

TRACECA Programme:
Regional traffic database and
forecasting model

Progress Report II:

Study Phase 1B

March 1997

**European Union
Takis Programme**

**TRACECA:
Regional Traffic Database and
Forecasting Model
(Project No. WW.93.05/05.01/B008)**

Progress Report: Phase II

March 1997

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Progress Report: Phase II

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Local Operator	:	Tacis Co-ordination Units
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1. INTRODUCTION AND PROJECT SYNOPSIS

1.1 This Progress Report deals with the Tacis project TRACECA Traffic Forecasting Model, Project No. WW93.05/05.01/B008. This report covers the period from December 1996 to February 1997. This Progress Report includes details of the progress on calibration of the traffic model and forecasting procedures including some preliminary forecasts of possible national freight traffic development. The Progress Report also includes a preliminary outline of possible future economic growth in the Traceca countries and an outline of the alternative scenarios for future developments of trading relations in the region.

1.2 This Progress Report consists of two main parts:

- the main body of the report, which is an administrative report in a format defined by Tacis for the use of Tacis, Brussels, and the local Co-ordination units;
- Appendices containing technical material relating to current progress, including:
 - data collected in responses to the first twelve months of the questionnaire-based data collection campaign;
 - details about the traffic forecasting model calibration;
 - descriptive notes on four future scenarios.

1.3 Table 1.1 shows the 'Project Synopsis'.

Table 1.1 - Project Synopsis

Project Title	: TRACECA Regional Traffic Database and Forecasting Model
Project Number	: WW 93.05/05.01/B008
Country	: All 8 TRACECA States
Wider Objectives: to assist in the prioritising of transport investment options in the region through the introduction of a quantitative planning tool which can simulate the impacts of investment.	
Specific Project Objectives:	
<ul style="list-style-type: none"> • introduction and establishment of computer-based planning tools in the eight TRACECA states including: <ul style="list-style-type: none"> - a common regional database of transport and trade flows and transport infrastructure and transport costs; - a multi-modal model for analysing scenarios and developing forecasts; • application of the tools to: <ul style="list-style-type: none"> - create comprehensive multi-modal synoptics of existing and forecast future flows; - highlight bottlenecks of all types; - identify preferred locations for multi-modal transfer centres; - identify and catalogue specific road/rail/maritime and multimodal projects for detailed feasibility studies; • transfer of know-how in transport database design and modelling. 	
Outputs/Activities:	
<ul style="list-style-type: none"> • an Inception Mission and Inception Report (month 3); • Phase 1A involving data acquisition and storage followed by Progress Report 1 (month 9); • Phase 1B consisting of the development of scenarios and database, followed by Progress Report II (month 13); • Phase 2 including synoptic forecasts and development of investment options, followed by Progress Report III (month 15); • Phase 3 which is the handover of the computer equipment and software and support missions, followed by a draft Final Report (month 18) and Final Report (month 21). 	
Inputs:	
<ul style="list-style-type: none"> • technical assistance; • computers and other office equipment; • database, forecasting and office-oriented computer software. 	
Project Starting Date	: Mid-January 1996
Project Duration	: 21 Months

2. SUMMARY OF PROJECT PROGRESS

2.1 This section contains a summary of progress since the start of the project.

2.2 Three stages of work have been accomplished so far:

- mobilisation/inception (January to March 1996);
- Phase 1A (April to August 1996);
- Phase 1B (September 1996 to February 1997).

2.3 The delays encountered on the project so far, particularly in setting up local partners in Uzbekistan and in obtaining satisfactory and consistent data on existing freight movement have resulted in the project progress being about 1 month behind schedule at present. This position is partly recoverable.

2.4 The major achievements of these three phases of work are:

- agreements have been made with local operators and technical partners in the 8 TRACECA states including recently concluded arrangements for data collection in Uzbekistan;
- regional offices have been set up in Almaty and Tashkent and we are moving to set up a project base in Georgia. In Almaty the technical partner has proved successful in data collection and assembly on the network and existing movements, securing completion of questionnaires and data entry tasks. The technical partner in Uzbekistan has been equipped and we will be moving to equip the office in Georgia in the coming months. Progress with data collection in Uzbekistan is still slow. We are hoping for a similar level of technical achievement to that attained in Almaty in these other project bases;
- a mission to UNESCAP in Bangkok has been carried out;

- a detailed questionnaire-based data collection exercise has been carried out in all 8 states and the data collected has been transferred to spreadsheet files. These are presented in Appendix A1 to A7. (The trade flow data were included in Progress Report 1A);
- model calibration has been significantly progressed as described in Appendix B;
- possible scenarios of future trade have been drafted as included in Appendix C for discussion with the local operators;
- preliminary forecasts of economic growth prospects in the Traceca countries have been drafted and circulated locally for comment. These are included in Appendix D.

3. SUMMARY OF PROJECT PLANNING

- 3.1 This section contains a summary of the planning for the remainder of the project.
- 3.2 Major progress has been achieved, sufficient for model calibration to be progressed. The forecasting process and development of scenarios has been commenced.
- 3.3 The overall programme for the project is shown in Figure 3.1. The remaining stages of work are:
- Phase 2 including synoptic forecasts and development of investment options followed by a Progress Report (month 15);
 - Phase 3 which is the handover of the computer equipment and software and support missions followed by a draft Final Report (month 18) and Final Report (month 21).
- 3.4 The project planning tables are included in Appendix E.

TRACECA REGIONAL TRAFFIC FORECASTING MODEL
 FIGURE 3.1: PROJECT PROGRAMME

TASK	1996		1997																				
	Month:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S		
MOBILISATION / INCEPTION	■	■																					
INCEPTION REPORT			X																				
PHASE Ia: DATA ACQUISITION AND STORAGE			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Equipment procurement			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Detailed database/model specification			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Methodology of data collection			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Collection of existing data						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Data review missions						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Surveys						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Data entry (spreadsheet)						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
PROGRESS REPORT I																						X	
PHASE Ib: SCENARIOS AND DATABASE/MODEL DEVELOPMENT																							
Database construction/testing																							
Forecasting model development																							
Data transfer to database																							
Scenario proposals																							
PROGRESS REPORT II																							X
PHASE 2: SYNOPTIC FORECASTS																							
Scenario definition																							
Zonal economic forecasts																							
Model runs (present/future)																							
Synoptic traffic forecasts																							
Investment/redeployment studies																							
PROGRESS REPORT III																							X
PHASE 3: IMPLEMENTATION/ HANDOVER																							
Database/model manual preparation																							
Handover missions																							
Study cases																							
Support missions																							
DRAFT FINAL REPORT																							X
TACIS Comments																							■
FINAL REPORT																							X

4. PROJECT PROGRESS IN THE REPORTING PERIOD

TRACECA MULTI-MODAL NETWORK MODEL DEVELOPMENT

- 4.1 The model network includes all major road, rail and sea routes within each of the eight TRACECA countries, together with many secondary links in order to ensure all significant freight routes are available in the model.
- 4.2 Progress with calibrating the model is summarised here. A more comprehensive account of the progress achieved with this aspect of the work is given in Appendix B to this report.

Elements of the Network

- 4.3 The TRACECA Regional Traffic Model network was designed for the assignment of freight traffic through Central Asia and the Caucasus Region. Each mode has separate links with speeds, delays and costs of travel by the mode.
- 4.4 In general the questionnaires provided the inventory data required to produce networks for each of the modes, road, rail and sea.

Rail Links

- 4.5 All existing significant rail linkages are represented in the model. For each section of railway network the questionnaires provided information on the overall length of each section distinguishing lengths of single track and double track; and the percentage leading gradient. The model includes the rail network in some detail as far west as a line from Moscow to the Crimea.

Road Links

- 4.6 As with the rail network the road network described in the model includes all significant road linkages for the purposes of freight traffic. Descriptive parameters for

each road link were derived from the questionnaires. Where data were not given, measurements were taken from detailed mapping.

- 4.7 In the absence of speed data, estimated speeds were applied to each pavement type in order to calculate weighted average speeds for each section of road.

Maritime Links

- 4.8 The shipping routes currently operating in the Caspian and Black Seas were established from locally available chart data and local enquiries. Within the assignment model an average speed of 20 kph (which equates to 17 Knots) was adopted for each shipping link.

Interchange Links

- 4.9 Interchange links have been incorporated to connect the different modal networks, which allows the transfer of freight between modes. Therefore *modal choice* is achieved quite simply as an integral part of the assignment.
- 4.10 The interchange links are being calibrated to also carry appropriate penalties to take account of the delay and cost of the interchange.

Zoning and Access Links

- 4.11 The zoning system described in both the Inception Report and Progress Report 1A comprised of 23 *internal* zones and 23 *external* zones. In developing the model this zoning system was slightly modified. As described in Progress Report 1A (Revised) Kazakhstan has been subdivided using a finer zoning system than that shown in the Inception Report. The revised zoning is based on the 19 oblasts.
- 4.12 The import and export data received for Tajikistan, Turkmenistan and Uzbekistan was disaggregated to the level of zoning shown in the Inception Report. It was not possible to disaggregate the data obtained for Kyrgyzstan in this way. However, the volume of import and export trade from Kyrgyzstan is comparable with those shown for each of the Caucasus countries which are also represented in the model by single zones. In view of these similarities the implications of Kyrgyzstan remaining as a single zone were not considered to be significant.

- 4.13 The access links feed traffic onto the network, and also hold charging data, for example initial costs to access the railways, which SATURN includes in calculating generalised costs but which diminish relative to total cost over distance travelled..
- 4.14 Initially the access links were connected at major city, or large settlements, in each of the zones where it was thought such traffic would likely be generated or attracted. For example the Kyrgyzstan zone is connected to the networks in a way to reasonably represent the major concentrations of activities around Bishkek and Osh. These connections are under review during the model calibration.

External Links

- 4.15 External links are included to represent the major freight corridors in areas on the fringes of the study area, including parts of Russia, North Russia, Eastern Europe, Turkey, Iran and China. These links ensure a realistic pattern of freight flow along major corridors outside the study area, and feed into and out of the Caucasus Regions and Central Asia.

Tariffs

- 4.16 Throughout Central Asia and the Caucasus Regions we have noted that tariffs vary not only by mode but also by region and commodity. This is allowed for in the network description files and SATURN uses this in combination with time costs to calculate “generalised costs” by link in the assignment.

Count Data

- 4.17 The observed flows were included in the network data file to be carried forward to the assignment stage for comparison against the modelled flows as part of the calibration process. The observed freight flows and traffic counts, plotted on the combined rail and road network diagrams are shown in Appendix A, Figures A1(for the Caucasus sub region) and Figure A2 (for the Central Asia sub region).

DEVELOPMENT OF BASE YEAR FREIGHT TRIP MATRICES

- 4.18 Import and export data for each of the eight TRACECA countries was collected as described in Progress Report 1A. This data includes annual freight tonnage flows between all zones for each of the 21 commodity groups. This data was then combined to produce origin - destination matrices by commodity. The matrices were presented,

together with the import / export data for each country, in the revised Progress Report 1A (December 1996).

- 4.19 The import / export data relates to freight traffic to and from each of the TRACECA countries. Therefore the matrices do not represent total freight flows as they will not include national traffic, and possibly external to external traffic that may use certain routes through the Traceca region. This should be taken into consideration with regards the count data during the calibration.

PROGRESS WITH MODEL CALIBRATION

Network Calibration

- 4.20 Network calibration has been carried out both before and during the assignment stage. This was undertaken to check for any obvious routing problems. Other network checks included reviewing delays incurred by traffic at border crossing points, sea ports and mode interchanges. In addition it was important to check, and revise accordingly, the zone centroid connectors as discussed earlier.

Assignment

- 4.21 This section discusses the performance of the model and compares the base year observed and modelled daily freight tonnage flows throughout the TRACECA network for all modes. This would ensure that the model was robust and could be used with confidence to forecast the effects of proposed freight network scenarios in future years.
- 4.22 We have employed a *stochastic user equilibrium* assignment which assumes that minimum cost routes between each origin - destination pair is not perceived to be the same by all freight forwarders and operators. Therefore some *multi-routing* will occur in the assignment where competing routes that appear to be slightly more costly (in terms of time and distance) will attract some traffic. This avoids the potentially unrealistic results that may arise from an *all-or-nothing* assignment.
- 4.23 At the time of preparing Progress Report II the model calibration is on-going. Hence the commentary given here, together with the figures shown, are not final.

- 4.24 Figures 4.1 and 4.2 shown the preliminary base year assignment results for the Caucasus Regions and Central Asia respectively.

Sea Links

- 4.25 On the Caspian Sea, the model shows 2-way flows between Baku and Turkmenbashi of approximately 4500 tonnes per day (over 1.6 million tonnes per annum). This compares with approximately 0.85 m.t.p.a handled by the ports in 1995. This has been reduced from initial assigned flows by adjusting the effective loading times and generalised costs of the ferry. The process is continuing and has also to take account of other adjustments on connecting links in the networks.
- 4.26 Similarly, modelled freight flows through the Black Sea Ports of Poti and Batumi are shown to be over 4100 tonnes per day (over 1.4 m.t.p.a) and almost 3300 tonnes per day (nearly 1.2 m.t.p.a) respectively. These figures compare well with the turnover traffic in 1995 reported by the World Food Programme for the two ports of 1.70 m.t.p.a and 1.29 m.t.p.a respectively.

Railway Links

- 4.27 The railways in both Central Asia and the Caucasus Regions play a dominant role in the transshipment of freight. Both Figures 4.1 and 4.2 show that this is the case in the model assignment.
- 4.28 Generally the modelled rail traffic appears on the correct corridors. However, large discrepancies can be seen between the modelled and any observed flows we have received, which are largely for 1993. These differences are primarily due to the levels of rail traffic in 1993 exceeding those in 1995 (?), and that the model does not include local or external to external traffic.

Road Links

- 4.29 The road network generally carries slightly lower levels of freight traffic than the railways, and largely carries more local traffic. Indeed over 90% of freight traffic to and from Poti and Batumi ports is carried by the railways. An exception to this, occurs at the road border crossing at Sarpi (between Turkey and Georgia) through which significant level of freight traffic is international.







-  Railways
-  Roads
-  Average Tonnes per day
(1mm = 5000 Tonnes)
-  National Boundary



FIGURE 4.1
TRACECA Regional Traffic Model
Base Year Assignment
Caucasus (Draft 1)



Railways
Roads
Average Tonnes per day
(1mm = 5000 Tonnes)
National Boundary

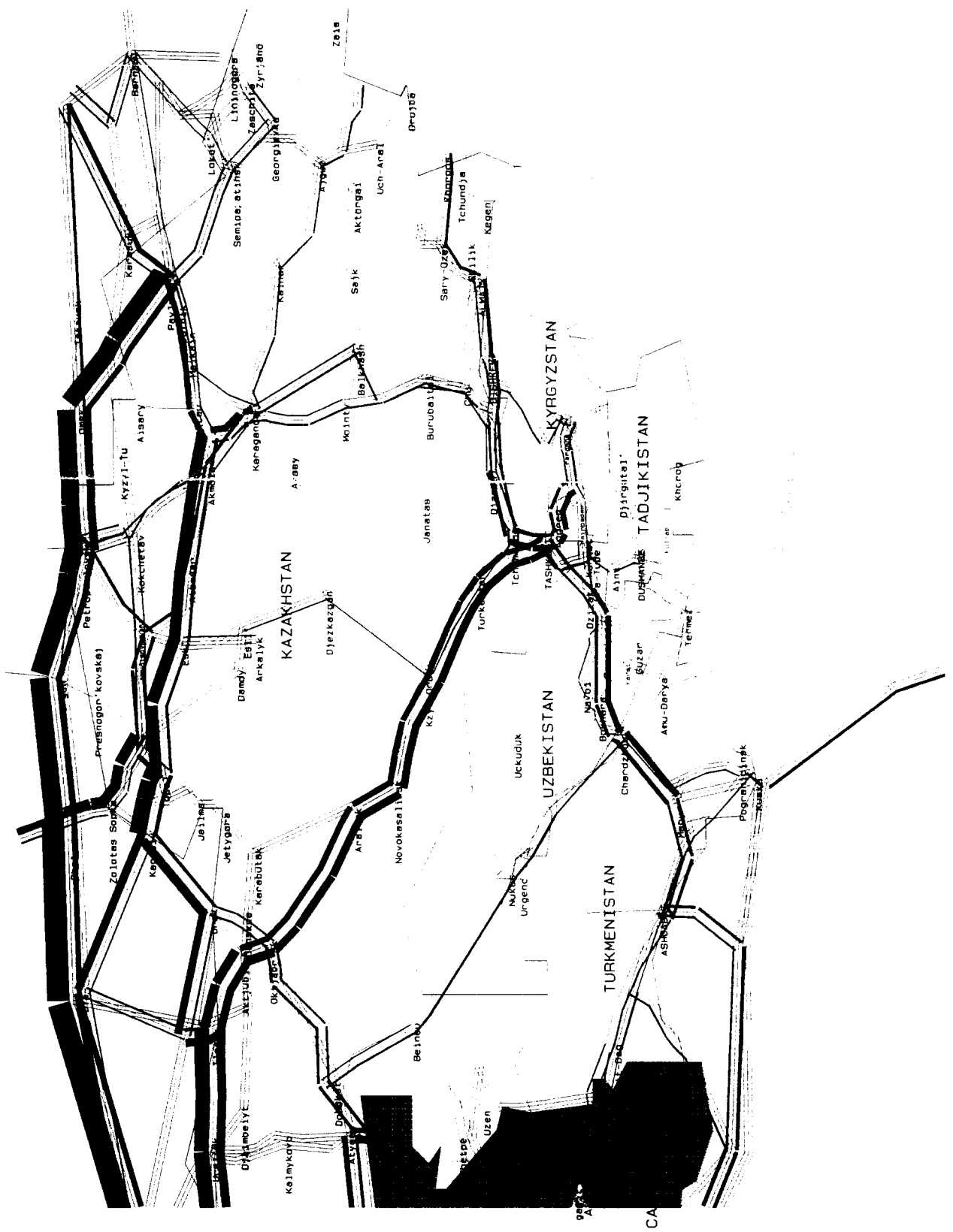


FIGURE 4.2
TRACECA Regional Traffic Model
Base Year Assignment
Central Asia (Draft 1)

- 4.30 Through the Sarpi border crossing the model shows daily freight flows of over 1250 tonnes from Turkey and over 1000 tonnes into Turkey. These figures compare well with average daily counts in 1995 of 65 trucks per day (1000-1300 tonnes per day) and 42 trucks per day (650-900 tonnes per day).

LOCAL TECHNICAL PARTNERS AND REGIONAL OFFICES

- 4.31 Project work in the countries continues to rest on a dual structure:
- a “local operator” which is the official counterpart organisation responsible for the project in the country;
 - a “local technical partner organisation” which will receive, operate and maintain the database and forecasting model.

Local Operators

- 4.32 The local operator in all countries is the Government in the form of the Ministry of Transport, the Ministry of Economy or the Cabinet of Ministers depending on the country:

Armenia	-	Ministry of Transport
Azerbaijan	-	Ministry of Economy
Georgia	-	Ministry of Transport
Kazakhstan	-	Ministry of Transport
Kyrgyzstan	-	Ministry of Transport
Tadjikistan	-	Ministry of Economy
Turkmenistan	-	Cabinet of Ministers
Uzbekistan	-	Cabinet of Ministers

Local Technical Partners

- 4.33 In all countries the local operator has been responsible for nominating an appropriate local technical partner organisation. The procedures followed and length of time taken in obtaining this nomination have varied from country to country. As previously reported we have established technical partners in seven of the eight countries as follows:

Azerbaijan	-	The computer centre of the Azerbaijan Railways
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Georgia	-	Centre for Market Research (associated with the University and Institute of Economy).
Kazakhstan	-	The Research Institute for transport (AO-NIAT).
Kyrgyzstan	-	The State Institute of Road Design “Kyrghzdortransproekt”
Tadjikistan	-	State of Project and Research Institute “Tajikgipro- transtroy”.
Turkmenistan	-	Institute of Economy
Uzbekistan	-	Uzavtotranssystema” - a subsidiary of the State road transport holding organisation “Uzavtotrans”.

- 4.34 In Armenia we are awaiting the Ministry of Transport to appoint a group of organisations to form a project base for this and other transport projects. This technical partner is likely, therefore, to comprise a mix of staff seconded from existing institutes and Ministries.

Involvement of Technical Partners

- 4.35 The ultimate objective of involving technical partners in the project is to facilitate the transfer of technology and know-how in forecasting and data management through the application of modelling and data analysis techniques. Progress towards this goal continues to be made through the involvement of technical partners in data collection, data processing, economic forecasting and model development.
- 4.36 Inevitably, the contribution that different partners are able to make varies from country to county and is dependent on their capabilities and their approach to participation in the project. The involvement to data can be summarised as follows:
- 4.37 **Armenia:** data collection has been completed by the local operator using staff who are likely to form part of a newly created project team.
- 4.38 **Azerbaijan:** data collection and data validation have been undertaken by the Railways computer centre. The local operators are providing information on economic forecasting.
- 4.39 **Georgia:** data collection and data validation including reprocessing initial figures on customs returns have been undertaken by the Centre for Government Statistics in co-

operation with our official local technical partner. Economic forecasts for different sectors of the economy have been produced by this local technical partner.

- 4.40 **Kazakhstan:** data collection, data processing and validation has been undertaken by the Research Institute. Surveys to establish freight costs and economic forecasting have also been undertaken. The capabilities of this institute have enabled us to involve technical staff in the co-ordination and processing of data sets for all countries. Moreover, during the course of the work, staff have acquired a working knowledge of transport modelling and have contributed to the base year model development work including the on-going translation of a modified software manual tailored to the TRACECA model being developed.
- 4.41 **Kyrgyzstan:** data collection and data validation have been undertaken by the local technical partner.
- 4.42 **Tadjikistan:** data collection and data validation have been undertaken by the local technical partner.
- 4.43 **Turkmenistan:** data collection has been co-ordinated by the Cabinet of Ministers. The local partner, the Institute of Economy, is currently reviewing economic forecasts based on internationally published sources.
- 4.44 **Uzbekistan:** data collection has been undertaken by a range of organisations including the University and the Institute of Economy with assistance from the Cabinet of Ministers. The local technical partner, Uzavtotransystema, who were not appointed until mid-way through this reporting period, are currently completing an analysis of freight costs and will be reviewing economic forecasts derived from internationally published sources.

Project Offices

- 4.45 Progress on the technical work has proceeded in parallel with establishing regional bases for the on-going application of the model and data analysis. As described in previous progress reports, the emphasis at the start of the project was placed on establishing a project office (equipped with communications and computer equipment) in Kazakhstan. The local technical partner operating from this office has now acquired a basic proficiency in the fundamentals of modelling and continues to contribute to the technical work. Over the latter part of this reporting period an

increased emphasis has been placed on Uzbekistan and a project office (equipped with a computer) has been established in Tashkent. Our Field Manager has based himself in Tashkent over this period. Project offices (equipped with communications and computing equipment) have also been established in Kyrgystan and Tadjikistan since before the start of this reporting period.

- 4.46 An increased emphasis is also being placed on Georgia and over the next reporting period a project office will be established in Tbilisi. Similarly, we anticipate establishing project offices in Azerbaidjan and Turkmenistan over this period. An office in Armenia will be dependent on the Ministry of Transport creating a project team.

Technology Transfer

- 4.47 It is clear that the function of these project offices is likely to vary depending on the technical strength and commitment of the nominated local partners. There is continuing evidence from our work to date that a number of the nominated technical partners will need to strengthen their staff if the technology and know-how transfer is to be wholly successful.

- 4.48 Our overall approach is to seek to encourage joint working between technical partners with the most capable and technically advanced teams supporting and training the weaker teams. Also this joint working will be essential beyond the end of the project in order to facilitate a co-ordinated approach to data and model updating.

- 4.49 Whilst this might best be achieved in the long-term through the creation of a multi-national statistical or forecasting group, our immediate priorities are to encourage joint working as part of the technology transfer process. We propose to focus the initial training in the use of the model on two regional centres:

- Tbilisi for the Caucasian countries;
- Tashkent for the Central Asian countries.

- 4.50 This initial training will be accompanied by assistance in the implementation of the model in each of the eight TRACECA countries together with supporting documentation. We stress that this does require the nominated local technical partners to identify suitably qualified staff to take responsibility for maintaining and applying the model beyond the end of the study.

4.51 On-going and future work to be undertaken by the local technical partners will focus on:

- refinement of the economic forecasts where initial forecasts have been based on internationally published sources;
- on-going data collection and validation (including, in particular, the collection of 1996 customs data);
- participation in training sessions in the use of the model (including any refinement to the local model calibration and review of the supporting documentation); and
- identification and refinement of appropriate scenarios for testing with the model.

4.52 Our overall approach to these activities is described in Section 5 on project planning for the next reporting period.

PROGRESS WITH DEVELOPMENT OF THE TRAFFIC FORECASTING MODEL

Traffic Forecasting Model

4.53 Preliminary macro-economic forecasts have been prepared for each country. These are described in Appendix D. Relationships established for the base year are being analysed to produce forecast productions and consumptions for each zone and commodity. The 'non-commercial' matrix for each commodity will be forecast based on an assessment of the overall scenario and these productions and consumptions removed from those derived, in a similar manner to that adopted in the base year.

4.54 The inter-zonal tonnage flow models (trip length distribution models) developed in the base year will allocate production to consumption for the remaining 'commercial' freight. This process will refer to generalised costs of trip making taken from the forecast network. Changes will include specific network alterations and adjustments to network-based economic parameters (e.g. value of transit time/cost of delay). Both the 'commercial' and 'non-commercial' matrix types will be combined to produce a forecast matrix for each commodity.

Preliminary Forecast Change in Tonne Kms Related to Change in GDP:1997-2001

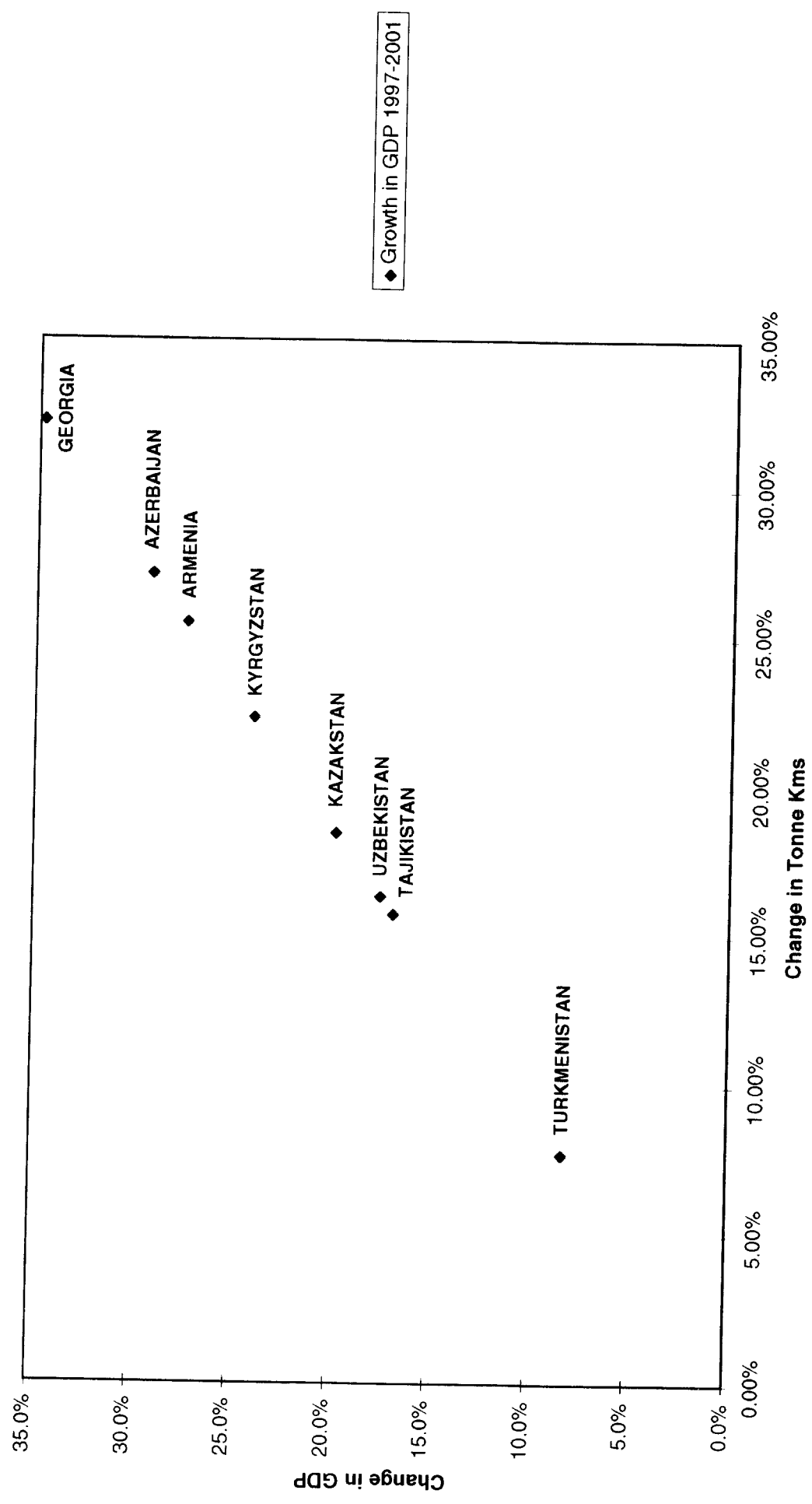


FIGURE 4.3

Preliminary Forecast Change in Tonne Kms Related to Change in GDP:1997-2006

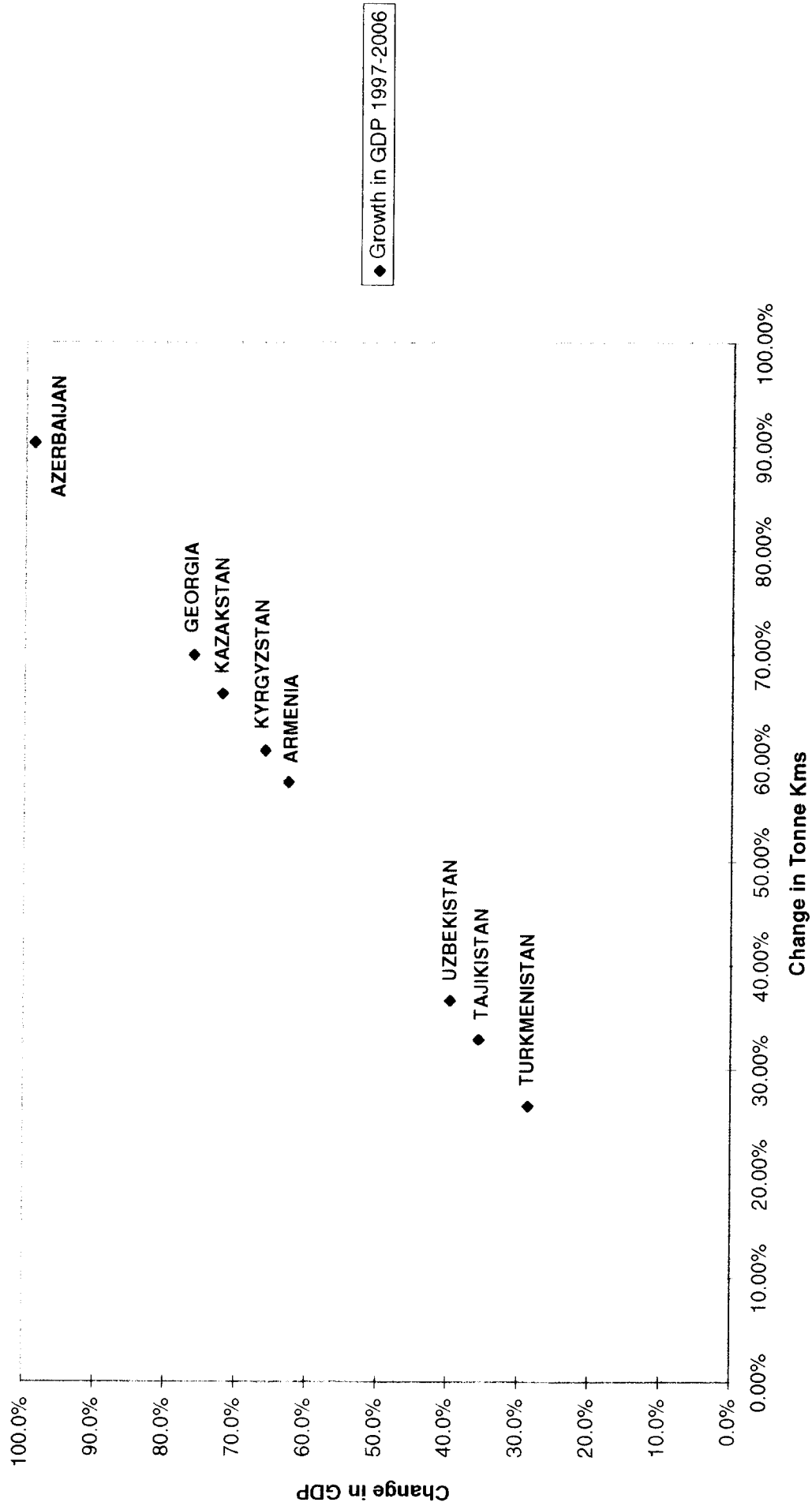


FIGURE 4.4

Preliminary Forecast Change in Tonne Kms Related to Change in GDP:1997-2011

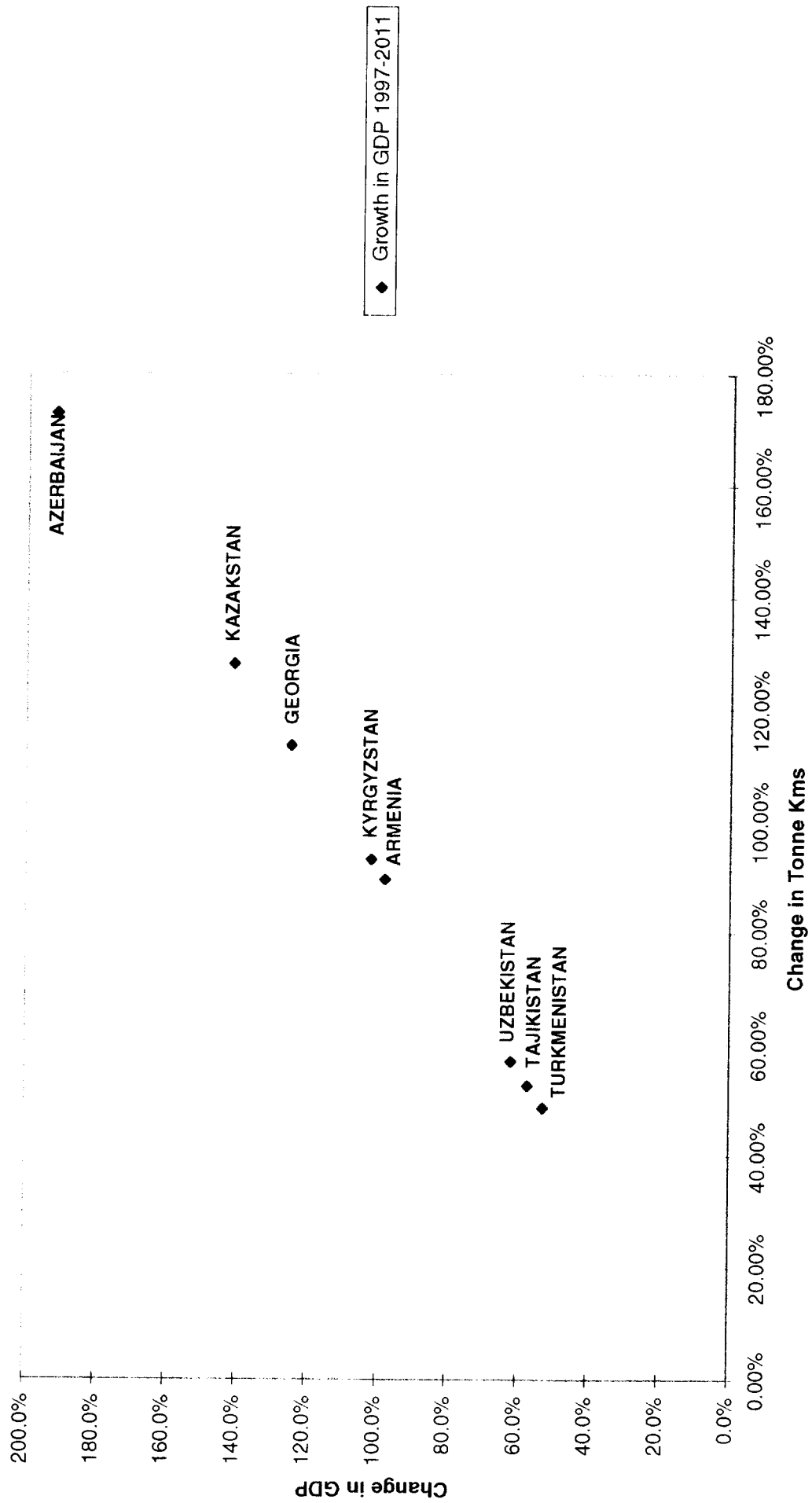


FIGURE 4.5

Preliminary forecast growth in national freight in the Caucasus Countries

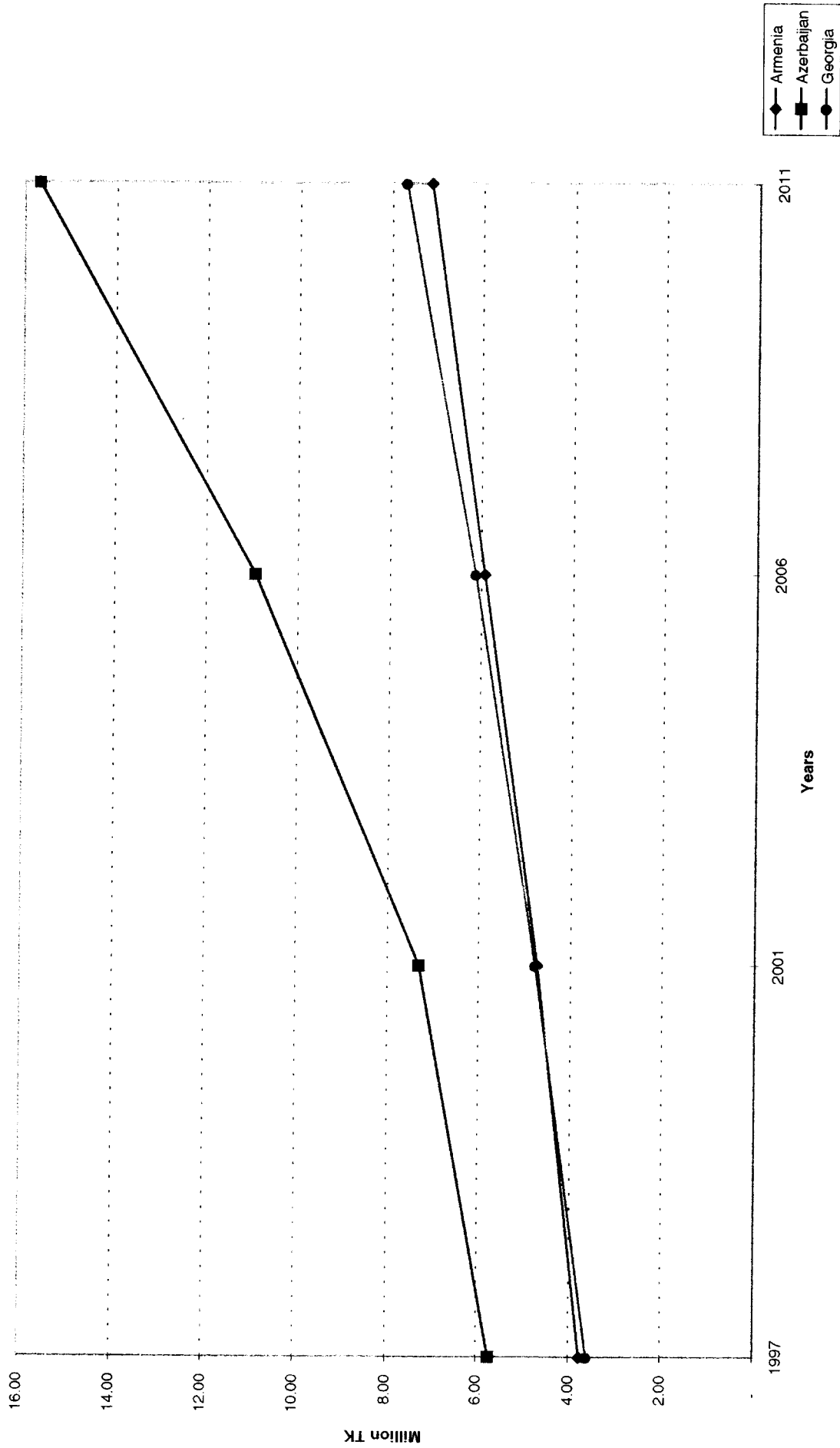


FIGURE 4.6

Preliminary forecast growth in national freight in Central Asian Countries

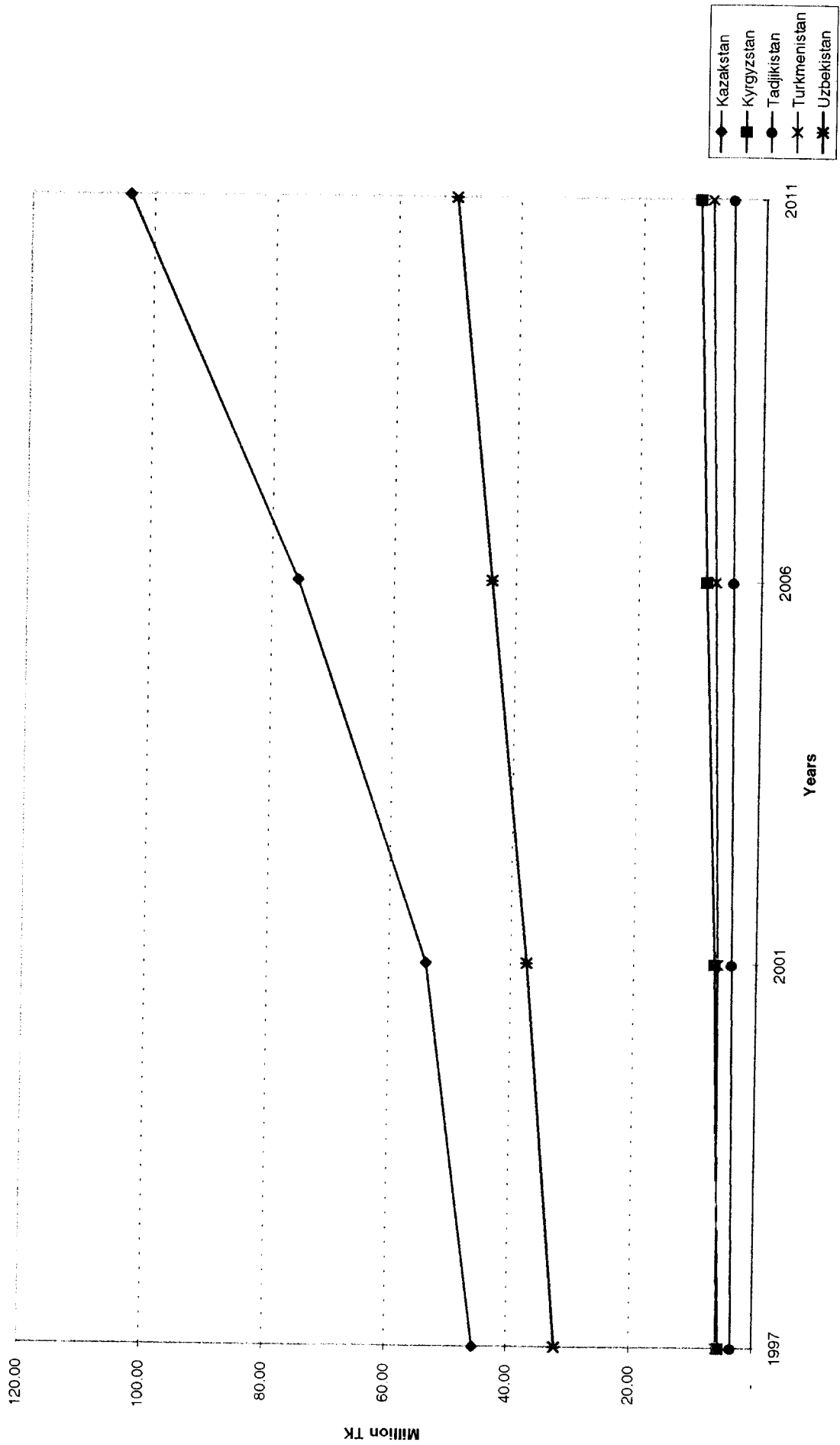


FIGURE 4.7

- 4.55 Matrices will again be factored to 24 hour flows and assigned, and converted to numbers of vehicles, wagons and vessels for analysis.
- 4.56 In forecasting, background national freight traffic can be ‘growthed’ based on global estimations derived from GDP growth and based on World Bank research. The preliminary results of this analysis for the TRACECA countries are shown in figures 4.3 to 4.7. Figures 4.3, 4.4 and 4.5 show the relationship between estimated growth in GDP and growth in national freight traffic overall for the periods from 1997 to 2001, 2006 and 2011 respectively. Figures 4.6 and 4.7 show the corresponding national freight traffic growth curves for each of the countries.
- 4.57 Where network changes occur likely to affect background traffic, links will be re-categorised. Bottlenecks will be identified by inspection. If appropriate, matrices will be manually adjusted to reflect destination and/or routeing changes as a result of network congestion. This may include freight that is transported by systems external to the model as a result of internal congestion (such as transfers to ocean transport or air).

PRELIMINARY REGIONAL TRADE DEVELOPMENT SCENARIOS

- 4.58 Many different pressures are evident in the current trade policy discussions going on in the region and it is not easy to foresee a clear trade development path for the region. The interplay of long standing cultural and economic attachments that persist on the one hand, and the recent de facto independence of the TRACECA countries and the consequent new linkages that are spawning make it likely to be some years before these trade development options resolve themselves and the transitional phase in these respects comes to an end. In the meantime it is desirable for the purposes of planning, to consider a range of futures through what may be termed “scenarios” of possible development options.
- 4.59 The following scenarios have been considered and are developed more fully in Appendix C to this report. These “draft” scenarios are put forward for discussion and examination at this preliminary stage. These scenarios are merely representative of a very wide range of possible futures which it is recognised that the national governments will consider and come to their own conclusions about their most appropriate courses. They are listed below.

Scenario A: The TRACECA Region Countries Maintain and Develop Commercial and Cultural Connections with The Russian Federation.

- 4.60 Economic and trade development of the TRACECA as a “Commonwealth” linked by the heritage of recent cultural, linguistic and economic interdependence with the Russian Federation and other CIS countries such as Ukraine. This scenario recognises the present reality for much of the region, of their dependence on the existing major infrastructure, in particular the existing high capacity transport linkages and lines of energy transfer; and the many established trading patterns. The scenario foresees a tendency to continuing substantial (though not total) reliance on trade with the Russian Federation. The principal strengths of this arrangement are its development through the known quantities of the status quo; whilst the weaknesses are inherent in over dependence on any one partner or source of supply
- 4.61 Scenario A may imply maintenance of a relatively low price internal economic system for some years due to the restricted purchasing power inherent in the current and future per capita income levels. The scenario is therefore likely to represent a slow growth scenario on account of the restricted internal purchasing power within the “commonwealth”. There may well be a need for continuing reliance on barter deals to a significant degree. In such case the relatively long transportation distances required in the region will impact on the external costs and therefore the volume of such deals. The impact of future increases in freight costs, as subsidies are worked out of the system and tariffs have perforce to rise, on the feasibility of reliance on barter will also tend to make the scenario a slow economic growth option.

The Implications for Infrastructure

- 4.62 In terms of the impact on transport of trade orientation remaining within the former Soviet bloc this scenario would place maximum stress on the north - south transport linkages. Transport demand can be expected to concentrate particularly on the north west - south east orientated corridors such as the Kuybyshev - Chimkent or Rostov - Baku railways and parallel road linkages.
- 4.63 Although in the past the railways have taken more than 90% of the freight, this modal share has already changed quite dramatically in some parts of the region. In the future this modal shift can be expected to continue to move towards world norms with increasing numbers of shippers preferring road transport for a variety of reasons as discussed elsewhere, and the average haul distances reducing significantly. A reasonably extensive network of trunk roads exists in the region but are not in a good

state of repair. This scenario is likely to involve substantial programme expenditure on highway repair and improvement and on-going maintenance. In view of the large distances involved in regional communications the scenario will involve substantial transport infrastructure budgets.

Network Implications

4.64 The evolution of Scenario A will have implications on the current network. Links which have fallen into disrepair or disuse may be re-established. The carrying capacity of some current links will need to be enhanced and the development of closer integration throughout the region will promote more integrated transport network such as rail infrastructure. In relation to the promotion of Scenario A, the following transport links and issues will be relevant:

- the development of a new railway line between Russia and Iran through Western Turkmenistan;
- improvement of the road link between Turkmenbashi and Aktau;
- improvement of the road link between Korezm and Kazakstan;
- upgrade of rail linking Georgia, Russia and Ukraine through Abkhazia, suitable for heavy freight;
- implementation of regular ferry services for Aktau-Baku, Turkmenbashi-Astrakhan and Baku-Makhachkala-Astrakhan;
- implementation of regular container ships and ro-ro services between Georgian ports (Poti, Batumi) and Russian (Novorossisk, Tagnarogm Rostov) or Ukrainian ports (Mariupol, Odessa); and
- rationalisation of rail equipment within CIS countries.

Conclusion

4.65 The scenario A option appears to represent the current situation. It is likely to predominate in most of the region for the short term. Geographic, network and

political factors make this scenario least predominant on the southern borders of TRACECA and in particular in Georgia (with access to the Black Sea), and Armenia.

- 4.66 Integration represents a viable option in the short term by being a lower cost option.

Scenario B: The TRACECA Region Develops Trading Linkages with the Southern and Eastern Neighbouring Countries such as Turkey, Iran, Pakistan, and China.

- 4.67 The development of this scenario is a possible reaction to the historical ties to the northern CIS and the Russian Federation, resulting in a renewal of cultural ties with the western and southern Asian countries and China and development of economic and trading patterns with this world region.

Trade Orientation

- 4.68 There have already been considerable developments in trade between the TRACECA countries and Turkey, Iran and elsewhere in the Middle East and with China. These linkages are most obvious in the fields of open market trading but they are also seen in greatly increased interest in intergovernmental trade and economic development deals especially in the oil and gas sectors.
- 4.69 Amongst the motivations for the Central Asian countries to develop closer links with the Southern neighbouring states such as Turkey and Iran is the potential access to warm water ocean ports rather than the ports linked by the Russian Federation. Sea access which avoids the bottleneck of the Bosphorus may also be advantageous for most of the TRACECA region countries. Alternative routes for Turkmen and Uzbek gas are also a prime trading consideration. Since the southern countries have relatively high economic growth rates their rapid economic expansion may provide good trading opportunities.
- 4.70 However, in the long run, the Southern neighbours may not represent an exclusive financially viable market places for TRACECA region products because the market size of all countries measured in terms of GDP is only slightly larger than that of the Russian Federation (approximately \$1.4 trillion) though growing more rapidly. Locally prevalent restrictive practices may also mean that access to the world market for some commodities via the southern routes may be closed.

- 4.71 The market with China is different. The economy is growing at approximately 9.3% and it is possible that increased formal sector trade with China could lead to accelerated development in Kazakhstan and Kyrgyzstan, especially in the mining and metallurgical industry sectors. There is also potential for the development of traffic through China to reach Pacific Ocean sea ports. However, an assessment of the potential of this route is uncertain owing to the lack of knowledge of the capacity and condition of the Chinese transport network.
- 4.72 Unlike Scenario A, this scenario is at present constrained by the limited infrastructure development and trading deals.

Implications for Infrastructure

- 4.73 Development of scenario B will call for early major capital expenditures on infrastructure. The Azerbaijan - Turkey oil pipeline proposals and Kazak and Turkmen oil and gas deals with Iran are all examples, as is the new rail link to Mashhad. The existing international transport linkages to the south and east are predominantly dependant on road links. These linkages to the south with Turkey, Iran and Afghanistan and to the east with China would all need to be improved. The very limited existing rail networks in these directions would make the scenario more dependant on road transportation, with the significantly higher long term costs that this is likely to entail.

Network Implications

- 4.74 The development of Scenario B creates the potential for significant development of new routes in the long term should there be sufficient traffic to warrant them. Initially there is evidence to show that some links could be encouraged through improved transshipment facilities or improved infrastructure capacity. The opportunities for improvement are as follows:
- upgraded facilities for fast transshipment of wagon loads at Druzbha and Sarakhs border stations;
 - possible long term rail link between Georgia and Turkey;
 - rail link between Azerbaijan and Iran;

- improved road links between Caucasian region and Iran through Armenia;
- possible new rail link connecting to the Iranian rail network via Kazandjik and Kyzyl-Atrek;
- upgraded road links between Kyrgyzstan and China (Kashgar) through both the Torugart pass and Sari-Tash pass;
- approximately 100 km new road linking Tajikistan (Murgab) and China;
- approximately 150 km new road linking Tajikistan (Khorog) and Pakistan (Chitral) through the Hindukush;
- road links between Central Asia, Pakistan and Afghanistan (Herat-Quandahar, or via Kabul in the future); and
- possible new rail route between Mashad and Bandar Abbas, reducing distance by 900 km, if Iranian Railways chose to invest.

Conclusions

- 4.75 If it were pursued in isolation Scenario B shows all the signs of a very slow take-off in economic development terms. This is on account of lack of development capital. Although some of these potential partners are characterised as “tiger economies” their ability to export growth is fragile. There is also a limited availability of necessary technologies. The Scenario B is a possible medium term option bearing in mind the caveats and implications for the rate of development mentioned above.
- 4.76 The development of the TRACECA countries has the potential to be more rapid in the medium term within this scenario providing that there is sufficient investment in the infrastructure connecting these areas.

Scenario C: The Development of Trading Links with The Developed Economies of Europe and the North Atlantic.

- 4.77 This Scenario foresees development of new trading ties with the western European and the north Atlantic economies. The attraction of developing these links is the

huge potential market. Measured in terms of GDP this represents \$15.7 trillion which is substantially greater than both of the previous scenarios.

Trade Orientation

- 4.78 Some of the countries in the TRACECA region have begun to establish new markets and in particular this has been reflected by those countries which have developed entrepreneurial flair or where their traditional markets have attracted the interest of foreign investors, such as oil and gas, metallurgy, viticulture, food processing and other agricultural products. Geographically some countries lend themselves to these new markets, such as Armenia, and Georgia which are well placed for the European markets (for example Armenia, which conducts an extensive trade with Belgium).
- 4.79 The indigenous oil and gas assets have already been prime attractors of immediate and medium term. This has been demonstrated particularly in Azerbaijan and Kazakstan where there has been substantial investment by western companies and in the interest being shown in new management contracts and outright purchase of former State Enterprises in several of the TRACECA states. This scenario may attract more rapid, more diversified and higher technological levels of economic development brought about by increased investment.
- 4.80 The development of new markets such as Europe or the United States requires the co-operation of many countries to ensure the transit of goods and therefore although with the TRACECA region there may be a more independent attitude to trade, transportation will require efficient co-operation.
- 4.81 The TRACECA corridor could become a catalyst for economic integration among the TRACECA countries. Close links between the countries and with high-income countries could provide for the development of economic activities which could take advantage of the very favourable conditions of relatively low wages and high skills.

Implications for Infrastructure

- 4.82 For its full realisation this scenario requires the development of new trading, financial and economic linkages as well as new or substantially redeveloped and re-equipped transport routes and corridors so as to enable trade largely independent of Russia.

4.83 This scenario represents the long term option, investment in routes which reduce the dependence on the Russian Federation and ensure economically efficient access to markets will take time to implement. The initial steps have been taken especially with regard to the development of pipelines for the export of oil and gas.

Network Implications

4.84 The TRACECA based trade orientation will require substantial investment in the network. This will primarily take the form of developing ferry links and the opportunity for multi-modal transportation. The potential network and transport related developments will include:

- upgraded railway line from Poti to Baku with high-frequency services;
- upgraded railway line - Turkmenbashi-Tashkent-Almaty-Druzbha;
- upgraded ferry service with the introduction of faster and lower-cost vessels;
- development of a ro-ro based services Baku-Turkmenbashi
- implementation of a regular ferry service from Aktau to Baku;
- rail ferry link Poti/Batumi - Central Europe (e.g. Varna)
- ro-ro service from Georgia to Central Europe and Georgia to either the Ukraine or Constanta to connect with the Danube ferry barge;
- upgraded rail link Georgia with Southern Russia and the Ukraine through Abkhazia;
- competing regular feeder shipping lines linking Georgian ports with European ports;
- renewal of the truck fleet with vehicles at international standards; and
- standardisation of the border crossing procedures along the TRACECA corridor.

Conclusion

- 4.85 As has been seen in the recent past, the transport and communication links with western Europe that rely on the former Soviet systems have a variety of defects. These are either of insufficient capacity or subject to seasonal blockage due to weather conditions, or may not be reliable due to regulatory problems. The TRACECA corridor offers a transport linkage independent of Russia but reliant on multi modal operation for its full realisation. Therefore Scenario C will require significant investment in on line equipment in the independent transportation corridors between western Europe and the TRACECA states to provide the level of transport service and security of communications needed to encourage the development of significant volumes of trade, this is especially so for the Central Asian countries which are dependant on the performance and capacity of the Caspian sea ferry link. For this reason Scenario C is only likely to develop fully in the medium/long term even if the investment capital required can be obtained and invested in the short term future.

Scenario D: The Development of a Trade Links Which Combine All the Above Scenarios Over the Long Term

- 4.86 A more varied pattern of trade development is foreseen in this scenario and a greater plurality of economic and trading linkages as the various countries pursue the linkages that are perceived to best suit their particular economic production and national goals. Scenario D also recognises the possibility of countries simultaneously pursuing more than one of the foregoing scenarios (e.g. the two pipeline strategy of Azerbaijan.), and the potential timing of “scenario switching”.
- 4.87 In reality it is unlikely that any one of the above scenarios will dominate over the others to the extent of exclusion. None of the newly independent countries would wish to restrict the potential for trade in any direction at this stage of their economic development. In addition, it is unlikely that the international institutions would regard such a restrictive practice as beneficial to the economy and therefore may be in a position of influence.
- 4.88 The development of trade relationships and the subsequent movement of goods will ultimately arise from economic decision making. Investment in infrastructure will come about as a result of demand for a link. Demand will be decided by the need to obtain a world price for a commodity.

- 4.89 It is likely that most countries will actively seek trade with countries the ability to pay in hard currency or those which will accept a mutually beneficially barter trade. It is assumed that in order to maximise revenues, TRACECA region countries will seek new markets. Trade alignments will develop over time and in the perceived interest of trading nations.
- 4.90 In the short run the dominance of traditional trade with the Russian Federation will be evident. However, there is increasing pressure for the TRACECA region countries to reduce their dependence on Russia while also maintaining good relations. Therefore it is unlikely that trade with Russia will disappear completely. The Russian market has potential to be large and when their economy lifts there will be increased economic activity.
- 4.91 The Newly Independent States are seeking their own cultural identities and therefore also seeking to make an impact on the political scene within the region. This is shown in the formation of various trade agreements and political alliances within the region and beyond. The instability which has afflicted many of the countries of the former Soviet Union has put pressure on investors (particularly those with interests in oil and gas) to find alternative methods of moving commodities. This has brought about the discussion of alternative pipelines, shipping routes and intermodal transport. Over the short and medium term there is likely to be several new routes opening which will allow choice of route and mode for the first time.
- 4.92 In the evolution of the new transport network there will be an increased need for transport integration. This primarily means the development of intermodal transport. This allows maximum efficiency and choice as well as competition, reducing the cost of transport. Companies and Governments will be able to chose routes and modes which are most appropriate to them. In the long term, the TRACECA route to Western markets is probably the one which will prevail with some commodities finding their way to the market place via the Southern States and also China.

Network Implications

- 4.93 Given that there is a movement of trade in most directions with the development of this scenario there are some links in the network are more likely than other to be developed. These represent those which are priorities for the efficient development of a transport network in the short medium and long term. For the purposes of this scenario the assumptions regarding the transport network are as follows:

- the rehabilitation of the Baku-Turkmenbashi ferry;
- improvement to the Poti-Baku road and rail links;
- normalisation of transport corridor conditions and restoration of maintenance cycles for rail and road infrastructure within the region;
- improved connections between Kazakstan and China;
- improved road links with Georgia-Turkey, Azerbaijan-Iran and Armenia-Iran;
- the reopening of the Baku-Nakhijevan rail line and resumed large-scale transshipments in Djulfa at the Iranian border;
- reopening of road and rail links between Armenia and Turkey;
- electrification of the Transasian railway line between Almaty and Charjau;
- upgraded rail links Aktogai-Balkhash and Beinau-Aktau in Kazakstan;
- new rail links in Uzbekistan: Uchkuduk-Nukus and Termes-Samarkand;
- stabilisation of the situation in Chechnia allowing transit trains between Azerbaijan and Western Russia; and
- resume passenger rail services between Georgia and Russia through Abkhazia.

5. PROJECT PLANNING FOR THE NEXT REPORTING PERIOD

5.1 The next reporting period is Phase 2 “Preparation of Synoptic Forecasts and Implementation of the Model”, and consists of:

- completion of model calibration;
- preparation of synoptic forecasts for the aggregated commodity groups and for overall freight traffic;
- implementation of the model in the regional centres.

5.2 In addition some work continuing from the previous work phases will be carried out:

- procurement of computer equipment for the partner organisations;
- 1996 data collection, including the processing the data from the questionnaire returns, collection of further data on modal costs and journey times and collection of additional local economic data.

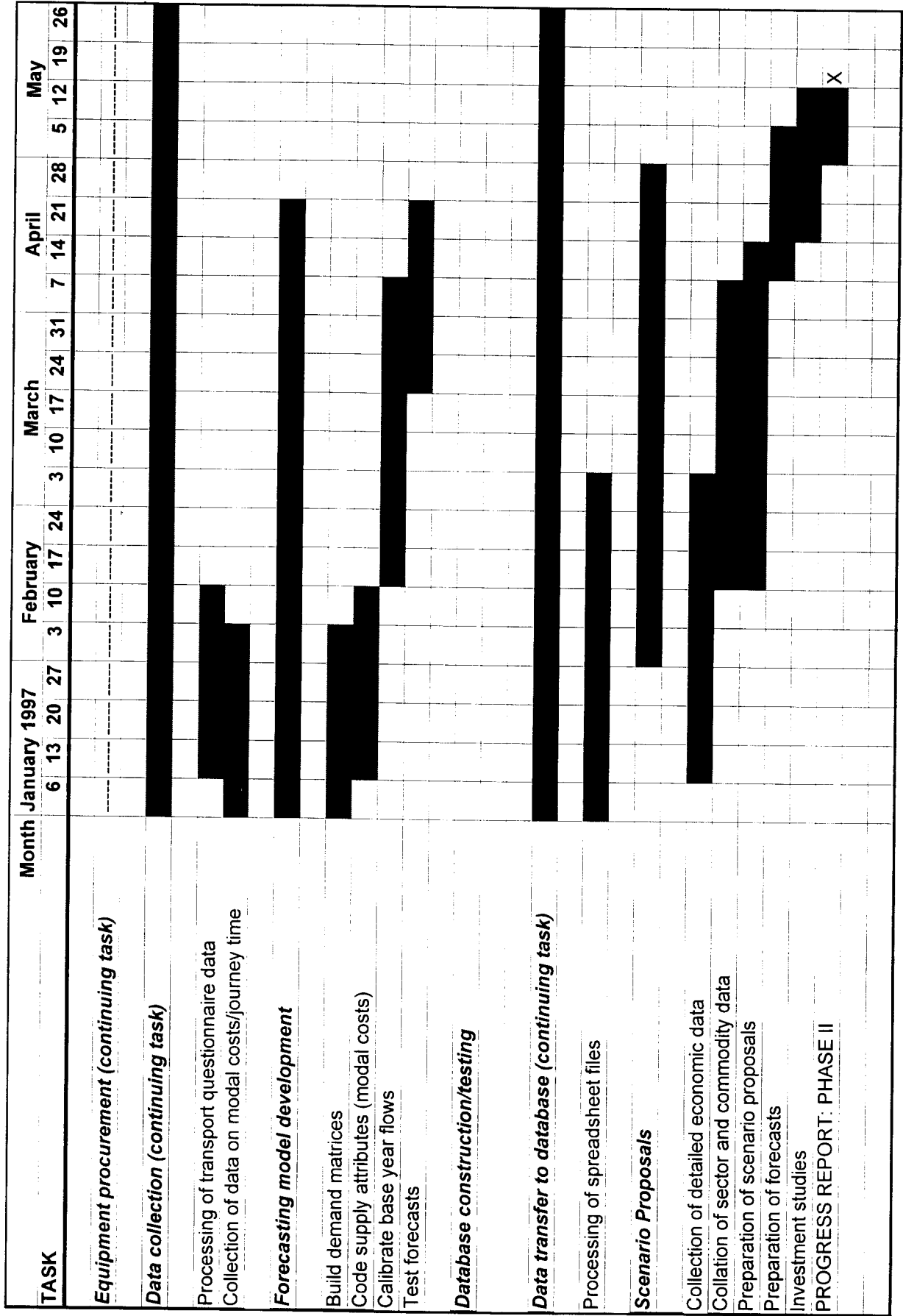
5.3 The Phase II Progress Report is to be submitted in May 1997. A detailed work plan is shown in Figure 5.1: the tasks are discussed below.

EQUIPMENT PROCUREMENT

5.4 Equipment procurement for the regional office in Tashkent is now complete. We now plan to proceed with the procurement of equipment for the local technical partners in the Caucuses.

5.5 The equipment to be supplied is essentially computer equipment for running the forecasting and database software and will consist typically of:

TRACECA REGIONAL TRAFFIC FORECASTING MODEL
 FIGURE 5.1 DETAILED WORK PLAN FOR PHASE II



- a desktop computer (at least 486DX with 8Mb of RAM, colour monitor);
- an A4 laser printer ;
- hardware (only) for an e-mail connection, or a fax machine, if requested;
- power safety devices.

5.6 The software to be provided will be a licensed copy of the Russian-language version of Windows-based Microsoft Office (including word processing, spreadsheet and database software). Although we will provide the necessary hardware for an e-mail connection, we expect the organisation itself to obtain the necessary contract with an Internet service provider. Where requested we will also supply a fax machine.

DATA COLLECTION/PROCESSING

5.7 Collection of 1996 trade data is now in hand. Because of the slow response to some of the routing and tariff questionnaire data sets we are continuing the data processing tasks during the next phase of work. Further data collection is underway for data on modal costs and transit times.

FORECASTING MODEL DEVELOPMENT

5.8 The development of the model is partially dependent on the availability of suitable data, much of which we are now confident that we have. However there are many tasks that can be carried out in parallel to the matrix development and network costing. In particular in refining the network structure, creation of commodity indices and developing documentation specific to the use of the software for freight modelling.

5.9 Prior to using the model to forecast future transport patterns for different scenarios we propose to undertake some test runs of the model in forecasting mode, principally to confirm the modelling procedures.

DATA TRANSFER TO DATABASE

5.10 As the work on the forecasting model progresses we will in parallel transfer data to the database. This will require testing the transfer of spreadsheet data into the database

structure as well as adjusting the links with the forecasting model so that data can be read as directly as possible from the database.

SCENARIO PROPOSALS

- 5.11 The draft scenarios outlined in Section 4 above and presented in Appendix D define the key elements that will influence the pattern and magnitude of international freight flows in the region. The scenario have taken account of locally generated data from Azerbaijan, Georgia and Kazakstan and initial enquiries with the local institutes in all other countries.
- 5.12 The economic profiles will be elaborated on with more insights into the important national and regional commodity sectors: cotton, grain, bauxite/alumina/aluminium, coal, oil etc.
- 5.13 During the next phase of work we expect to receive comments on the work that is included in this report. This feedback will ensure that the scenarios are well founded and relevant.