



TRACECA Programme:
Regional traffic database and
forecasting model

Traffic Model Development

June 1997

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

Traffic Model Development

Seminar Paper

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TRAFFIC MODEL DEVELOPMENT

IMPLEMENTATION OF THE MODEL

1. This paper documents the procedures employed to develop the TRACECA Regional Traffic Model.
2. The model study area covers the three Caucasus Regions, Armenia, Azerbaijan and Georgia, together with Kazakhstan, Kyrgyzstan, Tadjikistan, Turkmenistan and Uzbekistan which together form Central Asia. The model was developed to assist strategic planning of the freight network within the study area, and assess the impacts of various forecast scenarios in the region.

DATA COLLECTION

3. To facilitate the model development, and subsequent calibration and validation processes, current information on road and rail networks and traffic was collated for each of the eight TRACECA countries. Data regarding the operations and traffic at sea ports and airports was also collected. Full details of this data collection exercise, together with the data collected, have been presented in Progress Report II (December 1996), Database Manual and Data Collection Report (both May 1997).

SOFTWARE

4. The TRACECA traffic model was developed using the current SATURN suite of modelling programs. The programs which were used include the following:
 - SATNET - network building;
 - SATASS - freight traffic assignment;
 - M1, M5, MX - development of freight matrices and general matrix manipulation;
 - SATLOOK, SATDB - assignment analysis;
 - PIX - network and assignment analysis;

- M1, MX - matrix analysis

In addition, MICROSOFT EXCEL was used to process import/export data and road/rail network inventory data received via the questionnaires. It has also been used to facilitate the model development, analysis and presentation of data and results.

5. The following sections of this paper will discuss in turn the development of the network and freight matrices for the base year of 1995. The final section of this paper presents detailed instructions on the operation of the model.

TRACECA MULTI-MODAL NETWORK MODEL DEVELOPMENT

6. 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 were available in the model.
7. Initially SATURN networks were developed for road and rail separately using the inventory data obtained via the questionnaires. Where necessary additional information on link distance and link standard was determined from detailed mapping of the study area.

Elements of the Network

8. The TRACECA Regional Traffic Model network was designed for the assignment of freight traffic through Central Asia and the Caucasus Region. Since it is a strategic model, it was coded as a SATURN buffer network. Each mode has separate links with speeds and delays which reflect the cost of travel by each mode.
9. In general the questionnaires provided much of the inventory data required to produce networks for each of the modes, road, rail and sea.

Rail Links

10. For each section of railway the questionnaires provided information on the overall distance of each section; and a breakdown of each section indicating lengths of single track and double track; and the percentage leading gradient.

Road Links

11. Similarly, for the road links data on overall distance of each section; a breakdown of the lengths of each section by type of pavement (i.e. hot and cold asphalt, and unsealed surfaces); and road width. In the situation where distances were not given, it was necessary to complete the data through measurements taken from detailed mapping.
12. 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.

Sea Links

13. Generally, the sea transport data received via the questionnaires was concerned with the port handling, and no information was gained regarding the shipping routes currently operating in the Caspian and Black Seas. Therefore, it was necessary to establish the alignment and distances of shipping services currently in operation in the area from available mapping.
14. An average speed of 20 kph (which corresponds to 17 Knots) was adopted for each shipping link.

Interchange Links

15. The networks were then combined to form one multi-modal network data file. At this stage interchange links were introduced to connect the road and rail links included in each of the networks, which allows the transfer of freight between modes. Therefore *modal choice* is achieved simultaneously with, and as an integral part of the assignment.
16. The interchange links were calibrated to also carry appropriate penalties reflecting the delay and cost of the interchange.

Zoning and Access Links

17. 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 system is based on the 19 oblasts. The zone plan for the study area is shown in Figure 1.
18. 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. However, the volume of import and export trade from Kyrgyzstan is comparable with those shown for each of the Caucasus countries which are 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.
19. Each of the zones were connected by access links to either the rail network or the road network, or both, according to the opportunities realistically available within each area and reasonably representing the distribution of economic activities, and hence freight demands.
20. These access links feed traffic onto the network, and are also utilised to 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.
21. Initially the access links were connected to major cities, or large settlements, within 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 so as to reasonably represent the major concentrations of activities around Bishkek and Osh. These connections were reviewed during the model calibration.



FIGURE 1
Zone Plan

External Links

22. External links were 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, which will feed into and out of the Caucasus Regions and Central Asia.

Tariffs

23. Throughout Central Asia and the Caucasus Regions we have noted that tariffs can vary not only by mode but also by region and commodity. There is a facility within SATURN which enables *extra link data to be stored* for each user class alongside all links (KNOBS function). This has been used to hold the shipment cost per tonne along each link (i.e. tariff * distance) for each aggregated commodity group. In combination with time costs SATURN uses this to calculate generalised costs by link in the assignment.
24. This facility is particularly useful as traffic using certain routes or modes (Caspian Sea for example) are subject to tariffs significantly higher than others.

Count Data

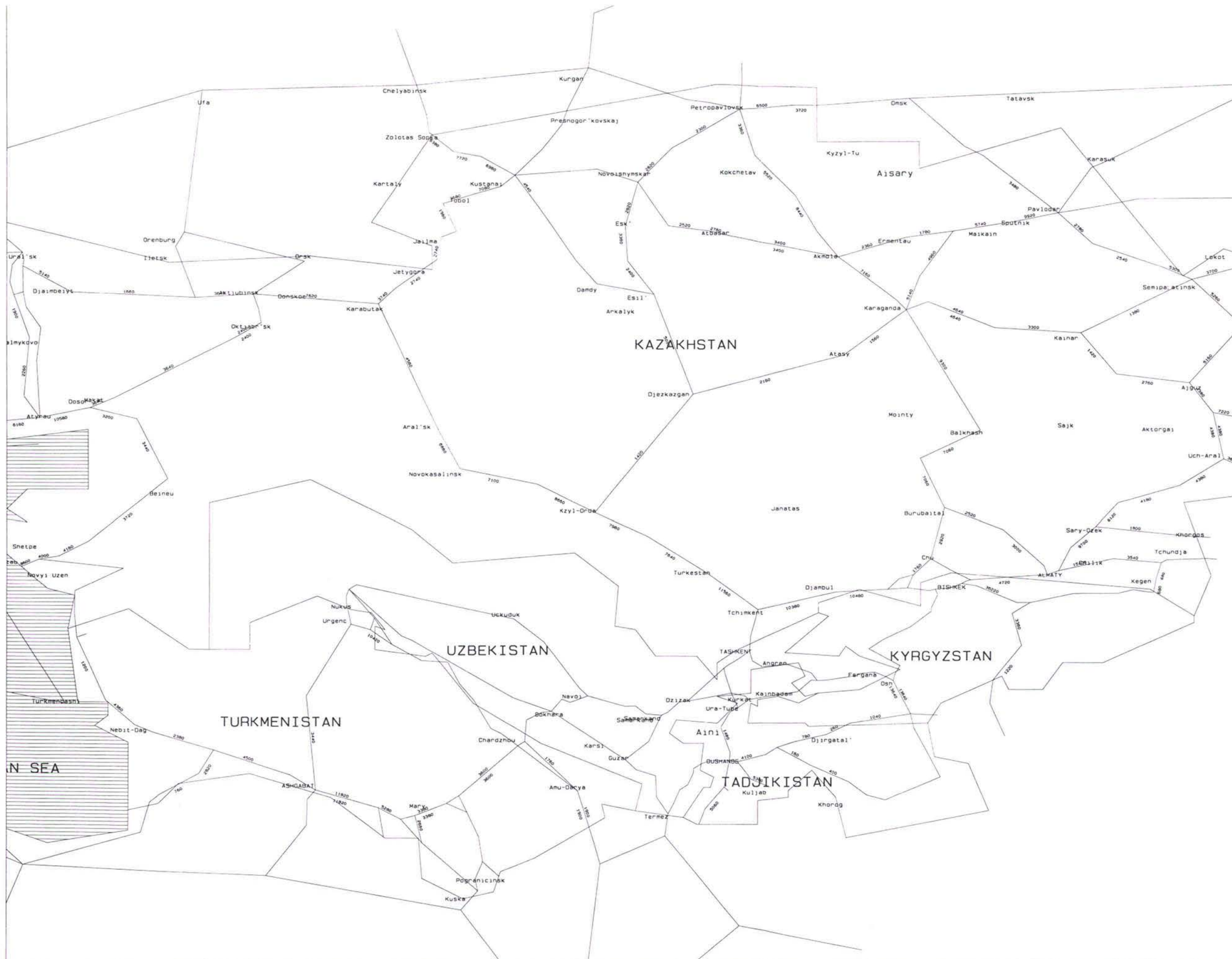
25. Observed freight flows for road and rail transport were obtained from the questionnaires. The rail figures were given as annual tonnage flows in 1993 by direction. The freight matrices assigned to the network were 24 hour tonnage flows, therefore the observed rail freight flows were factored to represent average daily flows.
26. Road flows were given in the questionnaires as total 2 way daily counts of vehicles, together with an observed percentage of heavy goods vehicles. Using these figures the number of trucks per day have been estimated. These were subsequently factored by a weighted average tonnage per truck in order to generate average 24 hour tonnage flows. The average load per truck has been assumed at 15 - 20 tonnes in the Caucasus taking account of the presence of Turkish and Iranian trucks in this region, and at 10 tonnes per truck elsewhere in central Asian regions.
27. These observed flows, as shown in Figures 2 and 3, 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.

Generalised Cost Parameters

28. The generalised costs are the total out of pocket cost incurred by the shipper including time costs. These generalised costs are utilised by the model to predict modal choice and route behaviour. In the model each aggregated commodity group was assigned its own *value of time* parameter in order to represent the relative importance of time in route and mode choice. Preliminary values of time have been assumed as shown in Table 1.

Table1 - Grouped Commodities and Values of Time for Freight

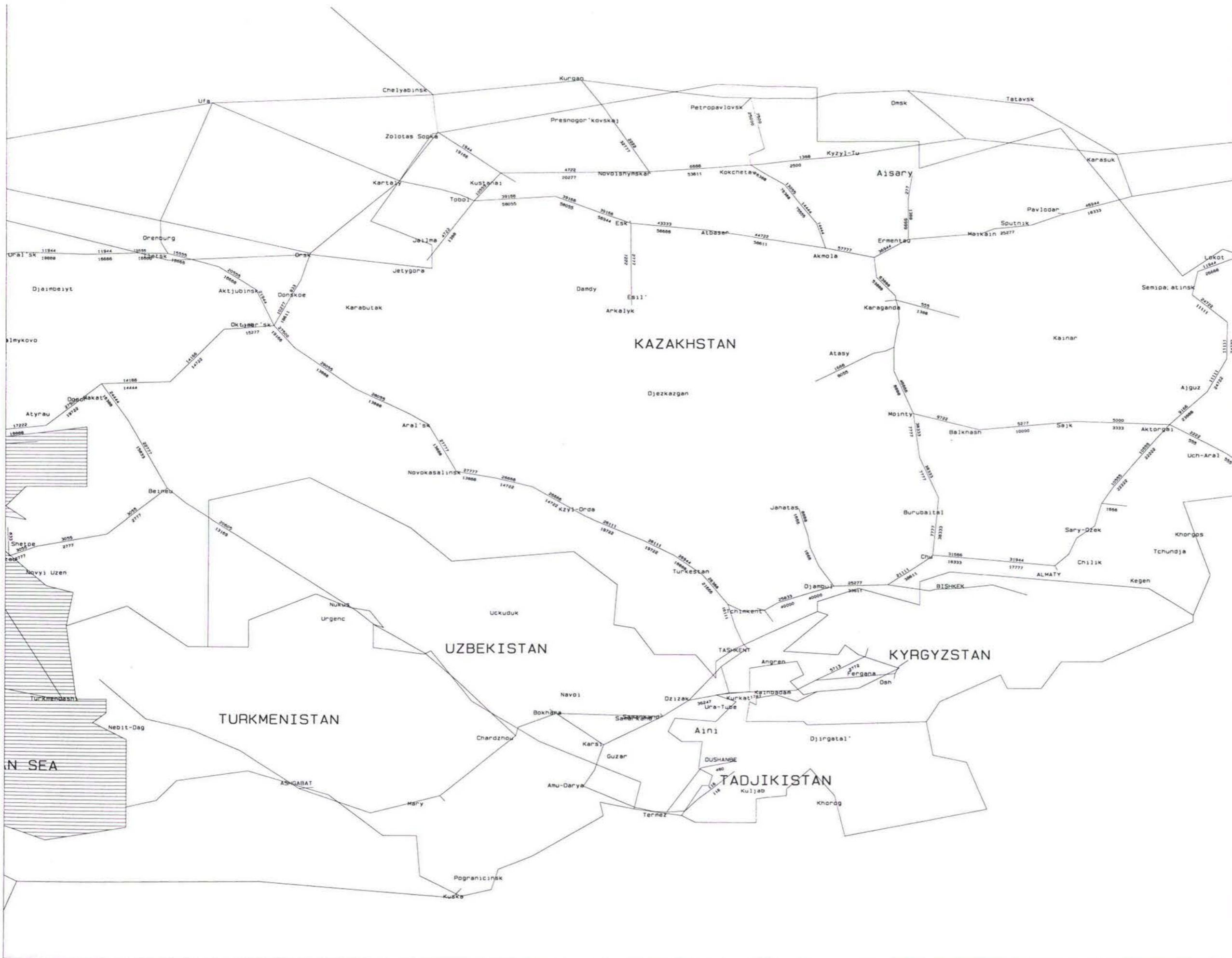
Aggregated Commodity Group	Commodity codes (from the 21 grouped commodities)	Description	Estimated value of time of commodity in \$ per minute
1	2	All grains, cereals etc.	0.007
2	11	Cotton and Textiles	0.001
3	13,14,15	Ores, Metals and Stone	0.001
4	5,6,7	Oil, petroleum & minerals	0.001
5	9,16,18,19	Wood, Construction plant, Equipment and machinery	0.003
6	8,10	Dry bulk (include. paper)	0.001
7	17	Vehicles	0.001
8	1,3,4,12,20,21	Other consumer goods	0.001



ROAD (CENTRAL ASIA) OBSERVED DAILY TONNAGE FLOWS FIGURE 2 (B)



RAIL (CAUCASUS) OBSERVED DAILY TONNAGE FLOWS FIGURE 3 (A)



RAIL (CENTRAL ASIA) OBSERVED ANNUAL TONNAGE FLOWS FIGURE 3 (B)

DEVELOPMENT OF BASE YEAR FREIGHT TRIP MATRICES

29. Import and export data for each of the eight TRACECA countries was collected through the questionnaires, and visits to all countries. 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 prepared using MICROSOFT EXCEL Workbooks, and were presented, together with the import / export data for each country, in the Data Collection Report (May 1997).
30. The import / export data relates to international freight traffic to and from each of the TRACECA countries. Therefore the matrices do not include local intra-regional traffic, and possibly external to external traffic that may use certain routes through the region. This should be taken into consideration with regards the count data during the calibration of the model.
31. Each of the 21 commodity matrices were then prepared for use in SATURN. After factoring the matrices to represent average 24 hour tonnage flows, they were combined to produce 8 *aggregated commodity groups* as shown in Table 1, and *stacked* together to form a multi dimensional layered SATURN matrix. This allows each aggregated commodity group, represented by a different level in the stacked matrix, to be assigned separately according to it's varying criteria for route and mode choice.

MODEL OPERATION AND CALIBRATION

32. The previous sections of this paper have detailed the individual elements and development of the TRACECA model network and freight demand matrices for a base year of 1995. This section concentrates on the operation of the model including the network build, assignment process and model calibration. The adopted approach for running the model is illustrated in flowchart form in Figure 4.
33. Results of the model calibration have been presented in the final section of this paper.

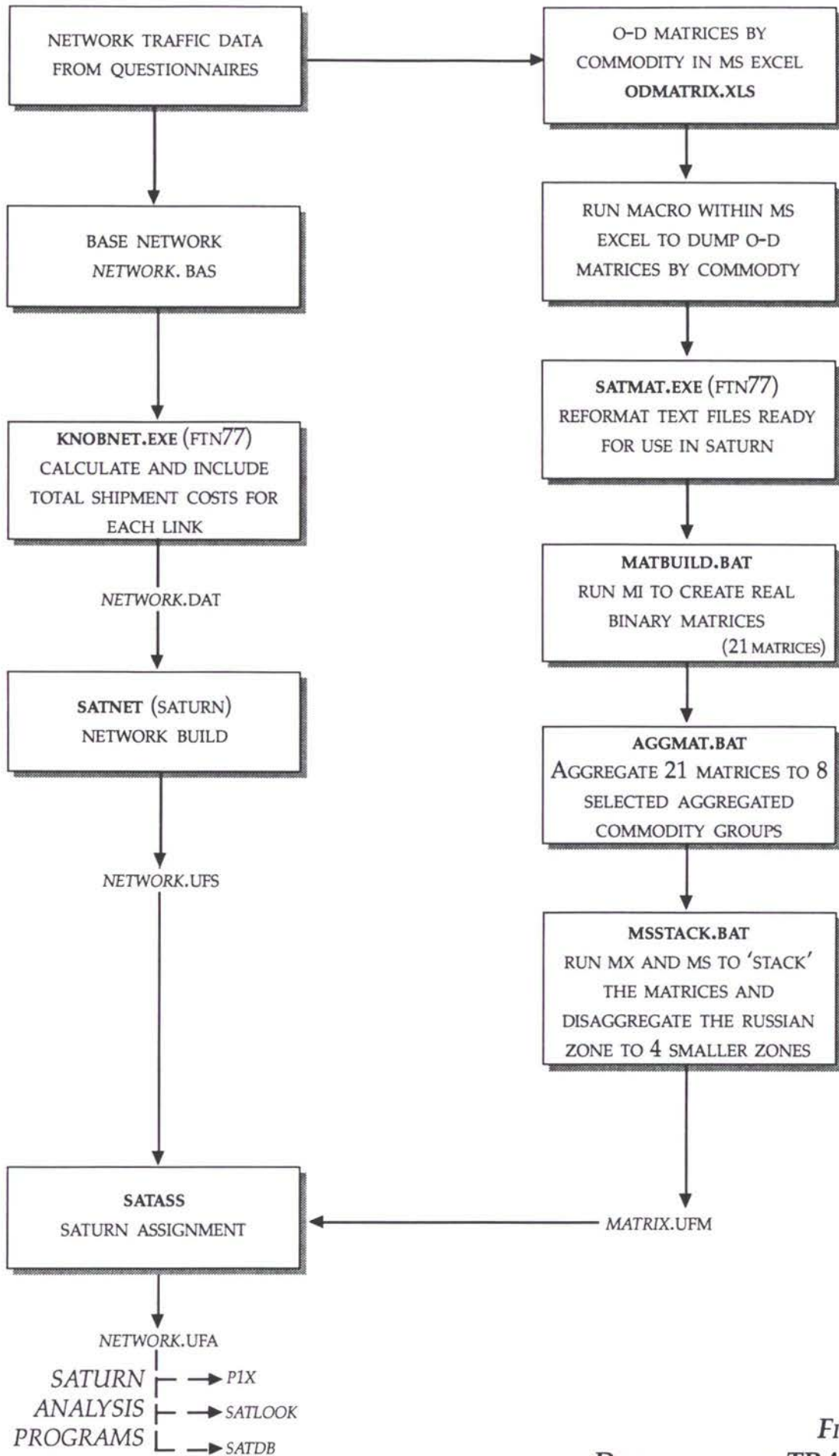


FIGURE 4
DEVELOPMENT OF TRACECA
TRAFFIC FORECASTING MODEL

Network build

34. The multi-modal freight model networks have been developed using the SATURN suite of programs, with the input data used to describe each link coded in the *buffer link data* section using the '33333' data records. The initial network coding, and any subsequent network changes (during both calibration and forecasting stages) , have been made to a *network.BAS* datafile. BAS is not a standard file extension with regards to SATURN naming conventions, but has been used here to distinguish between the input network file input to the KNOBNET program (discussed below), from the output file *network.DAT*, which is ready for use in SATURN.

KNOBNET Program (FTN77)

35. As discussed earlier in paragraph 23 of this paper total shipment costs per tonne along each link in the modelled network (i.e. tariff * distance) for each aggregated commodity group.
36. The tariff values are stored, and can be edited, in a input data file named **KNOBSv**, where 'v' is the run number/letter. The data file used in the base year model is shown in Annex A of this paper.
37. The KNOBS facility within SATURN (Refer to SATURN Manual) to hold *extra link data* for each user class (which in the case of the TRACECA model the 8 user classes allowed correspond to each of the aggregated commodity groups) has been used to store the shipment costs in the network data file. A FORTRAN77 (FTN77) program has been written to automate the process of calculating the shipment costs and incorporating these into the network data file.

Command line: **KNOBNET**

The program will then prompt the user to input the following files:

- input network data file (.BAS)
- input data file containing tariffs (.DAT)

(The extensions .BAS and .DAT are not required when inputing the file names.)

38. For example:

Input network data file	-	NETyyv.BAS
Input data file containing tariffs	-	KNOBSv.DAT
Output network data file	-	NETyyv.DAT

Where: 'yy' = year (i.e. 95 = 1995)
'v' = run number or letter

39. The data file output by the program is identical to the input file, but contains the shipment costs for each link. An extract from each network is also shown in Annex A.
40. The program KNOBNET also enables the user to apply a 'security' factor to reflect the perceived cost to the shippers of goods being stolen during shipment.

SATURN Network Build Program SATNET

41. The next step is to run the SATURN program **SATNET** which reads in the network *card image* (i.e. an ASCII or MSDOS Text file) data file and converts it after checking for errors in the coding to a binary file ready for use in SATURN. Reference should be made to the SATURN Manual for more information.
42. Command line: **SATNET** <network filename>
- For example: Input network file - NETyyv.DAT
- Output network file - NETyyv.UFS
43. The output network file produced by SATNET can be read and used by other programs in the SATURN suite, and in particular the assignment program SATASS.

Matrix Build

44. Base year origin and destination matrices for each commodity have been developed from import and export data received for each of the eight TRACECA countries as discussed earlier in this paper. These were prepared initially using MS EXCEL spreadsheets. While in the EXCEL spreadsheet, to either amend or update the data, **CTRL+D** executes a macro to dump each of the O-D matrices for the 21 commodities to MSDOS Text format in a directory named C:\MATRIXDUMP. This directory name, together with the names of the dumped matrices can be changed by editing the macro held within the workbook.

45. For the base year the naming convention adopted is as follows:

yyCGcc.TXT

Where: 'yy' = year (i.e. 95 = 1995)
CG = Commodity Group
'cc' = commodity category number (i.e. 1 to 21)

SATMAT Program (FTN77)

46. The next step was to reformat these text file to a card image form ready for use in SATURN's matrix build programs M1 and MX. Another FTN77 program has been specifically written to carry out this reformatting procedure.

47. Command line: **SATMAT y1 y2**

Where, for example: 'y1' = 9 'y2' = 5 (i.e. 95 = 1995)

48. Input text files: y1y2CGc.TXT, where 'cc' = commodity group (1 to 21)
Output SATURN card image matrix files: y1y2CGcc.DAT

MATBUILD Batch File

49. The batch file MATBUILD.BAT has been prepared to create real binary matrices for all 21 commodities. The output files from this batch file, which uses the SATURN matrix manipulation program \$M1, are ready for input to SATURN's assignment programs.

50. Command line: **MATBUILD y1 y2**

Where 'y1' and 'y2' are as above.

51. The input card image matrix file: y1y2CGcc.DAT (naming as above)

Output real matrix file: y1y2CGcc.UFM

Output line printer report file: MATBUILD.LPO

AGGMAT Batch File

52. The next step in the matrix build process combines the 21 commodity matrices to the 8 aggregated commodity groups shown in Table 1. This is achieved through running another specially prepared batch file AGGMAT.BAT

53. Command line: **AGGMAT y1 y2 y3 y4**

Where for example for 1995: 'y1' = 1, 'y2' = 9, 'y3' = 9, 'y4' = 5

54. Input commodity matrix files required: y3y4CGcc.UFM
where 'cc' = 1 to 21

Output aggregated commodity matrix files: y3y4ACGc
where AGC = Aggregated Commodity Group
'c' = 1 to 8

Output line printer report file: AGGMAT.LPO

M5STACK Batch File

55. The final step in the matrix build process is to prepare a multi-dimensional layered SATURN matrix, where each of the 8 aggregated commodity matrices produced are stacked together. This allows each aggregated commodity group, represented by a different level in the stacked matrix, to be assigned separately according to its varying criteria for route and mode choice.

56. The batch file M5STACK.BAT has been written to carry out this process by calling the SATURN matrix manipulation program \$M1 (Refer to SATURN Manual).

57. With regards the import and export information collected Russia has been treated as a single zone. For the purposes of the model this zone was considered too large to accurately model freight movement between Russia and the TRACECA countries. Therefore, this batch file also disaggregates the Russian zone into 4 smaller zone based on area, using the SATURN matrix manipulation program \$M5 (Refer to SATURN Manual)

58. Command line: **M5STACK y1 y2**

Where, for example for 1995 'y1' = 9 and 'y2' = 5

59. Input aggregated matrix files: **y1y2AGCc**
where: 'c' = aggregated commodity group (i.e. 1 to 8)

Output stacked matrix: **My1y2ALLCG.UFM**
where: **M = Matrix**
ALLCG = ALL Commodity Groups

Assignment

60. Having built a base year network (or future year network), the origin-destination freight matrix produced through the above procedures was assigned based on network characteristics using the SATURN assignment program SATASS. Reference should be made to the SATURN manual for further information.

61. Command line: **SATASS <network file> <matrix>**
(no extensions required)

62. Input network file from SATNET: **NETy1y2v.UFS**
Input freight O-D matrix: **My1y2ALLCG.UFM**

63. Output network file containing assigned flows: **NETy1y2v.UFA**

64. The *network.UFA* file can then be used in the SATURN assignment analysis and network plotting programs SATLOOK, PIX and SATDB. Again the SATURN manual should be referred to.

MODEL CALIBRATION

Network Calibration

65. Network calibration was 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.
66. The network calibration process continues throughout the model calibration exercise.

Assignment

67. 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.
68. 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.
69. The assignment calibration has been confined to looking at the strategic freight movements between the TRACECA countries. The freight matrices have been built from customs data, and therefore, represent international movements only. Direct comparison between assigned flows and observed flows has therefore, been confined to key ports and border crossings. In all countries it is clear that there are high levels of domestic traffic, which are included in the observed data, and hence, the observed flows should, and are, significantly higher than the assigned international movements on links within countries. In calculating total flows relative to link capacities it may be necessary to take account of this domestic traffic and this can be included in the model network as a fixed flow on links. In addition to this there are several other factors which prevent a direct comparison between observed flows of freight on links and assigned flows from the modelling process:

- annual observed flows for rail have been factored to average daily flows;
 - road flow data in number of trucks per day has been converted to represent daily tonne flows using a weighted average tonnage per truck;
 - history shows that there has been a significant volatility in trade movements over recent years resulting from economic conditions, trade barriers and the closure of border crossing points;
 - traffic information collected to date has mainly comprised of 1993 flow data, whereas the import/export data received represents trade in 1995.
70. The model assignment can be more easily analysed, especially by commodity, on a computer using the SATURN graphics program P1, therefore in this paper samples of what can be produced have been presented. Figures 5 and 6 show the base year assigned flows for the Caucasus Regions and Central Asia for rail and road respectively for all commodities.

Sea Links

71. On the Caspian Sea, the model shows 2-way flows between Baku and Turkmenbashi of approximately 3800 tonnes per day (over 1.3 million tonnes per annum). This compares with approximately 0.85 m.t.p.a handled by the ports in 1995. In earlier runs of the model the Caspian Sea Ferry route was shown to be more heavily loaded, possibly indicating an intrinsic attractiveness of this route. This has been reduced from the initial figures by increasing the loading times and delays at the ports together with the effective generalised costs of the ferry to better reflect the present day situation.
72. Modelled freight flows through the Black Sea Ports of Poti and Batumi are shown to be over 4200 tonnes per day (over 1.5 m.t.p.a) and almost 4000 tonnes per day (nearly 1.4 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.
73. Table 2 presents a comparison of modelled and observed imports and exports through both the Port of Poti and Port of Batumi. The figures show that the model compares well with the observed flows.

Table 2 - Modelled and Observed Imports and Exports Through the Ports of Poti and Batumi

Port	Modelled Imports (tonnes per day)	Modelled Imports (tonnes per annum)	Observed Imports (tonnes per annum)	Modelled Exports (tonnes per day)	Modelled Exports (tonnes per annum)	Observed Exports (tonnes per annum)
Poti	3000	1.1 million	1.37 million	1700	0.6 million	0.3 million
Batumi	2500	0.9 million	0.89 million	500	0.18 million	0.3million.

Railway Links

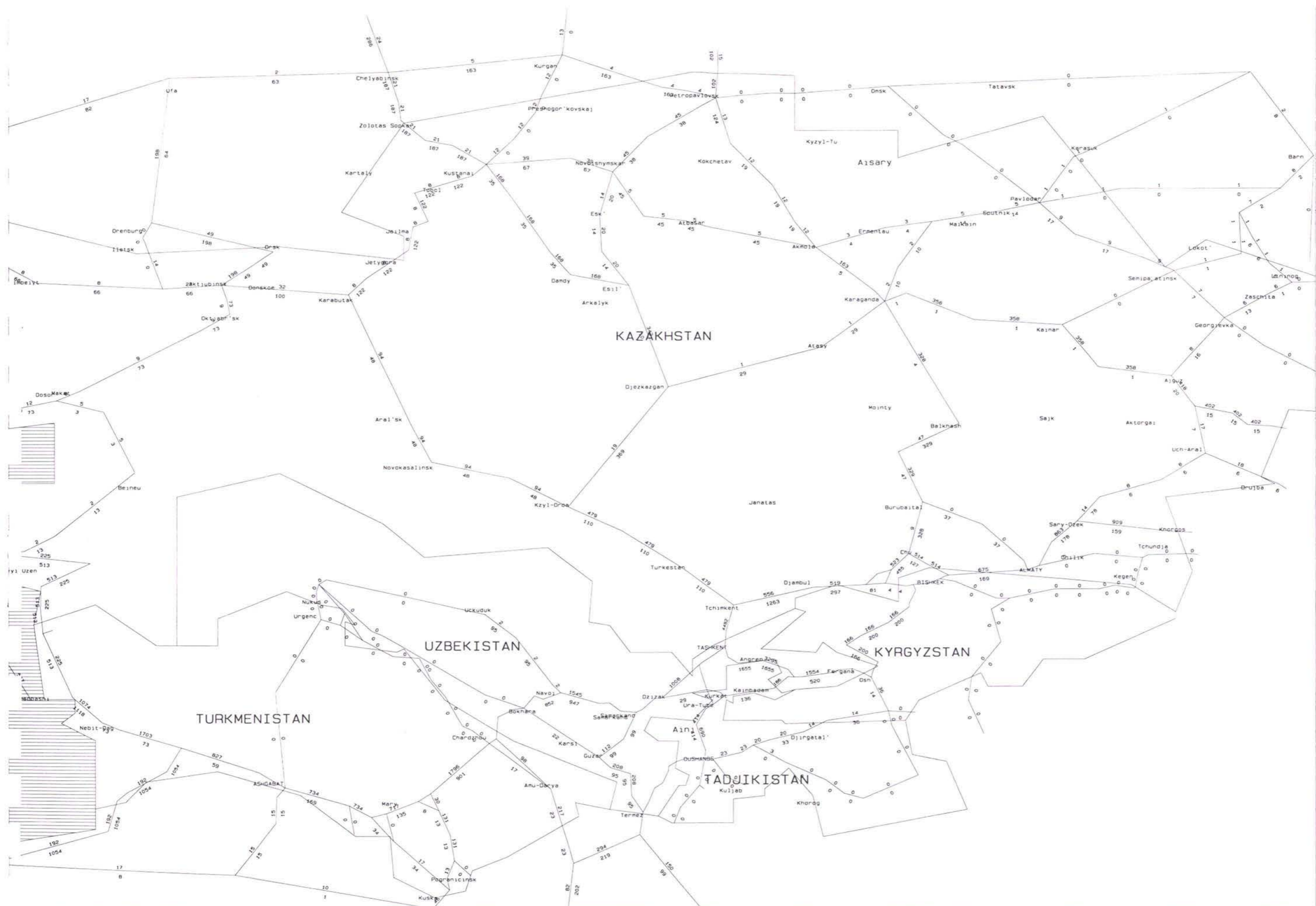
74. The railways in both Central Asia and the Caucasus Regions still play a dominant role in the transshipment of freight. Figures 5 shows that this is the case in the model assignment.
75. Generally the modelled rail traffic appears on the correct corridors. However, large discrepancies can be seen 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 as mentioned earlier.
76. Table 3 compares rail flows to and from Kazakhstan across selected screenlines to the north, south and east of the country. The locations of the screenlines are shown in Figure 7.



AIL (CAUCASUS) ALL COMMODITIES (THOUS TONNES PER ANNUM) FIGURE 5 (A)



RAIL (C. ASIA) ALL COMMODITIES (THOUS TONNES PER ANNUM) FIGURE 5 (B)



ROAD (C. ASIA) ALL COMMODITIES (THOUS TONNES PER ANNUM) FIGURE 6 (B)

77. In the corridor through Turkmenistan to Turkmenbashi the model is splitting the traffic equally between the rail route and the road which is close to the observed modal split in this corridor.

Table 3 - Rail flows to and from Kazakhstan

Screenline	To Kazakhstan		From Kazakhstan	
	Observed (tonnes per day)	Modelled (tonnes per day)	Observed (tonnes per day)	Modelled (tonnes per day)
Northern	29764	22693	107775	34491
Southern	42082	21618	67409	28761
Eastern	6388	2789	9162	3674

78. On the trans caucuses rail link there appears to be the basis for securing good agreement for both directions between the model and the observed data. In the eastbound direction the model shows a daily flow of 1500 tonnes, which agrees with the observed, whereas westbound flows of approximately 4600 are within 50% of the observed flows at Buyuk-Kassik on the border between Azerbaijan and Georgia.

Road Links

79. 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.
80. Through the Sarpi border crossing the model shows daily freight flows of over 1400 tonnes from Turkey and over 1200 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).
81. The model appears to be representing the freight movements through Iran and Turkey reasonably with appropriate flows into and out of Armenia and Turkmenistan. The pattern of movements as modelled accords well with reported road traffic and the

existing best routes into these parts of the TRACECA region as reported by freight forwarders.

ANNEX A

AREA=18								
COMM=8								
SECURITY								
1.750	1.000	1.750	1.750	1.750	1.750	1.750	1.750	rail
ROAD								
0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	ar
0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	az
0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	ge
0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	kaz
0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	kyrg
0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	ta
0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	tu
0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	uz
0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	russia
0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	ext
5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	x border
5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	interchge
								black sea
								caspian
0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	cc(=\$10) 50km
0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	bandar abbas
20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	x border (Kaz->russia)
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	x border UZ
RAIL								
0.012	0.014	0.008	0.012	0.012	0.012	0.012	0.012	ar
0.012	0.014	0.008	0.012	0.012	0.012	0.012	0.012	az
0.012	0.014	0.008	0.012	0.012	0.012	0.012	0.012	ge
0.012	0.014	0.008	0.012	0.012	0.012	0.012	0.012	kaz
0.012	0.014	0.008	0.012	0.012	0.012	0.012	0.012	kyrg
0.012	0.014	0.008	0.012	0.012	0.012	0.012	0.012	ta
0.012	0.014	0.008	0.012	0.012	0.012	0.012	0.012	tu
0.012	0.014	0.008	0.012	0.012	0.012	0.012	0.012	uz
0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	russia
0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	ext
10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	x border
10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	interchge
								black sea
								caspian
0.200	0.240	0.080	0.200	0.200	0.200	0.200	0.200	cc(\$10) 50km
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	bandar abbas
10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	x border (kaz->russia)
20.000	20.000	20.000	20.000	20.000	20.000	20.000	20.000	x border UZ
SEA								
								ar
								az
								ge
								kaz
								kyrg
								ta
								tu
								uz
								russia
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	ext
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	x border
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	interchge
0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	black sea (\$80) 1000km
0.030	0.065	0.065	0.065	0.065	0.065	0.065	0.002	caspian (\$5-\$20) 310km
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	cc
75.000	75.000	75.000	75.000	75.000	75.000	75.000	75.000	bandar abbas
								x border (kaz->russia)
								x border UZ

Data file containing tariff rates for program KNOBNET

3333333333

*Armenia

10001	10020	40	9999	2S	44	0.0	11	1
10020	10030	40	9999	2S	100	0.0	11	1
10030	10031	40	9999	2S	49	0.0	11	1
10030	10040	40	9999	2S	30	0.0	11	1
10031	10131	40	9999	2S	30	0.0	11	1
10040	10060	40	9999	2S	73	0.0	11	1
10040	10110	40	9999	2S	47	0.0	11	1
10060	10080	40	9999	2S	30	0.0	11	1
10080	10090	40	9999	2S	49	0.0	11	1
10080	10130	40	9999	2S	40	0.0	11	1
10090	10091	40	9999	2S	20	0.0	11	1
10110	10120	40	9999	2S	20	0.0	11	1
10130	10131	40	9999	2S	15	0.0	11	1
10130	10132	40	9999	2S	26	0.0	11	1
10130	10140	40	9999	2S	31	0.0	11	1
10131	10020	39	9999	2S	50	0.0	11	1
10132	10133	38	9999	2S	56	0.0	11	1
10140	10150	38	9999	2S	26	0.0	11	1
10150	10160	40	9999	2S	34	0.0	11	1
10170	10180	40	9999	2S	56	0.0	11	1
10180	10190	40	9999	2S	30	0.0	11	1
10190	10200	40	9999	2S	62	0.0	11	1
10200	10201	40	9999	2S	28	0.0	11	1
10200	10210	40	9999	2S	48	0.0	11	1
10210	19220	40	9999	2S	19	0.0	11	1
10210	10230	40	9999	2S	75	0.0	11	1
10230	10120	40	9999	2S	59	0.0	11	1
10230	10240	28	9999	2S	65	0.0	11	1
10240	10060	37	9999	2S	63	0.0	11	1

*Azerbaijan

10091	29020	40	9999	2S	15	0.0	11	2
10170	29631	20	9999	2S	8	0.0	11	2
10220	20600	38	9999	2S	34	0.0	11	2
20020	20050	40	9999	2S	113	0.0	11	2
20050	20060	40	9999	2S	70	0.0	11	2
20060	20070	30	9999	2S	16	0.0	11	2
20060	20391	40	9999	2S	98	0.0	11	2
20060	20451	40	9999	2S	90	0.0	11	2
20060	20500	40	9999	2S	27	0.0	11	2
20070	20080	30	9999	2S	40	0.0	11	2
20080	20081	30	9999	2S	24	0.0	11	2
20081	20090	30	9999	2S	25	0.0	11	2
20090	20091	30	9999	2S	36	0.0	11	2
20090	20130	30	9999	2S	27	0.0	11	2
20091	20092	30	9999	2S	14	0.0	11	2

**SATURN
Buffer Link
Coding**

Extract from NET95J.BAS, containing no shipment costs

