# E4-E5 (CM)

# MOBILE NETWORK PLANNING

# WELCOME

- This is a presentation for the E4-E5 Technical (CM-Module).
- Topic: Mobile Network Planning
- Eligibility: Those who have got the up gradation from E4 to E5.
- This presentation is last updated on 12-4-2011.
- You can also visit the Digital library of BSNL to see this topic.

# Agenda

- What is mobile network planning
- RF Planning Aspects
- Components of GSM N/W PLANNING
- Cell Planning Process
- Calculating Number of Sites – Coverage & capacity aspect
- Survey and other  Related Planning Aspects

# Main Steps of a Network Planning

- Collection of all relevant information .
- Network dimensioning based on coverage and capacity requirements
- Selection of MSC, BSC and Base Station sites (in this order).
- Survey of intended MSC, BSC and Base Station sites
- Detailed network planning.

# RF Planning Aspects

In RF planning we are concerned with planning of radio network.

Broadly this implies-

- Deciding number and location of BTS/BSC.
- Deciding the Radio Parameters.
- Transmission link for backhaul connectivity.

It becomes more important as it is an ongoing process, so as to cater the varying traffic and coverage requirements.

# GSM Cell Planning Requirement

- Provision of required Capacity
- Optimum use of the available frequency spectrum
- Minimum number of cell sites
- Provision of adequate Coverage of the given area, for a minimum specified level of interference
- Provision of easy and smooth expansion of the network in future

# GSM RF PLANNING: The Components

1. CAPACITY PLANNING

2. COVERAGE PLANNING

3. PARAMETER PLANNING

4. EQUIPMENT PLANNING

5. OPTIMIZATION.

# Cell Planning Process

- Coverage and traffic Analysis
- Nominal cell planning
- Survey
- System design
- Implementation
- System Tuning

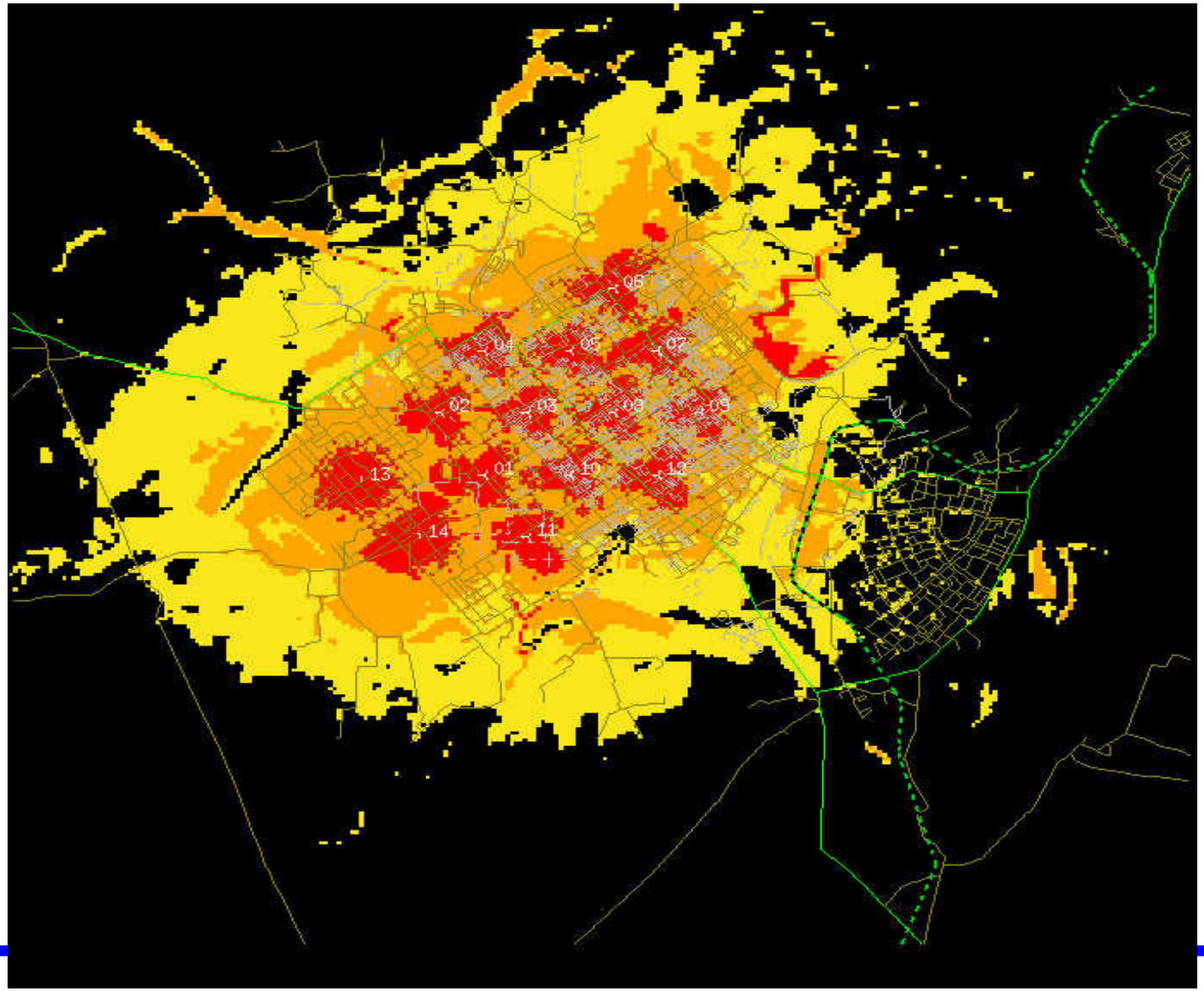
# Initial Cell Planning

- Objective: Creating a Nominal Cell Plan
- Calculating number of sites and distribution required to meet coverage requirement.
- Calculating number of sites and distribution required to meet capacity requirement.
- Assessment of available site locations.
- Locating the nominal sites.
- Making coverage predictions.

# Detailed Cell Planning

- Obtain Digitised Terrain Maps (DTM's)
- Prepare link budgets
- Make use of a Planning Tool.
- Get Coverage Plots.

# A Typical Coverage Plot



# Excerpts from Erlang B Table

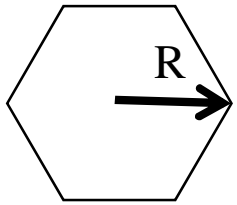
| No.of Trunks | Grade of Service | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0.01% | 0.10 | 0.50% | 1.00% | 2.00% | 4.00% | 5.00% |
| 1. | 0.0001 | 0.001 | 0.005 | 0.0101 | 0.0204 | 0.0417 | 0.0526 |
| 2. | 0.0142 | 0.0458 | 0.1054 | 0.1526 | 0.2235 | 0.3333 | 0.3813 |
| 3. | 0.0868 | 0.1938 | 0.349 | 0.4555 | 0.6022 | 0.812 | 0.8994 |
| 4. | 0.2347 | 0.4393 | 0.7012 | 0.8694 | 1.0923 | 1.3994 | 1.5246 |
| 5. | 0.452 | 0.7621 | 1.132 | 1.3608 | 1.6571 | 2.0573 | 2.2185 |
| 6. | 0.7282 | 1.1459 | 1.6218 | 1.909 | 2.2759 | 2.7649 | 2.9603 |
| 7. | 1.0541 | 1.5786 | 2.1575 | 2.5009 | 2.9354 | 3.5095 | 3.7378 |
| 8. | 1.4219 | 2.0513 | 2.7299 | 3.1276 | 3.6271 | 4.283 | 4.543 |
| 9. | 1.8256 | 2.5575 | 3.3326 | 3.7825 | 4.3447 | 5.0796 | 5.3702 |
| 10. | 2.2601 | 3.092 | 3.9607 | 4.4612 | 5.084 | 5.8954 | 6.2157 |
| 11. | 2.7216 | 3.8511 | 4.6104 | 5.1599 | 5.8415 | 6.7272 | 7.0764 |
| 12. | 3.2069 | 4.2314 | 5.2789 | 5.876 | 6.6147 | 7.5827 | 7.9501 |
| 13. | 3.7133 | 4.8305 | 5.9638 | 6.6072 | 7.4015 | 8.43 | 8.9349 |
| 14. | 4.2387 | 5.4464 | 6.6632 | 7.3517 | 8.2003 | 9.2977 | 9.7295 |
| 15. | 4.7811 | 6.0772 | 7.4755 | 8.108 | 9.0096 | 10.175 | 10.6327 |

# Calculating Number of Sites-Coverage

- Steps:
  - Step 1: Analyse Coverage Distribution
  - Step 2: Link Budget Analysis - MAPL
  - Step 3: Cell range calculation
  - Step 4: Estimate number of sites

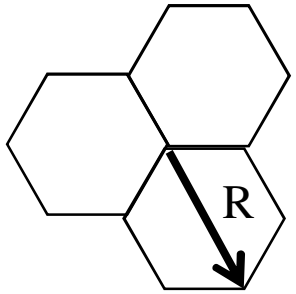
# Estimating Number of Sites

- Rough cell coverage area calculation
- For an omni site: or a sectorised site:




Cell coverage area $=(3/2)*\sqrt{3}*R^2$

R = cell radius.




Cell coverage area $= (9/8)*\sqrt{3}*R^2$
$= 1.95* R^2$

R = cell radius.

# Estimate the Number of Sites

Calculate number of sites for each area classification,

e.g.

- coverage area per site
- Total Coverage area
- no. of sites required for coverage in urban area

  Total Coverage Area / Coverage area per site

# Coverage Predictions

Required input data:

- Site locations (longitude, latitude)
- Propagation Model of the planning network
- Antenna design
  - height, tilt
  - direction
  - type, pattern

# Surveys

- Radio survey (Area visits)
- Site surveys
- Simulation of surveyed site alternatives
- Joint site surveys with civil works engineers
- Site survey reports

# Site Survey

- Important topics to consider during evaluation:
  - Coverage objectives (site locations)
  - Antenna Mounting (obstructions, etc)
  - Feeder Length (feeder cable loss)
  - Equipment room (size and location)
  - Cable ducts / Antenna masts (construction)
  - Transmission Links (Microwave, fixed line)
  - Construction Cost (alternative solutions)
  - Relationship to other sites (handover, etc)

# Joint Survey

- In principle this is done after the site candidate is finalised
- In some cases the joint survey is carried out in before the site survey in order accommodate some sites
- The joint survey team should consist of people responsible for different tasks e.g.
  - radio-planning
  - construction/civil work (CW)
  - site-acquisition
  - transmission

# Other Related Planning Aspects

- Dimensioning of BTS equipment
- Dimensioning of BSC
- Dimensioning E1s needed.
- Drive test after commissioning
- Optimization.
- Traffic Monitoring.
- Plan for expansion.

After the installation work has been completed, the radio environment has to be measured and tested to ensure its proper operation and coverage before putting it into use.

This is carried out in the surroundings of each individual site using portable test transmitters.


Thank You!