Regional Seminar on evolving network infrastructures to NGN and related Planning Strategies and Tools, for the CEE, CIS and Baltic States

Session 6.6

Case studies with

traffic forecasting, optimization benefits

and impact on solutions

Belgrade, Serbia and Montenegro, 20-24 June 2005

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.
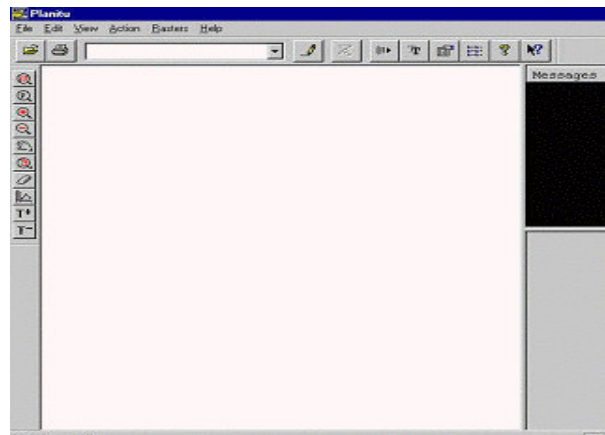
APPLICATION:

In PSTN circuit-switched (TDM) networks dimensioning and optimization , very limited for Data (packet) networks, limited for investigation of the evolution to NGN.
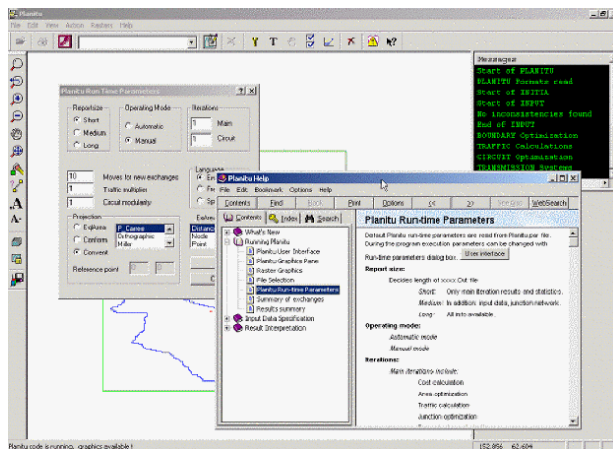
Application as training tool for network planning – set of real case studies data, self-training users manual, real-time help functions.

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

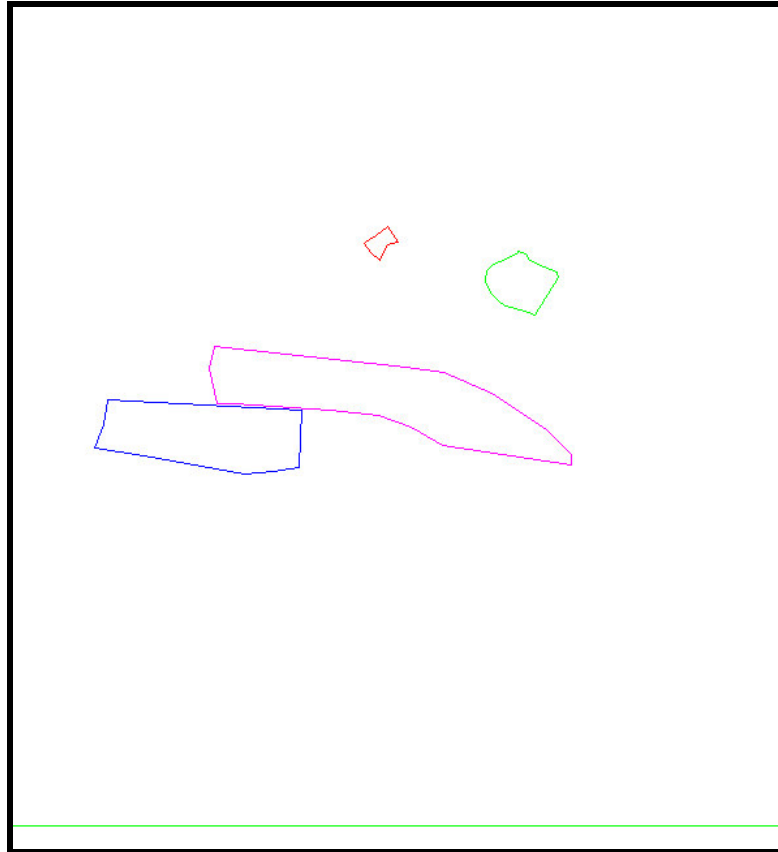- often the set of areas is similar to exchange areas

They can be from several to several hundreds.
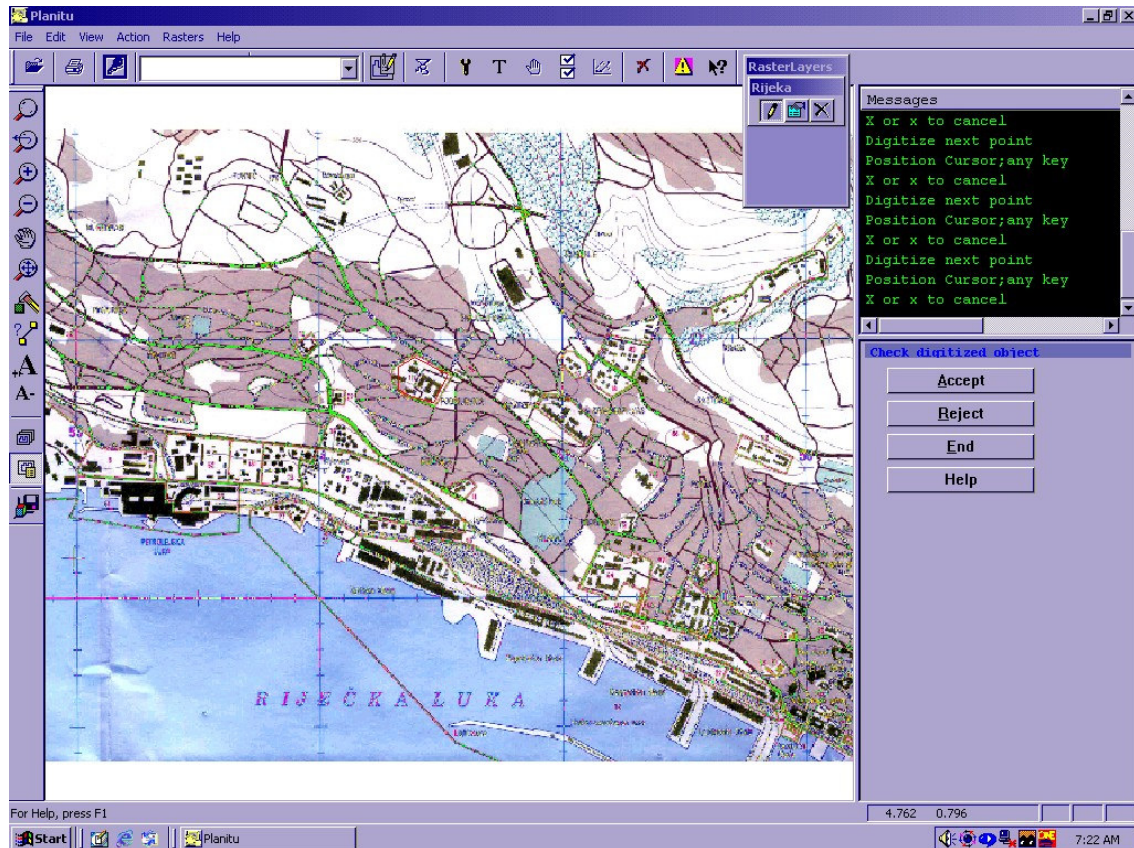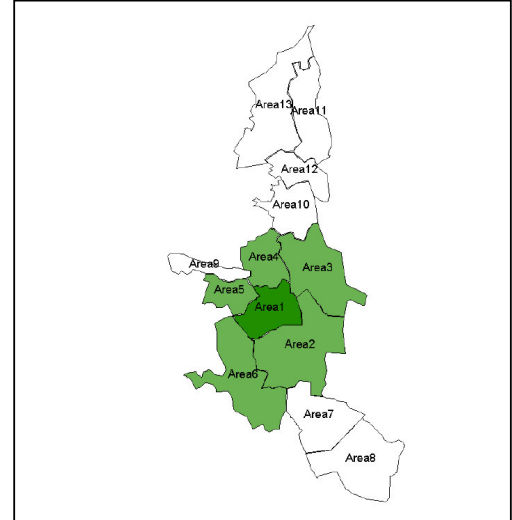
Digitizing of zones

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
    3.050    1.727    3.023    1.736    3.023    1.732
```

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".
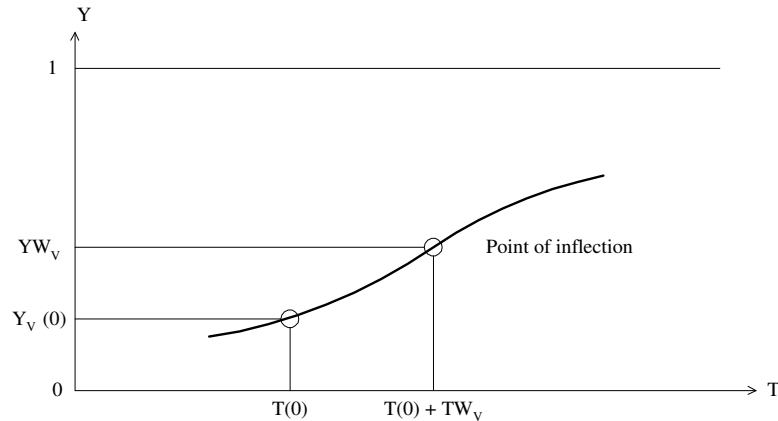
Forecasting of subscribers result – subscriber forecast after proceeding with PLANITU forecasting tool FCRURAL :
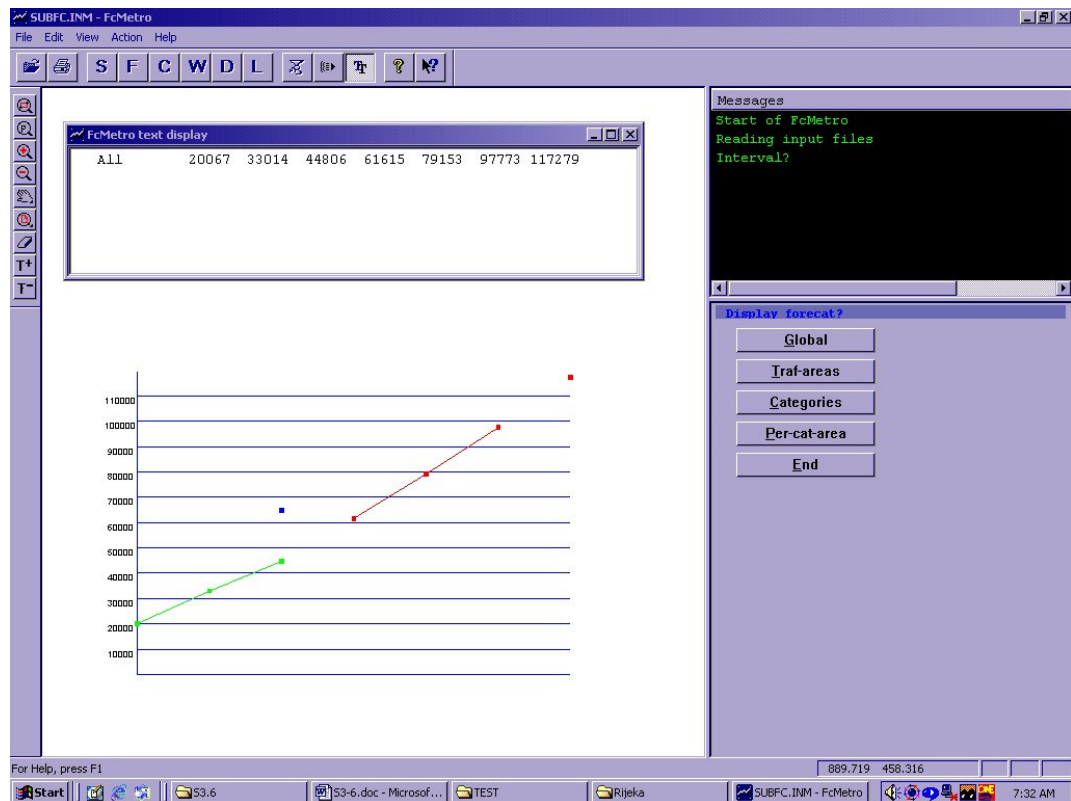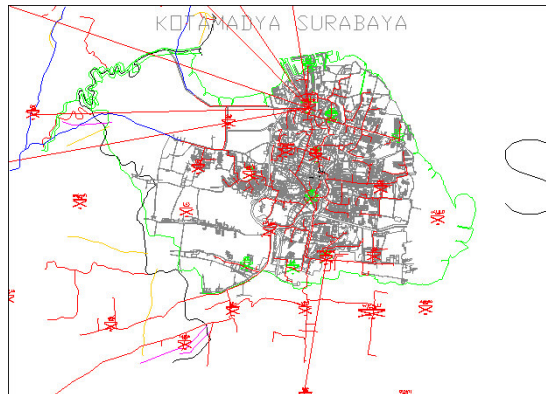
# Optimization benefits and impact on solutions:

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

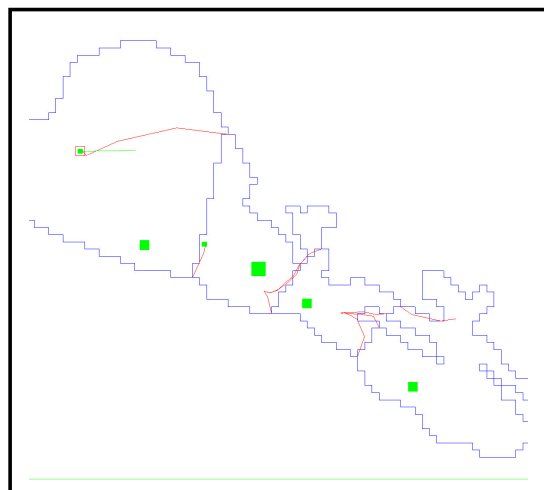• Transmission systems
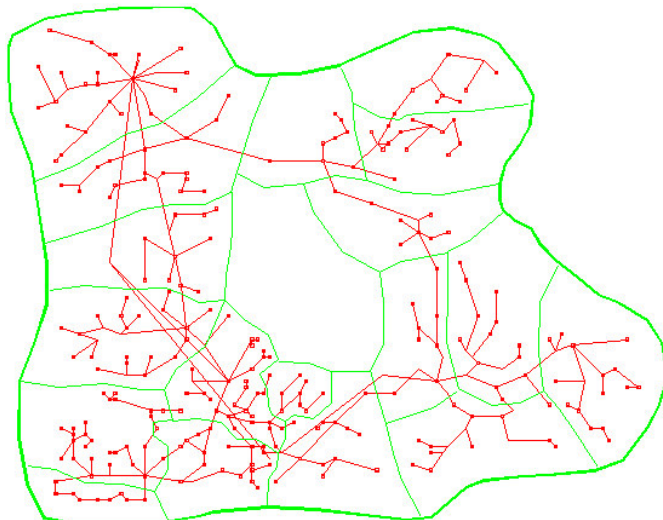
Optimizing of local network

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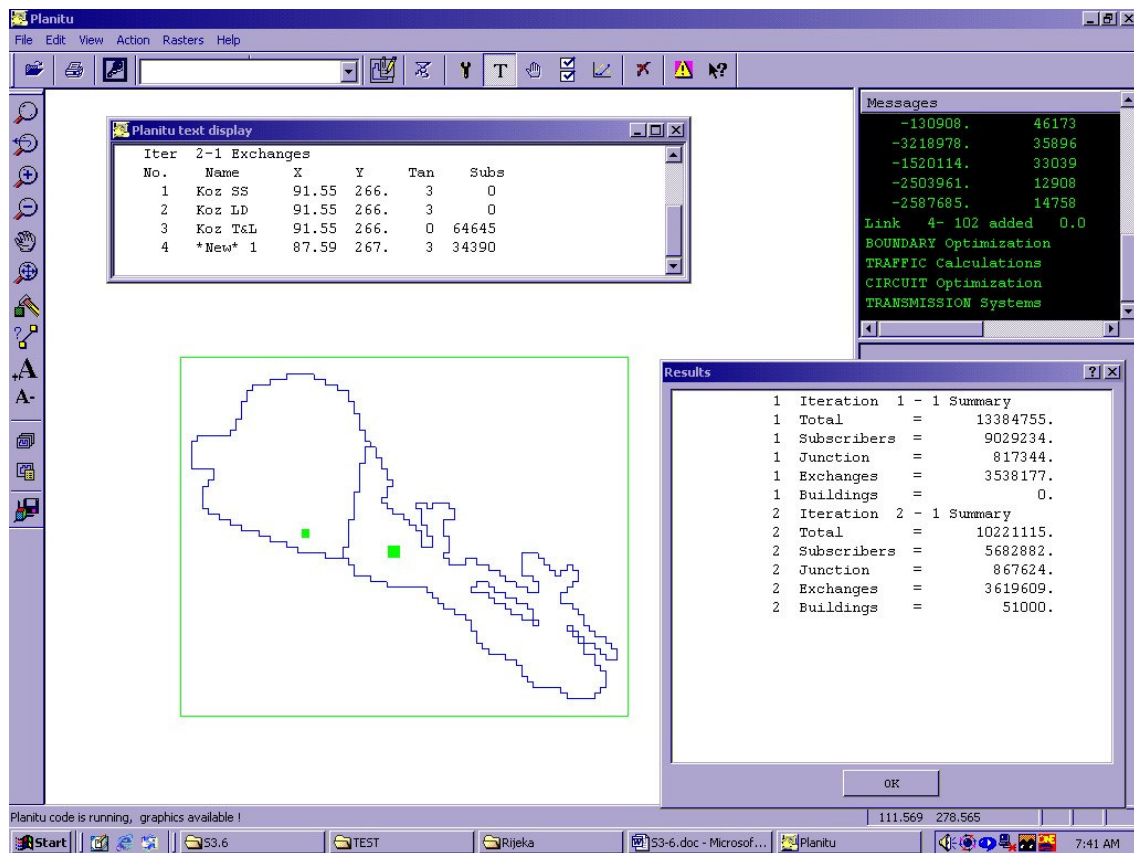
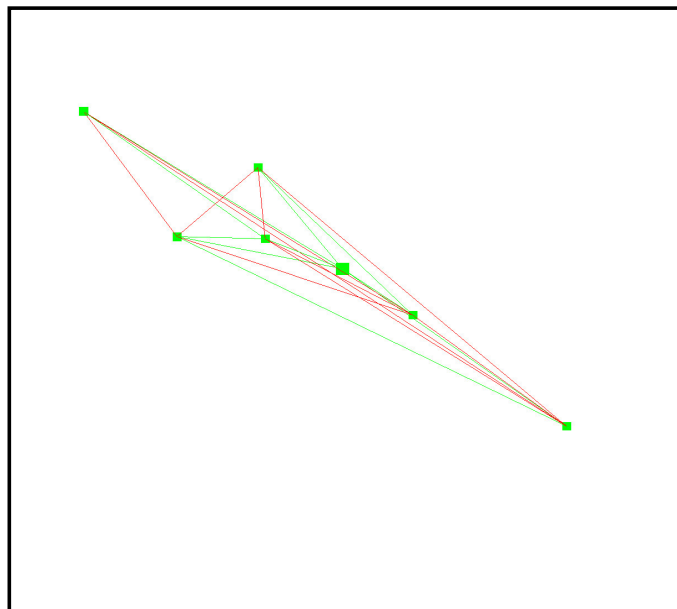Optimization results – application of PLANITU for optimization of a local network with results for new exchange locations :

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.
        8   *New* 5   89.71  267.09    3   11317    84495.   429163.    51000.
        9   *New* 6   89.53  268.95    3    6261    97698.   263326.    51000.
```

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

```
 Statistics for Cables

  Cable           Junction            Subscriber            Total
  Type      Pairs    PairKm       Pairs    PairKm       Pairs    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          Circuits        Peak Traffics
    #    Name      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.
    9   *New* 6    420   300     306.   234.     0.
```
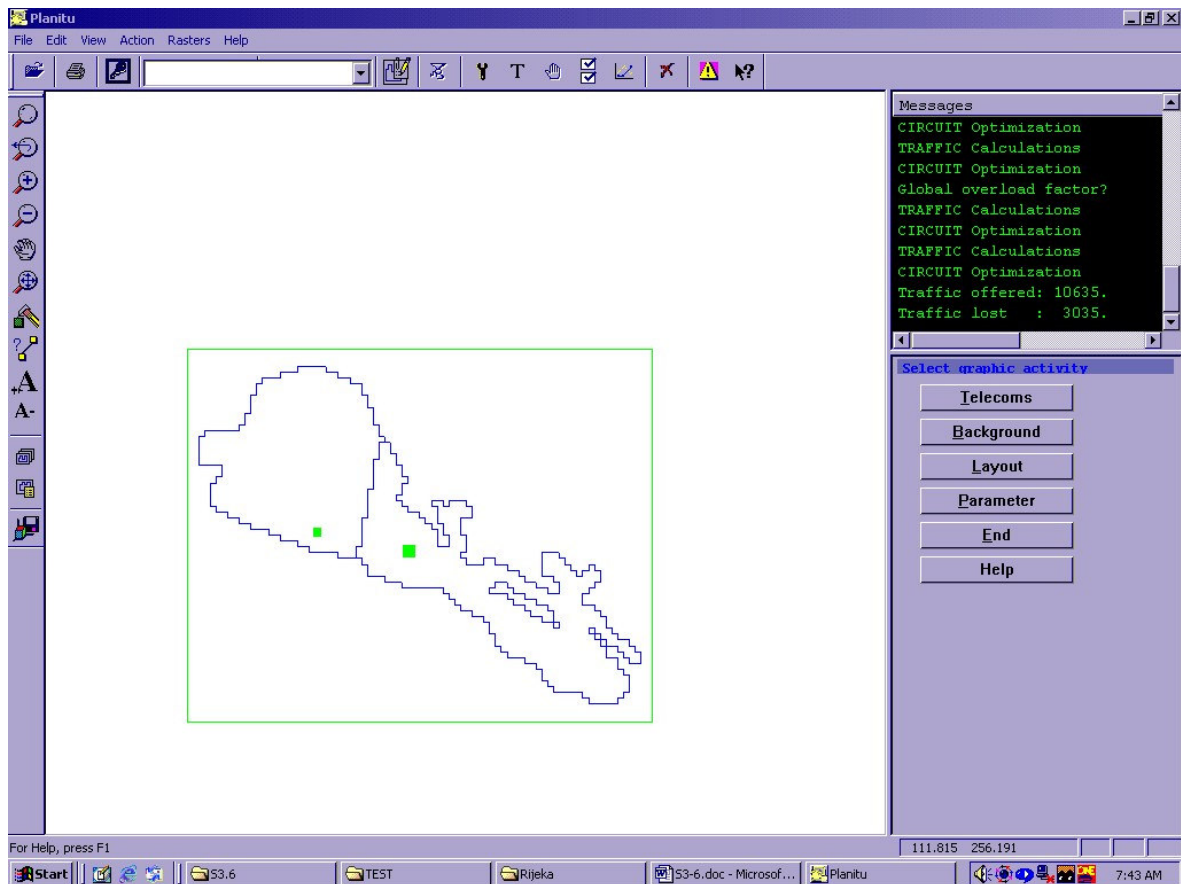
Sensitivity analysis

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.