FACULTY OF ELECTRONICS

COMPUTER ENGINEERING AND TELECOMMUNICATIONS DEPARTMENT

LABORATORY WORK #8

Modeling 4G Mobile Coverage Optimisation

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Contents

Objective and Tools

Objective: This lab involves modeling 4G mobile coverage using ArcGIS. It provides insight into cell tower installation planning and strengthens understanding of GIS modeling approaches for cellular mobile network deployment.

Tools Used: ArcGIS with Cellular Expert integration

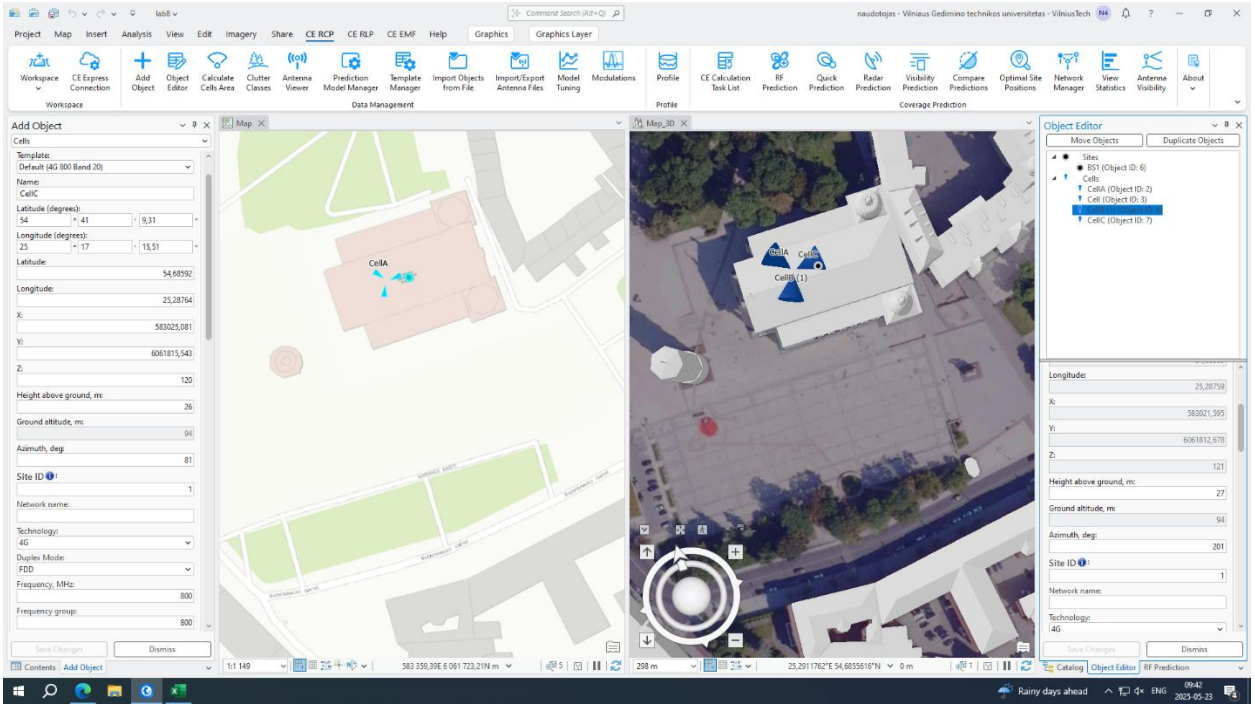
Lab Environment: The lab utilizes a previous project (Lab 7) workspace as the foundation for mobile coverage analysis.

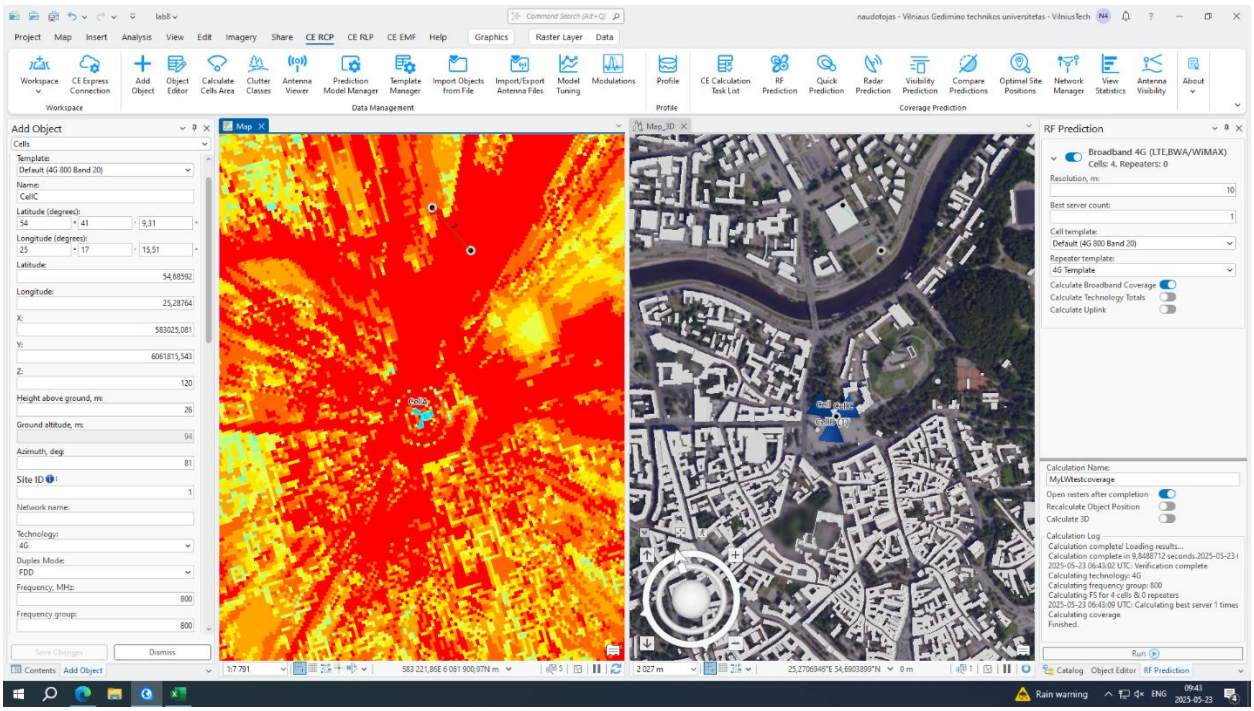
Section 1: Base Station Site Creation

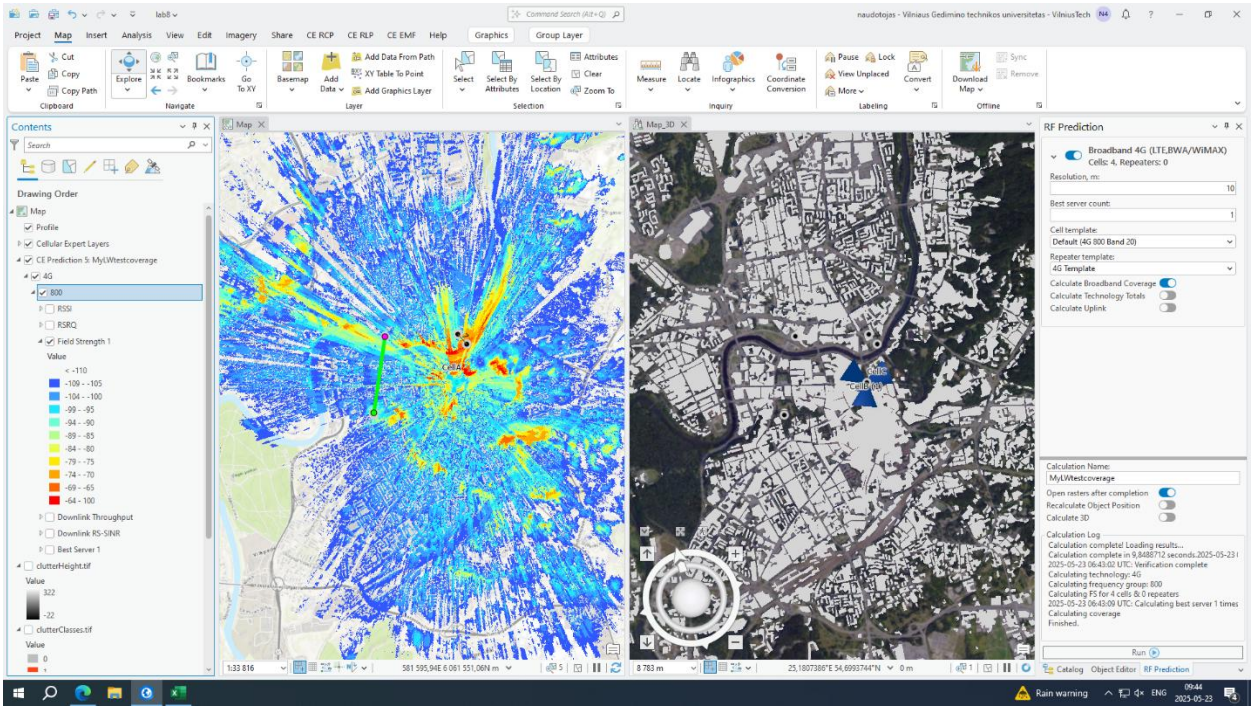
Objective: Model 4G mobile coverage using ArcGIS to understand cell tower installation planning.

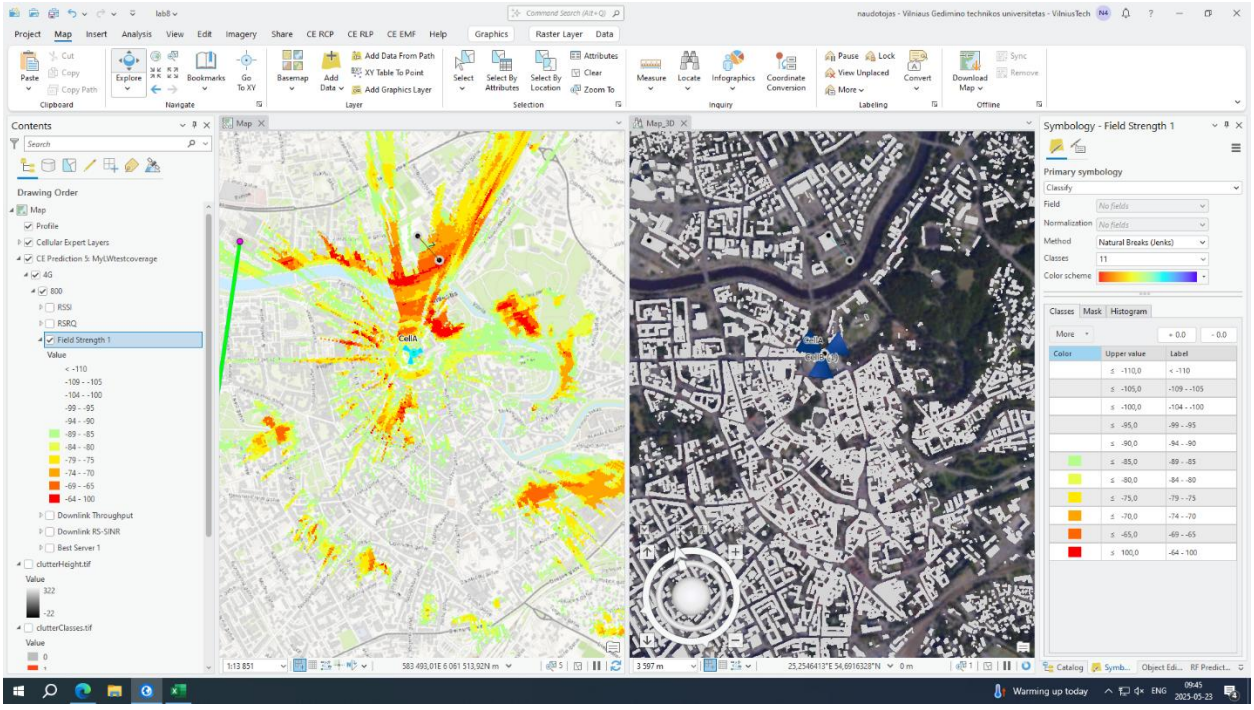
Steps:

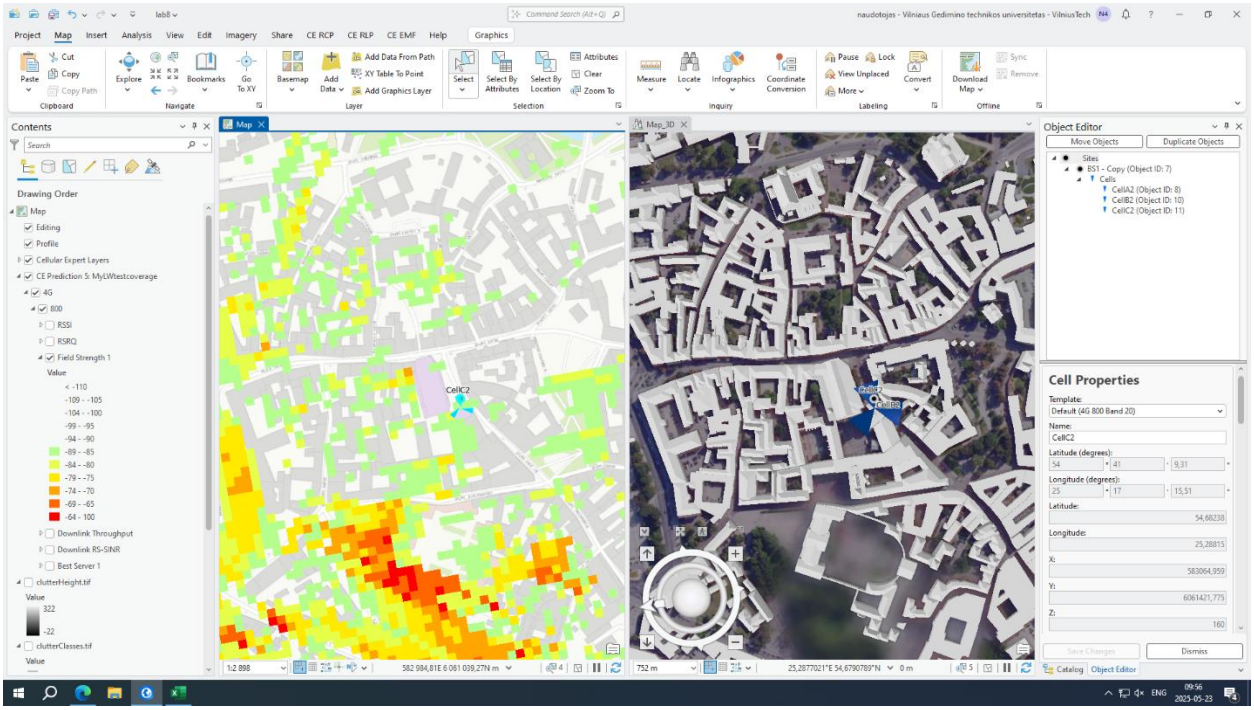
- **Create BS site object on building rooftop location**
- **Add three cells with 120-degree azimuth spacing for complete coverage**
- **Adjust antenna height 2-3 meters above rooftop level**
- **Verify proper site-cell hierarchy in Object Editor**


Add Object
Cells
Template:
Default (4G 800 Band 20)
Name:
CellC
Latitude (degrees):
54 ° 41 ' 9,31 "
Longitude (degrees):
25 ° 17 ' 15,51 "
Latitude:
54,68592
Longitude:
25,28764
X:
583025,081
Y:
6061815,543
Z:
120
Height above ground, m:
26
Ground altitude, m:
94
Azimuth, deg:
81
Site ID
1
Network name:
Technology:
4G
Duplex Mode:
FDD
Frequency, MHz:
800
Frequency group:
800
Save Changes
Dismiss
Contents
Add Object
Map
CellA
Map_3D
CellA
CellC
CellB (1)
Object Editor
Move Objects
Duplicate Objects
Sites
BS1 (Object ID: 6)
Cells
CellA (Object ID: 2)
Cell (Object ID: 3)
CellC (Object ID: 7)
Longitude:
25,28759
X:
583021,595
Y:
6061812,678
Z:
121
Height above ground, m:
27
Ground altitude, m:
94
Azimuth, deg:
201
Site ID
1
Network name:
Technology:
4G
Save Changes
Dismiss
Catalog
Object Editor
RF Prediction
Rainy days ahead
ENG
09:42
2025-05-23


Add Object
RF Prediction
Broadband 4G (LTE,BWA/WiMAX)
Cells: 4, Repeaters: 0
Calculation Name:
MyLWestcoverage
Calculation Log
Run


Contents
Drawing Order
RF Prediction
Broadband 4G (LTE,BWA/WiMAX)
Cells: 4, Repeaters: 0
Calculation Name:
MyLWestcoverage
Calculation Log
Run


Contents
Drawing Order
Map
Profile
Cellular Expert Layers
CE Prediction 5: MyLWtestcoverage
4G
800
RSSI
RSRQ
Field Strength 1
Value
< -110
-109 - -105
-104 - -100
-99 - -95
-94 - -90
-89 - -85
-84 - -80
-79 - -75
-74 - -70
-69 - -65
-64 - 100
Downlink Throughput
Downlink RS-SINR
Best Server 1
clutterHeight.tif
clutterClasses.tif
CellA
Symbology - Field Strength 1
Primary symbology
Classify
Field
Normalization
Method
Natural Breaks (Jenks)
Classes
Color scheme
Histogram
Upper value
Label


Contents
Drawing Order
Map
Editing
Profile
Cellular Expert Layers
CE Prediction 5: MyLWtestcoverage
4G
800
RSSI
RSRQ
Field Strength 1
Value
< -110
-109 - -105
-104 - -100
-99 - -95
-94 - -90
-89 - -85
-84 - -80
-79 - -75
-74 - -70
-69 - -65
-64 - 100
Downlink Throughput
Downlink RS-SINR
Best Server 1
clutterHeight.tif
clutterClasses.tif
CellC2
Object Editor
Move Objects
Duplicate Objects
Sites
BS1 - Copy (Object ID: 7)
Cells
CellA2 (Object ID: 8)
CellB2 (Object ID: 10)
CellC2 (Object ID: 11)
Cell Properties
Template:
Default (4G 800 Band 20)
Name:
CellC2
Latitude (degrees):
Longitude (degrees):
Latitude:
Longitude:
X:
Y:
Z:
Save Changes
Dismiss

Section 2: Coverage Analysis and Gap Identification

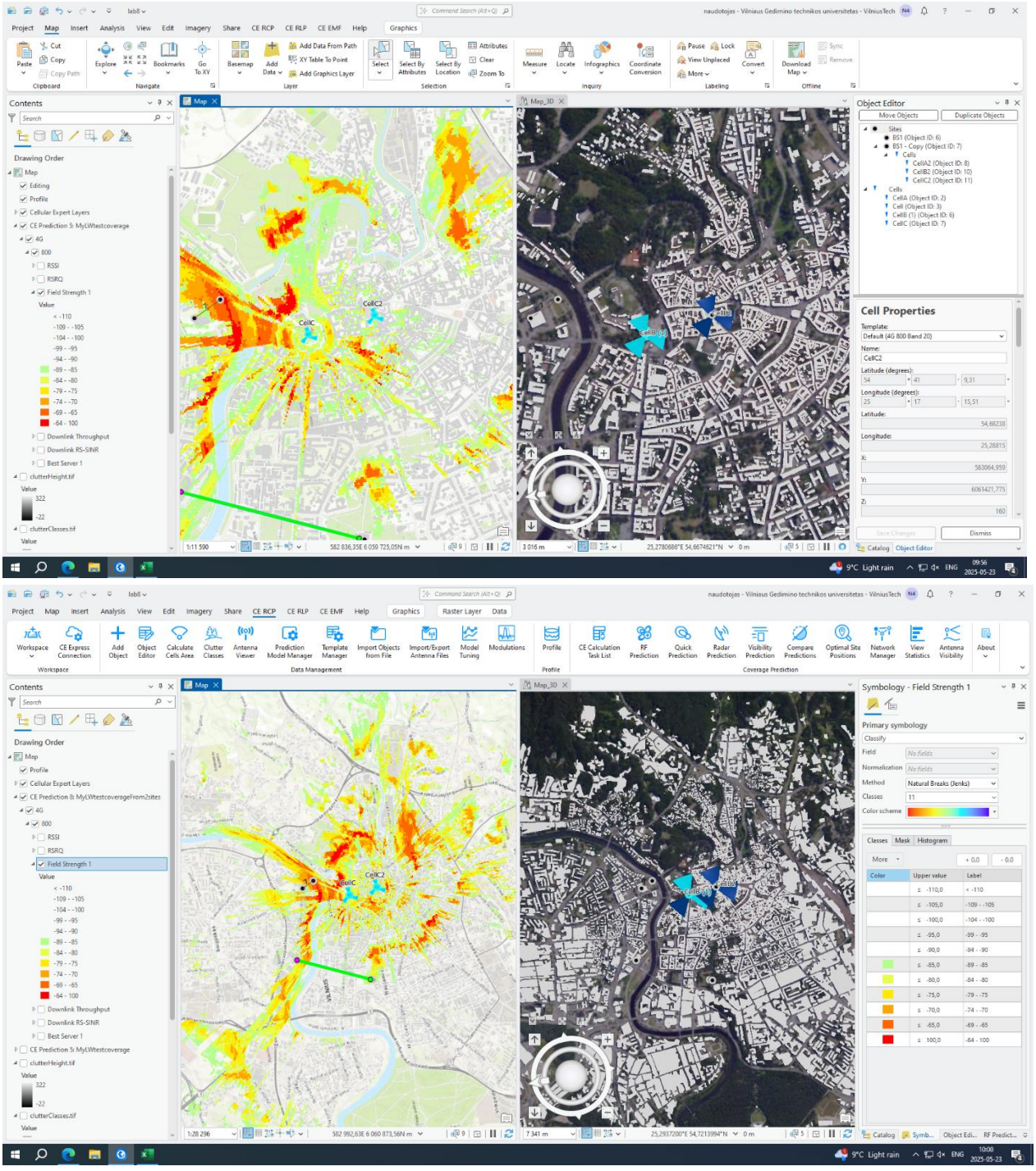
Steps:

- **Run RF Prediction simulation for single base station**
- **Filter results to show reliable coverage (-85 dBm threshold)**
- **Identify significant coverage gaps requiring additional infrastructure**
- **Create second base station in center of identified gap area**
- **Configure duplicate cells (CellBS2-A, B, C) at strategic location**

Section 3: Coverage Optimization Results

Comparison Analysis:

- **Single BS: Limited coverage with significant gap areas**
- **Dual BS: Enhanced coverage with minimized dead zones**
- **Improvement: Expanded service area and consistent signal quality**



Conclusion: Strategic placement of multiple base stations effectively addresses coverage deficiencies. GIS-based modeling enables optimal network planning by identifying gaps and validating infrastructure solutions before deployment