

A Radically Long-Term Sustainable Town

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A Radically Long-Term Sustainable Town

Introduction

To comprehensively meet and optimize all that Radical Sustainable Construction by Kibert and Grosskopf envisions encourages important paradigm shifts.

This Radically Long-Term Sustainable Town concept potentially has it all: evolving ecological designs, strategies, and scale beyond current green building thinking.

Considerations:

- (1.) A 3-D community is more efficient than current 2-D planning.
- (2.) Long-term (1000+ years) reduces town and housing costs 70%.
- (3.) Continual people-use is assured by flexibility to meet changing needs.
- (4.) Long-term-use justifies higher quality investment in research and design.
- (5.) It makes minimum contribution to global warming.
- (6.) This town's arrangement as a building is more efficient, flexible, and grow-able; and of large enough scale for ultimate sustainability.

It is inspired by structures like the Coliseum (Rome, A.D. 70-82) whose arches sheltered homes of 1000 people for hundreds of years. Actually no part of this town is totally new; best old parts of existing towns are just rearranged in new ways. It can be built anywhere. Over 20 or 100 years it can gradually be built by phases into deteriorating energy-inefficient suburbs or downtowns; important historic buildings can remain as focal points. This allows a gradual transition to sustainability.

For comparison, first studies use a square-mile (640 acre) site with the same number of homes typical in suburbia. Not spread across the land, its 3-D subdivisions leave 80% (500+ acres) as open space, which is integrated with comprehensive ecosystems, not an expense; this maintains farmland quality for 1000+ years. Pneumatic systems recycle everything everywhere. Reflected parallel sun or efficient single-source light is computer directed into each home site.

Stair-stepped two-story home-site lofts can be anything, four-plex to light industry. Interior walls and floors change like furniture. Weather exposure is $\frac{1}{4}$ of current typical housing. Solar patio tiles let light into home below backyard.

Indirect features enhance sustainability. Designed primarily for people, their satisfaction and ease of daily use of environmental systems will be the long-term true measure of sustainability. Its compact town arrangement enhances every dimension of life, young or old. Convenience, no car, sweat equity, special financing, and rental income offer other indirect sustainability's.

Home sites have ideal locations. Private backyards overlook open countryside. Each front porch overlooks play area, cluster, and Main Street. Main Street and the extended neighborhood is a functional and visual unit. Greater sense of community is a subtle sustainability factor.

Specialists in every area of this conference will discover ways to integrate their work into this town with the combined potential of achieving ultimate levels of sustainability.

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Brief Overview

Inventors and developers of every imaginable sustainable contribution will have opportunities to integrate their work in its framework.

This paper describes how this overall framework concept opens the potential for higher degrees of sustainability than is possible with any other concept. The advantages of a permanent, compact, three-dimensional subdivision framework designed for home-sites and neighborhoods are detailed. It reviews what is in existing 2D planning that will keep it from being able to solve the long list of challenges future towns face.

This is the second paper of two. There is too much information to cover for one paper. In the first paper the human interface connection is more fully covered. It's titled **A Town Primarily for People that Functions as a Living Organism**. Sections from that paper fully repeated below are noted with a star (*).

Throughout these papers are examples showing how almost all the Radical Sustainable Construction objectives can be satisfied.

Long-Term Comprehensive Sustainability Needs You*

This town's potential for ultimate sustainability depends on everyone's (technical, financial, industrial, etc.) contribution to its evolution. Please indicate interest and expertise through <http://www.sprawlsolutions.com>. The objective is a book with chapters by contributors of each integrated system.

Radical Sustainable Construction +Plus

Continual Use can reduce long-term housing cost by 70%; that's almost too radical a possibility to comprehend. Careful examination will show it is indeed possible and practical. Its savings long into the future will continue to help perfect components to achieve the ultimate in sustainability. However, it can do much more; better livability is another primary reason to build this town.

It looks like a tree-covered hillside (Fig.1), but it's not a hill, it's hollow; inside, every home's front porch overlooks Main Street. Each backyard views the countryside.

This entirely new arrangement for a town and housing does all this: It is "radically different from today's versions and is designed using integrated system approaches that can assist in the implementation of the major approaches suggested here: (continual use), deconstructable buildings, reusable components, recyclable materials, integration with ecosystems, optimized hydrologic cycles, extensive employment of passive design and renewable energy, and full implementation of indoor environmental (and human) quality measures."

Most of the previous statement is quoted from the article Rethinking Sustainable Construction, by C. Kibert. The words in parentheses are factors in this new town concept that additionally contribute to the objectives of radical sustainability. They are key features that make the concept in this paper more effective and more sustainable for the long-term than any other current town or housing concept.

It is designed to avoid adding to global warming and it can function efficiently in any climatic condition. Designed for the long-term means it is flexible enough to meet unforeseen challenges. The overall shape with appropriate refinements can help people cope with conditions of a hurricane, severe economic collapse, global warming or even an ice age.

The Advantages of a Long-Term Town

We build houses like leaves on a tree; they don't last long. A town needs something like a tree trunk, built to last.

This town's framework will be built to last 1000+ years. That frame amounts to 70% of the town or each house. The remaining 30%, what you put inside, is whatever you want as an optional cost.

Continual Use multiplies sustainability. Let this idea soak in: once built, 70% of a house never has to be built again. No recurring waste or recycling expense, all related environmental impacts are avoided for 1000+ years. Assume a 100-year life for a house, 1000 years = 10 houses, 30% = the optional interior cost of 3 houses including the first one. Buy the FIRST HOUSE and get the equivalent another SEVEN HOUSES FREE.

Another way to think of it: it's as if 7 of 10 steps are skipped each time a new house would normally be built.

Some may be surprised or doubt that a structure could be built to last 1000+ years. There are buildings all over the world that old still in use. Many generations of my friend's family have lived in the same structure in Spain for 500 years. Many of you have walked through the Coliseum in Rome. It's been there over 1500 years. Remember those tall arches under the seating? After its original use, people added notches for floor beams up about every eight feet on the sides of the arch columns. They built 3 to 5 floors of housing. Eight hundred to a thousand people lived within those arches, protected by that structure for hundreds of years. Simply the issue of age, the Pantheon in Rome is almost 2000 years old.

We would not use those same materials, but constructing near permanent buildings is not a revolutionary possibility. The first secret of enduring or sustainable structures is protection from the elements. This town's basic framework will be almost totally protected by the housing. The backyard dividers are wrapped. Second, materials have new advantages today. Some new material combinations can be unprotected. They also have increased strength with less weight and size. Special engineered shapes using fabric forming systems I have developed require 25% less than normal cast in place material.

This town's arrangements of spaces and structure offer new opportunities to use new material ideas and every imaginable system for long-term sustainability. Within a structural frame architectural spaces are arranged for houses and required services. This rather simple idea makes possible the paradigm shifts and quantum changes needed for maximum economic and energy efficiency. Designing a town as a large structure creates many new opportunities in every aspect of housing and town development.

Other Long-Term Impacts

The best systems with optimum sustainability will probably be too expensive to be installed in buildings without a sufficiently long economic life. Longer-term planning applied now can justify investment in more efficient and higher quality research, design, and materials.

Those great old ancient stone buildings and plazas we love to visit were planned. Romans and others built them with the best materials available at the time. Did they imagine we would visit them in 2006? Permanent construction, built today, may have value beyond what we can imagine.

Today we can build this new permanent framework town and housing for about the same costs as in a typical current town.

What we typically build today is extremely shortsighted. As such a young country, we don't yet realize that fact. What we build sets a pattern that will affect the surrounding land use for hundreds of years, directly or indirectly. That is only the land use issue. Imagine the burden of future replacement of old housing that's not planned for updating or future utilities.

We can now build normal houses to last longer; but with no better planning than we have today, they will lose value. We are simply making them harder to tear down when it becomes necessary.

No current concept of how we build towns today will allow them to adapt or be comprehensive enough to achieve a fully energy-efficient economy. Policies built around old concepts are limited by those concepts.

We need something like this entirely new vision for a town if we ever hope to develop an ultimate naturally efficient town. This may be the first attempt to invent from scratch a framework with the potential for a zero-energy town that also attempts to meet all the needs of people and nature. For the first time in history we may have the experience and technology to do that.

The challenge is to find the best and newest thinking to take advantage of and become part of this new framework for a town. When the first prototype is built, it is very important that it be without compromises or short cuts. A unique and highly qualified developer will be needed. Investments highest long-term return is possible in permanent-use or continual-use properties.

The comprehensive nature and flexible arrangement of this new town idea will make housing significantly more affordable, available and efficient. It offers a format for overcoming some basic social challenges, but that's another book. Once built and paid for, saving 7 out of 10 steps of building each home will have impacts on every facet of life, not only to materials or physical factors of sustainability. It will take time to visualize and be fully appreciated. It is revolutionary. What it could do for housing and towns is potentially as significant for the homes built as what the printing press was for a book.

Overcome the Two-Dimensional Planning Trap!

A town designed primarily for people is not restricted to grid streets or two-dimensional circulation patterns. Towns with grid streets are based on old outdated transportation systems. Buildings spread across the land are exposed. All the elements of streets, buried utilities and exposed surfaces are wasteful and expensive long-term. They require continual maintenance and often 25 to 50 year replacement.

A grid pattern of streets, multiplying across the land, with potentially fast moving machines that continually keeps that pavement grid clear of people, with only occasional places to cross, results in a less than optimal place for human life. Overtime, more people, more machines, more speed, it becomes less friendly.

Overcoming our 2-D planning and thinking is a necessary first step. After centuries we should know it still amounts to sprawl. Structures on lots are seen from all sides; zoning controls, CC&R's and policies are added to protect property values. They limit the usefulness and flexibility of the property. Spreading out structures and streets across the land unnecessarily wastes space.

Simply building four to six story housing to get more density is only a partial solution; it still becomes sprawl. Many of you have been to the top of the Eiffel Tower in Paris. Remember how the mass of multistory housing extends as far as you can see. As cities grow larger, they still become one continuous mass of structures. Scattered parks offer some relief, but they are an

expense. They are usually too small to be designed as an integral part of a recycling or farmland system. Buildings are too far apart for efficiently adding advanced distribution or collection systems.

Multistory or high-rise housing would seem to be a logical answer for conserving land and being compact enough to save on utilities and new technologies. Still, streets usually separate high-rises. Making changes to meet changing needs inside such homes are very limited. People in high-rise buildings often live in isolation inside their own condo and seldom see anyone in the hallways. It is difficult to provide arrangements that encourage a sense of neighborhood and community. Where personal respect and cultural appreciation have no opportunity to be enhanced, such housing has already been torn down.

This new town arrangement enhances social interaction while ordinary daily activities take less time and are more satisfying. It offers improvement for every activity, many in ways not possible in any previous arrangement.

Advantages of a Three-Dimensional Framework

This new 3-D framework is just like any other subdivision of lots, or home-sites, except it is three-dimensional. It's made primarily for people. It has better views than suburbia by not being spread across the land. It has the compact efficiencies of a high-rise but better neighborhoods.

A three-dimensional framework (Fig. 2) means it is a multistoried structure. It can have people-size horizontal raceways for utilities connecting below every part of the town. Vertical branch raceways and elevators connect to each home-site level. Every other floor (or between Home-Site levels) is continuous utility spaces within the structural frame that can service the floor above and below. This allows all systems to be easily updated with the latest technologies. Being a large enough scale increases opportunity and efficiency.

The compact town structure allows spaces for every imaginable new technology. Pneumatic tubes deliver goods purchased in a local shop or ordered from a large warehouse to be delivered to a home's hot, cold or normal cabinet. The highly advanced computerized pneumatic system can deliver to or from anyone; it's possible to collect and recycle everything. Connected to this are processing facilities, energy generation and systems to automatically maintain farmland quality long-term, 1000+ years. The open clear space over Main Street shops can be used for projecting high intensity parallel light, from the sun or a very large low-cost light source. This light can be reflected into each home by computerized mirrors and fiber optics. It can be for light or heat. The town arrangement itself offers many unique possibilities like this. The two-story living space between structural floors is open and completely flexible. Permanent wall locations are based on the use of the space and the culture. Openings in the dividing walls make larger spaces possible. Certain modular spacing will be found suitable for almost any use.

The final structure may look similar to a honeycomb, but with square-cornered, rather than hexagonal spaces. The home-site spaces are stair-stepped (Fig. 3). The top exposed portion of each stair-stepped home-site is the backyard of the home above.

For solar energy these yards offer a flat patio surface for solar collecting floor tiles. These same tiles are translucent for getting light to the interior of the unit below. The back wall can have a solar effective greenhouse. Planted portions have temperature and water management potential. Along the edge of this backyard deciduous trees provide summer shade and allow the winter sun, reducing energy demand. The finished town will look like a tree-covered hillside.

Similar Costs and Savings*

How can the initial cost be similar to that of a comparable house? The cost of labor and materials in typical suburban subdivisions for streets, curbs, gutters, sewer, water, utilities, sidewalks, driveways, foundations, slabs, sidewalls, fences, floors and roofs will almost pay for building the permanent framework. Add to that not having to pay the maintenance and replacement of all these elements over 1000+ years. Some may last 75 to 100 years, many less than 25 years. Replacement or maintenance over, over and over; over a long future, that's blatantly wasteful. Our current thinking and what we build still fits more with a Kleenex mentality than with long-term thinking.

The convenience and livability of these new Home-Sites will make them sought after in the housing market and as a tourist attraction. Their prices (value) could go up dramatically. If the infrastructure is owned by the town or individuals as stock, everyone could benefit from the increase. There will be more money for everything like new services and technologies without taxes. If Home-Sites are kept in the same family for hundreds of years, there are other valuable results. For them, once various components are paid for, their housing could approach the lowest imaginable cost for all future generations. If all our new housing were of this type it would be easier to survive the demand for materials, energy and labor when our current housing stock needs to be replaced.

Efficiently manufactured high quality housing: The housing industry has tried for over fifty years to make effective manufactured houses, components for floor and wall systems, and modules for kitchens and baths. A standardized framework for a house will make this practical. Such elements could be interchangeable and easily rearranged, almost like furniture. This gives flexibility to the way individuals are able to manage their purchases and improvements. For home-site owners, near complete flexibility contains entirely new sets of potential savings and ways to improve their financial future.

The Site: Open Space, Lakes, Natural Woods and Farms

The first prototype concept, for comparison with suburbia, was designed for a one-mile square site. The town has the same number of homes, a school and related community uses as in a typical square mile of suburbia. But it leaves 80% of the land as open space for recreation and farming. This provides for substantial food production on site in addition to backyard pleasure gardens.

The town's master plan system is composed of many freestanding modules of clusters (Fig. 4) connected as described below. The angles between modules can be adjusted to fit the terrain, similar to flexing vertebrae to achieve the desired curvature. The space between modules also allows for elevation change.

The town is connected and integrated into every part of its surrounding open space. The servicing and recycling systems spread from the town like from a tree with its roots running in all directions.

That open space is required; it is in a permanent land trust (Fig. 5) wherever this town is built. Because of all that it does, it is economically justified: it pays for itself, the views and recreation areas are secondary benefits. This means this town can reintroduce beautiful useful open spaces into old areas of cities with an economic and environmental purpose. It functions as part of complete recycling loops, from food to energy production; all operations combine to generate income rather than expenses. Its by-products can support heating and cooling; they are

combined with systems that maintain high quality soils for the towns long-term farming operation.

Lakes, creeks and ponds are for recreation and are part of the water management plan. Water treatment is handled on site. All runoff is collected from every structure and every site location. The large open space combined with the farming operations insures that every drop of water can be put to use. Multiple levels of reuse are possible.

Natural woods and lakes viewed from the homes are part of the overall systems. Lanes lined with fruit trees blooming on both sides lead to the dairy, orchards and farm patches offering produce and fresh vegetables. This new town with these kinds of amenities can replace deteriorated parts of older cities. Gradually growing from a small start allows it to retain historic buildings and other features. Phasing is practical if there is a 1000-year plan, even if it takes a hundred years. The subtle sustainable advantage of this feature is easily overlooked or underestimated.

Integrated Systems

This town will be a fully integrated part of its surrounding local ecosystems. Its proximity to the open space and long-term plans will allow comprehensive orchestration of every imaginable process. As mentioned, it could be gradually built in an old area of town. To manage all resources efficiently, the basic attitude is don't waste anything. Useful existing structures can remain for their economic life. Having a long-term plan assures no new structures are built that would interfere with the ultimate design. If newer baths or kitchens are needed in otherwise sound old existing structures, modular units are added that could later be installed in the new home-site when it's built. As people gradually move into the new town's infrastructure, the old home property helps pay for the new one. Anything useful or sentimental can be moved into the new home-site, even an entire favorite room or large plants from the old home. Opportunities like this will help old neighborhoods stay intact.

This new town provides perfect conditions to incorporate and update to the most advanced systems available. Standardized home-sites increase the practicality for closed loop material systems. Manufactured units for wall, floor, door or cabinet systems can also be standardized. That offers a new level of practicality, justifying a manufacturers investment.

That will also justify higher quality components that can have savings by simply lasting for decades with minor restoration of finishes. Easy to connect units will offer the biggest savings for people who do their own work. Kids learn by being part of it all. Inserting kitchen, bath or room modules will be possible. Long-lasting components (part of that optional 30%) help reduce waste and recycling to an absolute minimum.

Non-reusable decorator items like finish wall fabrics, drapes or carpets can be efficiently discarded into the pneumatic recycling tube containers for direct delivery to the appropriate destination. Reconstituting materials could be done in the town for maximum efficiency. This compact town arrangement will encourage development of new industries and systems.

Passive design has guided the basic form of this town. While the human purposes guided its overall shape rather than sun orientation, sun-heated fluids can be moved around its short distances from one side to the other. Compactness makes collecting and using all types of water possible. Some could be retained at each yard. Backyard trees are functional, with or without leaves, summer or winter. Backyard solariums or greenhouses can have variable type solar power collection. The overall sloping shape of the town is favorable for the wind. An end of the town could be designed as a multistory wind scoop. Gently moving large volumes of air through

and out wind devices above the street could generate power. This would also cool the town's interior. To retain heat in cold climates, Main Street can be covered. Moveable structural fabric roof sections can allow light in, their outside sprinkled for cooling, and its infrared nighttime transparency can increase the cooling effect.

The flexibility offered by the town framework, the neighborhoods and Main Street makes livability sustainable for the occupants. People will gradually but continually make improvements. Over time people will make the town's interior environment their own work of art, especially the part of Main Street running through each of their extended neighborhoods. The street will present the extended neighborhoods' character to the rest of the town. These could become some of the world's greatest streets.

This town would make a good neighbor anywhere. Perhaps it would be most appreciated in western states where there are not many trees. Scattered over the countryside a mile or more apart, these towns would appear as a series of green tree-covered hillsides.

Main Street*

Boring streets have no porches. You rarely see people on porches in current town concepts, even the best traditional towns. You can find miles of streets in almost any city that are boring. They are a waste of material, maintenance, and space.

This proposed town's Main Street links each extended neighborhood together like a string of beads. It has no cars. The space between overlooking clusters can be wide enough to surround a historic focal point or become a grand plaza (Fig.14). It can have fountains, street theatre, waterways, or boats.

Main Street and the town are one; it is the way to everything. The street is the town's stage. It can have everything, -sidewalk cafes, plazas, artwork, drama and all the pedestrian traffic. It's great for shop owners. It's the only street. It will be continuously full of activity. The homes relate to this Main Street as a focal point of interest for each individual resident at every age. The porch, extended neighborhood and street are a functional and visual unit. The street is the extended neighborhood's living room, like an extension of every home. Day or night, there will always be something of interest going on and people watching it from porches. This is about people casually getting to know each other by normal daily interaction. This is also about sustainable security. Features like these help build a sense of community and caring. No other town concept can match these features.

Shops can be built the same as on typical streets, up to 3 floors. They are efficiently serviced from below.

Transportation Systems

Everything is within a short walk, in the town. For out of town distances, what is the most efficient transit system we can have now? Current towns are too spread out; no existing system can be efficient or consistently attract enough riders to be self-supporting. To attract 100% of individuals want to go somewhere a transit system needs to be convenient, fast and have direct to destination service. It would be an interesting analysis if the idea below were modeled on a computer.

In this town, the walk from every home is almost as close as if the transit-stop serviced the bottom of a large high-rise. Simply give the computer your time and destination; it arranges for a transit lounge seat. The short walk is fun; pick up coffee and greet friends. You take your

seat, depart, read in comfort, arrive, and step out at your office door. When you want to return, tell the computer.

Computers arrange what size vehicle in what order will go to what general area. Vehicle sizes range from 4 to 15 passengers. Computers select and combine the people with the most efficient routes. Depending on return plans the vehicle could stay near the travel destination if it's at a far distance. The biggest savings will be when

traveling with more people. An individual has a savings if traveling with at least two other passengers. You can travel with more people simply by enlarging the general destination area designated. There can be many variables. Regularly scheduled travels will be the most efficient. A group can save if a passenger drives. The vehicle expense will be spread out if it is used many times per day.

Direct to your door service is practical because all travel starts and ends at the same convenient place. If everyone is traveling there will be many passengers. Many more people can share rides. Every vehicle can be full and efficient for its size. The transit company may own, lease or manage the vehicles. The total number of vehicles on streets will be less than with everyone driving their own cars. This reduces community cost in roads or a costly transit system. In time, if other towns like this one get together, a major fixed transit system may be practical.

In a compact city large items need transportation. Up to container-size items are delivered by truck below the shop level. At certain points large items are lifted and lowered into backyards by mobile cranes mounted on the town's roof. This is how people would move construction materials and furniture. Kitchen and bath modules or even an entire modular home could be delivered and slipped into a home site. This framework could be built in hurricane areas (New Orleans, etc.) with main street above high water levels; existing mobile homes could be slipped into the home sites and change or added to later.

The Home-Site, New Opportunities*

We have the opportunity to combine the best features of urban and suburban life. People move to the suburbs to be close to nature and open spaces. Those dreams can be satisfied and even enhanced beyond normal expectations simply by the new architectural arrangements in this town.

Rather than a typical suburban backyard with neighbors overlooking your back fence, we will make a completely private backyard that you can build with any design (Fig.7), plus it has a view over hundreds of acres of open space (Fig.8).

Rather than windows opening onto narrow side-yards, we will provide additional privacy with a solid soundproof wall on both sides.

Rather than a seldom-used front yard on a less than exciting typical street, we can provide a front porch that overlooks your cluster of homes, your cluster's play area and your extended neighborhood.

Rather than a pre-built home we will provide a Home-Site where you can build whatever you want. You can build a house with one room or ten; it can be a duplex or a four-plex. Cars are on a lower level. Therefore, within certain limits, the number of people living in your Home-Site will not have any negative effect on your neighbors.

Rather than a long walk or driving, everything is within a short walk: shopping, schools and services. In fact every front porch overlooks the section of Main Street that passes through your extended neighborhood. It continues through every part of town.

Rather than subdividing new land we can bring better housing, open space and farming to existing large deteriorated in-town areas and preserve historic buildings as focal points.

How is all this possible? The following diagrams and descriptions show the architectural arrangements that give this Home-Site its advantages. It is a two-story loft (Fig.9), wide and deep enough for a large typical house and a yard. Dimensions can vary based on local desires. This diagram shows a front porch, the sidewalls and the backyard. Only the front can be seen, so only it needs design guidelines. Typical health, safety and welfare requirements will apply. Otherwise, the space inside the walls is completely private; you can build and change whatever and whenever you want. Affordability is made practical for any budget.

Yes, it is a box. But compare a typical suburban lot. It is also a box. Height limits and setbacks define it. Suburban lots can be seen, so zoning laws control what is built to protect neighbors' values. This imposes sameness on buildings and occupants. Freedoms are very limited on typical suburban lots. (For more details, see other paper.)

This New Kind of Density Will Actually Be More Desirable

The need for naturally occurring human interactions in our daily lives is starting to be appreciated. Growing up and old in the same neighborhood can enhance every stage of life. Our current urban and suburban arrangements aren't designed to maximize this.

The privacy and flexibility of the individual Home-Site is basic to this concept. The surrounding town does not interfere with activities within each Home-Site, and vice versa. Being in the backyard is private; it's like being on your own hillside in the country. It has a great view and no other neighbors in sight. What could be better? If you want community activity, just step onto your front porch, wave to your friends to join you. Homes are arranged to maximize the opportunities of interactions during daily life.

Each Home-Site is stepped back in plan (Fig.10) to give maximum view from the front porch and backyard. This is the basic architectural arrangement of spaces to form a Cluster. Each porch has a view of the Cluster's play area. They are in voice distance. The play area is the cluster's activity center; everyone passes through it on the way to everything. Walkways extend past porches to connect each home (Fig.11) to it. Every porch overlooks Main Street (Fig.12) and other porches in the extended neighborhood. All are in waving distance. Dimensions may vary while the general spatial arrangements still achieve desired objectives.

To form a Double Cluster, a second cluster, with a flipped plan is placed opposite with the walkway side facing the first cluster's walkway side. The distance between is for Main Street. These facing clusters (Fig. 3) are stair-stacked, six are shown stacked in the drawing. (For more details, see other paper.)

This overall unique copyrighted 3-D arrangement of the architectural spaces and its variations offers advantages beyond any other housing and town concepts.

In Conclusion*

This concept represents an entire rethinking of the construction of a town and its housing systems. It's not finished. This has been a huge undertaking, much more than can be presented in two papers. These concluding paragraphs apply to both papers. There is a book: A Town Primarily For People, it has more information. Below is a brief restatement of the basics: the problem and the solution.

The Problem, Restated*

Problem: Design a town-size device to comprehensively solve all the interface problems between places for humans to live and the natural world, and between that device and the humans living in it.

The Solution, Restated*

Solution: Build a town-size device as compact as possible to make all connections, movements and operations as short and as efficient as possible. Allow space and raceways to accommodate function and change for every imaginable connecting and servicing system to every required location. The production and processing of all products and by-products will have interior spaces and will use an appropriately sized surrounding area of open space to maximize and optimize interaction with natural systems and processes necessary for a comprehensive interface. The interface is designed to function for 1000+ years with no residual or unused by-products; that interface will use and enhance the function, longevity and health of all systems.

Since, of all the systems involved, the human life function is the most variable, that interface is provided with complete flexibility within desired size and function parameters. The smallest fixed module, the home-site, can accommodate up to four minimum sized living units. The module height is for two levels, the fixed width and useable length is based on local custom. The home-site modules are double stacked in clusters of 12 to 20 modules arranged along one side of shared connecting spaces. A large central space, the play area, varies in size up to a surface area of 3 modules. A similar cluster with a flipped plan is placed opposite with connecting spaces facing. The distance between facing clusters creates a larger shared space, main street, open at each end.

This two-cluster grouping has other similar groupings stacked on top of it. The distance between clusters in the upper groups is reduced slightly to offer shelter for the lowest level of this partially enclosed space. Any desired number of these stacked cluster groupings can be connected at the open ends; over time many of these become a town.

Within this framework occupants build, change and refine whatever and whenever they desire with the least amount of arbitrary limitations on any future idea needed to perfect their existence and their interface with nature.

Closing Comments*

This concept offers the potential to accommodate any and all objectives, interest and systems for Radically Sustainable Construction. It is more than just an idea; it offers a real-world solution that can be built today with initial house cost similar to comparable typical houses in suburbia. It can satisfy the objectives of the comprehensively concerned environmentalist and real estate developer.

Its 3-Dimensional subdivision framework allows new relationships and functions to comprehensively address challenges in ways never possible before.

Once initially built, 70% of what we currently expect as recurring and replacement housing costs disappear for 1000+ years or more, including the related environmental impacts.

It has the potential to employ and optimize new solutions for all sustainability objectives. The framework's raceways make it possible to update every type of system and interface. This combined with the compactness inside this town as well as the surrounding open space and long time frames justifies the highest quality systems. Eventually, for every interface, systems will be invented that are as efficient as nature. At some point this will become a town, fully integrated with nature, that functions as a living organism.

Your critique is welcomed. With your help this idea will be refined and continue to evolve. This is an original copyrighted 3-D arrangement of architectural spaces potentially able to comprehensively meet all our challenges. It will require an equally new and comprehensively concerned entity to build the first prototype.

Acknowledgements*

This is almost part of the paper, because from home construction, planning, landscaping, to the overall framework, each started with a separate root and then became one in this comprehensive town concept.

More people than can be mentioned here have my highest gratitude. Everyone and everything I have encountered has influenced my thinking, understanding and appreciation of the interface between people, economics, and nature with what we build. Some individuals, those listed below, had more direct influence than others.

Eduardo Catalano convinced me of the logic of a permanent structural frame with changeable interiors in the mid 60's. I greatly appreciated that encounter and the support from MIT. While there, my research and structural investigation was critiqued and advised by Waclaw Zalewski, Paul Weidlinger, and Horatio Caminos. I am grateful for the additional funds offered by Dean, Petro Belluschi, and Eduardo Catalano for a technical fabrication assistant from Natick Laboratories. I also appreciated being inspired from working under Georgy Kepes in visual design, working briefly in Harold Edgerton's lab, and descriptions by Kevin Lynch on landscape design and people.

My interest in fabric was inspired by Frei Otto, our brief moments together in California and visiting his work and university studio in Germany. Working knowledge of fabric came from David Gieger (structural fabric pioneer), technicians at Natick Laboratories, and Walter Bird of Bird Air. Later, I gained more experience doing fabric projects with computer software systems and Roy Hall at Bird Air. And, Horst Berger (structural fabric pioneer) was the structural engineer on my major permanent fabric project.

My interest in the concept of a "Community Space Frame" was inspired by Kenneth R. Schneider. He wrote the text and I did some sketches to express his thoughts in a booklet published by UC Berkeley in the early 70's. There was no actual design, just the vision of an idea. That began my search to put those ideas into a functional, buildable set of architectural arrangements. Later I found a book and met Richard Register, a friend of Ken's, who encourage many of the same thoughts.

Gratitude for the practical side goes to my carpenter father and the fact that we had to build our homes. Also thanks for a willingness to explore together new and better ways to build goes to several builders and clients.

My sincere gratitude goes to Emmett Wemple for turning me on to the excitement of architectural and landscape design while at USC. Inspiration for high quality design also came from Conrad Buff III, Calvin C. Straub, and Maynard Lyndon. Years later, another USC connection, Sam Hurst, encouraged my opportunity at MIT. The importance of planning and concerns about what was happening in places like Los Angeles began with study under Simon Eisner and Arthur Gallion. The first roots of the need for a better way to design towns began then.

This is what becomes obvious from my 50 years of reflections above: if we hope to have future success in this finally popular issue of sustainability, it all begins with education.

Radically Long-Term Sustainable Town

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