Realistic Scenarios for System Evaluation

IEEE 802.16 Presentation Submission Template (Rev. 8.3)

Document Number:
IEEE S802.16m-07/083
Date Submitted:
2007-05-10
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Venue:
IEEE 802.16 Session #49, Portland, OR
Base Document:
IEEE C802.16m-07/083
Purpose:
Introduce realistic scenarios for Evaluation

Realistic Scenarios for System Evaluation

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Realistic Models for System Analysis

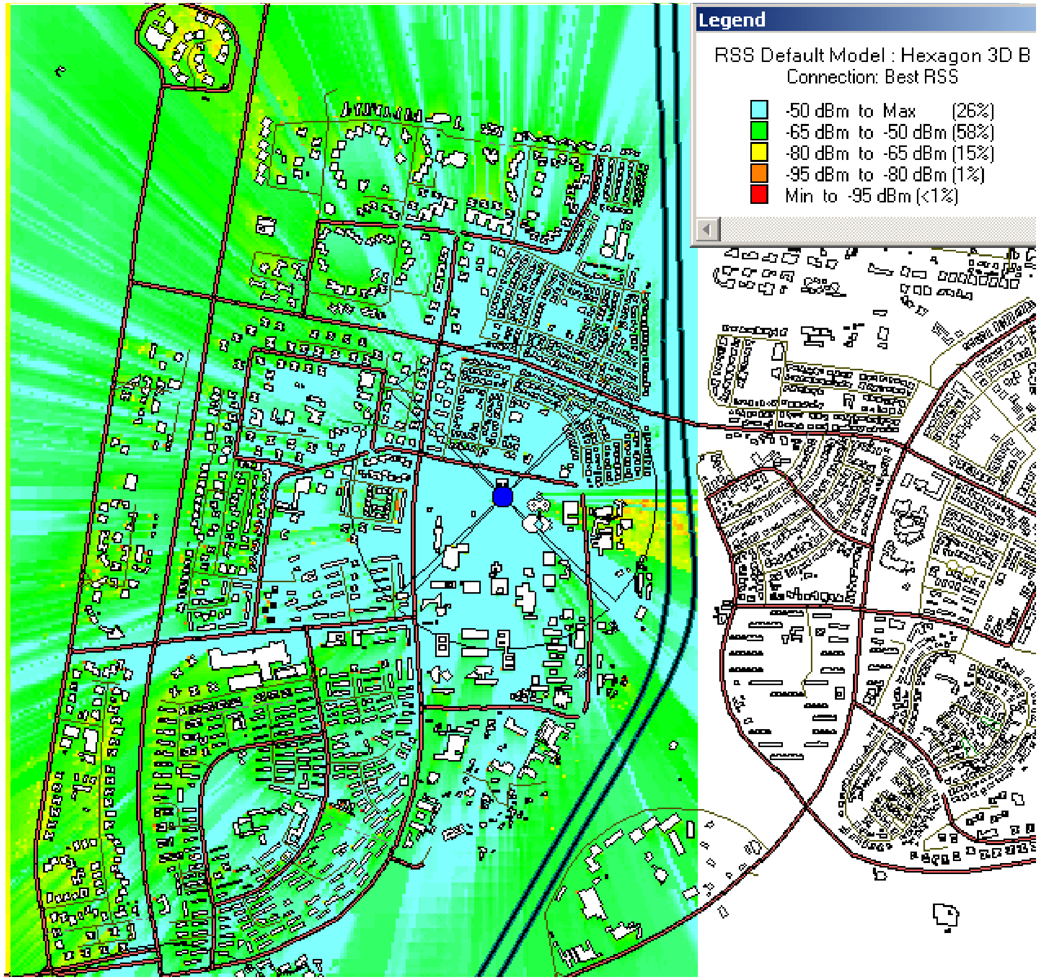
- The 19 wrap around hexagonal cell model is very useful:
  - Symmetric
  - Manageable
  - Used by other bodies
- Path loss and shadowing models suggested for path loss are:
  - Easy to calculate
  - Statistically represents path losses
  - Reproducible

But it is not Realistic!

Real Scenarios

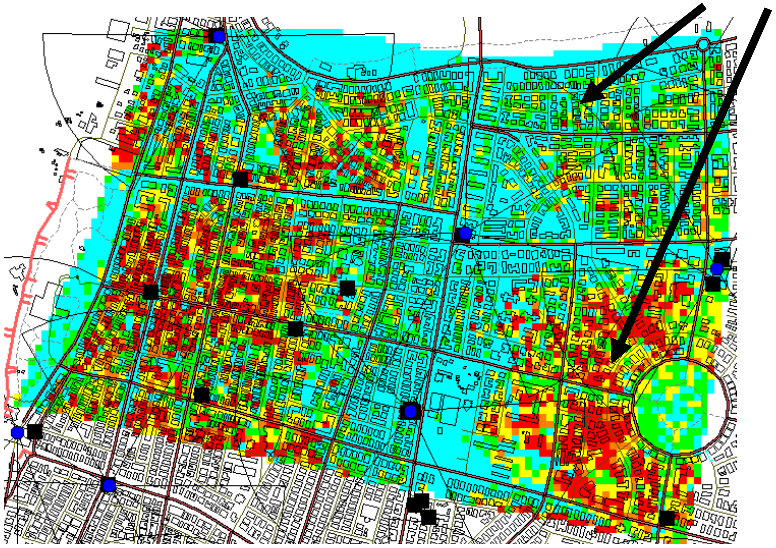
- Cells are not hexagonal
- Cells are not equal
- Cells are not contiguous
- Traffic is not uniform
- Empricial models are pessimistic for propagation but optimistic for interference
- The world is 3D

Realistic Shadowing Effect



Physical Vs. Empirical Model

known interfered areas in current GSM network



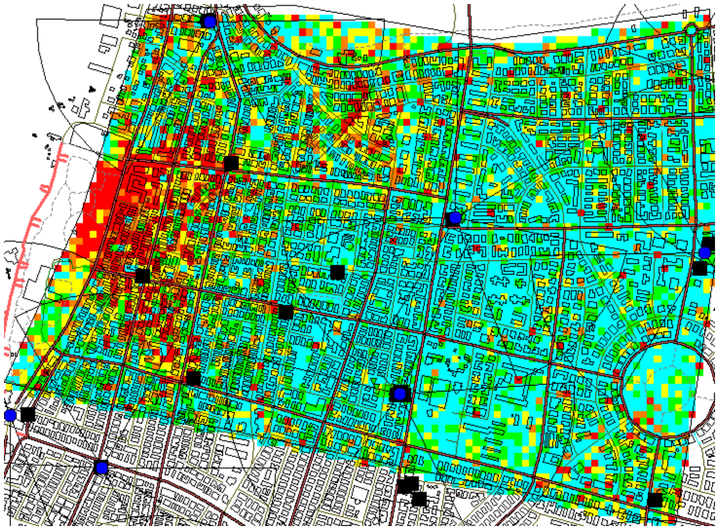
Range			Color	Distribution
Min	to	50%	red	12.571 %
50%	to	60%	orange	4.948 %
60%	to	75%	yellow	18.336 %
75%	to	85%	green	20.489 %
85%	to	Max	cyan	43.653 %

MKE-526

Probability Legend

Using Link Matrix

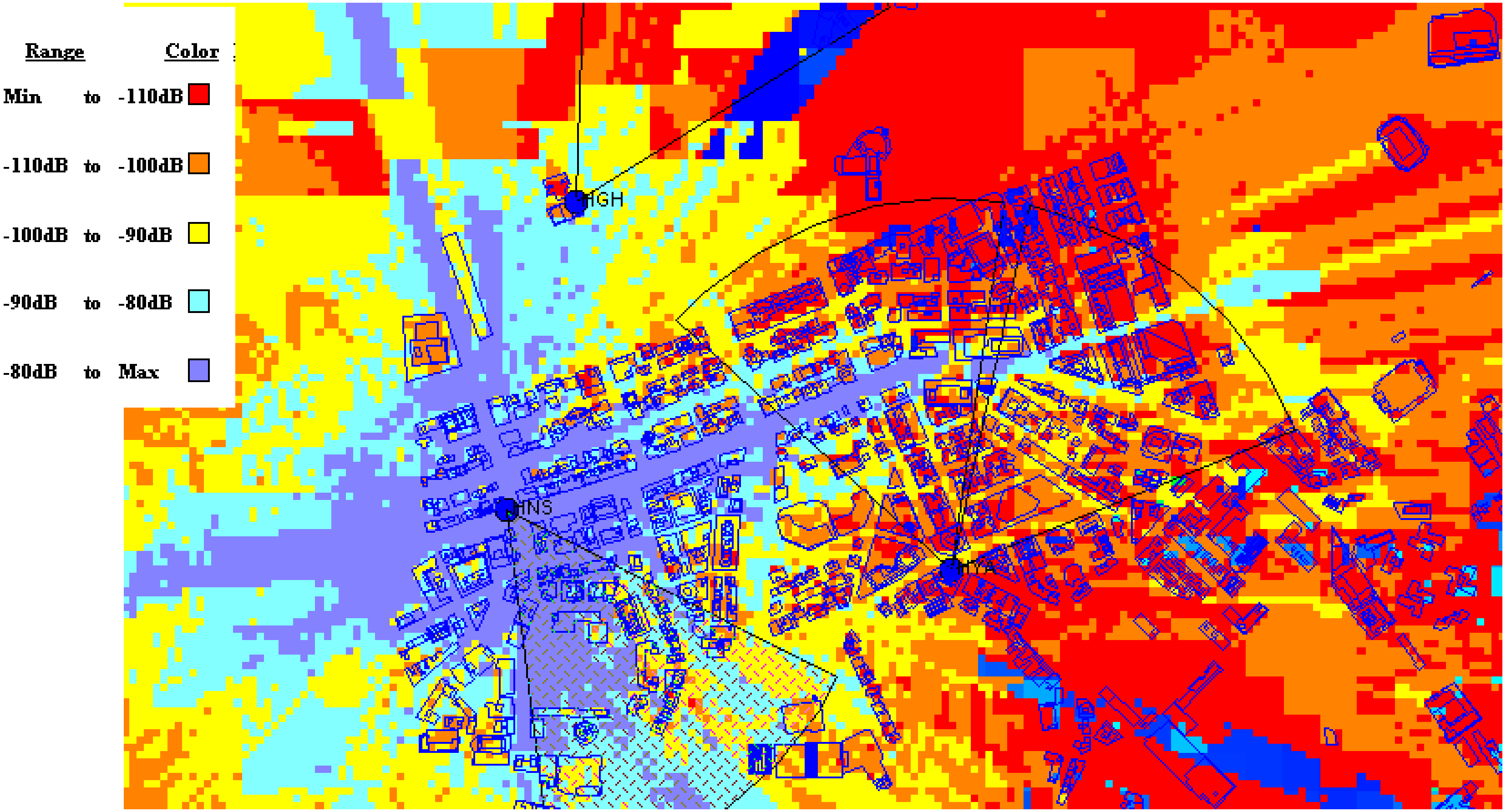
Connection: Best Pilot C/I



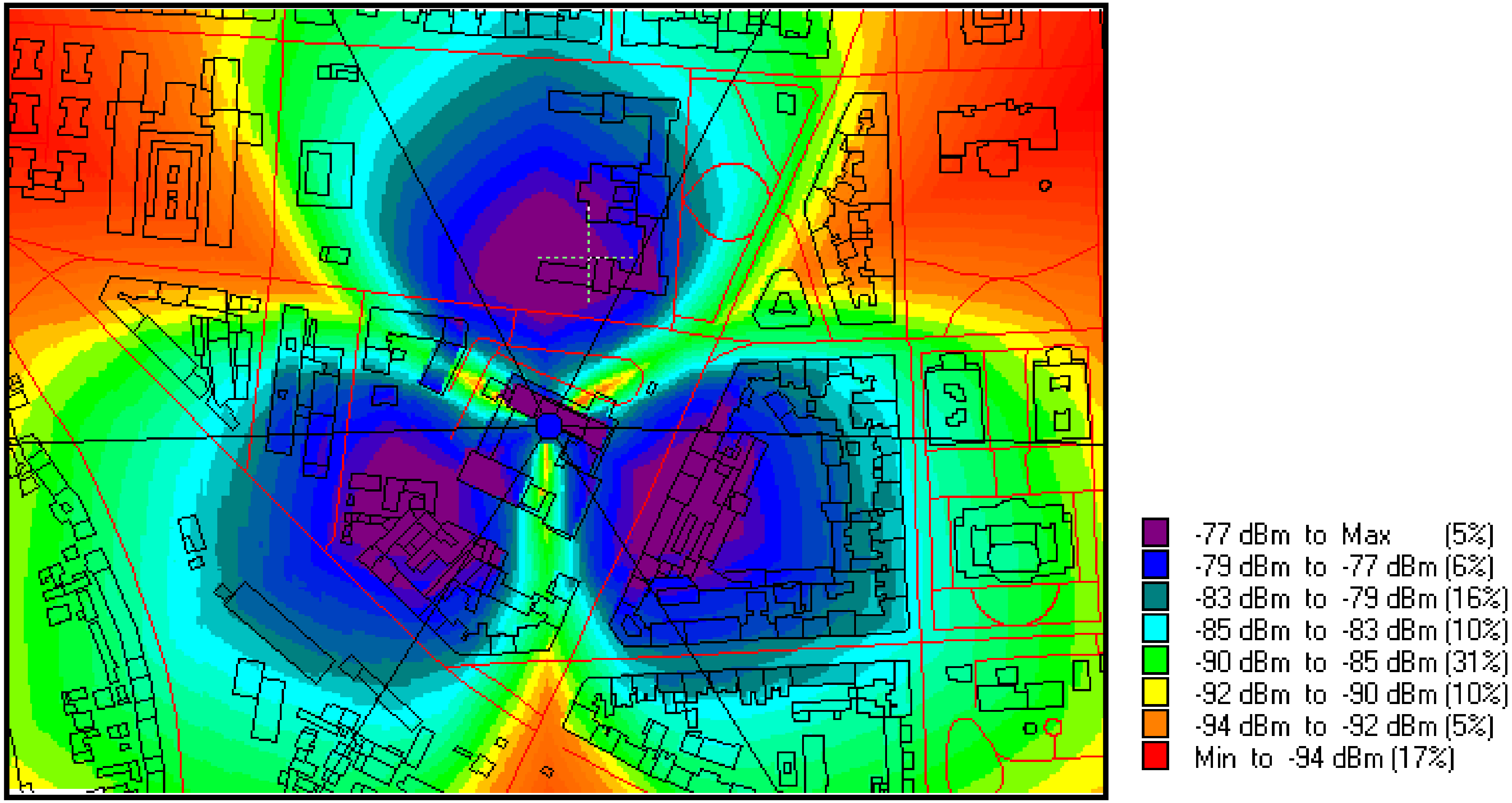
HATA

Range			Color	Distribution
Min	to	50%	red	7.275 %
50%	to	60%	orange	5.452 %
60%	to	75%	yellow	15.176 %
75%	to	85%	green	18.232 %
85%	to	Max	cyan	53.863 %

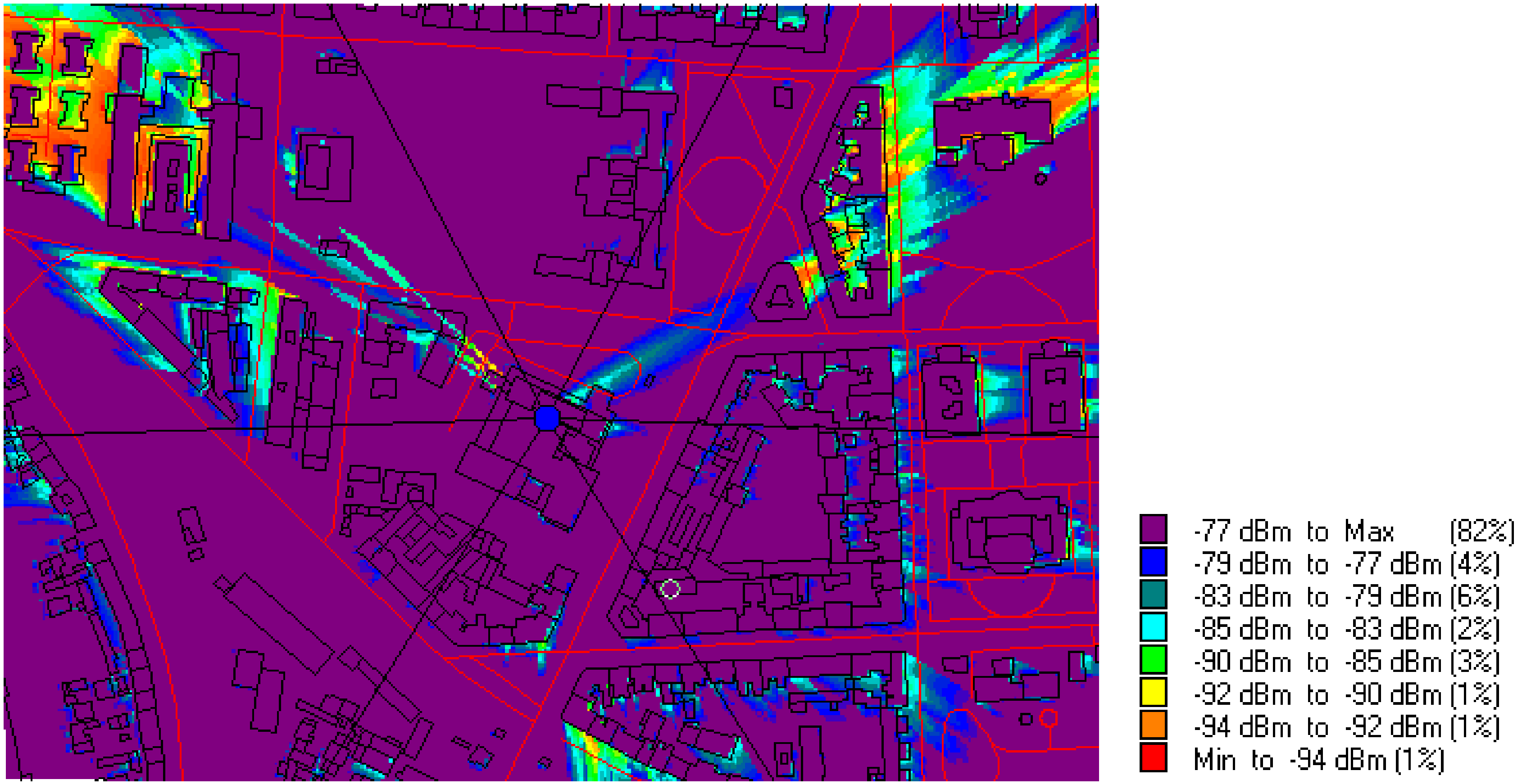
Waveguide Effect



COST-HATA MODEL

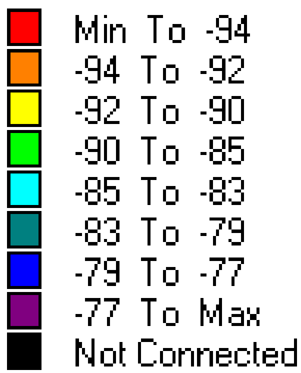


Physical Model - Outdoor

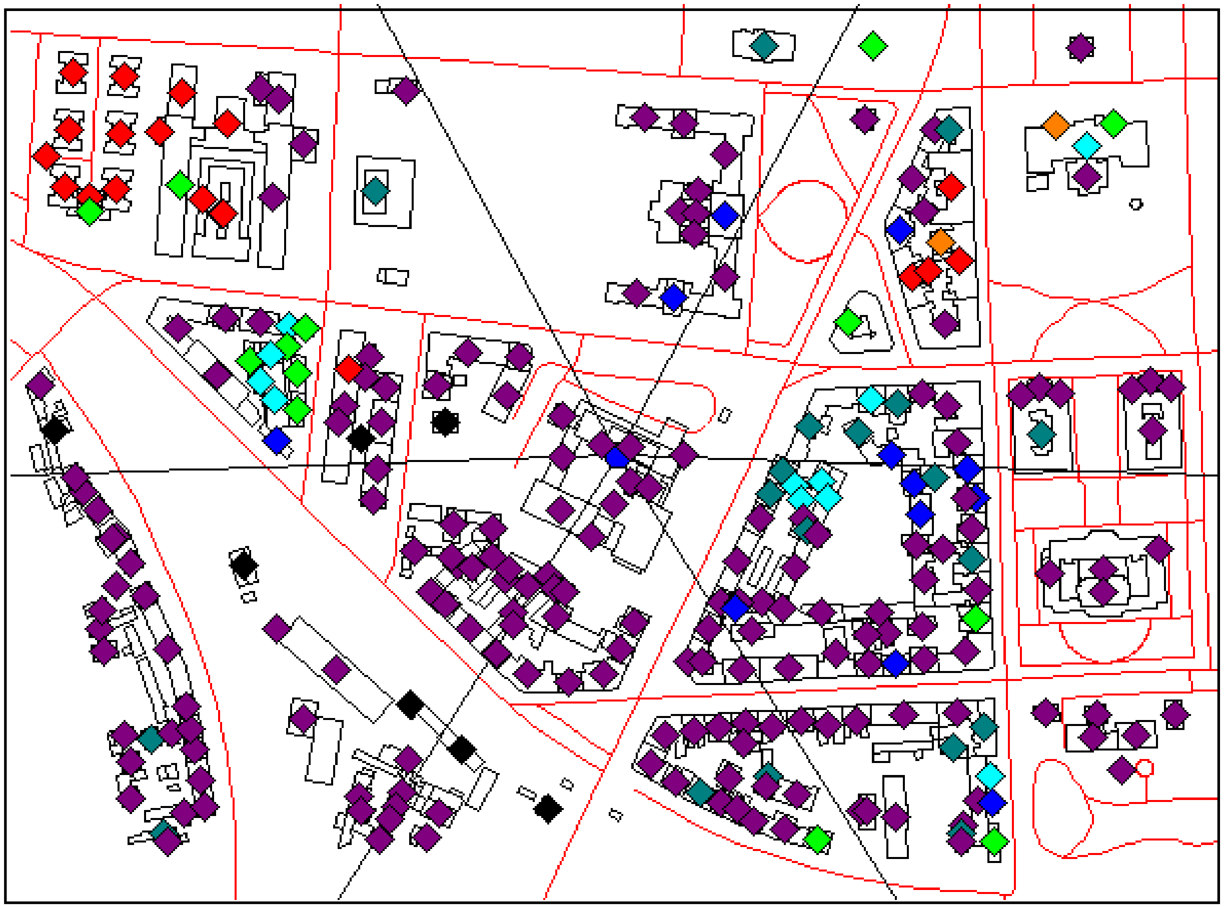


Physical Model - Indoor

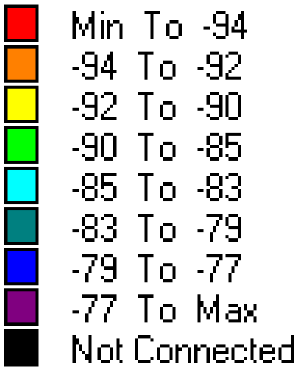
Ground Floor



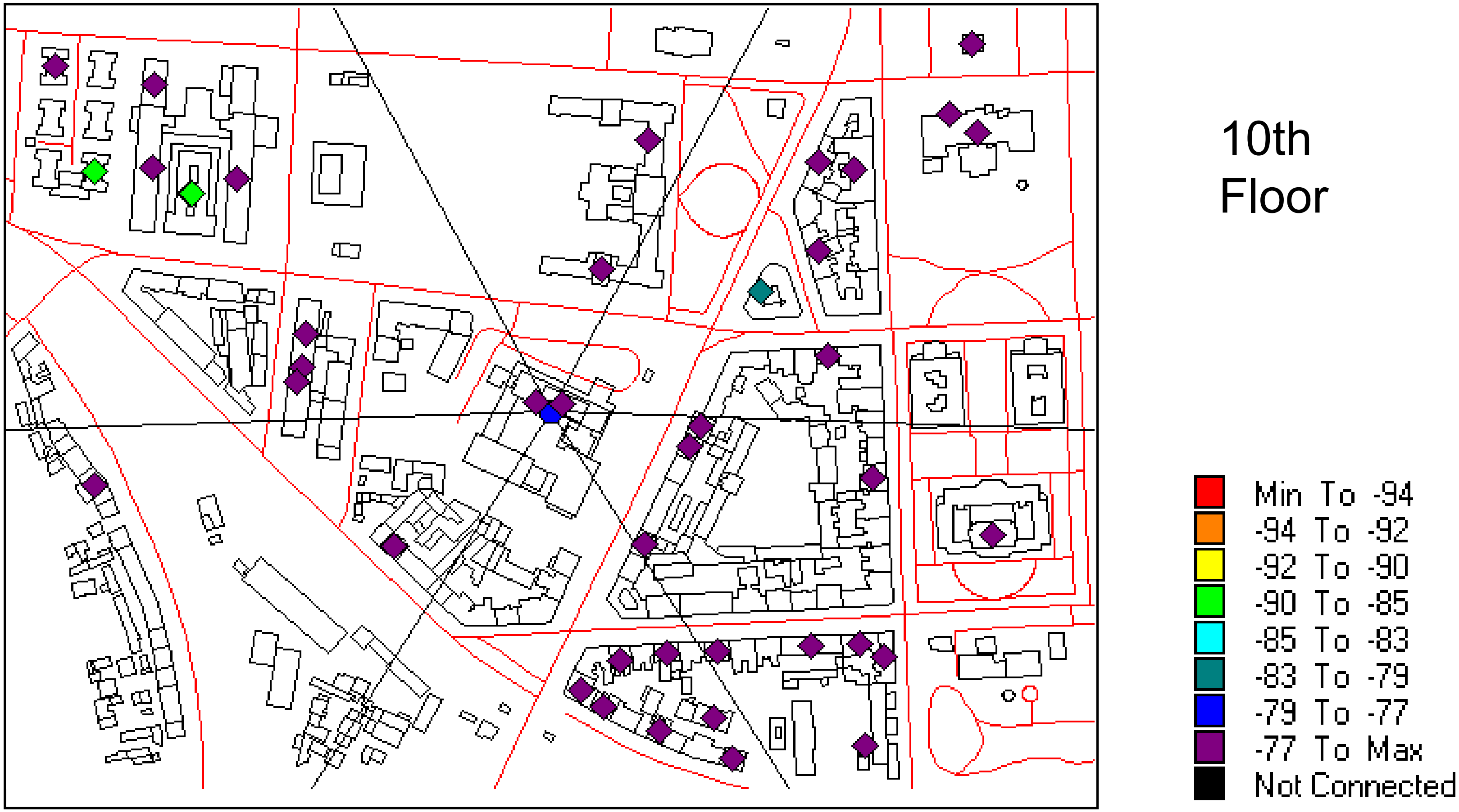
Physical Model - Indoor



2nd Floor



Physical Model - Indoor



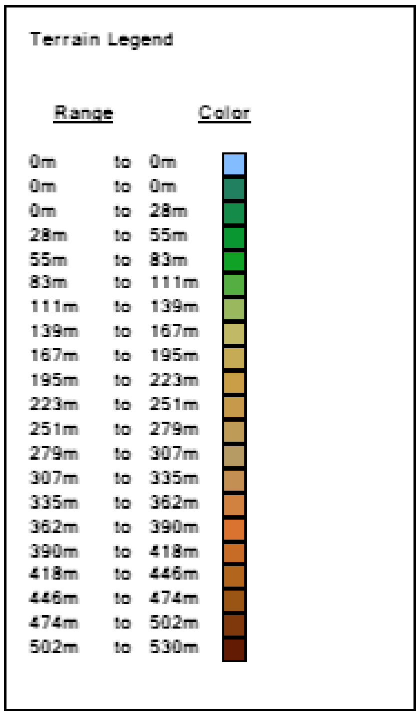
Evaluation Errors

- Disadvantage to range-capacity trade off vs. optimization to a given range
- Is a fixed interference cancellation a benefit?
- How applicable is the FUSC/PUSC zoning idea?
- What about antenna tilting?

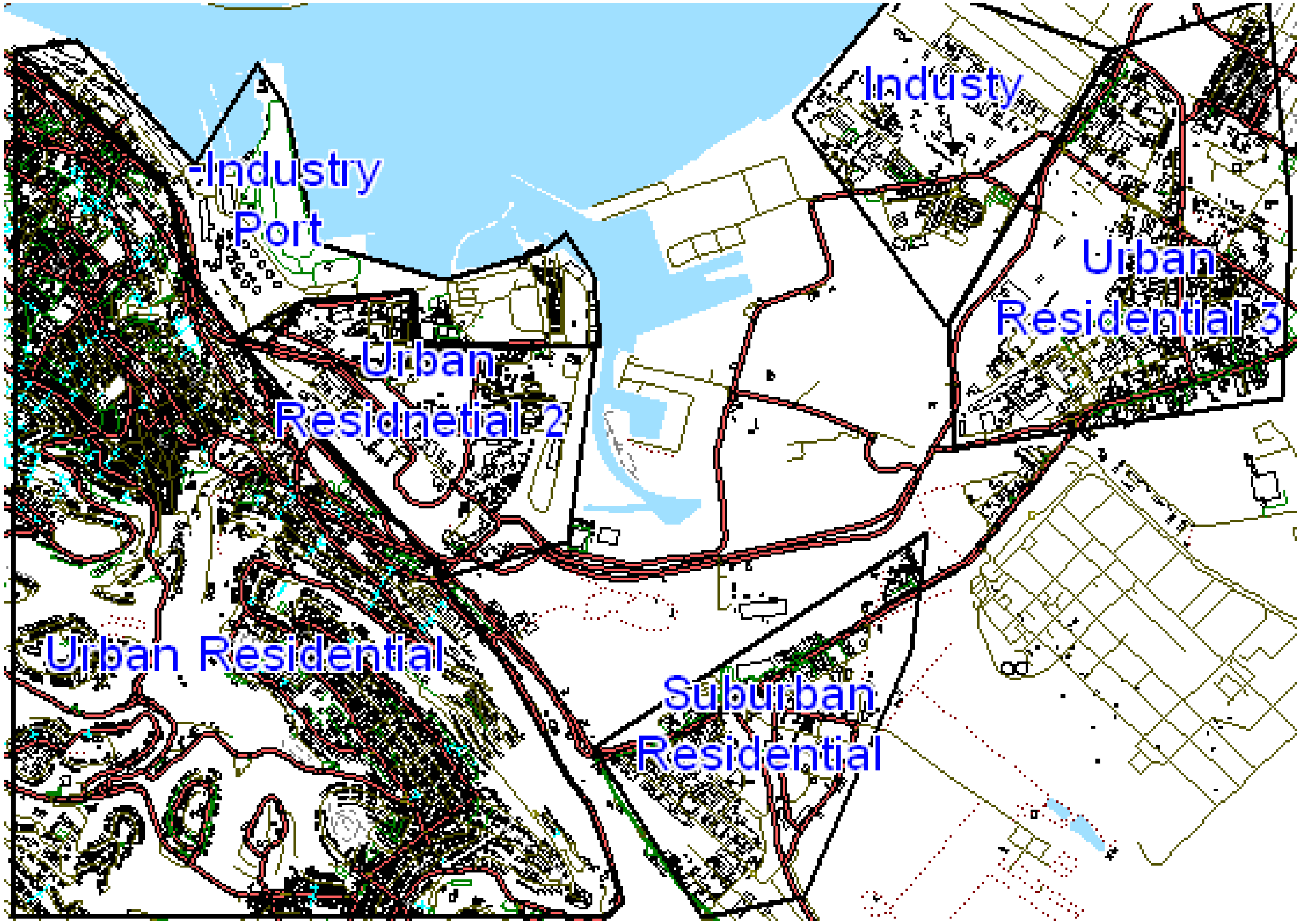
Proposal for Additional Scenario

- Add to system evaluation a real scenario for
  - sanity check
  - demonstration of “deployability”
- Select a couple of real regions including
  - Mixed terrain
  - Set of clutters
  - Non-uniform user traffic
  - An existing cellular system base station sites
- Use a high density grid of measurement points, indoor and outdoor
- Use pre-calculated path losses, using a PHYSICAL model (knife-edge…ray tracing)
- NO SHADOW FADING
- Plug and “play” in the existing simulation

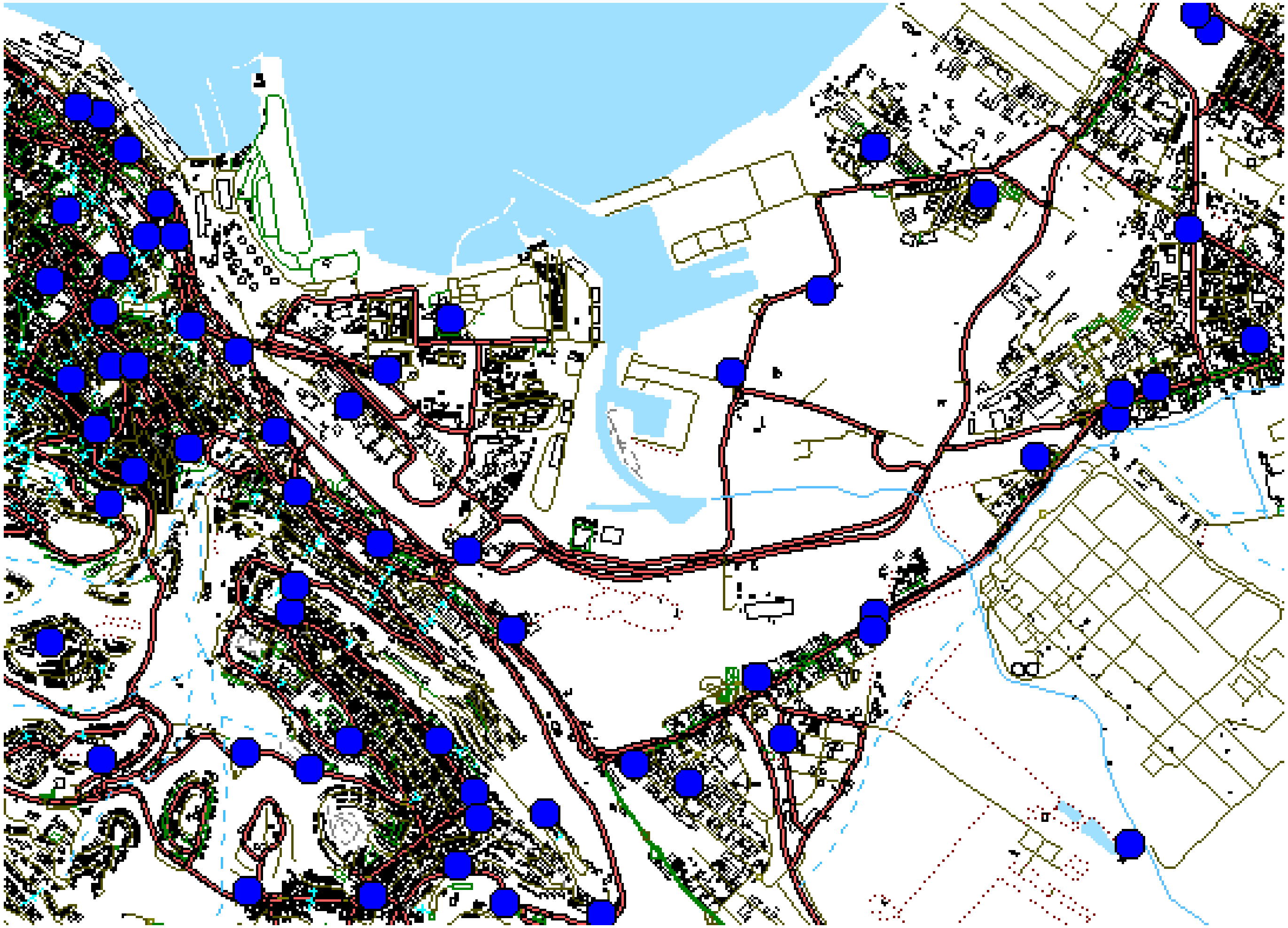
Terrain and Buildings



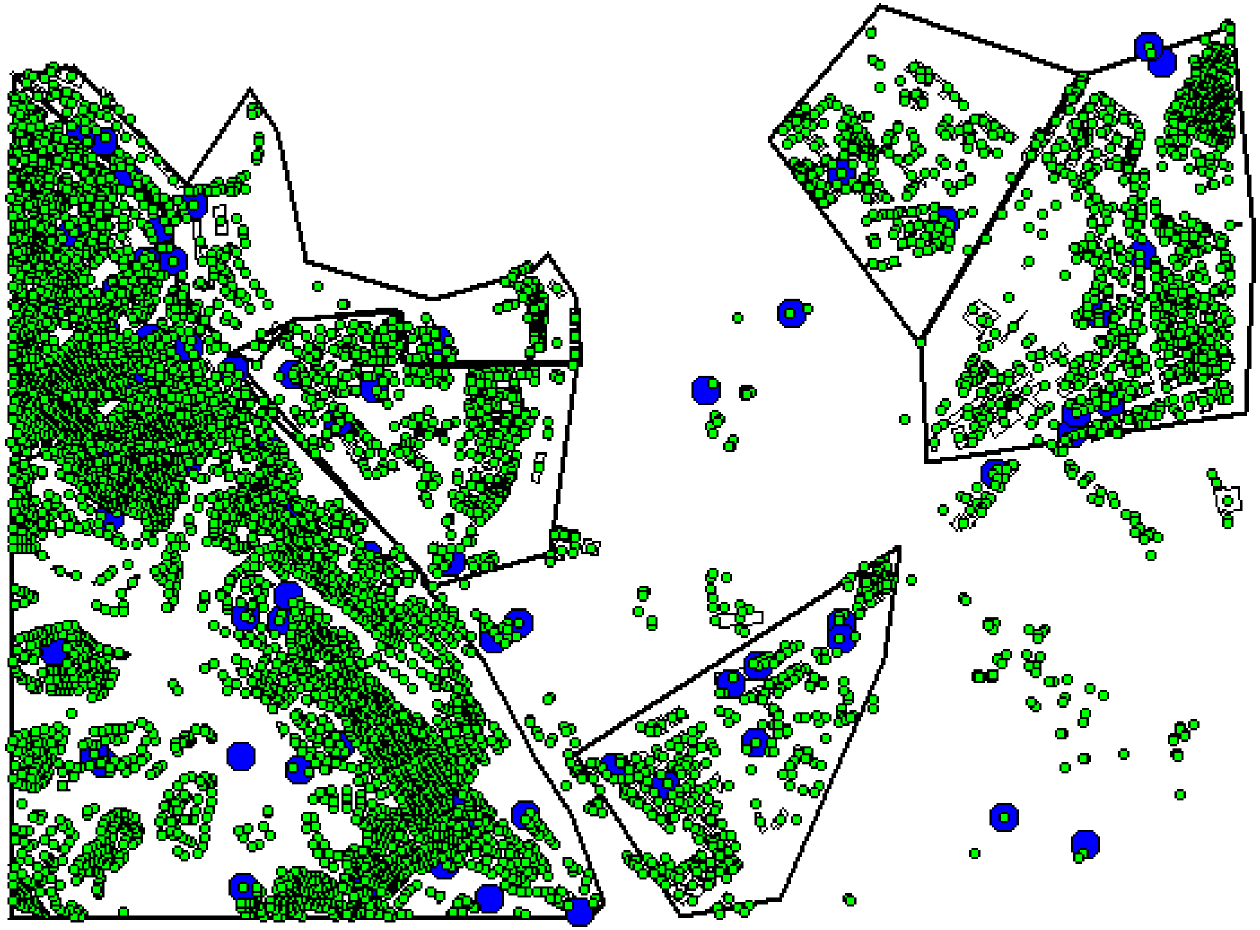
User and Traffic Density



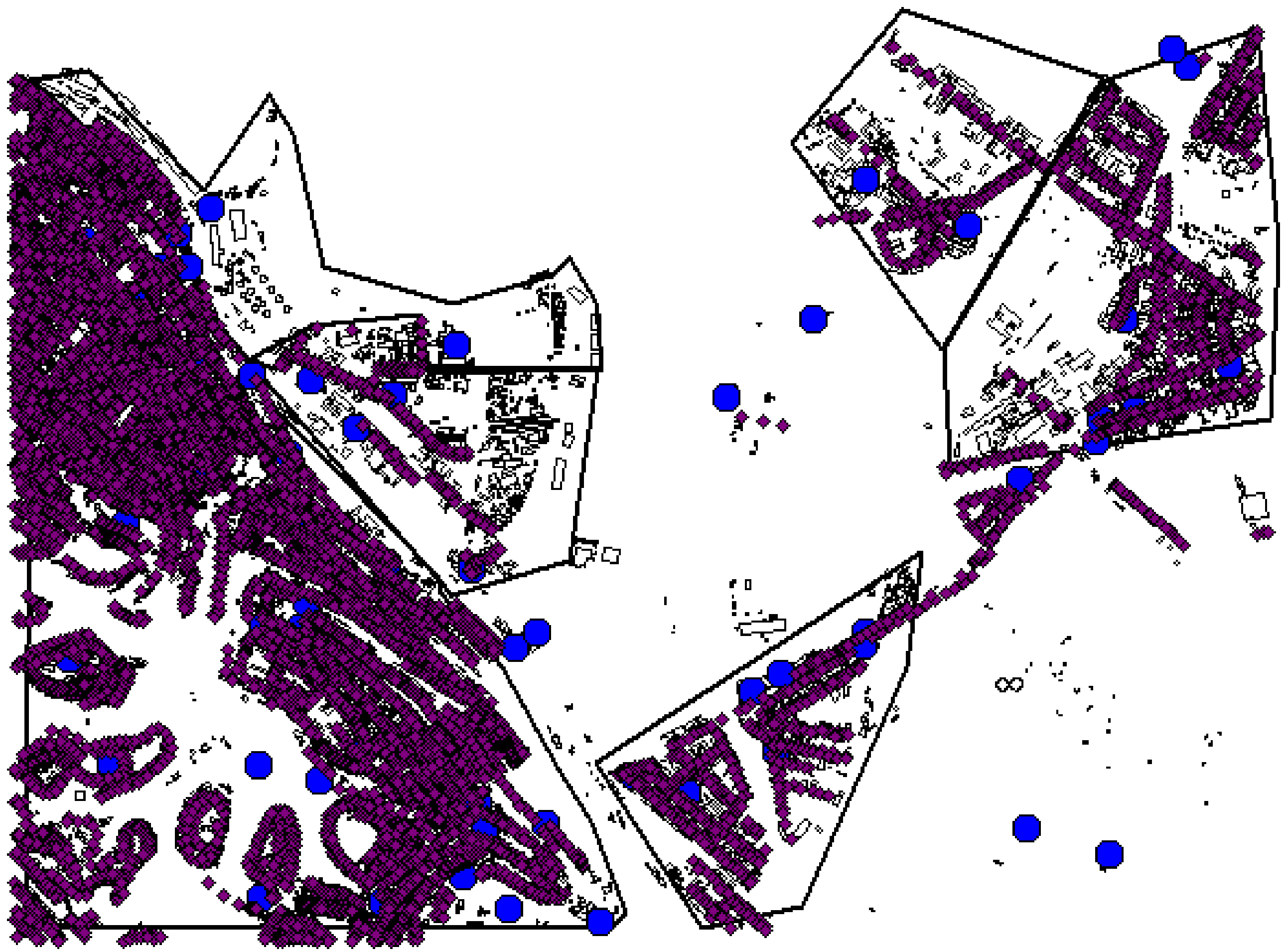
Base Station Locations



Indoor Measurement Points



Outdoor Measurement Points



Path Loss Matrix

Points			Sites												
x	y	z	1	2	3	4	5	6	7	8	9	10	11	12	13
155276.9	243518.5	96	-131	-156	-130	-138	-144	-156	-124	-130	-128	-142	-164	-156	-129
154721.3	247521	270	-129	-154	-131	-130	-139	-150	-144	-127	-131	-138	-163	-130	-130
155073.9	247362.7	91	-129	-130	-128	-141	-132	-146	-129	-128	-130	-131	-167	-130	-136
150756.2	246944	45	-126	-154	-120	-140	-110	-156	-129	-111	-118	-112	-160	-149	-122
155812.4	246328.9	46	-151	-130	-133	-147	-136	-150	-133	-132	-139	-136	-164	-130	-131
150518.3	246197.8	256	-109	-152	-102	-114	-115	-139	-122	-105	-112	-116	-156	-148	-105
151311	245996.6	58	-117	-122	-115	-107	-119	-158	-126	-115	-112	-119	-160	-149	-127
151189.4	245353.7	97	-142	-150	-129	-101	-145	-160	-118	-117	-108	-121	-159	-139	-115
151040.5	244640.7	100	-121	-115	-119	-114	-123	-118	-133	-120	-114	-123	-112	-115	-118
152567.8	244601.3	54	-124	-156	-123	-119	-125	-157	-98	-124	-121	-126	-159	-155	-123
152567.8	244601.3	161	-124	-149	-123	-119	-125	-151	-99	-124	-121	-126	-156	-145	-123
152567.8	244601.3	262	-124	-122	-123	-119	-125	-121	-102	-124	-121	-126	-146	-123	-123
153906.1	244365.4	116	-156	-175	-155	-151	-167	-165	-119	-155	-150	-162	-176	-168	-153
150206	243880.7	116	-157	-92	-162	-137	-164	-146	-163	-162	-155	-158	-124	-131	-161

Proposed Text Changes

Appendix-K: Optional System Analysis using Real Scenarios

In this optional analysis proponents will prove the system performance in a realistic scenario described below.

The chosen scenario is a based on a deployment of a real cellular network with the following data:

1. The base stations are located at the coordinates given at the attached file.
2. Measurement points were defined for this scenario, in every building floor and along the streets.
3. The path gains between each base station and each measurement point were calculated. The results are available in the attached files, one for in-building and one for street points.
4. A set of regions in the map will determine user density, user mix and channel model selection within each region. within each region.
5. The proponents will determine the antenna sector orientation, antenna tilt and frequency plan that would produce the best performance.

Proposed Text Changes

The simulation will follow the same lines as the system simulation described in Chapter 12:

1. MSs are dropped throughout the system. **The drop will be made by selecting a number of measurement points corresponding to the number of MSs needed**. Each mobile corresponds to an active user session that runs for the duration of the drop. **For pedestrian and in-building MSs all measurement points will be available for selection. For vehicular MSs only the streets' measurement points will be selected.**
2. **Mobiles are assigned channel models according to their location**. Depending on the simulation, these may be in support of a desired channel model mix, or separate statistical realizations of a single type of channel model.
3. MSs are dropped according to the specified traffic mix. The simulation runs are done with an increment of MSs per sector until a termination condition is met as shown in Figure 12-1.
4. Sector assignment to an MS is based on the received power at an MS from all potential serving sectors. The sector with best path to MS, taking into account antenna gains is chosen as the serving sector.

Proposed Changes (cont.)

5. Mobile stations are randomly dropped over the area such that each sector has the required numbers of users. Although users may be in regions supporting handoff each user is assigned to only one sector for counting purposes. All sectors of the system shall continue accepting users until the desired fixed number of probe and load users per sector is achieved everywhere.
6. Fading signal and fading interference are computed from each mobile station into each sector and from each sector to each mobile for each simulation interval.
7. Packets are not blocked when they arrive into the system (i.e. queue depths are infinite). Users with a required traffic class shall be modeled according to the traffic models defined in this document. Start times for each traffic type for each user should be randomized as specified in the traffic model being simulated.
8. Packets are scheduled with a packet scheduler using the required fairness metric. Channel quality feedback delay, PDU errors and ARQ are modeled and packets are retransmitted as necessary. The ARQ process is modeled by explicitly rescheduling a packet as part of the current packet call after a specified ARQ feedback delay period.
9. Simulation time is chosen to ensure convergence in desired output metrics.
11. Performance statistics are collected for MSs in all cells according to the output matrix requirements.
12. All sectors in the system shall be dynamically simulated. **MSs movement will be made along the streets.**