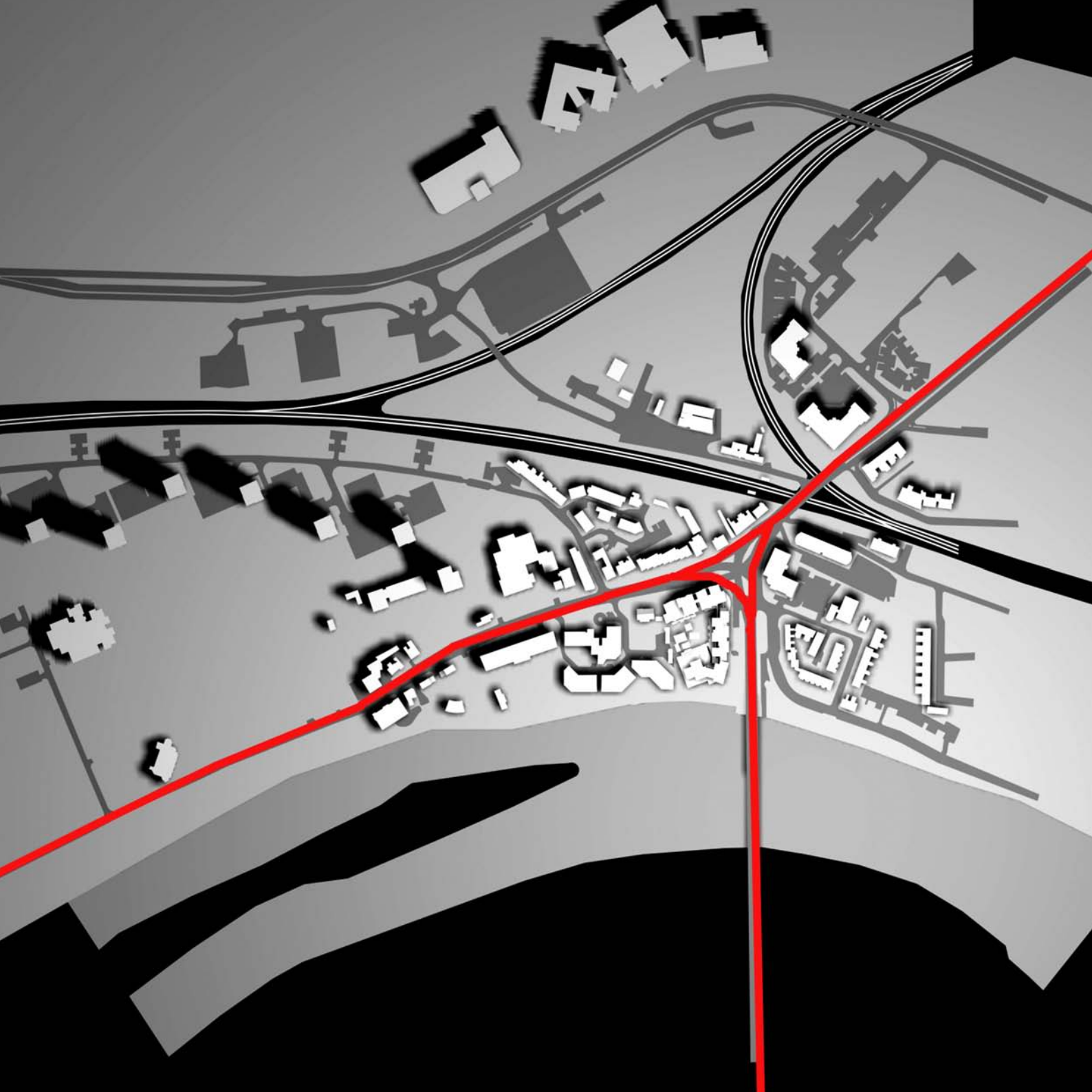


1:0 INTRODUCTION

The following document is the culmination of research into the possibilities of employing sustainable principles and new technologies to improve the way high-rise apartment blocks are designed. The Client is Saint Georges Homes of London. [Best Practice - Urban village - Kew bridge London - brief documentation 2003.]

The design is intended to meet a growing market share that is becoming increasingly aware of the environmental impacts of modern living. Triple bottom line principals have been employed in the design decision making process and can be viewed in the form of the Baseline criteria report and the Technical report which is part of this thesis documentation. [Best Practice - Urban village - Kew bridge London - technical report & baseline criteria 2003.]



2:0 LOCALITY



Fig - 2:01

Fig - 2:02



Fig - 2:03



The site is situated at Kew Bridge southwest of London.

3:0 _____ **QUALITY ENVIRONMENTS** _____



3:0 QUALITY ENVIRONMENTS

James Lovelock 1972 introduced the concept that all the life forms on the planet contribute to its continuing homeostasis. The principles of life supporting life and the theories of interconnectedness are vast and can be perceived in all forms of life.

The ever-increasing strain on the environment has been placed under the spotlight in recent years and this has led to an awakening in the architectural profession in terms of environmental concerns; sustainable strategies are taking centre stage in the decision making process of the built environment.

“As the century draws to a close, environmental concerns have become of paramount importance. We are faced with a whole series of global problems, which are harming the biosphere and human life in alarming ways that may soon become irreversible. We have ample documentation about the extent and significance of these problems.

The more we study the major problems of our time, the more we come to realise that they cannot be understood in isolation. They are a systemic problem, which means that they are interconnected and interdependent. For example, stabilising world population will only be possible when poverty is reduced worldwide. The extinction of animal and plant species on a mas-



Fig - 3:02

sive scale will continue as long as the Southern Hemisphere is burdened by massive debts. Scarcities of resources and environmental degradation combine with rapidly expanding populations to lead to the breakdown of local communities, and to the ethnic and tribal violence that has become the main characteristic of the Post-Cold-War era.

Ultimately, these problems must be seen as just different facets of one single crisis, which is largely a crisis of perception. It derives from the fact that most of us, and especially our large social institutions, subscribe to the concepts of an outdated worldview, a perception of reality inadequate for dealing with our overpopulated, globally interconnected world.

There are solutions to the major problems of our time; some of them even simple. But they require a radical shift in our perceptions, our thinking, our values. And, indeed we are now at the beginning of such a fundamental change of worldview in science and society, a change of paradigms as radical as the Copernican Revolution. But this realisation has not yet dawned on most of our political leaders. The recognition that a profound change of perception and thinking is needed if we are to survive has not yet reached most of our corporate leaders either, nor the administrators and professors of our large universities.

Not only do our leaders fail to see how different problems are inter-related; they also refuse to recognise how their so-called solutions affect future generations. From the systemic point of view, the only viable solutions are those that are "sustainable". The concept of sustainability has become a key concept in the ecology movement and is indeed crucial. Lester Brown of the Worldwatch Institute has given a simple, clear and beautiful definition: "A sustainable society is one that satisfies its needs without diminishing the prospects of future generations." This in a nutshell, is the great challenge of our time: to create sustainable communities, i.e. social and cultural environments in which we satisfy our needs and aspirations without diminishing the chances of future generations." [Fritjof Capra 1997.]

3:1 CONNECTIONS

The theories of interconnect-edness fall down almost immediately when one comes to the implementation of actual projects on actual sites. The notion of a site in isolation is the first problem because no site is completely isolated in terms of function. However, they are parcelled and packaged as such to developers who have very little interest in anything other than the site boundary lines in which they have to work. Urbanity is determined by criteria set forth by the respective town planning guidelines, and connections between buildings or site related functions are not con-

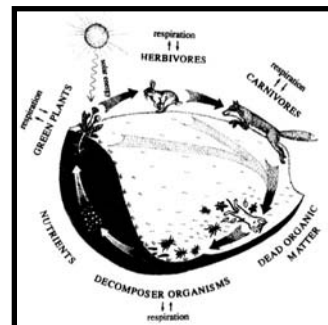


Fig - 3:03

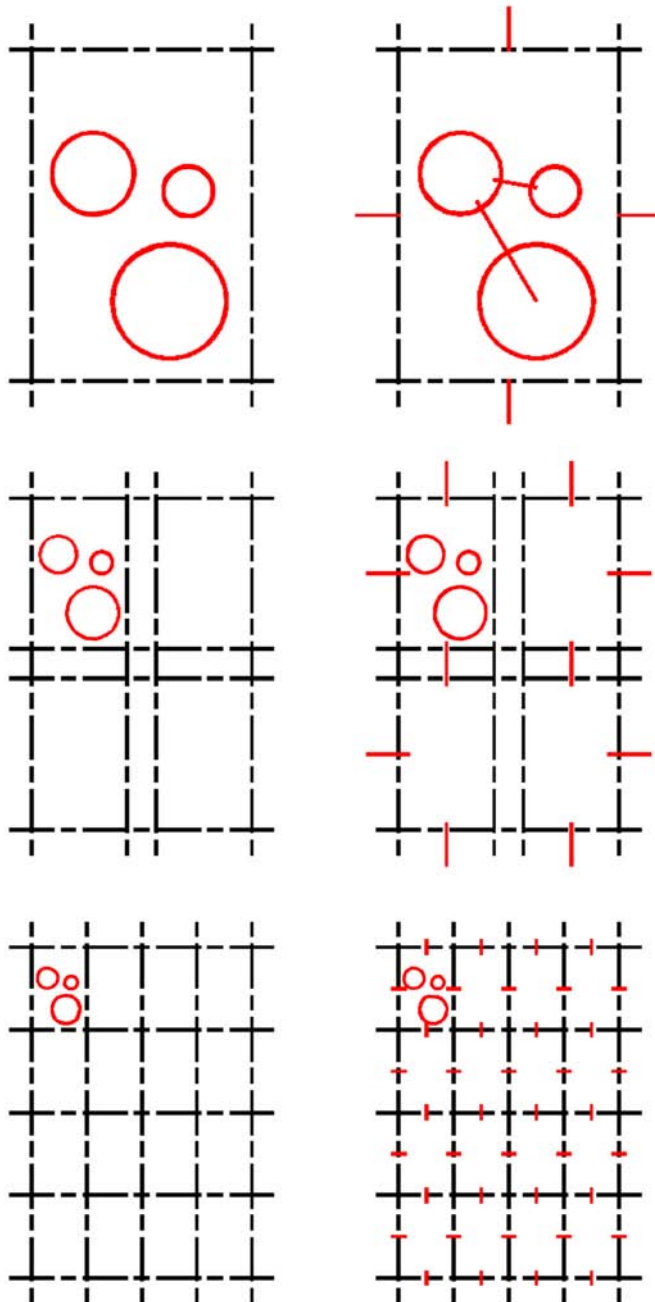


Fig - 3:04 Convention site connections vs ideal connections

sidered beyond commercial or retail opportunities. The connections that buildings and their users have with the immediate context in which they find themselves are of particular interest in that there is great potential for multi functioning on various levels, particularly in terms of environmental and energy use concerns, between sites. But this is as yet a largely underexploited resource for buildings and the way people use them to play a far more supporting role to one another. Perhaps the problem lies with the governing bodies where compensation or an awards system could be implemented for developers who do more than only that which is required by local authorities.

Although it is important for a site to explore the potential for connection to its immediate surroundings and of these surroundings to other areas and these areas to greater zones and so on, it is also important that the site begin this process within these boundaries set by the local council. In other words the interconnectedness must begin with the smallest detail, and if this is achieved the concept can be explored throughout and extended beyond the boundary.

The exploration of connections within the boundaries of the site must begin with the user, with what the requirements are and with how these requirements can be fulfilled.



Fig - 3:05



Fig - 3:06

3:2 QUALITY AND VALUE

The thesis project on the Kew Bridge site deals with a mixed-use development, which is predominantly residential, and as such the focus is placed on creating a quality living environment for the inhabitants. The question of quality living environments is a subjective and emotive topic: what may be seen as quality by one person may not be seen as such by another, so the question must then be that of an accepted norm or standard that is seen by the greater majority as representing quality.

Similarly, value has many different meanings and the answer that one receives depends largely on whom you ask. In the architectural context and in particular with a project the size of the Kew Bridge development there are several players; the developer, the architect and the end user are the most obvious ones. The developer has the money, the architect the design and the end user the demand.

The question of value when asked of the developer would provide the answer that one must ensure a building that is of high quality, that has a good return on capital investment: a monetary value is associated with a product.

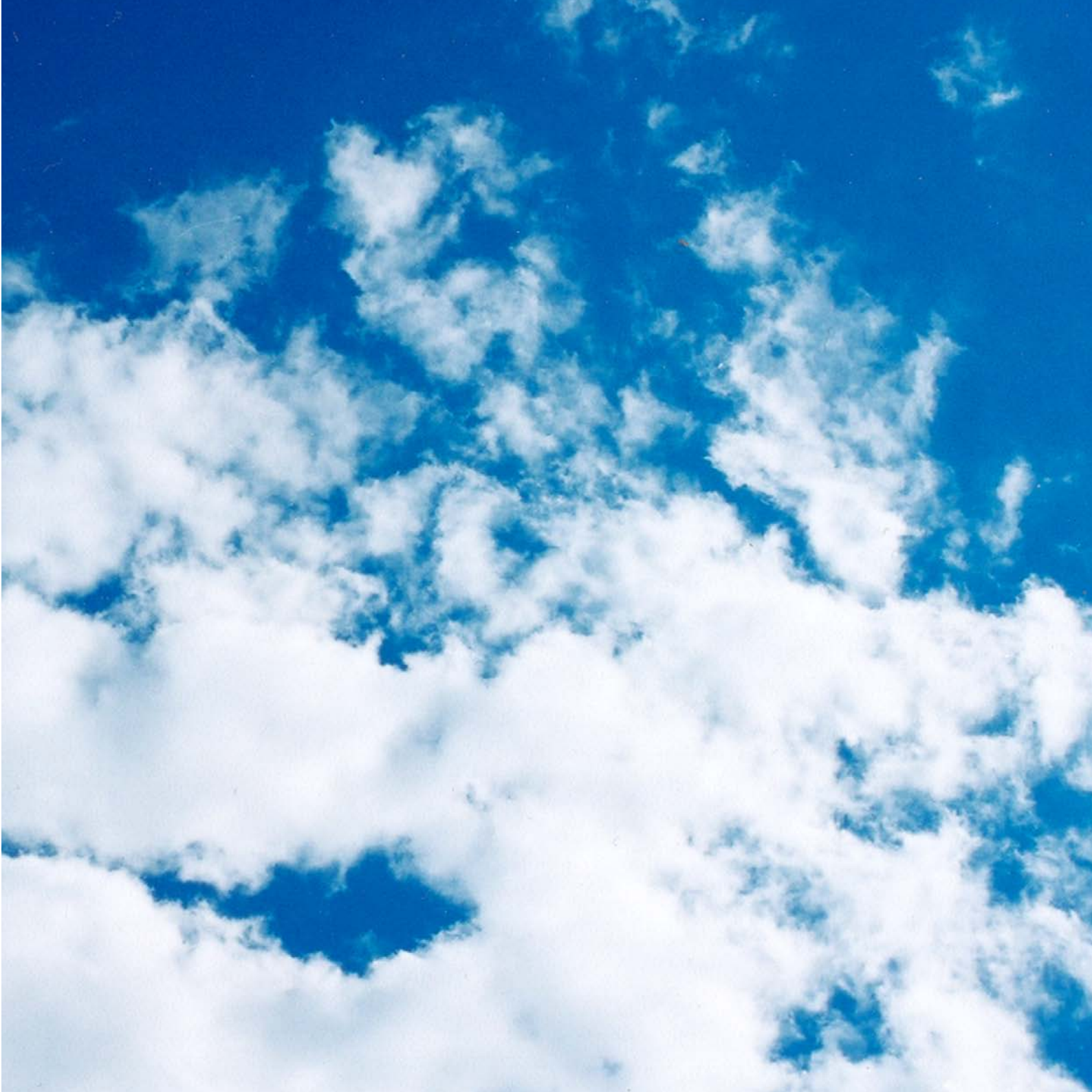
The same question to the user would provide the answer: a high quality living environment for an acceptable price, once again a monetary value associated with a product but with a far more personal interest attached. When asked of the architect the answer will be: to provide a quality building architecturally, that is responsible in terms of environmental impact and in the best interests of the public, as well as being a marketable product.

The answers to the questions of value and quality are largely different for the various parties, and the glue that binds the players can be a little thin in places depending on the extent of the differences between their opinions.

The question that is then asked is; who determines the standards and quality of development?

Various precedents have been selected in order to assist in establishing the meaning of value and quality, as it exists in the built environment. These include; Habitat 67 by Moshe Safdie 1967, BedZED by Bill Dunster Architects 2002, and the proposed development on the Kew Bridge Site by Broadway Malyan Architects 2002. These precedents have been selected here.

4:0 PRECEDENTS



4:1 HABITAT 67 MONTREAL

Projects such as Moshe Safdie's Habitat 67, which when constructed was considered highly controversial and the success of which was doubted, now stand as a brilliant example of quality living environments with contented residents. The project came into being primarily in a social paradigm intended to fulfil the needs of the low-income groups.

"Habitat questioned the validity of the closely stacked high-rise apartment building - whether poor people in publicly constructed towers or rich people in Trump-style towers - could enjoy the pleasure of living in "houses in the air" [Architectural Record 1992.]

In the July issue of Architectural Record 1992 Safdie looks back on the successes and failures of Habitat 67. Habitat was not intended to be just another building; it was intended to be a model that could be duplicated as an ideal for urban living, the ideas for which went as far back as Le Corbusier's 1922 apartment structure called "Immeubles Villas". This scheme involved stacking of dwelling units, allowing for the creation of gardens in the sky, as did Marseilles Unité d'Habitation; which was a further exploration of Le Corbusier's utopian ideals.

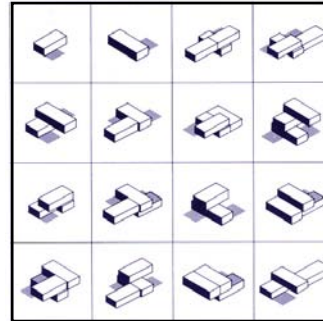


Fig - 4:1:02

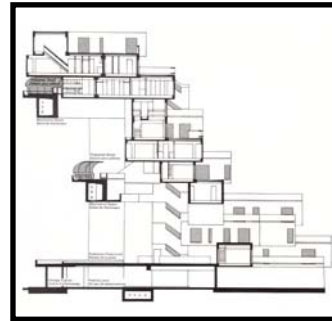


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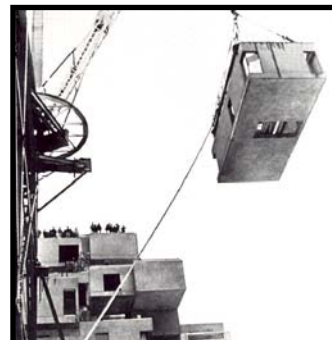


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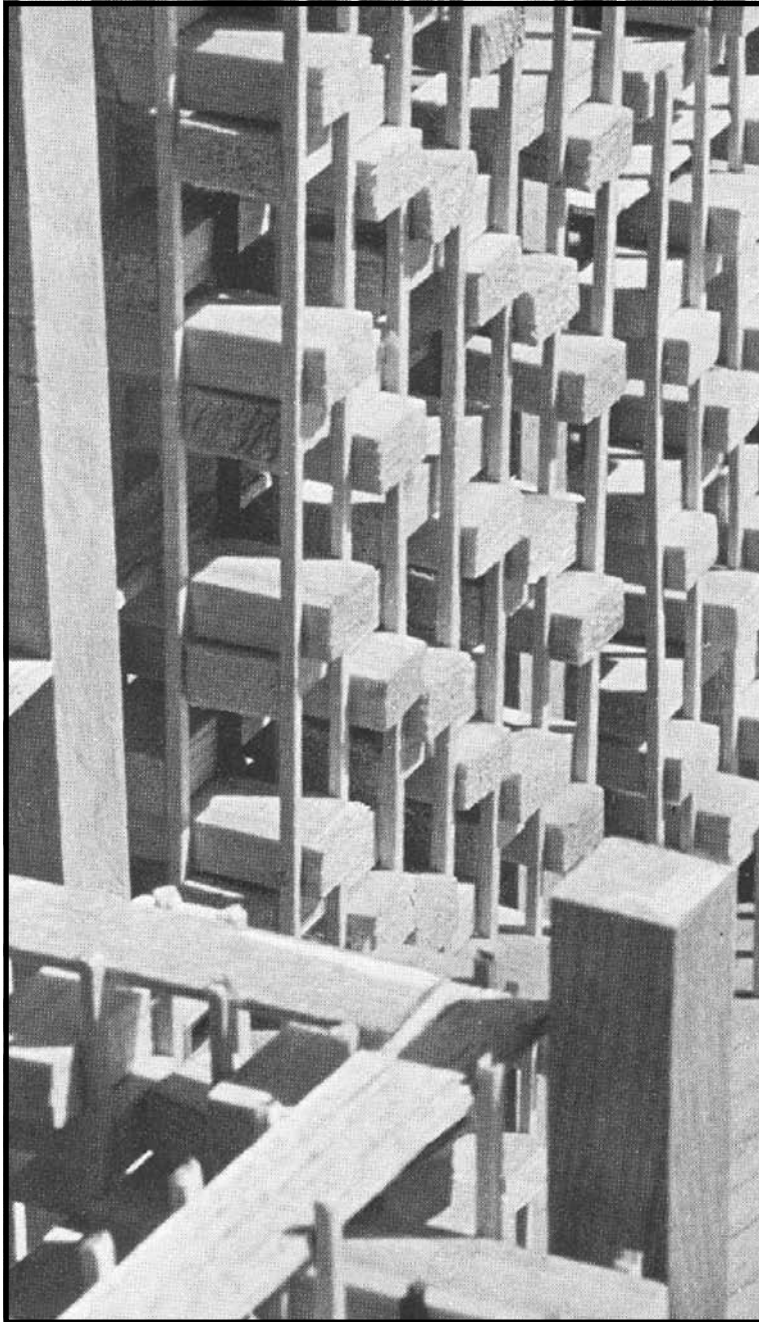


Fig - 4:1:05

Safdie felt that the ideal of houses in the sky, each with its own garden, was somewhat deserted in Unité; the project, which was far more compact with a complex arrangement of corridors and vertical circulation. Habitat was to be a revisiting of the stacking ideals and the exploration of the potential for prefabrication of units.

The units were to be constructed from concrete, making them very heavy, 70 tons per unit, but this would eliminate the need for supporting structure. A supporting structure would only be necessary if the units were constructed from lightweight fireproof materials, which were not available in 1967.

Habitat was intended to be a prototype model that was to be reproduced on the mass scale. The justification of the high building costs was that this project was the first and that production on a mass scale would allow for repetition of elements and refinement of technologies, leading to reduced costs. The reality is however that the utopian ideal of houses with gardens in the sky did not come cheaply and that the advances in technology to improve costs could quite easily be applied to the compact apartment block and as such the divide could never be breached. Habitat's structural clusters also led to higher façade ratios and more roofed surfaces, translating ultimately into higher maintenance costs.

Safdie's approach to projects since Habitat has been to rethink the fundamentals of housing for poor and middle class people; he suggests that high-density housing is not the correct typology due to its cost and adds that disruptions to income make it difficult to provide reasonable amenities for these families in such buildings. The better approach, according to Safdie, is medium-density projects that are close to the ground and utilise more land. This requires that authorities adjust urban zoning policies to make such land parcels in central areas of cities available to the poor and middle class income groups. The problem with this is that containment of urban sprawl into potentially valuable productive land is of worldwide concern.

The penthouse's private garden, giving the option of being inside or outside, makes it the most desirable unit in any high-rise apartment block. The idea of making every unit in this way would surely mean the creation of quality environments for all; the question then asked is not whether we want it or not but: can we afford it?

4:2 BEDZED BEDDINGTON LONDON

Ecology and concern for the environment is the paradigm in which we currently find ourselves, making the BedZED project in south west London one of the current leaders in environmental design, and is an example of what can be achieved when sustainable “triple bottom line” principles are implemented as primary decision making criteria.

BedZED is a collaboration between Peabody Trust Housing Association, Bill Dunster Architects and ARUP Engineers. The project set out with the aim of creating a living and working environment that fully embraces renewable natural resources, achieving closed loop material use, site resource autonomy and social involvement.

The project densities include 83 mixed tenure homes (social, key worker and for sale) in addition to 3000m² of living/workspaces, retail and leisure use space. These densities are in line with the UK’s projected requirements for new homes, utilising only brownfield sites to accommodate new housing developments without any further utilisation of precious greenfield amenities. It is worth noting that these densities are achieved with the projections of Moshe Safdie, in that the development is at most a 3-storey walk up model.

The project utilises a combination of methods to achieve reduction in conventional energy use. These include:

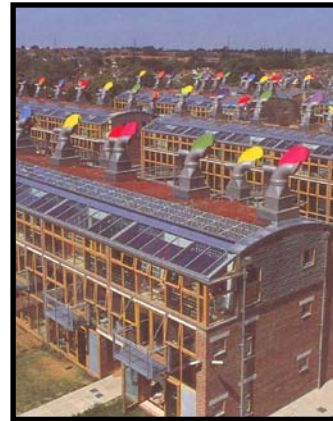


Fig - 4:2:01



Fig - 4:2:02



Fig - 4:2:03

4:2:1 ENERGY GRADING

Energy Grading, which is a technique, developed by ARUP “ranking the full range of possible renewable sources against end-use energy needs, to generate a checklist of building design properties. The key issue is to match the lowest possible grade of source against the grade of the end demand. This process also involves mapping demand and availability, given that most renewable energies tend to be more finite and need coupling via energy storage to allow this demand/availability match” [ARUP Journal 2003.]

4:2:2 ZERO-HEATING HOMES

Zero-heating homes, which involves the utilisation of internal heat gaining elements such as people and their activities to sufficiently heat the buildings day and night. This is achieved by increasing the insulation value in the thermal mass, trapping the heat and as such reducing the necessity of heating the buildings at all.

4:2:3 BUILDING PHYSICS

Building Physics, involves complex thermal analysis scrutinising the availability of heat gains from occupants, appliances, cooking, washing, and solar heat gain. Solar heating was found to be highly variable in terms of availability and quantity. Further factors, which are taken into consideration, are glazing areas; these allow for solar heat gain but are also the biggest culprit in thermal heat losses.

4:2:4 BUILDING MASSING AND ORIENTATION

Building massing and orientation, requires the analysis of both the working and the living environments. The working environment with its high occupancy and office machinery leads to high heat gains and as such the preferred orientation would be north; the living environments on the other hand have low occupancy and machinery heat gains and as such have great advantages in using the solar heat of the south orientation.

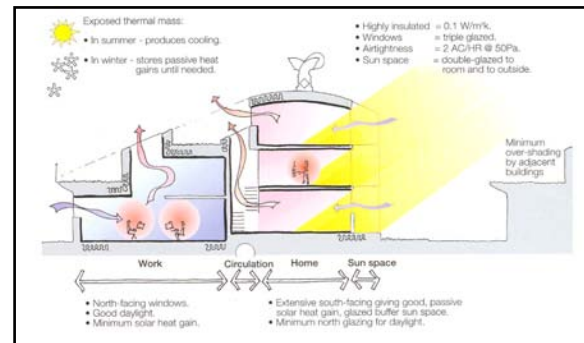


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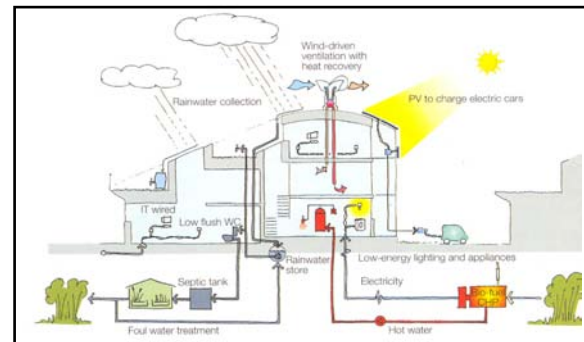


Fig - 4:2:05

4:2:5 BIO-FUELLED COMBINED HEAT AND POWER (CHP)

Bio-fuelled combined heat and power (CHP) is a system that utilises either gas or woodchip (converted to gas) to power an electric alternator for production of electricity. In addition the gas burning process allows an opportunity for heat harvesting conversion into hot water. In the case of BedZED the CHP plant uses woodchip that was identified as a suitable fuel, with the advantage that the urban tree waste was being used as landfill, saving the considerable costs associated with its removal.

4:2:6 PHOTOVOLTAICS

Photovoltaics were originally not considered as a source of electricity for the dwelling units; however, research into the lifestyles of the potential residents, in particular their travel needs, revealed that 95% of urban journeys were within a radius of 40 miles. This gave birth to the idea of utilising the photovoltaics to charge a fleet of electric cars, which can comfortably manage a 40-mile range. The electric cars are in addition a far cleaner means of transportation when compared with their conventional petrol or diesel counterparts.

4:2:7 CLEAN WATER

Clean water and the current process of its delivery, use, transportation, and treatment were assessed and found to be wasteful. BedZED aimed to reduce the demand for potable water

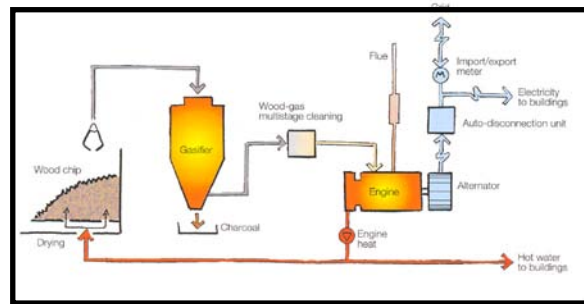


Fig - 4:2:06



Fig - 4:2:07



Fig - 4:2:08



Fig - 4:2:09



Fig - 4:2:10



Fig - 4:2:11

by 50% and to treat the effluent on site, providing recycled water for reuse in grey water functions. "Various good practice measures have been incorporated, including restrictors to prevent excessive flows, mains pressure showers to avoid power-showers, meters visible to consumers, EU 'A' grade water-consuming appliances, and very low/dual flush toilets. Rainwater is collected from roof surfaces and stored in underground tanks for irrigation and toilet flushing. An ecological on-site foul water treatment system was added to the development after a statutory water authority agreed that it would adopt and operate the completed system. This uses vegetation as a cleaning agent in the secondary and tertiary treatment stages, partly because of its low energy consumption. The system treats the water to a high enough standard for it to feed recycled 'green water' as a supplementary feed into the rainwater storage tanks." [ARUP Journal 2003.]

4:2:8 MATERIALS

Materials and the often-great distances that they must travel to site locations are one of the greater challenges that need to be overcome when dealing with a sustainable project such as BedZED. In this particular case most of the existing materials were retained on site and most of the heavy building materials were sourced within a 55km radius from the site. Recognised environmental standards formed part of the criteria for materials selection and on site sorting of construction waste for recycling was employed.

“BedZED seeks to offer its occupants the opportunity to live and work with a completely carbon-neutral lifestyle, making this choice attractive, cost effective, and appropriate to modern living. It offers solutions to many sustainable life-style issues in a practical and replicable way.

One key reason for embarking on the BedZED project was to demonstrate to a sceptical industry how sustainability is possible and can be cost-effective, and how we can really make a difference for society and its future. There is inherently considerable industry inertia to change and improvement. It is through delivering successful examples like BedZED and proving there is marked demand for this kind of project that mainstream developers and construction participants will feel that they can seriously take steps towards a more sustainable world. It requires innovation, a strong belief, considerable time input, and the dedication of the complete project team to show how this can be achieved.” [ARUP Journal 2003.]

4:3 KEW BRIDGE HOUSING -
KEW BRIDGE LONDON

The Kew Bridge project by BM Architects is a proposal for what sort of development should take place on the Kew site. The Developers were Saint Georges Homes. Their requirements for the site were to facilitate a mixed-use development that included retail opportunities on the ground floor with the possibility of a residents gym and residential units above. The scheme entails 2800m² of lettable retail space and a total of 18 storeys of residential units. The densities achieved in this project are extremely high and negotiations with local authorities as to the height restrictions in terms of the urban fabric were necessary.

The residential component consists of a wide variation of unit typologies ranging from 1 bedroom to 3 bedroom units with occasional balcony areas. The council requirements call for a 30% social housing component for all new developments: this was dealt with by segregating the building in terms of finishes, unit typologies and entrances.

The requirements for the improvement of the public realm were met by means of a defined courtyard space on the southern border adjacent to the River Thames, with an internalised courtyard to the northern half of the site designed to be a drop-off zone for residents as well as to provide access to the basement parking. Servicing of the building takes place via the access road on the western border of the site.

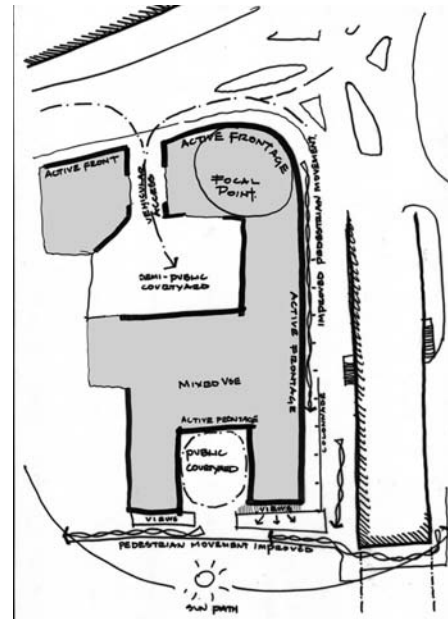


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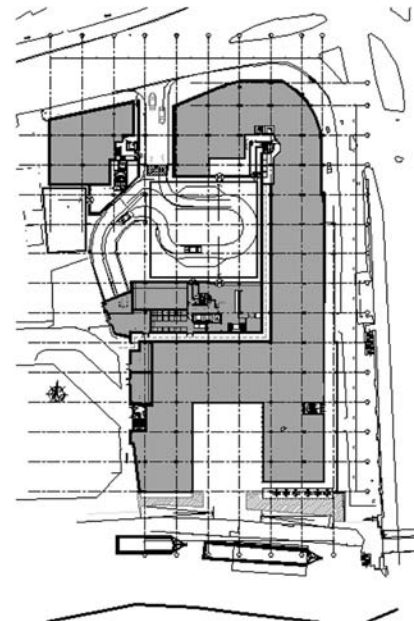


Fig - 4:3:02

The energy use of the building relies entirely on the conventional connections such as electricity from the grid and gas supply from service providers. The building envelope consists of conventional cladding and insulation as per the requirements of the British Standards Authority.

The above-mentioned precedents have helped in the design and decision-making process for the Best Practice Urban Village thesis project. They were chosen as specific examples, which provide a wide range of different approaches to an age-old architectural challenge namely housing.

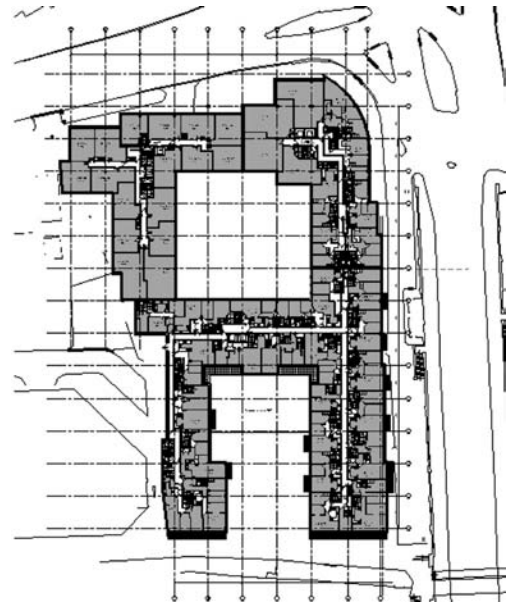


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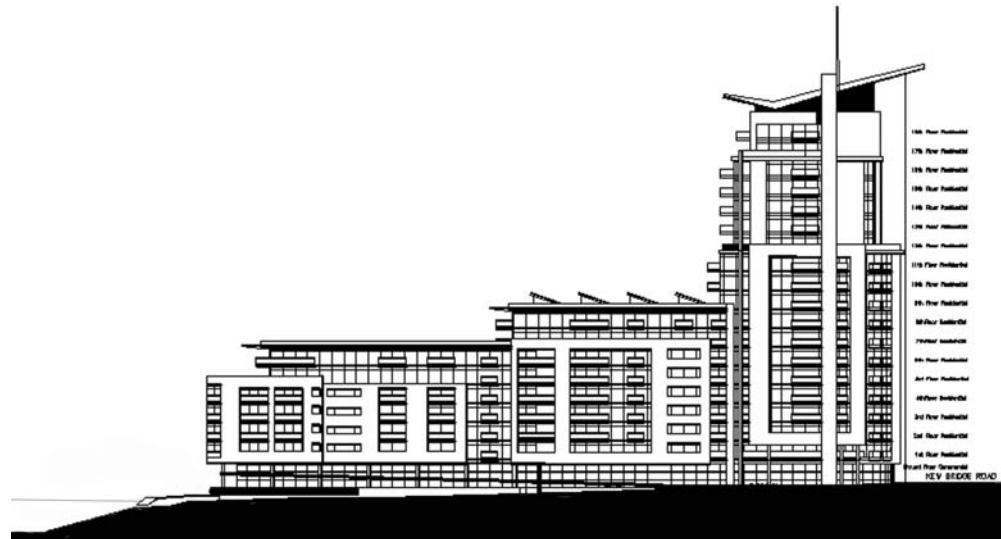
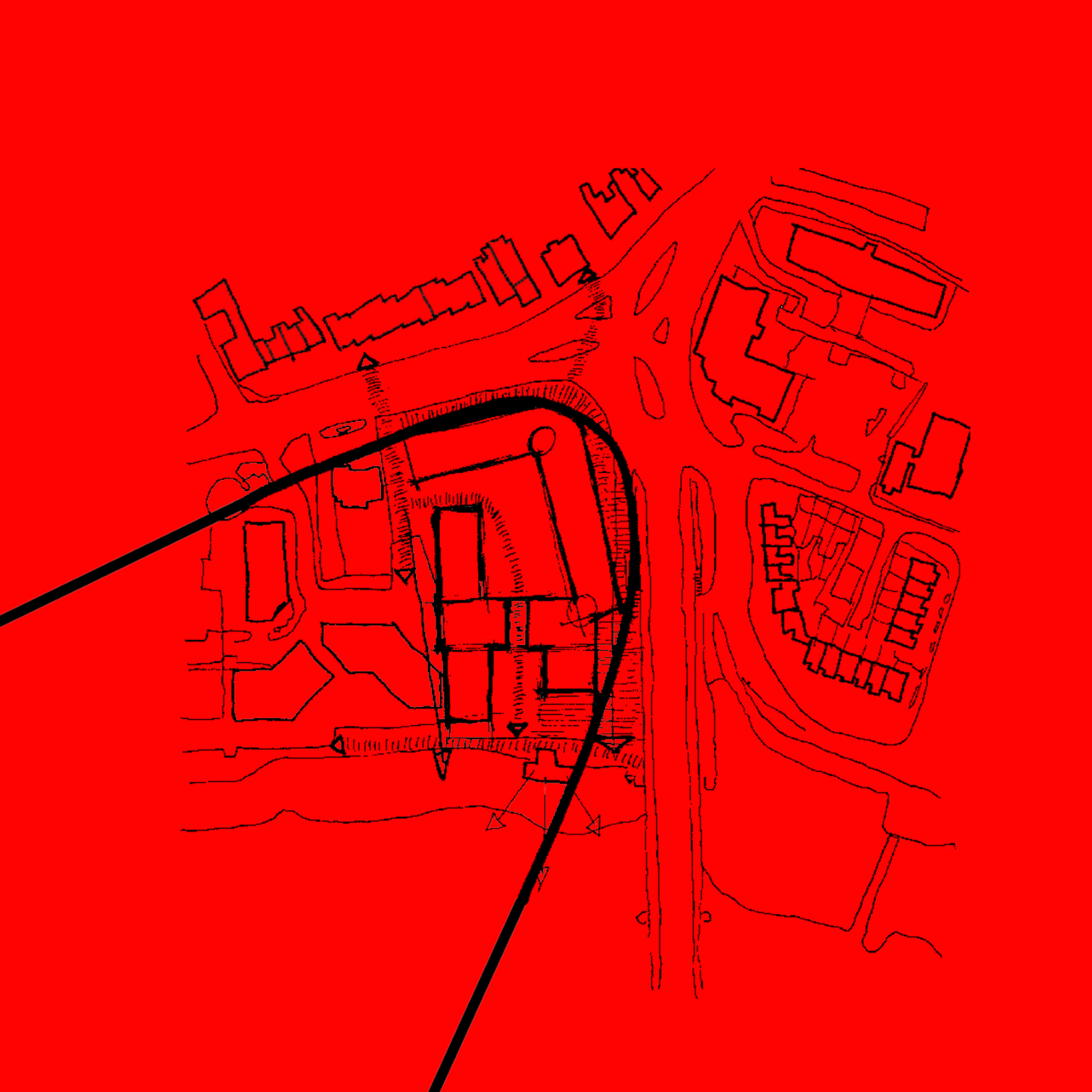


Fig - 4:3:04

5:0 _____ **DESIGN RESPONSE** _____



5:1 BEST PRACTICE URBAN VILLAGE -
KEW BRIDGE LONDON

This brings me to the design response that is the Best Practice Urban Village on the above-mentioned Kew Bridge site in London. The initial design response was based solely on the urban design framework refer to [Best Practice - Urban village - Kew bridge London - brief Document 2003.] The framework calls for specific urban responses, namely:

5:1:1 CHARACTER

The scale and fabric of the adjacent buildings is articulated and varies between 2 and 4 storeys. [Best Practice - Urban village - Kew bridge London - brief Document 2003.]

The response to this requirement was to create articulated façades by combining units in clusters varying in heights of 2-3 storeys and alternating these clusters of solid with voids of equal height making for a less imposing volume.

5:1:2 QUALITY OF THE PUBLIC REALM

Requires improved public access around the site as well as improving existing routes such as the Thames River Walk to the south of the site; and the Kew Road slipway which forms the site access on the eastern boundary of the site. The requirements in terms of the public realm suggest the creation of an area on the southern boundary of the site this area would facilitate the dual pur-

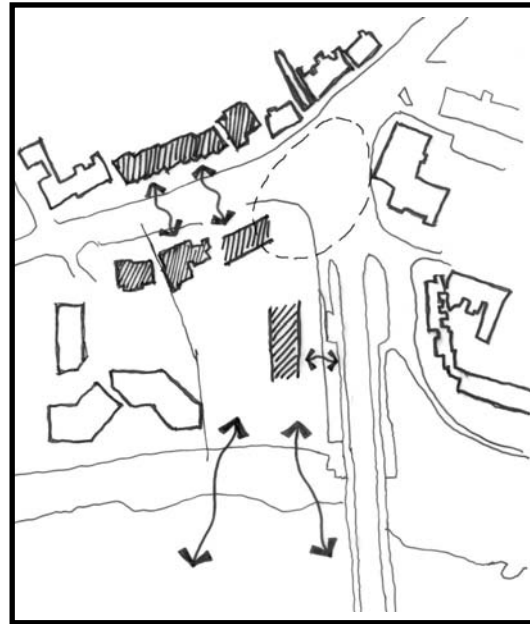


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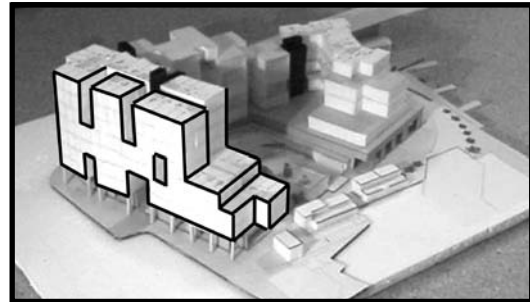


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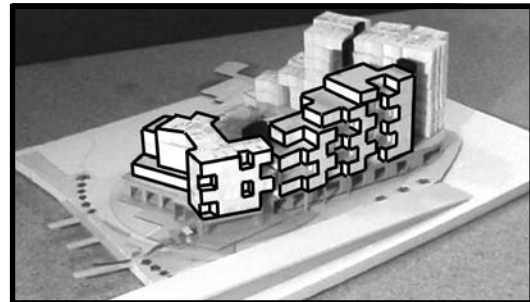


Fig - 5:1:03

poses of improved public interaction with the river as well as having the potential for establishing a boat club. [Best Practice - Urban village - Kew bridge London - brief Document 2003.]

These requirements were met by allowing public access through the site on the eastern boundary, which did not previously exist; this route would be developed for the purpose of making smaller retail opportunities available to entrepreneurs and small businesses, while the main high street Kew Bridge Road and Kew Road will facilitate the larger retail opportunities and anchor tenants. The orientation and bulking of the built form to the south of the site will facilitate the creation of a public open space with new and improved mooring jetties for the boat club.

5:1:3 CONTINUITY AND ENCLOSURE

This requirement calls for clear definition between public and private spaces and specifies that these spaces should be orientated towards the south with careful consideration being placed on the potential for overshadowing by the built form. [Best Practice - Urban village - Kew bridge London - brief Document 2003.]

The response to these criteria led to the creation of two distinct areas: one for the public domain and the other a semi private area designated exclusively for the use of the development's residents. The public area is situated at the south end of the site adjacent to the River

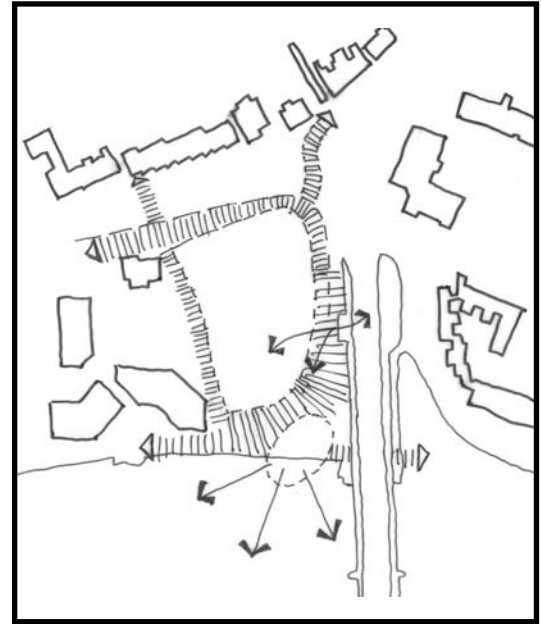


Fig - 5:1:04



Fig - 5:1:05

Thames and has been designed in such a way that it forms multi-platforms from which the general public can take the time to pause and enjoy the river and the activities that will be related to the boat club. In addition this area includes a terraced water feature which is intended to function as a splash pool for children in the hot summer months, as well as a place for remote controlled boating which will form part of the activities of the boating club.

The semi private area is situated within the courtyard in the northern half of the site. Access to this area is strictly controlled via the main entrance lobby adjacent to Kew Bridge Road. This area facilitates the opportunity for the residents to utilise a communal outdoor area for social activities such as barbeques and sun tanning. The area is home to the community crèche which will be made available to residents with small children who require day-care for their little ones; the crèche consists of 4 classrooms and a secure play area which is further segregated from the rest of the semi private social area.

Other activities within this area include a skateboarding half pipe and a one-on-one basketball hoop. These opportunities are intended to provide a safe semi public area for the younger adults or older children in the development to remain active, without having to go onto the streets.

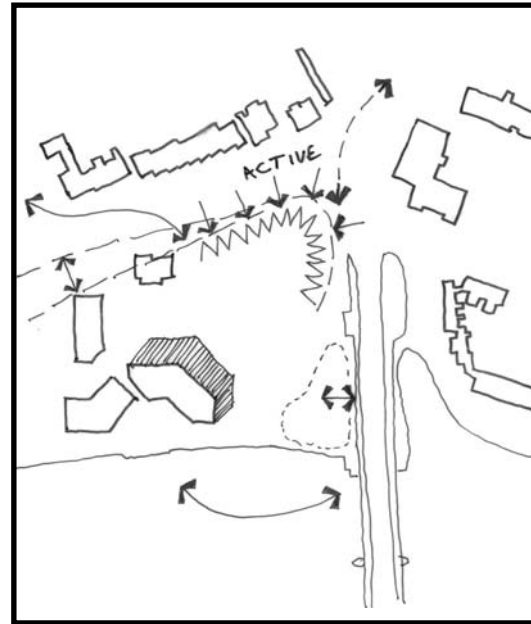


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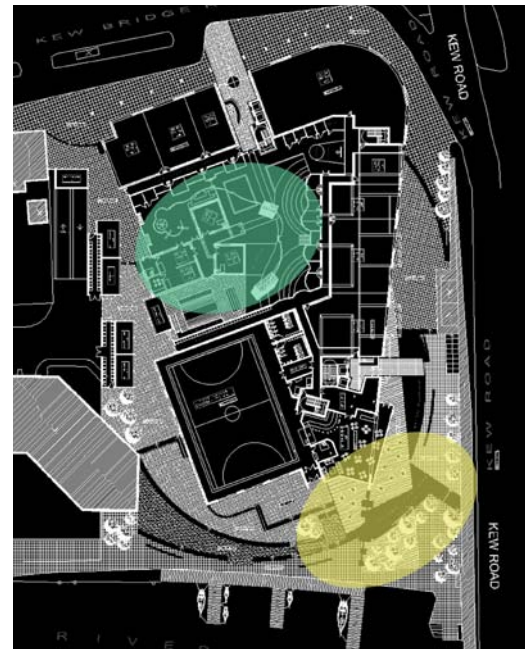


Fig - 5:1:07

5:1:4 DIVERSITY

Requires that the development allow for mixed uses including office space, residential, amenity/recreational use and river related activities. [Best Practice - Urban village - Kew bridge London - brief Document 2003.]

The response to these requirements came from an analysis of the immediate context, which revealed an abundance of unused office space in close proximity to the site. It was therefore decided not to include this utility in the new development and instead to focus on community, residential and retail opportunities in the hope that increasing the population in the area would increase the need for office space, by so doing solving the problems of surplus office space.

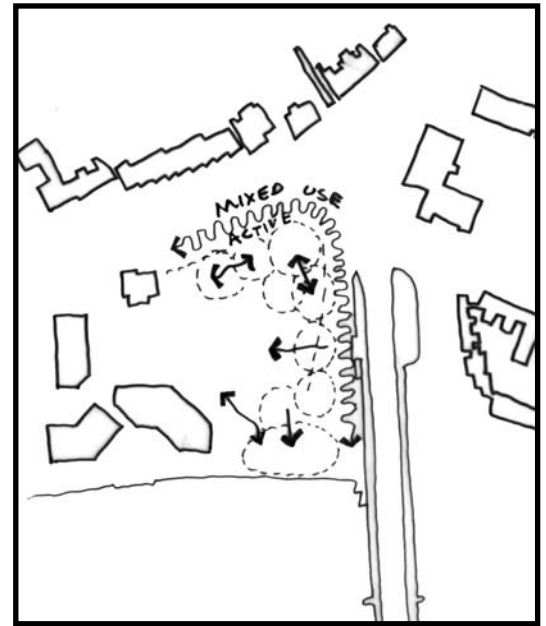


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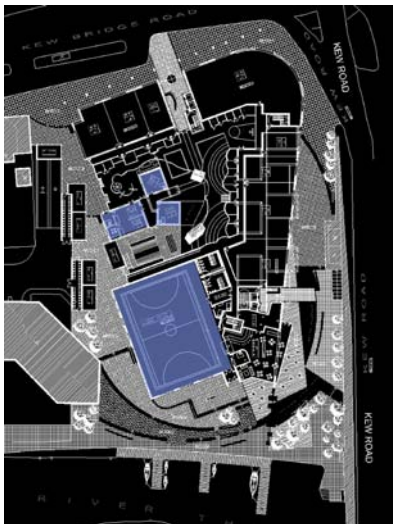


Fig - 5:1:09



Fig - 5:1:10



Fig - 5:1:11

5:2 DESIGN RESOLUTION

The main focus of the design resolution revolves around the residential unit, the way people live, and considers how the built form can utilise the environment and new technologies to help replace non-renewable energy loads with sustainable renewable energy.

Furthermore the main design resolution was placed on the eastern wing (which will now be known as block B) of the development adjacent to Kew Road. This section was chosen for resolution because of the challenges associated with a north south orientation.

The analysis of conventional high-rise typologies such as the BM Kew Bridge housing project reveals that the preferred model is that of a compact densely stacked construction. The reasons for this can be attributed to the compact unit having the greatest efficiency of construction costs, as discussed in the Habitat 67 project, and furthermore the financial advantage of being able to sell the greatest amount of floor space. These reasons are financially driven and do not necessarily make for the creation of quality environments. However the BedZED project has proven that with a like minded team of dedicated professionals it is possible to create quality environments that are both sustainable and financially viable and above all are an attractive option for an emerging market that is increasingly becoming aware of society's impact on the environment.

When evaluating the design requirements of the project in terms of sustainable options the following design decisions were made.

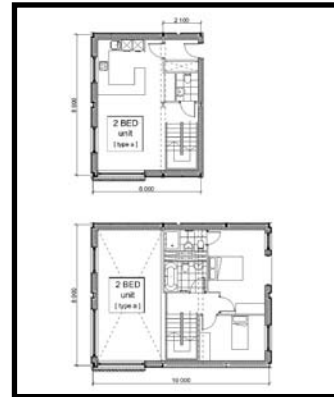


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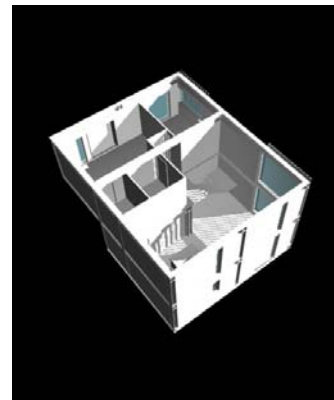


Fig - 5:2:02

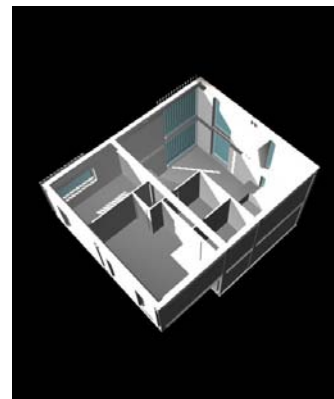


Fig - 5:2:03

5:2:1 LIGHTING

North south orientation means that the desirable north and south light is reduced due to the bulk of the façade facing the less desired east and west orientation. This problem was overcome by generating a fragmented volume, which increases the façade ratios of block B, which is therefore a more costly construction. However this was felt to be an acceptable intervention when weighed up against the advantages of lighting, passive solar heat gains, and the views towards the River Thames.

“The design of the development has where possible orientated units in such a way that the habitable rooms are south facing in order to utilise the best natural lighting opportunities. Where natural lighting lux levels are not achieved in the variations of rooms’ energy efficient fittings are to be used in all circumstances.” [Best Practice - Urban village - Kew bridge London - technical report 2003.]



Fig - 5:2:04

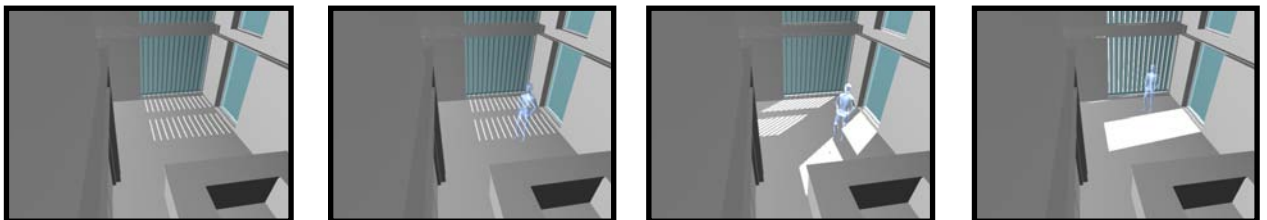


Fig - 5:2:05



Fig - 5:2:06



Fig - 5:2:07



Fig - 5:2:08

5:2:2 ACCESS TO GREEN OUTSIDE

The location of the site is within a 10min walk from one of the United Kingdom's most famous parks, Kew Gardens, providing excellent opportunities for access to large open green spaces for leisure activities such as softball and football. The site however also provides access to outdoor spaces in two ways. The first is private outdoor space, which is available due to the fragmentation of the bulk volume of the building. The second is the semi private courtyard space, which makes provision for the social interaction of the residents.

5:2:3 SOCIAL SPACES

In the pursuit of creating quality environments emphasis has been placed on the users of the building and more specifically on the social aspects of large groups of people living in close proximity. The need for people to engage socially requires more often than not an opportunity to do so, and as such designated social gathering spaces exist in the form of the outdoor spaces as described above and in the form of the community hall where various social and sporting events will take place. In addition to these outdoor spaces further areas have been created in the internal fabric of the building. These spaces are to be used for Internet cafes, vending machine locations, games areas and reading or leisure opportunities.

“On every floor of the residential fabric ‘pause areas’ have been designed for reading and for residents to gather for social interaction and a cup of coffee.” [Best Practice - Urban village - Kew bridge London - technical report 2003.]



Fig - 5:2:09



Fig - 5:2:10



Fig - 5:2:11



Fig - 5:2:12

5:2:4 BUILD-ABILITY

Prefabrication of the main structural elements and modular infill panels will make for a rapid construction time and will ultimately reduce construction costs. In addition these components will have the potential for reusability in future buildings. The construction cost for conventional compact buildings will always be lower as previously established; however the intent of this development is to challenge the conventional and to try and find a balance between the way things are done and the way things could be done.

5:2:5 HEATING AND COOLING SYSTEM

A Combined Heating and Power system such as the model included in the BedZED project will be used for the heating and power requirements of the Urban Village, the difference being that the heat that is recovered during the generation of electricity will be used to heat water for the specific intent of heating the building, via an under floor heating system throughout the development. The system uses an automated wood chip fired system which uses gasification technology; the engine then produces electricity at approx 40% efficiency and recovers heat at a rate of $e=2h$. Clean combustion of the wood is achieved by water and sand filtration. Provision has been made for the delivery of the wood chip via the River Thames with a minimum storage capacity of 7 days on site.

"The CHP plant aims to maximise mixed-use activities on site as well as the incorporation of other neighbouring sites with power and heating requirements; surplus power could be sold at green tariff rates to these sites." [Best Practice - Urban village - Kew bridge London - technical report 2003.]

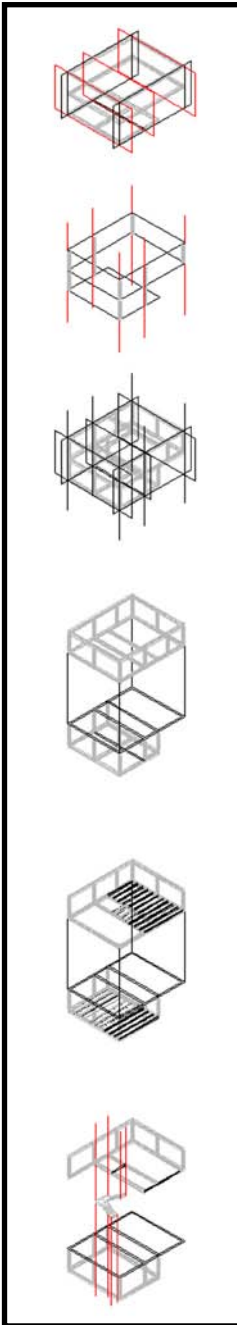


Fig - 5:2:13

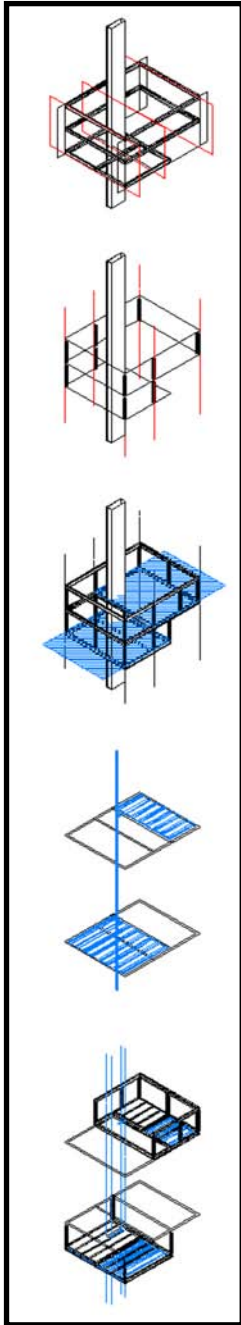


Fig - 5:2:14

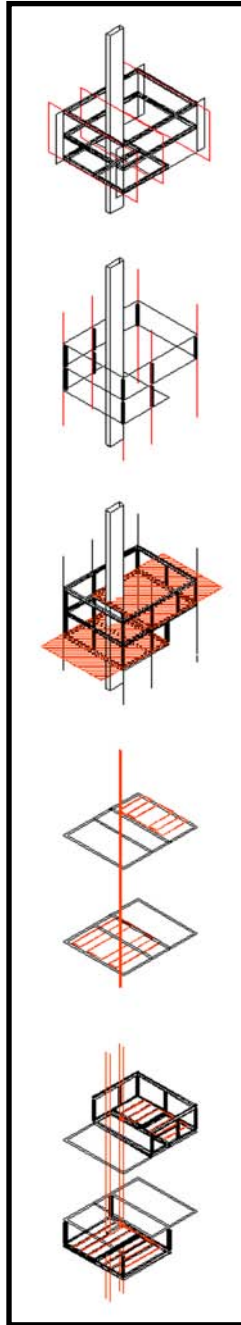


Fig - 5:2:15

6:0 CONCLUSION

The challenge facing architects today is to create buildings and environments that are sustainable and that facilitate a balance between all three aspects of the triple bottom line. The way that buildings use energy and what have come to be the accepted norms in terms of high-rise housing typologies must be evaluated. There is an improved way of creating the places in which we live and with the correct focus and further study the financial implications can be overcome, leaving us with a better world to live in.

