

## CHAPTER 4. STRATEGIC PREREQUISITES FOR DEVELOPMENT

### Role of transport and roads in solution of strategic problems in the Region

Among most important strategic problems of the Region, which could be solved in future only under condition of forward transport and road development, we should mark out:

- decrease of the level of territorial differentiation of social and economic development (i.e. achievement of social justice understood according to the rules of market economics as equality of starting conditions of life);
- enhancement of investment attractiveness due to the growth of territory capitalization by way of significant improvement of areas transport accessibility;
- increase in export services of transport due to increased transit.

It is necessary to bear in mind that territorial differentiation of the parameters of social and economic development on the territory of Astrakhan Region is extremely high. But it was the Region leaders who repeatedly gave publicity to this problem [2]. Development of road infrastructure may significantly smooth differentiation of social and economic development within the Region, first of all, due to the sphere of consumer services (to-date over 80% of chargeable services is provided in the city of Astrakhan).

According to evaluation made by the Russian Ministry of Economic Development and Trade (2004-2005), Astrakhan Region together with other 32 regions is attributed to «background depressing regions» with relatively low standards of population's living, out-of-date technological resources, insufficient positioning in the market and deficiency of human resources [3]. However, for the recent years Astrakhan Region has been characterized by a steady rate of increase in gross regional product, sphere of consumer services, many sectors of industry and agriculture. In 2006-2007 Astrakhan Region was in not numerous group of regions with the value of budget security exceeding all-Russia level (17<sup>th</sup> place in 2007 (forecast), 11<sup>th</sup> place in 2006) [3].

According to comprehensive evaluation of social and economic development of regions in the Russian Federation, Astrakhan Region since 2005 went up from 34 to 22<sup>nd</sup> place.



Not the least role plays the circumstance that one of criteria showing preparedness of regional strategies to join a general strategy of social and economic development of Russia is the level of

worked over transport development schemes [4]. Hence, this strategy is important from the viewpoint of validity of general strategy of social and economic development in the Region.

Thus, transport and, first of all, roads should become a locomotive of economic growth and in general capitalization of the Region territory. And the most important non-transport constituent for development of the given Strategy is consideration of macroeconomic and demographic characteristics of Astrakhan Region development.

## Prognosis of Astrakhan Region GRP

The parameter of gross regional product, to much extent, serves as a reference point of values for budget planning, including those for financing of road works.

The prognosis of realistic level of Astrakhan Region GRP (in comparable prices) was developed in accordance with the Prognosis of economics development and GRP by Astrakhan Region Ministry of Economics Development for the nearest future (see Table 4.1). According to this prognosis, maximum rate of GRP growth shall be reached by 2011-2012 (up to 13.5% in 2012). As a result, doubling of GRP will be possible by 2013.

There is also less optimistic prognosis of the rate of GRP growth. E.g., according to calculations made by the Institute of National Economics Prognostication under the Russian Academy of Science, within the period from 2004 to 2010 the rate of GRP growth in the regions of Southern Federal District will be 9.3% (mainly, due to high rate of growth in Krasnodarsky Krai, Astrakhan and Volgograd Regions).

In spite of the fact that Astrakhan Region the last years was at the leading position with regard to the rate of GRP growth among the regions of the Russian Federation, its steep growth in the following (after 2010) years is unlikely. As per GRP by head (with the account of purchasing-power parity) Astrakhan Region was occupying for the last years 31-35<sup>th</sup> places (about 6.900 thousand US Dollars, which corresponds to the level of Belarus). The most uncertain prognosis of Astrakhan Region GRP is related to the matters of fuel (gas production and gas processing) and sulfuric industries in this Region.

Table 4.1

### Prognosis of GRP value and rate of growth in Astrakhan Region up to 2030

Year	Rate of increase	GRP, mln. rub. (in comparable prices for 2007)	Year	Rate of increase	GRP, mln. rub. (in comparable prices for 2007)
2007	9.07	103700.0	2019	9.62	401366.4
2008	12.47	113105.6	2020	9.14	439977.8
2009	12.72	127209.9	2021	8.6	480191.8
2010	12.97	143391.0	2022	8.25	521488.3
2011	13.24	161988.8	2023	7.84	564511.1
2012	13.5	183436.1	2024	7.45	608768.8
2013	13.1	208199.9	2025	7.07	654122.0
2014	12.4	235474.1	2026	6.72	700368.5
2015	11.82	264767.1	2027	6.38	747433.2
2016	11.23	296062.6	2028	6.06	795119.5
2017	10.67	329310.4	2029	5.76	843303.7
2018	10.13	364447.8	2030	5.47	891878.0

## Demographic grounds of Road Sector Development Strategy

Development of transport system in the long-term and medium-term prospects is impossible without prognosis of basic characteristics of regional development in general, the most important of which is population of permanent residents and volume of shipped freight in each of the largest habitation areas in the Region. Just these two parameters, calculated per model for each of several thousand points of transport graph, predetermine a vector of transport system development. The basic feature of represented model is that for evaluation of gender/age structure and evaluation of population prognosis the affect of transport provision of habitation areas is taken into account.

### **Digression No 3. Model of prognosis of population demographic structure**

Implemented in the model method of population prognostication is based on the approach proposed by Lesley and consisting of the following: it is necessary to take a vector showing age distribution for a certain year, make a matrix of probability of transition from year to another and then using matrix multiplication forecast age distribution of population for the following year. In the considered model, Lesley matrix is built in order to define probability of people's transition from group of population into another, with the account of death rate for masculine and feminine population separately. Birth rate and migration of population were taken into account in the developed model in a different way than it was proposed in the original model. First of all, the model provides an opportunity to take into account dynamics of birth and death rate parameters<sup>1</sup>, as well as rational specifics of population reproduction, such as a level of medical care and standard of living, being in turn functions of administrative importance and a level of transport accessibility of habitation area. The level of transport accessibility is defined using cluster analysis of integral transport accessibility (ITA) calculated from the network structure. Initial gender/age structure of population is defined from blending types of gender/age pyramids the weights of which are functions of a level of transport accessibility and a level of medical care. Migration of population within a habitation area is evaluated based on administrative importance and level of ITA of this habitation area compared to the whole Region.

In addition, in order to make this model more precise, for major habitation areas we used the data on all existing, and not only permanent population. As deficiencies of the model we can state that it is impossible to calculate based on it spatial mobility of population, its dynamics and variations of population within one year.

Basic parameters of the model were defined: 1) total population of habitation area (h.a.); 2) administrative importance of h.a.; 3) level of transport accessibility of h.a.; 4) standard of population's living; 5) horizon of planning; 6) velocity of changes in a birth rate; 7) cumulative adjustments to a birth rate; 8) rate of increase in citizens' welfare; 9) cumulative increase in welfare compared to the previous level of living; 10) cumulative increase in welfare required for transition to the following level of welfare; 11) a number of population's age groups; 12) mechanical increase of population;

Let's consider provisions of the model concerning probability of population's transition from one year to another<sup>2</sup>.

Within a 10-year group population is distributed evenly. Birth rate in the group is determined only by women and distributed within a group evenly. Increase of population enters the 1<sup>st</sup> age group. Newborn, i.e. those who entered the first group are divided between genders as a ratio – 49% girls and 51% boys.

Death rate within an age group is distributed evenly. Migration for each gender in each age group shall be counted at the end of the year.

Prognosis of population for the following year is calculated by way of iterative use of algorithm.

1. Birth rate is determined by fertility of women and functionally depends on an age group of women and standard of living. Birth rate is also characterized by clear rate of acceleration (diminution) of birth rate being functions of time. Death rate is defined for men and women separately being a function of an age group and a level of transport provision.

2. This model is limited by the condition that people do not live longer than 79.9 years and each period of an individual being in the group is limited by 10 years. Respectively, we have  $n = 8$  age groups of population: 0-9 y.o., 10-19 y.o., 20-29 y.o., 30-39 y.o., 40-49 y.o., 50-59 y.o., 60-69 y.o., 70-79 y.o. Death rate in the last group is

$$d_8 = 1$$

According to results of carried out model calculation for all habitation areas in Astrakhan Region for 2040, the following was received:

1. In general for 33-year period population of the Region will reduce by 13.6% to become 859.1 thousand people (Fig. 4.1).

2. Contrasts between the districts shall grow, though insignificantly – rural districts of the Region will lose up to 20% of permanent population (e.g., Chernoyarsky district), and a share of «close-to-agglomeration» districts around Astrakhan in all-Region population will increase – they will lose only 13-14% of population (e.g., Privolzhsky district). Slight growth of population is possible in the very city of Astrakhan, however this process shall depend, to much extent, on the changes in the standard of living and nationality composition of the city residents.

3. Variation of population in all eleven districts of the Region can be reduced to two types of demographic behavior (Fig. 4.2 and 4.3). In case of the first type, e.g., in Akhtubinsky district, population will not change significantly before 2018-2020, after which it will smoothly reduce up to 86% - compared to the level of the year of 2007 – in 2040. Krasnoyarsky district is also attributed to this type. Its population will grow up to maximum value by 2026 (growth by 5.9% compared to the level of 2007), after that population will be smoothly reducing. In case of the second type, e.g., in Chernoyarsky district, there will be smooth reduction of population by 1.1-1.7% annually (depending on demographic structure of population in a specific year). The rate of population reduction will grow significantly after 2025-2030 and will reach 1.7-2.0% annually. The majority of districts in the region are also attributed to this type.

4. As a result of population reduction none of habitation areas (with current population over 10 people) will stop existing. This is related to pronounced large-scale settling in the Region. It is an outstanding result. For example, for the same period, in Kirov Region 306 settlements will stop existing.

5. In future the role of mechanical (migration) increase in formation of permanent population will be reducing. Greater importance will have increase of expected life interval, reduction of infant mortality due to reduction (reprofiling) of many enterprises with environmentally harmful production in Akhtubinsky district.

6. Calculated both in general per districts, and per individual habitation areas, summarized population of Astrakhan Region was used in all additional prognosis models considered in the given Strategy, including that for prognosis of passenger work, for prognosis of changes in transport accessibility and for prognosis of other parameters. Obtained results of prognosis model of Astrakhan Region population to much extent agree with demographic prognoses of the Russian Federation sectoral programs, in their part which refers to Astrakhan Region.

Figure 4.1

**Prognosis of dynamics of existing population in Astrakhan Region**

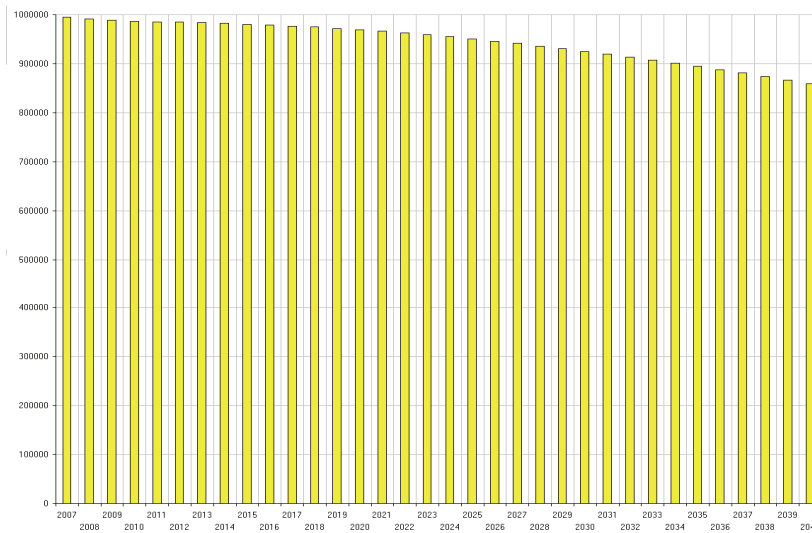


Figure 4.2

**Prognosis of dynamics of existing population in Akhtubinsky district of Astrakhan Region**

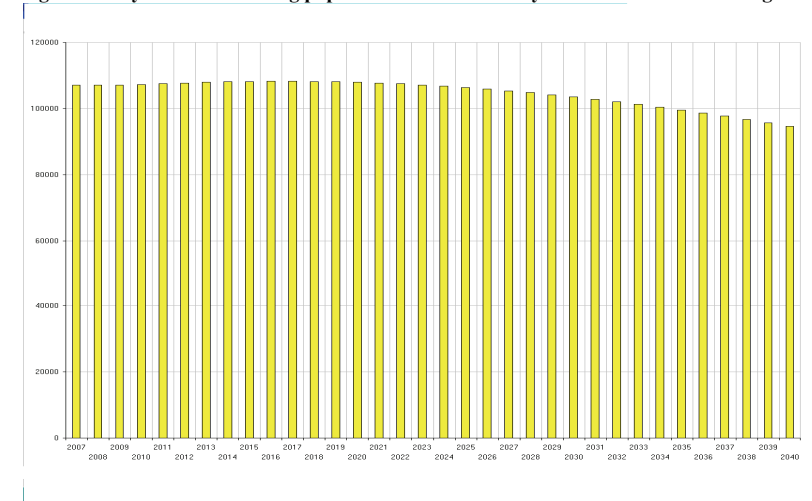
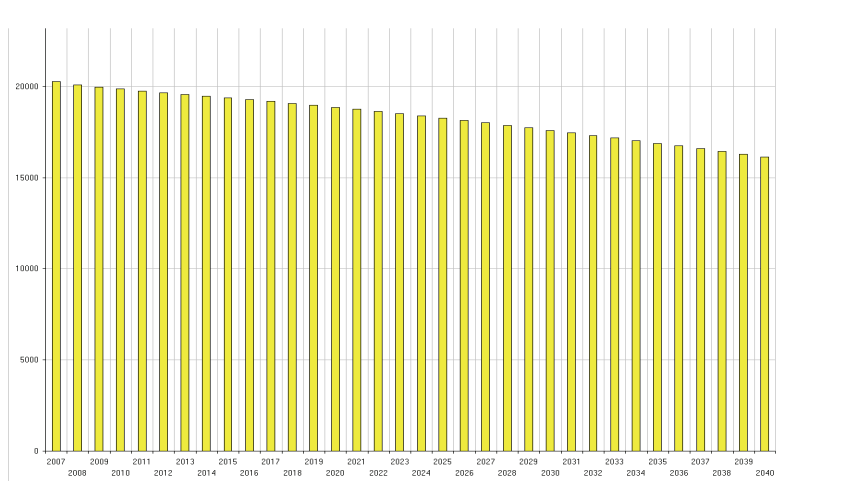


Figure 4.3

## Prognosis of dynamics of existing population in Chernoyarsky district of Astrakhan Region



## 4.2. Evaluation of transit potential and corridors

Astrakhan Region, being on the way of international transport corridor (Corridor) «North-South», possesses strong transit potential, in addition it refers immediately to 4 operating on the Region territory types of transport: railway, motor, river and sea transport.

Astrakhan Region is situated at the crossing of two corridors: «North-South» and «West-East», aimed at the countries of Transcaucasia, Central, South and East Asia (China, Korea) and the countries of South-Eastern Asia which are the biggest suppliers of consumer goods for Europe. And the Corridor «North-South» is the only corridor for which 13 countries signed mutual agreements. At present, the cost of shipping one 20-foot container from Germany and Finland to India by sea through Suez Canal is reduced, in case of transportation over the corridor «North-South», by 30 %.

But most part of freight flow passes over Russia. According to the Concept of development of transport and logistics infrastructure of Astrakhan transport junction, Astrakhan Region gets prospects of transit future. Term of delivery is the second after cost parameter of transit system effectiveness: the term of container delivery by Caspian transit route through Russia is 10 days shorter than by sea through Western Europe ports.

As per the data from Astrakhan Region Government, for the period from 2000 to 2004 summarized transit freight flow passing through the Region territory annually increased by 10-12%. Since 2005 increase of transit freight flow temporarily stopped. It can be an evidence that transit capacity of the region is temporarily exhausted both due to a low rate of construction and renovation of railway and sea infrastructure, and insufficient rate of growth of road infrastructure financing.

To-date roads of Astrakhan Region perform significant transit function. Most part of transit flows (outgoing the limits of the Region) falls on the Federal Road «Kaspij» (Moscow – Astrakhan). For this road also the biggest portion of transit flow (66%) is typical. Other federal roads

(Astrakhan-Elista and Astrakhan-Makhachkala), as well as the road Volgograd-Astrakhan (which in the proposed Strategy before 2027 will be brought to the level of expressway), play substantially less transit role. Essential transit function of most important roads of the Region will remain also in future (see Table 4.2). And two parallel meridional roads (Volgograd-Astrakhan) and (Moscow-Astrakhan), included in the Corridor «North-South», will have equal portion of transit flows (about 55%).

**Table 4.2**

**Proportion between total traffic volume and transit of vehicles on roads of Astrakhan Region (average value on a section, vehicles per day)**

Nos.	Section description (up to the border with other regions (states))	At present (2006-2007)		In future (2025)*	
		total traffic volume	including transit outgoing the limits of the Region (portion, %)	total traffic volume	including transit outgoing the limits of the Region (portion, %)
1	Astrakhan-Moscow	4,700	3,100 (66%)	8,500	4,700 (55%)
2	Volgograd-Astrakhan	3,500	1,200 (34%)	5,100 (9,500)	2,800 (4,800) (55%)
3	Astrakhan-Makhachkala	2,200	1,300 (59%)	4,200	3,000 (71%)
4	Astrakhan-Elista	1,600*	550 (34%)	4,300	2,800 (65%)
5	Astrakhan-Krasny Yar- border with Kazakhstan	1,500	300 (20%)	2,900	600 (21%)

Sources:

1. Program of modernization and development of road network in the Southern Federal District up to 2025 «Roads of Southern Russia», volume 2.
2. Data from Directorate of Northern Caucasus Federal Roads.

\* In brackets – the data of modeling by expert's system Geogracom 5W+.

Expanding of the Region transit function is impossible without modernization of road infrastructure facilities of various types. Our Strategy provides for construction of bypass round Akhtoubinsk, improvement of technical condition of access ways to Astrakhan, Kharabali, Krasny Yar, Narimanov.

Development of international transit freight and passenger flows and transit infrastructure is related to existing frontier and customs infrastructure. There are five entry points working on the territory of Astrakhan Region for overland transport at Russia-Kazakhstan border (see Table 4.3). Upon completion of construction of the bridge over the river Kigach obstacles for cooperation of Southern Russia and Western Kazakhstan will become much less. Great Silk Way will reappear in its new capacity.

**Table 4.3**

**Entry points in Astrakhan Region**

Nos.	Description of entry point	Nearest habitation area	Type of entry point	Type of transport	Type of transportation	Description and number of entry point
1	Karaozek (Krasny Yar)	Kotyaevka	Multidirectional	Motor transport	Freight and passenger	customs point "Krasny Yar"
2	Maly Aral	Zhylandy				Data not available
3	Kharabali	Balkhoudouk				customs point "Kharabali "
4	Verkhny Baskouchak	Tourgai		customs point "Verkhny Baskouchak"		
5	Verkhny Baskouchak	Saikhin		Railway		customs point "Verkhny Baskouchak"

Source: Federal Frontier Service under Russian FSS.

### 4.3. Consideration of federal and international experience of working out strategies of sustainable development

For development of the given strategy it is important to join regional and federal (international) vectors of road network development.

Proposed Strategy of road network development in Astrakhan Region completely complies with «Fundamentals of road sector reformation in Russia», developed in 2006 by Rosavtodor, where among the purposes of reforming the following were listed:

- establishment of a planning system focused at achievement of target parameters of transport operational condition and road network development (those are Minimum Transport Standard including thirteen non-sectoral parameters);

- improvement of management technologies (those are a set of means of the system for strategic planning of road sector «Geogracom 5W+» facilitating to carry out medium- and long-term planning of sector development);

- formation of a road sector financing system based on program and target approach, efficient use of budget funds (those are a so called «road curve» and built-in models of systematic evaluation of financial scenarios of road sector development).

«Concepts of Federal Special Program "Enhancement of traffic safety in 2006 - 2012» were also taken into consideration.

Major actions provisioned by these Concepts and taken into account in the given Strategy are:

- decrease of traffic accident severity and size due to observance of intervals between rehabilitations and raising of categories of most important roads;

- optimization of speed mode and level of traffic volume on most hazardous, with respect to traffic safety, road sections.

According to subprogram «Roads» in Federal Special Program «Modernization of transport system in Russia (2002-2010), by 2010 on the territory of Astrakhan Region it is envisaged to complete the following actions of high importance: construction of the bridge over the river Kigach (4.6 km., 768 mln. rub. in prices of 2006, payback 6.8 years), construction (completion of construction) of eastern bypass round Astrakhan (road of category 2, 26 km до 2012, payback 7.6 years).

Appendix to the above Federal Special Program, where results of road program implementation are divided by two: transport and non-transport parts (affects) should be considered separately.

Transport affect of the Federal Special Program implementation includes: affect of decrease in transport and operating expenses; affect of reduced time spending for the way (which is implemented in this Strategy by way of reducing Integral transport accessibility reducing its values to those standard); affect of decrease of traffic accident rate and severity.

Non-transport affect includes, first of all, effect of more energetic business activity, lower prime costs of goods due to reduced transport expenses, arrangement of additional jobs. Another part of non-transport affect is mitigation of negative impact of transport and road complex to the environment condition.

This division serves also as a reference point for working out of a Long-term Strategy of Road Development in Astrakhan Region.

*Transport Strategy of Russia* (edition of 2005) and *Strategy of Astrakhan Region development for medium-term and long-term prospects* also provide for modernization of sea infrastructure of port Olya (within the scope of Astrakhan water transport junction) in order to create competitive advantages in Russia and its cargo carriers working in the Corridor «North-South». In the road sector, in addition to development of arterial roads «Don», «Kaspjij», «Kavkaz» and other federal roads, within the Corridor «North-South» it is planned to reconstruct the road «Ukranian border – Volgograd – Astrakhan – border with Kazakhstan (Atyrau)», which will provide the shortest access from Southern Europe to Kazakhstan and Middle Asia.

The third scenario of the Strategy of Region social and economic development meant for a new portfolio of “development resources” was used as a basis for the Long-term Strategy of Road Development in Astrakhan Region.

Reviewing the tendencies of transport and road development in well-developed foreign countries (Germany, USA, Netherlands, Canada, New Zealand) [5, 6, 7], we should point out the following tendencies applied in the Long-term Strategy of Road Development in Astrakhan Region:

- the tendency of motor transport forward development will not remain in future (after 2020);
- growth of freight transportation is steadily less than growth of GDP;
- basic «transport values» in the transport policy of the above countries are improvement of transport accessibility, increase in freight and people mobility and creation of equal competition using transport, but not increase in the volume of transportation and other voluminous characteristics.

If we follow the logic basic transport documents of the above countries, than for roads in Astrakhan Region we need spending annually 2.4 bln. rub. (as per the strategy of Germany) or 2,1 bln. rub. (as per the strategy of New Zealand).

For analysis of road sector tendencies, the countries were chosen comparable by natural, geographic and economic characteristics with Astrakhan Region.

In all three territories (Astrakhan Region, Jordan and Croatia) motor transport is significant for domestic transportation. As we can see from the Table, the length of roads in Jordan and Croatia is more than in Astrakhan Region respectively by 3.2 and 12.4 times, whereas expenses in Jordan are comparable with Astrakhan Region.

Table 4.4

Some parameters describing development of compared territories (2004)

Parameters	Astrakhan Region	Kingdom of Jordan	Croatia
Population, thousand people	<b>988</b> (2006)	5,759	4,495
Area of territory, thousand sq. km	<b>44.1</b>	92.3	56.5
Length of roads, km (public, paved)	<b>2,295</b> (territorial)	7,301	28,344
Density of road network, km per 1 thousand people	<b>2.32</b>	1.27	6.31
Density of road network, km per 1 thousand sq. Km	<b>52.0</b>	79,1	501.7
GDP/GRP, bln doll.	<b>3.23</b> (2006)	24.70	15.76
GDP/GRP per head, thousand doll.	<b>3.24</b>	4.29	20.42
Investments into roads, mln. doll.	(in 2006) <b>35.0</b> (territorial roads)	38.0	983.7*
Investments into roads, % of GDP/GRP	<b>1.08</b>	0.15	6.24
Investments per 1 km of roads, thousand doll.	<b>15.3</b>	5.2	34.71

\* Average value for 2002-2004.

Source: World Road Statistic. IFR, Geneva, 2005.

With respect to the costs spent for 1 km of roads, Astrakhan Region can be compared with the considered countries (15.3 thousand dollars against 34.7 in Croatia and 5.2 in Jordan). And the portion of costs spent for roads (percentage of GRP (GDP)) in Croatia (with formed long ago network of paved roads) is about 6.24%, whereas in Astrakhan Region, with a substantial number of potential road construction sites, it is a bit over 1%. This speaks for great potential capacity of expanding road works in Astrakhan Region in the nearest future.

According to a number of parameters, including traffic safety, Astrakhan Region is in a relatively good position compared to the majority of European countries. E.g., there were about 11 traffic accidents with killed and injured (calculated per 10 thousand people) in Astrakhan Region in 2004, whereas in FRG – about 43, in Turkey only 9 and in Belarus – 7.4.

## SUMMARY:

1. Roads at present are one of limitations of regional economic growth. However, increased financing of road construction and reconstruction will allow mitigating social and economic contrasts and get the standard of living closer to the standards of well-developed countries. The concept of road network development in Astrakhan Region considers strategic prerequisites for an abrupt spurt of the road sector, incorporated in basic strategic documents of the Russian Federation and Region Government, as well as international experience.
2. Rate of GRP growth in Astrakhan Region will be increasing up to 2013 after which it will start decreasing. Population of Astrakhan Region will be gradually decreasing and will reach 859 thousand people by 2030.
3. In the nearest future transit flow through the territory of Astrakhan Region will grow, its growth will be especially noticeable on the roads Astrakhan – Makhachkala and Astrakhan – Elista.

