	15.91	6.22	6.58	5.47	6.33	6.58
Overheads	0.00	8.14	4.89	9.57	4.64	2.76
<b>TOTAL</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>AZERBAIJAN</b>						
Fuel	25.63	43.24	16.63	17.08	14.81	16.15
Lubricants	2.71	2.27	1.31	2.12	0.94	1.03
Tyres	4.13	3.45	30.44	20.05	30.17	35.55
Crew time	0.00	2.97	2.62	3.66	1.53	2.22
Maintenance labour	0.97	0.85	0.95	1.56	0.88	1.43
Maintenance parts	20.75	17.08	8.45	16.63	19.78	19.57
Depreciation	25.69	13.89	23.82	19.59	17.53	12.86
Interest	20.12	8.80	10.59	8.81	9.69	8.54
Overheads	0.00	7.45	5.18	10.50	4.67	2.65
<b>TOTAL</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>GEORGIA</b>						
Fuel	23.67	36.27	26.41	25.55	24.53	26.41
Lubricants	3.25	2.03	1.35	2.17	1.07	1.15
Tyres	4.24	4.24	19.51	12.94	17.12	20.95
Crew time	0.00	2.02	1.84	2.55	1.18	1.27
Maintenance labour	0.80	0.54	0.76	1.22	0.71	1.13
Maintenance parts	21.99	21.64	12.47	23.46	23.58	21.62
Depreciation	24.48	16.40	19.96	11.92	16.03	14.59
Interest	21.57	10.32	12.49	9.67	10.63	9.26
Overheads	0.00	6.53	5.22	10.51	5.16	3.61
<b>TOTAL</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>KAZAKHSTAN</b>						
Fuel	22.13	32.34	18.71	20.88	21.07	20.28
Lubricants	2.85	1.84	1.02	1.74	0.86	0.92
Tyres	4.03	3.94	31.77	17.17	26.47	28.22
Crew time	0.00	13.52	14.59	13.27	8.89	8.89
Maintenance labour	5.72	3.94	4.56	7.77	4.64	7.08
Maintenance parts	25.59	20.71	8.21	20.03	19.34	17.67
Depreciation	23.69	11.41	10.52	6.33	9.87	9.02
Interest	16.00	6.22	5.59	4.23	4.62	4.98
Overheads	0.00	6.07	5.04	8.59	4.24	2.94
<b>TOTAL</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

Table A.3.3 PERCENTAGE BREAKDOWN OF VEHICLE OPERATING COSTS

Vehicle Operating Cost Component	% of Total Vehicle Operating Costs					
	Car	Utility	Large Bus	Truck 2 axle	Truck 3 axle	Truck > 3 axle
<b>KYRGYZ REPUBLIC</b>						
Fuel	17.74	28.16	19.97	20.03	17.57	17.82
Lubricants	3.46	2.43	1.18	1.91	1.10	0.99
Tyres	4.63	4.85	37.65	23.79	31.01	40.62
Crew time	0.00	6.62	3.95	6.74	3.17	3.99
Maintenance labour	2.51	1.96	2.02	2.80	2.27	3.04
Maintenance parts	21.08	25.67	11.70	14.13	22.70	19.16
Depreciation	25.03	12.97	12.44	12.06	10.10	6.17
Interest	25.55	10.32	8.63	11.19	7.87	5.73
Overheads	0.00	7.02	2.46	7.33	4.22	2.47
<b>TOTAL</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>TAJKISTAN</b>						
Fuel	30.42	43.45	33.30	33.02	30.95	31.64
Lubricants	3.07	1.89	1.03	1.56	0.90	0.83
Tyres	3.97	3.55	31.55	26.15	26.72	35.59
Crew time	0.00	7.74	3.09	5.14	3.62	3.50
Maintenance labour	2.04	1.37	1.58	2.17	1.67	2.24
Maintenance parts	20.70	19.88	10.16	12.86	19.77	15.23
Depreciation	21.44	9.90	10.94	7.39	7.79	4.91
Interest	18.36	6.77	6.19	5.73	5.13	3.97
Overheads	0.00	5.46	2.15	5.98	3.46	2.07
<b>TOTAL</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>TURKMENISTAN</b>						
Fuel	10.30	20.50	9.09	9.35	8.68	8.58
Lubricants	1.44	1.17	0.55	0.76	0.44	0.42
Tyres	6.10	4.96	33.77	28.64	28.78	41.57
Crew time	0.00	8.37	3.97	6.68	3.18	4.05
Maintenance labour	2.37	2.11	1.99	2.79	2.02	2.73
Maintenance parts	26.16	26.90	13.35	23.95	29.45	21.80
Depreciation	32.42	16.48	20.82	10.39	14.89	11.15
Interest	21.22	9.35	10.20	7.57	6.82	6.18
Overheads	0.00	10.18	6.28	9.89	5.74	3.52
<b>TOTAL</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>UZBEKISTAN</b>						
Fuel	27.56	43.92	30.38	32.51	29.52	29.84
Lubricants	2.85	1.92	1.19	1.80	0.97	0.94
Tyres	3.94	3.87	26.35	23.42	22.84	30.68
Crew time	0.00	3.82	2.76	4.88	2.25	2.92
Maintenance labour	1.47	1.09	1.37	2.09	1.44	1.97
Maintenance parts	21.04	20.46	10.08	18.34	22.93	17.58
Depreciation	26.07	12.26	15.72	7.91	11.25	8.87
Interest	17.07	6.69	7.70	5.69	5.15	4.91
Overheads	0.00	5.96	4.45	3.37	3.64	2.28
<b>TOTAL</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

Note: Financial vehicle operating costs

Source: Consultant's estimates

Table A.3.4 RELATIVE SIGNIFICANCE OF VEHICLE OPERATING COST COMPONENTS

Vehicle type	Pavement roughness (IRI m/km)	Percentage Breakdown of Total Vehicle Operating Cost									
		Fuel	Lubricant	Tyres	Crew	Maintenance parts	Maintenance labour	Depreciation	Interest	Overheads	Total V.O.C
<b>Armenia</b>											
Car	3	34.4	3.4	3.7	0.0	17.9	1.0	22.2	17.3	0.0	100.0
Car	12	19.3	3.4	4.2	0.0	47.4	1.3	13.2	11.2	0.0	100.0
Utility	3	53.4	2.4	2.9	3.4	11.5	0.7	10.3	6.6	8.7	100.0
Utility	12	39.0	2.6	3.7	2.8	33.6	1.1	6.9	4.8	5.6	100.0
Bus	3	34.1	1.2	28.5	1.8	11.0	0.7	10.8	6.7	5.0	100.0
Bus	12	30.0	1.5	30.5	1.9	14.1	1.5	9.7	6.6	4.3	100.0
Truck 2 axle	3	39.6	2.0	20.6	3.4	10.3	1.1	6.7	5.8	10.4	100.0
Truck 2 axle	12	30.5	2.0	18.6	3.2	27.0	1.6	5.1	4.8	7.3	100.0
Truck 3 axle	3	32.5	1.0	24.2	1.4	17.8	0.7	10.6	6.7	5.0	100.0
Truck 3 axle	12	23.2	1.0	21.3	1.4	34.5	0.9	8.2	6.0	3.6	100.0
Truck >3 axle	3	30.2	0.9	30.0	1.7	17.1	1.0	9.2	6.8	2.9	100.0
Truck >3 axle	12	24.2	0.9	28.1	1.8	27.6	1.2	7.6	6.5	2.2	100.0
<b>Kyrgyzstan</b>											
Car	3	19.2	3.3	4.2	0.0	16.1	2.3	27.2	27.7	0.0	100.0
Car	12	11.0	3.3	4.8	0.0	43.3	3.1	16.5	18.0	0.0	100.0
Utility	3	30.7	2.3	4.4	7.2	20.0	1.8	14.4	11.4	7.8	100.0
Utility	12	18.7	2.1	4.6	5.1	48.2	2.2	8.0	6.9	4.2	100.0
Bus	3	20.5	1.1	37.2	4.0	11.1	1.7	12.9	8.9	2.6	100.0
Bus	12	17.6	1.3	38.9	4.0	13.8	3.4	10.9	8.1	2.0	100.0
Truck 2 axle	3	21.5	1.9	24.5	7.1	9.6	2.4	13.0	12.0	8.0	100.0
Truck 2 axle	12	16.6	1.8	22.2	6.6	24.9	3.3	9.5	9.5	5.6	100.0
Truck 3 axle	3	19.2	1.1	32.3	3.3	17.9	2.1	11.0	8.5	4.6	100.0
Truck 3 axle	12	13.3	1.1	27.9	3.4	33.8	2.4	8.0	6.9	3.2	100.0
Truck >3 axle	3	18.9	1.0	41.4	4.1	16.4	2.9	6.6	6.0	2.7	100.0
Truck >3 axle	12	14.8	0.9	38.4	4.2	25.9	3.2	5.2	5.4	2.0	100.0
<b>Turkmenistan</b>											
Car	3	11.3	1.4	5.6	0.0	20.3	2.2	35.9	23.4	0.0	100.0
Car	12	5.9	1.3	6.0	0.0	52.5	2.7	18.7	13.4	0.0	100.0
Utility	3	22.4	1.1	4.5	9.1	21.0	1.9	18.3	10.3	11.3	100.0
Utility	12	13.4	1.0	4.7	6.1	50.3	2.3	10.1	6.1	6.0	100.0
Bus	3	9.3	0.5	33.4	4.0	12.6	1.7	21.4	10.5	6.5	100.0
Bus	12	7.9	0.6	0.3	4.1	15.6	3.3	18.8	9.9	5.3	100.0
Truck 2 axle	3	10.5	0.8	30.8	7.3	16.9	2.5	11.7	8.4	11.2	100.0
Truck 2 axle	12	7.0	0.7	24.4	5.8	38.7	3.0	7.5	5.9	6.9	100.0
Truck 3 axle	3	9.6	0.5	30.6	3.4	23.7	1.9	16.5	7.5	6.4	100.0
Truck 3 axle	12	6.3	0.4	24.7	3.1	41.9	2.1	11.6	5.8	4.1	100.0
Truck >3 axle	3	9.2	0.4	42.7	4.2	18.8	2.6	11.9	6.5	3.8	100.0
Truck >3 axle	12	7.0	0.4	38.5	4.1	29.1	2.8	9.5	5.9	2.8	100.0

Note: Example taken from three countries with relatively high, medium and low fuel prices.

Source: Consultant's estimates based on use of HDM III Vehicle Operating Cost Sub Model



Table A.3.5 ARMENIA - VEHICLE OPERATING COSTS BY PAVEMENT ROUGHNESS LEVEL

Relationship Between Vehicle Operating Costs and Pavement Roughness (IRI)

For each vehicle category the model is of the form  $VOC = a + (b \cdot IRI) + (c \cdot IRI^2)$

Where VOC = Vehicle operating cost in US\$ / vehicle km

IRI = Pavement roughness (m/km)

Representative Vehicle Category	Coefficients			R <sup>2</sup>	Standard Error
	a	b	c		
Car	6.684633E-02	3.896476E-03	1.715079E-04	0.99809	2.016702E-03
Utility Vehicle (Minibus / Pickup)	9.929030E-02	3.913661E-03	2.147540E-04	0.99799	2.328003E-03
Large Bus	3.788748E-01	5.101956E-03	1.960511E-04	0.99988	6.107329E-04
2 - axle Truck (Medium)	2.104864E-01	9.690884E-03	1.054943E-04	0.99997	4.048614E-04
3 - axle Truck (Heavy)	4.319778E-01	2.061748E-02	1.449871E-04	1.00000	2.516544E-04
> 3 - axle Truck (Articulated)	7.666917E-01	2.661615E-02	2.463862E-04	0.99999	7.349606E-04

  

Roughness IRI (m/km)	Vehicle Operating Costs (US\$/km)				
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck
3	0.080	0.113	0.396	0.241	0.495
4	0.085	0.118	0.402	0.251	0.517
5	0.091	0.124	0.409	0.262	0.539
6	0.096	0.131	0.417	0.272	0.561
7	0.103	0.137	0.424	0.283	0.583
8	0.109	0.144	0.432	0.295	0.606
9	0.116	0.152	0.441	0.306	0.629
10	0.123	0.160	0.449	0.318	0.653
11	0.130	0.168	0.459	0.330	0.676
12	0.138	0.177	0.468	0.342	0.700
13	0.146	0.186	0.478	0.354	0.725
14	0.155	0.196	0.489	0.367	0.749
15	0.164	0.206	0.500	0.380	0.774

Table A.3.5 (continued) AZERBAIJAN - VEHICLE OPERATING COSTS BY PAVEMENT ROUGHNESS LEVEL

**Relationship Between Vehicle Operating Costs and Pavement Roughness (IRI)**

For each vehicle category the model is of the form  $VOC = a + (b \cdot IRI) + (c \cdot IRI^2)$   
 Where  $VOC =$  Vehicle operating cost in US\$ / vehicle km  
 $IRI =$  Pavement roughness (m/km)

Representative Vehicle Category	Coefficients			R <sup>2</sup>	Standard Error
	a	b	c		
Car	8.699331E-02	4.334294E-03	1.962563E-04	0.99802	2.313607E-03
Utility Vehicle	1.068999E-01	4.483537E-03	2.576305E-04	0.99787	2.818336E-03
Large Bus	3.598936E-01	4.368106E-03	1.925016E-04	0.99979	7.422111E-04
2 - axle Truck	1.886138E-01	9.560573E-03	8.050844E-05	0.99997	3.872247E-04
3 - axle Truck	4.332303E-01	1.984565E-02	1.538113E-04	0.99998	5.459150E-04
> 3 - axle Truck	6.345324E-01	2.334508E-02	2.090501E-04	0.99998	8.143106E-04

  

Roughness IRI (m/km)	Vehicle Operating Costs (US\$/km)				
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck
3	0.102	0.123	0.375	0.218	0.494
4	0.107	0.129	0.380	0.228	0.515
5	0.114	0.136	0.387	0.238	0.536
6	0.120	0.143	0.393	0.249	0.558
7	0.127	0.151	0.400	0.259	0.580
8	0.134	0.159	0.407	0.270	0.602
9	0.142	0.168	0.415	0.281	0.624
10	0.150	0.177	0.423	0.292	0.647
11	0.158	0.187	0.431	0.304	0.670
12	0.167	0.198	0.440	0.315	0.694
13	0.177	0.209	0.449	0.327	0.717
14	0.186	0.220	0.459	0.338	0.741
15	0.196	0.232	0.469	0.350	0.766

Table A.3.5 (continued) GEORGIA - VEHICLE OPERATING COSTS BY PAVEMENT ROUGHNESS LEVELS

Relationship Between Vehicle Operating Costs and Pavement Roughness (IRI)

For each vehicle category the model is of the form  $VOC = a + (b \cdot IRI) + (c \cdot IRI^2)$

Where  $VOC =$  Vehicle operating cost in US\$ / vehicle km

$IRI =$  Pavement roughness (m/km)

Representative Vehicle Category	Coefficients			R <sup>2</sup>	Standard Error
	a	b	c		
Car	7.297534E-02	3.936087E-03	1.772834E-04	0.99793	2.144824E-03
Utility Vehicle (Minibus / Pickup)	1.150720E-01	6.477818E-03	3.181135E-04	0.99763	3.942677E-03
Large Bus	3.587424E-01	4.131431E-03	1.794090E-04	0.99985	5.884039E-04
2 - axle Truck (Medium)	1.758005E-01	1.200502E-02	8.973174E-05	0.99999	3.066979E-04
3 - axle Truck (Heavy)	3.863084E-01	1.898494E-02	1.394170E-04	0.99999	3.762460E-04
> 3 - axle Truck (Articulated)	5.856887E-01	2.068022E-02	1.814735E-04	0.99997	7.549632E-04

Roughness IRI (m/km)	Economic Vehicle Operating Costs (US\$/km)						
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck	> 3-axle Truck	
3	0.086	0.137	0.373	0.213	0.445	0.649	
4	0.092	0.146	0.378	0.225	0.464	0.671	
5	0.097	0.155	0.384	0.238	0.485	0.694	
6	0.103	0.165	0.390	0.251	0.505	0.716	
7	0.109	0.176	0.396	0.264	0.526	0.739	
8	0.116	0.187	0.403	0.278	0.547	0.763	
9	0.123	0.199	0.410	0.291	0.568	0.787	
10	0.130	0.212	0.418	0.305	0.590	0.811	
11	0.138	0.225	0.426	0.319	0.612	0.835	
12	0.146	0.239	0.434	0.333	0.634	0.860	
13	0.154	0.253	0.443	0.347	0.657	0.885	
14	0.163	0.268	0.452	0.361	0.679	0.911	
15	0.172	0.284	0.461	0.376	0.702	0.937	

Table A.3.5 (continued) KAZAKHSTAN - VEHICLE OPERATING COSTS BY PAVEMENT ROUGHNESS LEVELS

**Relationship Between Vehicle Operating Costs and Pavement Roughness (IRI)**

For each vehicle category the model is of the form  $VOC = a + (b \cdot IRI) + (c \cdot IRI^2)$   
 Where  $VOC =$  Vehicle operating cost in US\$/ vehicle km  
 $IRI =$  Pavement roughness (m/km)

Representative Vehicle Category	Coefficients			R <sup>2</sup>	Standard Error
	a	b	c		
Car	7.455975E-02	5.704328E-03	2.198189E-04	0.99774	3.007956E-03
Utility Vehicle (Minibus / Pickup)	1.216896E-01	7.341310E-03	3.657943E-04	0.99767	4.467152E-03
Large Bus	4.577310E-01	5.636515E-03	4.403900E-04	0.99997	5.303390E-04
2 - axle Truck (Medium)	2.118114E-01	1.518606E-02	1.401869E-04	0.99999	3.787132E-04
3 - axle Truck (Heavy)	4.715226E-01	2.275477E-02	1.827899E-04	0.99999	6.072921E-04
> 3 - axle Truck (Articulated)	7.143817E-01	2.636025E-02	2.460973E-04	0.99997	1.0393391E-03

Roughness IRI (m/km)	Economic Vehicle Operating Costs (US\$/km)				
	Car	Utility Vehicle	Large Bus	2-axle Truck	> 3-axle Truck
3	0.094	0.147	0.479	0.259	0.796
4	0.101	0.157	0.487	0.275	0.824
5	0.109	0.168	0.497	0.291	0.852
6	0.117	0.179	0.507	0.308	0.881
7	0.125	0.191	0.519	0.325	0.911
8	0.134	0.204	0.531	0.342	0.941
9	0.144	0.217	0.544	0.360	0.972
10	0.154	0.232	0.558	0.378	1.003
11	0.164	0.247	0.573	0.396	1.034
12	0.175	0.262	0.589	0.414	1.066
13	0.186	0.279	0.605	0.433	1.099
14	0.198	0.296	0.623	0.452	1.132
15	0.210	0.314	0.641	0.471	1.165

Table A.3.5 (continued) KYRGYZ REPUBLIC - VEHICLE OPERATING COSTS BY PAVEMENT ROUGHNESS LEVEL

Relationship Between Vehicle Operating Costs and Pavement Roughness (IRI)

For each vehicle category the model is of the form  $VOC = a + (b \cdot IRI) + (c \cdot IRI^2)$   
 Where  $VOC =$  Vehicle operating cost in US\$ / vehicle km  
 $IRI =$  Pavement roughness (m/km)

Representative Vehicle Category	Coefficients			R <sup>2</sup>	Standard Error
	a	b	c		
Car	7.527203E-02	4.336024E-03	1.763690E-04	0.99776	2.337883E-03
Utility Vehicle (Minibus / Pickup)	9.961271E-02	7.367655E-03	3.435756E-04	0.99752	4.468716E-03
Large Bus	4.466620E-01	6.646871E-03	3.127660E-04	0.99993	6.577228E-04
2 - axle Truck (Medium)	2.403223E-01	1.148466E-02	1.196524E-04	0.99996	5.450614E-04
3 - axle Truck (Heavy)	4.106373E-01	2.150430E-02	1.576130E-04	1.00000	2.763484E-04
> 3 - axle Truck (Articulated)	7.428843E-01	2.842847E-02	2.728295E-04	0.99998	8.653227E-04

Roughness IRI (m/km)	Vehicle Operating Costs (US\$/km)					
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck	>3-axle Truck
3	0.090	0.125	0.469	0.276	0.477	0.831
4	0.095	0.135	0.478	0.288	0.499	0.861
5	0.101	0.145	0.488	0.301	0.522	0.892
6	0.108	0.156	0.498	0.314	0.545	0.923
7	0.114	0.168	0.509	0.327	0.569	0.955
8	0.121	0.181	0.520	0.340	0.593	0.988
9	0.129	0.194	0.532	0.353	0.617	1.021
10	0.136	0.208	0.544	0.367	0.641	1.054
11	0.144	0.222	0.558	0.381	0.666	1.089
12	0.153	0.237	0.571	0.395	0.691	1.123
13	0.161	0.253	0.586	0.410	0.717	1.159
14	0.171	0.270	0.601	0.425	0.743	1.194
15	0.180	0.287	0.617	0.440	0.769	1.231

Table A.3.5 (continued) TAJIKISTAN - VEHICLE OPERATING COSTS BY PAVEMENT ROUGHNESS LEVEL

Relationship Between Vehicle Operating Costs and Pavement Roughness (IRI)

For each vehicle category the model is of the form  $VOC = a + (b \cdot IRI) + (c \cdot IRI^2)$

Where VOC = Vehicle operating cost in US\$ / vehicle km

IRI = Pavement roughness (m/km)

Representative Vehicle Category	Coefficients			R <sup>2</sup>	Standard Error
	a	b	c		
Car	8.651241E-02	4.531006E-03	1.940690E-04	0.99811	2.301296E-03
Utility Vehicle (Minibus / Pickup)	1.395357E-01	7.321529E-03	3.829289E-04	0.99777	4.475796E-03
Large Bus	5.158381E-01	6.908082E-03	3.112893E-04	0.99995	5.790303E-04
2 - axle Truck (Medium)	2.997984E-01	1.300297E-02	1.560857E-04	0.99997	5.312163E-04
3 - axle Truck (Heavy)	5.201688E-01	2.233171E-02	1.966760E-04	0.99999	4.505866E-04
> 3 - axle Truck (Articulated)	9.145111E-01	2.800398E-02	3.196092E-04	0.99997	1.166075E-03

  

Roughness IRI (m/km)	Vehicle Operating Costs (US\$/km)				
	Car	Utility Vehicle	Large Bus	2 - axle Truck	3 - axle Truck
3	0.102	0.165	0.539	0.340	0.589
4	0.108	0.175	0.548	0.354	0.613
5	0.114	0.186	0.558	0.369	0.637
6	0.121	0.197	0.568	0.383	0.661
7	0.128	0.210	0.579	0.398	0.686
8	0.135	0.223	0.591	0.414	0.711
9	0.143	0.236	0.603	0.429	0.737
10	0.151	0.251	0.616	0.445	0.763
11	0.160	0.266	0.629	0.462	0.790
12	0.169	0.283	0.644	0.478	0.816
13	0.178	0.299	0.658	0.495	0.844
14	0.188	0.317	0.674	0.512	0.871
15	0.198	0.336	0.689	0.530	0.899

Table A.3.5 (continued) TURKMENISTAN - VEHICLE OPERATING COSTS BY PAVEMENT ROUGHNESS LEVEL

**Relationship Between Vehicle Operating Costs and Pavement Roughness (IRI)**

For each vehicle category the model is of the form  $VOC = a + (b \cdot IRI) + (c \cdot IRI^2)$   
 Where  $VOC =$  Vehicle operating cost in US\$ / vehicle km  
 $IRI =$  Pavement roughness (m/km)

Representative Vehicle Category	Coefficients			R <sup>2</sup>	Standard Error
	a	b	c		
Car	5.625183E-02	4.186225E-03	1.669899E-04	0.99737	2.424083E-03
Utility Vehicle (Minibus / Pickup)	6.816704E-02	5.231963E-03	2.344881E-04	0.99743	3.165123E-03
Large Bus	3.214417E-01	4.665640E-03	2.534994E-04	0.99984	7.798421E-04
2 - axle Truck (Medium)	1.793641E-01	1.443552E-02	6.628018E-05	0.99998	3.920054E-04
3 - axle Truck (Heavy)	3.233846E-01	2.199485E-02	1.181139E-04	0.99999	5.014550E-04
> 3 - axle Truck (Articulated)	5.840736E-01	2.464410E-02	1.889400E-04	0.99998	7.598816E-04

Roughness IRI (m/km)	Vehicle Operating Costs (US\$/km)				
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck
3	0.070	0.086	0.338	0.223	0.390
4	0.076	0.093	0.344	0.238	0.413
5	0.081	0.100	0.351	0.253	0.436
6	0.087	0.108	0.359	0.268	0.460
7	0.094	0.116	0.367	0.284	0.483
8	0.100	0.125	0.375	0.299	0.507
9	0.107	0.134	0.384	0.315	0.531
10	0.115	0.144	0.393	0.330	0.555
11	0.123	0.154	0.403	0.346	0.580
12	0.131	0.165	0.414	0.362	0.604
13	0.139	0.176	0.425	0.378	0.629
14	0.148	0.187	0.436	0.394	0.654
15	0.157	0.199	0.448	0.411	0.680

Table A.3.5 (continued) UZBEKISTAN - VEHICLE OPERATING COSTS BY PAVEMENT ROUGHNESS LEVEL

Relationship Between Vehicle Operating Costs and Pavement Roughness (IRI)

For each vehicle category the model is of the form  $VOC = a + (b * IRI) + (c * IRI^2)$   
 Where VOC = Vehicle operating cost in US\$ / vehicle km  
 IRI = Pavement roughness (m/km)

Representative Vehicle Category	Coefficients			R <sup>2</sup>	Standard Error
	a	b	c		
Car	8.731890E-02	4.520043E-03	1.985542E-04	0.99807	2.349358E-03
Utility Vehicle	1.273387E-01	6.833320E-03	3.511330E-04	0.99773	4.177064E-03
Large Bus	4.182766E-01	5.072220E-03	2.484320E-04	0.99987	7.346437E-04
2 - axle Truck	2.283498E-01	1.326489E-02	1.132072E-04	0.99998	4.305034E-04
3 - axle Truck	4.386529E-01	2.140778E-02	1.412576E-04	1.00000	2.862803E+00
> 3 - axle Truck	7.490906E-01	2.435702E-02	2.305894E-04	0.99997	8.834298E-04

Roughness IRI (m/km)	Vehicle Operating Costs (US\$/km)				
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck
3	0.103	0.151	0.436	0.269	0.504
4	0.109	0.160	0.443	0.283	0.527
5	0.115	0.170	0.450	0.298	0.549
6	0.122	0.181	0.458	0.312	0.572
7	0.129	0.192	0.466	0.327	0.595
8	0.136	0.204	0.475	0.342	0.619
9	0.144	0.217	0.484	0.357	0.643
10	0.152	0.231	0.494	0.372	0.667
11	0.161	0.245	0.504	0.388	0.691
12	0.170	0.260	0.515	0.404	0.716
13	0.180	0.276	0.526	0.420	0.741
14	0.190	0.292	0.538	0.436	0.766
15	0.200	0.309	0.550	0.453	0.792



Table A.3.6 ARMENIA - TOTAL VEHICLE OPERATING COSTS ON MAIN ROADS AT DIFFERENT ROUGHNESS LEVELS

Roughness IRI (m/km)	Total Vehicle Operating Costs (US\$ million)							Total	Index (IRI 3 = 100)
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck	> 3-axle Truck			
3	107.9	19.9	42.3	39.1	71.5	28.0	308.7	100.0	
4	114.7	20.9	43.0	40.8	74.6	28.9	323.0	104.6	
5	122.1	21.9	43.8	42.5	77.8	29.9	337.9	109.5	
6	129.8	23.0	44.5	44.3	81.0	30.9	353.5	114.5	
7	138.1	24.2	45.3	46.1	84.2	31.8	369.8	119.8	
8	146.8	25.4	46.2	47.9	87.5	32.8	386.7	125.3	
9	156.0	26.8	47.1	49.8	90.9	33.9	404.4	131.0	
10	165.6	28.2	48.1	51.7	94.2	34.9	422.7	136.9	
11	175.7	29.7	49.0	53.6	97.7	35.9	441.6	143.1	
12	186.3	31.2	50.1	55.6	101.1	37.0	461.3	149.4	
13	197.3	32.9	51.1	57.6	104.6	38.1	481.6	156.0	
14	208.8	34.6	52.2	59.6	108.2	39.2	502.6	162.8	
15	220.7	36.4	53.4	61.7	111.7	40.3	524.2	169.8	

Note: Excluding urban and local / district roads

IRI 3 m/km = good.

IRI 5-6 m/km = fair

IRI 7-8 m/km = poor

IRI 10+ m/km = bad / very bad

Source: Consultant's estimates

Table A.3.6 (continued) AZERBAIJAN - TOTAL VEHICLE OPERATING COSTS ON MAIN ROADS AT DIFFERENT ROUGHNESS LEVELS

Roughness IRI (m/km)	Total Vehicle Operating Costs (US\$ million)						TOTAL	Index (IRI 3 = 100)
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck	> 3-axle Truck		
3	200.2	74.2	103.7	231.9	128.8	228.5	967.3	100.0
4	211.4	78.0	105.2	242.7	134.3	236.6	1,008.2	104.2
5	223.4	82.1	106.9	253.6	139.8	244.7	1,050.6	108.6
6	236.2	86.6	108.7	264.7	145.4	253.0	1,094.7	113.2
7	249.7	91.3	110.6	276.0	151.1	261.4	1,140.3	117.9
8	264.1	96.4	112.6	287.5	156.9	270.0	1,187.4	122.8
9	279.2	101.7	114.7	299.1	162.8	278.7	1,236.2	127.8
10	295.0	107.4	117.0	310.9	168.7	287.6	1,286.5	133.0
11	311.7	113.4	119.3	322.9	174.7	296.5	1,338.4	138.4
12	329.1	119.7	121.7	335.0	180.8	305.6	1,391.9	143.9
13	347.2	126.3	124.3	347.3	187.0	314.9	1,447.0	149.6
14	366.2	133.2	126.9	359.8	193.2	324.3	1,503.6	155.4
15	385.9	140.5	129.7	372.4	199.6	333.8	1,561.8	161.5

Note: Excludes urban and local / district roads

IRI 3 m/km = good

IRI 5-6 m/km = fair

IRI 7-8 m/km = poor

IRI 10+ m/km = bad / very bad

Source: Consultant's estimate

Table A.3.6 (continued) GEORGIA - TOTAL VEHICLE OPERATING COSTS ON MAIN ROADS AT DIFFERENT ROUGHNESS LEVELS

Roughness IRI (m/km)	Total Vehicle Operating Costs (US\$ million)						Total	Index (IRI 3 = 100)
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck	>3-axle Truck		
3	141.5	10.8	55.5	20.2	39.4	25.3	292.7	100.0
4	150.0	11.5	56.3	21.4	41.2	26.2	306.5	104.7
5	159.1	12.2	57.2	22.6	42.9	27.1	321.1	109.7
6	168.7	13.0	58.1	23.8	44.8	27.9	336.3	114.9
7	178.9	13.8	59.1	25.1	46.6	28.8	352.3	120.4
8	189.8	14.7	60.1	26.3	48.5	29.7	369.1	126.1
9	201.1	15.6	61.2	27.6	50.4	30.7	386.6	132.1
10	213.1	16.6	62.3	28.9	52.3	31.6	404.8	138.3
11	225.7	17.6	63.5	30.2	54.2	32.6	423.8	144.8
12	238.8	18.7	64.7	31.6	56.2	33.5	443.5	151.5
13	252.5	19.8	66.0	32.9	58.2	34.5	464.0	158.5
14	266.8	21.0	67.3	34.3	60.2	35.5	485.1	165.7
15	281.7	22.3	68.7	35.7	62.2	36.5	507.1	173.2

Note: Excludes urban and local / district roads

IRI 3 m/km = good

IRI 5-6 m/km = fair

IRI 7-8 m/km = poor

IRI 10+ m/km = bad / very bad

Source: Consultant's estimate

Table A.3.6 (continued) KAZAKHSTAN - TOTAL VEHICLE OPERATING COSTS ON MAIN ROADS AT DIFFERENT ROUGHNESS LEVELS

Roughness IRI (m/km)	Total Vehicle Operating Costs (US\$ million)					Total	Index (IRI 3 = 100)	
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck			> 3-axle Truck
3	593.0	75.9	52.2	465.4	559.9	257.1	2,003.6	100.0
4	637.2	81.0	53.1	494.2	584.8	266.2	2,116.4	105.6
5	687.7	86.7	54.2	522.9	610.7	275.2	2,237.3	111.7
6	738.2	92.4	55.3	553.5	636.5	284.6	2,360.3	117.8
7	788.6	98.6	56.6	584.0	662.4	294.3	2,484.4	124.0
8	845.4	105.3	57.9	614.6	688.3	303.9	2,615.3	130.5
9	908.5	112.0	59.3	646.9	715.2	314.0	2,755.8	137.5
10	971.6	119.7	60.8	679.3	742.1	324.0	2,897.5	144.6
11	1,034.7	127.5	62.5	711.6	770.0	334.0	3,040.2	151.7
12	1,104.1	135.2	64.2	744.0	798.0	344.3	3,189.7	159.2
13	1,173.5	144.0	65.9	778.1	825.9	355.0	3,342.4	166.8
14	1,249.2	152.7	67.9	812.2	854.9	365.6	3,502.6	174.8
15	1,324.9	162.0	69.9	846.4	883.9	376.3	3,663.4	182.8

Note: Excludes urban and local / district roads

IRI 3 m/km = good      IRI 5-6 m/km = fair

IRI 7-8 m/km = poor

IRI 10+ m/km = bad / very bad

Source: Consultant's estimate

Table A.3.6 (continued) KYRGYZ REPUBLIC - TOTAL VEHICLE OPERATING COSTS ON MAIN ROADS AT DIFFERENT ROUGHNESS LEVELS

Roughness IRI (m/km)	Total Vehicle Operating Costs (US\$ million)							Total	Index (IRI 3 = 100)
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck	> 3-axle Truck	Total		
3	79.5	16.9	34.5	71.4	44.0	51.0	297.4	100.0	
4	84.4	18.2	35.2	74.6	46.1	52.9	311.4	104.7	
5	89.7	19.6	35.9	77.9	48.2	54.8	326.0	109.6	
6	95.2	21.1	36.6	81.2	50.3	56.7	341.2	114.7	
7	101.1	22.7	37.4	84.6	52.5	58.7	357.0	120.0	
8	107.2	24.4	38.3	88.0	54.7	60.6	373.3	125.5	
9	113.7	26.2	39.1	91.5	56.9	62.7	390.2	131.2	
10	120.5	28.1	40.1	95.1	59.2	64.7	407.7	137.1	
11	127.6	30.1	41.0	98.7	61.5	66.8	425.8	143.2	
12	135.1	32.1	42.1	102.4	63.8	69.0	444.4	149.5	
13	142.8	34.3	43.1	106.1	66.2	71.1	463.7	155.9	
14	150.8	36.5	44.2	110.0	68.5	73.3	483.5	162.6	
15	159.2	38.9	45.4	113.8	70.9	75.6	503.8	169.4	

Note: Excludes urban and local / district roads

IRI 3 m/km = good

IRI 5-6 m/km = fair

IRI 7-8 m/km = poor

IRI 10+ m/km = bad / very bad

Source: Consultant's estimate

Table A.3.6 (continued) TAJIKISTAN - TOTAL VEHICLE OPERATING COSTS ON MAIN ROADS AT DIFFERENT ROUGHNESS LEVELS

Roughness IRI (m/km)	Total Vehicle Operating Costs (US\$ million)							Total	Index (IRI 3 = 100)
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck	>3-axle Truck			
3	38.8	5.6	12.4	36.0	33.4	20.2	146.5	100.0	
4	41.0	6.0	12.6	37.5	34.7	20.8	152.7	104.3	
5	43.4	6.4	12.8	39.0	36.1	21.5	159.2	108.7	
6	45.9	6.7	13.1	40.6	37.5	22.1	166.0	113.3	
7	48.6	7.2	13.3	42.2	38.9	22.7	173.0	118.1	
8	51.4	7.6	13.6	43.8	40.3	23.4	180.2	123.1	
9	54.4	8.1	13.9	45.5	41.8	24.1	187.8	128.2	
10	57.6	8.6	14.2	47.2	43.3	24.8	195.5	133.5	
11	60.8	9.1	14.5	48.9	44.8	25.5	203.6	139.0	
12	64.3	9.7	14.8	50.7	46.3	26.2	211.9	144.7	
13	67.8	10.2	15.1	52.4	47.8	26.9	220.4	150.5	
14	71.5	10.8	15.5	54.3	49.4	27.7	229.2	156.5	
15	75.4	11.5	15.9	56.1	51.0	28.4	238.3	162.7	

Note: Excludes urban and local / district roads

IRI 3 m/km = good

IRI 5-6 m/km = fair

IRI 7-8 m/km = poor

IRI 10+ m/km = bad / very bad

Source: Consultant's estimate

Table A.3.6 (continued) TURKMENISTAN - TOTAL VEHICLE OPERATING COSTS ON MAIN ROADS AT DIFFERENT ROUGHNESS LEVELS

Roughness IRI (m/km)	Total Vehicle Operating Costs (US\$ million)						Total	Index (IRI 3 = 100)
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck	> 3-axle Truck		
3	105.7	27.6	71.4	161.5	63.6	411.7	841.4	100.0
4	113.7	29.8	72.8	172.3	67.3	427.9	883.7	105.0
5	122.3	32.2	74.3	183.2	71.0	444.3	927.2	110.2
6	131.3	34.7	75.8	194.1	74.8	461.0	971.7	115.5
7	140.9	37.3	77.5	205.2	78.7	477.9	1,017.4	120.9
8	150.9	40.1	79.3	216.4	82.5	495.0	1,064.3	126.5
9	161.5	43.1	81.2	227.6	86.4	512.4	1,112.2	132.2
10	172.5	46.2	83.2	239.0	90.4	530.0	1,161.3	138.0
11	184.1	49.5	85.3	250.4	94.4	547.9	1,211.5	144.0
12	196.2	52.9	87.5	262.0	98.4	566.0	1,262.9	150.1
13	208.7	56.4	89.9	273.6	102.4	584.3	1,315.4	156.3
14	221.8	60.1	92.3	285.3	106.5	602.9	1,369.0	162.7
15	235.3	64.0	94.9	297.2	110.7	621.7	1,423.7	169.2

Note: Excluding urban and local / district roads

IRI 3 m/km = good. IRI 5-6 m/km = fair

IRI 7-8 m/km = poor

IRI 10+ m/km = bad / very bad

Source: Consultant's estimates

Table A.3.6 (continued) UZBEKISTAN - TOTAL VEHICLE OPERATING COSTS ON MAIN ROADS AT DIFFERENT ROUGHNESS LEVELS

Roughness IRI (m/km)	Total Vehicle Operating Costs (US\$ million)										Total	Index (IRI 3 = 100)
	Car	Utility Vehicle	Large Bus	2-axle Truck	3-axle Truck	>3-axle Truck						
3	422.1	174.1	159.3	894.4	413.5	572.1	2,635.4	100.0				
4	446.4	184.8	161.7	941.1	431.8	590.1	2,756.0	104.6				
5	472.3	196.3	164.4	988.5	450.4	608.5	2,880.5	109.3				
6	499.9	208.6	167.3	1,036.8	469.2	627.1	3,008.9	114.2				
7	529.1	221.8	170.3	1,085.7	488.3	646.1	3,141.3	119.2				
8	559.9	235.7	173.5	1,135.4	507.6	665.4	3,277.6	124.4				
9	592.4	250.5	176.9	1,185.9	527.1	685.1	3,417.9	129.7				
10	626.5	266.0	180.5	1,237.1	546.9	705.0	3,562.1	135.2				
11	662.2	282.4	184.3	1,289.1	566.9	725.3	3,710.2	140.8				
12	699.6	299.6	188.2	1,341.8	587.1	745.9	3,862.2	146.6				
13	738.6	317.6	192.3	1,395.3	607.6	766.8	4,018.1	152.5				
14	779.2	336.4	196.6	1,449.6	628.2	788.0	4,178.0	158.5				
15	821.5	356.0	201.1	1,504.5	649.2	809.5	4,341.8	164.8				

Note: Excluding urban and local / district roads

IRI 3 m/km = good.

IRI 5-6 m/km = fair

IRI 7-8 m/km = poor

IRI 10+ m/km = bad / very bad

Source: Consultant's estimates



Table A.3.7 TRACECA COUNTRIES - TOTAL VEHICLE OPERATING COSTS AND GROSS DOMESTIC PRODUCT

Country	Length of main road network (a) (km)	Vehicle km on the main road network (million)	Total Vehicle Operating Costs (US \$ million) @ average roughness level			Gross Domestic Product (US\$ million)	Total Main Road Vehicle Operating Costs as % of GDP with roughness at		
			IRI 3 (Good)	IRI 6 (Fair)	IRI 8 (Poor)		IRI 3 (Good)	IRI 6 (Fair)	IRI 8 (Poor)
Armenia	3,147.8	1,970.0	308.7	353.5	404.0	2,789.5	11.1	12.7	14.5
Azerbaijan	4,689.0	4,496.0	967.3	1,094.7	1,236.0	2,939.0	32.9	37.2	42.1
Georgia	5,005.3	2,088.4	292.7	336.3	387.0	1,959.9	14.9	17.2	19.7
Kazakhstan	17,496.0	10,089.0	2,003.6	2,360.3	2,756.0	16,532.0	12.1	14.3	16.7
Kyrgyzstan	3,109.9	1,506.1	297.4	341.2	390.0	2,506.0	11.9	13.6	15.6
Tajikistan	1,785.2	620.6	146.5	166.0	188.0	1,767.9	8.3	9.4	10.6
Turkmenistan	7,682.6	3,545.4	841.4	971.7	1,112.0	4,898.2	17.2	19.8	22.7
Uzbekistan	21,825.0	10,466.7	2,635.4	3,008.9	3,418.0	21,077.8	12.5	14.3	16.2

Note: The GDP estimates are based on World Bank 1994 population and per capita GDP estimates, EBRD estimates of GDP growth between 1994 and 1995 and World Bank population growth estimates.

Source: World Bank- "World Development Report 1996".

Consultant's estimates of total vehicle operating costs.

Table A.3.8 TRACECA COUNTRIES - BACKGROUND ECONOMIC DATA

Country	Area ('000 sq.km)	Population			Density / sq.km	% urban
		Total 1994 (million)	Total 1995 (million)	Annual change (%)		
Armenia	30	3.7	3.8	1.4	125	68.5
Azerbaijan	87	7.5	7.6	1.0	87	55.5
Georgia	70	5.4	5.4	-0.2	77	58.0
Kazakhstan	2,717	16.8	16.8	0.1	6	59.3
Kyrgyz Republic	198	4.5	4.5	0.4	23	38.8
Tajikistan	143	5.8	5.9	2.0	41	32.2
Turkmenistan	488	4.4	4.6	4.6	9	44.9
Uzbekistan	447	22.4	22.9	2.2	51	41.2

  

Country	GDP 1994		GDP 1995		Change (%)	
	(US\$ million)	Per Capita (US\$)	(US\$ million)	Per Capita (US\$)	GDP	GDP per Capita
Armenia	2,607.0	704.6	2,789.5	743.5	7.0	5.5
Azerbaijan	3,541.0	472.1	2,939.0	388.0	-17.0	-17.8
Georgia	2,063.0	382.0	1,959.9	363.7	-5.0	-4.8
Kazakhstan	18,167.0	1,081.4	16,532.0	983.1	-9.0	-9.1
Kyrgyz Republic	2,666.0	592.4	2,506.0	554.7	-6.0	-6.4
Tajikistan	2,009.0	346.4	1,767.9	298.8	-12.0	-13.7
Turkmenistan	5,156.0	1,171.8	4,898.2	1,064.3	-5.0	-9.2
Uzbekistan	21,508.0	960.2	21,077.8	920.7	-2.0	-4.1

Source: World Bank: "World Development Report 1996" - 1994 GDP, GDP per capita, population and land area.  
EBRD: GDP growth rates 1994-1995.

Table A.3.9 AZERBAIJAN AND KYRGYZSTAN - BASE VEHICLE OPERATING COSTS AND PASSENGER AND GOODS DELAY COSTS.

Country and Cost Component	US\$ per 1,000 Vehicle Kilometres						
	Car	Utility	Large Bus	Truck 2 axle	Truck 3 axle	Truck >3 axle	
<b>AZERBAIJAN</b>							
Fuel	28.76	58.02	64.19	40.65	79.27	121.95	
Lubricants	3.04	3.04	5.05	5.05	5.05	7.79	
Tyres	4.63	4.63	117.47	47.73	161.53	268.38	
Crew time	0.00	3.98	10.12	8.71	8.21	16.75	
Maintenance labour	1.09	1.14	3.68	3.72	4.69	10.80	
Maintenance parts	23.28	22.91	32.59	39.59	105.89	147.78	
Depreciation	28.83	18.64	91.91	46.62	93.84	97.07	
Interest	22.58	11.81	40.87	20.96	51.86	64.50	
Overheads	0.00	10.00	20.00	25.00	25.00	20.00	
<b>TOTAL V.O.C</b>	<b>112.21</b>	<b>134.17</b>	<b>385.88</b>	<b>238.03</b>	<b>535.34</b>	<b>755.02</b>	
Passenger time costs	3.67	n.e	120.00	n.e	n.e	n.e	
<b>V.O.C + Pass.Time</b>	<b>115.88</b>		<b>505.88</b>				
<b>KYRGYZ REPUBLIC</b>							
Fuel	17.73	40.08	97.29	60.14	91.65	158.71	
Lubricants	3.46	3.46	5.74	5.74	5.74	8.86	
Tyres	4.63	6.90	183.39	71.42	161.76	361.82	
Crew time	0.00	9.43	19.24	20.22	16.54	35.55	
Maintenance labour	2.51	2.79	9.85	8.42	11.84	27.12	
Maintenance parts	21.07	36.54	57.00	42.43	118.40	170.65	
Depreciation	25.01	18.46	60.58	36.21	52.71	54.95	
Interest	25.53	14.69	42.06	33.60	41.06	51.00	
Overheads	0.00	10.00	12.00	22.00	22.00	22.00	
<b>TOTAL V.O.C</b>	<b>99.94</b>	<b>142.35</b>	<b>487.15</b>	<b>300.18</b>	<b>521.70</b>	<b>890.66</b>	
Passenger Time	8.58	18.86	126.95	2.08	1.71	2.73	
<b>V.O.C + Pass.Time</b>	<b>108.52</b>	<b>161.21</b>	<b>614.10</b>	<b>302.26</b>	<b>523.41</b>	<b>893.39</b>	
Goods Delay Costs	0.00	0.00	0.00	1.04	1.71	4.10	
<b>Road User Costs</b>	<b>108.52</b>	<b>161.21</b>	<b>614.10</b>	<b>303.30</b>	<b>525.12</b>	<b>897.49</b>	
Country	Vehicle - Km (million)						Total
	Car	Utility	Large Bus	Truck 2 axle	Truck 3 axle	Truck >3 axle	
Azerbaijan	1,967.3	605.1	276.6	1,063.7	260.7	323.5	4,496.9
Kyrgyz Republic	884.5	135.3	73.6	259.0	92.3	61.4	1,506.1
Country and Cost category	Road User Costs (US\$ '000)						Total
	Car	Utility	Large Bus	Truck 2 axle	Truck 3 axle	Truck >3 axle	
<b>Azerbaijan</b>							
Vehicle Operating Costs	220,751	81,186	106,734	253,193	139,563	244,249	1,045,676
Passenger Delay Costs	7,220	0	33,192	0	0	0	40,412
<b>Sub Total</b>	<b>227,971</b>	<b>81,186</b>	<b>139,926</b>	<b>253,193</b>	<b>139,563</b>	<b>244,249</b>	<b>1,086,088</b>
<b>Kyrgyz Republic</b>							
Vehicle Operating Costs	88,397	19,260	35,854	77,747	48,153	54,687	324,097
Passenger Delay Costs	7,589	2,552	9,344	539	158	168	20,348
<b>Sub Total</b>	<b>95,986</b>	<b>21,812</b>	<b>45,198</b>	<b>78,285</b>	<b>48,311</b>	<b>54,854</b>	<b>344,446</b>
Goods delay costs	0	0	0	269	158	252	679
<b>TOTAL R.U.C</b>	<b>95,986</b>	<b>21,812</b>	<b>45,198</b>	<b>78,555</b>	<b>48,469</b>	<b>55,106</b>	<b>345,125</b>
Sources:	Carl Bro International a/s - Kyrgyzstan passenger and goods delay costs Wilbur Smith and Associates - Azerbaijan passenger delay costs Consultant's estimate - other vehicle operating costs						



**ANNEX 4**



Table A.4.1 AXLE LOADING AND VEHICLE WEIGHTS BY VEHICLE TYPE IN TRACECA COUNTRIES

Vehicle Type and Axle	Sample size (vehicles)	Weight (tonnes)								Weight Distribution on Axles (%)
		Mean	95% Confidence range for Mean		Median	Standard Error	Standard Deviation	Coefficient of Variation (%)	Maximum	
			Lower	Upper						
<b>2 Axle Buses (all)</b>	15	4.91	4.31	5.51	5.20	0.30	1.18	24.0	7.41	35.7
Axle 1		8.83	7.84	9.82	9.03	0.51	1.96	22.2	13.05	64.3
Axle 2										
GVW		13.73	12.25	15.21	14.01	0.75	2.92	21.3	18.48	100.0
<b>3 Axle Buses (non-CIS)</b>	2	5.81	5.36	6.26	5.81	0.23	0.33	5.7	6.04	29.3
Axle 1		9.50	8.90	10.10	9.50	0.30	0.43	4.5	9.80	48.0
Axle 2		4.50	4.39	4.61	4.50	0.05	0.08	1.8	4.55	22.6
GVW		19.80	18.86	20.74	19.80	0.48	0.68	3.4	20.28	100.0
<b>2 Axle HGV (all)</b>	899	2.66	2.57	2.75	2.25	0.04	1.32	49.6	7.82	37.0
Axle 1		4.53	4.34	4.72	3.51	0.10	2.92	64.5	23.44	63.0
Axle 2		7.19	6.94	7.44	6.32	0.13	3.84	53.4	31.26	100.0
<b>2 Axle HGV (non-CIS)</b>	15	4.15	3.21	5.09	3.37	0.48	1.85	44.6	6.98	34.2
Axle 1		7.97	5.34	10.60	6.50	1.34	5.20	65.2	23.25	65.8
Axle 2		12.12	8.75	15.49	10.88	1.72	6.65	54.9	29.72	100.0
<b>3 Axle HGV (all)</b>	1017	3.79	3.73	3.85	3.82	0.03	0.96	25.3	10.07	29.6
Axle 1		4.57	4.41	4.73	3.58	0.08	2.60	56.9	18.97	35.7
Axle 2		4.47	4.31	4.63	3.46	0.07	2.63	58.8	21.81	34.7
Axle 3		12.80	12.45	13.15	10.80	0.18	5.63	44.0	39.95	100.0
<b>3 Axle HGV (non-CIS)</b>	41	4.45	4.04	4.86	4.27	0.21	1.36	30.6	7.59	24.0
Axle 1		7.78	6.48	9.08	8.80	0.66	4.24	54.5	15.18	41.9
Axle 2		6.30	4.99	7.61	6.65	0.67	4.28	67.9	21.81	34.1
Axle 3		18.52	15.83	21.21	18.82	1.37	8.78	47.4	37.41	100.0
<b>4 Axle HGV (all)</b>	152	4.62	4.39	4.85	4.43	0.11	1.42	30.7	8.77	21.5
Axle 1		6.50	5.96	7.04	5.45	0.27	3.37	51.8	13.56	30.2
Axle 2		5.13	4.62	5.64	4.14	0.26	3.21	62.6	14.02	23.8
Axle 3		5.26	4.75	5.77	4.39	0.26	3.23	61.4	21.51	24.5
Axle 4		21.51	19.87	23.15	19.44	0.84	10.31	47.9	48.62	100.0
<b>4 Axle HGV (non-CIS)</b>	56	5.05	4.69	5.41	5.49	0.18	1.36	26.9	7.84	19.1
Axle 1		7.72	6.84	8.60	7.50	0.45	3.36	43.5	13.56	29.2
Axle 2		6.97	6.02	7.92	6.48	0.49	3.65	52.4	14.02	26.4
Axle 3		6.66	5.69	7.63	6.89	0.49	3.69	55.4	21.51	25.2
Axle 4		26.40	23.50	29.30	26.34	1.48	11.08	42.0	48.62	100.0
<b>5 Axle HGV (all)</b>	370	4.34	4.23	4.45	4.13	0.05	1.05	24.2	6.82	19.4
Axle 1		4.57	4.32	4.82	3.89	0.13	2.44	53.4	22.41	20.4
Axle 2		4.35	4.09	4.61	3.66	0.13	2.56	58.9	20.87	19.4
Axle 3		4.56	4.22	4.90	3.47	0.17	3.36	73.7	32.21	20.4
Axle 4		4.55	4.23	4.87	3.67	0.16	3.13	68.8	21.62	20.4
Axle 5		22.39	21.27	23.51	19.23	0.57	10.97	49.0	73.99	100.0
<b>5 Axle HGV (non-CIS)</b>	615	4.92	4.72	5.12	5.11	0.10	1.17	23.8	6.82	17.1
Axle 1		5.95	5.47	6.43	6.13	0.25	2.75	46.2	22.41	20.6
Axle 2		5.47	4.96	5.98	5.20	0.26	2.92	53.4	20.87	19.0
Axle 3		6.16	5.64	6.68	5.99	0.26	2.96	48.1	11.89	21.4
Axle 4		6.34	5.80	6.88	6.50	0.28	3.09	48.7	15.25	22.0
Axle 5		28.83	26.93	30.73	31.60	0.97	10.83	37.6	63.83	100.0

Source: Consultant's analysis of axle load surveys carried out in Uzbekistan, Kyrgyzstan, Kazakhstan, Azerbaijan, Georgia and Armenia.

Table A.4.2 PAVEMENT DAMAGE FACTORS FOR DIFFERENT VEHICLE TYPES IN THE TRACECA COUNTRIES

Vehicle Type and Axle	Sample size (vehicles)	Mean Weight (tonnes)	Pavement Damage Factors (Single Axle)			
			8.16 T Standard Axle		10.00 T Standard Axle	
			Exponent = 4 (ESA)	Exponent = 4.5 (ESA)	Exponent = 4 (ESA)	Exponent = 4.5 (ESA)
<b>2 Axle Buses (all)</b>	15					
Axle 1		4.91	0.1311	0.1017	0.0581	0.0407
Axle 2		8.83	1.3711	1.4263	0.6079	0.5712
GVW		13.73	1.5022	1.5280	0.6660	0.6120
<b>3 Axle Buses (non-CIS)</b>	2					
Axle 1		5.81	0.2570	0.2169	0.1139	0.0869
Axle 2		9.50	1.8371	1.9822	0.8145	0.7939
Axle 3		4.50	0.0925	0.0687	0.0410	0.0275
GVW		19.80	2.1866	2.2678	0.9695	0.9082
<b>2 Axle HGV (all)</b>	899					
Axle 1		2.66	0.0113	0.0064	0.0050	0.0026
Axle 2		4.53	0.0950	0.0708	0.0421	0.0283
GVW		7.19	0.1063	0.0772	0.0471	0.0309
<b>2 Axle HGV (non-CIS)</b>	15					
Axle 1		4.15	0.0669	0.0477	0.0297	0.0191
Axle 2		7.97	0.9101	0.8994	0.4035	0.3602
GVW		12.12	4.8669	5.9314	2.1578	2.3755
<b>3 Axle HGV (all)</b>	1017					
Axle 1		3.79	0.0465	0.0317	0.0206	0.0127
Axle 2		4.57	0.0984	0.0736	0.0436	0.0295
Axle 3		4.47	0.0900	0.0666	0.0399	0.0267
GVW		12.80	0.2350	0.1720	0.1042	0.0689
<b>3 Axle HGV (non-CIS)</b>	41					
Axle 1		4.45	0.0884	0.0653	0.0392	0.0262
Axle 2		7.78	0.8263	0.8069	0.3664	0.3232
Axle 3		6.30	0.3553	0.3122	0.1575	0.1250
GVW		18.52	1.2701	1.1844	0.5631	0.4743
<b>4 Axle HGV (all)</b>	152					
Axle 1		4.62	0.1028	0.0773	0.0456	0.0310
Axle 2		6.50	0.4026	0.3593	0.1785	0.1439
Axle 3		5.13	0.1562	0.1239	0.0693	0.0496
Axle 4		5.26	0.1727	0.1386	0.0765	0.0555
GVW		21.51	0.8342	0.6991	0.3699	0.2800
<b>4 Axle HGV (non-CIS)</b>	56					
Axle 1		5.05	0.1467	0.1154	0.0650	0.0462
Axle 2		7.72	0.8011	0.7792	0.3552	0.3121
Axle 3		6.97	0.5323	0.4920	0.2360	0.1970
Axle 4		6.66	0.4437	0.4009	0.1967	0.1606
GVW		26.40	1.9239	1.7875	0.8530	0.7159
<b>5 Axle HGV (all)</b>	370					
Axle 1		4.34	0.0800	0.0584	0.0355	0.0234
Axle 2		4.57	0.0984	0.0736	0.0436	0.0295
Axle 3		4.35	0.0808	0.0590	0.0358	0.0236
Axle 4		4.56	0.0975	0.0729	0.0432	0.0292
Axle 5		4.55	0.0967	0.0722	0.0429	0.0289
GVW		22.39	0.4533	0.3360	0.2010	0.1346
<b>5 Axle HGV (non-CIS)</b>	125					
Axle 1		4.92	0.1322	0.1026	0.0586	0.0411
Axle 2		5.95	0.2827	0.2414	0.1253	0.0967
Axle 3		5.47	0.2019	0.1653	0.0895	0.0662
Axle 4		6.16	0.3248	0.2822	0.1440	0.1130
Axle 5		6.34	0.3644	0.3212	0.1616	0.1286
GVW		28.83	1.3059	1.1127	0.5790	0.4456

Source: Consultant's estimates based on the results of axle load surveys in six TRACECA countries.



Table A.4.3 PAVEMENT DAMAGE FACTORS FOR THE HEAVIEST TEN PERCENT OF GOODS VEHICLES IN EACH CATEGORY

Vehicle Type and Axle	Sample size (vehicles)	Mean Weight (tonnes)	Distribution of Axle Weight (%)	Pavement Damage Factors (Single Axle)			
				8.16 T Standard Axle		10.00 T Standard Axle	
				Exponent = 4 (ESA)	Exponent = 4.5 (ESA)	Exponent = 4 (ESA)	Exponent = 4.5 (ESA)
2 Axle HGV (all) Axle 1 Axle 2 GVW	90	4.85	30.64	0.1248	0.0962	0.0553	0.0385
		10.98	69.36	3.2783	3.8028	1.4535	1.5230
		15.83	100.00	3.4031	3.8990	1.5088	1.5616
3 Axle HGV (all) Axle 1 Axle 2 Axle 3 GVW	102	4.84	19.46	0.1238	0.0953	0.0549	0.0382
		10.08	40.53	2.3285	2.5880	1.0324	1.0365
		9.95	40.01	2.2107	2.4412	0.9801	0.9777
		24.87	100.00	4.6630	5.1245	2.0674	2.0524
4 Axle HGV (all) Axle 1 Axle 2 Axle 3 Axle 4 GVW	15	6.16	15.23	0.3248	0.2822	0.1440	0.1130
		11.40	28.19	3.8094	4.5026	1.6890	1.8033
		11.69	28.91	4.2121	5.0415	1.8675	2.0191
		11.19	27.67	3.5364	4.1412	1.5679	1.6586
		40.44	100.00	11.8827	13.9675	5.2683	5.5940
5 Axle HGV (all) Axle 1 Axle 2 Axle 3 Axle 4 Axle 5 GVW	37	5.50	12.63	0.2064	0.1694	0.0915	0.0679
		8.05	18.49	0.9472	0.9408	0.4199	0.3768
		8.37	19.22	1.1070	1.1211	0.4908	0.4490
		11.14	25.59	3.4736	4.0586	1.5401	1.6255
		10.48	24.07	2.7207	3.0833	1.2063	1.2349
43.54	100.00	8.4549	9.3733	3.7486	3.7540		

Source: Consultant's estimates based on the results of axle load surveys in six TRACECA countries.

Table A.4.4 AVERAGE PAVEMENT DAMAGE FACTORS PER PAYLOAD TONNE

Vehicle Type and Axle	Sample size (vehicles)	Mean GVW (tonnes)	Pavement Damage Factors (Single Axle)		Estimated Payload (tonnes)	Pavement Damage Factors per Payload Tonne	
			B 16 T Reference Axle			B 16 T Reference Axle	
			Exponent = 4 (ESA)	Exponent = 4.5 (ESA)		Exponent = 4 (ESA)	Exponent = 4.5 (ESA)
2 Axle HGV (all)	899	7.19	0.1063	0.0772	4.31	0.02	0.01
2 Axle HGV (non-CIS)	15	12.12	4.8669	5.9314	7.27	0.67	0.30
3 Axle HGV (all)	1017	12.80	0.2350	0.1720	7.68	0.03	0.01
3 Axle HGV (non-CIS)	41	18.52	1.2701	1.1844	11.11	0.11	0.05
4 Axle HC.V (all)	152	21.51	0.8342	0.6991	12.91	0.06	0.03
4 Axle HGV (non-CIS)	56	26.40	1.9239	1.7875	15.84	0.12	0.05
5 Axle HGV (all)	370	22.39	0.4533	0.3360	13.43	0.03	0.01
5 Axle HGV (non-CIS)	125	28.83	1.3059	1.1127	17.30	0.08	0.03

Note: GVW = gross vehicle weight. Payload estimated at 60 percent of GVW.

Source: Consultant's estimates based on the results of axle load surveys in six TRACECA countries.

Table A.4.5 SUMMARY OF EQUIVALENT STANDARD AXLES BY VEHICLE TYPE

Country	Equivalent Standard Axles (ESA) by Vehicle Type (from axle load survey results)					
	Car	Utility Vehicle	Large Bus	Truck 2 axle	Truck 3 axle	Truck >3 axles
Armenia	0.0001	0.0014	0.6348	0.1616	0.4073	0.3566
Azerbaijan	0.0001	0.0014	1.2341	0.1272	0.1792	0.3384
Georgia	0.0001	0.0014	1.9811	0.0974	0.5004	1.1296
Kazakhstan	0.0001	0.0014	0.2481	0.0453	0.1814	0.2148
Kyrgyz Republic	0.0001	0.0014	0.1660	0.0686	0.1667	0.6335
Tajikistan	0.0001	0.0014	0.1660	0.0686	0.1667	0.6335
Uzbekistan	0.0001	0.0014	1.0997	0.1930	0.1879	1.0115
Country	Equivalent Standard Axles (ESA) by Vehicle Type (allowing for growth in truck sizes)					
	Car	Utility Vehicle	Large Bus	Truck 2 axle	Truck 3 axle	Truck >3 axles
Armenia	0.0001	0.0014	0.6348	0.2069	0.5214	0.4565
Azerbaijan	0.0001	0.0014	1.2341	0.1628	0.2294	0.4332
Georgia	0.0001	0.0014	1.9811	0.1247	0.6406	1.4460
Kazakhstan	0.0001	0.0014	0.2481	0.0580	0.2322	0.2750
Kyrgyz Republic	0.0001	0.0014	0.1660	0.0878	0.2134	0.8109
Tajikistan	0.0001	0.0014	0.1660	0.0878	0.2134	0.8109
Uzbekistan	0.0001	0.0014	1.0997	0.2471	0.2405	1.2948

Note: An annual growth of 2.5% in ESA/Vehicle has been assumed for trucks over the period 1996 - 2006

Source: Consultant's estimate based on axle survey results.



**ANNEX 6**



Table A.6.1 ARMENIAN PUBLIC ROAD NETWORK BY DESIGN CATEGORY IN 1996

Road No.	Road Name	Length (km) of Inter-Urban Roads by Design category					Urban roads	Grand Total
		I	II	III	IV	V		
M.1 (E)	Yerevan-Giumri-Ashotsk-Bavra (Georgia)	18.4	131.5	0.0	0.0	0.0	23.8	173.7
M.2 (E)	Markara (Turk.border)-Ashtarak-Vanadzor-Tashir-Dzoramat-(Georgia)	0.0	130.7	48.4	0.0	0.0	4.6	183.7
M.3 (E)	Yerevan-Sevan-Ijevan-(Azerbaijan)	63.7	40.6	42.8	5.2	0.0	0.0	152.2
M.4 (E)	Yerevan-Yeraskh-Goris-Meghri-(Iran)	38.0	209.0	77.2	36.9	0.0	10.0	371.1
M.5	Verdaghiur - Tashir	0.0	0.0	0.0	54.0	0.0	0.0	54.0
M.6	Spitak-Giumri-Akhurit	0.0	45.0	0.0	7.5	0.0	3.6	56.1
M.7	Vanadzor-Alaverdi-Bagratashen - (Sadakhlo Georgia)	0.0	14.4	66.0	0.0	0.0	10.9	91.2
M.8	Gulakarak - Tounanian	0.0	0.0	0.0	18.0	0.0	0.0	18.0
M.9	Vanadzor-Dilijan	0.0	41.6	0.0	0.0	0.0	0.0	41.6
M.10	Talin-Karakert-Bagaran - (Turkey)	0.0	0.0	41.0	0.0	0.0	0.0	41.0
M.11	Ashtarak-Abovian	0.0	0.0	25.2	0.0	0.0	0.0	25.2
M.12	Yerevan-Oktemberjan-Karakala - (Turkey)	45.0	0.0	10.7	0.0	0.0	7.0	62.7
M.13	Yerevan-Geghart	0.0	0.0	38.1	0.0	0.0	0.0	38.1
M.14	Sevan-Martuni-Getap	0.0	134.0	0.0	0.0	0.0	0.0	134.0
M.15	Martuni-Vardenis-Sotk	0.0	42.0	12.0	0.0	0.0	0.0	54.0
M.16	Vardenis-Shorja-Tcovagugh	0.0	0.0	84.0	0.0	0.0	0.0	84.0
M.17	Angerakot- (Nakhichevan / Azerbaijan)	0.0	0.0	23.0	0.0	0.0	0.0	23.0
M.18	Goris - Zabukh - (Azerbaijan)	0.0	0.0	25.4	0.0	0.0	0.0	25.4
"M"	<b>Sub-Total Inter State Roads</b>	<b>165.1</b>	<b>788.7</b>	<b>493.7</b>	<b>121.6</b>	<b>0.0</b>	<b>59.9</b>	<b>1,629.0</b>
"13P"	<b>Sub - Total Intra State Roads</b>	<b>0.0</b>	<b>83.0</b>	<b>150.0</b>	<b>1,045.7</b>	<b>300.0</b>	<b>0.0</b>	<b>1,578.7</b>
	<b>TOTAL MAIN ROAD NETWORK</b>	<b>165.1</b>	<b>871.7</b>	<b>643.7</b>	<b>1,167.3</b>	<b>300.0</b>	<b>59.9</b>	<b>3,147.8</b>
	Local and other public roads							4,580.4
	<b>TOTAL PUBLIC ROAD NETWORK</b>							<b>7,788.0</b>

Source: ARD

Table A.6.1 (continued) AZERBAIJAN PUBLIC ROAD NETWORK BY DESIGN CATEGORY IN 1996

Road No.	Road Name	Length (km) of Inter-Urban Roads by Design category										Total	
		I	II	II - III	III	III - IV	IV	III-IV-V	V				
M.1	Baku - Georgia border	1.5	499.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	501.0
M.1	Approach roads	0.0	87.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.0
M.2	Baku - Russian border	73.0	155.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	228.0
M.4	Approach roads	0.0	54.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.0
M3	Baku - Astara (Iranian border)	70.0	56.0	192.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	318.0
M.4	Alat - Kurdamir - Yevlak	0.0	212.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	212.0
M.4	Approach roads	0.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
	<b>Sub-Total Inter State Roads</b>	<b>144.5</b>	<b>1,072.5</b>	<b>192.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>1,409.0</b>
A	<b>Sub - Total Intra State (Republican) Roads</b>	<b>0.0</b>	<b>253.0</b>	<b>297.0</b>	<b>1,159.0</b>	<b>874.0</b>	<b>371.0</b>	<b>326.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>3,280.0</b>
	<b>TOTAL MAIN INTER URBAN ROADS</b>	<b>144.5</b>	<b>1,325.5</b>	<b>489.0</b>	<b>1,159.0</b>	<b>874.0</b>	<b>371.0</b>	<b>326.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>4,689.0</b>
A33-A53	Republican roads in occupied areas	0.0	0.0	60.0	438.0	555.0	110.0	203.0	0.0	0.0	0.0	0.0	1,366.0

Source: Azeravtoyol



Table A.6.1 (continued) GEORGIA - PUBLIC ROAD NETWORK BY DESIGN CATEGORY

Road No. and Class	Road Name	Road Length by Design Category (km)					Total
		I	II	III	IV	V	
S.1	Tbilisi-Kutaisi-Senaki	37.0	61.0	187.0	0.0	0.0	285.0
S.2	Senaki-Batumi	0.0	14.0	53.0	38.0	0.0	105.0
S.3	S1/S3 - Kasbegi-(Russia)	0.0	0.0	57.0	101.0	7.0	165.0
S.4	Tbilisi-Tsiteli Khidi-(Azerbaijan)	0.0	14.0	13.0	29.0	0.0	56.0
S.5	Tbilisi-Lagodekhi-(Azerbaijan)	0.0	70.0	57.0	11.0	0.0	138.0
S.6	Tbilisi-Marneuli-Bolnisi-Guguti (Armenia)	0.0	12.0	58.0	23.0	0.0	93.0
S.7	Marneuli-Sadakhlo-(Armenia)	0.0	5.0	3.0	26.0	0.0	34.0
S.8	Khashuri-Borjomi-Akhaltzikhe-(Armenia)	0.0	0.0	16.0	5.0	0.0	21.0
S.9	Tbilisi Bypass	0.0	0.0	23.0	26.0	0.0	49.0
	<b>Total Inter State</b>	<b>37.0</b>	<b>176.0</b>	<b>467.0</b>	<b>259.0</b>	<b>7.0</b>	<b>946.0</b>
	<b>Total Intra State (Republican)</b>	<b>2.2</b>	<b>83.5</b>	<b>301.1</b>	<b>2,247.1</b>	<b>1,425.4</b>	<b>4,059.3</b>
	<b>TOTAL MAIN ROADS</b>	<b>39.2</b>	<b>259.5</b>	<b>768.1</b>	<b>2,506.1</b>	<b>1,432.4</b>	<b>5,005.3</b>

Note: The republican road network is in the process of redefinition and it may finally be smaller than indicated above.

Source: Consultant's estimate based on Sakavtogsa data.

Table A. 6.1 (continued) KAZAKHSTAN - PUBLIC ROAD NETWORK BY DESIGN CATEGORY

Road No. and Class	Road	Road Length by Design Category (km)					Total
		I	II	III	IV	V	
M32	Chimkent-Aralsk-Aktiubinsk-(Russia-Samara)	33	135	1,691	189	0	2,048
M36	M36/M39-Kaskelen--Karaganda-Akmola-Kustanai-(Russia)	52	450	1,594	0	0	2,096
M38	(Russia)-Pavlodar-Semipalatinsk-Maikapchagai - (China)	51	432	642	0	0	1,125
M39	Almaty-Kaskelen-Georgievka-Djambul-Chimkent-(Uzbekistan)	130	455	88	0	0	673
M51	(Russia)-Petropavlovsk-Bulavaev-(Russia)	6	162	22	0	0	190
	<b>Total Inter State</b>	<b>272</b>	<b>1,634</b>	<b>4,037</b>	<b>189</b>	<b>0</b>	<b>6,132</b>
A340	Aktubinsk-Makat-Ganushkino-(Russia)	0	83	807	0	17	907
A341	Mamlytk-Leninskoe-Kustanai	0	0	404	0	0	404
A342	Yezkazgan-Derzhavinsk-Petropavlovsk	65	41	755	62	26	949
A343	Akmola-Kokshetau-Petropavlovsk	8	11	444	0	0	463
A344	Kyzil Orda-Karaganda-Pavlodar	76	110	1,190	0	0	1,376
A345	Karaganda-Ayaguz-Bugaz	0	0	921	0	0	921
A349	Semipalatinsk-(Russia)	0	13	100	0	0	113
A350	Almaty-Taldy Kurgan-Ayaguz-Ust Kaminogorsk	142	156	780	0	0	1,078
A351	Almaty-Kokpek-Chundzha-Koktal	29	276	0	0	0	305
A353	Sari Ozek-Jarkent-Khorgos	0	0	232	0	0	232
A355	Ucharal-Druzhba (Dostyk)	0	0	184	0	0	184
A356	Taskesken-Makanchi-Bachty -(China)	0	0	190	0	0	190
A358	Merke-Dzambul-Burubaital	0	151	124	0	0	275
A359	Georgievka-Merke	0	150	0	0	0	150
A362	Kokpek-Kegen-(Kyrgyzstan)	0	6	109	0	0	115
	<b>Sub Total Main Intra State (Republican)</b>	<b>320</b>	<b>997</b>	<b>6,240</b>	<b>62</b>	<b>43</b>	<b>7,662</b>
	Other Intra State (Republican)	41	422	3,028	211	0	3,702
	<b>Total Intra State (Republican)</b>	<b>361</b>	<b>1,419</b>	<b>9,268</b>	<b>273</b>	<b>43</b>	<b>11,364</b>
	<b>TOTAL MAIN INTER URBAN ROADS</b>	<b>633</b>	<b>3,053</b>	<b>13,305</b>	<b>462</b>	<b>43</b>	<b>17,496</b>
	Local roads (including urban roads)	242	1,451	19,153	41,290	2,851	69,841
	<b>GRAND TOTAL</b>	<b>875</b>	<b>4,504</b>	<b>32,458</b>	<b>41,752</b>	<b>2,894</b>	<b>87,337</b>

Source: Consultants' estimates based on KAZDORNII and Department of Highways data.

Table A.6.1 (continued) KYRGYZSTAN - PUBLIC ROAD NETWORK BY DESIGN CATEGORY

Road Number and Class	Road name	Road Length by Design Category (km)					Total	
		I	II	III	IV	V		Other
M39 (a)	Chaldovar-Bishkek- Georgijevka	12.2	119.9	0.0	0.0	0.0	0.0	132.1
M41 (b)	Kara Balta - Osh	0.0	89.3	137.6	388.6	0.0	0.0	615.5
	<b>Inter State</b>	<b>12.2</b>	<b>209.2</b>	<b>137.6</b>	<b>388.6</b>	<b>0.0</b>	<b>0.0</b>	<b>747.6</b>
A361	(Dzambul)- Talas-Oetmek Pass (M41)	0.0	0.0	167.0	49.0	0.0	0.0	216.0
A362	Tyup - (Keghen)	0.0	0.0	0.0	76.0	0.0	0.0	76.0
A363	Tyup - Toktoyan	0.0	80.5	267.0	97.5	0.0	0.0	445.0
A364	Borso'on - Kara Saja - Enichek	0.0	0.0	30.0	322.0	97.0	0.0	449.0
A365	Bishkek-Tokmak-Balykchi-Naryn-Torugatt - (China)	0.0	107.0	301.1	123.9	7.0	0.0	539.0
A367	Tyuz Ahu (M41) - Kochkorka (A365)	0.0	0.0	90.2	148.1	0.0	0.0	238.3
A370	Osh - Uzghen - Kok Art	0.0	0.0	30.0	100.0	45.0	0.0	175.0
A371 (c)	Sari tash - Irkeshtam	0.0	0.0	0.0	78.0	0.0	0.0	78.0
A372 (c)	Sari Tash - Karamyk - (Tajikistan)	0.0	0.0	0.0	146.0	0.0	0.0	146.0
	<b>Intra State (Republican)</b>	<b>0.0</b>	<b>187.5</b>	<b>885.3</b>	<b>1,140.5</b>	<b>149.0</b>	<b>0.0</b>	<b>2,362.3</b>
	<b>Total Main Inter Urban Roads</b>	<b>12.2</b>	<b>396.7</b>	<b>1,022.9</b>	<b>1,529.1</b>	<b>149.0</b>	<b>0.0</b>	<b>3,109.9</b>
	Other roads	127.8	0.0	1,037.1	7,380.9	6,934.3	0.0	15,480.1
	<b>TOTAL</b>	<b>140.0</b>	<b>396.7</b>	<b>2,060.0</b>	<b>8,910.0</b>	<b>7,083.3</b>	<b>0.0</b>	<b>18,590.0</b>

Source: Ministry of Transport

Note:

(a) Including the Bishkek bypass

(b) Does not include the 229 km of the M41 between Osh and the Tajikistan border (the "Pamir Highway").

This section does not come under the jurisdiction of the Ministry of Transport in Bishkek which has no information about it.

(c) In the absence of reliable data, this has been estimated.

Table A.6.1 (continued) TAJIKISTAN - PUBLIC ROAD NETWORK BY DESIGN CATEGORY AND PAVEMENT TYPE

Road Number	Location	Road Length by Design Category (km)					Total
		I	II	III	IV	V	
<b>"M" Roads</b>							
M34	Dushanbe-Ura Tube-(Tashkent)	0.0	30.9	24.9	100.5	143.4	299.7
M34	Dushanbe-Kurgan Tube-Aivaj	6.0	0.0	195.8	12.0	0.0	213.8
M41	Dushanbe-Turzunzade-(Termez)	0.0	0.0	61.0	0.0	0.0	61.0
M41	Dushanbe-Chorog	0.0	12.0	54.0	65.0	383.6	514.6
<b>Sub total</b>	<b>Inter State Roads</b>	<b>6.0</b>	<b>42.9</b>	<b>335.7</b>	<b>177.5</b>	<b>527.0</b>	<b>1,089.1</b>
<b>"A" Roads</b>							
A372	Konsomolabad-Garm-Dzirgatal-Karamyk	0.0	0.0	0.0	0.0	217.2	217.2
A376	(Kokand)-Kanibadan-Hudzand-Bekabad-(Dzizak)	0.0	98.1	36.0	0.0	0.0	134.1
A377	(Samar kand)-Ajni (M34)	0.0	5.0	14.7	50.0	43.0	112.7
A385	Ordzonikidzabad (M41)-Dangara-Piandj	0.0	0.0	49.0	89.8	93.3	232.1
<b>Sub-total</b>	<b>Intra State Roads</b>	<b>0.0</b>	<b>103.1</b>	<b>99.7</b>	<b>139.8</b>	<b>353.5</b>	<b>696.1</b>
<b>TOTAL</b>	<b>MAIN ROADS</b>	<b>6.0</b>	<b>146.0</b>	<b>435.4</b>	<b>317.3</b>	<b>880.5</b>	<b>1,785.2</b>
% of total		0.3	8.2	24.4	17.8	49.3	100.0

Note: Locations in brackets are in Uzbekistan.

Source: Ministry of Transport

Table A.6.1 (continued) UZBEKISTAN - PUBLIC ROAD NETWORK BY DESIGN CATEGORY

Road Number and Category	Road Name	Road Length by Design Category (km) - January 1995						Total
		I	II	III	IV	V	Other	
M34	Tashkent-Sirdarya-Gulistan-Khavast-(Tajikistan)	92	52	16	0	0	0	160
M37	Samarkand - Bokhara - Turkmenistan	283	70	12	0	0	0	365
M39	(Kazakhstan)-Tashkent-Samarkand-Termez-(Afghanistan)	384	136	102	52	7	0	681
M41	(Turzunzade)-Dinau-Termez-(Afghanistan)	0	187	0	0	0	0	187
	<b>Inter State</b>	<b>759</b>	<b>445</b>	<b>130</b>	<b>52</b>	<b>7</b>	<b>0</b>	<b>1,393</b>
A373	Tashkent-Kokand-Andijan-(Osh) and approach road to Tashkent Airport	123	219	36	26	0	0	404
A376	Kokand-(Kanibadan)-(Bekabad)-Dzizak	49	103	16	0	0	0	168
A377	Samarkand - (Tajikistan)	3	10	12	12	0	0	37
A378	Samarkand - Karshi	15	23	74	21	0	0	133
A379	Navoi - Zarafsan - Uchkuduk	116	175	0	0	0	0	291
A380	Guzar (M39)-Bokhara-Urgench-Nukus	152	217	294	107	0	0	770
A381	Nukus - Khojeili - (Turkmenistan)	22	20	0	0	0	0	42
	<b>Main Intra State (Republican)</b>	<b>480</b>	<b>767</b>	<b>432</b>	<b>166</b>	<b>0</b>	<b>0</b>	<b>1,845</b>
	Other Republican	515	3,775	5,518	7,296	1,413	70	18,587
	<b>Total Republican</b>	<b>995</b>	<b>4,542</b>	<b>5,950</b>	<b>7,462</b>	<b>1,413</b>	<b>70</b>	<b>20,432</b>
	<b>TOTAL MAIN INTER URBAN ROADS</b>	<b>1,754</b>	<b>4,987</b>	<b>6,080</b>	<b>7,514</b>	<b>1,420</b>	<b>70</b>	<b>21,825</b>
	Oblast / Regional	26	87	1,494	7,651	2,555	0	11,813
	Rayon / District	32	84	299	4,545	4,720	0	9,680
	<b>Sub-total Regional and District Roads</b>	<b>58</b>	<b>171</b>	<b>1,793</b>	<b>12,196</b>	<b>7,275</b>	<b>0</b>	<b>21,493</b>
	<b>TOTAL</b>	<b>1,812</b>	<b>5,158</b>	<b>7,873</b>	<b>19,710</b>	<b>8,695</b>	<b>70</b>	<b>43,318</b>

Source: Uzavtoyul

Table A.6.2 C.I.S REPUBLICS - GEOMETRIC AND PAVEMENT DESIGN STANDARDS

GEOMETRIC DESIGN STANDARDS	ROAD DESIGN CATEGORY				
	I	II	III	IV	V
<b>TRAFFIC</b>					
ADT (vehicles)	> 7,000	> 3,000-7,000	> 1,000-3,000	100-1,000	< 100
PCU / Day	> 14,000	> 6,000-14,000	> 2,000-6,000	200-2,000	< 200
<b>DESIGN SPEED (Kph)</b>					
Flat/rolling terrain	150	120	100	80	60
Winding/hilly terrain	120	100	80	60	40
Mountainous terrain	80	60	50	40	30
<b>PAVEMENT WIDTH (m)</b>					
No. of lanes	4, 6 or 8	2	2	2	1
Lane width (m)	3.75	3.75	3.50	3.00	4.50
Shoulder width (m)	3.75	3.75	2.50	2.00	1.75
Formation width (m)	27.5-43.5	15.00	12.00	10.00	8.00
<b>PAVEMENT DESIGN STANDARDS</b>					
Surface	4 cm AC (hot)	5 cm AC (cold)	5 cm AC (cold)	8cm crushed stone with bitumen	9-18 cm crushed stone
2nd layer	6 cm AC (hot)	8 cm AC (cold)	5 cm AC (cold)		
3rd layer	8 cm AC (hot)				
Base course	20 cm sand-gravel with cement (4-6%) or 20 cm crushed rock	15 cm crushed stone with bitumen	8 cm crushed stone with bitumen	18 cm crushed stone-sand	
Sub-Base	20 cm sand with bitumen (4%) or 20 cm loam	19 cm crushed stone	16 cm crushed stone - sand		
<b>Theoretical Structural Number (SN)</b>					
Surface	0.63	0.39	0.39	0.95	0.74
2nd layer	0.95	0.63	0.39		
3rd layer	0.95				
Base course	1.58	1.77	0.95	0.69	
Sub-base	0.79	1.05	0.69		
Sub-grade	0.79	0.79	0.79	0.79	0.79
TOTAL	5.69	4.63	3.21	2.43	1.53

Table A.6.3 ARMENIA - ANALYSIS OF BENKELMAN SURVEY RESULTS

Road No.	Road Location	Benkelman Beam Survey		Design Class	No. of Observations	Statistical Results (SNC - Modified Structural Number)			95% Confidence Limits for Mean SNC	
		Km from	Km to			Mean SNC	Standard Deviation SNC	Coefficient of Variation (%)	Upper	Lower
M.1	Yerevan - Ashtarak	0.00	13.00	1	131	7.50	0.80	10.67	7.60	7.40
M.1	Ashtarak - Giumri	30.20	119.20	2	903	4.96	0.58	11.79	4.96	4.88
M.1	Giumri - Bavra	0.00	43.70	2	438	4.72	0.45	9.41	4.82	4.74
M.2	Ashtarak - Spitak	0.00	77.10	2	772	4.89	0.90	16.92	5.38	5.26
M.4	Yeghegnadzor - Goris	165.00	201.00	2	361	4.12	0.36	8.74	4.16	4.08
M.4	Goris - Kapan	277.18	298.98	2	219	4.13	0.24	5.81	4.16	4.10
M.4	Goris - Kapan	241.18	277.08	3	360	4.00	0.12	3.00	4.01	3.99
<b>WEIGHTED AVERAGE</b>						<b>7.50</b>	<b>0.80</b>	<b>10.67</b>	<b>7.60</b>	<b>7.40</b>
						<b>4.84</b>	<b>0.59</b>	<b>12.26</b>	<b>4.89</b>	<b>4.80</b>
						<b>4.00</b>	<b>0.12</b>	<b>3.00</b>	<b>4.01</b>	<b>3.99</b>

Note: Deflection measures in original surveys converted to Modified Structural Numbers (SNC) using the following formula:

$$SNC = 3.2 * (\text{Deflection mm})^{-0.63}$$

This formula is suggested in the World Bank's "Description of the HDM-III Model" (Volume 1), notably in the discussion of pavement structural characteristics.

Source: Consultant's estimates based on ARD survey data

Table A.6.4 ARMENIA - AVERAGE DAILY TRAFFIC AND VEHICLE KILOMETRES BY DESIGN CLASS 1996

Road Class	Design Standard	Road Length (km)	Average Daily Traffic						TOTAL ADT
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
M	1	165.1	4,628	477	369	364	331	53	6,222
M	2	788.7	2,106	237	181	213	204	48	2,988
M	3	493.7	856	159	78	151	139	27	1,410
M	4	121.6	410	92	41	157	104	37	841
M	5	-							
		<b>1,569.1</b>							
Rep.	1	-							
Rep.	2	83.3	3,681	312	178	253	250	25	4,700
Rep.	3	150.0	970	145	43	92	39	13	1,302
Rep.	4	1,045.4	285	67	21	74	61	18	525
Rep.	5	300.0	142	33	10	37	30	9	263
		<b>1,578.7</b>							
Road Class	Design Standard	Road Length (km)	Vehicle Kilometres (million)						TOTAL
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
M	1	165.1	278.9	28.7	22.2	22.0	19.9	3.2	374.9
M	2	788.7	606.3	68.3	52.0	61.2	58.6	13.8	860.1
M	3	493.7	154.3	28.7	14.1	27.2	25.0	4.9	254.1
M	4	121.6	18.2	4.1	1.8	7.0	4.6	1.7	37.3
M	5	-	-	-	-	-	-	-	-
		<b>1,569.1</b>	<b>1,057.7</b>	<b>129.8</b>	<b>90.1</b>	<b>117.3</b>	<b>108.2</b>	<b>23.5</b>	<b>1,526.5</b>
Rep.	1	-	0.0	0.0	0.0	0.0	0.0	0.0	-
Rep.	2	83.3	111.9	9.5	5.4	7.7	7.6	0.8	142.9
Rep.	3	150.0	53.1	7.9	2.4	5.1	2.1	0.7	71.3
Rep.	4	1,045.4	108.6	25.4	7.9	28.3	23.2	7.0	200.4
Rep.	5	300.0	15.6	3.6	1.1	4.1	3.3	1.0	28.8
		<b>1,578.7</b>	<b>289.2</b>	<b>46.5</b>	<b>16.8</b>	<b>45.2</b>	<b>36.2</b>	<b>9.4</b>	<b>443.3</b>
M + Rep.	1	165.1	278.9	28.7	22.2	22.0	19.9	3.2	374.9
M + Rep.	2	872.0	718.2	77.8	57.4	68.9	66.2	14.5	1,003.0
M + Rep.	3	643.7	207.4	36.6	16.4	32.3	27.2	5.6	325.4
M + Rep.	4	1,167.0	126.8	29.5	9.7	35.3	27.8	8.6	237.7
M + Rep.	5	300.0	15.6	3.6	1.1	4.1	3.3	1.0	28.8
		<b>3,147.8</b>	<b>1,346.9</b>	<b>176.2</b>	<b>106.9</b>	<b>162.5</b>	<b>144.4</b>	<b>32.9</b>	<b>1,969.8</b>



Table A.6.4 (continued) AZERBAIJAN - AVERAGE DAILY TRAFFIC AND VEHICLE KILOMETRES BY DESIGN CLASS

Road Class	Design Standard	Road Length (km)	Average Daily Traffic						TOTAL ADT
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
M	1	144.5	5,842	1,010	737	1,982	336	632	10,539
M	2	1,072.5	1,605	509	222	934	215	239	3,724
M	2-3	192.0	4,802	380	253	727	101	463	6,726
M	3	-							
M	3-4	-							
M	4	-							
M	4-5	-							
M	5	-							
M		<b>1,409.0</b>							
Rep.	1	-							
Rep.	2	253.0	658	418	187	618	182	186	2,249
Rep.	2-3	297.0	883	522	187	838	231	266	2,927
Rep.	3	1,159.0	594	286	126	495	145	165	1,811
Rep.	3-4	874.0	475	249	101	440	108	107	1,480
Rep.	4	371.0	754	175	62	281	90	85	1,447
Rep.	4-5	326.0	278	55	14	58	16	23	444
Rep.	5	-							
		<b>3,280.0</b>							
		<b>4,689.0</b>							
Vehicle Kilometres (million)									
Road Class	Design Standard	Road Length (km)	Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	TOTAL
M	1	144.5	308.1	53.3	38.9	104.5	17.7	33.3	555.9
M	2	1,072.5	628.3	199.3	86.9	365.6	84.2	93.6	1,457.8
M	2-3	192.0	336.5	26.6	17.7	50.9	7.1	32.4	471.4
M	3	-							
M	3-4	-							
M	4	-							
M	4-5	-							
M	5	-							
M		<b>1,409.0</b>	<b>1,272.9</b>	<b>279.2</b>	<b>143.5</b>	<b>521.1</b>	<b>109.0</b>	<b>159.3</b>	<b>2,485.0</b>
Rep.	1	-							
Rep.	2	253.0	60.8	38.6	17.3	57.1	16.8	17.2	207.7
Rep.	2-3	297.0	95.7	56.6	20.3	90.8	25.0	28.8	317.3
Rep.	3	1,159.0	251.3	121.0	53.3	209.4	61.3	69.8	766.1
Rep.	3-4	874.0	151.5	79.4	32.2	140.4	34.5	34.1	472.1
Rep.	4	371.0	102.1	23.7	8.4	38.1	12.2	11.5	195.9
Rep.	4-5	326.0	33.1	6.5	1.7	6.9	1.9	2.7	52.8
Rep.	5	-							
		<b>3,280.0</b>	<b>694.5</b>	<b>325.9</b>	<b>133.1</b>	<b>542.6</b>	<b>151.7</b>	<b>164.2</b>	<b>2,012.0</b>
M+Rep.	1	144.5	308.1	53.3	38.9	104.5	17.7	33.3	555.9
M+Rep.	2	1,325.5	689.1	237.9	104.2	422.7	101.0	110.7	1,665.5
M+Rep.	2-3	489.0	432.2	83.2	38.0	141.8	32.1	61.3	788.7
M+Rep.	3	1,159.0	251.3	121.0	53.3	209.4	61.3	69.8	766.1
M+Rep.	3-4	874.0	151.5	79.4	32.2	140.4	34.5	34.1	472.1
M+Rep.	4	371.0	102.1	23.7	8.4	38.1	12.2	11.5	195.9
M+Rep.	4-5	326.0	33.1	6.5	1.7	6.9	1.9	2.7	52.8
M+Rep.	5	-							
		<b>4,689.0</b>	<b>1,967.4</b>	<b>605.0</b>	<b>276.6</b>	<b>1,063.7</b>	<b>260.7</b>	<b>323.5</b>	<b>4,497.0</b>

Note: Republican (Rep.) roads exclude those in the occupied areas.

Source: Consultant's estimate based on Azeravtoyol data.

Table A.6.4 (continued) GEORGIA - AVERAGE DAILY TRAFFIC AND VEHICLE KILOMETRES BY DESIGN CLASS

Road Class	Design Standard	Total Length (km)	Average Daily Traffic 1996						
			Car	Utility	Large Bus	Truck 2 axle	Truck 3 axle	Truck >3 axle	TOTAL
S	1	37	7,285	316	705	338	352	118	9,114
S	2	176	5,872	280	565	293	293	101	7,405
S	3	467	3,469	177	342	208	193	82	4,471
S	4	259	1,415	62	96	97	83	50	1,803
S	5	7	643	27	59	30	31	10	800
		<b>946</b>							
Rep.	1	2	5,232	227	506	243	253	84	6,545
Rep.	2	84	2,216	106	213	111	111	38	2,795
Rep.	3	301	904	46	89	54	50	21	1,165
Rep.	4	2,247	275	12	19	19	16	10	350
Rep.	5	1,425	76	3	7	4	4	1	95
		<b>4,059</b>							
Road Class	Design Standard	Total Length (km)	Vehicle-Km (million) By Vehicle Category, 1996						
			Car	Utility	Large Bus	Truck 2 axle	Truck 3 axle	Truck >3 axle	TOTAL
S	1	37	98.4	4.3	9.5	4.6	4.8	1.6	123.1
S	2	176	377.2	18.0	36.3	18.9	18.8	6.5	475.7
S	3	467	591.4	30.2	58.2	35.5	32.9	14.0	762.1
S	4	259	133.8	5.8	9.1	9.2	7.8	4.7	170.4
S	5	7	1.6	0.1	0.2	0.1	0.1	0.0	2.0
		<b>946</b>	<b>1,202.4</b>	<b>58.4</b>	<b>113.3</b>	<b>68.1</b>	<b>64.4</b>	<b>26.8</b>	<b>1,533.4</b>
Rep.	1	2	4.2	0.2	0.4	0.2	0.2	0.1	5.3
Rep.	2	84	67.5	3.2	6.5	3.4	3.4	1.2	85.2
Rep.	3	301	99.3	5.1	9.8	6.0	5.5	2.3	128.0
Rep.	4	2,247	225.3	9.8	15.3	15.5	13.1	8.0	287.1
Rep.	5	1,425	39.7	1.7	3.7	1.8	1.9	0.6	49.4
		<b>4,059</b>	<b>436.1</b>	<b>20.0</b>	<b>35.7</b>	<b>26.8</b>	<b>24.2</b>	<b>12.2</b>	<b>555.0</b>
S + Rep.	1	39	102.6	4.4	9.9	4.8	5.0	1.7	128.3
S + Rep.	2	260	444.8	21.2	42.8	22.2	22.2	7.7	560.9
S + Rep.	3	768	690.7	35.3	68.0	41.4	38.5	16.3	890.2
S + Rep.	4	2,506	359.1	15.7	24.4	24.6	20.9	12.7	457.5
S + Rep.	5	1,432	41.4	1.7	3.8	1.9	2.0	0.7	51.5
		<b>5,005</b>	<b>1,638.5</b>	<b>78.4</b>	<b>149.0</b>	<b>94.9</b>	<b>88.5</b>	<b>39.0</b>	<b>2,088.4</b>

Source: Consultant's estimate based on Sakavtogsa data

Table A.6.4 (continued) KAZAKHSTAN - AVERAGE DAILY TRAFFIC AND VEHICLE KILOMETRES BY DESIGN CLASS

Road Class	Design Category	Road length (km)	Average Daily Traffic						TOTAL
			Car	Utility Vehicle	Large Bus	2-axle Trucks	3-axle Trucks	>3-axle Trucks	
M	1	272	2,464	256	97	509	282	108	3,717
M	2	1,634	1,625	102	15	373	280	41	2,436
M	3	4,037	899	70	17	350	189	38	1,563
M	4	189	810	63	15	316	170	34	1,409
M	5	0							
		<b>6,132</b>							
A	1	320	2,919	222	81	433	340	49	4043
A	2	997	1,016	98	20	297	154	49	1633
A	3	6,240	807	78	16	236	122	39	1297
A	4	62	443	51	7	189	49	32	772
A	5	43	443	51	7	189	49	32	772
		<b>7,662</b>							
Other Republican	1	41	3,105	246	89	560	157	85	4242
Other Republican	2	422	1,732	87	18	404	320	79	2641
Other Republican	3	3,028	730	52	7	179	101	92	1161
Other Republican	4	211	383	80	4	181	140	34	821
Other Republican	5	0	248	52	3	117	91	22	533
		<b>3,702</b>							

  

Road Class and Design Category	Design Category	Road length (km)	Vehicle Kilometres (million)						TOTAL
			Car	Utility Vehicle	Large Bus	2-axle Trucks	3-axle Trucks	>3-axle Trucks	
M	1	272	244.7	25.5	9.6	50.5	28.0	10.7	369.0
M	2	1,634	969.1	61.0	8.7	222.5	167.1	24.7	1,453.0
M	3	4,037	1,324.3	103.6	25.3	515.9	278.7	55.3	2,303.1
M	4	189	55.9	4.4	1.1	21.8	11.8	2.3	97.2
M	5	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		<b>6,132</b>	<b>2,593.9</b>	<b>194.5</b>	<b>44.7</b>	<b>810.7</b>	<b>485.6</b>	<b>93.0</b>	<b>4,222.3</b>
A	1	320	340.9	26.0	9.4	50.5	39.7	5.7	472.2
A	2	997	369.6	35.7	7.1	108.2	55.9	17.8	594.3
A	3	6,240	1,837.4	177.2	35.4	537.6	277.7	88.6	2,954.0
A	4	62	10.0	1.2	0.2	4.3	1.1	0.7	17.5
A	5	43	7.0	0.8	0.1	3.0	0.8	0.5	12.1
		<b>7,662</b>	<b>2,565.0</b>	<b>240.8</b>	<b>52.3</b>	<b>703.6</b>	<b>375.1</b>	<b>113.4</b>	<b>4,050.1</b>
Other Republican	1	41	46.5	3.7	1.3	8.4	2.3	1.3	63.5
Other Republican	2	422	266.9	13.4	2.8	62.2	49.2	12.2	406.8
Other Republican	3	3,028	807.1	57.7	7.7	197.8	111.6	101.4	1,283.4
Other Republican	4	211	29.5	6.2	0.3	13.9	10.7	2.6	63.2
Other Republican	5	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		<b>3,702</b>	<b>1,149.9</b>	<b>81.0</b>	<b>12.2</b>	<b>282.4</b>	<b>174.0</b>	<b>117.4</b>	<b>1,816.9</b>
TOTAL NON-LOCAL	1	633	632.1	55.1	20.4	109.4	70.1	17.7	904.7
TOTAL NON-LOCAL	2	3,053	1,605.5	110.1	18.7	392.8	272.2	54.7	2,454.1
TOTAL NON-LOCAL	3	13,305	3,968.8	338.6	68.5	1,251.4	668.0	245.3	6,540.5
TOTAL NON-LOCAL	4	462	95.4	11.7	1.5	40.0	23.6	5.7	177.9
TOTAL NON-LOCAL	5	43	7.0	0.8	0.1	3.0	0.8	0.5	12.1
		<b>17,496</b>	<b>6,308.8</b>	<b>516.4</b>	<b>109.2</b>	<b>1,796.6</b>	<b>1,034.6</b>	<b>323.8</b>	<b>10,089.3</b>

Source: Consultant's estimate based on Kazdornii data.

Table A.6.4 (continued) KYRGYZ REPUBLIC - AVERAGE DAILY TRAFFIC AND VEHICLE KILOMETRES BY DESIGN CLASS

Road Class	Design Standard	Road Length (km)	Average Daily Traffic						TOTAL AADT
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
M	1	12.2	7,063	950	426	1,197	322	294	10,252
M	2	209.2	4,090	431	341	1,055	168	110	6,195
M	3	137.6	878	119	32	180	210	123	1,543
M	4	388.6	252	61	3	57	210	69	651
M	5	0.0							
A	1	0.0							
A	2	187.5	2,339	316	229	873	99	97	3,953
A	3	885.3	749	122	69	144	53	50	1,187
A	4	1,140.5	137	53	13	116	32	30	381
A	5	149.0	32	7	4	27	8	7	85
Vehicle Kilometres (million)									
Road Class	Design Standard	Road Length (km)	Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	TOTAL
M	1	12.2	31.5	4.2	1.9	5.3	1.4	1.3	45.7
M	2	209.2	312.3	32.9	26.0	80.6	12.8	8.4	473.0
M	3	137.6	44.1	6.0	1.6	9.0	10.5	6.2	77.4
M	4	388.6	35.7	8.7	0.4	8.1	29.8	9.8	92.5
M	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M		<b>747.6</b>	<b>423.6</b>	<b>51.8</b>	<b>30.0</b>	<b>103.0</b>	<b>54.6</b>	<b>25.7</b>	<b>688.6</b>
A	1	0.0	160.1	21.6	15.7	59.7	6.8	6.6	270.5
A	2	87.5	242.0	39.4	22.3	46.5	17.1	16.2	383.6
A	3	885.3	57.0	22.1	5.4	48.3	13.3	12.5	158.6
A	4	1,140.5	1.7	0.4	0.2	1.5	0.4	0.4	4.6
A	5	149.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A		<b>2,362.3</b>	<b>460.9</b>	<b>83.5</b>	<b>43.6</b>	<b>156.0</b>	<b>37.7</b>	<b>35.7</b>	<b>817.3</b>
M+A	1	12.2	191.5	25.9	17.6	65.1	8.2	7.9	316.2
M+A	2	396.7	554.3	72.3	48.3	127.1	30.0	24.6	856.6
M+A	3	1,022.9	101.1	28.0	7.0	57.3	23.9	18.7	236.0
M+A	4	1,529.1	37.5	9.0	0.6	9.6	30.2	10.2	97.1
M+A	5	149.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M+A		<b>3,109.9</b>	<b>884.5</b>	<b>135.3</b>	<b>73.6</b>	<b>259.0</b>	<b>92.3</b>	<b>61.3</b>	<b>1,505.9</b>

Table A.6.4 (continued) TAJIKISTAN - AVERAGE DAILY TRAFFIC AND VEHICLE KILOMETRES BY DESIGN CLASS

Road Class	Design Standard	Road Length (km)	Average Daily Traffic (TRACECA average)						TOTAL AADT
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
M	1	6.0	3,539	854	307	1,461	305	236	6,702
M	2	42.9	2,172	301	152	620	239	134	3,618
M	3	335.7	1,138	94	54	324	186	45	1,840
M	4	177.5	714	67	36	151	158	60	1,186
M	5	527.0	572	28	45	156	68	23	891
		<b>1,089.1</b>							
A	1	0.0	2,185	375	115	897	237	221	4,031
A	2	103.1	1,187	201	84	475	173	113	2,233
A	3	99.7	728	105	36	249	110	68	1,294
A	4	139.8	303	53	22	93	44	26	540
A	5	353.5	95	10	7	16	10	4	142
		<b>696.1</b>							
Road Class	Design Standard	Road Length (km)	Vehicle Kilometres (million)						TOTAL
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
M	1	6.0	7.8	1.9	0.7	3.2	0.7	0.5	14.7
M	2	42.9	34.0	4.7	2.4	9.7	3.7	2.1	56.7
M	3	335.7	139.4	11.5	6.6	39.7	22.8	5.5	225.5
M	4	177.5	46.3	4.3	2.3	9.8	10.2	3.9	76.8
M	5	527.0	109.9	5.4	8.6	30.0	13.1	4.4	171.4
		<b>1,089.1</b>	<b>337.4</b>	<b>27.8</b>	<b>20.5</b>	<b>92.4</b>	<b>50.5</b>	<b>16.5</b>	<b>545.0</b>
A	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A	2	103.1	27.4	3.9	1.3	9.4	4.1	2.5	48.7
A	3	99.7	11.0	1.9	0.8	3.4	1.6	0.9	19.6
A	4	139.8	4.8	0.5	0.4	0.8	0.5	0.2	7.2
A	5	353.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		<b>696.1</b>	<b>43.2</b>	<b>6.4</b>	<b>2.5</b>	<b>13.5</b>	<b>6.2</b>	<b>3.7</b>	<b>75.6</b>
M + A	1	6.0	7.8	1.9	0.7	3.2	0.7	0.5	14.7
M + A	2	146.0	61.4	8.7	3.7	19.1	7.9	4.6	105.3
M + A	3	435.4	150.4	13.4	7.4	43.1	24.3	6.5	245.1
M + A	4	317.3	51.1	4.8	2.7	10.6	10.7	4.1	84.1
M + A	5	880.5	109.9	5.4	8.6	30.0	13.1	4.4	171.4
		<b>1,785.2</b>	<b>380.6</b>	<b>34.2</b>	<b>23.1</b>	<b>105.9</b>	<b>56.7</b>	<b>20.1</b>	<b>620.6</b>

Source: Consultant's estimate

Table A.6.4 (continued) UZBEKISTAN - AVERAGE DAILY TRAFFIC AND VEHICLE KILOMETRES BY DESIGN CLASS

Road Class	Design Standard	Length (km)	AVERAGE DAILY TRAFFIC						TOTAL
			Car	Utility Vehicle	Large Bus	Truck 2 axle	Truck 3- axle	Truck >3 axle	
M	1	759	3,010	1,145	266	2,000	299	251	6,971
M	2	445	3,014	614	226	1,558	248	248	5,907
M	3	130	1,518	250	100	735	211	126	2,941
M	4	52	1,042	91	43	513	223	188	2,101
M	5	7	500	29	30	282	105	36	982
		<b>1,393</b>							
Rep.	1	995	1,605	489	139	1,237	175	348	3,994
Rep.	2	4,542	738	173	70	523	107	153	1,764
Rep.	3	5,950	220	60	26	245	83	48	682
Rep.	4	7,462	151	46	10	228	96	33	565
Rep.	5	1,483	153	9	9	86	32	11	300
		<b>20,432</b>							

  

Road Class	Design Standard	Length (km)	Vehicle Kilometres (million)						TOTAL
			Car	Utility Vehicle	Large Bus	Truck 2 axle	Truck 3- axle	Truck >3 axle	
M	1	759	834.0	317.1	73.7	554.1	82.9	69.5	1,931.2
M	2	445	489.5	99.7	36.7	253.0	40.2	40.3	959.5
M	3	130	72.0	11.9	4.8	34.9	10.0	6.0	139.5
M	4	52	19.8	1.7	0.8	9.7	4.2	3.6	39.9
M	5	7	1.3	0.1	0.1	0.7	0.3	0.1	2.5
		<b>1,393</b>	<b>1,416.6</b>	<b>430.5</b>	<b>116.0</b>	<b>852.4</b>	<b>137.6</b>	<b>119.4</b>	<b>3,072.6</b>
Rep.	1	995	582.8	177.7	50.5	449.2	63.7	126.5	1,450.4
Rep.	2	4,542	1,223.3	287.1	115.7	867.4	176.9	253.3	2,923.8
Rep.	3	5,950	478.4	131.0	55.9	532.1	180.7	104.0	1,482.0
Rep.	4	7,462	410.5	126.5	27.4	621.7	261.2	90.9	1,538.1
Rep.	5	1,483	82.6	4.7	5.0	46.7	17.3	6.0	162.4
		<b>20,432</b>	<b>2,777.6</b>	<b>727.0</b>	<b>254.5</b>	<b>2,517.1</b>	<b>699.9</b>	<b>580.7</b>	<b>7,556.6</b>
M + Rep.	1	1,754	1,416.8	494.8	124.2	1,003.3	146.6	195.9	3,381.5
M + Rep.	2	4,987	1,712.8	386.8	152.4	1,120.4	217.1	293.7	3,883.2
M + Rep.	3	6,080	550.4	142.8	60.7	566.9	190.7	110.0	1,621.5
M + Rep.	4	7,514	430.2	128.2	28.2	631.5	265.5	94.5	1,578.0
M + Rep.	5	1,490	83.9	4.8	5.1	47.4	17.6	6.1	164.9
		<b>21,825</b>	<b>4,194.1</b>	<b>1,157.5</b>	<b>370.5</b>	<b>3,369.5</b>	<b>837.5</b>	<b>700.1</b>	<b>10,629.2</b>

Source: Consultant's estimate based on Uzavtoyul data

Table A.6.5 ARMENIA - EQUIVALENT STANDARD AXLE KILOMETRES BY ROAD DESIGN CATEGORY

Road Class	Design Standard	Road Length (km)	ESAL km (million)						TOTAL
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
			ESA per Vehicle						
			<b>0.0001</b>	<b>0.0014</b>	<b>0.6348</b>	<b>0.1616</b>	<b>0.4073</b>	<b>0.3566</b>	
			ESAL - Kilometres (million)						
M	1	165.1	0.03	0.04	14.10	3.55	8.12	1.13	26.97
M	2	788.7	0.06	0.10	33.00	9.89	23.86	4.91	71.81
M	3	493.7	0.02	0.04	8.92	4.40	10.20	1.74	25.31
M	4	121.6	0.00	0.01	1.16	1.12	1.87	0.59	4.76
M	5	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		<b>1,569.1</b>	<b>0.11</b>	<b>0.18</b>	<b>57.19</b>	<b>18.96</b>	<b>44.06</b>	<b>8.36</b>	<b>128.86</b>
Rep.	1	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rep.	2	83.3	0.01	0.01	3.44	1.24	3.09	0.28	8.08
Rep.	3	150.0	0.01	0.01	1.51	0.82	0.86	0.25	3.45
Rep.	4	1,045.4	0.01	0.04	5.02	4.58	9.44	2.48	21.57
Rep.	5	300.0	0.00	0.01	0.72	0.66	1.35	0.36	3.10
		<b>1,578.7</b>	<b>0.03</b>	<b>0.07</b>	<b>10.69</b>	<b>7.30</b>	<b>14.75</b>	<b>3.36</b>	<b>36.19</b>
M + Rep.	1	165.1	0.03	0.04	14.10	3.55	8.12	1.13	26.97
M + Rep.	2	872.0	0.07	0.11	36.44	11.13	26.95	5.18	79.89
M + Rep.	3	643.7	0.02	0.05	10.43	5.22	11.06	1.98	28.76
M + Rep.	4	1,167.0	0.01	0.04	6.19	5.70	11.32	3.07	26.33
M + Rep.	5	300.0	0.00	0.01	0.72	0.66	1.35	0.36	3.10
		<b>3,147.8</b>	<b>0.13</b>	<b>0.25</b>	<b>67.88</b>	<b>26.25</b>	<b>58.81</b>	<b>11.72</b>	<b>165.05</b>
Road Class	Design Standard	Road Length (km)	ESA / lane / km / Year (million)						TOTAL
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
M	1	165.1	0.00	0.00	0.02	0.01	0.01	0.00	0.04
M	2	788.7	0.00	0.00	0.02	0.01	0.02	0.00	0.05
M	3	493.7	0.00	0.00	0.01	0.00	0.01	0.00	0.03
M	4	121.6	0.00	0.00	0.00	0.00	0.01	0.00	0.02
M	5	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		<b>1,569.1</b>	<b>0.00</b>	<b>0.00</b>	<b>0.06</b>	<b>0.02</b>	<b>0.05</b>	<b>0.01</b>	<b>0.13</b>
Rep.	1	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rep.	2	83.3	0.00	0.00	0.02	0.01	0.02	0.00	0.05
Rep.	3	150.0	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Rep.	4	1,045.4	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Rep.	5	300.0	0.00	0.00	0.00	0.00	0.00	0.00	0.01
		<b>1,578.7</b>	<b>0.00</b>	<b>0.00</b>	<b>0.03</b>	<b>0.01</b>	<b>0.03</b>	<b>0.00</b>	<b>0.08</b>
M + Rep.	1	165.1	0.00	0.00	0.02	0.01	0.01	0.00	0.04
M + Rep.	2	872.0	0.00	0.00	0.04	0.01	0.03	0.00	0.09
M + Rep.	3	643.7	0.00	0.00	0.01	0.01	0.01	0.00	0.04
M + Rep.	4	1,167.0	0.00	0.00	0.01	0.01	0.01	0.00	0.03
M + Rep.	5	300.0	0.00	0.00	0.00	0.00	0.00	0.00	0.01
		<b>3,147.8</b>	<b>0.00</b>	<b>0.00</b>	<b>0.09</b>	<b>0.03</b>	<b>0.07</b>	<b>0.01</b>	<b>0.21</b>

Source: Consultant's estimates

Table A.6.5 (continued) AZERBAIJAN - EQUIVALENT STANDARD AXLE KILOMETRES BY DESIGN CATEGORY

Road Class	Design Standard	Road Length (km)	ESAL - km (million)						TOTAL
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
			ESA per Vehicle						
			0.0001	0.0014	1.2341	0.1272	0.1792	0.3384	
M	1	144.5	0.03	0.07	47.97	13.30	3.18	11.28	75.83
M	2	1,072.5	0.06	0.28	107.25	46.51	15.08	31.66	200.84
M	2-3	192.0	0.03	0.04	21.88	6.48	1.27	10.98	40.68
M	3	-							
M	3-4	-							
M	4	-							
M	4-5	-							
M	5	-							
		<b>1,409.0</b>	<b>0.13</b>	<b>0.39</b>	<b>177.10</b>	<b>66.29</b>	<b>19.53</b>	<b>53.92</b>	<b>317.35</b>
Rep.	1	-							
Rep.	2	253.0	0.01	0.05	21.31	7.26	3.01	5.81	37.45
Rep.	2-3	297.0	0.01	0.08	25.02	11.56	4.49	9.76	50.91
Rep.	3	1,159.0	0.03	0.17	65.78	26.64	10.99	23.62	127.22
Rep.	3-4	874.0	0.02	0.11	39.76	17.85	6.17	11.55	75.47
Rep.	4	371.0	0.01	0.03	10.36	4.84	2.18	3.90	21.32
Rep.	4-5	326.0	0.00	0.01	2.06	0.88	0.34	0.93	4.21
Rep.	5	-							
		<b>3,280.0</b>	<b>0.07</b>	<b>0.46</b>	<b>164.29</b>	<b>69.02</b>	<b>27.19</b>	<b>55.56</b>	<b>316.59</b>
M+Rep.	1	144.5	0.03	0.07	47.97	13.30	3.18	11.28	75.83
M+Rep.	2	1,325.5	0.07	0.33	128.56	53.77	18.09	37.47	238.30
M+Rep.	2-3	489.0	0.04	0.12	46.90	18.04	5.76	20.74	91.59
M+Rep.	3	1,159.0	0.03	0.17	65.78	26.64	10.99	23.62	127.22
M+Rep.	3-4	874.0	0.02	0.11	39.76	17.85	6.17	11.55	75.47
M+Rep.	4	371.0	0.01	0.03	10.36	4.84	2.18	3.90	21.32
M+Rep.	4-5	326.0	0.00	0.01	2.06	0.88	0.34	0.93	4.21
M+Rep.	5	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		<b>4,689.0</b>	<b>0.20</b>	<b>0.85</b>	<b>341.39</b>	<b>135.31</b>	<b>46.72</b>	<b>109.48</b>	<b>633.94</b>

  

Road Class	Design Standard	Road Length (km)	ESA / Lane / Km / Year (million)						TOTAL
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
M	1	144.5	0.00	0.00	0.08	0.02	0.01	0.02	0.13
M	2	1,072.5	0.00	0.00	0.05	0.02	0.01	0.01	0.09
M	2-3	192.0	0.00	0.00	0.06	0.02	0.00	0.03	0.11
M	3	-							
M	3-4	-							
M	4	-							
M	4-5	-							
M	5	-							
		<b>1,409.0</b>	<b>0.00</b>	<b>0.00</b>	<b>0.19</b>	<b>0.06</b>	<b>0.02</b>	<b>0.06</b>	<b>0.33</b>
Rep.	1	-							
Rep.	2	253.0	0.00	0.00	0.04	0.01	0.01	0.01	0.07
Rep.	2-3	297.0	0.00	0.00	0.04	0.02	0.01	0.02	0.09
Rep.	3	1,159.0	0.00	0.00	0.03	0.01	0.00	0.01	0.05
Rep.	3-4	874.0	0.00	0.00	0.02	0.01	0.00	0.01	0.04
Rep.	4	371.0	0.00	0.00	0.01	0.01	0.00	0.01	0.03
Rep.	4-5	326.0	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Rep.	5	-							
		<b>3,280.0</b>	<b>0.00</b>	<b>0.00</b>	<b>0.15</b>	<b>0.06</b>	<b>0.03</b>	<b>0.05</b>	<b>0.29</b>
M+Rep.	1	144.5	0.00	0.00	0.08	0.02	0.01	0.02	0.13
M+Rep.	2	1,325.5	0.00	0.00	0.09	0.04	0.01	0.03	0.17
M+Rep.	2-3	489.0	0.00	0.00	0.10	0.04	0.01	0.05	0.19
M+Rep.	3	1,159.0	0.00	0.00	0.03	0.01	0.00	0.01	0.05
M+Rep.	3-4	874.0	0.00	0.00	0.02	0.01	0.00	0.01	0.04
M+Rep.	4	371.0	0.00	0.00	0.01	0.01	0.00	0.01	0.03
M+Rep.	4-5	326.0	0.00	0.00	0.00	0.00	0.00	0.00	0.01
M+Rep.	5	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		<b>4,689.0</b>	<b>0.00</b>	<b>0.00</b>	<b>0.34</b>	<b>0.12</b>	<b>0.04</b>	<b>0.11</b>	<b>0.62</b>

Source: Consultant's estimate based on axle load survey results and Azeravtoyol data.



Table A.6.5 (continued) GEORGIA - EQUIVALENT STANDARD AXLE KILOMETRES BY DESIGN CLASS

Road Class	Design Standard	Total Length (km)	ESA per Vehicle and ESAL - Km (million) By Vehicle Category, 1996						TOTAL
			Car	Utility	Large Bus	Truck 2 axle	Truck 3 axle	Truck >3 axle	
			ESA per vehicle						
			<i>0.0001</i>	<i>0.0014</i>	<i>2.0001</i>	<i>0.0974</i>	<i>0.5004</i>	<i>1.1296</i>	
			ESAL / Km (million)						
S	1	37	0.01	0.01	19.04	0.45	2.38	1.79	23.67
S	2	176	0.04	0.03	72.65	1.84	9.41	7.35	91.31
S	3	467	0.06	0.04	116.45	3.45	16.48	15.77	152.26
S	4	259	0.01	0.01	18.21	0.89	3.90	5.35	28.38
S	5	7	0.00	0.00	0.30	0.01	0.04	0.03	0.38
		<b>946</b>	<b>0.12</b>	<b>0.08</b>	<b>226.66</b>	<b>6.64</b>	<b>32.22</b>	<b>30.29</b>	<b>296.01</b>
Rep.	1	2	0.00	0.00	0.81	0.02	0.10	0.08	1.01
Rep.	2	84	0.01	0.00	13.01	0.33	1.69	1.32	16.35
Rep.	3	301	0.01	0.01	19.56	0.58	2.77	2.65	25.58
Rep.	4	2,247	0.02	0.01	30.68	1.51	6.58	9.02	47.81
Rep.	5	1,425	0.00	0.00	7.31	0.18	0.95	0.72	9.17
		<b>4,059</b>	<b>0.04</b>	<b>0.03</b>	<b>71.38</b>	<b>2.61</b>	<b>12.09</b>	<b>13.78</b>	<b>99.92</b>
S + Rep.	1	39	0.01	0.01	19.85	0.46	2.48	1.87	24.68
S + Rep.	2	260	0.04	0.03	85.66	2.16	11.10	8.67	107.66
S + Rep.	3	768	0.07	0.05	136.02	4.03	19.25	18.41	177.83
S + Rep.	4	2,506	0.04	0.02	48.89	2.40	10.48	14.37	76.20
S + Rep.	5	1,432	0.00	0.00	7.62	0.19	0.99	0.75	9.55
		<b>5,005</b>	<b>0.16</b>	<b>0.11</b>	<b>298.04</b>	<b>9.25</b>	<b>44.30</b>	<b>44.07</b>	<b>395.93</b>

  

Road Class	Design Standard	Total Length (km)	ESAL / Lane / Km / Year (million)						TOTAL
			Car	Utility	Large Bus	Truck 2 axle	Truck 3 axle	Truck >3 axle	
S	1	37	0.00	0.00	0.13	0.00	0.02	0.01	0.16
S	2	176	0.00	0.00	0.21	0.01	0.03	0.02	0.26
S	3	467	0.00	0.00	0.12	0.00	0.02	0.02	0.16
S	4	259	0.00	0.00	0.04	0.00	0.01	0.01	0.05
S	5	7	0.00	0.00	0.02	0.00	0.00	0.00	0.03
		<b>946</b>	<b>0.00</b>	<b>0.00</b>	<b>0.52</b>	<b>0.01</b>	<b>0.07</b>	<b>0.06</b>	<b>0.66</b>
Rep.	1	2	0.00	0.00	0.09	0.00	0.01	0.01	0.11
Rep.	2	84	0.00	0.00	0.08	0.00	0.01	0.01	0.10
Rep.	3	301	0.00	0.00	0.03	0.00	0.00	0.00	0.04
Rep.	4	2,247	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Rep.	5	1,425	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		<b>4,059</b>	<b>0.00</b>	<b>0.00</b>	<b>0.21</b>	<b>0.01</b>	<b>0.03</b>	<b>0.02</b>	<b>0.27</b>
S + Rep.	1	39	0.00	0.00	0.22	0.01	0.03	0.02	0.27
S + Rep.	2	260	0.00	0.00	0.28	0.01	0.04	0.03	0.36
S + Rep.	3	768	0.00	0.00	0.16	0.00	0.02	0.02	0.21
S + Rep.	4	2,506	0.00	0.00	0.04	0.00	0.01	0.01	0.07
S + Rep.	5	1,432	0.00	0.00	0.02	0.00	0.00	0.00	0.03
		<b>5,005</b>	<b>0.00</b>	<b>0.00</b>	<b>0.73</b>	<b>0.02</b>	<b>0.10</b>	<b>0.09</b>	<b>0.93</b>

Table A.6.5 (continued) KAZAKHSTAN - EQUIVALENT STANDARD AXLE KILOMETRES BY DESIGN CLASS

Road Class and Design Category	Design Category	Road length (km)	ESAL / Vehicle and ESAL - Kilometres (million)						TOTAL	
			Car	Utility Vehicle	Large Bus	Trucks				
						2-axle	3-axle	>3-axle		
			ESA / Vehicle							
			0.0001	0.0014	0.2481	0.0453	0.1814	0.2148		
			ESAL - Kilometres (million)							
M	1	272	0.02	0.04	2.38	2.29	5.09	2.30	12.12	
M	2	1,634	0.10	0.09	2.16	10.08	30.31	5.31	48.04	
M	3	4,037	0.13	0.15	6.29	23.37	50.55	11.87	92.36	
M	4	189	0.01	0.01	0.27	0.99	2.13	0.50	3.90	
M	5	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
			<b>6.132</b>	<b>0.26</b>	<b>0.27</b>	<b>11.09</b>	<b>36.72</b>	<b>88.08</b>	<b>19.98</b>	<b>156.41</b>
A	1	320	0.03	0.04	2.34	2.29	7.20	1.22	13.12	
A	2	997	0.04	0.05	1.77	4.90	10.13	3.83	20.72	
A	3	6,240	0.18	0.25	8.79	24.35	50.37	19.04	102.99	
A	4	62	0.00	0.00	0.04	0.19	0.20	0.16	0.60	
A	5	43	0.00	0.00	0.03	0.13	0.14	0.11	0.41	
			<b>7.662</b>	<b>0.26</b>	<b>0.34</b>	<b>12.97</b>	<b>31.87</b>	<b>68.04</b>	<b>24.35</b>	<b>137.83</b>
Other Republican	1	41	0.00	0.01	0.33	0.38	0.43	0.27	1.42	
Other Republican	2	422	0.03	0.02	0.71	2.82	8.93	2.62	15.12	
Other Republican	3	3,028	0.08	0.08	1.91	8.96	20.25	21.77	53.06	
Other Republican	4	211	0.00	0.01	0.08	0.63	1.95	0.56	3.23	
Other Republican	5	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
			<b>3.702</b>	<b>0.11</b>	<b>0.11</b>	<b>3.03</b>	<b>12.79</b>	<b>31.56</b>	<b>25.23</b>	<b>72.83</b>
TOTAL NON-LOCAL	1	633	0.06	0.08	5.05	4.96	12.71	3.79	26.65	
TOTAL NON-LOCAL	2	3,053	0.16	0.15	4.64	17.80	49.37	11.76	83.87	
TOTAL NON-LOCAL	3	13,305	0.40	0.47	16.99	56.69	121.17	52.68	248.40	
TOTAL NON-LOCAL	4	462	0.01	0.02	0.38	1.81	4.29	1.22	7.72	
TOTAL NON-LOCAL	5	43	0.00	0.00	0.03	0.13	0.14	0.11	0.41	
			<b>17.496</b>	<b>0.63</b>	<b>0.72</b>	<b>27.09</b>	<b>81.38</b>	<b>187.68</b>	<b>69.56</b>	<b>367.07</b>

  

Road Class and Design Category	Design Category	Road length (km)	ESAL / Lane / Km / Year (million)						TOTAL	
			Car	Utility Vehicle	Large Bus	Trucks				
						2-axle	3-axle	>3-axle		
M	1	272	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
M	2	1,634	0.00	0.00	0.00	0.00	0.01	0.00	0.01	
M	3	4,037	0.00	0.00	0.00	0.00	0.01	0.00	0.01	
M	4	189	0.00	0.00	0.00	0.00	0.01	0.00	0.01	
M	5	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
			<b>6.132</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.03</b>	<b>0.01</b>	<b>0.05</b>
A	1	320	0.00	0.00	0.00	0.00	0.01	0.00	0.01	
A	2	997	0.00	0.00	0.00	0.00	0.01	0.00	0.01	
A	3	6,240	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
A	4	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
A	5	43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
			<b>7.662</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.02</b>	<b>0.01</b>	<b>0.04</b>
Other Republican	1	41	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
Other Republican	2	422	0.00	0.00	0.00	0.00	0.01	0.00	0.02	
Other Republican	3	3,028	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
Other Republican	4	211	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
Other Republican	5	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
			<b>3.702</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.02</b>	<b>0.01</b>	<b>0.05</b>
TOTAL NON-LOCAL	1	633	0.00	0.00	0.01	0.01	0.01	0.00	0.03	
TOTAL NON-LOCAL	2	3,053	0.00	0.00	0.00	0.01	0.02	0.01	0.04	
TOTAL NON-LOCAL	3	13,305	0.00	0.00	0.00	0.01	0.01	0.01	0.03	
TOTAL NON-LOCAL	4	462	0.00	0.00	0.00	0.01	0.01	0.00	0.02	
TOTAL NON-LOCAL	5	43	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
			<b>17.496</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.03</b>	<b>0.07</b>	<b>0.02</b>	<b>0.13</b>

Table A.6.5 (continued) KYRGYZ REPUBLIC - EQUIVALENT STANDARD AXLE KILOMETRES BY DESIGN CLASS

Road Class	Design Standard	Road Length (km)	ESAL Kilometres (million)						TOTAL
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
			ESAL / Vehicle						
			0.0001	0.0014	0.166	0.0686	0.1667	0.6335	
			ESAL KM (million)						
M	1	12.2	0.00	0.01	0.31	0.37	0.24	0.83	1.76
M	2	209.2	0.03	0.05	4.32	5.53	2.14	5.32	17.39
M	3	137.6	0.00	0.01	0.27	0.62	1.76	3.01	6.57
M	4	388.6	0.00	0.01	0.07	0.55	4.97	6.20	11.81
M	5	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M		<b>747.6</b>	<b>0.04</b>	<b>0.07</b>	<b>4.97</b>	<b>7.07</b>	<b>9.10</b>	<b>16.26</b>	<b>37.52</b>
A	1	0.0	0.02	0.03	2.60	4.10	1.13	4.21	12.08
A	2	187.5	0.02	0.06	3.70	3.19	2.85	10.24	20.06
A	3	885.3	0.01	0.03	0.90	3.31	2.22	7.91	14.38
A	4	1,140.5	0.00	0.00	0.04	0.10	0.07	0.24	0.45
A	5	149.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A		<b>2,362.3</b>	<b>0.05</b>	<b>0.12</b>	<b>7.24</b>	<b>10.70</b>	<b>6.28</b>	<b>22.59</b>	<b>46.98</b>
M+A	1	12.2	0.02	0.04	2.92	4.46	1.37	5.03	13.84
M+A	2	396.7	0.06	0.10	8.02	8.72	4.99	15.56	37.45
M+A	3	1,022.9	0.01	0.04	1.17	3.93	3.98	11.82	20.95
M+A	4	1,529.1	0.00	0.01	0.11	0.66	5.04	6.44	12.26
M+A	5	149.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M+A		<b>3,109.9</b>	<b>0.09</b>	<b>0.19</b>	<b>12.21</b>	<b>17.77</b>	<b>15.38</b>	<b>38.86</b>	<b>84.50</b>

  

Road Class	Design Standard	Road Length (km)	ESAL / Km / Lane / Year (million)						TOTAL
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle	Truck >3-axle	
M	1	12.2	0.00	0.00	0.01	0.01	0.00	0.02	0.04
M	2	209.2	0.00	0.00	0.01	0.01	0.01	0.01	0.04
M	3	137.6	0.00	0.00	0.00	0.00	0.01	0.01	0.02
M	4	388.6	0.00	0.00	0.00	0.00	0.01	0.01	0.02
M	5	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M		<b>747.6</b>	<b>0.00</b>	<b>0.00</b>	<b>0.02</b>	<b>0.02</b>	<b>0.02</b>	<b>0.05</b>	<b>0.12</b>
A	1	0.0	0.00	0.00	0.00	0.01	0.00	0.01	0.02
A	2	187.5	0.00	0.00	0.00	0.00	0.00	0.01	0.01
A	3	885.3	0.00	0.00	0.00	0.00	0.00	0.00	0.01
A	4	1,140.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	5	149.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A		<b>2,362.3</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.01</b>	<b>0.00</b>	<b>0.02</b>	<b>0.04</b>
M+A	1	12.2	0.00	0.00	0.01	0.01	0.01	0.02	0.05
M+A	2	396.7	0.00	0.00	0.01	0.02	0.01	0.02	0.05
M+A	3	1,022.9	0.00	0.00	0.00	0.00	0.01	0.02	0.03
M+A	4	1,529.1	0.00	0.00	0.00	0.00	0.01	0.01	0.02
M+A	5	149.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M+A		<b>3,109.9</b>	<b>0.00</b>	<b>0.00</b>	<b>0.02</b>	<b>0.03</b>	<b>0.03</b>	<b>0.07</b>	<b>0.15</b>

Table A.6.5 (continued) TAJIKISTAN - EQUIVALENT STANDARD AXLE KILOMETRES BY DESIGN CLASS

Road Class		Road Length (km)	ESAL per Vehicle and ESAL Km (million)					TOTAL	
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle		Truck >3-axle
			ESAL per vehicle						
			0.0001	0.0014	0.116	0.0686	0.1667	0.6335	
			ESAL Km (million)						
M	1	6.0	0.00	0.00	0.08	0.22	0.11	0.33	0.74
M	2	42.9	0.00	0.01	0.28	0.67	0.62	1.33	2.91
M	3	335.7	0.01	0.02	0.77	2.72	3.79	3.51	10.83
M	4	177.5	0.00	0.01	0.27	0.67	1.70	2.46	5.11
M	5	527.0	0.01	0.01	0.99	2.06	2.18	2.80	8.05
		<b>1,089.1</b>	<b>0.03</b>	<b>0.04</b>	<b>2.38</b>	<b>6.34</b>	<b>8.41</b>	<b>10.43</b>	<b>27.64</b>
A	1	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	2	103.1	0.00	0.01	0.16	0.64	0.69	1.61	3.10
A	3	99.7	0.00	0.00	0.09	0.23	0.26	0.59	1.19
A	4	139.8	0.00	0.00	0.04	0.06	0.08	0.12	0.31
A	5	353.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		<b>696.1</b>	<b>0.00</b>	<b>0.01</b>	<b>0.29</b>	<b>0.93</b>	<b>1.03</b>	<b>2.33</b>	<b>4.59</b>
M + A	1	6.0	0.00	0.00	0.08	0.22	0.11	0.33	0.74
M + A	2	146.0	0.01	0.01	0.43	1.31	1.31	2.94	6.01
M + A	3	435.4	0.02	0.02	0.86	2.95	4.06	4.11	12.01
M + A	4	317.3	0.01	0.01	0.31	0.73	1.79	2.58	5.42
M + A	5	880.5	0.01	0.01	0.99	2.06	2.18	2.80	8.05
		<b>1,785.2</b>	<b>0.04</b>	<b>0.05</b>	<b>2.67</b>	<b>7.27</b>	<b>9.45</b>	<b>12.76</b>	<b>32.23</b>
Road Class		Road Length (km)	ESAL / Lane / Km / Year (million)					TOTAL	
			Car	Utility	Bus	Truck 2-axle	Truck 3-axle		Truck >3-axle
M	1	6.0	0.00	0.00	0.00	0.01	0.00	0.01	0.03
M	2	42.9	0.00	0.00	0.00	0.00	0.00	0.01	0.02
M	3	335.7	0.00	0.00	0.00	0.00	0.00	0.00	0.01
M	4	177.5	0.00	0.00	0.00	0.00	0.00	0.00	0.01
M	5	527.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		<b>1,089.1</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.02</b>	<b>0.01</b>	<b>0.03</b>	<b>0.07</b>
A	1	0.0	0.00	0.00	0.00	0.01	0.00	0.01	0.02
A	2	103.1	0.00	0.00	0.00	0.00	0.00	0.01	0.01
A	3	99.7	0.00	0.00	0.00	0.00	0.00	0.00	0.01
A	4	139.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	5	353.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		<b>696.1</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.01</b>	<b>0.02</b>	<b>0.05</b>
M + A	1	6.0	0.00	0.00	0.00	0.01	0.01	0.03	0.05
M + A	2	146.0	0.00	0.00	0.00	0.01	0.01	0.01	0.03
M + A	3	435.4	0.00	0.00	0.00	0.00	0.00	0.01	0.02
M + A	4	317.3	0.00	0.00	0.00	0.00	0.00	0.00	0.01
M + A	5	880.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		<b>1,785.2</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.03</b>	<b>0.02</b>	<b>0.05</b>	<b>0.11</b>

Table A.6.5 (continued) UZBEKISTAN - EQUIVALENT STANDARD AXLE KILOMETRES BY DESIGN CLASS

Road Class	Design Standard	Length (km)	ESA per vehicle and ESAL - Kilometres (million)					TOTAL	
			Car	Utility Vehicle	Large Bus	Truck 2 axle	Truck 3- axle		Truck >3 axle
			ESA per vehicle						
			0.0001	0.0014	1.0997	0.193	0.1879	1.0115	
			ESAL-Kilometres (metres)						
M	1	759	0.08	0.44	81.05	106.93	15.58	70.25	274.3
M	2	445	0.05	0.14	40.34	48.84	7.56	40.79	137.7
M	3	130	0.01	0.02	5.23	6.73	1.88	6.03	19.9
M	4	52	0.00	0.00	0.91	1.88	0.80	3.61	7.2
M	5	7	0.00	0.00	0.08	0.14	0.05	0.09	0.4
		<b>1,393</b>	<b>0.14</b>	<b>0.60</b>	<b>127.61</b>	<b>164.52</b>	<b>25.86</b>	<b>120.77</b>	<b>439.5</b>
Rep.	1	995	0.06	0.25	55.53	86.69	11.97	127.92	282.4
Rep.	2	4,542	0.12	0.40	127.28	167.41	33.24	256.24	584.7
Rep.	3	5,950	0.05	0.18	61.49	102.69	33.95	105.19	307.6
Rep.	4	7,462	0.04	0.18	30.09	119.99	49.08	91.95	291.3
Rep.	5	1,483	0.01	0.01	5.49	9.01	3.26	6.06	23.8
		<b>20,432</b>	<b>0.28</b>	<b>1.02</b>	<b>279.88</b>	<b>485.79</b>	<b>131.50</b>	<b>587.37</b>	<b>1,485.8</b>
M + Rep.	1	1,754	0.14	0.69	136.58	193.63	27.55	198.17	556.8
M + Rep.	2	4,987	0.17	0.54	167.62	216.24	40.80	297.03	722.4
M + Rep.	3	6,080	0.06	0.20	66.72	109.42	35.83	111.23	323.5
M + Rep.	4	7,514	0.04	0.18	30.99	121.87	49.88	95.56	298.5
M + Rep.	5	1,490	0.01	0.01	5.58	9.15	3.31	6.15	24.2
		<b>21,825</b>	<b>0.42</b>	<b>1.62</b>	<b>407.49</b>	<b>650.31</b>	<b>157.36</b>	<b>708.14</b>	<b>1,925.4</b>

  

Road Class	Design Standard	Length (km)	ESA / Lane / Km / Year (million)					TOTAL	
			Car	Utility Vehicle	Large Bus	Truck 2 axle	Truck 3- axle		Truck >3 axle
M	1	759	0.00	0.00	0.03	0.04	0.01	0.02	0.09
M	2	445	0.00	0.00	0.05	0.05	0.01	0.05	0.15
M	3	130	0.00	0.00	0.02	0.03	0.01	0.02	0.08
M	4	52	0.00	0.00	0.01	0.02	0.01	0.03	0.07
M	5	7	0.00	0.00	0.01	0.01	0.00	0.01	0.03
		<b>1,393</b>	<b>0.00</b>	<b>0.00</b>	<b>0.11</b>	<b>0.14</b>	<b>0.03</b>	<b>0.13</b>	<b>0.42</b>
Rep.	1	995	0.00	0.00	0.01	0.02	0.00	0.03	0.07
Rep.	2	4,542	0.00	0.00	0.01	0.02	0.00	0.03	0.06
Rep.	3	5,950	0.00	0.00	0.01	0.01	0.00	0.01	0.03
Rep.	4	7,462	0.00	0.00	0.00	0.01	0.00	0.01	0.02
Rep.	5	1,483	0.00	0.00	0.00	0.00	0.00	0.00	0.01
		<b>20,432</b>	<b>0.00</b>	<b>0.00</b>	<b>0.04</b>	<b>0.06</b>	<b>0.01</b>	<b>0.08</b>	<b>0.19</b>
M + Rep.	1	1,754	0.00	0.00	0.04	0.06	0.01	0.06	0.16
M + Rep.	2	4,987	0.00	0.00	0.06	0.07	0.01	0.07	0.22
M + Rep.	3	6,080	0.00	0.00	0.03	0.03	0.01	0.03	0.10
M + Rep.	4	7,514	0.00	0.00	0.01	0.03	0.01	0.04	0.09
M + Rep.	5	1,490	0.00	0.00	0.01	0.01	0.00	0.01	0.03
		<b>21,825</b>	<b>0.00</b>	<b>0.00</b>	<b>0.14</b>	<b>0.20</b>	<b>0.05</b>	<b>0.21</b>	<b>0.61</b>

Table A.6.6 ARMENIA - ANALYSIS OF ANNUAL ROAD USE COSTS

Country: ARMENIA

Road Class	Design Standard Category	Length (km)	SNC	AADT	ESA per Lane/Year (million)	Average Annual Costs / US\$ Km				Average Annual Costs (US\$ million)					
						Fixed (No Traffic)	AADT	Variable Costs ESAL	Total	Fixed Costs	Vehicle Related	Variable Costs	Sub Total		
Inter State	1	165	4.5	6,222	0.040	5,718	16,023	9,496	25,519	31,237	0.9	2.6	1.6	4.2	5.2
Inter State	2	789	4.0	2,988	0.050	3,956	6,780	4,207	10,987	14,944	3.1	5.3	3.3	8.7	11.8
Inter State	3	494	3.5	1,410	0.030	3,196	2,787	2,021	4,808	8,005	1.6	1.4	1.0	2.4	4.0
Inter State	4	122	3.0	841	0.020	2,948	1,417	1,392	2,808	5,756	0.4	0.2	0.2	0.3	0.7
Inter State	5	0	2.3								0.0	0.0	0.0	0.0	0.0
Inter State	Total	1,569				3,824	6,080	3,858	9,938	13,763	6.0	9.5	6.1	15.6	21.6
Intra State	1	0	4.5								0.0	0.0	0.0	0.0	0.0
Intra State	2	83	4.0	4,700	0.050	4,884	11,575	7,048	18,624	23,508	0.4	1.0	0.6	1.6	2.0
Intra State	3	150	3.5	1,302	0.010	3,207	2,892	2,079	4,971	8,178	0.5	0.4	0.3	0.7	1.2
Intra State	4	1,045	3.0	525	0.010	2,812	735	985	1,721	4,532	2.9	0.8	1.0	1.8	4.7
Intra State	5	300	2.3	263	0.010	2,706	29	825	854	3,560	0.8	0.0	0.2	0.3	1.1
Intra State	Total	1,579				2,938	1,378	1,379	2,757	5,695	4.6	2.2	2.2	4.4	9.0
TOTAL		3,148				3,380	3,722	2,614	6,337	9,717	10.6	11.7	8.2	19.9	30.6

Source: Consultant's estimates

Table A.6.6 (continued) AZERBAIJAN - ANALYSIS OF ANNUAL ROAD USE COSTS

Country: AZERBAIJAN

Road Class	Design Standard Category	Length (km)	SNC	AADT	ESA per Lane/Year (million)	Average Annual Costs / US\$ Km				Average Annual Costs (US\$ million)				
						Fixed (No Traffic)	AADT	Variable Costs ESAL	Total	Fixed Costs	Vehicle Related	Variable Costs Axle Related	Sub Total	Total Road Use Costs
Inter State	1	145	4.9	10,503	0.130	7,707	26,164	15,379	41,543	1.1	3.8	2.2	6.0	7.1
Inter State	2	1,264	4.0	4,181	0.100	4,430	9,102	5,596	14,699	5.6	11.5	7.1	18.6	24.2
Inter State	3	0	3.8											
Inter State	4	0	3.5											
Inter State	5	0	2.9											
Inter State	Total	1,409				4,766	10,853	6,600	17,453	6.7	15.3	9.3	24.6	31.3
Intra State	1	0	4.9											
Intra State	2	550	4.0	2,615	0.080	3,650	5,124	3,234	8,357	2.0	2.8	1.8	4.6	6.6
Intra State	3	2,033	3.8	1,668	0.050	3,251	3,090	2,095	5,186	6.6	6.3	4.3	10.5	17.2
Intra State	4	697	3.5	978	0.020	2,997	1,781	1,423	3,204	2.1	1.2	1.0	2.2	4.3
Intra State	5	0	2.9											
Intra State	Total	3,280				3,264	3,153	2,143	5,296	10.7	10.3	7.0	17.4	28.1
<b>TOTAL</b>		<b>4,689</b>				<b>3,715</b>	<b>5,466</b>	<b>3,482</b>	<b>8,948</b>	<b>17.4</b>	<b>25.6</b>	<b>16.3</b>	<b>42.0</b>	<b>59.4</b>

Source: Consultant's estimates

Table A.6.6 (continued) GEORGIA - ANALYSIS OF ANNUAL ROAD USE COSTS

Country: GEORGIA

Road Class	Design Standard Category	Length (km)	SMC	AADT	ESA per Lane/Year (million)	Average Annual Costs / US\$ Km			Average Annual Costs (US\$ million)			TOTAL ROAD USE COSTS			
						Fixed Traffic	AADT	Variable Costs ESAL	Total	Fixed Costs	Vehicle Related		Variable Costs Axle Related	Sub Total	Total
Inter State	1	37	5.0	9,114	0.160	6,845	21,658	12,681	34,338	41,183	0.3	0.8	0.5	1.3	1.5
Inter State	2	176	4.2	7,405	0.260	5,614	14,863	8,977	23,841	29,454	1.0	2.6	1.6	4.2	5.2
Inter State	3	467	3.5	4,471	0.160	4,406	8,711	5,565	14,276	18,681	2.1	4.1	2.6	6.7	8.7
Inter State	4	259	3.2	1,803	0.050	3,356	3,492	2,555	6,047	9,402	0.9	0.9	0.7	1.6	2.4
Inter State	5	7	2.6	800	0.030						0.0	0.0	0.0	0.0	0.0
Inter State	Total	946				4,406	8,869	5,613	14,481	18,887	4.2	8.4	5.3	13.7	17.9
Intra State	1	2	5.0	6,545	0.110						0.0	0.0	0.0	0.0	0.0
Intra State	2	84	4.2	2,795	0.100	3,669	5,212	3,218	8,430	12,099	0.3	0.4	0.3	0.7	1.0
Intra State	3	301	3.5	1,165	0.040	3,029	1,897	1,497	3,394	6,422	0.9	0.6	0.5	1.0	1.9
Intra State	4	2,247	3.2	350	0.010	2,706	237	616	854	3,560	6.1	0.5	1.4	1.9	8.0
Intra State	5	1,425	2.6	95	0.000	2,634	-250	547	297	2,931	3.8	0.2	0.2	0.4	4.2
Intra State	Total	4,059				2,723	292	711	1,003	3,726	11.1	1.7	2.3	4.1	15.1
TOTAL		5,005		3,041		1,913	1,637	3,551	6,592	15.2	10.1	7.6	17.8	33.0	

Source: Consultant's estimates



Table A.6.6 (continued) KAZAKHSTAN - ANALYSIS OF ANNUAL ROAD USE COSTS

Country: KAZAKHSTAN

Road Class	Design Standard Category	Length (km)	SIN	AADT	ESAL per Lane/Year (million)	Average Annual Costs / US\$ Km				Average Annual Costs (US\$ million)				
						Fixed (No Traffic)	Variable ESAL	Total	Fixed Costs	Variable Costs		Sub Total	TOTAL ROAD USE COSTS	
										AADT	ESAL			Vehicle Related
Inter State	1	272	4.6	3,717	0.010	9,614	5,654	15,268	19,727	1.2	2.6	1.5	4.2	5.4
Inter State	2	1,634	4.0	2,436	0.010	6,049	3,764	9,813	13,609	6.2	9.9	6.2	16.0	22.2
Inter State	3	4,037	3.0	1,563	0.010	3,643	2,708	6,351	9,725	13.6	14.7	10.9	25.6	39.3
Inter State	4	189	2.4	1,409	0.010	3,235	2,688	5,923	9,244	0.6	0.6	0.5	1.1	1.7
Inter State	5	0	2.0		0.000					0.0	0.0	0.0	0.0	0.0
Inter State	Total	6,132				4,536	3,119	7,656	11,189	21.7	27.8	19.1	46.9	68.6
Intra State	1	361	4.6	4,066	0.010	4,436	2,811	7,248	10,736	0.0	0.0	0.0	0.0	0.0
Intra State	2	1,419	4.0	1,933	0.020	2,775	2,193	4,968	8,174	5.0	6.3	4.0	10.3	15.2
Intra State	3	9,268	3.0	1,253	0.010	1,557	1,694	3,251	6,248	29.7	25.7	20.3	46.0	75.8
Intra State	4	273	2.4	810	0.010	1,589	1,858	3,447	6,465	0.8	0.4	0.5	0.9	1.7
Intra State	5	43	2.0	772	0.004	2,860	2,188	5,048	8,182	0.1	0.2	-0.1	0.1	0.3
Intra State	Total	11,364				2,860	2,188	5,048	8,182	35.6	32.6	24.7	57.4	93.0
<b>TOTAL</b>		<b>17,496</b>				<b>3,448</b>	<b>2,514</b>	<b>5,962</b>	<b>9,235</b>	<b>57.3</b>	<b>60.5</b>	<b>43.9</b>	<b>104.3</b>	<b>161.6</b>

Source: Consultant's estimates

Table A.6.6 (continued) KYRGYZ REPUBLIC - ANALYSIS OF ANNUAL ROAD USE COSTS

Country: KYRGYZ REPUBLIC

Road Class	Design Standard Category	Length (km)	SNC	AADT	ESA per Lane/Year (million)	Average Annual Costs / US\$ Km				Average Annual Costs (US\$ million)					
						Fixed (No Traffic)	Variable Costs		TOTAL COSTS	Fixed Costs	Variable Costs		TOTAL ROAD USE COSTS		
							AADT	ESAL			Total	Vehicle Related		Anti Related	Sub Total
Inter State	1	12	4.6	10,251	0.040	7,897	27,305	16,142	43,447	51,344	0.1	0.3	0.2	0.5	0.6
Inter State	2	209	3.9	6,195	0.040	5,735	15,971	9,686	25,657	31,392	1.2	3.3	2.0	5.4	6.6
Inter State	3	138	3.0	1,543	0.020	3,329	3,383	2,556	5,939	9,268	0.5	0.5	0.4	0.8	1.3
Inter State	4	389	2.8	651	0.020	2,856	892	1,155	2,047	4,903	1.1	0.3	0.4	0.8	1.9
Inter State	5	0													
Inter State	Total	748				3,831	6,001	4,045	10,046	13,876	2.9	4.5	3.0	7.5	10.4
Intra State	1	0													
Intra State	2	188	3.9	3,953	0.010	4,623	10,302	6,321	16,623	21,246	0.9	1.9	1.2	3.1	4.0
Intra State	3	885	3.0	1,187	0.010	3,170	2,590	2,084	4,674	7,844	2.8	2.3	1.8	4.1	6.9
Intra State	4	1,141	2.8	381	0.002	2,771	503	919	1,422	4,194	3.2	0.6	1.0	1.6	4.8
Intra State	5	149	1.5	85	0.000	2,684	0	714	714	3,398	0.4	0.1	0.0	0.1	0.5
Intra State	Total	2,362				3,062	2,031	1,772	3,803	6,865	7.2	4.9	4.1	9.0	16.2
TOTAL		3,110				3,247	2,985	2,318	5,303	8,550	10.1	9.4	7.1	16.5	26.6

Source: Consultant's estimates

Table A.6.6 (continued) TAJIKISTAN - ANALYSIS OF ANNUAL ROAD USE COSTS

Country: TAJIKISTAN

Road Class	Design Standard Category	Length (km)	SNC	AADT	ESA per Lane/Year (million)	Average Annual Costs / US\$ Km			Average Annual Costs (US\$ million)				TOTAL ROAD USE COSTS		
						Fixed (No Traffic)	Variable Costs		Fixed Costs	Variable Costs		Sub Total			
							AADT	ESAL		Total	Vehicle Related			Arte Related	Total
Inter State	1	6	4.6	6,702	0.030	6,008	17,567	10,371	27,939	33,946	0.0	0.1	0.1	0.2	0.2
Inter State	2	43	3.9	3,618	0.020	4,407	9,160	5,647	14,807	19,213	0.2	0.4	0.2	0.6	0.8
Inter State	3	336	3.0	1,840	0.010	3,524	4,419	3,167	7,586	11,110	1.2	1.5	1.1	2.5	3.7
Inter State	4	178	2.8	1,186	0.010	3,180	2,595	2,161	4,755	7,935	0.6	0.5	0.4	0.8	1.4
Inter State	5	527	1.5	891	0.000	1,811	2,242	1,608	3,851	5,662	2.0	2.4	1.8	4.2	6.2
Inter State	Total	1,089													
Intra State	1	0													
Intra State	2	103	3.9	2,233	0.010	3,691	5,484	3,466	8,951	12,642	0.4	0.6	0.4	0.9	1.3
Intra State	3	100	3.0	1,294	0.010	3,228	2,889	2,261	5,151	8,379	0.3	0.3	0.2	0.5	0.8
Intra State	4	140	2.8	540	0.000	2,864	985	1,205	2,189	5,053	0.4	0.1	0.2	0.3	0.7
Intra State	5	354	1.5	142	0.000	2,716	0	978	978	3,694	1.0	0.1	0.2	0.3	1.3
Intra State	Total	696				2,963	1,424	1,576	3,000	5,963	2.1	1.1	1.0	2.1	4.2
TOTAL		1,785				2,261	1,923	1,596	3,519	5,779	4.0	3.5	2.7	6.3	10.3

Source: Consultant's estimates

Table A.6.6 (continued) UZBEKISTAN - ANALYSIS OF ANNUAL ROAD USE COSTS

Country: UZBEKISTAN

Road Class	Design Standard Category	Length (km)	SNC	AADT	ESA per Lane/Year (million)	Average Annual Costs / US\$ Km				Average Annual Costs (US\$ million)					
						Fixed (No Traffic)	Variable Costs		Fixed Costs	Variable Costs			TOTAL ROAD USE COSTS		
							AADT	ESAL		Total	Vehicle Related	Arte Related		Sub Total	
Inter State	1	759	4.7	6,971	0.090	5,941	17,094	10,069	27,163	33,104	4.5	13.0	7.6	20.6	25.1
Inter State	2	445	4.0	5,907	0.150	5,193	12,918	7,870	20,787	25,980	2.3	5.7	3.5	9.3	11.6
Inter State	3	130	3.0	2,941	0.080	3,879	6,076	4,167	10,243	14,122	0.5	0.8	0.5	1.3	1.8
Inter State	4	52	2.5	2,101	0.070	3,484	3,946	3,088	7,034	10,518	0.2	0.2	0.2	0.4	0.5
Inter State	5	7	2.0	982	0.030	5,388	14,155	8,505	22,659	28,047	7.5	19.7	11.8	31.6	39.1
Inter State	Total	1,393													
Intra State	1	995	4.7	3,994	0.070	3,258	3,148	2,058	5,206	8,464	0.0	0.0	0.0	0.0	0.0
Intra State	2	4,542	4.0	1,764	0.060	2,827	767	1,010	1,777	4,604	14.8	14.3	9.3	23.6	38.4
Intra State	3	5,950	3.0	682	0.030	2,824	663	1,130	1,793	4,617	16.8	4.6	6.0	10.6	27.4
Intra State	4	7,462	2.5	565	0.020	2,741	144	1,004	1,149	3,890	21.1	4.9	8.4	13.4	34.5
Intra State	5	1,483	2.0	300	0.010	2,778	1,176	1,237	2,413	5,191	4.1	0.2	1.5	1.7	5.8
Intra State	Total	20,432									56.8	24.0	25.3	49.3	106.1
TOTAL		21,825				2,945	2,004	1,701	3,705	6,650	64.3	43.7	37.1	80.9	145.1

Source: Consultant's estimates

Table A.6.7 COMPARISON OF ROAD REHABILITATION AND MAINTENANCE COSTS - EASTERN EUROPE AND C.I.S COUNTRIES

Type of Roadworks	Unit Costs (US\$ / kilometre) assuming 7.5 metre pavement								
	Kazakhstan	Armenia			Turkmenistan	Kyrgyz Republic	Russia - World Bank	Azerbaijan	Croatia
	World Bank Mission and Kazdorni 1996	Armenia Highway Survey (1) 1994	World Bank revised estimates 1994	ARD - PRJ 1996	(2) 1995	(3) 1995	(4) 1993	(5) 1995	(6) 1998
<b>Periodic Maintenance</b>									
Surface Dressing	9,600-17,100	14,025	7,000	12,750	12,000			11,475	23,025
4cm Overlay	78,200						52,500	34,425	56,025
4cm Overlay with levelling course							97,500		
5cm Overlay		50,000	32,000						
5cm Overlay without levelling				30,375					
5cm Overlay + 40% Levelling				42,750					
5cm Overlay + 100% Levelling				53,906					
6cm Overlay	109,200								
6cm Overlay (cold mix asphalt) inc.preparation of the old pavement					52,500				
8cm Overlay	144,600				90,000		90,000		96,000
8cm Overlay with levelling course							135,000		
9cm Overlay		120,000							
10cm Overlay	167,100								
Overlay (inc.repair & regulation of existing surface where necessary)							75,000		
Repair, regulation, overlay & full edge strengthening where necessary							101,775		
Repair, regulation, overlay & full edge strengthening							128,550		189,975
Strengthening (5cm surface layer & 8cm base course)					135,000				
Partial Reconstruction	257,000	200,000	120,000	136,500	225,000		225,000		
Heavy reconstruction				167,063					
Reconstruction of existing pavement (full depth)							503,550		
Reconstruction of existing road (inc. embankment)							680,325		

Sources:

- (1) TecEcon - "The Armenia Highway Survey"
- (2) Kocks Consult & TecEcon - "Review of Administration and Financing of Road Improvement"
- (3) Carl Bro International a/s - "Road Rehabilitation Project for Asian Development Bank - Kyrgyz Republic" [Bishkek - Osh Road]
- (4) World Bank
- (5) Wilbur Smith & Associates - "Pre-Feasibility Study of Baku-Astara Road"
- (6) World Bank - quoted in "Highway Rehabilitation & Maintenance in Central & Eastern Europe - A Survey"



**ANNEX 7**





Table A.7.1 ARMENIA - ROAD USER CHARGES REQUIRED TO COVER FIXED AND VARIABLE ROAD USE COSTS

Country: ARMENIA

Fixed costs (US\$)		10,600,000	Percentage covered	99.83					
Variable costs - vehicle related (US\$)		11,700,000							
Variable costs - loading related (US\$)		7,600,000							
Variable costs (US\$)		19,300,000	Percentage covered	100.04					
TOTAL ROAD USE COSTS (US\$)		29,900,000							
Fuel levy (US\$/litre)		0.0556							
Vehicle type	VARIABLE COSTS OF ROAD USE (ANNUAL)					Fuel levy (US\$/veh-km) @ 0.0556 per litre	Fuel levy (US\$/Year)	Variable Costs minus Fuel Levy	
	Vehicle related (US\$/veh-km)	Axle related (US\$/ESAL-km)	Total (US\$/veh-km)	Vehicle related (US\$)	Axle related (US\$)			Total (US\$)	(US\$/veh-km)
Car	0.0059	0.0000	0.0059	8,000,168	6,202	0.0045	6,057,661	0.0014	1,948,708
Utility	0.0059	0.0001	0.0060	1,046,573	11,359	0.0099	1,744,012	-0.0039	-686,080
Bus	0.0059	0.0292	0.0352	634,953	3,124,774	0.0253	2,699,720	0.0099	1,060,007
Truck 2 axle	0.0059	0.0074	0.0134	965,200	1,209,202	0.0178	2,899,603	-0.0045	-725,201
Truck 3 axle	0.0059	0.0188	0.0247	857,691	2,708,230	0.0300	4,329,765	-0.0053	-763,844
Truck > 3 axle	0.0059	0.0164	0.0224	195,416	540,233	0.0480	1,577,610	-0.0256	-841,961
Total (US\$)	11,700,000	7,600,000	19,300,000	11,700,000	7,600,000	19,300,000	19,308,371		-8,371
Vehicle type	ANNUAL FIXED COSTS (US\$)		Fixed costs to be covered (US\$)	Possible annual licence fee (US\$)	Potential Licence Fee Revenue (US\$)	TOTAL ROAD USER CHARGES			
	Vehicle related (US\$/veh-km)	Axle related (US\$/ESAL-km)				(US\$/Vehicle-km)	(US\$/trillion)		
Car	1,948,708			10	2,940,000	0.0067	9.00		
Utility	-686,080			15	577,500	0.0132	2.32		
Bus	1,060,007			30	699,000	0.0318	3.40		
Truck 2 axle	-725,201			50	1,775,000	0.0288	4.67		
Truck 3 axle	-763,844			100	3,150,000	0.0518	7.48		
Truck > 3 axle	-841,961			200	1,440,000	0.0917	3.02		
Total	10,600,000	-8,371	10,591,629		10,581,500	0.0152	29.89		
Vehicle type	Estimated vehicle fleet	Vehicle kilometres (million)	ESAL kilometres (million)	ESA per vehicle	Fuel Consumption (litres/veh-km)	TOTAL ROAD USER CHARGES			
						(US\$/Vehicle-km)	(US\$/trillion)		
Car	294,000	1,346.90	0.13	0.0001	0.08				
Utility	38,500	176.20	0.25	0.0014	0.18				
Bus	23,300	106.90	67.86	0.6348	0.45				
Truck 2 axle	35,500	162.50	26.26	0.1616	0.32				
Truck 3 axle	31,500	144.40	58.81	0.4073	0.54				
Truck > 3 axle	7,200	32.90	11.73	0.3566	0.86				
Total	430,000	1,969.80	165.05						

Table A.7. (continued) AZERBAIJAN - ROAD USER CHARGES REQUIRED TO COVER FIXED AND VARIABLE ROAD USE COSTS

Country: AZERBAIJAN

Vehicle type	Vehicle related (US\$/veh-km)	Axle related (US\$/ESAL-km)	VARIABLE COSTS OF ROAD USE (ANNUAL)			Fuel levy (US\$/veh-km) @ 0.03633 per litre	Fuel levy (US\$/Year)	Variable Costs (US\$/Year)	
			Total (US\$/veh-km)	Vehicle related (US\$/veh-km)	Axle related (US\$/veh-km)				Total (US\$/Year)
Car	0.0057	0.0000	0.0057	11,199,466	5,089	0.0029	5,781,371	0.0028	5,423,185
Utility	0.0057	0.0000	0.0057	3,444,720	21,915	0.0065	3,913,464	-0.0007	-446,829
Bus	0.0057	0.0319	0.0376	1,574,631	8,830,663	0.0165	4,564,401	0.0211	5,840,893
Truck 2 axle	0.0057	0.0033	0.0090	6,055,443	3,500,234	0.0117	12,402,090	-0.0027	-2,846,413
Truck 3 axle	0.0057	0.0046	0.0103	1,484,116	1,208,565	0.0196	5,107,740	-0.0093	-2,415,060
Truck > 3 axle	0.0057	0.0088	0.0144	1,841,624	2,832,014	0.0313	10,136,046	-0.0169	-5,462,408
Total (US\$)	25,600,000	16,400,000	42,000,000	25,600,000	16,398,481	41,998,481	41,905,112		93,368
Vehicle type	ANNUAL FIXED COSTS (US\$)	Variable Costs minus Fuel Levy (US\$)	Fixed costs to be covered (US\$)	Potential annual licence fee revenue (US\$)	TOTAL ROAD USER CHARGES (US\$/Vehicle-km)	TOTAL ROAD USER CHARGES (US\$/Year)			
						(US\$/Year)	(million)		
Car	5,423,185	-446,829	15.00	4,446,000	0.0052	10.23	10.23		
Utility	-446,829		20.00	510,000	0.0073	4.42	4.42		
Bus	5,840,893	-2,846,413	50.00	550,000	0.0185	5.11	5.11		
Truck 2 axle	-2,846,413		125.00	5,662,500	0.0170	18.06	18.06		
Truck 3 axle	-2,415,060		205.00	2,275,500	0.0283	7.38	7.38		
Truck > 3 axle	-5,462,408		290.00	4,002,000	0.0437	14.14	14.14		
Total	17,400,000	93,368	17,493,368	17,446,000	0.0132	59.35	59.35		
Vehicle type	Estimated vehicle fleet	Vehicle kilometres (million)	ESAL kilometres (million)	ESA per vehicle	Fuel Consumption (litres/veh-km)	TOTAL ROAD USER CHARGES (US\$/Year)			
						(US\$/Year)	(million)		
Car	296,400	1,967.30	0.20	0.0001	0.08				
Utility	25,500	605.10	0.85	0.0014	0.18				
Bus	11,000	276.60	341.39	1.2341	0.45				
Truck 2 axle	45,300	1,063.70	135.31	0.1272	0.32				
Truck 3 axle	11,100	260.70	46.72	0.1792	0.54				
Truck > 3 axle	13,800	323.50	109.48	0.3384	0.86				
Total	403,100	4,496.90	633.95						

Table A.7.1 (continued) GEORGIA - ROAD USER CHARGES REQUIRED TO COVER FIXED AND VARIABLE ROAD USE COSTS

Country: GEORGIA

		15,200,000	Percentage covered	100.24		
Fixed costs (US\$)		10,100,000				
Variable costs - vehicle related (US\$)		7,600,000				
Variable costs - loading related (US\$)		17,700,000	Percentage covered	99.99		
Variable costs (US\$)		32,900,000				
TOTAL ROAD USE COSTS (US\$)		0.0534				
Fuel levy (US\$/litre)						
VARIABLE COSTS OF ROAD USE (ANNUAL)						
Vehicle type	Vehicle related (US\$/veh.km)	Axis related (US\$/ESAL.km)	Total (US\$/veh.km)	Vehicle related (US\$)	Axis related (US\$)	Total (US\$)
Car	0.0048	0.0000	0.0048	7,924,176	3,145	7,927,321
Utility	0.0048	0.0000	0.0048	379,161	2,107	381,268
Bus	0.0048	0.0384	0.0432	720,600	5,770,289	6,440,888
Truck 2 axle	0.0048	0.0019	0.0067	458,959	177,421	636,380
Truck 3 axle	0.0048	0.0096	0.0144	428,491	851,003	1,279,494
Truck > 3 axle	0.0048	0.0217	0.0265	189,613	845,608	1,034,222
Total (US\$)	10,100,000	7,600,000	17,700,000	10,100,000	7,599,573	17,699,573
TOTAL ROAD USER CHARGES						
Vehicle type	ANNUAL FIXED COSTS (US\$)	Variable Costs minus Fuel Levy (US\$)	Fixed costs to be covered (US\$)	Possible annual licence fee (US\$)	Potential contribution to Fixed Cost coverage (US\$)	TOTAL ROAD USER CHARGES (US\$)
Car		849,778		10.0	3,606,000	10.68
Utility		-447,671		12.5	178,750	1.01
Bus		2,605,807		50.0	510,000	4.35
Truck 2 axle		-828,174		80.0	2,289,000	3.75
Truck 3 axle		-1,398,388		140.0	3,752,000	6.43
Truck > 3 axle		-779,723		215.0	4,902,000	6.72
Total	15,200,000	1,630	15,201,630		15,236,750	32.93
FUEL LEVY						
Vehicle type	Estimated vehicle fleet	Vehicle kilometres (million)	ESAL kilometres (million)	ESA per vehicle	Fuel Consumption (litres/veh.km)	Variable Costs minus Fuel Levy (US\$/veh.km)
Car	360,600	1,638.50	0.16	0.0001	0.08	0.0005
Utility	14,300	78.40	0.11	0.0014	0.20	-0.0057
Bus	10,200	149.00	298.04	2.0001	0.48	0.0175
Truck 2 axle	28,600	94.90	9.25	0.0974	0.29	-0.0087
Truck 3 axle	26,800	88.60	44.31	0.5004	0.57	-0.0158
Truck > 3 axle	22,800	39.00	44.07	1.1296	0.87	-0.0200
Total	463,300	2,088.40	385.94			

Table A.7.1 (continued) KAZAKHSTAN - ROAD USER CHARGES REQUIRED TO COVER FIXED AND VARIABLE ROAD USE COSTS

Country: KAZAKHSTAN

Fixed costs (US\$)		57,300,000	Percentage covered	99.81					
Variable costs - vehicle related (US\$)		60,500,000							
Variable costs - loading related (US\$)		43,900,000							
Variable costs (US\$)		104,400,000	Percentage covered	100.08					
TOTAL ROAD USE COSTS (US\$)		161,700,000							
Fuel levy (US\$/litre)		0.0492							
Vehicle type	VARIABLE COSTS OF ROAD USE (ANNUAL)					Fuel levy (US\$/veh-km) @ 0.0492 per litre	Fuel levy (US\$/Year)	Variable Costs minus Fuel Levy	
	Vehicle related (US\$/veh-km)	Axis related (US\$/ESAL-km)	Total (US\$/veh-km)	Vehicle related (US\$/veh-km)	Axis related (US\$/veh-km)			Total (US\$/veh-km)	(US\$/veh-km)
Car	0.0060	0.0000	0.0060	37,832,739	75,459	0.0040	25,108,482	0.0020	12,799,715
Utility	0.0060	0.0002	0.0062	3,094,261	86,403	0.0091	4,671,245	-0.0029	-1,490,581
Bus	0.0060	0.0297	0.0357	653,633	3,233,176	0.0228	2,488,339	0.0128	1,398,469
Truck 2 axle	0.0060	0.0054	0.0114	10,775,944	9,736,377	0.0150	26,877,370	-0.0035	-6,365,048
Truck 3 axle	0.0060	0.0217	0.0277	6,206,512	22,455,812	0.0306	31,622,562	-0.0029	-2,960,238
Truck > 3 axle	0.0060	0.0257	0.0317	1,936,911	8,298,277	0.0425	13,714,451	-0.0108	-3,479,262
Total (US\$)	60,500,000	43,900,000	104,400,000	60,500,000	43,885,504		104,482,449		-96,945
Vehicle type	ANNUAL FIXED COSTS (US\$)			TOTAL ROAD USER CHARGES (US\$)		TOTAL ROAD USER CHARGES (US\$/Vehicle-km)			
	Vehicle related (US\$/veh-km)	Axis related (US\$/veh-km)	Total (US\$/veh-km)	Potential Licence Fee Revenue (US\$)	(million)				
Car	12,799,715	10.0	10,113,000	10,113,000	35.22	0.0056			
Utility	-1,490,581	15.0	1,230,000	1,230,000	5.90	0.0114			
Bus	1,398,469	47.5	2,075,750	2,075,750	4.56	0.0419			
Truck 2 axle	-6,365,048	80.0	18,816,000	18,816,000	45.69	0.0254			
Truck 3 axle	-2,960,238	115.0	15,651,500	15,651,500	47.27	0.0457			
Truck > 3 axle	-3,479,262	220.0	9,306,000	9,306,000	23.02	0.0713			
Total	57,300,000	96.945	57,203,055	57,192,250	161.67	0.0160			
Vehicle type	ESAL		ESAL		Fuel Consumption				
	Estimated vehicle fleet	Vehicle kilometres (million)	Estimated vehicle fleet	Vehicle kilometres (million)	Estimated vehicle fleet	Fuel Consumption (litres/veh-km)			
Car	1,011,300	6,309.00	0.63	0.0001	0.08	0.08			
Utility	82,000	516.00	0.72	0.0014	0.18	0.18			
Bus	43,700	109.00	27.09	0.2480	0.46	0.46			
Truck 2 axle	235,200	1,797.00	81.36	0.0453	0.30	0.30			
Truck 3 axle	136,100	1,035.00	187.68	0.1814	0.62	0.62			
Truck > 3 axle	42,300	323.00	69.56	0.2148	0.86	0.86			
	1,550,600	10,089.00	367.04						

Table A.7.1 (continued) KYRGYZ REPUBLIC - ROAD USER CHARGES REQUIRED TO COVER FIXED AND VARIABLE ROAD USE COSTS

Country: KYRGYZ REPUBLIC

Fixed costs (US\$)		10,100,000	Percentage covered	99.54			
Variable costs - vehicle related (US\$)		9,400,000					
Variable costs - loading related (US\$)		7,100,000					
Variable costs (US\$)		16,500,000	Percentage covered	100.31			
TOTAL ROAD USE COSTS (US\$)		26,600,000					
Fuel levy (US\$/litre)		0.055					
Vehicle type	VARIABLE COSTS OF ROAD USE (ANNUAL)			Fuel levy (US\$/veh-km) @ 0.055 per litre	Fuel levy (US\$/Year)	Variable Costs minus Fuel Levy	
	Vehicle related (US\$/veh-km)	Axle related (US\$/ESAL-km)	Total (US\$/veh-km)			(US\$/veh-km)	US\$/Year
Car	0.0062	0.0000	0.0062	0.0044	3,935,096	0.0018	1,592,753
Utility	0.0062	0.0001	0.0064	0.0100	1,354,353	-0.0037	-493,991
Bus	0.0062	0.0139	0.0202	0.0267	1,967,328	-0.0065	-481,402
Truck 2 axle	0.0062	0.0058	0.0120	0.0166	4,287,745	-0.0045	-1,178,370
Truck 3 axle	0.0062	0.0140	0.0202	0.0252	2,325,037	-0.0049	-456,144
Truck > 3 axle	0.0062	0.0532	0.0595	0.0437	2,681,338	0.0158	970,137
Total (US\$)	9,400,000	7,100,000	16,500,000	16,503,880	16,550,897		-47,017
Vehicle type	ANNUAL FIXED COSTS (US\$)		Possible annual license fee (US\$)	Potential License Revenue (US\$)	TOTAL ROAD USER CHARGES (US\$)		
	Variable Costs minus Fuel Levy (US\$)	Fixed costs to be covered (US\$)			(US\$/Vehicle-km)	(million)	
Car	1,592,753		25.0	6,825,000	0.0122	10.76	
Utility	-493,991		45.0	252,000	0.0119	1.61	
Bus	-481,402		90.0	279,000	0.0305	2.25	
Truck 2 axle	-1,178,370		115.0	1,184,500	0.0211	5.47	
Truck 3 axle	-456,144		200.0	720,000	0.0330	3.05	
Truck > 3 axle	970,137		305.0	793,000	0.0566	3.47	
Total	-47,017	10,052,983		10,053,500	0.0177	26.60	
Vehicle type	Estimated vehicle fleet	Vehicle kilometres (million)	ESAL per vehicle	Fuel Consumption (litres/veh-km)			
		ESAL kilometres (million)					
Car	273,000	884.50	0.0001	0.08			
Utility	5,600	135.30	0.0014	0.18			
Bus	3,100	73.60	0.1660	0.49			
Truck 2 axle	10,300	259.00	0.0686	0.30			
Truck 3 axle	3,600	92.30	0.1667	0.46			
Truck > 3 axle	2,600	61.40	0.6335	0.79			
	298,200	1,506.10					
		84.50					

Table A.7.1 (continued) TAJIKISTAN - ROAD USER CHARGES REQUIRED TO COVER FIXED AND VARIABLE ROAD USE COSTS

Country: TAJIKISTAN

Fixed costs (US\$)		4,000,000		Percentage covered			
Variable costs - vehicle related (US\$)		3,500,000					
Variable costs - loading related (US\$)		2,700,000					
Variable costs (US\$)		6,200,000		Percentage covered			
TOTAL ROAD USE COSTS (US\$)		10,200,000		100.45			
Fuel levy (US\$/litre)		0.05					
Vehicle type	VARIABLE COSTS OF ROAD USE (ANNUAL)						
	Vehicle related (US\$/veh-km)	Axis related (US\$/ESAL-km)	Total (US\$/veh-km)	Vehicle related (US\$)	Axis related (US\$)	Total (US\$)	
Car	0.0056	0.0000	0.0056	2,146,471	3,188	2,149,660	
Utility	0.0056	0.0001	0.0058	192,878	4,011	196,889	
Bus	0.0056	0.0097	0.0154	129,713	223,506	353,219	
Truck 2 axle	0.0056	0.0057	0.0114	597,245	608,588	1,205,833	
Truck 3 axle	0.0056	0.0140	0.0196	319,771	791,812	1,111,583	
Truck > 3 axle	0.0056	0.0531	0.0587	113,922	1,072,016	1,185,938	
Total (US\$)	3,500,000	2,700,000	6,200,000	3,500,000	2,703,122	6,203,122	
Vehicle type	ANNUAL FIXED COSTS (US\$)		Fixed costs to be covered (US\$)	Possible annual licence fee (US\$)	Potential Licence Fee Revenue (US\$)	TOTAL ROAD USER CHARGES (US\$)	
	Variable Costs minus Fuel Levy (US\$)	Vehicle kilometers (million)				(US\$/veh-km)	(US\$/Year)
Car	627,260				0	0.0040	1,522,400
Utility	-119,461				0	0.0093	316,350
Bus	-180,381				0	0.0232	533,600
Truck 2 axle	-403,847				0	0.0152	1,609,680
Truck 3 axle	-286,072				0	0.0247	1,397,655
Truck > 3 axle	337,538				0	0.0420	848,400
Total	4,000,000	-24,963	3,975,037		0	0.0100	6,228,085
Vehicle type	Estimated vehicle fleet	Vehicle kilometers (million)	ESAL per vehicle	Fuel Consumption (litres/veh-km)	TOTAL ROAD USER CHARGES (US\$)		
					(US\$/veh-km)	(US\$/Year)	
Car		380.60	0.04	0.0001	0.08		
Utility		34.20	0.05	0.0014	0.19		
Bus		23.00	2.67	0.1160	0.46		
Truck 2 axle		105.90	7.27	0.0686	0.30		
Truck 3 axle		56.70	9.44	0.1667	0.49		
Truck > 3 axle		20.20	12.76	0.6335	0.84		
Total	0	620.60	32.23				

Table A.7.1 (continued) UZBEKISTAN - ROAD USER CHARGES REQUIRED TO COVER FIXED AND VARIABLE ROAD USE COSTS

Country: UZBEKISTAN

Fixed costs (US\$)		64,300,000		Percentage covered		99.91			
Variable costs - vehicle related (US\$)		43,700,000							
Variable costs - loading related (US\$)		37,100,000							
Variable costs (US\$)		80,800,000		Percentage covered		100.10			
TOTAL ROAD USE COSTS (US\$)		145,100,000							
Fuel levy (US\$/litre)		0.0737							
Vehicle type	VARIABLE COSTS OF ROAD USE (ANNUAL)								
	Vehicle related (US\$/veh-km)	Axis related (US\$/ESAL-km)	Total (US\$/veh-km)	Vehicle related (US\$)	Axis related (US\$)	Total (US\$)	Fuel levy (US\$/veh-km) @ 0.0137 per litre	Fuel levy (US\$/Year)	Variable Costs minus Fuel Levy (US\$/Veh-km)
Car	0.0041	0.0000	0.0041	17,243,270	8,082	17,251,352	0.0110	46,082,254	-0.0069
Utility	0.0041	0.0000	0.0041	4,758,848	31,226	4,790,074	0.0027	3,076,404	0.0015
Bus	0.0041	0.0212	0.0253	1,523,243	7,851,071	9,374,314	0.0062	2,309,512	0.0191
Truck 2 axle	0.0041	0.0037	0.0078	13,853,079	12,531,101	26,384,181	0.0044	14,864,212	0.0034
Truck 3 axle	0.0041	0.0036	0.0077	3,443,227	3,032,341	6,475,568	0.0074	6,195,825	0.0003
Truck > 3 axle	0.0041	0.0195	0.0236	2,878,332	13,645,594	16,523,926	0.0119	8,354,083	0.0117
Total (US\$)	43,700,000	37,100,000	80,800,000	43,700,000	37,099,415	80,799,415		80,882,290	-82,875
Vehicle type	TOTAL ROAD USER CHARGES								
	ANNUAL FIXED COSTS (US\$)	Variable Costs minus Fuel Levy (US\$)	Fixed costs to be covered (US\$)	Possible annual licence fee (US\$)	Potential Licence Fee Revenue (US\$)	TOTAL ROAD USER CHARGES (US\$/Vehicle-km)	Fuel Levy (US\$/Year)	Variable Costs minus Fuel Levy (US\$/Year)	
Car	-28,830,902	8,460,000	10.0	10.0	8,460,000	0.0130	54.54		
Utility	1,713,671	3,216,000	15.0	15.0	3,216,000	0.0054	6.29		
Bus	7,064,802	27,020,000	40.0	40.0	27,020,000	0.0792	29.33		
Truck 2 axle	11,519,968	14,040,000	100.0	100.0	14,040,000	0.0086	28.90		
Truck 3 axle	279,743	5,520,000	160.0	160.0	5,520,000	0.0140	11.72		
Truck > 3 axle	8,169,843	5,986,000	205.0	205.0	5,986,000	0.0205	14.34		
Total	64,300,000	-82,875	64,217,125		64,242,000	0.0137	145.12		
Vehicle type	ESAL								
	Estimated vehicle fleet	Vehicle kilometres (million)	ESAL kilometres (million)	ESA per vehicle	Fuel Consumption (litres/veh-km)				
Car	846,000	4,194.10	0.42	0.0001	0.80				
Utility	214,400	1,157.50	1.62	0.0014	0.19				
Bus	675,500	370.50	407.49	1.0997	0.46				
Truck 2 axle	140,400	3,369.50	650.31	0.1930	0.32				
Truck 3 axle	34,500	837.50	157.36	0.1879	0.54				
Truck > 3 axle	29,200	700.10	708.14	1.0115	0.87				
Total	1,940,000	10,629.20	1,925.34						

