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Caucasus Transport Corridor for Oil and Oil Products

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Abbreviations and Acronyms

ACG	Azeri, Chirag and deepwater Gunashli (oil fields)
ADDY	Azerbaijan Railway
AIOC	Azerbaijan International Oil Consortium
bpd	Barrels per day
BTC	Baku-Tbilisi-Ceyhan (pipeline)
CA or CAR	Central Asian Region
Caspar	Azerbaijan State Caspian Shipping Company
CIS	Commonwealth of Independent States
CNPC	China National Petroleum Corporation
CPC	Caspian Pipeline Consortium (pipeline)
dwt	Deadweight ton
FOB	Free on board
FSU	Former Soviet Union
GDP	Gross Domestic Product
GR	Georgian Railway
km	Kilometer
KCTS	Kazakhstan Caspian Transport System
KMG	KazMunaiGaz
KMTP	Kazmortransflot
kV	Kilovolt
MEP	Middle East Petroleum
MOU	Memorandum of Understanding
OECD	Organization for Economic Co-operation and Development
RTC	Rail tank-car
RZD	Russian Railway
SOCAR	State Oil Company of Azerbaijan
tpa	Tons per annum (per year), metric
TRACECA	Transport Corridor Europe-Caucasus-Asia

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EXECUTIVE SUMMARY

The Central Asian Republics are seeking transport options for their exports and imports which would provide competitive alternatives to transport through Russia. Of particular concern is finding export routes for growing oil production. Potential transport routes for this oil include the Caspian Pipeline Consortium (CPC) pipeline, the Kazakhstan-China pipeline, the Transneft pipeline system through Russia, rail through Russia, Caspian sea/pipeline or Caspian sea/rail through the Caucasus. Pipeline operating costs are much cheaper than sea/railway, but access to those pipelines and ensuring diversification of transport options are concerns for the Central Asian Republics. The Caspian Sea/pipeline routes through the Caucasus will be important routes for oil export.

This study evaluates the potential demand for oil and oil products transport via the existing rail corridor in the Caucasus, taking into consideration the competition from alternative routes. It identifies potential bottlenecks that would prevent the potential traffic from using the corridor and proposes solutions for the physical and operational improvements to the corridor needed to attract the potential traffic. The report is based on a review of studies of oil production and transport, and interviews with oil producers, transportation intermediaries, railways, and ports in the region.

Crude oil production in the region will increase sharply over the next 5-10 years as the Azeri, Chirag, and deepwater Gunashli (ACG) fields in Azerbaijan are fully developed and as the major Kazakhstan fields such as Tengiz, Karachaganak, and particularly Kashagan increase production. The analysis of production, consumption and imports in this study indicates that by 2010, regional exports are expected to nearly double to over 140 million tpa, and by 2015, to 150-225 million tpa. Refined product will make up only a small proportion of this volume, coming mostly from Turkmenistan and Azerbaijan.

The transport routes for oil from the Caspian Basin encompass a complex and rapidly changing network of pipelines, railways, ports, shipping and railways. In 2015, if planned capacity enhancements take place, the network will be dominated by two pipelines, BTC and Caspian Pipeline Consortium (CPC)—assuming Russia permits expansion of the latter. This will be supplemented by smaller-capacity rail, port, shipping, and pipeline links. The Caspian Sea/rail route through the Caucasus is likely to provide "swing" transport capacity for crude oil, providing transport when the other, cheaper options are full or unavailable due to political or commercial reasons.

The Caucasus transport corridor will always have some secure traffic, such as Azeri oil products (3-4 million tpa). The remaining potential traffic has many competitive transport options. At today's transport rates, the secure traffic represents revenue to the rail

corridor of US$ 30-40 million per year, while likely traffic open to competition represents additional revenue of US$ 100 million.

This situation creates three challenges for the corridor. First, to attract traffic beyond the base of secure traffic, the corridor will have to offer competitive service. Second, to attract longer term traffic volumes, the corridor needs to leverage short term needs for its service into longer term commitments of traffic. Finally, the corridor needs to match investments to demand—a difficult task in a volatile market. ***The prudent commercial strategy in such a situation is to invest for the likely steady volume of traffic and only invest to handle additional traffic if the traffic volume is secured by contract.***

To attract the additional traffic and secure it over time with contracts, the service providers in the corridor must improve service and transform themselves into more desirable contracting partners. Shippers interviewed about the potential for the corridor indicated that they look for transport partners who offer:

- *Fair price*. Customers want prices that are predictable and reasonable in terms of the cost of the service provided and the market situation.
- *Transparency & Commercial Structures*. Customers only want to contract with reliable and transparent commercial partners.
- *Operational Reliability*. Customers are only interested in contracting with partners that they believe can actually deliver the service.
- *Environmental Reliability*. Customers require that their transporters be able to manage environmental risks and respond appropriately to any environmental damage that occurs.

Currently, customers give the corridor rather poor marks on these measures. ***If the service providers on the corridor want to attract the potentially large volumes of traffic available, they must improve their performance on these key measures.*** This would require addressing the monopolist structure of transport supply in the corridor, restructuring the organization of the railways, carrying out necessary investment and improving oil spill prevention and response capabilities. Key actions are outlined in the table below.

Table 1: Actions for Improving Competitiveness of Caucasus Rail Corridor

Problem	Action
Pricing	
Caspian Shipping	• Allow non-Azeri vessels to work in Azeri ports.
Azeri Port Monopoly	• Split ownership and operation of Dubendi, Sangachal (Azertrans) and Baku ports between three un-affiliated commercial firms
Georgia Ports	• Preserve competition among Georgian ports

Problem	Action
ADDY/GR monopoly	• Regulate to ensure transparency of tariffs and access to railway services by all parties
Intermediaries	• End intermediaries control over railway traffic—promote competition between forwarders
Revenue Divisions	• Either develop a commercial marketing and revenue division agreement among service providers in the corridor or create enough competition among forwarders that forwarders fill this role.
Transparency & Commercial Structures	
ADDY	• Carry out Restructuring Program • Increase transparency of Tariff Council actions
GR	• Continue executing the Strategy-Based Transformation and Implementation Plan, until private operator in place • If concession, Government select able, commercial private operator. • Government to clarify its tariff, safety and other regulatory roles
Operational Reliability	
ADDY	• Implement ADDY's 5 year investment program, including. – Rehabilitate East-West mainline – Replace power supply network on East-West mainline – Purchase 50 mainline locomotives – Eliminate locomotive changes along East-West mainline – Invest in additional locomotives and wagons to handle traffic growth after securing long term contract commitments covering the traffic. • Change operating practices to eliminate locomotive changes between Baku and Georgian border
GR	• GR continues its investment program, including: – Refurbishment/replacement of locomotives and wagons – Track & electrification rehabilitation • GR invest in capacity enhancements after securing long term contract commitments covering the traffic. – Retrofit brakes on locomotives and wagons – Restore ABS signaling to missing sections of mainline – Purchase additional locomotives and wagons – If traffic growth is in direction of Batumi Port, upgrade signaling and passing loops on Samtredia-Batumi line – Double track remaining section of Zestaponi-Samtredia line • Change operating practices to eliminate locomotive changes between Baku and Georgian border and stage port deliveries from Samtredia.
Environmental Response	

Problem	Action
ADDY	• Adopt & implement draft Oil Spill Contingency Plan • Adopt recommendations in Gap Analysis for improvement of oil spill preparedness and response • Conduct additional training of staff • Upgrade response equipment & supplies
GR	• Develop, adopt & implement environmental response plan

1. CASPIAN OIL TRANSPORT MARKET DYNAMICS

The Central Asian Republics are seeking transport options for their exports and imports which would provide competitive alternatives to transport through Russia. Of particular concern is finding export routes for oil and oil products. Kazakhstan oil exports, for example, are expected to grow to more than 100 million tpa[1] by 2015 and remain at more than 60 million tpa through 2030. Potential transport routes for this oil include the Caspian Pipeline Consortium (CPC) pipeline, the Kazakhstan-China pipeline, the Transneft pipeline system through Russia, rail through Russia, Caspian sea/pipeline or Caspian sea/rail through the Caucasus. Pipeline operating costs are much cheaper than sea/railway, but access to those pipelines and ensuring diversification of transport options are concerns for the Central Asian Republics. The Caspian Sea/pipeline routes through the Caucasus will be important routes for oil export. The Caspian Sea/rail route through the Caucasus, however, is likely to provide "swing" transport capacity for crude oil, providing transport when the other, cheaper options are full or unavailable for political or commercial reasons.

Transport of transit traffic to/from Central Asia is an important business for the Caucasus countries, and a sector with growth potential. In 2006, for example, rail transit services produced five percent of the service credit in the balance of payment for Azerbaijan. In Georgia, railway activities represent approximately three percent of GDP and over 15,000 jobs. The associated port sectors are another significant source of income and jobs. The Caucasus countries are eager to expand their economies and transit transport services appear to have significant growth potential. However, transport infrastructure will require investment. The Caucasus countries need to know where investment would be prudent, given the "swing" role that the rail route through the Caucasus is likely to play.

This study evaluates the potential demand for oil and oil products transport via the existing rail corridor in the Caucasus, taking into consideration the competition from alternative routes. It identifies potential bottlenecks that would prevent traffic from using the corridor and proposes physical and operational improvements to the corridor—including infrastructure assets, operational practices, structural issues, regulatory regimes, and pricing/coordination issues—needed to attract the potential traffic.

[1] Oil production and reserves are measured in both barrels or barrels per day (bpd) and metric tons or metric tons per year (tpa), while transport volumes are measured in metric tons. The conversion between the two depends on the density of the specific oil or oil product. In this report, all figures are reported in tons, and a standard conversion for crude oil of 50 tpa:1 bbd is used, equivalent to 7.3 barrels:1 ton.

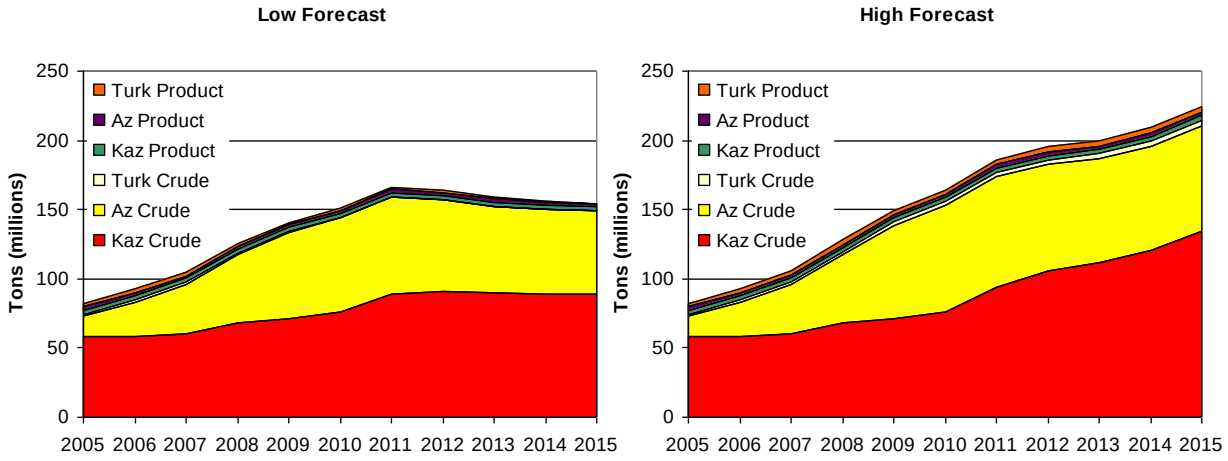
The study is based on a review of numerous studies and reports on oil production and transport, supplemented with data gathered from oil producers, shippers and transporters, and interviews conducted with oil producers, transport intermediaries, railways and ports associated with the transport of oil through the Caucasus. A list of the entities interviewed is contained in Annex 1.

OUTLOOK FOR CASPIAN OIL PRODUCTION

The Caspian Sea region, encompassing Azerbaijan, Iran, Kazakhstan, Russia, Turkmenistan, and Uzbekistan,[2] has large oil reserves and growing production. Proven reserves for the region are estimated at 2.3-6.8 billion tons. Since the 1990s, production has particularly increased in Azerbaijan and Kazakhstan, with three major oil development projects in the Azeri, Chirag and deepwater Gunashli (ACG) fields in Azerbaijan, and the Tengiz and Karachaganak fields in Kazakhstan. These fields produced nearly 47 million tons in 2006—about 40 percent of the regional total, and are expected to reach production of 100 million tpa by 2010.

Major discoveries have also been made at Shah Deniz in Azerbaijan in 1999 (gas and gas concentrate) and at Kashagan in Kazakhstan in 2000 (oil). The region's production in 2006 reached 112 million tons, and forecast 2010 production is estimated at 150-200 million tons. (See Annex 2.) This production increase will be accompanied by a substantial increase in exports.

Figure 1: Forecast Caspian Export of Oil & Oil Products



By 2010, exports are expected to nearly double to over 140 million tpa. By 2015, the volume of exports needing transport to market is expected to rise further to 150-225 million tpa. Refined product will make up only a small proportion of this volume, coming

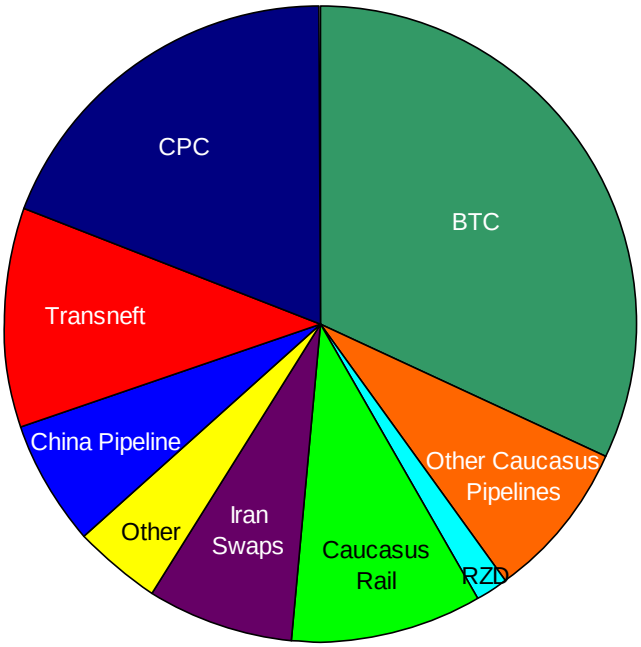
[2] Although Uzbekistan does not directly border the Caspian Sea, it is included in the Caspian region as it shares several of the region's hydrocarbon basins.

mostly from Turkmenistan and Azerbaijan. Figure 1 shows the range of likely exports from the Caspian Region.

TRANSPORT OPTIONS FOR CASPIAN OIL

Caspian Basin oil currently moves over a myriad of pipelines, ports, ships and railways. As shown in Figure 2, two high capacity pipeline routes—CPC and BTC—dominate the network, providing over half the available capacity. A handful of smaller pipelines

Figure 2: Transport Capacity for Caspian Basin Oil & Oil Products



together with the share of the Russian pipeline system made available to Caspian Basin production provide another quarter of the capacity. This is supplemented by smaller, but significant, routes involving railways, swaps with Iran and other transport options. The current transport options are shown on Map 1 in a density map format. A detailed description of the transport network is contained in Annexes 4 and 6-8.

Map 1: Oil Transport Options—Estimated Capacities for 2006

Source: Study data

Several major decisions are likely to change the capacity and balance of the transport network in coming years. The most important of these involve changes to the capacity of the BTC and CPC pipelines, which potentially could add 67 million tpa of capacity to the network. The major changes in the capacities of transport options in 2015 are shown on Map 2 in a density map format.

CPC's owners planned to increase the pipeline's capacity from 30 to 65 million tpa by 2009. However, expanding the pipeline is proving difficult. Russia appears to be trying to assert control over the pipeline in various ways, including legal steps related to licence

conditions, and is keen to increase the tariff from the current $28.25 per ton to at least $30.73 per ton. Russia has also taken steps to transfer its shares in CPC to Transneft, the direct competitor of CPC. Recently, Russia is reported to have agreed to expand the capacity of CPC to 40 million tpa[3]. This follows an announcement of the Bosporus bypass pipeline and suggestions that Kazakhstan might more actively develop routes through Azerbaijan. The timing of the expansion remains uncertain.

Map 2: Oil Transport Options—Estimated Capacities for 2015

Source: Study data

[3] "Putin's Energy Victory," Turkish Weekly, May 11, 2007. Also in "Weekly News Review" of Kazakh Embassy, Brussels, June 10, 2007.

Although BTC was originally built to carry ACG production, Kazakhstan has negotiated space in the BTC pipeline for its Kashagan oil production. Capacity of the BTC pipeline can be increased from 50 to 60-65 million tpa by employing drag reducing chemicals and to 80 million tpa by also adding additional pumping capacity. Some of the smaller pipelines and other outlets may also be expanded and pipeline construction in Europe could relieve the pressure on the Bosporus gateway.

Mapping the potential demand to the likely transport network highlights certain gaps in capacity (see Annex 5).

- *CPC Not Expanded*. If CPC is not expanded, the volume carried by the smaller capacity options (other pipelines, rail, swaps) would have to increase. However, under the high forecast, these smaller capacity options would also reach their capacity limit and a medium-capacity route such as the Kazakhstan-China pipeline would need to be expanded to handle all the traffic.

- *Production-Capacity Mismatches*. Since having enough capacity to serve forecast traffic depends on expansion of major pipelines, mismatches in the timing of production vs. transport capacity expansions are likely to occur. This may create temporary periods in which production outstrips capacity, even if capacity is sufficient in the longer term.

Both situations create an opportunity for the railway corridor to capture market, increasing oil and oil products traffic from 12-13 million tpa to as much as 20 million tpa. To do this, however, the railways in the corridor must address both physical and commercial constraints. Their success in addressing these issues will determine how much market the corridor can capture and—critically—how much market the corridor can retain once competing transporters up capacity.

2. CAUCASUS RAIL CORRIDOR—PHYSICAL CONSTRAINTS

The Caucasus railway corridor links the Azerbaijan's Caspian ports with Georgia's Black Sea ports. This corridor carried 11.2 million tons of oil and oil products in 2005 and 13.3 million in 2006. Traffic is down to 11.5 million tons in 2007 due to diversion of oil traffic to Iran and other railway corridors, and opening of the BTC pipeline. Oil and oil products make up more than half of the makes up about half of the traffic carried by Georgian and Azerbaijan Railways. This chapter examines the physical condition of the corridor and identifies the critical investments needed for the corridor to handle current traffic levels and future volumes in the range predicted—10-20 million tpa.

PORTS

The port capacity along the Caucasus corridor is adequate to handle the current oil traffic and expansions are planned to handle the future increase in oil production (see Maps 1 and 2). On the Caspian Sea, Kazakhstan is planning the construction of new oil terminal at Kuryk, 70km south of Aktau. The port is expected to open in 2011. Its planned initial capacity is 25 million tpa, increasing to 40 million tpa as Kashagan production ramps up. The Kuryk project will satisfy the oil transhipment demand and thus reduce the need for new oil berths at Aktau, perhaps even causing the loss of some existing traffic in Aktau.

Azerbaijan's major port, the Port of Baku, and oil terminals at Sangachal and Dubendi are currently capable to handle the growth of oil traffic. In addition, a new oil terminal at Garadagh is being constructed about 40 km south of Baku. The new terminal will replace existing Baku terminal and mainly handle trans-Caspian shipping of the new Kazakh oil production. The expected capacity is 10-20 million tpa.

Georgia's ports in the Black Sea such as Batumi, Poti, Kulevi, and Supsa have sufficient transhipment capacity to handle the increased oil traffic flow. Poti terminal's capacity is three million tpa by design. Kulevi Port is a new port currently under construction expected to initially handle 4-5 million tpa of crude oil, increasing to 10 million tpa by 2008. Kulevi plans to expand its capacity to 20 million tpa (according to press reports). Batumi oil terminal's capacity is planned for expansion from 15 million to 25 million tpa. The major challenge for these terminals is not capacity but the loss of traffic to competing routes and the increased competition within Georgia once Kulevi commences its operations. See Annexes 4 and 7 for a more detailed discussion on ports capacities.

RAIL

Railway Track

The rail corridor is shown in the map below. Azerbaijan Railway's mainline runs 502 km from Baku westward to the Georgian border. The railway is double track the entire route. The terrain is mostly flat, so the railway has few structures. Georgian railway continues the corridor westward 279 km to Samtredia, where the line splits, with a 66 km section running to the port of Poti, and a 103 km section running to the port of Batumi. With one six km exception, the line from the border to Samtredia is double track. The line to Batumi is single track, as is most of the line to Poti. The terrain in Georgia is much more challenging than in Azerbaijan, with mountains in the central section and wetlands near the ports. Consequently the Georgian Railway line has many bridges, tunnels, galleries and other structures. (See Annex 8 for additional details on the railways.)

Map 3: Caucasus Railway Corridor

The railway lines were built to a heavy freight standard with R65[4] rail and switches. It was designed for 100 kph operation for passenger and 80 for freight. GR operates approximately 43 train pairs a day (including both freight and passenger) in the densest part of its network.[5] This is a modest number for a double track railway. However, the corridor exhibited some strain in 2006, when traffic was at a peak. The most critical bottlenecks to carrying more traffic are in Georgia:

[4] 65 kg per meter.
[5] Georgian Railway, *Georgian Railway Overview Report*, May 2007, p. 23.

- *Singe track line to Batumi.* The line to Batumi is operating at fairly close to its existing capacity. If traffic were to grow above 12-13 million tons, and be handled through Batumi Port (rather than Kulevi), the capacity of the line would need to be increased. This could be accomplished with fairly modest investments to upgrade signaling, increase the number of passing loops, and improve yard facilities. Changes in GR operating practice to form longer trains to operate on the Batumi lead, would also allow approximately 25 percent more RTCs to be handled with the existing track capacity. Estimated cost: ~ US$ 20 million.

- *Gorge.* The section of GR line between Khashuri and Zestaponi is quite rugged and includes a long grade. Operations through this section are very slow. Each train stops at the top of the grade to increase brake pressure and adjust the brake valves on the wagons to limit the release of air pressure (an event that may take 1-3 hours). The train may stop again several times on the way down the hill to allow the brakes to cool (15 to 20 minutes per stop). At the bottom of the hill, the train stops again to reset the brake pressure and valves. This causes effective capacity on the section track to be lower than other sections of the line. Installing fully functional dynamic brakes on the locomotives and retrofitting wagons with improved brakes would obviate the need for these practices and increase the effective capacity of the track. Estimated cost ~US$ 2.5 million.

- *Staging Yard in Samtredia.* As traffic increases and becomes more complex because of the opening of Kulevi Port, GR will need expanded yard capacity near the ports to receive bulk oil trains, and sort and stage the wagons for delivery to the ports in time to meet the ships. GR has an existing yard in Samtredia, with considerable space that could be rehabilitated for this purpose. Estimated cost US$ 5 million.

- *Single track section Zestaponi-Samtredia.* The GR mainline from the border to Samtredia has one 6-km single track section. GR is double tracking this section. Estimated cost is ~ US$ 20 million.

Beyond these bottlenecks, the corridor suffers from general maintenance deficiencies (e.g., defective rails, switches and sleepers) that in practice reduce capacity. This is the main constrain on the Azeri portion of the corridor where ADDY operates with 183 km of speed restrictions. ADDY's investment program envisions spending US$ 99 million during the next five years to address this issue by upgrading the track on the East-West mainline and eliminating all existing speed restrictions.

Power Supply

The full length of the Caucasus rail corridor is electrified at 3.3 kV DC. In Georgia, the system suffered from a maintenance backlog that included corroded catenary support, worn contact wire and deficiencies in sub-stations. Since 2000, however, GR has made significant improvements in the system. During the past seven years, it has replaced more than 1,300 heavily corroded power supply poles on the mainline network (about six

percent of the mainline network total) and replaced 115 km of contact wire.[6] GR's power supply group has developed a renovation plan for the network that would involve upfront expenditure of US$ 16-20 million and annual expenditure of US$ 3-4 million.

By contrast, the electrification system in Azerbaijan is in a critical state. The line was electrified in the 1960s, and the Russian and Ukrainian built substations are 38 to 43 years old. The system has not been maintained sufficiently to prevent a gradual deterioration. As a consequence, transformers have failed and 8 of 25 substations lack redundancy. Emergency power supply is at risk in some stations due to defect rechargeable batteries. Fires have also broken out in some substations, more than once in some.[7] Much of the catenary and supporting structure has rusted or decayed to the point where it must also be replaced. The supply masts show strong damages from rust and alkali and many stand inclined.

To insure safe operation, the system needs to be replaced. Since ADDY's locomotives are also in a critical state, the railway compared the costs and benefits of three power supply/traction options: replacing 3 kV electrification and locomotives with 3 kV, taking down the electrification and operating diesel locomotives, and replacing 3 kV electrification and locomotives with 25 kV. It has selected the 25 kV option, and over the next five years will progressively replace the electrification network. This US$ 260 million investment will be partly financed by a World Bank loan.

Signaling and Communications

The corridor was equipped with automatic block signals (ABS) of Soviet design and mostly Russian manufacture, with wayside colored lights to communicate information to trains. This signalling remains operable and in acceptable condition on the Azeri part of the corridor. In Georgia, however, much of the equipment was damaged, stolen or vandalized between 1991 and 1996. Today, only 83 km of GR's mainline are equipped with ABS.

The remainder has a semi-ABS system, in which the stations control the approach signals. Telephone communications between stations have significantly improved during the past 5-7 years because of the installation of fiber-optic cable and related equipment. GR has installed a 24-strand fiber-optic communications system throughout the mainline network.[8]

The GR signalling system is adequate for the volumes of traffic that it has been carrying. While only one train can occupy the track between a pair of station, station spacing is relatively short, so operations have not been significantly hampered. However, increases in traffic and elimination of little-used stations will require upgrading the signal and train control systems. The cost to install full ABS with dispatch control is estimated at US$ 20

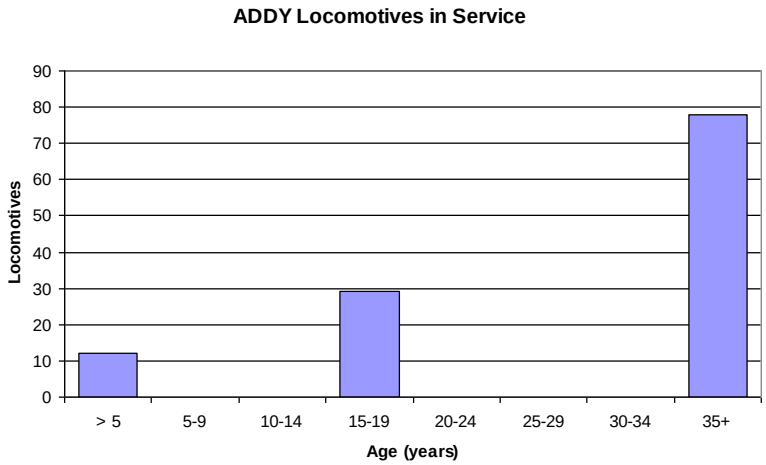
[6] *Id. p. 17.*
[7] Padeco/Seneca/Sulaco, Consulting Services For Restructuring And Revitalizing The Railway Of Azerbaijan: Rollingstock Report, Appemdix 4 (2006).
[8] Georgian Railway Overview Report, Georgian Railway, May 2007

million. This investment would be necessary, to handle traffic volumes on the high end (e.g., 20 million tpa) of the possible oil traffic forecast.

Locomotives

Both ADDY and GR locomotive fleets suffer from deferred maintenance and little investment during the last 20 years. This has become a choke point for the corridor. During 2006, railway traffic was limited by locomotive availability.

Figure 3: ADDY Locomotives in Service



ADDY needs a fleet of 118 mainline locomotives to handle its current traffic. As can be seen in the graph, ADDY has 41 locomotives less than 20 years old; the remainder is 35+ years old. More than half of ADDY's locomotives in service are well past their service life and need urgently to be replaced. Approximately 50 of these locomotives can be nursed along for another five years, to provide motive power while a major renewal of ADDY's locomotive fleet takes place. Some 28 of the locomotives should be retired sooner. This means that, even with operating improvements to improve utilization, ADDY needs to replace more than 50 locomotives in the next five years.

ADDY's investment program includes US$ 280 million to purchase 50 new locomotives. The locomotives will be 25 kV and operate on the Caucasus corridor. This investment will be partly financed by a World Bank loan, and provide ADDY with locomotives to handle existing volumes of traffic and modest growth. But to handle the high end of the forecast, ADDY would need to further scale up its locomotive fleet.

GR needs a fleet of approximately 90 mainline locomotives to handle its current traffic. Out of a total fleet of 180 electric locomotives, 124 are serviceable, which is more than sufficient to handle current traffic and allow for potential growth. Like ADDY, however, GR's fleet is heavily weighted to older locomotives. Only about 17 percent of the fleet is younger than 20 years. Over time GR will have a heavy locomotive replacement requirement.

Wagons

The fleet of rail tank cars (RTCs) operating in the region consists of RTCs provided by GR (~1600), ADDY (~3600) and private shippers (~1400). The wagons circulate freely

with wagon hire charges compensating the owner of the RTC for its use by other parties. The current fleet is sufficient to meet average demand, but not peak demand. As with locomotives, little investment in tank wagons was made in the last 20 years, so the age profile of the fleet is heavily weighted toward older wagons. This means that heavy replacement will be needed over the next ten years. In addition, if traffic grows, the wagon fleet would need to be scaled up proportionally.

Table 2: ADDY and GR Wagon Fleets - 2007

Type	Total Fleet	Condition		
		For scrap	Awaiting repair	Operational
Total fleet				
ADDY	20098	11697		8401
GR	11635	3122	2417	6096
Private	1417			
Tank wagons				
ADDY	3660	374		3286
GR	1667	292	146	1213
Private	1417			1417
Total	6744			5916

Source: ADDY and GR.

Tank wagons can be leased from other parts of the FSU, but a booming oil demand in Russia and elsewhere has created a tight market for RTCs. Private shippers currently provide nearly 25% of the fleet. If commercial transparency concerns are addressed, required investment in RTCs could be made by the private sector.

Environmental Planning and Oil Spill Response Issues

Major oil producers require their transporters to have a demonstrated and auditable safety plan for hazardous goods, including oil and oil products. These firms are increasingly concerned about reputational risk and are keen to ensure that not only they, but also their transporters, have clearly-established procedures to prevent accidents and to respond if they occur. Currently, customers perceive the rail corridor as both weak and non-transparent on this issue.

Risks. Environmental hazard for rail transport of oil and oil products can occur in three main ways:

- Spills can occur while loading, unloading and cleaning the rail tank wagons. Preventing and responding to such spills is the responsibility of the terminal operator. The newer or refurbished terminals in the corridor (Dubendi, Sangachal, Batumi, Poti) and the RTC washing plant at Balajari have modern transfer equipment and containment structures to prevent any spills from contaminating soil or water.

- Spills can occur while fueling diesel locomotives (generally used for shunting), lubricating locomotives, and in storage facilities for fuel and lubricants. The railways need to upgrade their equipment and containment structures for fueling/lubricating facilities. However, spills at such sites are likely to be relatively small and able to be addressed with existing railway environmental response resources. Moreover, these hazards are general to the railway activity, not unique to transport of oil, and so of less concern to major oil customers.

- RTCs can be involved in an accident that causes one or more tank wagons to be breached and the contents of the wagon(s) spilled. Spills from RTCs are higher risk, because of the quantity of material that may be spilled. (A typical RTC holds 60 tons, so a derailment of, say, five RTCs could cause as much as 300 tons of oil to be spilled.) Such accidents could occur in stations or on the railway line. The risk is higher on the railway line, because RTCs are typically moving faster on the line, so may spread the spill further and cause the accident to involve multiple cars. Also, on the line, a spill is more likely to come into contact with a waterway.

In the Caucasus corridor, many of the RTCs in operation are quite old and have been poorly maintained, so have a higher probability of wheel, brake and other mechanical deficiencies that may cause accidents. Track condition is poor in some sections of the corridor, which can also contribute to an accident.

Emergency Response. The railways position emergency response trains at key locations along the corridor to respond to accidents. Such trains are equipped with cranes, pumps, storage tanks and earthmoving equipment. They allow responders to create a containment area around the spill, pump the spilled material into tanks, and lift equipment back onto the railway lines.

A recent review of oil spill response capability of Azerbaijan Railway indicated that the environmental prevention and response capability needed strengthening through the following actions[9]:

- Refine and adopt the draft Oil Spill Contingency Plan.
- Provide training to response and environmental teams in execution of the plan.
- Upgrade equipment of response trains to ensure adequate first response.
- Upgrade spill kits at main stations and refueling station, and improve containment within stations.
- Adopt plan for using external resources (national and international), when spill is too large to be handled effectively with the railway's own resources.
- Improve coordination of spill response with national government agencies.

The World Bank has an investment project under preparation with ADDY that would include a component for enhancing ADDY's oil spill response capabilities along the lines

[9] Briggs Environmental Services Ltd., *Azerbaijan State Railway Oil Spill Contingency Plan*, *Environmental Sensitivity Audit Report*, and *Action Plan* (2007).

outlined above. Georgian Railway's emergency response capabilities suffer from many of the same issues as ADDY's and would merit a comprehensive review and similar actions.

Prevention. In addition to improving their emergency response capability, the railways can reduce risk through adhering to safety operating practices such as service inspections of RTCs and tracks. Investment to improve the condition of the tracks and RTCs will also reduce risk.

Operational Practices

ADDY and GR follow the operating practices inherited from the Soviet time. These practices are generally safe but not necessarily efficient. In particular, the railways change locomotives frequently—as many as three times on ADDY and twice on GR during a single trip. Given the fragile condition of its fleet, ADDY feels it must assign a crew to each locomotive to care for as well as drive it, and have the locomotive remain in its district, running only a few hours each day. The frequent changing of locomotives, however, is very costly in terms of trip time and locomotive utilization. As new locomotives are introduced, ADDY has the opportunity to operate trains from Baku to the border without a locomotive change. This will save ADDY as many at 30 locomotives, with their associated capital and ongoing maintenance costs. Similar potential savings in transit time and locomotive requirements are available to GR, with a change in operating practice.

Analysis of Key Physical Constraints

Currently, customers perceive that the railway corridor is operationally unreliable and would be unable to deliver any significant increase in oil traffic transport. Service on the Georgian side has seen significant improvement in recent years, and shippers expressed confidence that GR's current management could address any traffic expansions and invest where needed. However, the ADDY side is viewed as stressed and near failure, especially in terms of locomotive availability and reliability.

In fact, the corridor has current capacity to carry 12-13 million tpa of oil and products, with the potential infrastructure capacity to carry twice that traffic. The rail corridor is still recovering from the deterioration and lack of reinvestment that occurred during the 1990s. However, both railways are profitable and should be able to support substantial reinvestment. Major expansion of infrastructure capacity is not needed—even to carry higher traffic volumes—but the infrastructure needs to be refurbished and some bottlenecks removed. The locomotive fleet is old and needs a major renewal program. Electrification on ADDY and signalling on GR are in poor condition. Tank wagon fleets are also old, but options exist for a mix of renewing railway owned wagons, leased wagons and shipper owned wagons. As the assets are renewed, operational practices that limit asset productivity—such as restricting locomotives to divisional boundaries—should be revised.

The key investments, and the level of traffic for which they are needed, are summarized in Table 3.

Table 3: Investments Needed to Handle Traffic Growth

Description	Current Traffic	15 million tpa	20 million tpa
Track	• Address rehabilitation backlog (ADDY, GR)	• Expand staging yard at Samtredia (GR) • if traffic growth flows to Batumi Port, upgrade signalling and passing loops on Samtredia-Batumi Line (GR)	• Double track remaining section of Zestaponi-Samtredia line (GR)
Power Supply	• Replace (ADDY) • Address rehabilitation backlog (GR)		
Signalling		• Restore ABS to missing sections of mainline (GR)	
Locomotives	• Purchase 50 (ADDY) • Replacement program (GR)	• Install dynamic brakes on existing locomotives (GR) • Scale up fleet proportionally to traffic increase (GR, ADDY)	• Scale up fleet proportionally to traffic increase (GR, ADDY)
Wagons	• Replacement program (GR, ADDY)	• Retrofit brakes on wagons (GR) • Scale up fleet proportionally to traffic increase (GR, ADDY)	• Scale up fleet proportionally to traffic increase (GR, ADDY)

ADDY is looking to address its investment backlog with a major Five Year Investment Program to rehabilitate all aspects of the railway including the infrastructure, motive power and wagon deficiencies discussed above. World Bank is preparing an investment project that would finance a portion of this overall investment program and EBRD has prepared an investment project for locomotives and other equipment. This plan will position the railway to handle current volumes of traffic and provide sufficient infrastructure capacity to accommodate traffic growth. If traffic grows more rapidly than expected additional traffic could be handled by scaling up the locomotive and wagon fleets.

In the last two years, GR has been investing much of its considerable operating profit back into the railway. In 2006 and 2007, GR investments totalled US$ 53 million and US$ 82 million respectively mainly in bridge rehabilitation, tracks upgrade,

refurbishment of locomotives and wagons, passenger and freight stations, and construction of a new rail link to Tbilisi airport. In 2008, GR's investment plans are estimated to be about US$ 34 million. Shippers interviewed indicated that GR had substantially improved its operation in recent years, and were rebuilding the railway. They expressed confidence that if investments were needed to handle growing traffic, GR could raise the necessary investment funds. The Georgian Railway management is currently making investment plans only up to 2009, because the government is seeking to privatize the railway, and interested private parties have been invited to submit their expression of interests by late January 2008.

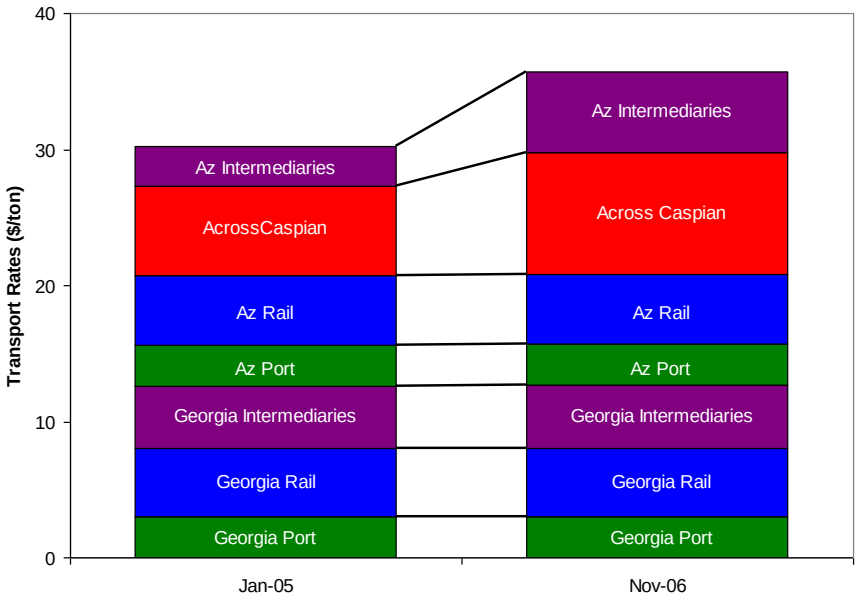
3. CAUCASUS RAIL CORRIDOR—COMMERCIAL CONSTRAINTS

The competitiveness and traffic potential of the Caucasus Rail Corridor are also constrained by business practices. This chapter discusses commercial aspects of the transport service that are important to oil customers—fair price, commercial transparency—and how customers evaluate the corridor on these aspects. It outlines the steps needed to make the corridor more attractive from a business perspective and identifies actions underway to make the railways in the corridor more commercially transparent.

PRICING AND COMMERCIAL RELIABILITY

The price for transporting a ton of crude oil from Kazakhstan to the Black Sea via the Caucasus Rail Corridor stood at about US$ 36 per ton at the end of 2006 (FOB Aktau – FOB Batumi). As shown in the Figure 4, this price includes estimated payments for the ports, the railways, the shipment across the Caspian, and the forwarder/intermediaries involved in the movement.

Figure 4: Transport Rates for Caucasus Rail Corridor



Source: Customer interviews, other financial analyses.

When oil prices exceeding US$ 100 per barrel (~US$ 730 per ton), the overall transport rate of US$ 36 per ton was not so high as to cause producers to stop producing rather than pay for transport through the corridor. (That is, at these rates producers can still make a profit, even after paying production and transport costs.) However, with prices volatile and dipping below US$ 40 per barrel, the transport price will affect the volume

produced. In addition, evidence exists that pricing at these levels is high enough that competitors are successfully diverting traffic to other routes. In July 2006, for example, Russian railway discounted the rail transit charges from Makhachkala to the Black Sea and Sea of Azov to attract business away from the Caucasus corridor.[10] And during the two year period shown in the graph, the volume of traffic from East Caspian ports (Atkau, Alaja and Okarem) shifted transport options. In January 2005, twice as much moved through Azerbaijan as to Iran. But by the end of 2006, nearly three times as much moved to Iran as Azerbaijan.

Limiting the corridor's competitiveness is the unusually high share of revenues that appears to be going to intermediaries compared to actual service providers. In the Caucasus corridor, an estimated third of revenues goes to intermediaries. By contrast, in Europe and North America freight forwarders typically earn three percent of revenues.

Customers indicate that the distribution of the revenues concerns them for several reasons. First, the amount going to freight forwarders is excessive compared to international practice. Second, customers recognize that the corridor badly needs investment for rehabilitation, and would like to see more of what they pay spent on investing in the corridor to provide better service. Third, both customers and other service providers in the corridor expressed the concern that Caspian shipping rates are excessive and hurting the corridor's competitive position.

Monopoly Pricing. These points highlight an issue that arises in any logistics chain, when multiple parties have monopolies on different segments of the service. The interest of the group as a whole is to charge a price that is competitive with alternative transport corridors. But the interest of any one monopolist in the chain is to extract as high a share of the revenue as possible. As long as each party is charging their "monopoly rent" the total charge is likely to exceed a rate that maximizes revenue to the group as a whole.

In the Caucasus rail corridor, almost all the segments are operated by de jure or de facto monopolies. In Azerbaijan, the monopoly shipping company, the three general use ports/terminal facilities and access to the railway are all controlled by an affiliation of SOCAR together with Middle East Petroleum (see Figure 5). Any transit customer that wants to use the corridor:

- Must arrange shipping across the Caspian through Cross Caspian Logistics, which controls access to CASPAR and its operating contractor Meridian Shipping. Only CASPAR tankers can unload at Azeri ports.

- Must arrange terminal handling (at any of the three ports) through Middle East Petroleum.

- Must arrange rail transport through Cross Caspian Logistics.

[10] "Russian Railways to Capture Crude Flow to Georgia," www.kommersant.com (August 4, 2006).

Figure 5: Industry Structure in Azerbaijan

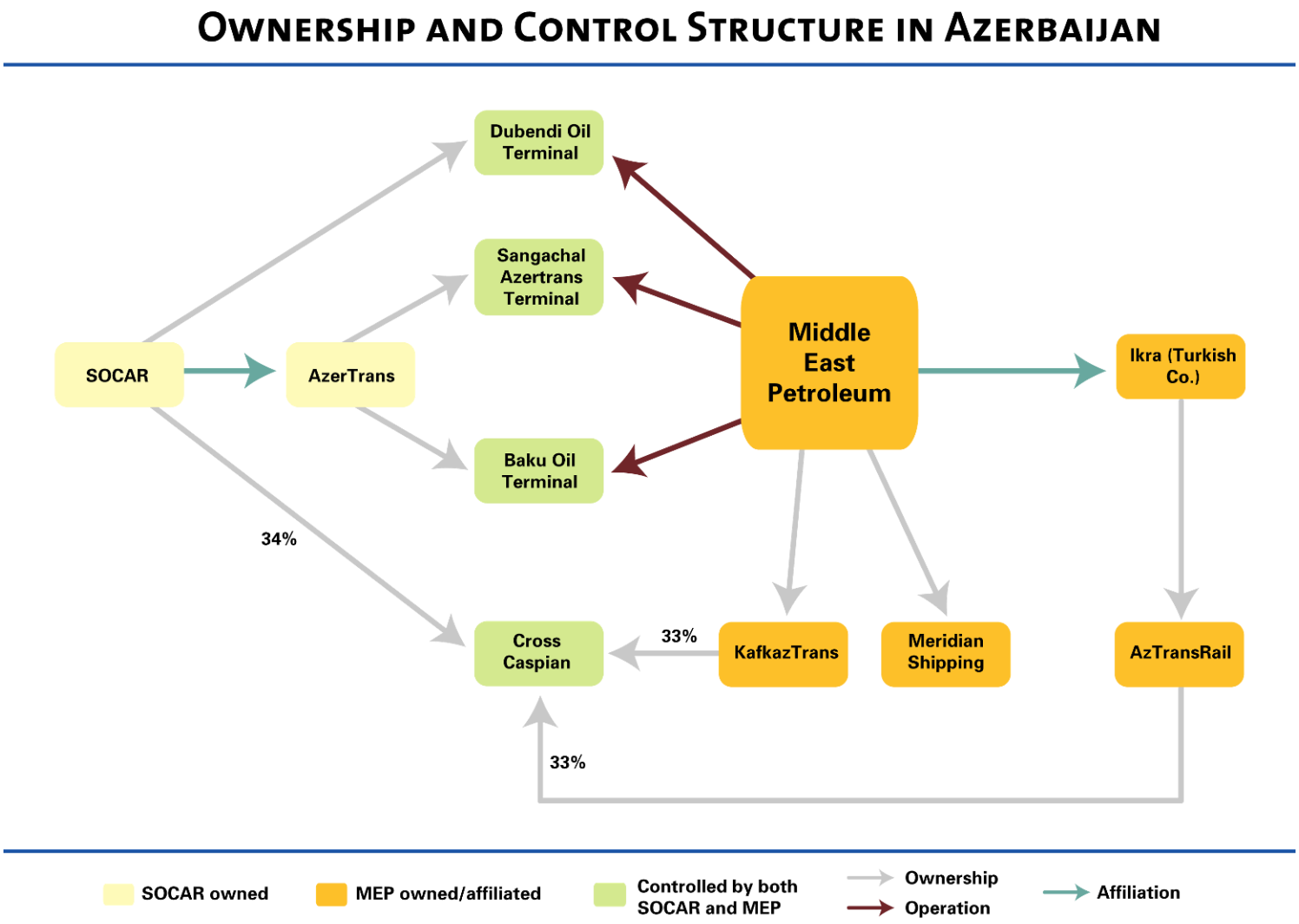
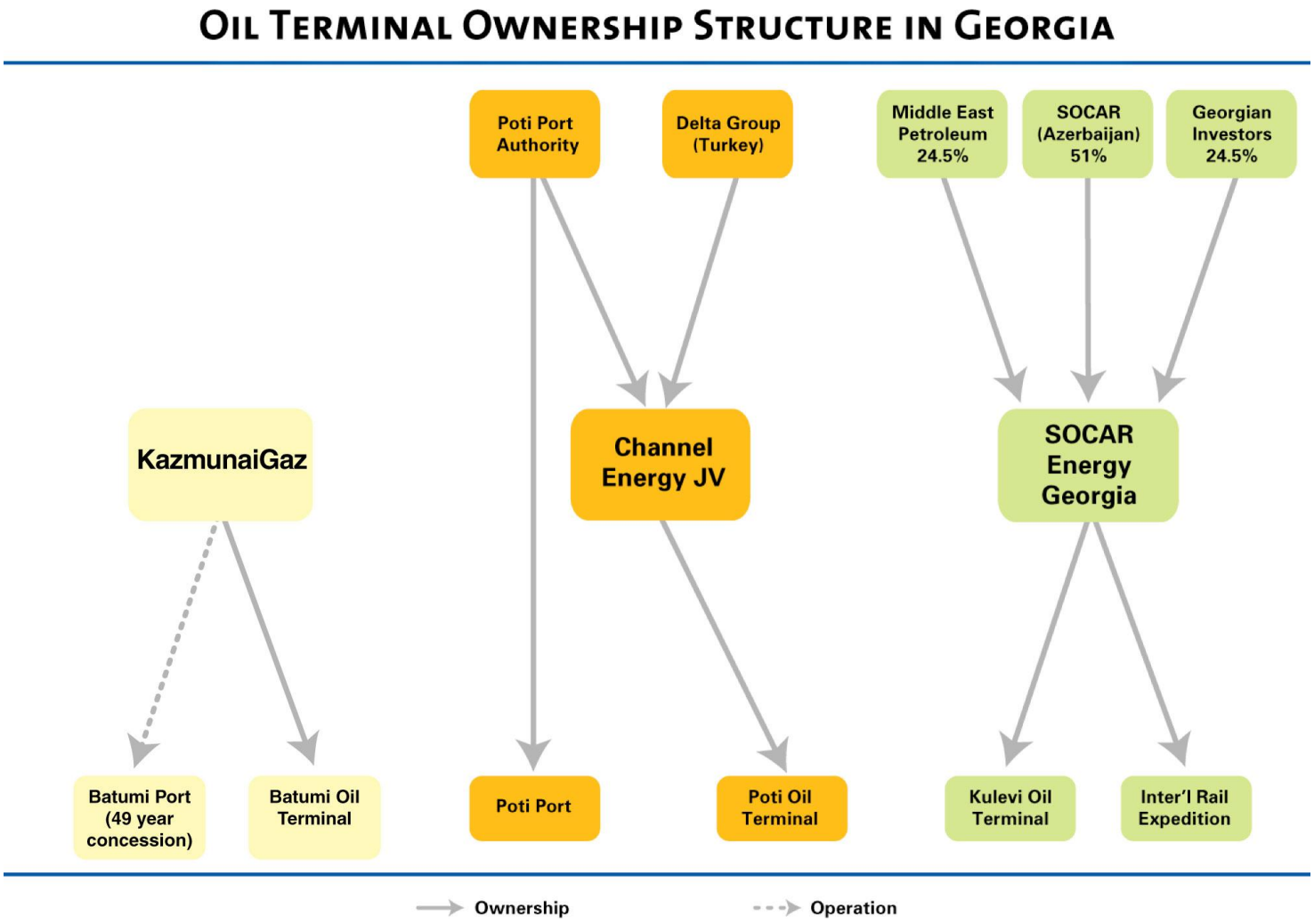


Figure 6: Industry Structure in Georgia



The critical entry points to the actual service providers are controlled by SOCAR, Middle East Petroleum and their affiliates. The ports/terminals are owned by SOCAR and its affiliate AzerTrans and operated by Middle East Petroleum. Cross Caspian, the gatekeeper for shipping across the Caspian and for Azerbaijan Railway, is owned one-third by SOCAR, one-third by Middle East Petroleum and one-third by an affiliate of Middle East Petroleum.

On the Georgian side, the railway also has a monopoly, but lack of clarity about Government regulation of tariffs has led the railway to leave published rates unchanged for several years. Most of the crude oil traffic is handled by freight forwarder Petrotrans. Petrotrans, in turn, works through Georgia Transit, which has a volume discount rate from the railway. Other forwarders also work with the railway (but without a comparable discount). The two active ports in Georgia and the one under construction are owned by different groups, so there is growing competition in the port sector (see Figure 6).

To address pricing and commercial reliability concerns, two issues must be tackled: (a) monopoly power, including the monopoly of certain intermediaries over access to transport services and pricing, and (b) a mechanism for fairly sharing the revenue generated by the corridor.

The monopoly problem has numerous elements, so would require multiple actions to address:

- Monopolization of transport across the Caspian could be eliminated by allowing non-Azeri vessels to work in Azeri ports.

- Ending monopolization of Azeri public ports would require separating the ownership/operation of the three public ports between three un-affiliated commercial firms.

- Creating competition on railways is much more difficult, although competition in train operations could be created over time. Until then, Government regulation could ensure transparency of tariffs and access to railway services by all parties.

- Existing/potential competition among Georgian ports should be preserved.

- Creating competition in freight forwarding would require eliminating Middle East Petroleum's hold over access to ADDY. In Georgia, the introduction of Kulevi Port with its affiliated freight forwarder, International Rail Expedition, should create competition to Petrotrans/Georgia Transit. The potential new commercial management of Georgian Railway may put pressure on forwarder to reduce their margins.

While identifying the mechanisms for ending monopolies is relatively straightforward, ending these monopolies will be difficult and require great political will.

To be able to offer the customer one attractive price, the service providers in the corridor need to develop a commercial pricing mechanism that offers the customer a market responsive price and creates a mechanism for sharing the revenues in an equitable fashion. In North America, for example, the railways routinely agree on contract rates with customers and revenue "divisions" among the railways. While the revenue "divisions" are negotiated between the railways, they reflect generally agreed principles such as fair cost coverage and value of service provided. In Europe, such contract rates are organized by freight forwarders (who, as noted above, earn about three percent of the revenues for their services). Such a mechanism is needed for the Caucasus Railway Corridor as well. Either the service providers need to develop a marketing and revenue division agreement among themselves or the Governments need to create enough competition among forwarders so that forwarders fill this role.

TRANSPARENCY AND COMMERCIAL STRUCTURES

In addition to the monopoly prices being charged, the lack of transparency and the multiple layers of intermediaries between the service providers and the customers are a major concern for potential shippers. To attract contracts, the customer must have confidence in the commercial reliability of the other contracting party—the willingness and ability of the other contracting party to fulfill its side of the agreement.

Recent commercial experience has made such confidence scarce. In Azerbaijan, for example, a major railway customer has seen multiple layers of new intermediaries substituted for the professional freight forwarder with which it had contracted. In such an environment, potential customers expressed special concern about the lack of transparency in pricing of transport services in the corridor. Many interviews expressed dismay about the lack of published rail tariffs, and the non-transparent tariff council process for changing rates. These users indicated that such characteristics made them reluctant to use the corridor and unwilling to enter into long term contacts or traffic volume commitments in the corridor.

Azerbaijan Railway recognizes the strong need for it to operate more commercially, and has developed a business plan that calls for "reorganizing their enterprise form and management structure, substantially improving their accounting and financial reporting systems, and rebuilding their operating infrastructure and equipment fleet."[11] The key steps planned to implement this include:

- Separating policy and regulatory functions from commercial functions, transferring the former to the Ministry of Transport and retaining that latter in ADDY.

- Organizing ADDY into a joint stock holding company, with stock owned by the government of Azerbaijan

[11] ADDY, *Railway of Azerbaijan Business Plan 2007 – 2010* (June 2007), p. 1.

- Organizing ADDY along lines of business, creating four wholly owned subsidiary companies for Infrastructure, Passenger Operations, Freight Operations and Non-core Activities.

- Introducing IFRS accounting standards and reporting.

- Renewing ADDY assets.

These critical steps will provide the organizational structure and financial reporting necessary if ADDY is to operate as a commercial entity.

Georgian Railway has already undertaken some of these same steps. GR's 2005 restructuring plan called for the railway to restructure around five main topics: financial restructuring, asset restructuring, investment program and operational restructuring, organizational transformation and legal, regulatory and institutional reforms.[12] GR has made some progress on this reform in the areas that are under the railway's control.[13] GR has started reorganizing itself into strategic business units (SBUs): Passenger Operations, Freight Operations and Infrastructure. It is gathering accounting information by SBU and developing a strategic plan for each. GR has worked to rationalize its passenger service to reduce losses and has been reinvesting its profits in the railway assets. In interviews, customers noted that GR service had greatly improved and expressed confidence in working with GR management.

In October 2007, Georgia's Ministry of Economy officially invited interested private entities for submission of expression of interests on privatization of Georgian Railway. The deadline for submissions was January 25, 2008. However, no further action on the privatization has been taken.

[12] Booz Allen Hamilton, Strategy-Based Transformation and Implementation Plan for Georgian Railway (Oct. 2005), p. 5.
[13] Government's role in regulating railway tariffs, safety and other aspects remains unsettled. This hamper's GR's efforts to become more commercial.

4. CAUCASUS RAIL CORRIDOR—STRATEGY

The Caucasus Rail Corridor has some traffic, such as the Azeri products traffic, on which it can almost always rely. However, such secure traffic is a relatively small part of its total potential traffic volume. Most of the traffic on the corridor will come from shippers who are not members of the major shipper-owned pipeline consortia, or as "insurance" volumes from major shippers who do not want to commit themselves completely to one corridor—particularly a corridor through Russia. Much of the traffic has a choice of transport route—at least a dozen transport options are open to producers on the eastern shore of the Caspian.

This situation creates three challenges for the corridor. First, to attract traffic beyond the base of secure traffic, the corridor will have to offer competitive service. Second, to attract longer term traffic volumes, the corridor needs to leverage short term needs for its service into longer term commitments of traffic. Finally, the corridor needs to match investments to demand—a difficult task in a volatile market.

This chapter outlines a strategy for maximizing the attractiveness of the corridor, to attract the greatest volume of traffic to the corridor and increase predictability of traffic volume through establishing transport contracts. Both physical constraints and commercial issues must be addressed to attract such contracts.

MARKET ANALYSIS FOR THE CAUCASUS RAIL CORRIDOR

The traffic segments served by the corridor are:

- *Kazakh crude.* This traffic is likely to come from smaller producers around Aktau who do not have an allocation of pipeline capacity. Some traffic may also come from major producers in large fields like Tengiz, who wish to keep their transport options open. The Central Kazakhstan traffic previously carried by the Caucasus rail corridor will likely be redirected to China. The smaller flows have ready alternatives via Makhachkala and the Russian rail system, and through swaps arrangements with Iran. In the past, quality characteristics of the Tengiz crude were said to preclude it from using the Azeri pipelines, but now this difficulty appears to have been overcome. Consequently, none of the Kazakhstan traffic is captive to the rail corridor.

- *Kazakh product*. The volume of this traffic is likely to be very small, as refinery output is likely to be used domestically or exported to China and Central Asia. Only occasional consignments are likely and these will have competitive options via Makhachkala and direct rail through the Russian Railway (RZD).

- *Turkmen crude*. The volume of Turkmen crude traffic is uncertain, but Turkmen crude exports have never been very large. Swaps with Iran are an attractive option to the Caucasus rail corridor for this traffic.

- *Turkmen product*. This has historically been a steady, if small, traffic for the Caucasus rail corridor, but its recent diversion to routes via Makhachkala/RZD shows it is price-sensitive. Iran is also a potential alternative for this traffic.

- *Azeri crude*. This consists of traffic from producers who do not have access to the main export pipelines. A small amount of the traffic lacks access to the pipelines because of location. This traffic is relatively secure for the rail corridor. However, most of the Azeri production moving on the railway results from a commercial decision to contract for rail transport rather than pipeline transport. Such commercial decisions could be reconsidered when the contract expires.

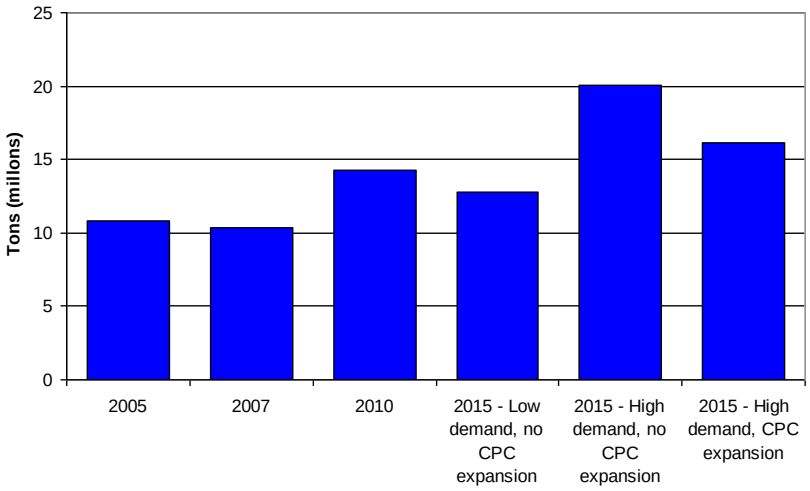
- *Azeri product*. Azeri refineries do not produce the mix of products consistent with current domestic market demand, so some products are exported. Nearly all of these exports use the Caucasus rail corridor. Azeri product is probably the closest thing to a captive traffic for the rail corridor. But like Turkmen products, they are always subject to competition from Russian railway.

- *Black Sea Refinery Traffic*. Investors in the ports of Batumi and Kulevi are exploring the possibility of building refineries at these ports. An important consideration in analyzing the profitability of these investments is whether reasonably priced, quality transport service is available for inbound crude.

This analysis of markets indicates that a base load of 3-4 million tpa of relatively secure traffic exists for the Caucasus Rail Corridor. The remaining traffic, however, has competitive options. At today's transport rates, the secure traffic represents revenue to the rail corridor of US$ 30-40 million per year. But the potential traffic represents revenue of a further $100 million per year—more in some demand/supply scenarios.

Annex 4 develops a "capacity driven" forecast of how Caspian Basin oil would be transported, by mapping expected demand to likely transport capacity. This analysis assumed that the relative attractiveness of the transport options remained the same. That is, the large pipelines such as BTC and CPC would be the most attractive to major producers with large volumes to transport, smaller pipelines would attract smaller volume flows, and rail routes/swaps would handle the "spill over" traffic. In this analysis, the Caucasus Railway Corridor was forecast to handle between 10 and 20 million tons in 2015, depending on demand and capacity supplied by other transporters.

Figure 7: Caucasus Rail Corridor, Traffic Forecast



The "capacity driven" forecast is only a starting point, however, in determining how much traffic might move on the Caucasus Rail Corridor. Most of the corridor traffic has competitive options. This means that, within the overall framework of supply and demand, the attractiveness of the Caucasus Rail Corridor compared to other transport options will determine the volume of traffic.

Some traffic will use the railway corridor because a short-term mismatch occurs between expansion in production and expansion in transport capacity. For example, production in the Kashagan field could ramp up ahead of expansion in the CPC pipeline. While such traffic would not be captive to the Caucasus Rail Corridor, the desire to use the corridor will be greater in the period of mismatch. But this market power will be temporary. As soon as the alternative is built, it will disappear.

Such short term spikes in demand are a problem for the corridor, because the capacity required to serve them is expensive and long lived. The railways cannot afford to expand their fleets and invest in infrastructure expansions for short term traffic. ***The most prudent commercial strategy in such a situation is to invest for the likely steady volume of traffic (e.g., about 10 million tons) and only invest to handle additional traffic if the traffic volume is secured by contract.*** Agreeing contracts with customers would leverage the short term need for railway capacity into longer term commitments for its use. This would allow the railways to match investments to predictable traffic volume and would allow the corridor to reap multiple year benefits from short term opportunities. However, to attract such contracts, the service providers in the corridor must transform themselves into desirable contracting partners.

ATTRACTING BUSINESS TO THE CORRIDOR

To leverage short term market advantage into longer term contracts, and to attract more of the traffic that has competitive options, the service providers along the corridor must transform themselves into desirable business partners that offer reliable and safe service at a competitive price. The Corridor is a logistics chain that will be evaluated on its performance as a whole, so any weak link in the chain—especially links like the railways that cannot be bypassed—will lose business for all the links in the chain.

When interviewed about the potential for the corridor, shippers indicated that they sought several characteristics in their transport providers:

- *Fair price*. Customers are looking for the price to be predictable and reasonable in terms of the cost of the service provided and the market situation.
- *Transparency & Commercial Structures*. Customers only want to contract with reliable, transparent, commercial partners.
- *Operational Reliability*. Customers are only interested in contracting with partners that they believe can actually deliver the service.
- *Environmental Reliability*. Customers require that their transporters be able to manage environmental risks and respond appropriately to any environmental damage that occurs.

Currently, customers give the corridor rather poor marks on these measures. ***If the service providers on the corridor want to attract the potentially large volumes of traffic available, they must improve their performance on these key measures. This requires addressing both the physical and commercial constraints in the corridor.***

REQUIRED ACTIONS

If the corridor is to attract the maximum amount of traffic and leverage its available capacity into long term contract commitments, it will need to address the concerns that prevent customers from contracting to use the corridor. The discussion above identified the significant actions needed to address these problems. These actions are summarized in the table below.

Table 4: Actions for Improving Competitiveness of Caucasus Rail Corridor

Problem	Action
Pricing	
Caspian Shipping	• Allow non-Azeri vessels to work in Azeri ports.
Azeri Port Monopoly	• Split ownership and operation of Dubendi, Sangachal (Azertrans) and Baku ports between three un-affiliated commercial firms
Georgia Ports	• Preserve competition among Georgian ports
ADDY/GR monopoly	• Regulate to ensure transparency of tariffs and access to railway services by all parties
Intermediaries	• End intermediaries control over railway traffic—promote competition between forwarders
Revenue Divisions	• Either develop a commercial marketing and revenue division agreement among service providers in the corridor or create enough competition among forwarders that forwarders fill this role.

Problem	Action
Transparency & Commercial Structures	
ADDY	• Carry out Restructuring Program • Increase transparency of Tariff Council actions
GR	• Continue executing the Strategy-Based Transformation and Implementation Plan, until private operator in place • If concession, Government select able, commercial private operator. • Government to clarify its tariff, safety and other regulatory roles
Operational Reliability	
ADDY	• Implement ADDY's 5 year investment program, including. – Rehabilitate East-West mainline – Replace power supply network on East-West mainline – Purchase 50 mainline locomotives – Eliminate locomotive changes along East-West mainline – Invest in additional locomotives and wagons to handle traffic growth after securing long term contract commitments covering the traffic. • Change operating practices to eliminate locomotive changes between Baku and Georgian border
GR	• GR continues its investment program, including: – Refurbishment/replacement of locomotives and wagons – Track & electrification rehabilitation • GR invest in capacity enhancements after securing long term contract commitments covering the traffic. – Retrofit brakes on locomotives and wagons – Restore ABS signaling to missing sections of mainline – Purchase additional locomotives and wagons – If traffic growth is in direction of Batumi Port, upgrade signaling and passing loops on Samtredia-Batumi line – Double track remaining section of Zestaponi-Samtredia line • Change operating practices to eliminate locomotive changes between Baku and Georgian border and stage port deliveries from Samtredia.
Environmental Response	
ADDY	• Adopt & implement draft Oil Spill Contingency Plan • Adopt recommendations in Gap Analysis for improvement of oil spill preparedness and response • Conduct additional training of staff • Upgrade response equipment & supplies
GR	• Develop, adopt & implement environmental response plan

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ANNEX 1: INTERVIEWS

Azerbaijan
Azerbaijan State Caspian Shipping Company (CASPAR), External Economic Affairs and Commercial Works Department
AzerTrans
Aztranspetrol/Baghlan/Transcaucasus, Logistics
Baku Port
British Petroleum and BTC Co
Chevron and TengizChevrOil
Corporate Solutions Consulting
Exxon Azerbaijan Operating Company LLC
McDermott Caspian Contractors, Inc
Meridian Shipping
Middle East Petroleum
State Oil Company of Republic of Azerbaijan (SOCAR), Marketing & Operations
TRACECA Office in Azerbaijan

Georgia
Association of Freight Forwarders of Georgia
Batumi Sea Port
British Petroleum
Chevron
Customs Department of Georgia
EBRD, Caucasus Office in Tbilisi
ExxonMobil International Ltd
Georgia Transit
Georgian Railway
Greenoak Group/Naftrans - Batumi Oil Terminal Owner and Batumi Port Concessionaire
International Railway Expedition (Freight-forwarder for SOCAR)
Kulevi Port - SOCAR
Maersk Georgia
National Transport Regulation Commission (former)[14]
Oil Spill Preparedness Regional Initiative (Caspian Sea- Black Sea – Central Eurasia)
PetroTrans Limited/Greenoak
Poti Oil Terminal – Channel Energy
Poti Sea Port

[14] This meeting took place before the closure of the National Transport Regulatory Commission.

Silk Road Group
SOCAR Energy Georgia

Kazakhstan
Exxon Almaty
KazMunaiGaz
Ministry of Energy and Natural Resources

ANNEX 2: OUTLOOK FOR OIL PRODUCTION IN THE CASPIAN

The Caspian Sea region has large oil reserves, which have only begun to be fully developed within the last decade. Strong competition exists between companies wishing to develop these reserves and between countries seeking to promote their routes for transporting the oil to market. The Caspian Sea itself (1100 km north to south) has six different hydrocarbon basins under its waters and adjoining countries also have onshore basins. Many of the nations in the Caspian Sea region—Azerbaijan, Iran, Kazakhstan, Russia, Turkmenistan, and Uzbekistan [15] —have historically been significant energy producers (see Table 2.1). Since the dissolution of the Soviet Union, production has particularly increased in Azerbaijan and Kazakhstan, with major investment, the introduction of modern technology and the development of new export outlets. The region's production in 2006 reached 112 million tons, and forecast 2010 production is estimated at 150-200 million tons.

Table 2.1: Caspian Sea Region Oil Production and Exports (million tons)

	Production			Net exports		
	1990	2000	2006	1990	2000	2006
Azerbaijan	13.0	15.5	32.5	3.9	7.8	26
Kazakhstan	30.1	35.9	66.1	5.5	27.6	57.1
Turkmenistan(1)	6.3	7.9	8.1	3.5	4.2	4.3
Uzbekistan	4.3	7.6	5.4	8.4	0.8	-0-
Iran(2)	-0-	na	na	-0-	-0-	-0-
Russia(3)	3.1	-0-	-0-	-0-	-0-	-0-
Total	56.7	66.8	112.1	4.4	40.7	73.3

Source: EIA, 2006, and BP Statistical Review of World Energy, 2007.
(1) Turkmenistan net exports are given for 2005.
(2) Only includes the regions near the Caspian.
(3) Only includes these regions bordering the Caspian Sea: Astrakhan, Kalmyk Republic, Dagestan, and Stavropol Kray.

Azerbaijan was the world's biggest oil-producing province in the early 1900s. The former Soviet Union did not have the technology, however, to develop the Caspian's offshore oil and gas reserves. Once the onshore Azeri oil was developed, the FSU focused its oil development on other onshore areas such as the Volga-Urals region and West Siberia. Most of the oil and gas reserves in the Caspian region (see Table 2.2) have not been developed, and many areas of the region remain unexplored. Most of Azerbaijan's oil resources (proven as well as possible reserves) are located offshore, as are perhaps 70 –

[15] Although Uzbekistan does not directly border the Caspian Sea, it is included in the Caspian region as it shares several of the region's hydrocarbon basins.

Map 2.1: Caspian Sea Oilfields

80 percent of the total oil resources of Kazakhstan. Proven oil reserves for the entire Caspian Sea region are estimated at 2.3 – 6.8 billion tons, equal to or larger than those in the United States (3 billion tons) or the North Sea (2.3 billion tons). The region's possible reserves (25.5 billion tons) are roughly equivalent to a quarter of the Middle East's total proven reserves.[16]

Table 2.2: Oil Reserves in the Caspian Sea Region

	Oil reserves (billion tons)		
	Proven	Possible	Total
Azerbaijan	1.0	4.4	5.3
Iran(1)	0.01	2.1	2.1
Kazakhstan	2.6-5.5	12.6	13.8-18.1
Russia(1)	0.04	1.0	1.0
Turkmenistan	0.1-0.2	5.2	5.3
Uzbekistan	0.04-0.1	0.3	0.4
Total	2.3-6.8	25.5	27.8-32.3

Source: EIA, 2006.
(1) Only includes the regions near the Caspian.

All countries except Russia and Iran have expanded oil production in the Caspian Region since 1992. Three major oil development projects have greatly expanded production in Azerbaijan and Kazakhstan. These are the Azeri, Chirag and deepwater Gunashli (ACG) fields in Azerbaijan, and the Tengiz and Karachaganak fields in Kazakhstan. These fields produced nearly 47 million tons in 2006—about 40 percent of the regional total. Production from these fields is expected to reach 100 million tpa by 2010. Since the mid-1990s, when these fields were initially developed, further major discoveries have been made at Shah Deniz (Azerbaijan) in 1999 (gas) and at Kashagan (Kazakhstan) in 2000 (oil). Developments in Uzbekistan and Turkmenistan have been smaller, partly because of their smaller resource endowments and partly because of their business environments.

The volume of oil exports is a function of both production and domestic consumption. Currently, most of Azeri and Kazakh crude oil is exported. Consumption in the Caspian countries is around 0.8 tons/person/year.[17] As the Caspian economies grow, their demand for petroleum products will increase, but probably more slowly than GDP,[18] leaving substantial volumes for export for the foreseeable future.

KAZAKHSTAN

Kazakhstan is currently the largest producer in the Caspian region, and likely to remain so for at least the medium-term. Most production is centered along and off-shore the eastern edge of the Caspian from Aktau to Atyrau and further north to the Russian border

[16] Source : EIA. However, the Middle East also has in addition vast possible reserves.
[17] The comparable figure for North America is around 3.3 tons /person/year; Western Europe averages around 1.5-2.0 tons/person/year, Eastern Europe around 0.8-1.3 tons/person/year.
[18] Analyses of the per capita demand in developing countries for petroleum products typically show elasticities with respect to GDP/person of about 0.7 and with respect to price of about -0.3. See e.g. A Literature review of Demand Studies in World Oil Markets, Atkins and Jayazeri 2004.

near Orenburg. A separate group of fields are centered on South Turgay and the Kumkol field in central Kazakhstan. Kazakhstan production in 2006 was about 66.1 million tons. Some 85 percent of this was crude oil and the remainder gas condensates. In 2006, production increased by about 7 percent.

Production from most of the existing smaller fields is likely to remain steady in aggregate for at least the medium-term. However, substantial growth is forecast from three large fields:

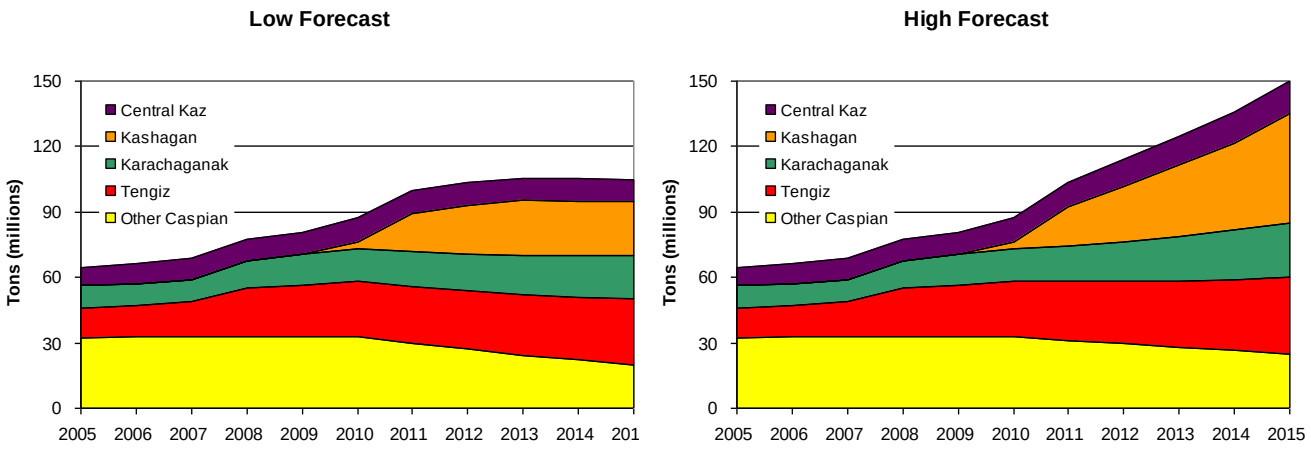
- *Tengiz*. Currently the single largest producing field, which produced 13.3 million tons in 2006. Its production is expected to nearly double to around 25 million tpa by 2010 as more sophisticated recovery techniques are used.

- *Karachaganak*. This field, near the Russian border, is also expected to increase production from its 2006 level of 10.4 million tons to over 25 million tpa by 2015, or perhaps later.

- *Kashagan*. This field, off-shore from Tengiz, will dwarf both Tengiz and Karachaganak. Production at Kashagan was originally planned to start in 2008 and reach full production of 60 million tpa by 2013. Because of delays in development, it is now unlikely to be in full production before 2015.

Some expansion is also expected in the South Turgay field, where production has been limited by the availability of transport to market. Now that it has a direct pipeline link to China, and production is expected to increase significantly.

Figure 2.1: Kazakhstan Oil Production Forecast



Source: Interviews with KMG, Kazakhstan Ministry of Energy, and other major producers.

Figure 2.1 summarizes the likely range of production over the coming decade. The upper production forecast is similar to the Kazakhstan government's estimates. The lower figures are closer to those used by the state oil company, KazMunaiGaz (KMG). A range

of technical, political and environmental uncertainties cause the substantial difference between the high and low forecasts.

Kazakhstan has three refineries with a combined capacity of 18 million tpa. Pavlodar, in Eastern Kazakhstan, is supplied with imported crude from Siberia. Shimkent, in Southern Kazakhstan, generally uses local crude from central Kazakhstan, together with some supplies from Siberia. Atyrau is fed by Caspian crude produced by KMG. In 2005, local demand was 11 million tons.

Kazakhstan is nominally self-sufficient in refinery capacity. The pattern of refinery supply and product distribution, however, is still predominantly north-south so regional imbalances occur. In addition, the refinery technology and crude oil characteristics do not match the current demand for the various products. Consequently, some regional cross-border trading and export of production surpluses occurs. Historically, these product exports were transported by rail to the Baltic ports, but more recently they have also been moved through Georgian ports. Although Atyrau refinery (dating from 1945) has recently been modernized, exporting crude is more profitable than exporting product.[19] Thus, significant volumes of refined products are unlikely to be exported for at least the medium-term.

Table 2.3: Kazakhstan Production, Export, Import & Consumption of Refined Oil Products (2004)

	Capacity (mill tpa)	Throughput (mill tpa)	Volume (000 tons)		
			Gasoline	Diesel	Fuel oil
Refineries					
Pavlodar	7.0	3.1	788	874	820
Atyrau	5.0	2.9	388	1136	1158
Shimkent	6.9	3.5	750	877	1102
Subtotal	18.9	9.5	1926	2887	3079
Import			802	525	196
Export			321	912	883
Total consumption			2407	2499	2392

Source: A review of the oil and gas sector in Kazakhstan, Kaiser and Pulsipher 2006 and various[20]

Recent export volumes of refined product have been around 2-3 million tpa. In early 2007 oil product exports by rail through Russia were running at about 3 million tpa, with imports from Russia at about 1.5 million tpa. Exports via Georgian ports were much smaller—130,000 tons in 2006.

Kazakhstan exports a much larger volume of crude oil—some 58 million tons in 2005. Crude imports are quite small. About 3-4 million tpa of Russian crude is imported to feed Pavlodar refinery and Russia has also been supplying the Shimkent refinery with 2 million tpa. Some Russian crude also transits through Kazakhstan en route to western

[19] The gain in value on the export market for product compared to crude does not offset the additional cost of refining and transporting product.

[20] Refinery outputs by product are estimated from 11 months data. Care should be exercised in using these data as inconsistencies exist in the available data.

China, partly for technical reasons to improve the flow characteristics in winter of the Kumkol crude exported from Kazakhstan.

Table 2.4: Forecast Exports of Crude & Oil Products – Kazakhstan (million tons)

	2005	2010	2015
Crude Oil			
Production	64.7	87.5	105-150
Import	6.0	4.0	2.0
Consumption	12.6	15.0	18.0
Export	58.1	76.5	89-134
Oil Products			
Production	12.6	15.0	18.0
Import	1.5	1.5	1.5
Consumption	11.1	13.5	16.5
Export	3.0	3.0	3.0

The analysis of production, consumption and imports described above is summarized in Table 2.4. This indicates that Kazakhstan is likely to export about 80 million tpa of oil and oil products by 2010 and 92 – 137 million tpa by 2015.

AZERBAIJAN

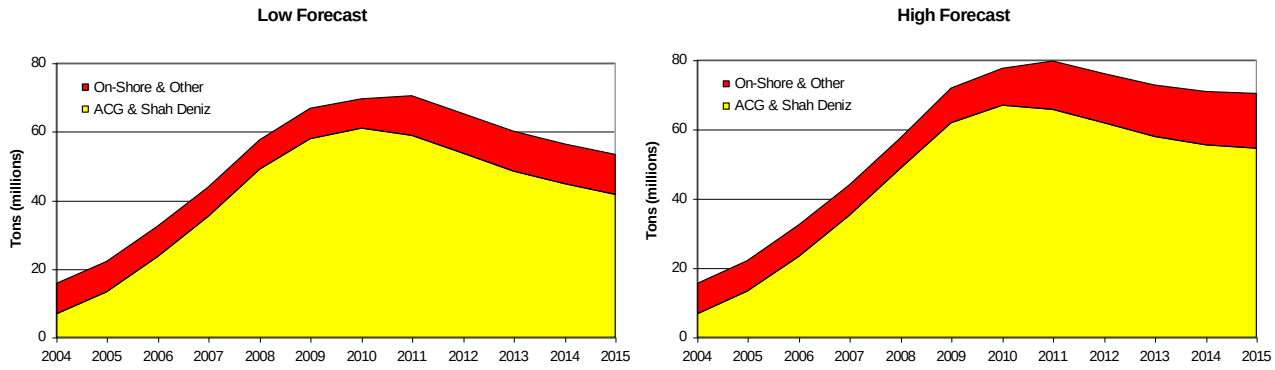
Azerbaijan produces a small amount of oil from several (reportedly high-cost) on-shore fields. However, almost all crude oil is now produced from off-shore fields, particularly the Azeri, Chirag, Gunashli (ACG) fields currently under development.

Although off-shore oil had been discovered in Soviet times, production was limited to the "shallow Gunashli" field, whose depth is up to about 120 metres. Production from this field has been relatively stable for several years but the field is aging and requires increasing maintenance. About 60 percent of the production from this field is refined in Azerbaijan, with the remainder exported through the Baku-Novorossiysk pipeline ("Northern Route").

The ACG fields have now become the main producing field in Azerbaijan. This is operated by the Azerbaijan International Oil Consortium (AIOC), consisting of the State Oil Company of Azerbaijan (SOCAR) and a number of international oil firms. In 1994, AIOC signed a 30-year contract to produce oil from the Azeri, Chirag, and deep-water portions of the Gunashli oil fields. These are located about 120 km offshore from Baku in the Caspian, with reserves estimated at 0.7 – 1.0 billion tons. Production began in the late 1990s, with "early oil" from the Chirag field averaging 7 million tpa. In early 2005, the Central Azeri field commenced production and the West and East Azeri fields have followed in 2006 and 2007. The final phase will see the "deepwater" Gunashli field reach full production by about 2010. By this time, total production from the ACG fields should reach 50-60 million tpa.

Several other major projects are either planned or have undergone preliminary exploration. However, results have generally been disappointing. None are expected to play a major role for several years, although there will be some minor contribution from condensates from the Shah Deniz gas field, which commenced operations in late 2006. A number of potential fields exist further out in the Caspian which have not been explored because sea-bed boundary disputes have not been settled. It is possible that at least some of these will be developed over the next decade, in which case Azerbaijan's production could remain at or above 60 million tpa at least until 2020.

Figure 2.2: Azerbaijan Oil Production Forecast



Source: Interviews with SOCAR and other major producers.

Azerbaijan has two large refineries in Baku, with a combined capacity of over 20 million tpa. Both plants are old and need overhauling, which is planned to take place over the next five years. These refineries are currently operating well below capacity, with domestic demand in 2007 at only about 6 million tons. Azerbaijan exported about 2.2 million tons of oil products, mostly to and through Georgia.

Azerbaijan exported about 26 million tons of crude oil in 2006, mostly to Turkey and Mediterranean ports for on-shipment to Europe. However, with the increased production from ACG and the opening of the BTC pipeline, exports have increased sharply and are expected to be over 60 million tpa by 2010.

The analysis of production, consumption and imports described above is summarized in Table 2.5. This indicates that Azerbaijan is likely to export about 63-71 million tpa of oil and oil products by 2010 and between 46 and 63 millions tpa by 2015.

Table 2.5: Forecast Exports of Crude & Oil Products – Azerbaijan (million tons)

	2005	2010	2015
Crude Oil			
Production	22.2	70 - 78	53.4 - 70.4
Import	-0-	-0-	-0-
Consumption	7.2	9.5	10.5
Export	15.0	60.2 - 68.2	43 - 60
Oil Products			
Production	7.2	9.5	10.5
Import	-0-	-0-	-0-
Consumption	5.0	7.0	8.0
Export	2.2	2.5	2.5

OTHER CASPIAN BASIN

Turkmenistan

For some years, Turkmenistan has been producing about 10 million tpa of crude oil.[21] In 1993, Turkmenistan adopted a program aiming to increase production to 28 million tpa by 2000 but foreign investment was hindered by the lack of a legal framework. Joint ventures in the southern Caspian Sea became trapped in disputes with the Government and production increased relatively slowly. Turkmenistan has also been engaged in disputes with Azerbaijan concerning the Caspian Sea reserves. With a new President, these may be resolved and development accelerated. Nevertheless, total production is unlikely to more than double over the next decade.

Turkmenistan has a refining capacity of 12 million tpa, which is used to about 60 percent of capacity. As it only consumes around 5.5 million tpa, it has been exporting around 4.5 million tpa of crude and refined products. These have been transported to regional destinations, principally Iran and Azerbaijan (for on-shipment), but are increasingly moving to Russia (also for on-shipment).

Turkmenistan exports amounted to 4 million tons in 2005, of which about 1.5 million tons was crude oil. By 2010, based on production and local consumption forecasts, exports could grow to 7 million tpa and reach 8 million tpa by 2015. However, this is dependent on a more positive approach to development without which the decline in exports in recent years (20 percent since 2003) will continue.

[21] However, DOE statistics give 2004 production (the latest year for which they have data) at 13 million tpa, up from 10.1 million tpa in 2003.

Table 2.6: Forecast Exports of Crude & Oil Products - Turkmenistan[22] (million tons)

	2005	2010	2015
Crude Oil			
Production	9.8	8.5 - 17.5	7.5 - 20
Import	-0-	-0-	-0-
Consumption	8.3	8.5 - 14.5	7.5 - 16
Export	1.5	0 - 3	0 – 4
Oil Products			
Production	8.3	8.5-14.5	7.5 - 16
Import	-0-	-0-	-0-
Consumption	5.8	6.75 - 10.75	7.5 - 11.75
Export	2.8	1.75 - 3.75	0 - 4.25

Uzbekistan

Although Uzbekistan increased oil and condensate production from 4 million tons in 1990 to an estimated 7.5 million tons in 2004, production then fell by 28 percent in 2006. Most current production is in the Bukhara region but the Government has identified a series of blocks for exploitation, including in the Fergana basin that it shares with Tajikistan and Kyrgyzstan. This is estimated to contain over 0.1 billion tons of oil in addition to a large quantity of gas.

Uzbekistan has a refining capacity of 12.5 million tpa. It has been importing crude oil from Russia to maintain refinery output. Uzbekistan now appears to be no longer self-sufficient in oil and it is unlikely to generate any significant exports over the next decade.

Caspian Russia

In early 2006, Lukoil discovered the first major oilfield for some years in the Russian sector of the Caspian. This field is likely to be brought into production by 2010 to provide feedstock for a petrochemical plant near Astrakhan. As with Uzbekistan, the production is likely to be used locally, and no significant exports are anticipated from the region.

SUMMARY

Crude oil production in the region will increase sharply over the next 5-10 years as the ACG fields in Azerbaijan are fully developed and as the major Kazakhstan fields, particularly Kashagan, increase production. By 2010, exports are expected to nearly

[22] Oil production and consumption data are not publicly available for Turkmenistan. Imports of both crude and product are low and assumed to be zero, because of lack of data. Exports only include those through ports. Exports exclude any cross-border trade in products with neighbouring countries.

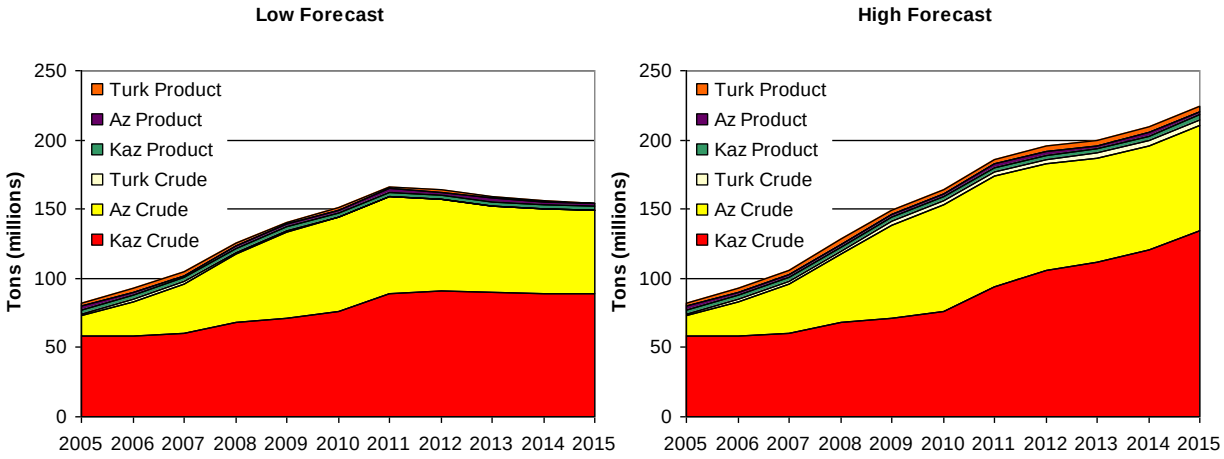

Low Forecast
High Forecast
Tons (millions)
250
200
150
100
50
0
Turk Product
Az Product
Kaz Product
Turk Crude
Az Crude
Kaz Crude
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

Figure 2.3: Forecast Caspian Export of Oil & Oil Products

double to over 140 million tpa. By 2015, the volume of exports needing transport to market is expected to rise further to 150-225 million tpa. Refined product will make up only a small proportion of this volume, coming mostly from Turkmenistan and Azerbaijan.

ANNEX 3: OIL FIELDS

Major Oil Fields in Caspian Region and Central Asia

Oil Field	Location	Ownership	Current Production (estimates)	Forecast Future Production (estimates)
Azerbaijan				
Azeri, Chirag, Gunashli Deep (ACG)	120 km offshore from Baku in the Caspian Sea	Azerbaijan International Oil Consortium (AIOC): BP (34.14%), UNOCAL 10.28%, INPEX Southwest Caspian Sea 10%, SOCAR 10%, Statoil 8.56%, ExxonMobil 8%, ITOCHU 3.92%, others (15.1%)	23 mln tpa	40-60 mln tpa (peak production in 2010)
Shah Deniz	100 km south of Baku offshore in the Caspian Sea	BP (25.5%), Statoil Azerbaijan (25.5%), SOCAR Azerbaijan (10%), Elf Petroleum Azerbaijan (10%), LukAgip N.V. (10%), Oil Industries Engineering & Construction (10%), Turkish Petroleum Overseas Company Limited (9%)	180,000 tpa	1.5-2 mln tpa
Kazakhstan				
Aktobe	Onshore Kazakhstan, north-west of Uzen	CNPC and Aktobemunaigaz (88%), within Block ADA partners include Korean National Oil Corp (KNOC), LG Intl Corp, Vertom	5-6 mln tpa	6 mln tpa
Arman	Onshore, Mangistau region of Kazakhstan	Lukoil (50%), Shell (50%)	180,000 tpa	Reserves: 1.5 mln t
Karachaganak	Onshore Kazakhstan near the Russian border	Karachaganak Integrated Organization (KIO): Agip (Italy) 32.5%; BG (UK) 32.5%; Chevron (US) 20%; Lukoil (Russia) 15%	10 mln tpa	20-25 mln tpa

Oil Field	Location	Ownership	Current Production (estimates)	Forecast Future Production (estimates)
Karakuduk	Onshore, Mangistau region of Kazakhstan	Lukoil	500,000 tpa	1 mln tpa
Karazhanbas	Onshore Kazakhstan, north-east of Aktau	Nations Energy	2.2 mln tpa	4-5 mln tpa
Kashagan	North Caspian offshore	Agip Kazakhstan North Caspian Operating Company (Agip KCO, formerly OKIOC): Eni, Total, ExxonMobil, and Shell (18.52%), ConocoPhillips (9.26%), KazmunaiGaz (8.33%), Inpex (8.33%)	Not producing	25-50 mln tpa by 2015
Kazgermunai	Central Kazakhstan onshore	Petrokazakhstan (a subsidiary of the China National Petroleum Corporation, 50%), KazmunaiGaz (50%)	2 mln tpa	2 mln tpa Reserves: 55 mln t
Kumkol (North)	Central Kazakhstan onshore, South Turgay	Turgai Petroleum: Petrokazakhstan (CNPC - 50%), and Lukoil (50%). Legal dispute between CNPC and Lukoil led to ownership change of North Kumkol oilfield to LUKoil's benefit and dilution of CNPC share in South Kumkol.	3 mln tpa	11-15 mln tpa
Kumkol (South)	Central Kazakhstan onshore, South Turgay	Petrokazakhstan Kumkol Resoure (PKKR, owned by CNPC) - 100%	3.1 mln tpa	
Kurmangazy	North Caspian offshore	KazmunaiGaz 50%, Rosneft/Zarubezhneft 50%	Not producing	0.3-1.2 bln tons of oil reserves
Mangistau	Onshore Kazakhstan, east of Aktau, Mangistau region of Kazakhstan	Mangistaumunaigaz	5-6 mln tpa	5-6 mln tpa Reserves: 190 mln t

Oil Field	Location	Ownership	Current Production (estimates)	Forecast Future Production (estimates)
North Buzachi	Onshore in the Mangistau province of Kazakhstan	Lukoil 50%, China National Petroleum Corporation 50%	750,000 tpa	1.7 mln tpa Reserves: 130-200 mln t
Tengiz	Along the northeast shores of the Caspian Sea, western Kazakhstan, north of Atyrau	TengizChevroil (TCO): Chevron (US) 50%; ExxonMobil (US) 25%; KazmunaiGaz 20%; LukArco (Russia) 5%	14 mln tpa	30-35 mln tpa
Uzen	Onshore in the Mangistau region of Kazakhstan	Uzenmunaigaz (KazmunaiGaz subsidiary) 100%	7 mln tpa	5 mln tpa
Turkmenistan				
Cheleken	Offshore west of Cheleken peninsula, in Turkmen part of Caspian	Dragon Oil (UAE)	430,000 tpa	Reserves: 82 mln t
Nesbit Dag	Onshore western Turkmenistan near Caspian Sea	Burren Energy (UK)	1.5 mln tpa	Reserves: 13-14 mln t

ANNEX 4: TRANSPORT OPTIONS FOR CASPIAN OIL

In 2005, Caspian oil and oil products exports moved over four main transport routes:

- North and west through the Russian pipeline and rail network (including the CPC pipeline (~66 percent of regional exports in 2005),
- West through Azerbaijan and the Georgian Black Sea ports (~ 22 percent),
- South through Iran (~ 8 percent in 2005),
- East to China by rail (~ 4 percent in 2005).

Since 2005, two major pipelines have opened and production has grown rapidly. This is changing the historical transport pattern. These changes are due not only to the availability of additional capacity, but also to the apparent desire of both Kazakhstan and Azerbaijan to reduce dependence on Russian routes, because of a history of tariff problems and the risk of arbitrary closure.

This annex summarises the key characteristics of the existing oil transport infrastructure and the main projects proposed to provide the additional capacity required to handle projected growth in production. Map 4.1 (next page) shows the network with its existing capacities. Map 4.2 (at the end of this annex) shows the network in 2015, given planned capacity expansions.

THE PIPELINE SYSTEM

In the mid-1990s, all pipelines in the Caspian region had been built as part of the internal Soviet Union network and were oriented towards Russia. The main Caspian Basin countries were linked by pipeline to each other, but until the mid-1990s the only export pipeline for Caspian crude oil was the Atyrau-Samara pipeline from Kazakhstan, which feeds into the Russian export pipeline system. New transportation routes have therefore been developed, and will continue to need to be developed, to carry Caspian oil to world markets.

Russia has commercial and political interests in continuing to tranship Caspian oil from the Caspian region. Oil producers in the region, however, have sought other options because of concerns about reliability, security, tariffs, lack of a quality bank (which reduces returns for Kazakh and Azeri producers) and access to Russia's existing pipeline system. Moreover, Russia's pipeline network, even where under-utilised, lacks the

capacity to absorb all of the forecast output of the Caspian region. Finally, most existing oil export pipelines terminate on the Black Sea, requiring tankers to then transit the congested and ecologically and politically sensitive Bosporus to gain access to the Mediterranean and world markets.

Map 4.1: Oil Transport Options—Estimated Capacities for 2006

As a result, multiple routes for Caspian oil exports have been pursued and a major pipeline was built from Baku to Ceyhan on the southern coast of Turkey. The Baku-Tbilisi-Ceyhan (BTC) began operations in 2006 to carry output from the expanding ACG field. The current transport system for oil exports is shown in Map 4.1. Construction of a subsea Trans Caspian pipeline has been proposed as one alternative for transporting

increased oil volumes across the Caspian to the BTC pipeline. Russia and Iran are opposing this project for political and environmental reasons. Given the impossibility of constructing the Trans Caspian pipeline without approval of all littoral states, the project has been delayed indefinitely, and oil from Kazakhstan is planned to be moved across the Caspian by tanker to Azerbaijan, at least for the foreseeable future.

Table 4.1: Existing and Proposed Crude Oil Pipelines serving the Caspian

Pipeline	Route	Capacity (mln tpa)	Length (km)	Status
AIOC - Northern Route (NREP)	Baku-Novorossiysk via Chechnya	6	1400	Operational
AIOC – Western Route (WREP)	Baku-Supsa (Georgia)	7.3	885	Under repair, operational by end of 2007
Northern Route - Chechnya bypass	Azerbaijan/Russia border-Terskoye (Russia) via Dagestan	16	328	Operational
Baku-Tbilisi-Ceyhan (BTC)	Baku-Georgia-Ceyhan, Turkey	50	1780	Operational
Atyrau – Samara	Atyrau (Kazakhstan)-Samara (Russia)	20	695	Operational
Kenkiyak – Orsk	Kenkiyak (Kazakhstan)-Orsk (Russia)	6.5	400	Operational
Kenkiyak – Atyrau	Aktobe fields – Atyrau (Kazakhstan)	12	448	Operational
Karachaganak - Atyrau	Karachaganak-Atyrau (Kazakhstan)	9	635	Operational
Caspian Pipeline Consortium (CPC)	Tengiz (Kazakstan)– Novorossisk	30, maybe rising to 65	1580	Operational but expansion delayed
Kazakhstan – China	Aktyubinsk area (Kazakstan) –Xinjiang (China)	10, rising to 20	Eastern section: 962 km Western section: 448 km	Eastern and Western section operational, central section not constructed (1)
Trans – Caspian	Aktau–Baku/ Makhachkala	20 – 25	600 or 300 (under sea)	Feasibility Study
Kazakhstan – Iran				Suggested, unlikely
Turkmenistan - Afghanistan - Pakistan (possibly Uzbekistan)	Charjou (Turkmenistan) -Gwadar (Pakistan)	50	1,600	Deferred indefinitely
Turkmenistan -Persian Gulf (may extend to Kazakhstan)	Turkmenbashi-Kharg Island (Iran)	10 – 20	1500	Unknown

Source: EIA, 2006 and interviews.
(1) Remainder of route uses other existing pipelines.

Pipelines from Northern Caspian

Three pipelines operate from the northern Caspian: The Atyrau-Samara pipeline, Kenkiyak-Orsk pipeline and the Caspian Pipeline Consortium (CPC) pipeline. Historically, most of Kazakhstan's oil exports entered the Russian pipeline system (Transneft) through the Atyrau-Samara pipeline. This had a capacity of 12 million tpa for many years (since increased to 20 million tpa). Kazakhstan's exports via this route are limited by Kazakhstan's annual oil export quota through the Russian pipeline system and the lack of an agreement with Russia on transportation tariffs. Although no longer Kazakhstan's main export route, Transneft has been guaranteed 17.5 million tpa of Kazakh oil for the next 15 years under an inter-governmental agreement of 2002. Some 15 million tpa flows through the Atyrau-Samara pipeline to Transneft. The remainder is shipped across the Caspian and loaded to Transneft at Makhachkala.

A second group of export pipelines is the Kenkiyak-Orsk line, which carries oil from the Aktyubinsk fields to the Orsk refinery in Russia and the Krachagank-Orenburg pipeline, which carries condensate to Orenburg. The pipeline has a capacity of 6.5 million tpa. It is used for an oil swap arrangement in which Kazakhstan supplies oil to the Orsk refinery in Russia and receives an equivalent amount of Russian oil through the Omsk-Pavlodar pipeline for processing at the Pavlodar refinery in Kazakhstan.

The 1580-km Caspian Pipeline Consortium (CPC) pipeline was opened in 2001. It links the Kazakh fields to a terminal north of Novorossiysk. CPC was developed by the governments of Russia, Kazakhstan, and Oman in conjunction with a consortium of international oil companies. It operates outside the immediate control of Transneft. The initial capacity of the CPC pipeline is nominally 28 million tpa. Two feeder pipelines from Kenkiyak[23] and Karachaganak have been constructed independently, and in 2005 throughput was 31 million tons. Throughput has since increased even further, to around 35 million tons in early 2007, by using drag reducing chemicals.

CPC's owners plan to increase the pipeline's capacity to 65 million tpa by 2009. Expanding the pipeline is proving difficult, however. Russia appears to be trying to assert control over the pipeline in various ways, including legal steps related to licence conditions, and is keen to increase the tariff from the current $28.25 per ton to at least $30.73 per ton. Russia has also taken steps to transfer its shares in CPC to Transneft, the direct competitor of CPC. Recently, Russia is reported to have agreed to expand the capacity of CPC to 40 million tpa[24]. This follows an announcement of the Bosporus bypass pipeline (see below) and suggestions that Kazakhstan might more actively develop routes through Azerbaijan. The timing of the expansion remains uncertain.

[23] Actually, the western section of the Kazakhstan-China pipeline.
[24] "Putin's Energy Victory," Turkish Weekly, May 11, 2007. Also in "Weekly News Review" of Kazakh Embassy, Brussels, June 10, 2007.

Pipelines from Baku

Currently, three pipelines operate from the western shore of the Caspian: Baku–Novorossiysk pipeline, the Baku-Supsa pipeline, and the BTC pipeline. The Baku–Novorossiysk pipeline (known as the Northern route in Azerbaijan) was created by reversing an existing Soviet pipeline that previously had delivered Russian crude to the Baku refineries and extending it to the AIOC terminal for off-shore oil at Sangachal. Subsequently, a bypass to avoid Chechnya was also constructed. The route passes close to the Russian port of Makhachkala, to which it is also connected, thus allowing access for crude oil from the eastern side of the Caspian.

Baku–Novorossiysk pipeline is 720 mm in diameter and has a reported capacity of 6 million tpa. This could be expanded to around 15 million tpa by adding additional pumping stations at a cost of approximately US$ 300 million. The oil exported from Azerbaijan is not physically transported to Novorossiysk through this pipeline. Rather, Transneft receives the Azerbaijan crude into its system and then supplies an equivalent volume of lower-quality (probably West Siberian) crude at Novorossiysk. Transneft does not operate a "quality bank." Producers such as AIOC that feed higher-quality crude into the system are not fully compensated for the quality of their crude, thereby introducing a hidden cost into their use of the network. The tariff on the Baku- Novorossiysk pipeline, including port costs, was reported to be about $16.43 per ton in 2004.

The Baku-Supsa pipeline (known as the "Western route") was constructed in 1998 by refurbishing a partially constructed product pipeline in Azerbaijan and connecting it to a disused crude oil pipeline running from northwest of Tbilisi to Batumi. This was also refurbished as far as Supsa, where an off-shore loading facility was constructed. The pipeline diameter is 530 mm with a capacity of 7 million tpa. As with the Northern route, the capacity can be increased to about 10 million tpa by adding further pumping stations (at an estimated cost of US$ 100 million). The Baku-Supsa pipeline was closed in mid-2006 because of corrosion and a landslide but is expected to reopen late in 2007.

The BTC pipeline opened in mid-2006. It runs parallel to the Western route as far as Georgia but then turns south through Turkey to Ceyhan on the Mediterranean coast. This pipeline has a 1067 mm diameter, and is capable of transporting around 50 million tpa of crude oil. It is currently moving some 31 million tpa. Capacity can be increased to 60-65 million tpa by employing drag reducing chemicals and to 80 million tpa by also adding additional pumping capacity.

The BTC pipeline is owned by a consortium which is similar, but not identical, to the ACG consortium. (See Annex 3 for ownership/control of oil fields and Annex 6 for ownership/control of pipelines.) As Kashagan is developed, it is likely that the 15 percent of the pipeline owned by Conoco/ENI/Total will be used for their production (assuming a solution is found to transporting it across the Caspian). It could also be used in the interim for other Kazakh and Turkmenistan crude oil, and reportedly even for Tengiz crude.[25]

[25] Tengiz crude mercaptans and would need to be segregated to use the BTC pipeline.

Pipeline to China

The 962 km eastern section of the Kazakhstan-China pipeline provides the first direct link between oilfields in Central Kazakhstan and the Chinese market. It links Kazakhstan's South Turgay basin and the Russian pipeline system to refineries in western China. Deliveries to the Dushanzi refinery began in July 2006. The initial capacity (and throughput) of the line is 10 million tpa, with oil coming from both Kazakhstan and Russia. In addition to production from the Kumkol fields in South Turgay (now majority owned by China's China National Petroleum Corporation (CNPC), Kazakh oil is also delivered by rail for insertion into the pipeline from fields in the northwest of the country (Aktobe), also being developed by CNPC.

In addition to the segment that operates east to China, the pipeline has a separate segment, completed in 2003 that runs westward from CNPC's Aktobe field to Atyrau near the Caspian Sea. The final stage of the pipeline project will link the two sections and allow oil to flow either east to Atyrau or west to China. It is scheduled to open in 2011, with the final capacity planned as 20 million tpa.

Cross Caspian Pipeline

Kazakhstan has negotiated space in the BTC pipeline for future Kashagan oil production, but how to deliver that oil to Azerbaijan remains unanswered. Construction of a direct subsea Trans Caspian pipeline connection from Aktau to Baku has been proposed as one alternative. However, Russia and Iran oppose the construction of any pipelines crossing Caspian seabed for political reasons and environmental risks the pipeline would pose to the Caspian ecosystem. Given the difficulty of constructing the Trans Caspian pipeline without approval of all littoral states, the pipeline is unlikely to be built in time to handle the boost in Kashagan production. Thus, transportation by tanker across Caspian remains the likely means of moving oil from Kazakhstan to Azerbaijan at least for the foreseeable future.

Other Pipeline Routes

The total capacity of the existing and currently planned pipelines (including the uncertain CPC expansion) described above is about 175 million tpa. This could handle the lower end of the forecast for oil exports from the region. Thus, most of the growth in production during this period can potentially (and in practice probably will) be transported by pipeline. However, a gap exists between Kazakhstan, which will supply most of the additional crude, and the three pipelines starting in Azerbaijan. This gap will either have to be handled by a direct pipeline from Kazakhstan to Azerbaijan or through shipping to the western or southern shores of the Caspian.

Several options have been proposed for pipelines to transport oil from Kazakhstan and/or Turkmenistan across the Caspian to Azerbaijan. These would avoid Iranian or Russian territory and connect with the export pipelines flowing westwards. For example, a 2002 study of alternative routes recommended the use of barges for volumes up to 7.5 million

tpa and a pipeline (or pipelines) for higher volumes.[26] The route was from Aktau to either Makhachkala (if capacity on the Baku-Novorossiysk pipeline were available) or to a point close to the Azeri-Russian border and on to Baku. Russia and Iran are opposed to the construction of any pipelines crossing the Caspian, ostensibly on environmental grounds but almost certainly also for geo-political reasons. It appears, therefore, that any west-bound Kazakh export oil that does not use the Transneft or the CPC pipeline will therefore need to be shipped across the Caspian.

CASPIAN SHIPPING OPTIONS

All crude and product shipments from Turkmenistan and a significant portion of the crude from Kazakhstan are likely to require shipment across the Caspian.

Caspian shipping

At the break-up of the former Soviet Union, the Caspian Sea Fleet was assigned to the country of its home port. The main shipping company, the Caspian Shipping Company (Caspar), had registered its ships in Baku and they were therefore assigned to Azerbaijan. This left Kazakhstan and Turkmenistan without a fleet. Caspar remains the largest shipping company in the region, particularly for dry cargo.

The Caspar fleet is fairly old, with an average age of over 20 years, many of the vessels are in poor condition[27], and few comply with international conventions or best modern operating practice. In total, 86 tankers are operating on Caspian Sea. Forty are managed by Meridian Shipping; 46 belong to others.[28]

Meridian Shipping, owned by Middle East Petroleum (MEP), has been contracted by Caspar to operate the Caspar fleet. Meridian Shipping currently has a monopoly for shipping to and from the Azeri ports. One of the main freight forwarders on the Caspian (and the only one serving Baku), Cross Caspian is also controlled by MEP.

Until recently Caspar handled around 90 percent of all cross-Caspian oil shipments. The absence of competition resulted in comparatively high freight rates, e.g. (Aktau–Makhachkala: US$ 7-9 per ton, Aktau–Baku / Dubendi: $US 7-8 per ton; Aktau– Neka: US$ 12-12.5 per ton), some 40-50 percent higher than equivalent rates outside the Caspian. The market to non-Azeri ports has recently become more competitive with the arrival of three Russian shipping companies:

- Palmali is a Turkish company which operates a total of around 100,000 dwt of modern tankers under the Russian flag with the support of Lukoil.

[26] Gulf Interstate Engineering, 2002.

[27] Around two-thirds of its tonnage will need to be replaced by 2010 as Marpol regulations require the scrapping of its older single hull vessels.

[28] Vessels can reach the Caspian Sea from the Black Sea via the Volga-Don Canal, and from the Baltic Sea via the Volga-Balt Canal. Draft restrictions on the two canals so limit the size of vessel which can be used to around 10-12,000 dwt.3.5 metres on the Volga-Don and 3.0 metres on the Volga-Balt Canal. There are also air draft and width restrictions whilst navigation is limited by ice to the summer period (1 May – 15 November). Foreign flag vessels require permission from the Russian authorities to use the Volga-Don Canal, whilst only Russian and Caspian flag vessels are allowed to use the Volga Balt Canal.

- Volgotanker, has up to 10 tankers totalling 50,000 dwt in the Caspian in the winter months. It transfers most of them to the Russian river trades during the summer season. The ships are small and over 20 years old, but are unlikely to be replaced by larger vessels designed for the Caspian because the company's core business lies in the Russian river trades.

- Safinat NJ, is the shipping subsidiary of Makhachkala port. It operates five tankers of around 6,000 dwt on bareboat charter between Makhachkala and Aktau.

Iran is planning to establish a shipping company and Kazakhstan is committed to the development of a substantial national fleet. In 1998, Kazakhstan established Kazmortransflot (KMTF) as the national shipping line. KMTF is a subsidiary of the national oil and gas corporation, KMG. By 2006, KMTF owned 8 vessels, including three new 12,000 dwt tankers. Its long-term needs include larger tankers to handle the Kashagan output when it comes on stream after 2010. At present, KMTF can operate into Russian and Iranian ports, but not Azerbaijan ports.

Consequently, competition remains limited on routes to and from Azerbaijan. To ship oil from Kazakhstan or Turkmenistan through the Caucasus Corridor, a customer must arrange transportation through Cross-Caspian[29] (i.e. MEP) and ship FOB Aktau or FOB Turkmenbashi on a Caspar (i.e. MEP) vessel to an MEP terminal. This provides many opportunities for monopoly pricing. The increase in tariffs for transport FOB Aktau to Batumi in 2006 suggests that these do not go unnoticed. Such rate increases are said to be behind the recent reduction in traffic through the Caucasus corridor.[30]

[29] Cross- Caspian is a freight forwarder created together by Socar and Middle East Petroleum (MEP). Shareholders are: Socar 34percent, KafkazTrans (MEP) 33percent, Aztransrail (Transkafkaz) 33percent.

[30] "Georgian Railways Quest for Cargo: Is it a transport monopoly or the new BTC pipeline that's behind the country's freight woes?" www.georgiatoday.ge (22-06-07 – 28-06-07.

Table 4.2: Trans-Caspian Oil Transport 2003 – 2006 (thousand tpa)

Destination	2003	2004	2005	2006
Kazakhstan/Crude Oil				
Azerbaijan	2,852	2,989	3,003	2,281
Iran	1,050	1,507	2,098	4,330
Russia	3,068	3,730	3,717	3,429
Total	**6,971**	**8,225**	**8,817**	**10,040**
Turkmenistan/Crude Oil				
Azerbaijan	1,568	566	849	237
Iran	290	799	660	991
Russia	0	0	0	5
Total	**1,858**	**1,364**	**1,509**	**1,233**
Turkmenistan/Oil Products				
Azerbaijan	2,525	2,283	1,874	1,434
Iran	406	701	657	607
Russia	0	0	3	556
Total	**2,931**	**2,984**	**2,534**	**2,603**

Source: Industry Interviews, 2007.

CASPIAN OIL PORTS AND TERMINALS

Kazakhstan currently has only one major port, at Aktau. It is, however, planning to build a build a new oil terminal for Kashagan crude at Kuryk, south of Aktau, to be fed by pipeline. Turkmenistan operates two crude oil terminals at Ajala and Okarem as well as a rail-ferry terminal and a refinery/oil terminal (Ufra) at the main port of Turkmenbashi. Azerbaijan has three oil terminals in the Baku area, in Baku port, Dubendi and Sangachal. In Russia, the main receiving port is at Makhachkala, whilst Iran receives Caspian oil at Neka. More information about the Caspian Ports is contained in Annex 7.

Kazakhstan

The port of Aktau is the principal seaport of Kazakhstan. It is located on the Caspian Sea in Southwestern Kazakhstan. The port is owned by the State Enterprise Aktau International Sea Commercial Port. Aktau port comprises five oil berths (with a fifth under construction), three general cargo berths, a grain terminal, a rail ferry berth which is used for part of the time by oil tankers, and a small basin for port craft and other small boats. The four oil berths are leased to the national shipping company KazMorTransFlot to operate for 49 years. The capacity of Aktau oil terminal at end 2005 was around 13.5 million tpa: 10-11 million for oil and 2.5 million for products.

The approach channels and oil berths have 6 metre drafts, allowing oil tankers of up to 12,000 dwt. In 2001 three of the four oil berths were leased to KazMorTransFlot, the

national shipping company, for 49 years[31]. In addition, a fifth oil berth was built for Mobilex in 2005. The port is served by rail, and a rail ferries operates 3-4 times per week to Baku, with a 50:50 mixture of rail wagons (almost all oil) and trucks (general cargo). The capacity of Aktau port at end-2005 was around 10-11 million tpa for oil and 2.5 million tpa for other traffic.

Oil traffic through Aktau has grown strongly from 3.4 million tons in 2000 to over 10 million tons in 2006. Some 35% of this traffic was shipped to Makhachkala for onward movement to Novorossiysk by pipeline (mostly) and rail. Another 43 percent was shipped to Neka for oil swaps. The remaining 22 percent was shipped to Azerbaijan ports.

Aktau's 2004 Port Development Plan included four new oil berths. However, in 2005, it was agreed that KazMorTransFlot, with the support of its parent company KazMunaiGaz and other oil companies, would be developing an alternative plan for the construction of new oil berths at Kuryk, 70km south of Aktau. The new terminal will be able to handle 60,000 dwt tankers as opposed to the 12 – 15,000 dwt vessels that can be handled at Aktau. It is expected to open in 2011. Planned initial capacity is 25 million tpa, increasing to 40 million tpa as Kashagan production ramps up. (See Annex 4 for details on the Kazakhstan Caspian Transport System.) The Kuryk project will reduce the need for new oil berths at Aktau, perhaps even causing the loss of some existing traffic.

Turkmenistan

Turkmenistan has two oil terminals at Okarem and Adjala and a major port at Turkmenbashi. Ports are state owned by Turkmen Maritime and River Lines, which has the status of a ministry. The two oil terminals handle small volumes of crude oil and oil products (mostly products). The capacity of Tukmenbashi Oil Terminal is around 3. million tpa. The main port at Turkmenbashi is being renovated. Okarem is planned for expansion into a second major Caspian port.[32] In total, the Turkmen ports handled about 3.6 million tons in 2006, of which about 1.5 million tons were despatched to each of Neka and Baku and the remainder to Makhachkala. In 2006 Turkmenistan had eight merchant marine vessels of more than 1,000 tons displacement, of which four were cargo ships, two oil tankers, one refrigerated cargo, and one combination ore and oil ship.[33]

Iran

The Iran's Caspian oil port is at Neka. Neka has seen its throughput fluctuate considerably in recent years, driven by a swap arrangement between Kazakhstan, Turkmenistan and Iran. The Caspian crude is received at Neka port and transported by pipeline to refineries near Tehran. In exchange, Iran makes an equivalent amount of its own oil available at the Persian Gulf, for payment of a fee of $10.95 to $14.60 per ton. During early 2004, Iran upgraded Neka port and the domestic pipelines to increase route

[31] This was revoked in June 2006 but now appears to be restored again.
[32] *Country Profile: Turkmenistan,* Library of Congress – Federal Research Division, February 2007
[33] Ibid

capacity from around 2.5 to 7.5 million tpa. In late 2006, capacity was increased further to 12.5 million tpa with plans to reach 25 millions tons in early 2007. Iran also plans to expand its refinery capacity in northern Iran—Tehran, Tabriz and a new refinery near Neka—to 25 million tpa. This route has clear advantages over the Black Sea routes for marketing Caspian oil to the growth markets of East and South Asia. Caspian crude shipments to Neka have trebled in the last two years from 2.5 million to nearly 7.5 million tpa.

Azerbaijan

Azerbaijan has one major port, the Port of Baku, and oil terminals at Sangachal and Dubendi.

Baku. Baku International Sea Port is state owned and functions as a landlord port. It has an old ferry/general terminal in the centre of the city, together with two rail-connected oil terminals. Baku Port handles about 5 million tpa. Most of the port's traffic is transit oil; dry cargo through the main port accounts for less than 3 percent of total traffic. The ferry terminal is functioning at only 10 percent of its real capacity, taking small volumes of cargo in rail tank wagons from Turkmenbashi and Aktau. The ferry terminal was constructed in 1963. Its two berths are in poor condition, as are the associated facilities (e.g., access ramps, link spans, paved areas).

Baku Oil Terminal's capacity is 6 million tpa, which is not fully used. Storage capacity is 86,000 tons[34]. The terminal can transfer oil/oil products to rail: it has the capacity simultaneously load 20 rail tank wagons with crude and 34 with product. The Baku terminal does not have pipeline access. The Baku oil terminal is leased to Middle East Petroleum (MEP).

Dubendi. Dubendi Oil Terminal is owned by State owned by SOCAR, and contracted out for operation to MEP.[35] The Dubendi oil terminal is located some 40 km to the northeast of Baku, across from Pirallahi Island, and has a natural breakwater. It has two operational jetties and a capacity of 10 million tpa for oil transshipment. Storage capacity is 250,000 tons. A pipeline links the terminal with a rail loading facility some 4 km inland. The rail loading facility has the capacity simultaneously load 78 rail tank wagons with crude and 32 with product.

Dubendi also has a pipeline connection to the Northern pipeline. This has been disused for many years and would require rehabilitation before it could be used again. As long as the Northern pipeline continues to flow north, Dubendi will continue to be isolated from BTC and the Western pipeline. A new pipeline could be constructed to the AIOC terminal at Sangachal. Such a connection has been proposed for several years and is

[34] The storage capacities were provided in m^3 but for comparison purposes in the study they were converted to tons on the basis of conversion factor 1 m^3 = 0.86 tons for heavy oil, and 1 m^3 = 0.83 tons for light oil.
[35] Owned by Azersun Holdings, an industrial conglomerate. Dubendi, together with the Baku city terminals, was previously owned by Azpetrol, whose assets were taken over by Azersun Holdings in early 2006.

likely to be constructed if the Dubendi terminal is expanded to receive Kazakh oil. The Baku oil terminal, owned by Azertrans, has no pipeline connection.

Sangachal. The Sangachal area contains two terminals, which are connected by pipeline.

- The Sangachal port is located about 45 km south of Baku. It has two moorings for 10 – 12,000 dwt tankers. The transshipment capacity of the terminal is 13 million tpa. Storage capacity is 172,000 tons; four more tanks of 17,200 tons each are under construction. This terminal has a rail loading facility. It is owned by AzerTrans, and operated by MEP.

- A separate Sangachal on-shore terminal receives oil by pipeline from the off-shore ACG field and is connected to the BTC, Northern and Western pipelines. This terminal is owned by AIOC.

The two terminals, about 12 km apart, are linked by pipelines (one flowing in each direction). Thus off shore oil can flow to the AIOC Sangachal terminal, through the connecting pipeline to the MEP operated terminal and be loaded by rail. Similarly, tankers of Kazak oil can be unloaded at the MEP operated Sangachal terminal and be moved by pipeline to the AIOC Sangachal terminal for further movement by pipeline.

Garadagh. Ocean Energy, in association with MEP, is constructing a new oil terminal at Garadagh, about 40 km south of Baku city. Once this is completed the current Baku terminal will be closed. The new terminal, designed for trans-Caspian shipping of the new Kazakh production, will be able to handle 60,000 dwt tankers and have a capacity of 10-20 million tpa.

Traffic through the Azeri ports is shown in the table below. Note that Sangachal port was not operational in 2006.

Table 4.3: Oil Traffic into Azerbaijan Ports, 2003-2006 (thousand tpa)

Route	2003	2004	2005	2006
Ex Kazakhstan (tanker)				
Aktau-Sangachal	345	404	594	0
Aktau-Baku	1,601	1,176	1,290	571
Aktau-Dubendi	910	1,470	1,138	1,705
Total	2,856	3,050	3,022	2,276
Of which crude oil	n.a.	n.a.	2,916	2,246
Ex Kazakhstan (railferry)	79	103	n.a.	n.a.
Ex Turkmenistan (tanker)				
Oil products				
Turkmenbashi-Sangachal	134	197	107	0
Turkmenbashi-Baku	1,019	935	543	269
Turkmenbashi-Dubendi	1,346	1,165	1,255	1,192
Subtotal	2,499	2,297	1,905	1,461
Crude oil				
Aladja-Sangachal	212	28	76	0
Aladja-Baku	364	152	118	62
Aladja-Dubendi	30	191	248	63
Subtotal[(1)]	606	371	442	125
Ex Turkmenistan (railferry)	1,023	288	n.a.	n.a.

Source: CASPAR, Port of Baku, ADDY.
[(1)] Some exports from Okarem may occur, which are not included in this table.

CAUCASUS RAIL LINK

The railways of Azerbaijan and Georgia link the Caspian ports in Azerbaijan and the Black Sea ports in Georgia. During the Soviet period, the railways were part of one larger railway, and were built and operated to the same technical standards. The railway link is a double track, electrified mainline. The railway corridor carried 10 million tons of oil and oil products in in 2005 and 12 million in 2006, but is down in 2007.

The railway corridor has the potential infrastructure capacity to carry twice the traffic it did in 2005/6. However, capacity is currently constrained by the poor condition of railway assets. The locomotive fleet is a concern for both railways, but particularly for Azerbaijan Railway (ADDY). More than half of ADDY's fleet of locomotive is well past its service life and need urgently to be replaced. Because of this constraint, the railway has been strained to handle current volumes of oil. ADDY has large investment programs for the next five years, and Georgian Railway (GR) is planned for privatization, which would entail heavy investments. If implemented, these investments would position the corridor to handle an increasing volume of traffic.

See Annex 8 for additional information on the railway corridor.

BLACK SEA AND MEDITERRANEAN PORTS

The main Black Sea port for handling oil and oil products are Batumi, Poti, Supsa and Kulevi in Georgia and Novorossiysk in Russia.

Batumi

In 2006, Batumi Port handled 1 million tons of dry cargo (largely imports) and 12 million tons of oil and oil products. Traffic in 2007 is expected to be lower, as crude traffic has diverted to Iran and other rail routes. The port is currently operating at nearly 80 percent of its capacity and has plans to expand. This would increase capacity from 15-16 million tpa to 28 million tpa, of which 25 million tpa would be for oil. A new container terminal (12 metre draught) is under construction. The terminal can handle vessels of 20,000 – 50,000 dwt at its three jetties and up to 130,000 dwts at an offshore loading buoy mooring.

Batumi Oil Terminal adjacent to the port trans-shipped 12 million tons of crude and oil products in 2006 (normally about 60-65 percent is crude). Its current storage capacity is 570,000 tons, with a rail discharge capacity of 600 tank wagons per day.

In 1999, the Batumi Oil Terminal was bought by Greenoak Holdings in 1999, who also leased all other berths from the Batumi Port Authority. In June 2006, Greenoak took over the management of the Port in a 49 year concession. In February 2008, Greenoak sold Batumi Oil Terminal and Batumi Port to the Kazakh State Company KazMunaiGas. Batumi Terminal's current storage capacity is 570,000 tons, with a rail discharge capacity of 600 tank wagons per day.

Crude oil and refined product come from Azerbaijan (including some from AIOC) and crude oil from Kazakhstan. A forwarding company, Petrotrans[36], is responsible for all transport and logistics, replacing the previous arrangement in which customers would have to separately deal with the oil terminal, Batumi Station and GR.

A closed refinery is located in the Batumi port area. The refinery was supplied through a pipeline from Khashuri to Batumi, which had fallen into disrepair. In the late 1990s, Mitsui agreed to rebuild this refinery as a modern plant with a capacity of 2 million tpa, but this project was never carried out. In March 2007, it was announced that that Greenoak and KazmunaiGaz would jointly develop a new 5-7 million tpa refinery at a cost of about US$ 1 billion.[37] This is expected to be fed with Kazakh crude. No information has been released on whether the feedstock would be transported by rail or by a rehabilitated pipeline.

[36] Petrotrans, a subsidiary of Nafrtans, was established in July 2004 to increase the efficiency of the route, providing combined transportation and transshipment services from Gardabani, on the Azeri-Georgian border, to FOB Batumi.

[37] Batumi in 2007 and Beyond: Ready for Fair Competition , Ruseckas, GIOGE, March 2007 and Georgia Today, April 6, 2007.

Poti

Poti Sea Port is currently a state-owned landlord port that leases out berths on a long term basis. In July 2007, the Georgian Ministry of Economy announced a tender to concession the Port of Poti with an adjacent land of 400 hectares for 49 years for development of free economic zone. Eleven companies have expressed interest, and the short-listed parties have been notified and requested to submit proposals by January 25, 2008.

The port handled 6.9 million tons in 2006. This included 1.25 million tons of liquid cargo (mostly light oil products) and 2.6 million tons of general cargo. The remainder is bulk traffics such as sugar. Seventy-five percent of the cargo is transit traffic to/from Azerbaijan and Armenia, while 15 percent is to/from Central Asia.

The berths have draughts of 8-10 metres, which can be deepened by continuous dredging up to 11.5 metres. The port has reached its capacity of 7 million tons per year and is now developing extension areas. Some 80 hectare of vacant land belonging to the port are planned to be developed into a free trade zone by the Government of Georgia.

Poti Oil Terminal, adjacent to the port, is owned by Channel Energy, a joint venture of Poti Port (25 percent) and Delta Group from Turkey (75 percent). The terminal handles light oil products (gasoline and kerosene) only, mostly transit traffic from Azerbaijan to Europe, and from Europe to Armenia. The terminal occupies 2 acres with 8 tanks and has a total storage capacity of 103,200 tons. Its design capacity is 3 million tpa. The daily rail tank-car (RTC) discharge capacity is 10,000 tons (48 RTC simultaneously). The terminal feeds one dedicated berth, which allows loading of 35,000 ton vessels, and one berth shared with the ferry terminal. The terminal complies with international quality standards, safety and environmental protection, including a full oil spill contingency plan that is regularly reviewed and updated.

Oil traffic in 2007 is forecast to increase to over 1.5 million tons. Eighty percent of the products are from Azerbaijan (Heydar Aliev Oil Refinery transported by Silk Road), with 10 percent each from Kazakhstan and Turkmenistan (Turkmenbashi Oil Refinery transported by Total).

Kulevi

Kulevi Port is a new port currently under construction. It is owned by a consortium of SOCAR (51 percent), Middle East Petroleum (34 percent) and Georgian individual investors 15 percent). The port will operate two berths (13.6 m and 6.13 m deep, which will accommodate 100,000 ton and 40,000 ton vessels respectively). An offshore buoy mooring located 4 km from the shore in an area which is 17.1 m deep will allow the loading of 100,000-120,000 ton vessels.

Kulevi is expected to handle 4-5 million tons of crude oil in 2007, increasing to 10 million tons in 2008. Its planned annual capacity is 10 million tons, comprising 3 million tons of crude oil, 3 million tons of diesel and 4 million tons of fuel oil. The port capacity

can be readily increased to 20 million tpa in the future. Kulevi plans to expand to handle oil products from Kazakhstan, Turkmenistan and Azerbaijan, and to add a dry cargo terminal. Construction of an oil refinery is also under discussion.

The oil terminal has storage capacity of 275,200 tons (50 percent for crude oil, 25 percent for diesel and 25 percent for fuel oil). This could be increased to 326,800 tons. The terminal is linked to the main railway network by a private 14 km branch line, currently under construction. The terminal can discharge four 42-RTC trains simultaneously.

Supsa

Supsa, the terminus of the Western Route pipeline, is a modern oil terminal with an off-shore mooring point capable of handling vessels of 150,000 dwt. The terminal is owned by the Georgian Pipeline Company and has four 40,000-ton capacity reservoirs. The pipeline extends from the terminal to the single buoy mooring. Prior to the opening of the BTC pipeline, the port was handling up to 7 million tpa but is currently inoperative while the Western pipeline is under repair.

Novorossiysk

Two oil ports are located near Novorossiysk, one in the port itself and the CPC one nearby at Yuzhnaya-Ozereyevka. The Novorossiyst port is one of Russia's main ports, situated in non-freezing Tsemess bay. The port includes a general cargo area and the the Sheskharis oil harbour and terminal. In 2006, the port handled 80 million tons, of which 28 mln tons was dry and fluid cargo, and about 52 mln tons of oil and oil products[38]. Some 95 percent of oil capacity and 90 percent of dry cargo capacity were used in 2006.

Sheskharis is connected to the most important oil-producing regions of Syberia, Kazakhstan and Azerbaijan. The main berth of the terminal was built in 1978 and has been operating for 28 years without overhaul. It has a very deep draft—24 meters—and can accommodate VLCC vessels (up to 250,000 dwt). The length of the mooring for the oil terminal is 2.2 km. It is fed by the part of the Black Sea pipelines of Chernomortransneft JSC,[39] which also feed Odessa and Tuapse and have a total capacity of around 65 millions tpa. In 2006, Sheskharis Oil Terminal transshipped 52 million tons of oil and oil products, of which about 47 mln tons was crude oil. The terminal handles about 30% of Russia's export oil shipped via sea terminals. Capacity is being expanded to about 85 million tpa.

The depth at dry-cargo terminals is 13.5 meters, allowing the port to accept panamax vessels. The length of the mooring line for the dry-cargo terminals is 4.5 km. The general cargo terminal specializes in handling grain, sugar, metal, scrap, mineral fertilizers, refrigerated goods, and timber.

[38] *NCSP official website*, retrieved August 2007
[39] Chernomortransneft is a subsidiary company of Transneft.

Novorossiysk Commercial Sea Port (NCSP) is a Holding Company which has over 50 percent of shares of the largest stevedoring and service companies of city Novorossiysk and Kaliningrad Region such as: Novoroslesexport OJSC, Novorossiysk Ship-Repair Yard OJSC, IPP OJSC, Fleet of Novorossiysk Commercial Sea Port PJSC, Novorossiysk Grain Terminal OJSC and Baltic Stevedoring Company LLC. NCSP plans the reconstruction of berth No. 1, as well as reconstruction and overhaul of basic technological equipment of Sheskharis oil terminal. Implementation of a reconstruction project will allow the new cargo area to handle 80,000 dwt to 150,000 dwt tankers, and will increase transshipment of oil cargo by 15 million tpa provided that the capacity of ChernomorTransNeft pipeline system is increased. The port's overall annual throughput is expected to increase to 110 million tons by 2010. The terminal is scheduled to be put into operation in February 2008.[40]

The CPC terminal is separate institutionally and physically from Novorossiysk port. It is located at a place called Yuzhnaya-Ozereyevka on the Black Sea, as opposed to Novorossiysk port, which is in a bay. It is owned and operated by Caspian Pipeline Consortium (Russian 24%, Kazakhstan 19%, Oman 7%, 50% between Chevron-Texaco, Lukoil, and other petroleum companies). The oil terminal is linked to the CPC pipeline. The CPC terminal has a capacity of 30 million tpa that can be increased to 67 million tpa if the CPC pipeline is expanded.

THE BOSPORUS & BOSPORUS BYPASS ROUTES

An important factor in determining export routes for the large forecast volumes of oil is that most westwards export routes from the Caspian pass through the Black Sea and the Bosporus Straits en route to the Mediterranean Sea and world markets. Oil exports through the Bosporus have grown significantly since the dissolution of the Soviet Union in 1991 and now reach 100 million tpa. Concern is growing that the projected Caspian export volumes will exceed the capacity of the Bosporus to accommodate the tankers. Turkey is concerned that the projected increase in large oil tankers would pose serious navigational, safety and environmental threats to the Bosporus. These concerns are recognised in international law and reflected in the Law of the Sea Convention.

Turkey has imposed stringent rules on shipping through the Bosporus, including spacing tankers and limiting large vessels to daylight hours. This already causes backups of many days during bad weather and during the winter, when daylight hours are limited. A significant increase in the volume of oil seeking to exit the Black Sea via the Bosporus would likely choke on this bottleneck.

Whilst the introduction of a modern navigation system could improve the safety, capacity and smooth operation of the Bosporus, export routes which bypass the Bosporus are also needed. BTC, which carries oil to Ceyhan on Turkey's Mediterranean coast, was the first such project.

[40] *NCSP to exceed a hundred*, PortNews Information Agency, 2007

The next most likely route around the Bosporus is the proposed Burgas-Alexandropoulos pipeline. This pipeline would link the Bulgarian port of Burgas on the Black Sea with Alexandropoulos on the Mediterranean coast of Greece. Plans for this pipeline have languished for nearly 10 years, but in March 2007, it was announced that a consortium of three Russian companies will own a 51 percent stake in the pipeline venture, with Greece and Bulgaria dividing the remainder.[41] Planned capacity is 30 million tpa. Russia appears to be linking agreement on CPC expansion to its construction. In May 2007, it was reported that Russia has agreed to allow Kazakh participation in the project.[42]

THE TRANSPORT NETWORK IN 2015

The transport network and routes will continue to change over time. The Map 4.2 shows the network in 2015, if planned capacity enhancements take place. The network will be dominated by two pipelines BTC and CPC—if Russia permits expansion of CPC. This will be supplemented by smaller-capacity rail, port, shipping and pipeline links.

[41] International Herald Tribune, March 15, 2007.
[42] Turkish Weekly, May 11, 2007.

Map 4.2: Oil Transport Options—Estimated Capacities for 2015

ANNEX 5: FUTURE TRANSPORT PATTERNS

This annex discusses possible patterns of future export flows of oil from the Caspian region. The current transport network is not equipped to handle the huge upsurge in production that is expected. As traffic increases from 80 million tons in 2005 to 152 million tons in 2010 to as much as 200 million tons in 2015, the existing outlets will fill and additional capacity will be needed. How the traffic will flow depends in great part on the expansion of the two large-capacity pipelines.

If both BTC and CPC are expanded, the transport network should be quite adequate to handle the projected traffic. If CPC is not expanded, the volume carried by the smaller capacity options (other pipelines, rail, swaps) would increase but, under the high forecast, these would also reach capacity and a medium-capacity route such as the Kazakhstan-China pipeline would need to be expanded to handle all the traffic. Until decisions on these pipeline expansions are taken, the flow of traffic cannot be forecasted with any great certainty.

KEY INFRASTRUCTURE DEVELOPMENTS

The two most important factors affecting future transport patterns are the increasing production in Kazakhstan over the next few years and the more aggressive steps being taken by the Caspian countries to reduce their dependence on Russia for transport. Russia's apparent willingness to use pipelines as a political tool, and its efforts to impose energy policies on other countries within the region, appear to have led both Kazakhstan and Azerbaijan to start developing alternative transport corridors as a matter of priority. Recent experiences with CPC suggest that Russia is intending to eventually absorb it (or at least the Russian section) into Transneft, with any future decisions on capacity expansion being made on the basis of Russia's interests as much as Kazakhstan's. As a result, the preferred route for at least part of the new Kazakh production is likely to be through the BTC pipeline rather than through CPC. At the same time, the recent dispute between Azerbaijan and Russia over gas prices, and similar incidents involving other countries, appears to have accelerated Azerbaijan's moves to develop alternative routes.

In the short-term, production from the Tengiz field is likely to increase in 2007-2008 by up to 12.5 million tpa. With little prospect of CPC being expanded in time, in February 2007, agreement in principle was reached to export Tengiz oil by tanker to Baku and then through the BTC pipeline and also to move it by rail to Odessa. In April 2007, however, Kazakhstan also announced that Russia would remain the main export route for Kazakh oil for the foreseeable future.

In January 2007, a Memorandum of Understanding was signed on the creation of the Kazakhstan Caspian Transport System (KCTS). KCTS would transport around 50 million tons of crude oil when the Kashagan field is developed, probably some time after 2010. KCTS consists of a pipeline from Atyrau, where the Kashagan crude comes ashore and is processed, to the new port of Kuryk, which will be designed to handle tankers up to 60,000 dwt. From Kuryk the crude would be moved by tanker to Baku. From Baku, most of the crude would flow into BTC and be delivered to Ceyhan in Turkey. Small amounts might also move by rail to Georgian ports or the Baku-Supsa or Baku-Novorossiysk pipelines. The expected cost of the KCTS is about $3 billion consisting of: (a) the pipeline from Atyrau to Kuryk, (b) the port at Kuryk, (c) three new 60,000 dwt tankers, (d) the refurbishment/construction of terminals in Azerbaijan, and (e) pipelines connecting the terminals in Azerbaijan with the BTC pipeline.

At the same time, increasing volumes are likely to be exported through both Iran and China. The growth in Iran, in particular, is likely to be relatively strong, given its plans to increase both its pipeline capacity from Neka, and its refining capacity in northern Iran, to 25 million tpa. In the longer-term, the middle section of the Kazakhstan-China pipeline could be completed, providing an eastern route for North Caspian production. With a design capacity of 20 million tpa, this pipeline could handle either production from Aktobe only, or, with some flow reversals, from Aktobe and Atyrau.

The level and pattern of rail traffic through the Caucasus will also be affected by the final development and ownership of the three Georgian ports on the Black Sea and on the market structure of the other transport links in Georgia and Azerbaijan. Currently, KMG has an interest in Batumi Port and has stated it intends to reopen the oil refinery there. Meanwhile, SOCAR is developing the new port at Kulevi, again possibly with a refinery. This would presumably handle Azeri crude (up to 20 million tpa, according to press reports).

Thus, a total port capacity of around 30-40 million tpa together with two planned refineries are in play on the Black Sea coast. This probably represents at least twice the throughput that would naturally flow through the Caucasus if only economic and not political factors were involved.

THE RAPIDLY CHANGING PATTERN OF FLOWS – 2005 TO 2007

The transport routes for oil from the Caspian Basin encompass a complex and rapidly changing network of pipelines, railways, ports, shipping and railways. Tables 5.1 and 5.2, and Figures 5.1 and 5.2, demonstrate how rapidly traffic has shifted during the last two years.

Table 5.1: Export Routes and Volumes – 2005 (million tons)

Transport Routes	Kazakh Crude	Kazakh Product	Turkmen Crude	Turkmen Product	Azeri Crude	Azeri Product	Total
Russia							
CPC pipeline	25.8						25.8
Transneft ex Makhachkala[1]	3.7						3.7
Transneft other	17						17
Russia rail	2.9[2]						2.9
Baku-Novorossiisk					4		4
Subtotal	49.4				4		53.4
China/Central Asia							
Rail	3.5	2.7					6.2
Pipeline	0						0
Subtotal	3.5	2.7					6.2
Caucasus/Turkey							
Baku-Supsa					6.6		6.6
BTC					0		0
Caucasus rail[3]	3	0.3	0.8	1.9	2.6	2.2	10.8
Subtotal	3	0.3	0.8	1.9	9.2	2.2	17.4
Iran	2.1		0.7	0.7			3.5
Total	58	3	1.5	2.6	13.2	2.2	80.5

[1] All products and a small proportion of crude by rail.
[2] Probably about half for exports outside FSU.
[3] Includes about 500 – 750,000 tpa of Azeri and Turkmen oil products consigned for Georgia domestic use.

Figure 5.1: Export Routes of Caspian Basin Oil – 2005

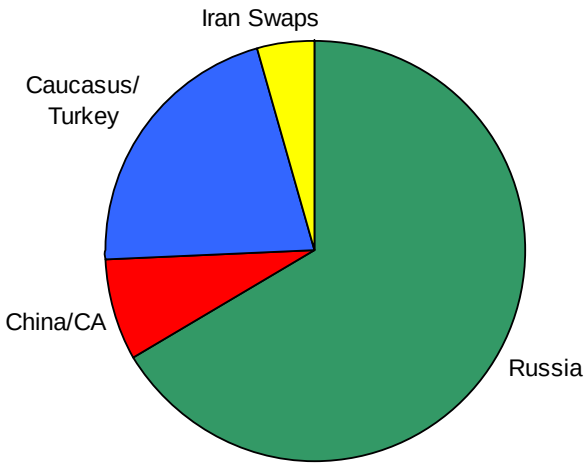


Table 5.1 and Figure 5.1 summarize the export flows and routes from the Caspian Basin in 2005. About two-thirds of total exports from the region transited through Russia, with nearly a quarter traveling through the Caucasus/Turkey and the remainder moving to Iran as swaps or to China and Central Asia. About 71 percent was transported by pipeline and 25 percent by rail. The remainder (Iran swaps) was transported by tanker. The CPC pipeline was the single most important route, carrying 32 percent of the total; the Samara pipeline carried the second largest volume. Although the rail route through the Caucasus carried around 11 million tpa, [43] this included relatively small volumes of crude and product from each of the three countries.

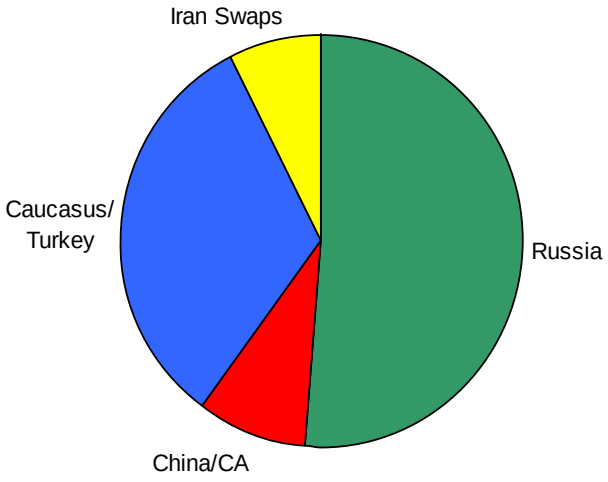
[43] About 10 million tons of transit oil and 0.6 million of oil products for Georgia.

Table 5.2: Export Routes and Volumes – 2007 (million tons)

	Kazakh crude	Kazakh product	Turkmen crude	Turkmen product	Azeri crude	Azeri product	Total
Russia							
CPC pipeline	25.8						25.8
Transneft ex Makhachkala[1]	3			1			4
Transneft other	15.8						15.8
Russia rail	2.8[2]						2.8
Baku-Novorossiisk					5.1[4]		5.1
Subtotal	47.4			1	5.1		53.5
Chin/Central Asia							
Rail	0.9	2.9					3.8
Pipeline	5.5						5.5
Subtotal	6.4	2.9					9.3
Caucasus/Turkey							
Baku-Supsa							
BTC					23.5		23.5
Caucasus rail[3]	2	0.1	0	1	6	1.2	10.4
Subtotal	2	0.1	0	1	29.5	1.2	33.9
Iran	5.8		1.5	0.6			7.9
Total	61.6	3	1.5	2.6	34.6	1.2	104.5

[1] All products and a small proportion of crude by rail.
[2] Probably about half for exports outside FSU.
[3] Includes about 500,000 – 750,000 tpa of Azeri and Turkmen oil products consigned for Georgia domestic use.
[4] Azeri volume using Novorossiysk in spite of government policy, but much reduced on planned volume.

Figure 5.2: Export Routes of Caspian Basin Oil - 2007



By early 2007, the transport pattern had changed significantly. The total volume exported from the region has increased by nearly 30 percent, largely due to the increase in ACG production. Most ACG production is exported through the BTC pipeline, which is now carrying over 25 million tpa. At the same time, the Western route to Supsa is closed for repairs.

The opening of the Kazakhstan-Chinese pipeline from Atasu to Dostyk has captured crude oil traffic previously carried by rail to China and through the Caucasus. Swaps with Iran have increased. Some of the Kazakh and Turkmen traffic have partly switched from the Caucasus rail route to the Makhachkala – Novorossiysk route (by rail for product and largely by pipeline for crude) in response to

price increases in Azerbaijan. Overall, Russia now handles just half of the region's exports, with the Caucasus handling nearly a third. China/Central Asia and Iran have both increased their shares at Russia's expense. Rail's share has reduced from 25 to about 17 percent.

PATTERN OF FLOWS IN 2010

By 2010, the total volume exported from the region is expected to increase by up to 50 million tpa[44] or by nearly 50%. About 70% of this growth will come from the ACG field and the remainder mostly from Tengiz. The growth in ACG production is expected to mostly be exported through the BTC pipeline, although this may be reduced if substantial diversion to Kulevi port occurs.

Since the CPC pipeline is full, if it is not expanded, the incremental Tengiz production will need to find alternative routes. These are likely to be (in approximate order of priority):

- Rail routes through Russia to the northern Black Sea ports,
- Tanker to Azerbaijan and export through BTC (this would almost certainly be via Sangachal marine terminal),
- Rail routes through the Caucasus, for which it is committed for a minimum throughput (this could be either through Sangachal or Dubendi port).

The Kashagan production is expected to travel through BTC using KCTS. Other changes affecting the smaller flows include maintenance (and possible increase) of the Iran swaps, and continuing switching of Turkmen products between the Caucasus and Makhachkala routes depending on pricing.

Table 5.3 summarizes the possible pattern of export flows in 2010, taking into account the above developments. Overall, Russia would handle 40 percent of the region's exports, with the Caucasus share increasing to half. Rail share would remain steady at about 18 percent.

[44] Upper bound; but the lower bound is only about 8 million tons.

Table 5.3: Export Routes and Volumes – 2010 (million tons)

Route\Traffic	Kazakh crude	Kazakh product	Turkmen crude[3]	Turkmen product[3]	Azeri crude	Azeri product	Total
Russia							
CPC pipeline	26						26
Transneft ex Makhachkala[1]	2			0.5			2.5
Transneft other	18						18
Russia rail	9						9
Baku-Novorossiisk					6.5		6.5
Subtotal	55			0.5	6.5		62
China/Central Asia							
Rail	1	2.7					3.7
Pipeline	6						6
Subtotal	7	2.7					9.7
Caucasus							
Baku-Supsa							
BTC	7				53.8		60.8
Caucasus rail[2]	3	0.3		0.5	8	2.5	14.3
Subtotal	10	0.3		0.5	61.8	2.5	75.1
Iran	4.5			0.8			5.3
Total	76.5	3		1.8	68.3	2.5	152

[1] Product and some crude by rail.
[2] Includes about 500-750,000 tons per year of product for Georgian domestic consumption.
[3] Turkmenistan flows based on mid-point of forecast range.

PATTERN OF FLOWS IN 2015

Considerable uncertainty exists about the export volume for the Caspian Basin by 2015. It depends on whether further discoveries are made to prolong the life of the ACG and associated fields in Azerbaijan and the level of production that can be obtained from Kashagan. Consequently, the total volume exported from the region is expected be somewhere between 135 and 205 million tpa.

The low case represents a flattening of export volume compared to 2010, with the rundown of the Azeri fields being compensated by the growth in Kashagan. In this scenario, little change would occur in the overall pattern, with BTC volumes remaining stable at about 60 million tpa. Instead of Azeri crude representing 90 percent of the volume, however, by 2015 about half of the volume would be from Kazakhstan. As a result, Russia's share of the exports would reduce further to less than 40 percent and the Caucasus would handle about 55 percent.

Table 5.4: Export Routes and Volumes – 2015, Low Forecast (million tons)

Route\Traffic	Kazakh Crude	Kazakh Product	Turkmen Crude	Turkmen Product	Azeri Crude	Azeri Product	Total
Russia							
CPC pipeline	26						26
Transneft ex Makhachkala[(1)]							0
Transneft other	18						18
Russia rail	7						7
Baku-Novorossiisk							
Subtotal	51						51
China/Central Asia							
Rail		2.7					2.7
Pipeline	4						4
Subtotal	4						6.7
Caucasus							
Baku-Supsa					4.7		4.7
BTC	26				30.8		56.8
Caucasus rail[(2)]	5	0.3			5	2.5	12.8
Subtotal	31	0.3			40.5	2.5	74.3
Iran	3						3
Total	89	3			40.5	2.5	135

[(1)] Product and some crude by rail.
[(2)] Includes about 750,000-1,000,000 tons per year of product for Georgian domestic consumption.
[(3)] Turkmenistan flows based on mid-point of forecast range.

The high forecast is a greater test on the transport network. The additional 45 million tpa from Kazakhstan and 17 million tpa from Azerbaijan will use all the available capacity on both BTC and CPC. Although some additional capacity is available in the Transneft system and on minor routes such as rail through Russia and the various routes through the Caucasus, such a large increase can only be accommodated if a major new pipeline is made available. The most likely pipeline to be built is the missing link in the Kazakhstan-China pipeline from Kumkol to Kenkiyak, which is currently under serious consideration by both countries. With this pipeline link, the high forecast can just be accommodated within the system without the expansion of CPC. In such a case a comparatively large volume would travel by high-cost non-pipeline routes.

Under this scenario, even greater diversion from Russia occurs, with barely a third of the regional exports transiting Russia, while half move through the Caucasus and 10 percent to China.

Table 5.5: Export Routes and Volumes – 2015, High Forecast & No CPC Expansion (million tons)

Route\Traffic	Kazakh Crude	Kazakh Product	Turkmen Crude	Turkmen Product	Azeri Crude	Azeri Product	Total
Russia							
CPC pipeline	26						26
Transneft ex Makhachkala[1]	1			1.5			2.5
Transneft other	27.5						27.5
Russia rail	7						7
Baku-Novorossiisk					6		6
Subtotal	61.5			1.5	6		69
China/Central Asia							
Rail		2.7					2.7
Pipeline	18.5						18.5
Subtotal	18.5	2.7					21.2
Caucasus							
Baku-Supsa					7		7
BTC	46				34		80
Caucasus rail[2]	5	0.3		1.8	10.5	2.5	20.1
Subtotal	51	0.3		1.8	51.5	2.5	107.1
Iran	3		4	1			8
Total	134	3	4	4.3	57.5	2.5	205.3

[1] Product and some crude by rail.
[2] Includes about 750,000-1,000,000 tons per year of product for Georgian domestic consumption.
[3] Turkmenistan flows based on mid-point of forecast range.

If the CPC pipeline is expanded, the high forecast is less of a strain on the transport network. In this case, the extra capacity on CPC would be used by the North Caspian production. This would reduce pressure on the other routes and make extending the Kazakhstan-China pipeline unnecessary in strict capacity terms. Table 5.6 shows the likely distribution of traffic over routes, if CPC is expanded to 67 million tpa.

Table 5.6: Export Routes and Volumes – 2015, High Forecast & CPC Expansion (million tons)

Route\Traffic	Kazakh Crude	Kazakh Product	Turkmen Crude	Turkmen Product	Azeri Crude	Azeri Product	Total
Russia							
CPC pipeline	57.5						57.5
Transneft ex Makhachkala[1]	1			1.5			2.5
Transneft other	27.5						27.5
Russia rail	1						1
Baku-Novorossiisk					2		2
Subtotal	87			1.5	2		90.5
China/Central Asia							
Rail		2.7					2.7
Pipeline	8						8
Subtotal	8	2.7					10.7
Caucasus							
Baku-Supsa							
BTC	35				45		80
Caucasus rail[2]	1	0.3		1.8	10.5	2.5	16.1
Subtotal	36	0.3		1.8	55.5	2.5	96.1
Iran	3		4	1			8
Total	134	3	4	4.3	57.5	2.5	205.3

[1] Product and some crude by rail
[2] Includes about 1.5-2 million tons per year of product fro Georgian domestic consumption
[3] Turkmenistan flows based on mid-point of forecast range

The analysis of transport capacity and demand indicates that by 2010, if CPC is not expanded, a significant shortage of capacity approximately 8.5 million tpa will have developed in Kazakhstan ports. Even with CPC, by 2015, capacity will need to be expanded by 27-38 million tpa (depending on production). Kazakhstan is planning to build a new port at Kuryk, to address this issue, and purchase three new tankers to expand tanker capacity on the Caspian. Planned port capacity expansions in Azerbaijan and Georgia also appear sufficient to meet the demand.

ANNEX 6: PIPELINES

Existing Oil Pipelines in the Caspian Region

Name/Location	Route	Total Length (km)	Current Capacity (estimated)	2006 Traffic (estimated)	Future Capacity (estimated)
Atyrau-Samara Pipeline	Runs from Uzen in southwestern Kazakhstan to Caspian port of Atyrau linking to Russian pipeline system at Samara	695	20 mln tpa	15.5 mln tpa	25 mln tpa
Baku-Novorossiysk Pipeline (AIOC Northern Route – NREP)	Baku via Chechnya (Russia) to Novorossiysk (Russia), terminating at Novorossiysk Black Sea oil terminal	1400	6 mln tpa	4.4 mln tpa	6 mln tpa
Baku-Novorossiysk Pipeline - Chechnya bypass (with link to Makhachkala)	Baku via Dagestan to Tikhoretsk (Russia) via Dagestan, and terminating Novorossiisk Black Sea oil terminal	283	N/A	N/A	N/A
Baku-Supsa Pipeline (AIOC Western "Early Oil" Route – WREP)	Baku (Azerbaijan) to Supsa (Georgia), terminating at Supsa Port on Black Sea	885	7 mln tpa	5.6 mln tpa	7 mln tpa
Baku-Tbilisi-Ceyhan (BTC)	Baku (Azerbaijan) via Tbilisi (Georgia) to Ceyhan (Turkey), terminating at the Ceyhan Mediterranean Sea port	1780	50 mln tpa	7.7 mln tpa	80 mln tpa

Name/Location	Route	Total Length (km)	Current Capacity (estimated)	2006 Traffic (estimated)	Future Capacity (estimated)
Caspian Pipeline Consortium (CPC)	Tengiz (Kazakhstan) to Russian Black Sea Port of Novorossiysk (Russia)	1580	30 mln tpa	32.3 mln tpa	32-67 mln tpa (expansion delayed)
Iran Oil Swap Pipeline	Loaded onto from tankers via Caspian, the pipeline follows from Neka Port in Iran to Tehran refinery	335	12.5 mln tpa	5.2 mln tpa	18-20 mln tpa
Karachaganak-Atyrau Pipeline	Karahaganak oil field in Kazakhstan to Atyrau (Kazakhstan), connecting to Atyrau-Samara and CPC pipelines	635	7 mln tpa	7 mln tpa	7 mln tpa (can be expanded if needed)
Kazakhstan-China Pipeline (Atashu-Alashanko-Dushanzi section)	Links Central Kazakhstan oil fields in South Turgay to refineries in China (planned to expand from Aktyubinsk fields to Kumkol connecting to Atasu)	987	10 mln tpa	10 mln tpa	20 mln tpa (second phase expansion by 2011)
Kenkiyak-Orsk Pipeline	Links Aktyubinsk fields in Kazakhstan to Orsk refinery in Russia	400	6.5 mln tpa	6.5 mln tpa	6.5 mln tpa
Kenkiyak – Atyrau	Links Aktobe fields and Atyrau region with the Atyrau-Samara and the Caspian pipeline system	448	12 mln tpa	N/A	12 mln tpa

ANNEX 7: PORTS

Ports in Caspian and Black Sea Region: Handling Capacity for Oil and Oil Products Only

Port/Terminal	Location	Ownership	Current Capacity	Oil Handled in 2006 (estimated)	Future Capacity (estimated)
Azerbaijan					
Baku Port	In city of Baku, Absheron peninsula	Owned by AzerTrans; operated by Middle East Petroleum (planned for relocation upon completion of Garadagh Terminal)	6 mln tpa	4 mln tpa	6 mln tpa (or none if to be moved)
Dubendi Terminal	40km northeast of Baku, across from Pirallahi Island; natural breakwater	State owned by SOCAR (Azersuns Holding), operated by Middle East Petroleum	10 mln tpa	7 mln tpa	10 mln tpa
Garadagh Terminal	Outside of Baku city on Caspian Sea	Under construction by Ocean Energy (associated by MEP)	N/A	N/A	10-20 mln tpa
Sangachal AzerTrans Terminal	45 km South of Baku City on Caspian Sea	Owned by AzerTrans, operated by Middle East Petroleum	10 mln tpa	Not operational	10 mln tpa
Sangachal AIOC Terminal	45 km South of Baku City on Caspian Sea	AIOC, operated by BP	50 mln tpa	7.7 mln tpa	80 mln tpa
Georgia					
Batumi Port	Adjara region of Georgia in the Black Sea	Port owned by KazMunaiGaz and operated by its subsidiary Rompetrol	15-16 mln tpa	12 mln tpa	25 mln tpa

Port/Terminal	Location	Ownership	Current Capacity	Oil Handled in 2006 (estimated)	Future Capacity (estimated)
Kulevi Port	North of Poti in the Black Sea	Under development by SOCAR Georgia: 51% SOCAR, 24.5% Georgian investors, 24.5% Middle East Petroleum	5 mln tpa	N/A	22 mln tpa
Poti Port	Black Sea port town of Poti, between Supsa and Kulevi	Port state owned; Oil terminal owned by Channel Energy JV (25% Poti Port, 75% Delta Group Turkey)	1.5 mln tpa	1.25 mln tpa	2 mln tpa
Supsa Terminal	Terminus of Western Route pipeline in Black Sea	Georgian Pipeline Company (currently not operating – pipeline under repair)	7 mln tpa	5.6 mln tpa	7 mln tpa
Iran					
Neka Port	Caspian port town of Neka in northern Iran	Iran	12.5 mln tpa	5.2 mln tpa	25 mln tpa
Kazakhstan					
Aktau Port	Caspian Sea port town in southwestern Kazakhstan	Owned by State Enterprise Aktau International Sea Commercial Port, four oil berths leased to National Shipping Co KazMorTransFlot (49 years)	10-11 mln tpa	10-11 mln tpa	10-11 mln tpa
Kuryk Terminal	Town of Kuryk on Caspian Sea, 60 km south of Aktau	Under development by KazMorTransFlot (KazMunaiGaz subsidiary)	N/A	N/A	25-40 mln tpa
Russia					
CPC Terminal	Yuzhnaya-Ozereyevka in the Black Sea	Owned and operated by Caspian Pipeline Consotrium (Russian 24%, Kazakhstan 19%, Oman 7%, 50% between Chevron-Texaco, Lukoil, and other petroleum companies)	67 mln tpa	32.3 mln tpa	67 mln tpa
Novorossiysk Port – Sheskhrais Terminal	Tsemess Bay shore in the North-East part of Black Sea	Novorossiysk Commercial Sea Port Holding Company	50 mln tpa	52 mln tpa	85 mln tpa
Turkmenistan					

Port/Terminal	Location	Ownership	Current Capacity	Oil Handled in 2006 (estimated)	Future Capacity (estimated)
Turkmenbashi Port	Caspian Sea port town in eastern Turkmenistan	State owned – by Turkmen Maritime and River Lines (ministry)	N/A	N/A	N/A

ANNEX 8: RAILWAYS

Two national railways, Azerbaijan Railway (ADDY) and Georgia Railway (GR) transport oil and oil products between the terminals in Azerbiajan and the ports on the Black Sea. Although they are separate organizations, they effectively operated as a single railway for transit traffic for over a century and have identical infrastructure and operating standards and use identical rolling stock. Since the break up of the Soviet Union, they have both divested many of their previous ancillary businesses and both are now primarily railway operators to the exclusion of other activities.

Organizationally, ADDY remains a state organization, with its General Manager reporting directly to the Council of Ministers and the Government having a major say in determining railway policy. ADDY is vertically integrated, responsible for both infrastructure and operations. Georgia has commercialized its railway and recently announced the plans to privatize the GR and invited interested parties to submit expressions of interest by January 25, 2008. GR however remains 100 percent owned by the state. Both ADDY and GR have had profitable freight operations which cross-subsidize passenger and lead to an overall profit for the railway as a whole.

INFRASTRUCTURE

The Azerbaijan railway network consists of 2125 route km of track at the Russian gauge (1520 mm), of which 815 km are double-track and 1310 km are single-track. 260 km route-km consists of lines currently not operated because of the dispute with Armenia. Three of the four main-lines, and the Baku/Apsheron Peninsula network, are electrified at 3000v DC. The main-line network in Azerbaijan consists of four international routes radiating from Baku (or nearby) to the four adjacent countries:

- From Baku to the Russian border at Yalama, consisting of 206 km of electrified double-track. This route passes through Chechnya on the Russian side of the border and was disrupted for long periods in the early 1990s.

- The Trans-Caucasus route west from Balajari (near Baku) through Gyandja to the Georgian border at Beyuk-Kasik, consisting of 488 km of electrified line which is double-track except for 1-km of single-track over a bridge. This is the main route used for export oil traffic.

- The previous main-line to Armenia, diverging from the Trans-Caucasus route at Alyat. This route passes through about 40 km of Armenian territory on its way to Nakichevan and has been closed to through traffic since 1993.

- A line running south from Osmanli Novy, on the Nakichevan line, to a railhead at Astara on the Iran border. This line is single track, apart from the first 17 km, and non-electrified. This line will shortly be extended to the Iranian border, where it will join a line being constructed north from the Iranian network. This will then create a through north-south route which is expected to carry at least 5 million tons of north-south transit traffic (possibly including oil exports from Russia and Azerbaijan to Iran).

Three-quarters of long-distance passenger and freight traffic remains concentrated on the main Trans-Caucasian route to and from the Black Sea ports of Batumi and Poti in Georgia. Electric multiple-unit passenger services operate over all electrified lines but are concentrated in the Baku area.

The main line in Georgia runs from the two Black Sea ports of Poti and Batumi to Tbilisi, splitting there with separate lines to Azerbaijan and Armenia. The network consists of approximately 512 route-km of main-line (including 293 km of double-track line) and 796 route-km of single-track branch lines. A 10 km connection to the new port of Kulevi, near Poti, is being constructed as part of the port infrastructure.

The routes used to export oil are between the Azerbaijan border and Poti, a mostly double-track[45] electrified line of some 385 route-km, and a mostly single-track electrified line of some 104 route-km between Samtredia and Batumi. These routes carry the vast majority of the rail freight and passenger traffic through and within Georgia. About 80 percent of the network is in mountainous terrain and major segments of the main line traverse a narrow gorge. Although the entire railway was constructed in accordance with Soviet design parameters, the majority of tunnels and bridges are 100 or more years old.

The key characteristics of the ADDY and GR mainline infrastructure are:

- Track gauge 1520 mm
- Design axle load of 23 tons
- Maximum gradient of 1.2 percent
- Minimum design horizontal curve of 300-meters or more
- Design speed of 100 kph for passenger trains and 80 kph for freight
- R65 rail (65 kilograms-per-meter, Russian design), with mostly R50 in shunting yards and some station tracks
- Sleeper density of 1840 sleepers/km, increased to 2000/km in curves. These were originally all concrete monoblock but are now interlaced with treated pine timber sleepers where the original sleepers have failed.
- Electrical Power System is an overhead simple catenary with a nominal working voltage of 3.3 kV DC.
- Predominantly automatic block signaling, with most of the remainder being semi-automatic block.

45 SR is currently in the process of duplicating the single-track section. By 2008, it is planned to have continuous double-track main-line between Tbilisi and Samtredia

As the route is effectively double-track from Baku to Samtredia, it is capable of handling a significant increase in current traffic. There are a number of infrastructure deficiencies on various parts of the main-line network on both networks that in practice reduce capacity below the design throughput (defective rail, switches, embankments, stations, signalling and electrical power equipment) and speed restrictions, either because of alignment (mostly in Georgia) or track condition. However, in general, these can be remedied incrementally and do not represent a fundamental constraint on throughput in the long-term.

In early 2007 it was announced that the construction of the long-considered Akhalkalaki-Kartsakhi railway has been agreed between the governments of Azerbaijan, Georgia and Turkey as part of the Baku-Tbilisi-Akhalkalaki-Kars railway. The Georgian section of 29 km will be financed through a 25-year soft loan of $200 million from Azerbaijan to Georgia, at an interest rate of 1 percent per annum. However, loan payments are only due if they can be supported by revenues – otherwise the life of the loan will be extended. It is expected that the line would mostly carry general freight but some oil may be carried as Kars has a large oil terminal and is connected to Ceyhan (and potentially 300,000 ton tankers) by pipeline.

ROLLING STOCK

In general, the rolling stock used by both railways can be characterized as old and in poor condition. The locomotive fleets consist of electric and diesel line haul locomotives and diesel shunting locomotives. The main locomotives used in the export of oil are the VL8, VL10 and VL11 electric locomotives (with some diesel locomotives used for shunting in the terminals). See Table 8.1.

Table 8.1: Characteristics of ADDY and GR Main Line Electric Locomotives

Type	Axle arr.	Weight Tons	Maximum axle load	Continuous power (kW)	Maximum. speed (km/h)	Tractive power kN (starting)
VL8	2xBoBo	2 x 92	23,0	2x1880	100	2x298
VL10	2xBoBo	2 x 92	23,0	2x2300	100	2x307
VL11M	2xBoBo	2 x 92	23,0	2x2300	100	2x306

Source: ADDY and GR.

These locomotives are all 3 kV freight locomotives, built by Novocherkassk and Tbilisi Locomotive Works between 1955 to the mid-1980s. The VL8 locomotives now suffer major reliability problems while the later models, such as the VL11, have electronic components and are thus not as easily repaired as the simpler VL8. All the VL8 locomotives have far exceeded their 30-year life. FSU regulations, which still apply to interchanged vehicles, imposed a life limit at this age, but, unlike wagons and coaches, the locomotives are confined to their home systems and can thus continue to operate. Both railways have extended the life span where practicable and intend to repair and keep the life-expired VL8 locomotives in service, if possible, until they are 50 years old. The fleet condition in 2005 is summarized in Table 8.2. Since 2005 ADDY have purchased new electric locomotives from Russia; it is reported they purchased nine locomotives in

2006 and are planning to buy a further six in 2007. GR's electric locomotive fleet decreased to 187 units since 2005 with 122 serviceable ones. GR has not purchased new locomotives since 2005 but been investing in locomotives refurbishment in the last two years.

Table 8.2: Mainline Electric Locomotive Condition -2005

Type	Total Fleet(1)	Age	Condition			Average daily operating requirement
			For scrap	Awaiting repair	Operational	
ADDY						
VL8	162	35-46	28	56	78	
VL11M	43	10-20	2.5	9.5	31	
Other	7	-	-	-	7	
Total	212		30.5	65.5	116	92
GR						
VL8	53	35-45	34	-	19	
VL10	107	20-40	1	37	67	
VL11M	41	10-25	-	3	38	
Other	26	-	2	-	24	
Total	227		37	40	148	79

Source: ADDY and GR

(1) Measured in terms of complete operational locomotive; each locomotive is a twin-unit, consisting of 2 permanently coupled sections. The 'other' locomotives are mostly single-unit locomotives used for passenger services.

(2) Locomotives 'awaiting repair' normally require major overhauls, i.e. can be refurbished given sufficient time, money and spare parts; the 'operational' fleet includes many who are also not serviceable, generally because of lack of spare parts, but for which any repairs are comparatively minor.

Both railways have large fleets of wagons but, as with locomotives, many of these are either awaiting scrapping or major repair to extend their life. The key wagon for the oil traffic is the tank wagon. The railways own some 5300 taken together. A further 1400 wagons are provided by private shippers, who either own them or have leased them from one of the major Russian leasing firms. Currently, GR owns 1667 tank wagons of which 482 exceed 30-years of service life.

Table 8.3: ADDY and GR Wagon Fleets - 2007

Type	Total Fleet	Condition		
		For scrap	Awaiting repair	Operational
Total fleet				
ADDY	20098	11697		8401
GR	11635	3122	2417	6096
Private	1417			
Tank wagons				
ADDY	3660	374		3286
GR	1667	292	146	1213
Private	1417			1417
Total	6744			5916

Source: ADDY and GR.

RAIL OPERATIONS

The break-up of the FSU generated a decline in traffic on ADDY and GR as on all other FSU railways. This was then aggravated by the general unrest in the Caucasus, which closed key routes and for long periods effectively cut the three local railways off from each other (at least in part), the rest of the FSU network and from Turkish and Iranian Railways (via Armenia) to the south. Freight traffic on ADDY declined from about 90 million tpa in 1990 to 9 million tpa in 1995. After the development of the Caspian oil fields, however, traffic has recovered and exceeded 20 million tons in 2003. The pattern in Georgia is similar, reducing from 54 million tons in 1990 to 4.5 million tons in 1995 before recovering steadily to its current level of about 22 million tons.

In both cases, this growth has been largely, but not entirely, due to the growth in transit oil traffic. In Azerbaijan, transit oil traffic alone represents about 60 percent of the total freight traffic task[46], with oil in total comprising over 65 percent. In Georgia, transit traffic in 2006 has been about 75 percent of the total traffic by tonnage and, of this, oil and oil products has been about 80 percent. Since 2000, transit oil traffic has increased by 50 percent from 8.6 million tons to 12.3 million tons. Table 8.4 below summarizes trans-Caucasus transit oil traffic on Georgian Railway for 2005 and 2006 by origin and type.

Table 8.4: Transit Oil Traffic on GR 2005-2006 (thousand tpa)

	2005	2006
Crude Oil		
Azerbaijan	2,611	5,877
Turkmenistan	870	277
Kazakhstan	3,039	2,317
Subtotal	6,519	8,471
Oil Products		
Azerbaijan	1,854	2,171
Turkmenistan	1,335	1,535
Kazakhstan	326	129
Russia	42	34
Subtotal	3,557	3,869
Total:	10,076	12,340

Source: Georgia Transit.

The total oil transported through the corridor by rail is 10-12 million tpa. Revenue received by ADDY and GR (from the forwarders) totals approximately $11 per ton, equivalent to 1.1 c/ntkm. This varies by product and volume discount, with crude oil a little cheaper than oil products. Although these are competitive rates by world standards, both ADDY and GR make substantial operating profits. Working ratios (expenses excluding depreciation, interest and tax compared to revenue) around 55-60 percent, also very good by world standards.

[46] As measured in net ton-km.

Although ADDY and GR are predominantly freight railways (over 90 percent of gross ton-km in 2005), they operate a significant number of passenger services, which contribute over 30 percent of train-km. Freight trains are typically around 2100 trailing tons. The average (network-wide) technical speed of freight trains is about 30 km/hr, similar to the 1990 network average.[47]

The section of the route with the greatest density is on GR, which is currently operating about 43 train pairs (trains in each direction) a day on the busiest parts of its railway line between Khashuri and Zestaponi, which is also where the grades are steepest and curves sharpest. Thus, GR's double-track line currently handles 80 trains a day on a line between Tbilisi and Samtredia. For a double track line, 80 trains a day is a moderate amount and capacity would not seem to be a fundamental issue, especially as GR handled considerably greater volumes prior to 1990. Since that time, however, track speeds have been reduced below design speeds (100 kph to 80 kph), aging locomotives frequently break down and generate less tractive-effort (taking longer to get trains up to speed), and the signal system has been reduced to near inoperability by vandalism and theft. Increased traffic is likely to strain current capacity unless some operations practices are changed and critical assets are improved. Nonetheless, line capacity is unlikely to ever be more than a temporary constraint.

COMMERCIAL ARRANGEMENTS

Inter-railway traffic in the region is currently controlled through conventions administered by the CIS-based OSShD (Organization for the Co-operation of Railways), of which ADDY is a member. International freight tariffs are based on the principles of the Commonwealth of Independent States Tariff Agreement (CISTA), which covers railways in most CIS countries. The members meet annually to set maximum rates for transit freight (in Swiss Francs) for the following year. Although individual railways can set their own rates as long as they are below those agreed in the joint meeting, CIS railways normally try to charge the maximum for transit. In 1996, the Governments of Georgia, Azerbaijan, Turkmenistan and Uzbekistan made a number of agreements to co-ordinate and co-operate in developing rail transit traffics. These have since included an agreement which reduced the rail and ferry tariffs for traffic on the Traceca corridor between Batumi/Poti and Central Asia by 50 percent. Agreements are in place between Azerbaijan and Georgia governing freight and passenger tariffs and the inter-working of wagons and they operate under common technical regulations.

Currently, the policy of most CIS railways is that new customers pay in advance for services but, in time, may graduate to an account (often requiring pre-payment). However, as in most CIS railways, freight forwarders are employed as intermediaries in making arrangements with the end customer. These offer the shipper a simplified through rate for service, which may include the rail through rate, rail wagon supply charges, and demurrage, and, in some cases, non-rail elements such as truck distribution and port charges. The forwarder's charges to the shipper are largely unregulated and market-based. The forwarder, rather than the railway, is able to take advantage of captive

[47] Comparison of these two speeds needs some care because of the change in the pattern and density of operations since 1990.

shippers and adjust rates to shippers with elastic demand to maximize net revenue. Reliance on forwarders as intermediaries can also create additional transaction costs and can reduce the competitiveness of rail.