

The process of recovery had its lessons for new construction.

- Buildings more than 30 years old generally give a better recovery. Other factors that help are; correct mortar mix (mortar strength should be less than the brick), uniform brick sizes and quality of bricks (older the buildings, better the quality of bricks).
- The natural materials are far more conducive to recovery compared to manufactured tiles. One of the important learning was that the bedding must not contain any binder ('morthuthu', glue, epoxy etc.) other than the requisite cement.
- Structural Steel is extremely easy to recover and reuse. However, the reinforcement steel can be recovered and down cycled as non structural steel.

PROJECT 4 – DESIGN FOR RECOVERY

Challenged with a project for a weekend house at a site with steep slopes, very little flat land and loose sandy soil of ravine, we decided to intrude as less as possible on the terrain and in a manner that the building, when needed, can be fully dismantled and material/ elements recovered (figure 6). As a result the program was divided in smaller components with each component designed to touch the ground lightly.

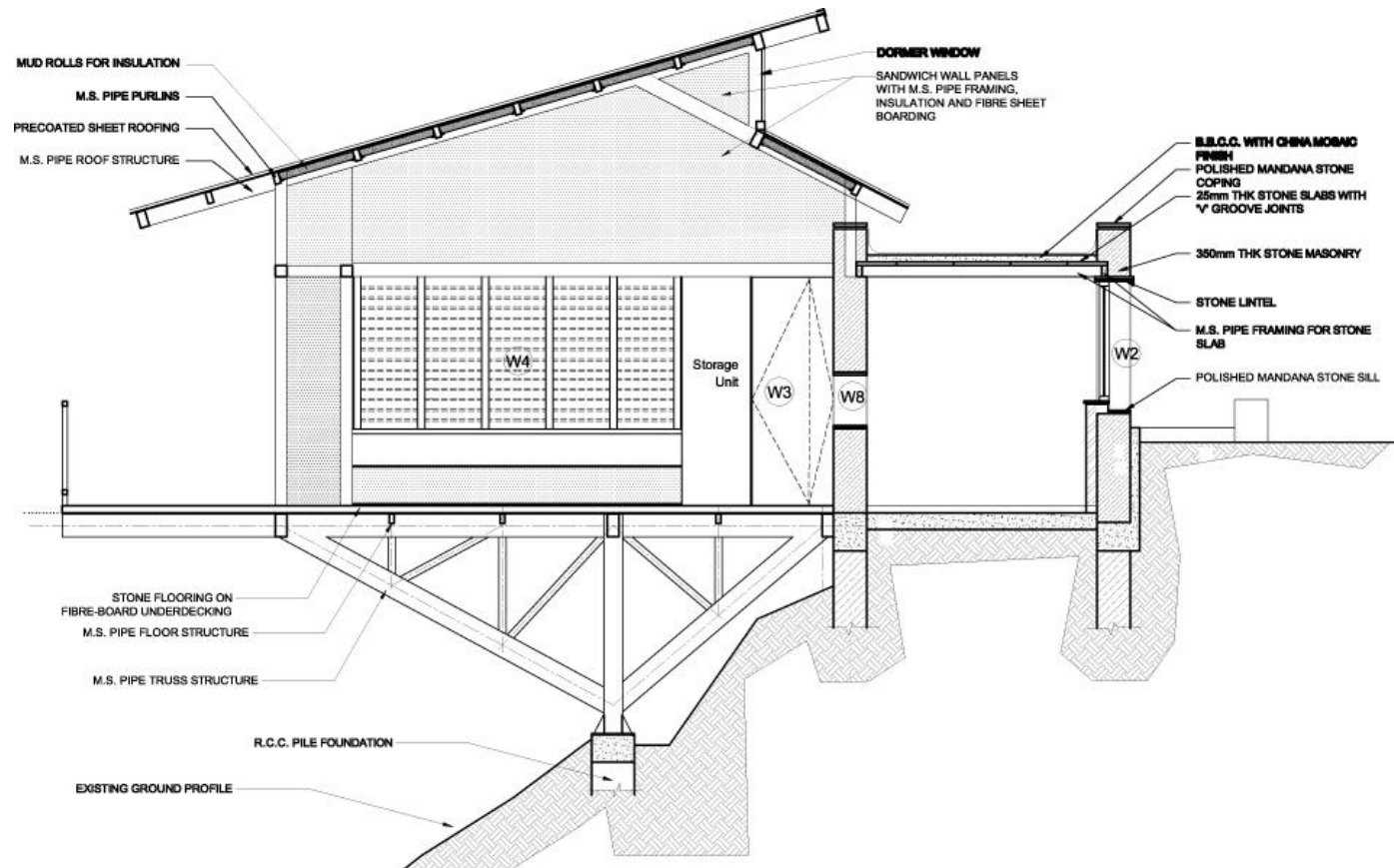


Figure 6 Section through the proposed building unit.



Figure 7 Images of the buildings under construction.

INFERENCES AND CONCLUSION

	Energy Impacts	Social Impacts
Project 1 (Why Build?)	Built up area reduced due to the space efficiency study: 1140 sq.m (more than 90% reduction in original programmatic require). Elements added for better functionality of the existing building: Elevator, central court cover, bridges.	Playground remains undisturbed. The negative spaces are converted to active spaces. The available funding to be diverted for better amenities and site management.
Project 2 (Why not Reuse?)	Retrofitting will consume only 30% of the energy required to demolish and construct a new building. The façade screen treatment on South and West sides reduces the operational energy requirement by 25%, thus mitigating the negative aspect of higher floor to floor height	--
Project 3 (Recover and Regenerate)	Approximately 7.5 lac MJ of energy saved through material recovery and through using waste for generating new material (in comparison with procuring available bricks).	Sand and top soil used for making conventional bricks is avoided. Availability of recovered materials provides affordable resources for low cost construction in informal sector housing.
Project 4 (Design for Recovery)	Though the embodied energy of the structure is higher than the conventional concrete structure, its design for material/ components retrievability at the end of life cycle makes it sustainable.	--

This paper has discussed four resource centric approaches to sustainability. It is estimated that India generates close to 530 million tones of construction and demolition waste per year. While a regulatory mechanism to check this loss of precious resource is in a very nascent stage, we as architects have to consider it our responsibility towards a judicious employment of construction materials. This can be approached at various stages of the project:

DESIGN STAGE:

1. Evaluation of the contextual relevance, relationships and possibilities of reuse.
2. Optimisation of existing structures, if any.
3. Rationalisation of design to maximize the efficiency of structure and other building elements.
4. Selection of materials with reference to local availability, technological feasibility and possibilities of recycle/ reuse at the end of the life-cycle.
5. 'Design' and management of the demolition as a process of dismantling to recover building materials.

CONSTRUCTION STAGE:

1. Though currently it is difficult to include waste management as a contractual obligation, a codification of materials selection, their procurement policies and procedures ensures resource consciousness amongst all the stake holders of the project.
2. Creating awareness of construction materials as energy intensive resource also helps in ensuring waste minimisation right from the client to the construction workers.

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