

# CRITERIA FOR STRATEGIC DECISION-MAKING AT THE PRE-BRIEFING STAGE

Jim Smith<sup>1</sup> and Ray Wyatt<sup>2</sup>

<sup>1</sup>*School of Architecture and Building, Deakin University, Geelong 3217, Australia*

<sup>2</sup>*Department of Geography and Environmental Studies, University of Melbourne, Parkville 3052, Australia*

The client briefing stage is heavily researched throughout the world. The pre-briefing, or strategic stage, which precedes it, is the focus of this research. This is where the nature of the project is defined because a choice has to be made between alternative strategies. Ten criteria have been established as the means of evaluating such strategies and the criteria compared to those emerging from the design, procurement and project management literature.

Criteria from the urban planning literature have been incorporated into one of the author's neural network-based software for addressing urban planning and other problems; titled, Strategizer. The original Strategizer was then modified in order to manage client problems. This new version is called Stratbuild and it has used our ten criteria for several simulated and real client briefing problems. The criteria are described and compared with those used by researchers in the procurement and client briefing literature. Alternative solutions (some not concerned with a building solution) have been evaluated using these criteria. Implications for the design team in focussing on the strategic stages are discussed.

Keywords: Clients, project objectives, strategic management, neural networks.

## CONTEXT

The lack of communication between everyone involved in the development and construction process has been a persistent theme in the literature for the last fifty years. The UK provides a fertile field for relevant governmental and institutional studies, analyses and reports. For example, reports have published on a regular basis in every decade from the 1940s beginning with the Simon Report (HMSO 1944, and most recently the Latham Report (1994). More recently in Australia demands for a more efficient and effective construction industry has paralleled similar concerns as the UK (National Public Works Conference/National Building Construction Council Joint Working Party 1990).

These reports have consistently focussed issues such as:

- improving the organisation, management and coordination of members of the design and construction teams (Walker 1997);
- a lack of integration between architects, building professionals and the contractor (Latham 1994);

---

<sup>1</sup> [jasmit@deakin.edu.au](mailto:jasmit@deakin.edu.au)

<sup>2</sup> [r.wyatt@geography.unimelb.edu.au](mailto:r.wyatt@geography.unimelb.edu.au)

- poor communication between these teams and inadequate client consultation (Morlock 1980);
- the demand for more complex buildings from more exacting clients made the resolution of these issues more urgent.

The response of professions and industry has often been erratic, temporary and often too slow. Consequently, clients have demanded improved service and improved methods of procurement (Bresnen 1990).

Evidence of this, in the UK, occurred when the largest grouping of private sector clients, the British Property Federation (BPF) seized the initiative in 1983 and introduced its own project organisation and procurement method (BPF 1983). The BPF method emphasised the primacy of client needs/requirements with the project manager taking control of the design and construction process on behalf of the client. Government was similarly spurred to adopt alternative approaches to procurement (National Economic Development Office, NEDO 1983, 1985, 1987) and the Department of Industry (1982). These initiatives encouraged different and innovative project arrangements as well as procurement methods that are designed to align client needs with improved project delivery process.

More recently in the UK the Latham Report (1994) has provided a catalyst for the industry to become more client focussed and to remove impediments to poor performance. Whilst conflict and disputes received most attention in the report, special emphasis was given to the importance of clients, good briefing and the essential need for the industry to become client focussed. The strategic needs of clients did not receive any detailed attention, but the briefing process was identified as an important factor in the successful development of a project.

In Australia, the *No Dispute* Report (National Public Works Conference/National Building Construction Council Joint Working Party 1990) was prepared with the objective of,

*...developing co-operatively proposals for changes in the practices of the building and construction industry which would lead to improved practices, and better quality work, with the over-riding aim of achieving a reduction in claims and disputes.*

This report was well received and it encouraged the Federal Government to introduce in December 1991, the Construction Industry Reform Strategy, contained several reform initiatives in labour relations, but an important component of which was the establishment of the Construction Industry Development Agency (CIDA). CIDA had the role of stimulating and measuring progress on implementation of the agreement and evaluating its effect on productivity. CIDA's life was fixed and ended in June 1995.

Hence, the clear message from at least two countries is that the construction industry is an essential sector of the economy. Its efficiency and effectiveness in providing buildings (capital works or assets) is crucial to the industries and to clients in the rest of the economy. The drive for greater productivity and competitiveness throughout these economies cannot overlook the construction industry (Stoeckel and Quirke 1992; Leonard 1992). External forces throughout the economy are driving change and clients are responding to these forces by demanding design that is more effective, and a more efficient delivery and construction of its buildings. The industry, and

particularly its professions, has been put on notice that they must improve their performance.

## STRATEGIC DECISION MAKING

The construction disciplines have long recognised that the early stages in the development of a project are crucial to its success (General Accounting Office 1975). The value management literature too, has promoted this principle (Kelly and Male 1993, Dell'Isola 1982). The reason is that the inception or pre-inception stage, are when significant decisions are made that will influence the characteristics and the form of the project. Once these significant decisions have been made, by their very nature, they cannot be readily deleted or dramatically altered in the subsequent stages. Therefore, if these early stages are so crucial to the success of a project, they should attract sufficient resources and expertise to be carried out exhaustively. Value management processes and techniques have been introduced to guide such design decision making during the inception and outline proposals stages. Indeed, Green's work (1992) on decision making techniques such as the SMART methodology have highlighted the need for design team members to broaden their core design and construction expertise into broader management areas that reflect client demands.

More recently, work by CIDA (1993), the Australian Institute of Project Management, AIPM/CIDA (1995) into project initiation and research by Atkin and Flanagan (1995) have identified the need for clients and their advisers to be aware of the importance of what can be commonly termed, the *strategic level of decision making*. The latter's survey of construction clients indicated that the strategic level had the most potential for cost savings in a project when they identified opportunities for savings at three levels:

- Strategic (client's business case): 10 – 20 % saving;
- Tactical (development of the design): 5 – 15% saving;
- Operational level (management of the project): 1 – 10% saving.

The authors believe that cost savings are an important part of the complex equation that contributes to the quality, value and effectiveness of a project. The potential of these early stages, in terms of processes, methods and techniques making a substantial contribution to the decision making, is vast. However, it has to be a broad-based process that delivers the following benefits:

- Recognition of the opportunity created by the decision to build;
- Client commitment to the project;
- Greater client understanding of the brief and the problem(s) it is attempting to solve;
- Clearer formulation of the service needs, functional needs and objectives;
- Improved versatility or flexibility of the selected project option because a more thorough evaluation of its purpose has been carried out;
- Dissemination of client and user information to the design team;
- Broad discussion of the proposed activities within the new facility by all the participants.

STAGE	PROCESS	ACTIVITIES	V I S I O N
STRATEGY ANALYSIS →	STRATEGIC INFORMATION SYSTEM ↓ Formulate Strategic Objectives	ANALYSIS: <ul style="list-style-type: none"> <li>external environment</li> <li>internal skills and resources</li> <li>stakeholder needs and expectations</li> </ul>	
	↓ Generate Strategic Options ↓ Evaluate Strategic Options ↓ Choose a Preferred Strategy	<ul style="list-style-type: none"> <li>Techniques such as <i>Brainstorming</i>, Delphi, Scenario writing and others.</li> <li>Evaluations such as <i>soft systems</i>, operations research, decision-making software, etc.</li> </ul>	
STRATEGY IMPLEMENTATION →	↓ Implement the Strategy ↓ Evaluation and Control	<ul style="list-style-type: none"> <li>Following organisational requirements and policies.</li> </ul>	

**Figure 1:** Strategic management process (adapted from Viljoen 1991: 56)

## STRATEGIC MANAGEMENT

The strategic planning/management literature is extensive and has grown in the last twenty years. The strategic management process has been described by many authors, too numerous to review here. Porter (1985), Quinn, et al (1988), Thompson and Strickland (1993) capture the essence of strategic approaches and concepts. A diagrammatic summary of the strategic process is given in Figure 1 (Viljoen 1991). This provides a framework for the work presented in this paper.

This framework has guided the authors in the design and development of their model for the pre-briefing stage of a project. The two initial stages identified, strategy analysis and strategy choice, form the backbone of the methodology developed by the authors. Since the focus of this research is identify alternative strategies and make a choice the third part of the strategic process, strategy implementation, has been excluded from the research at the present time. The implementation stage proceeds into the briefing, design development and construction stages.

## A PRE-BRIEFING PROCESS: STRATEGIC NEEDS ANALYSIS

The authors have used the strategic management literature as a model for designing and developing a planning/workshop procedure that identifies, supports and crystallises client needs and aims to provide direction to implement the proposed solution to satisfy those needs. We have termed this pre-briefing process, Strategic Needs Analysis. The process utilises the *Stratbuild* neural network-based software to evaluate the alternative strategies developed in workshops that Strategic Needs Analysis uses. The experience of using Strategic Needs Analysis is described in detail in separate papers being prepared by the authors. The neural network and its mechanisms are not discussed in this paper. They are discussed in Wyatt 1995.

The *Stratbuild* evaluation is based on strategic criteria developed by the authors. These are now discussed.

## STRATEGIC CRITERIA

We have developed ten strategic-level criteria in *Stratbuild* for the assessment of alternatives. They are each designed to encapsulate a characteristic of the alternative being scored on the neural network. The lack of detail (or abstraction) of the named criteria may be criticised as being too imprecise. However, it must be recognised that this evaluation is being carried out during the strategic or formative stages, where options or alternative strategies are emerging and the level of detail in them is not exhaustive. Therefore, the authors have tried to equate their criteria with the general level of information available for each strategy. It would seem unprofitable to score alternative strategies on criteria that reflect a level of accuracy which can only be obtained later in the process when more information is available. The authors also recognise that some of the criteria may overlap with others. However, this is only a problem when such overlap exceeds the range of different interpretations that users put on each one, and our experience makes us confident that it does not. The ten criteria, with brief explanation of each, follows:

- **Responsiveness to effort:** marginal utility, or payoff per unit of effort. This means the amount of progress towards the overall vision for each unit of effort expended, as often expressed in time, money or other resources.
- **Effectiveness:** extent to which it helps achieve the overall goal or vision. Effective means how well the strategy satisfies the needs of the client.
- **Likelihood:** probability that it can and will be pursued. Likely means how probable it is that the strategy (project) will come to fruition.
- **Improvability:** room still left for improvement within any current option. Improvable means how much potential for improvement there is in the current filling of needs which the proposed strategy is intended to satisfy.
- **Permissiveness:** how much it enables other possibilities. Permissive means an ability to enable other alternatives in the future to be incorporated with minimum change and expenditure of resources.
- **Correctness:** extent to which it feels like the *right thing to do*. Correct means the extent to which the project strategy makes one *feel good*.
- **Speed:** how fast it can be implemented. Speed means how quickly completing the alternative can be completed whilst still accomplishing the overall vision.
- **Ease:** easiness of implementation. Ease means lack of hardship when assembling the necessary resources for the alternative and actually completing it
- **Autonomy:** non-reliance on other things. Autonomous means how self-contained the alternative is. That is, how much it is not dependent on the success of other objectives for its own success?
- **Safety:** unlikelihood of generating physical and financial damage. Safety is how risky the alternative is to complete and run during its life. It is an expression of security to the client or site workers or users.

Such criteria were derived from the urban planning literature which has a more natural focus on the strategic level of decision making rather than the tactical or operational (Wyatt 1997a, 1997b). However, in the authors' view, they represent a universal means of analysing any option or alternative at the strategic level. They attempt to represent a balance. Too much detail is inappropriate for this stage. On the other

hand, if a criterion is too vague then it cannot be measured realistically by the participants.

**Table 1:** Preliminary Criteria Evaluation

Criteria	Very Clear	Clear	No View	Not Clear	Very Unclear
1. Responsiveness to Effort	29%	43%	14%	14%	0
2. Effectiveness	29%	57%	14%	0	0
3. Likelihood	42%	29%	29%	0	0
4. Improvability	43%	43%	14%	0	0
5. Permissiveness	29%	43%	14%	14%	0
6. Correctness	57%	29%	14%	0	0
7. Speed	72%	14%	14%	0	0
8. Ease	72%	14%	14%	0	0
9. Autonomy	43%	29%	14%	14%	0
10. Safety	58%	14%	14%	14%	0

But, thankfully, a limited number of simulations and workshops to date has shown us that a high level of acceptance and understanding of the criteria exists amongst participants. We know this because the criteria (and other aspects of the process) are always monitored by an exit survey of all participants.

A recent exit evaluation survey showed the following opinions from participants using the criteria in the *Stratbuild* software. The number of participants in the workshop was not large, but the authors believe it represents the generally high level of understanding of the criteria by most users to date. The responses indicate a trend towards having a *very clear* or *clear* understanding of the criteria in most instances. Naturally, more data is required from future users to confirm this initial data and the authors will continue to monitor understanding of the criteria in every application.

The authors have reviewed the recent literature on client briefing factors, project goals, and we have then placed such goals within our ten criteria noted above. Many early works in the 1980s looked at time, cost and quality, whereas later work has tended to be more detailed and comprehensive in its coverage. Moreover, some of this literature has built upon earlier work and many of the factors have been applied at different stages of the design and construction process. Also, a large number are found in the expanding field of procurement of construction projects. Masterman and Gameson (1994) contain a useful review of client needs criteria by a number of authors in work. Nevertheless, all goals that were found can be described in terms of, or accommodated by our ten criteria, as shown in Table 2.

Note that some factors such as *life cycle costs* may be taken under two headings: *responsiveness to effort* capturing the economical part of the concept and the need to conserve and be energy efficient is captured under *correctness*. This demonstrates the overlap between some factors/criteria. Improvability and autonomy seem to be the missing strategic criteria from this procurement literature.

## CONCLUSION

The strategic stages of a project must engage the client and the design team in a broader evaluation of the need for a project during the strategic stage of its development. The process should provide an opportunity for integrated activities involving a number of stakeholders in the project. It should attempt to give reality to the objective that resources expended at the start of a project are better investments for improving the quality and effectiveness of the final project. Simply, this is the stage

where most of the significant decisions are made and it is important that the client and design consider all the realistic alternative strategies.

**Table 2:** Strategic criteria and client needs factors

<b>Stratbuild criteria</b>	<b>Client needs: Literature-based factors</b>
Responsiveness to effort	Contractor performance, Value for money (Bresnen <i>et al.</i> 1990) Price competition (Skitmore and Marsden 1988) Value for money (Masterman and Gameson 1994; Construction Industry Institute 1995) Economy/Cost (Franks 1990, Kometa, <i>et al.</i> 1995) Price, Capital costs, Life cycle costs (Walker 1997) Client's Maximum value (Birrell 1991) Economy (Kemper 1979)
Effectiveness	Suitability for user, Commitment and involvement, Overall quality, Professional team performance (Bresnen, <i>et al.</i> 1990; Keel and Douglas 1994) Quality (Chan and Fung 1996, Walker 1997) Quality level (Skitmore and Marsden 1988)
Effectiveness (Contd)	Aethetics/prestige, Exceptional size (Franks 1990) Function, Quality (Kometa, <i>et al.</i> 1995) Functional standards, Aesthetic standards (Walker 1997) Rework and Benchmarking (Love <i>et al.</i> 1998) Client Satisfaction (Construction Industry Institute 1995) Accountability – Competition and Price (Hibberd 1990)
Likelihood	Certainty of time, Technical complexity (Chan and Fung 1996) Certainty (Skitmore and Marsden 1988) Certainty of Performance (Sanvido <i>et al.</i> 1992) Construction time performance (Walker 1995) Certainty of final cost, Certainty of completion date, Lowest possible tender (Masterman and Gameson 1994) Date for Completion, Certainty of Programme (Keel and Douglas 1994) Client's Minimum Construction Cost (Birrell 1991) Lowest Price (CIDA 1995) Predictable Cost (Hibberd 1990)
Improvability	Can be considered to contain aspects of adaptability in buildings. This is more commonly dealt with in the design literature under obsolescence (Lawson 1980) or Form and Function (Kemper 1979).
Permissiveness	Contractor Communications and coordination (Bresnen <i>et al.</i> 1990) Flexibility (Skitmore and Marsden 1988; Chan and Fung 1996; Keel and Douglas 1994) Facility for variations (Franks 1990) Flexible to uses (Kometa, <i>et al.</i> 1995)
Correctness	Client organisation, Client involvement and team work (Bresnen <i>et al.</i> 1990) Running/maintenance costs (Kometa, <i>et al.</i> 1995) Life cycle costs (Walker 1997) Green issues, Energy efficiency, Environmental issues (Keel and Douglas 1994) Desire to be actively involved and informed at all stages of the project (Masterman and Gameson 1994) Long Term Client Relations (CIDA 1995)
Speed	Time (Tramer 1993, Walker 1997, Kometa, <i>et al.</i> 1995) Speed (Skitmore and Marsden 1988) Speed – Punctuality (Hibberd 1990) Time of essence (Franks 1990) Time taken (Bresnen, <i>et al.</i> 1990) Faster building ... (National Economic Development Office 1983) Time Performance (Construction Industry Institute 1994) Timeliness (Construction Industry Institute 1995)

**Table 2:** Strategic criteria and client needs factors

<b>Stratbuild criteria</b>	<b>Client needs: Literature-based factors</b>
Ease	Budget (Tramer 1993) Overall cost (Bresnen et al 1990) Technical complexity (Franks 1990) Complexity (Skitmore and Marsden 1988) Technical standards (Walker 1997)
Autonomy	Disruption caused (Bresnen, et al 1990)
Safety	Type of contract, Functional Specification (Bresnen, et al 1990) Direct professional responsibility, Risk, Certainty of cost (Chan and Fung 1996) Price certainty, Exceptional size (Franks 1990) Risk avoidance and responsibility (Skitmore and Marsden 1988) Risk allocation (Love, et al 1998) Safety (Kometa, et al 1995) Disputes/Arbitration (Love, et al 1998) Safety Record (CIDA 1995) Health and Safety, Insurance (Hibberd 1990)

In some cases, this may be a construction project of some kind. In others a better solution may be a non-construction solution such as outsourcing/sub-contracting, delegation, privatisation or some other organisational arrangement. We have to recognise that for the foreseeable future in an environment where we need to maximise the use of our existing resources the best solution to satisfy a client's needs may not always be a built, rebuilt, extended or renovated facility of any kind.

This stage can be considerably improved if we develop more universal and succinct evaluation methods, and our ten criteria are offered as a contribution to this aim. We believe they have the potential to simplify, clarify and therefore improve the pre-briefing process.

Whatever approach is used recent research highlights the need for better approaches, new skills and meaningful comments from users and facility managers (who are often ignored) and a greater sensitivity to client needs. We also need to recognise that some design professionals and facility managers have a contribution to make at this strategic level of decision making. This is because they have significant specialised expertise in built facilities to guide clients at this stage of the decision making process. Design professionals cannot claim this position as a right, but it is a possibility when such people can make useful contributions to strategic decision making that lead to better solutions to the client's needs. If they keep abreast of current methodological developments they just might do so!

## REFERENCES

- Atkin, B. and Flanagan, R. (1995) Improving value for money in construction: guidance for chartered surveyors and their clients. London: Royal Institution of Chartered Surveyors.
- British Property Federation (1983) Manual of the BPF system. London: British Property Federation.
- Bresnen, M.J., Haslam, C.O., Beardsworth, A.D., Bryman, A.E. and Keil, E. T. (1990) Performance on site and the building client. Occasional Paper 42, Ascot: Chartered Institute of Building.

- Australian Institute of Project Management/Construction Industry Development Agency (1995) Construction industry project management guide for project management principals (sponsors/clients/owners), project managers, designers and constructors, Canberra: Australian Institute of Project Management.
- Construction Industry Development Agency (1993) Construction industry project initiation guide for project sponsors, clients and owners. Canberra: Commonwealth of Australia.
- Construction Industry Development Agency (1995) Measuring up or muddling through: best practice in the Australian non-residential construction industry. Canberra: Commonwealth of Australia.
- Construction Industry Institute (1994) Benchmarking engineering and construction: review of performance and case studies. Adelaide: Construction Industry Institute.
- Construction Industry Institute (1995) Benchmarking engineering and construction: winning teams. Adelaide: Construction Industry Institute.
- Dell'Isola, A.J. (1982) Value engineering for the construction industry, 3rd ed. New York: Van Nostrand.
- Department of Industry (1982) The UK construction industry. London: HMSO.
- Gray, C., Hughes, W. and Bennett, J. (1994) The successful management of design: a handbook of building design management, Reading: Centre for Strategic Studies in Construction.
- Green, S.D. (1992) A SMART methodology for value management. Occasional Paper No 53, Ascot: Chartered Institute of Building.
- Green, S.D. (1996) Group decision support for value management. In: Procs CIB W-65 Symposium, Shaping Theory and Practice, D. Langford (Ed), Glasgow, UK.
- Hibberd, P., Merrifield, D. and Taylor, A. (1990) Key factors in contractual relationships. London: Royal Institution of Chartered Surveyors.
- HMSO (1944), Report of the management and planning of contracts (The Simon Report), London: HMSO.
- Keel, D. and Douglas, I. (1994) Client's value systems: a scoping study, London: Royal Institution of Chartered Surveyors.
- Kelly, J., Macpherson, S. and Male, S. (1992) The briefing process: a review and critique. RICS Research Series, Paper No. 12, London: Royal Institution of Chartered Surveyors.
- Kelly, J. and Male, S. (1993) Value management in design and construction. London: Spon.
- Latham, M. (1994) Constructing the team: joint review of procurement and contractual arrangements in the UK construction industry. London: HMSO.
- Lawson, B. (1980) How designers think. London: The Architectural Press.
- Leonard, R. (1992) Improving the competitiveness of building and construction. Business Council Bulletin, November, Sydney, Australia.
- Love, P.E.D., Skitmore, R.M. and Earl, G. (1998) Selecting a suitable procurement method for a building project. Construction Management and Economics, **16**(2), 221-233.
- Love, P.E.D., Smith, J. and Li, H.L. (1998) Benchmarking the costs of poor quality in construction: a case study. Procs Second International and Fifth National Research Conference on Quality Management, 8-11 February 1998, Faculty of Business and Economics, Monash University, Melbourne, Australia.

- Masterman, J.W.E. and Gameson, R. (1992) Client characteristics and needs in relation to their selection of building procurement systems Procs CIB W-92 Symposium, East Meets West, Procurement Systems, Hong Kong, 4-7 December 1994, CIB Publication No 175, Department of Surveying, The University of Hong Kong.
- Morlock, B. (1980) Improved building communication. Builder NSW, Sydney, Australia, 606-613.
- National Economic Development Office (1983) Faster building for industry. London: HMSO.
- National Economic Development Office (1985) Thinking about building. London: HMSO.
- National Economic Development Office (1987) Faster building for commerce. London: HMSO.
- National Public Works Conference/National Building Construction Council Joint Working Party, (1990), No Dispute, Canberra, Australia.
- Palmer, M.A. (1981) The architect's guide to facility programming. Washington DC: The American Institute of Architects and New York: Architectural Record Books.
- Porter, M.E. (1985) Competitive advantage, The Free Press.
- Quinn, J.B., Mintzberg, M. and James R.M. (1988) The strategy process concepts, contexts and cases, Prentice-Hall.
- Sanvido, V., Grobler, F., Parfitt, K., Guvenis, M. and Coyle, M. (1992) Critical success factors for construction projects, Journal of Construction Engineering and Management, **118**(1), 94-111.
- Skitmore, R.M. and Marsden, D.E. (1988) Which procurement system? towards a universal procurement selection technique. Construction Management and Economics, **6**(1), 71-89.
- Stoekel, A. and Quirke, D. (1992) Services: setting the agenda for reform, Department of Industry, Technology and Commerce, Centre for International Economics, Australia.
- Thompson, A.A. and Strickland, A.J. (1993) Strategy formulation and implementation: concept and cases, 7th ed, Homewood IL.
- United States General Accounting Office (1978) Computer-aided building design, Washington DC: US Department of Commerce.
- Viljoen, J. (1991) Strategic management: how to analyse, choose and implement corporate strategies. Melbourne: Longman Cheshire.
- Walker, A. (1997) Project management in construction. 3rd ed. Oxford: Blackwell Science.
- Walker, D.H.T. (1995) An investigation into construction time performance. Construction Management and Economics, **13**(3), 263-274.
- White, E.T. (1991) Project programming: a growing architectural service. Tucson, Arizona: Architectural Media.
- Wyatt, R.G. (1995) Using neural networks for generic strategic planning. In: D.W. Pearson et al. (Eds.), Artificial neural nets and genetic algorithms, Vienna: Springer Verlag.
- Wyatt, R.G. (1997a) Reversing decision support systems to reveal differences in human strategizing behaviour. In: H. Timmermans (Ed), Design and decision support systems in architecture and urban planning., Spon, London.
- Wyatt, R.G. (1997b) Consistency of planning style. In: P.K. Sikdar, S.L. Dhingra and K.V. Krishna Rao (Eds), Procs Fifth International Conference on Computers in Urban Planning and Urban Management. Mumbai, India: Narosa Publishing, 181-192.