

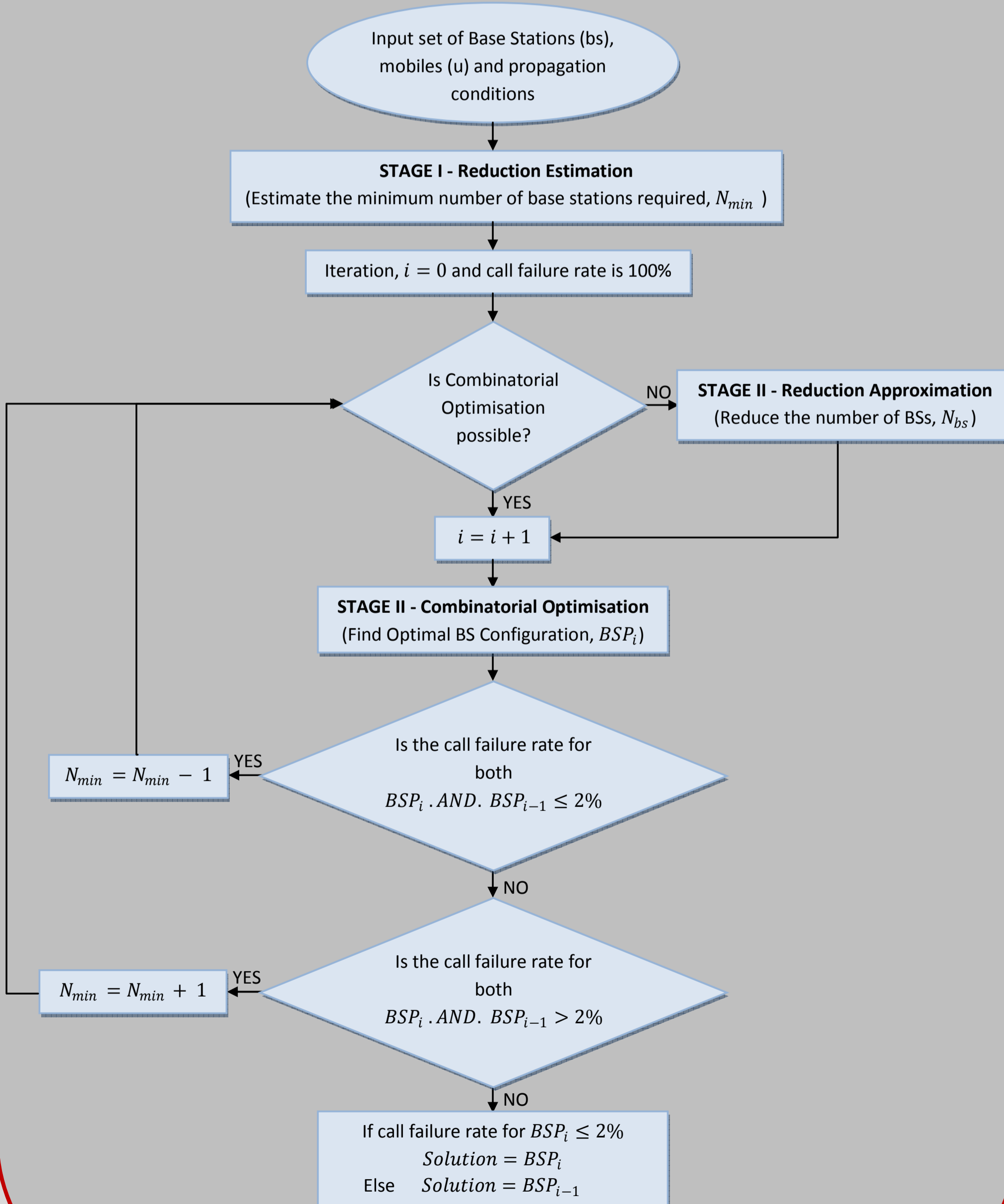
AIM

To find the optimal base station configuration for a multi-floored building from a set of internal and external potential base station sites considering a range of traffic scenarios.

OPTIMISATION ALGORITHM [1, 2]

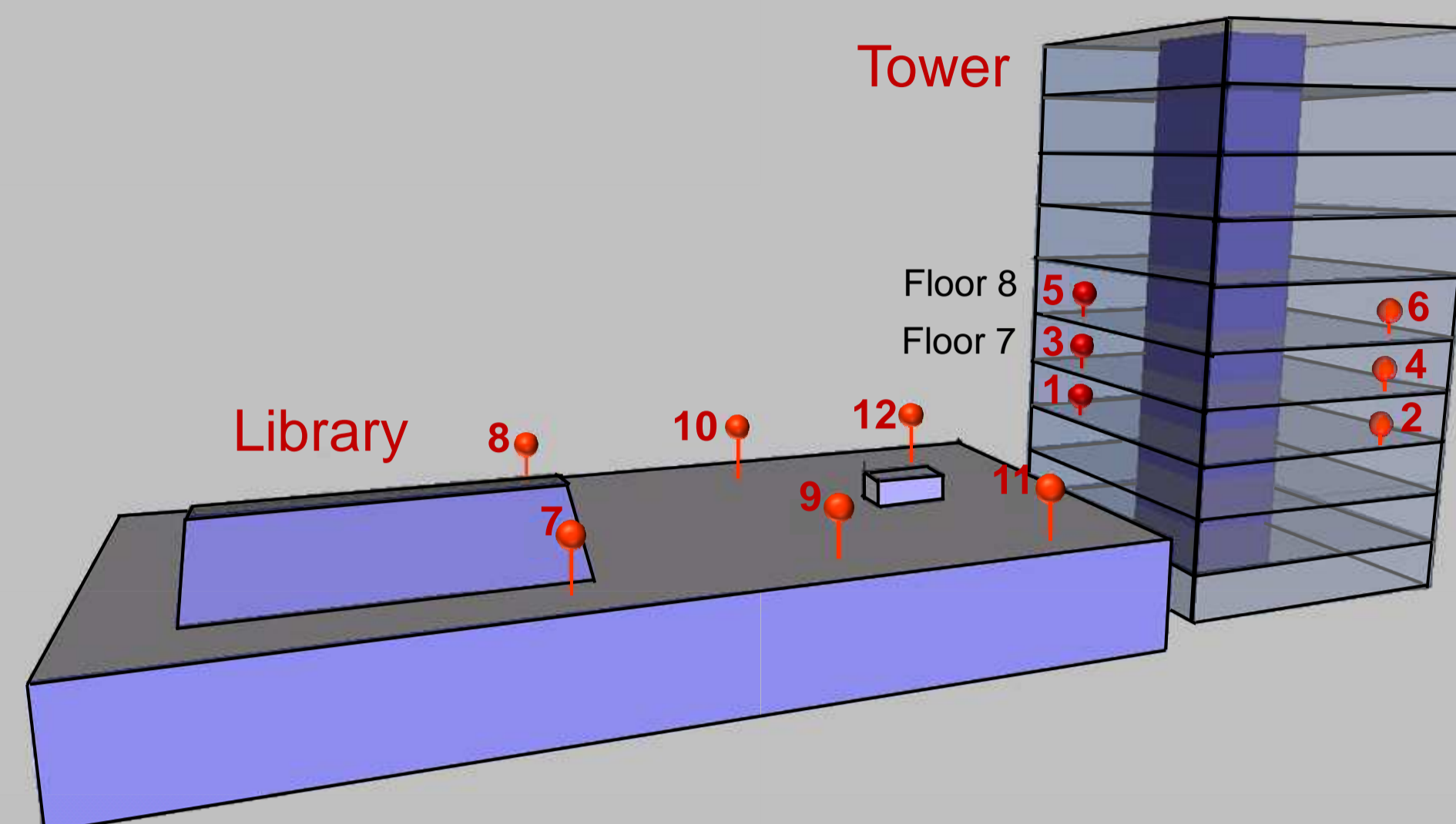
The RCR algorithm is divided into two stages:

1. *Reduction Estimation*; and
2. *Combinatorial Optimisation* with or without *Reduction Approximation* depending on the size of the system.



CASE STUDY

Potential Base Station (BS) sites



- 12 Potential base station sites.
Vertically aligned sites : (1,3, 5) and (2, 4, 6).
Internal_user floor sites : 3 - 6 .
- 108 potential user locations on floor 7 and 8.
- Measured propagation data [3].
- WCDMA system model assumed.
- Average call failure rate is 2% [4].
- Five traffic scenarios (with 501 trials) considered — Very low (5 erlangs) to Very high (25 erlangs).
- **Dynamic call schedules — erlang model [4]**
- Call arrival rates — Poisson distribution.
- Call duration rates — Negative exponential distribution.
- Blocked calls are cleared.

REFERENCES

- [1] L. K. Pujji, K. W. Sowerby, and M. J. Neve, "Base Station Placement in Multi-Floored Buildings," 20th Virginia Tech Symp. on Wireless Pers. Commun., 2010.
- [2] L. K. Pujji, K. W. Sowerby, and M. J. Neve, "A hybrid algorithm for efficient optimisation of indoor base station placement," submitted to IET Commun., 2010.
- [3] K. S. Butterworth, *Performance, planning and deployment of DS-CDMA in-building wireless communication systems*. PhD thesis, The University of Auckland, New Zealand, 2000.
- [4] M. Tolstrup, *Indoor Radio Planning: A practical guide for GSM, DCS, UMTS and HSPA*. John Wiley & Sons Ltd, 2008.

RESULTS

Optimal BSP and of calls connected

Scenario	Traffic	Case I		Case II	
		<i>Internal BS sites only</i>		<i>Internal and External BS sites</i>	
I	Very Low	3	50%	3	50%
		5	48.5%	5	48.5%
II	Low	3	28.5%	4	41%
		4	32%	6	39.5%
		6	39%	7	18.5%
III	Med.	3	28%	4	41%
		4	32%	6	39%
		6	38.5%	7	18.5%
IV	High	3	23%	4	35.5%
		4	27.5%	5	23%
		5	22%	6	27.5%
		6	27%	8	13%
V	Very High	3	23%	4	35.5%
		4	27%	5	23%
		5	22%	6	27%
		6	26.5%	8	13%

CONCLUSIONS

- ✓ RCR algorithm can be applied to find optimal BSP for multi floor buildings under dynamic conditions.
- ✓ *Vertically aligned internal_user floor* base station sites are preferred as they produce minimum call failure rate.
- ✓ As traffic increases, an *external* site is selected over an *internal* site because it causes less interference.
- ✓ If the traffic is too high, another *internal_user floor* site is selected to cope with the load.
- ✓ The *internal* base station sites serve the greater proportion of calls with maximum calls served by *vertically aligned internal* sites.