



**SEMINAR ON NETWORK PLANNING  
STRATEGY FOR EVOLVING NETWORK  
ARCHITECTURES  
FOR ASIA PACIFIC REGION**

***Session 3.5***

**Case studies with  
traffic forecasting, optimization benefits  
and impact on solutions**

ITU, Bangkok, Thailand, 11-15 November 2002

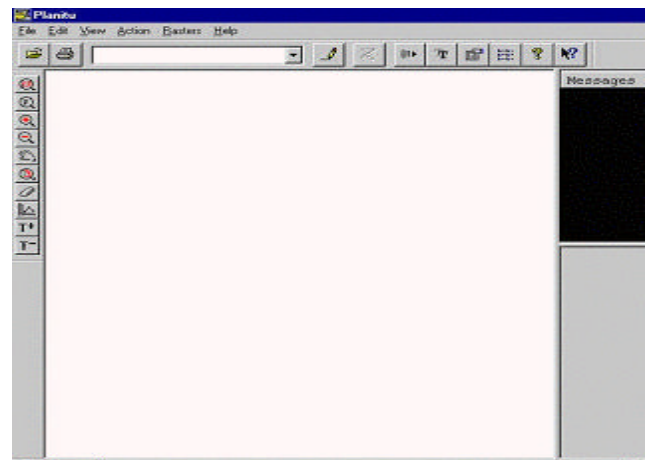
# Case studies :

## **Traffic forecasting, optimization benefits and impact on solutions**

Presented with application of the network planning tool PLANITU in the form of a live demo.

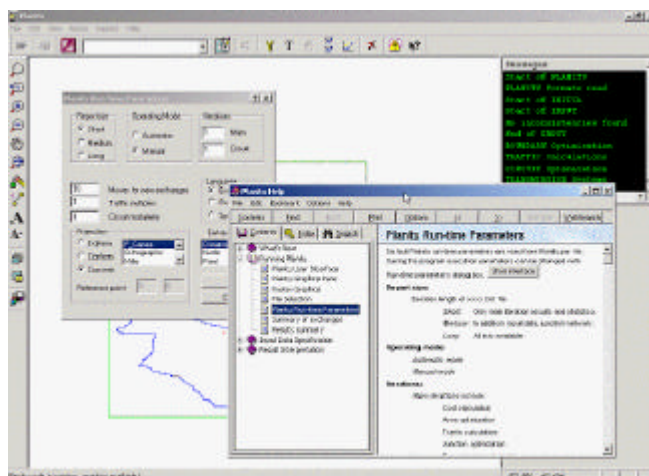
PLANITU is a tool for optimisation and dimensioning of telecom networks, based on an integrated interactive approach for finding minimum cost solutions for:

- location and boundaries of exchanges
- selection of switching and transmission equipment
- circuit quantities, traffic routing, switching hierarchy
- choice of transmission paths.



### APPLICATION:

In PSTN circuit-switched (TDM) networks dimensioning and optimization , very limited for Data (packet) networks, limited for investigation of the evolution to 5NGN.



Application as training tool for network planning – set of real case studies data, self-training users manual, real-time help functions.

# Service/Traffic forecasting:

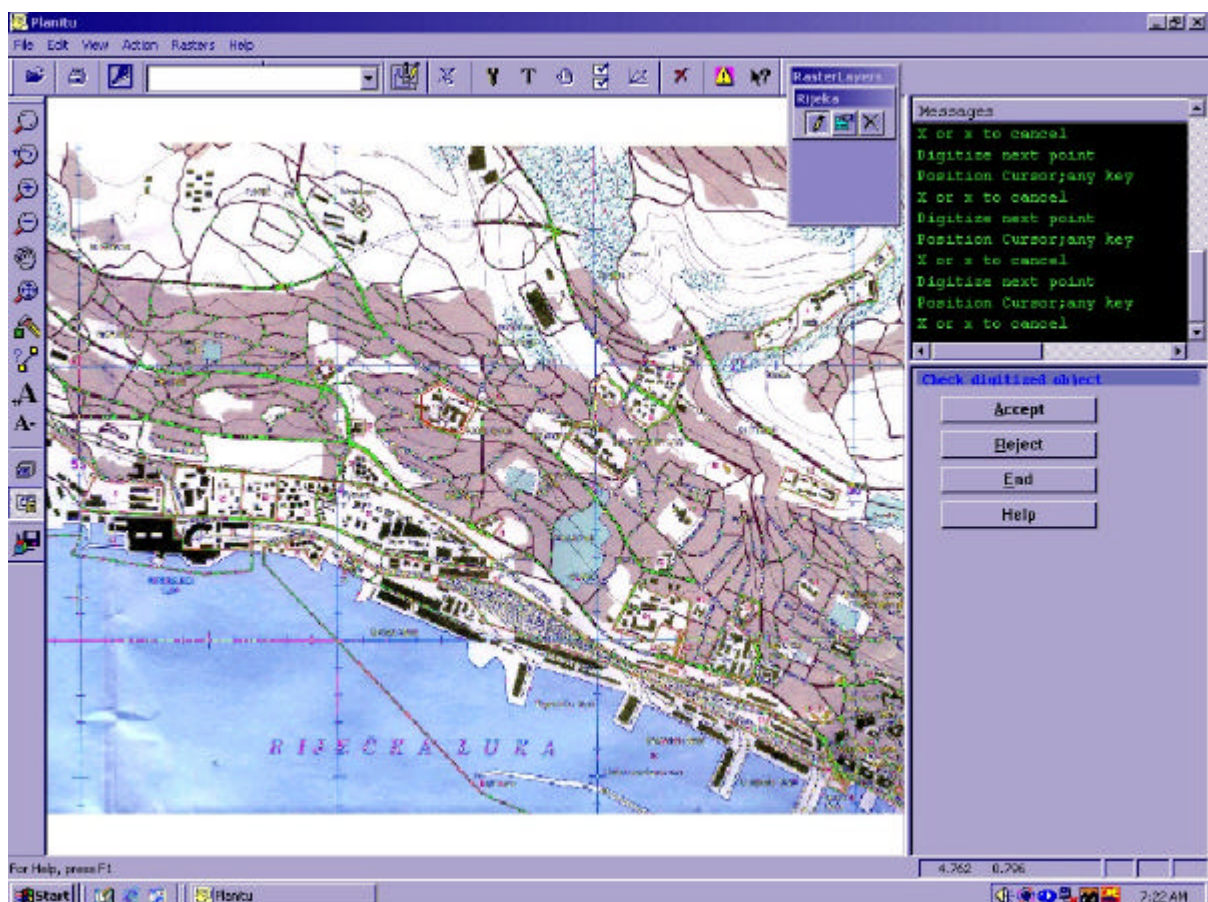
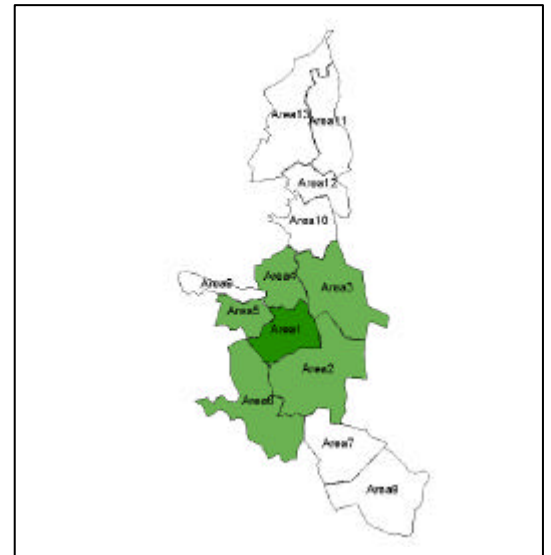
## *Digitizing of zones*

### Subscriber zones

Group of subscribers, homogeneously distributed in a geographical area (group of buildings, houses, etc.)

- usually the city centre is surrounded by urban areas with high customer density, while the areas in the edge are suburban areas
- often the set of areas is similar to exchange areas

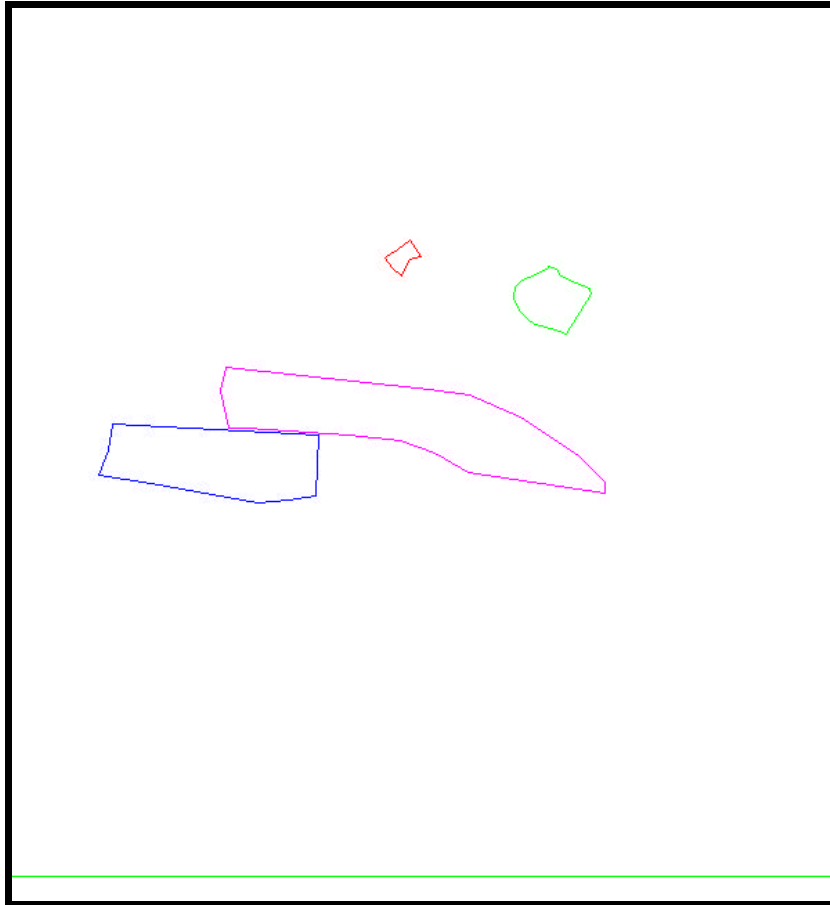
They can be from several to several hundreds.



# Digitizing of zones

## Subscriber zones

Digitizing result – subscriber zones after digitizing with PLANITU as raster coordinates:



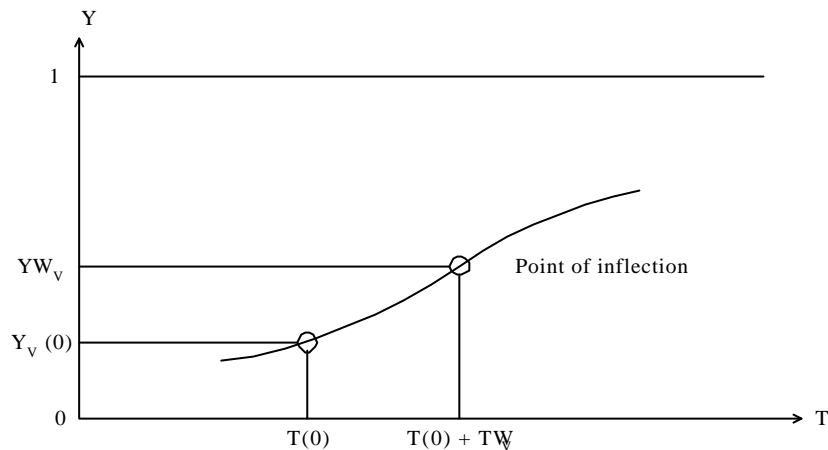
Digitizing result – data file with coordinates:

Z1	9	1Z	VT340	1.533	2.259	0.955	1.215	1	0	1
	1.533	1.041	1.565	1.128	1.578	1.215	2.259	1.179	2.250	0.977
	2.159	0.964	2.058	0.955	1.706	1.014	1.533	1.041		
Z2	10	1Z	VT340	2.483	2.598	1.704	1.823	2	0	1
	2.483	1.764	2.511	1.727	2.538	1.704	2.547	1.736	2.566	1.759
	2.598	1.768	2.566	1.823	2.520	1.791	2.488	1.768	2.483	1.764
Z3	15	1Z	VT340	1.935	3.210	0.982	1.403	4	0	1
	1.962	1.201	1.935	1.325	1.953	1.403	2.625	1.329	2.762	1.311
	2.931	1.233	3.123	1.110	3.210	1.019	3.210	0.982	2.758	1.051
	2.648	1.119	2.529	1.160	2.364	1.179	2.022	1.201	1.962	1.201
Z4	18	1Z	VT340	2.908	3.164	1.512	1.736	3	0	1
	3.023	1.732	2.982	1.709	2.936	1.690	2.913	1.668	2.908	1.631
	2.931	1.585	2.954	1.563	2.977	1.544	3.014	1.535	3.059	1.521
	3.082	1.512	3.164	1.645	3.160	1.663	3.114	1.681	3.064	1.704

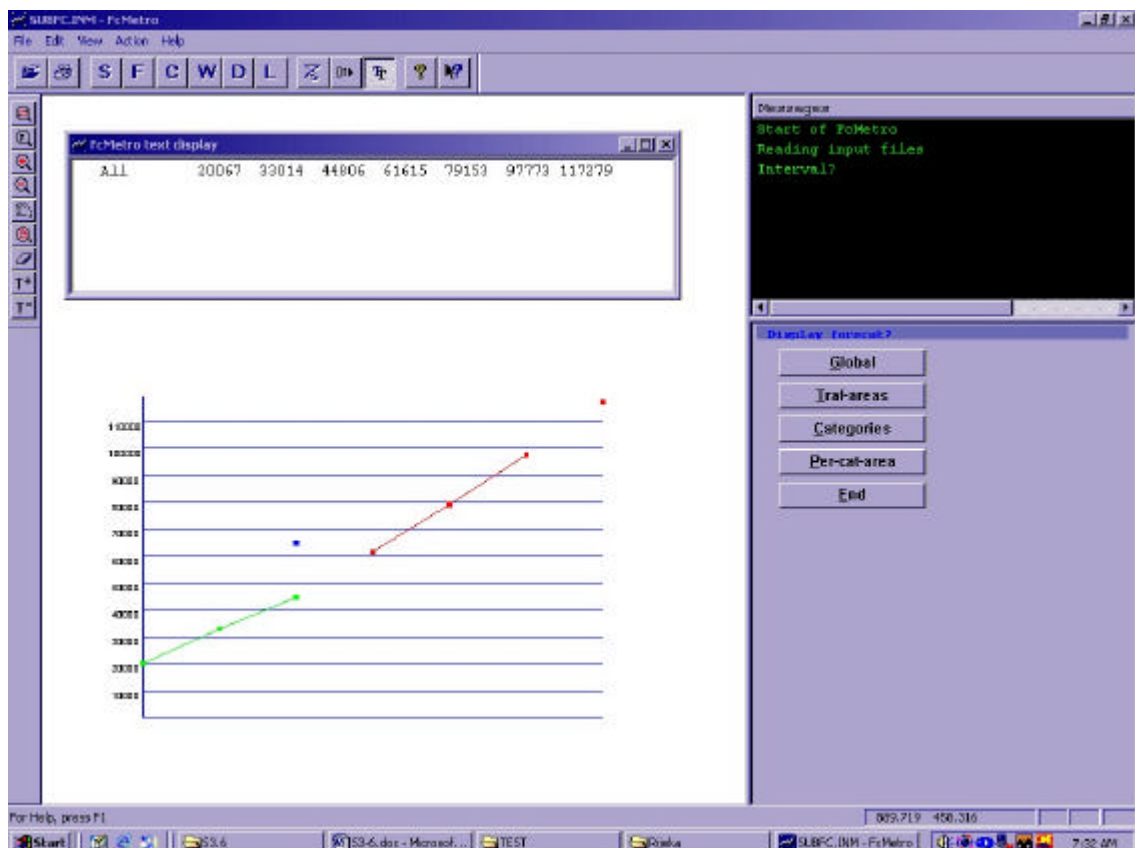
# Forecasting

## Methods for forecasting of subscribers - Logistic model

The development is supposed to follow a curve which first accelerates, then passes a point of inflection, and finally the development slows down and approaches an asymptote, the “saturation level”, or “the maximum density”.



Forecasting of subscribers result – subscriber forecast after proceeding with PLANITU forecasting tool FCRURAL :

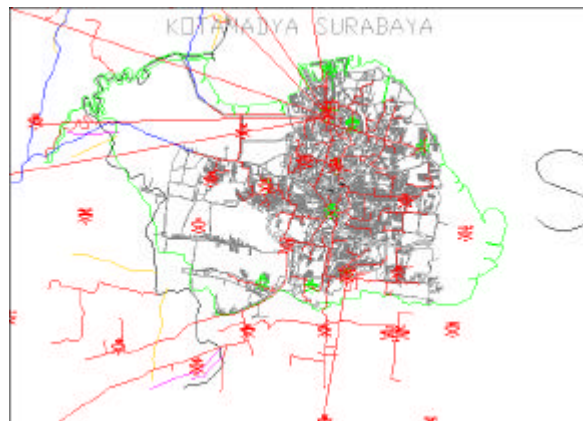


# Optimization benefits and impact on solutions:

## *Optimizing of telecom networks*

Local Networks optimization objectives:

- Exchange locations
- Exchange boundaries
- RSU locations & boundaries
- Inter-exchange network
- Exchange hierarchy
- Transmission systems



Rural Networks optimization objectives:

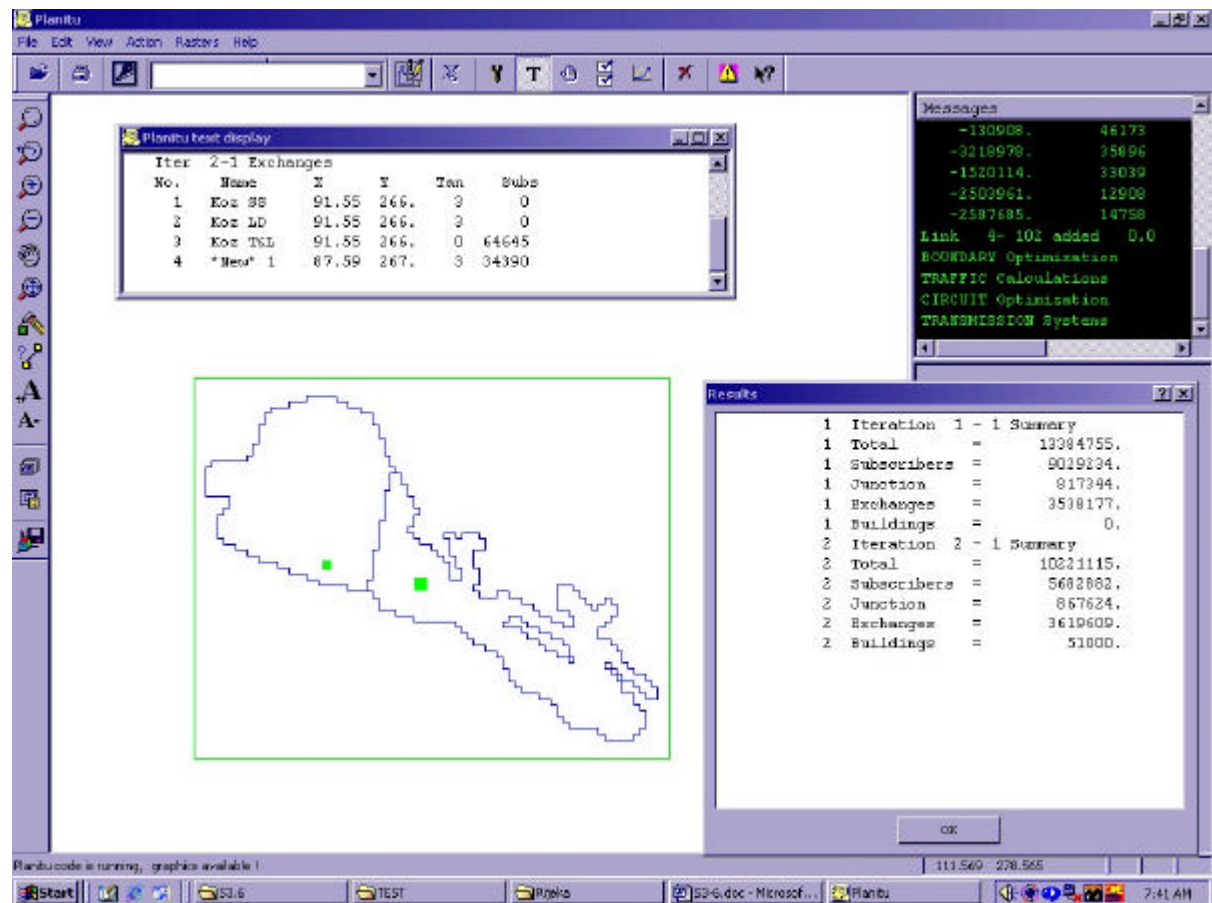
- Exchange locations & boundaries
- Exchange hierarchy
- Inter-exchange network
- Transmission systems



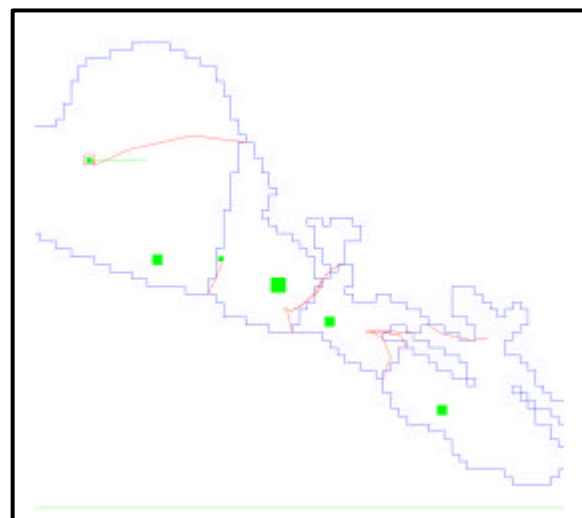


## Optimizing of local network

Optimization results – application of PLANITU for optimization of a local network with results for number of exchanges/RSUs, optimized locations and service areas, routing and dimensioning of junction network, etc. :



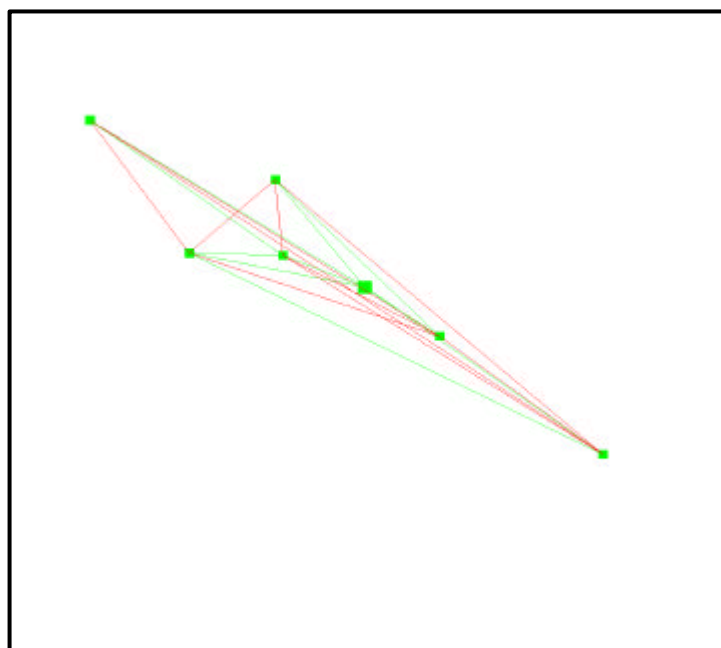
Optimization results – application of PLANITU for optimization of a local network with results for new exchange locations :



Optimization results – application of PLANITU for optimization of a local network with results for optimal number of exchanges, locations and service areas :



Optimization results – application of PLANITU for optimization of a local network with results for routing in the network :





Optimization results – output text results from the application of PLANITU for optimization of a local network.

Results for the total network costs and summary for number of exchanges, coordinates of the locations and service areas as subscribers quantity:

Iteration 9 - 1								
Total Cost of Network= 6472179.00								
Cost of Subscribers = 1327214.62								
Cost of Junctions (S)= 697296.00								
Cost of Junctions (T)= 327495.56								
Cost of Exchanges = 3814172.75								
Cost of Buildings = 306000.00								
No.	Name	X	Y	Tan	Subs	SubCost	ExCost	BuildCst
1	Koz SS	91.55	266.30	3	0	0.	57965.	0.
2	Koz LD	91.55	266.30	3	0	0.	69000.	0.
3	Koz T&L	91.55	266.30	0	24657	252233.	877750.	0.
4	*New* 1	87.59	267.14	3	16800	201739.	620040.	51000.
5	*New* 2	96.93	262.21	3	12142	284396.	456223.	51000.
6	*New* 3	93.24	265.10	3	19412	204951.	705714.	51000.
7	*New* 4	85.35	270.40	3	8446	201701.	334994.	51000.

Results for the transmission media used in the network as subscriber cables, inter-exchange transmission systems, etc. :

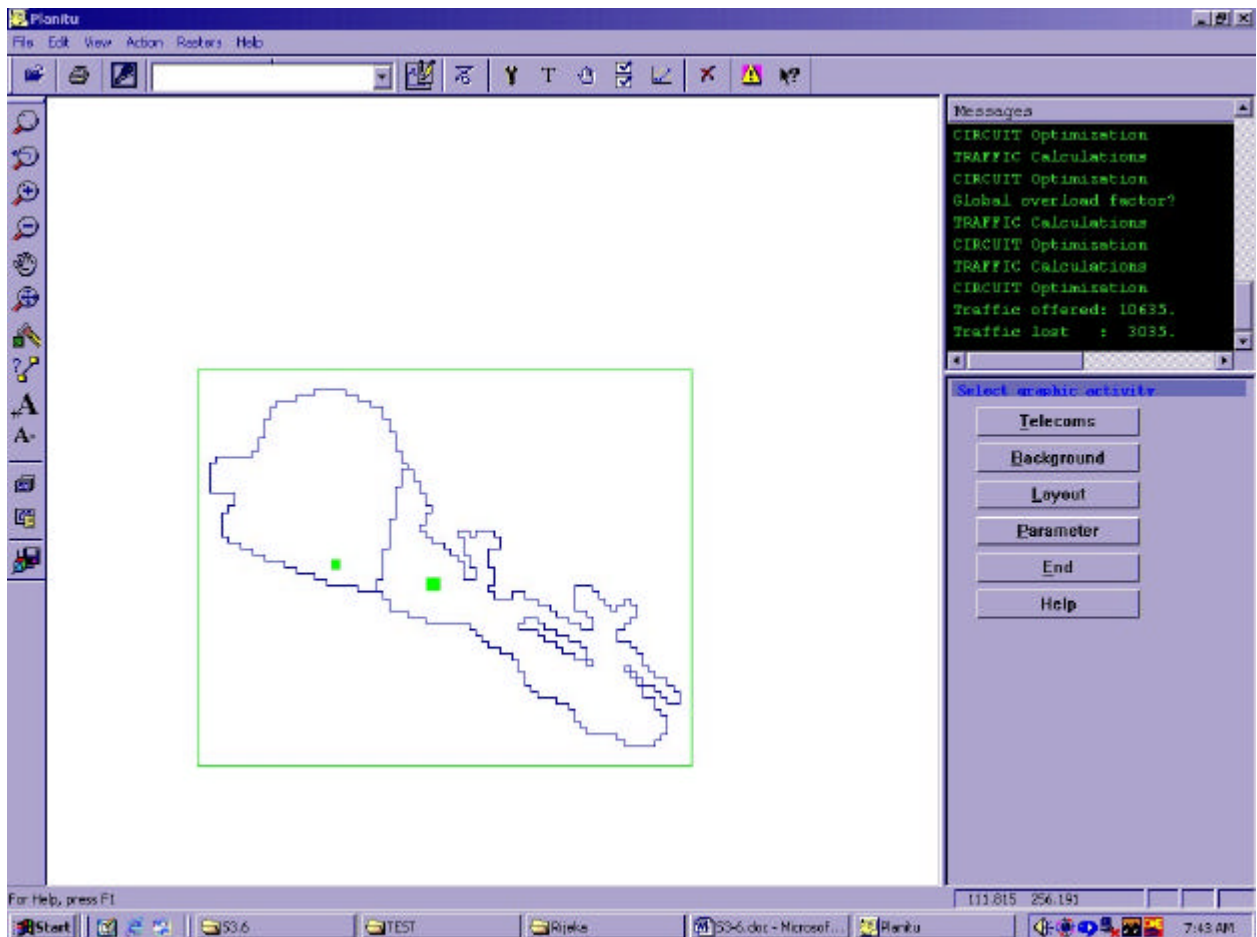
Statistics for Cables						
Cable Type	Junction Pairs	Junction PairKm	Subscriber Pairs	Subscriber PairKm	Total Pairs	Total PairKm
0.4	0	0.	96413	110983.	96413	110983.
0.6	0	0.	2543	10466.	2543	10466.
0.8	0	0.	0	0.	0	0.
0.81	0	0.	0	0.	0	0.
pcm0	8760	36400.	0	0.	8760	36400.
pcm1	0	0.	0	0.	0	0.
pcm2	0	0.	0	0.	0	0.
rsu	0	0.	0	0.	0	0.
fict	0	0.	79	407.	79	407.

Results for the traffic flows accumulation in the exchanges as incoming, outgoing and transiting traffics and the corresponding conversion to equipment (inter-exchange circuits) :

Statistics for Circuits & Traffics						
Exchange #	Name	Circuits		Peak Traffics		
		Inc	Outg	Inc	Outg	Transit
1	Koz SS	150	0	98.	0.	0.
2	Koz LD	1680	1440	1535.	1272.	0.
3	Koz T&L	2430	2460	1806.	1779.	253.
4	*New* 1	960	930	780.	780.	0.
5	*New* 2	660	900	543.	747.	0.
6	*New* 3	1020	1380	867.	1194.	0.
7	*New* 4	510	480	398.	369.	0.
8	*New* 5	930	870	758.	715.	0.

## *Sensitivity analysis*

Sensitivity analysis results – application of PLANITU for verifying of the sensitivity of the optimized network for traffic overload :



*End of the case study for traffic forecasting optimization benefits and impact on solutions with the application of the PLANITU network planning tool.*