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## EXECUTIVE SUMMARY

This report presents a methodological framework for upgrading high-density informal settlements 'in-situ'. The evolution of this framework derives from two primary sources. The first is an extensive desk study of informal settlement internationally, carried out for the Water Research Commission as part of this same research contract (Abbott et al, 2001). The second is a practical experience of upgrading in the informal settlement of New Rest, Cape Town. Thus the first source provides the theoretical rationale, while the second source provides the practical experience of implementation.

The upgrading of informal settlements differs quite fundamentally from the development of vacant land for housing. Yet the majority of existing approaches continues to mirror traditional practice in developing an implementation strategy. Specifically they continue to place a great deal of emphasis on physical conditions, and the improvement thereof, and rely heavily upon the independent use of specific, sector-based activities. The result is a diverse range of approaches to upgrading which seek to achieve specific objectives, without thought being given to the longer-term development. The result is the prioritising of short-term objectives rather than the achievement of long-term sustainability.

There are a number of exceptions to this broad statement. In particular there are two experiences that provide a completely different approach, and in doing so demonstrate the potential of in-situ upgrading as a viable urban development strategy. These two experiences are the upgrading programme of Belo Horizonte in Brazil and the so-called 'Million Houses' project in Sri Lanka. This South African research project has drawn on the experience of both of these international programmes. At the same time, the research project has also been driven by an independent analysis based upon what is most appropriate for South Africa.

The underlying characteristics of informal settlements are poverty and social exclusion. All else flows from that. Thus any upgrading intervention should be able to define, and preferably quantify, its impact in ameliorating poverty and contribution to social integration. This means that any approach to informal settlement upgrading that seeks to be viable and replicable has to deal with these issues.

Taking this into account, an informal settlement can be seen to have two, albeit strongly inter-related facets. The one relates to the physical environment, and revolves around that dwelling that families occupy. The other relates to the families themselves, and their needs and circumstances. To accommodate both, it is necessary to deal with both place and people equally and inter-actively.

This requires an extremely flexible spatial management system with a rapid response time if it is to operate successfully. It cannot function with paper-based mapping, for example, as the time taken to track, map and act on changes in the physical environment would be too slow. By the time the responses had been developed, the spatial relationships between both shacks and families would have been changed. So what is required is a system that approaches real-time mapping as closely as possible. This can be achieved using a GIS-based information management system. However, in the same way that the planning process for greenfield sites evolved to suit the medium of paper-based output, so the new planning system for informal settlement upgrading has to be structured around the optimisation of geo-information. Hence, it is necessary to change not only the approach (which determines what is to be done) but also to change the means by which it is done.

The new planning paradigm that emerges from all of this is one that is heavily dependent upon a knowledge of what exists in the settlement. It is also one that is built around the twin goals of social sustainability and integration into the formal city. Neither of these can be achieved through spatial determinism. It can only be achieved by integrating spatial form and physical development with social and economic activity. That is the basis for the upgrading process described in this report.

The practical side of the methodology is based upon the construction of a suitable geospatial database management system, which in turn is built around two primary identifiers, the shack and the head of the household occupying the shack. In situations where there are a number of separate households, this would require an additional identifier for each additional head of household. In assembling the database, the first step is a detailed spatial definition of the shacks as vectors in a digital format. This is best done using geo-referenced images of the site, which can be obtained from the new 1-metre satellite imagery, from aircraft or from helicopter.

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Having defined the shacks that occupy the site, the data collection process then moves into two parallel streams. The first of these deal with the physical environment. This technical and spatial database contains information that pertains to the site, ie. that piece of land on which the informal settlement is situated. The construction of this data set necessitates the identification and evaluation of a range of spatially referenced technical information, which makes it an appropriate place to build the spatial information system. This means that, before the data can be assembled and attached, it is first necessary to construct a spatial information management system.

The underlying philosophy of informal settlement upgrading in-situ is minimum relocation, ie. the intent is to enable as many families as possible to remain on the site. However it is important to define what this term means. It does not mean no relocation. It means that relocations take place only for specific, agreed, and clearly defined reasons. Furthermore, the relocations should, wherever possible, be internal, ie. families may have to move their shacks, but they do not leave the settlement.

There are three major causes for relocation. The first relates to physical risk. The major causes of physical risk are unstable sloping ground (with the inherent risk of landslides), flood-prone land, whether from rivers or rising groundwater, and unstable flat land (eg. sinkholes or old landfills). The second cause of relocation is to create improved access. Again this requires clarification. With a minimum relocation policy it is not feasible or practical to define large swathes of land as roads and road reserves. Access has to be carefully considered and each route justified. The third cause of relocation stems from compliance with cadastral boundaries. In this new development paradigm, thinking about space is structured around (a) the individual shacks and (b) the line drawn around the external perimeter of the shacks (ie. the settlement). The cadastral boundaries are not the determinants of development. Nonetheless, it may be that, in some cases, certain cadastral boundaries are recognised, as was the case with New Rest.

The second parallel stream of data capture relates to social and economic data. Broadly, the collection of social and economic data can be seen to address four sets of needs, as follows:

1. Structural development. This requires demographic data in order to facilitate the short-, medium- and long-term physical development strategies. The approach within greenfield site development, whereby physical and social services are linked to the number of dwellings, is inappropriate for informal settlements at this stage. Too little is known of these settlements to be able to generalise on ratios for services such as water, schools or hospitals. This means that provision had to be based on site-specific information. In addition, the huge differential between demand and supply inevitably means that self-help programmes will play a major role in development. These programmes require accurate levels of information if they are to be optimal.
2. Social development. All communities have a degree of social stratification. Upgrading has to be an inclusive process, and this means that it is necessary to identify those less able to participate. In addition, the whole process of social integration means that there is the need to interact with each individual household in the settlement. This is crucial not only for land regularisation and the extension and connection of basic services, but also to deal with the fundamental issues of relocation and access.
3. Gender equity. People living in informal settlements also reflect many characteristics of the wider society. This includes a large gender imbalance and a strong bias towards male domination of the society. Yet women bear the brunt of the social dislocation. A good database is an essential pre-requisite to addressing this imbalance.
4. Economic development. This has to be built on what already exists. This requires information on the level of both skills and economic activity within the settlement.

The primary source of data collection is the survey questionnaire. The first step should be to reach agreement in principle among the primary stakeholders (in this case the community of New Rest and the local authority) that information would be gathered. Then, having agreed that the information collected would be owned by the community (a core issue), a series of workshops need to be held which focus on the detailed nature, and extent, of the information to be collected. From this process, as carried out in New Rest, six groupings emerged for the data set, comprising:

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- Shack data, including details of ownership.
  - Detailed information on the head of household.
  - Employment and skills data related to the head of household.
  - Information on the spouse/partner.
  - Information on dependants.
  - Information on other shack residents.

The integration of the shack data with the physical data for the site and the social and economic data pertaining to the community members enables a detailed analysis of needs to be carried out. From a physical point of view it identifies the areas of highest risk, where families should be moved for their own safety. From a social and economic point of view it provides the data that enables an analysis of quantifiable family conditions to be carried out. This provides an information base that deals with the four sets of issues described earlier, namely structural development, social development, gender equity and economic development.

Having reached this point in the process, it becomes possible to initiate an implementation strategy. At this stage a number of factors have to be considered, the majority of which relate to spatial structure and spatial relationships. Foremost among these is movement. The approach to movement corridors should be one that limits vehicular access, whilst recognising the need for access for emergency and delivery vehicles. This results in a hierarchy that is significantly different to that used for conventional township design. This is achieved through a greater integration of movement and accessibility within a wider framework of multi-functional social space. Taking this factor in conjunction with the need expressed earlier to meet social and economic objectives, this leads to a set of planning principles, the key objectives of which are seen as follows:

- to create a continuum or hierarchy of public spaces and movement systems, which attract and give order to activities, events and elements according to their need for public use and privacy;
- to create opportunities within the collective public social space network, where small scale economic activities and street trading can locate and be formally sustained over time;
- to create spatial opportunities in the landscape, where a network of public social facilities can locate and be consolidated into a public 'capital web', which offers optimal sustainable benefit to the community and meets their immediate basic needs.

The spatial definition of the major movement routes completes the assessment of the impact of physical and spatial features associated with the settlement that impinge on existing dwellings and are, therefore, likely to require internal relocation of families. By following this process in New Rest, the number of families needing to be relocated was reduced to below 200, representing less than 20% of the total number of dwellings currently on the site. This up-front planning of relocation supports the long-term social sustainability of the settlement whilst at the same time providing a sustainable basis for planning the infrastructure and dealing with the issue of land regularisation. At the same time it requires a completely different approach to both infrastructure provision and land management.

Taking infrastructure first, the most important point to emerge is that the different infrastructure services are independent of one another. They relate to different planning elements and thereby interact with the wider upgrading process at different points in time.

The first service to be considered is stormwater. An analysis of the impact of rainfall and runoff is crucial, and takes place in the early stages of analysis, since it provides one of the highest elements of risk. The major impact of stormwater runoff therefore is on relocation. The second service is that associated with the movement network. This is not determined in terms of a road hierarchy, but rather in terms of social space, with the recognition that there has to be a basic skeletal core of the network that can accommodate vehicular traffic. This definition of use of the movement network based upon internal, rather than external need has a significant impact upon pavement design, requiring it to be more accommodating of multi-functional usage and derived from a usage hierarchy that derives internally. Its direct impact on stormwater generation is therefore greatly reduced, as mentioned earlier, and this allows the two engineering elements of roads and stormwater to be de-coupled to a large degree.

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Recent advances in knowledge and understanding of sanitation systems mean that different sanitation options can be used within a single project. For the upgrading of dense informal settlements in South Africa, two options are proposed. The first is conventional sewerage and the second what is known as shallow sewerage. The core network can be designed with conventional sewerage, while the smaller blocks defined by the primary road network use a shallow sewer system. The use of this hybrid sewerage system has the added advantage of situating the shallow sewerage component within a community management framework.

The remaining service is water. From an engineering perspective this is the most flexible service. It is also one that is easily accommodated to a two-stage design process. The critical issue is to determine when it should be installed, given its crucial importance in community health. Thus a distinction needs to be drawn between an emergency supply (which may be installed prior to upgrading) and a permanent supply, which will only be supplied much later.

Only once all of this work is carried out does it become possible to explore the issue of land regularisation. This framework for informal settlement upgrading provides the most flexible approach to land tenure and ultimate regularisation. It means that communities in informal settlements can choose one of three forms of land ownership. The first is full communal ownership, the second a more limited form of communal ownership based upon local blocks of land defined by the road network, and the third individual ownership. The final choice will lie with the community.