

URBAN DESIGN & SUSTAINABILITY

City Gates: Enterprise Zones Using Metabolic Planning

November 1988

Presented To:

MIT Center For Real Estate Studies
Cambridge, Massachusetts

Presented By:

Pliny Fisk III
Director of Research
Center for Maximum Potential Building Systems, Inc.
8604 F.M. 969
Austin, TX 78724

The concept of the city has certainly changed since the era of city gates. In the old days, a city's gates instilled a sense of protection. The gates were a control mechanism designed to admit only those thought to be friendly. Yet, if we look more closely at those city gates, we realize that in many ways they served as a selection gate, admitting only those who supplied the city with essential life support needs of food, water, building materials, information and, conversely, ridding the city of unwanted people, wastes, diseases, and other unsavory things. In many ways the old city gates were a critical juncture between urban and rural that differentiated as well as combined roles in a kind of selective partnership.

Unfortunately in contemporary planning and design, if city gates are recognized at all they are limited to a symbolic image manifested as arches to signify that everything and anything is welcome as long as it promotes the immediate economic survival of those within. Instead of the important functions that a city's gates once served, we no longer have selection criteria nor bridging criteria. The economic vitality of the city is more and more at the mercy of those whose interests are not so much what becomes of the city as whether it serves a frenzied global economy.

Today we need city gates to be even more than those of the castles and hamlets of bygone eras. If our modern day cities are to survive, we need to start again being selective as to what enters and leaves them. What are these new city gates and how can we again build them into the importance they once held?

I believe a new type of city gate must emerge that reinitiates a symbiotic relationship between man and nature--that builds not only a clean rural environment but, just as important, a healthy urban and regional economy. The recent interest in healthy businesses can be viewed, in essence, as the bare beginnings of the links that convert a region's raw materials into useful products. "City Gates" could be thought of today as complex metabolic units that have inputs, conversion processes, and outputs which in many ways mimic processes of healthy natural systems, especially when they are continually linked in chains so that the input required by one process is actually derived as the output (waste?) of another. In this way, as was the case in the past, the gates of the future become the selectors which fit the city into its region, and which affirm the future of the world as primarily dependent on the health of its cities. And, as in the past, our city gates of the future not only prepare raw resources to fulfill human requirements, but also prepare the by-products from our own metabolic processes for use in the natural world.

In order to understand better the many levels on which this new approach to community and regional economics works and how we could place the designer/developer as one of many actors in a key role we offer some explicit examples.

The first example is a materials related scenario which, from a different viewpoint, is a metabolic incubator based on housing need as its local triggering mechanism to rally the necessary financing. This housing incubator capitalizes on huge quantities of a region's natural and waste materials to supply low energy and climatically relevant building shells. As one will find there are many other important city gate components to this housing incubator park that turn housing and its various support systems once again back into a regionally relevant activity.

The second example is a farm that uses as its trigger the economic plight of 175 Texas farmers who lose their farms each week. This example relates to a slightly different global condition-- CO2 build-up which, along with ultra-violet radiation, will significantly impact farming. Let us first review and gain some global perspective on some key material issues.

Sulphur dioxide (SO₂) poses one of the most serious environmental health hazards to modern society, and results primarily from burning high sulphur coal and other hydrocarbons, thereby producing acid rain. It is widely known that sulphur can be collected out the precipitator stack of a coal plant. So far such procedures have been justified almost exclusively on environmental rationale, rather than on the basis of metabolic unit economics (except by the Japanese). It happens that sulphur is not only a useful chemical in many industrial processes but also is proven to be quite useful in a number of applications in the building industry. When used with gypsum, for example, sulphur becomes almost totally fireproof. Structurally, sulphur concrete is able to achieve a compressive strength of over 5000 psi, and an adhesive strength of about 30,000 psi. Additionally, sulphur can be sprayed for structural surface concrete applications or shells, foamed to form a reasonable insulation, and used as a natural pesticide to retard home insect infestation. In many areas of the world, sulphur is less expensive than concrete; it is also the 14th most available element in the world.

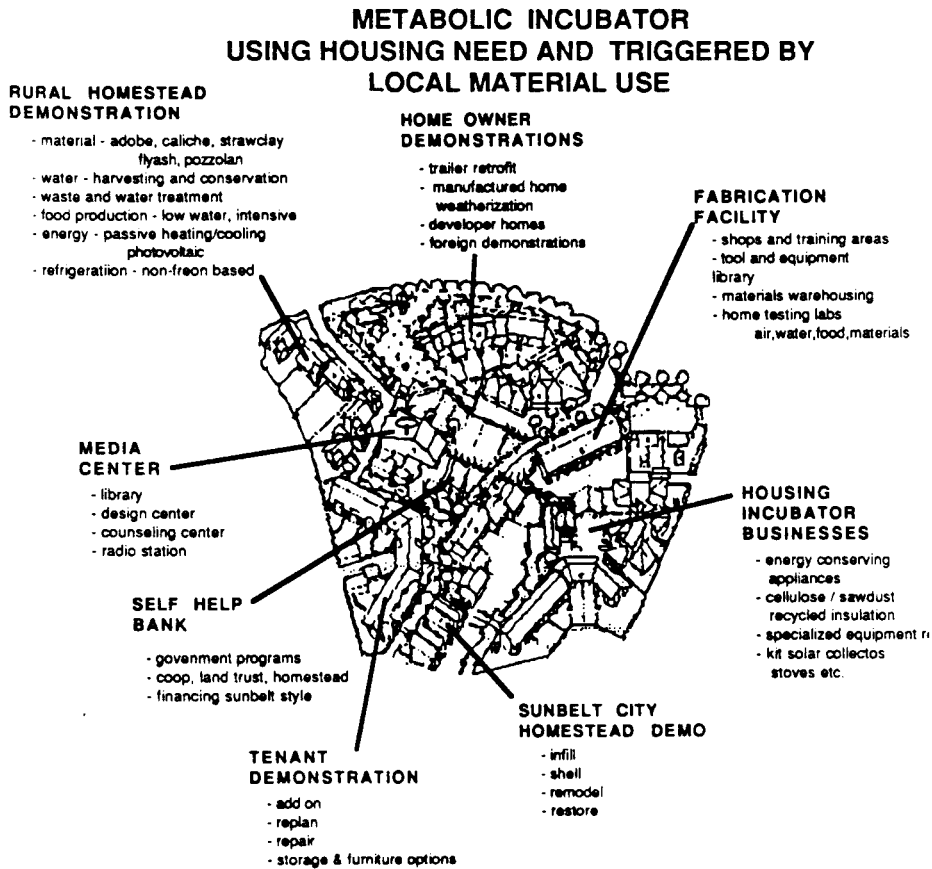
A sister material also derived from coal fired power plants is fly ash. Fly ash derived from a high calcium coal or, when mixed with the lime slag after it has been used in the sulphur precipitating process, produces a concrete with compression strengths tested to exceed 12,000 psi. Both sulphur and fly ash require a fraction of the energy needed to produce portland cement. Not only have we successfully used both sulphur and fly ash for building, but we are presently developing a method to foam fly ash using organic, renewable foams to produce a lightweight porous concrete. We are particularly interested in applying this technique for use as a porous paving to increase groundwater replenishment, the lack of which presents a serious condition in many parts of the U.S..

The housing-based incubator, diagrammed below, combines indigenous material applications in a business park atmosphere. This means that nearly every element in the park that is materially based is derived either from the development of an area resource or the interlinking of existing metabolic units to better circulate materials and therefore financial resources within the community. Alternative cements such as flyash, pozzolan, calcrete, organic based cements, enzymatic stabilizers, as well as many earthen based and organic waste-based building systems with technical and economic efficiencies behind each technique are displayed. Straw clay, straw bale and straw panel construction serve as a gate to the farming sector; poured adobe using the efficiency of pumping earth into form boards as though it were concrete, poured caliche, pressed block that spill from the machine at a rate of 840 per hour, a machine that goes behind a pick-up truck and costs \$18,000 to get into business each provide point of entry, or gate, into other sectors.

Construction cost savings achieved by using local materials, as we all know, are less than extraordinary since these overall costs have much to do with land prices, financing, etc. However, what is

often forgotten is the fact that how we build our houses has a lot to do with how money is spent in our communities. Tracking the impact of materials as we had been so prone to do in formulating our arguments to promote the use of renewables can be equally or more impressive as to the extent that this sector has in the job multiplier category. Once one tracks the entire house support system, i.e. utilities such as water and waste water, food production, transportation, etc. one would find many instances in which immediate cost savings might not be too great in sustainable community planning, unless one were to illustrate how all the money flows could ultimately return to the mother community. Such a housing incubator attempt among the many other incubator types that are triggered by a need combined with highly available community and regional resources needs to be highly visible, highly accessible, and well supported politically and otherwise by the community.

In addition, our housing-based metabolic incubator addresses crucial contemporary social needs: affordable housing, the homeless, innovative finance mechanisms for addressing these issues, combinations of self help, "I'll help you if you help me"-- in short, mechanisms that open up the many options within the housing sector that are usually confined to a small minority in rural areas and only at an informal level. We are creating an excuse to demonstrate how self help zones within the urban environment can happen in a way quite different from the urban homesteading model, which was predicated on an abundance of old housing stock not characteristic of the newer sunbelt cities. Our housing incubator is an information center, a training center, an entrepreneurial center for opportunity to those wise enough to want to understand and put into action businesses that are viable economic opportunities while helping the region cope with its own problems using its own resources. It introduces new transportation forms such as The Center for Alternative Transportation's bike and ride depot. Any paved areas are done with recently developed, continuously surfaced permeable paving-- in some cases debuting their use in this region so desperate for alternative water catchment methods. The landscape is a live demonstration of the same-- native plants --but also new backyard farming methods that need nothing but a roof cistern and deep composted soil to sustain itself through a climate considered impossible to exist without heavy dependence on pumped water.



As we progress through each level of integration, we understand more detailed attributes at the levels of community and regional economics. We find that there are compatible scales of use, from the individual unit to the inputs and outputs of entire regions. For example, the solid waste under which some cities are drowning could be fed back to where it came from-- the farm. The farm, of course, desperately needs a replenishment of organic matter, with some farms losing an acre of topsoil each minute and a half. Liquid waste becomes an equally precious asset, supplying the nitrogen so essential to balance the carbon-to-nitrogen ratio within the organic solid waste. In this instance we have a different type of metabolic unit developing-- it could be waste triggered or triggered by farming in combination with an innovative agricultural commissioner such as we have in the State of Texas. Whatever the case, the important issue is can it be done?

The Laredo Demonstration Farm in Texas, for which we are designer, engineer, and site supervisor, is a case in point. This "Blueprint Farm" demonstrates the many critical links between the farm and the city that must take place if either is going to survive and live a healthy existence. The farm is constructed as a multi-use three dimensional field in which a forest's canopy layers are replicated using variegated shade materials whose strobe effect and color stimulates plant growth 20 to 30% beyond normal yields. With its filtering capacity of ultraviolet light, it is in itself a model for future urban openspace environments. Furthermore, with buildings within the farm complex covered by a continuous shade system, one can imagine whole modern towns and cities with built-in shade components as were characteristic of many the ancient desert cities.

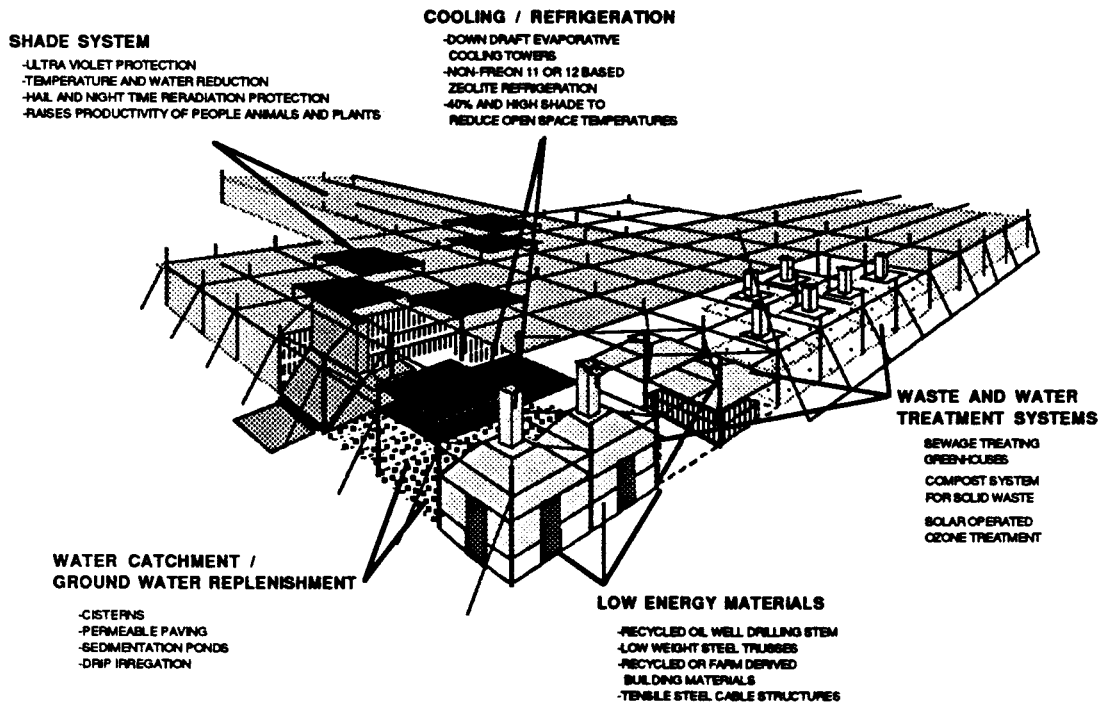
But there are other examples which alter one's view as to how the city is built by how the farm is built. Using straw building on the farm so that the farmer can lower the initial expense for purchased building materials is borrowed from old European practices, where entire cities were actually built with agricultural materials. A similar straw process used to stuff the classic German half timber frame cities of the past finds a new vernacular on the farm where all buildings are plastered straw bales made with a maintstay farm implement -- the straw baler cum straw brick machine.

The flows between city and farm are among the most crucial linkages upon which sustainability rests. These functional "bridges" become the city/region of the future. Liquid waste is treated as an asset to feed water treatment greenhouses that, in turn, produce flowers and animal feed. This treatment process is then connected to the fields where the water is joined with the built-in composting unit which transforms the cities' garbage to valuable mulch and water-retaining medium for the nutrient rich liquid waste. So what is usually considered a farm is now a waste treatment plant and a water supplier.

But one other metabolic example in our city gates scenario holds particular importance today-- the use of non-freon based refrigeration. In place of freon, known now to contribute to the depletion of the earth's ozone layer, we utilize an absorption process based on a mineral called zeolite that can use a refrigerant as simple as water. Similarly, the insulation around our refrigerator is organically-based to demonstrate that non-plastic CFC produced styrofoams can work as well as the CFC-based materials.

My fascination is not with any one of these technologies, but rather with their synergistic potential to develop an ecologically-based regional economy, and with reversing a mindset that focuses on the negative aspects of economic and environmental problems instead of on their potentials. Our metabolic unit scenario to create a new kind of city gate can be accomplished through very real means even from the analytical standpoint. Input/output analysis is not uncommon in economics, neither is the identification of gaps between these inputs and outputs.

METABOLIC INCUBATOR USING FARM NEEDS AND WASTE AND WATER TREATMENT AS TRIGGERS



At one level, one often finds the existing inputs and outputs among and between regional enterprises unorganized, providing an opportunity for better integration. At another level, we find certain obvious gaps that can be filled by introducing another industry or business to better connect the inputs and outputs of local businesses. This linking process relies on what we refer to as **gap industries** or **gap businesses**. And, at yet another level, we at times discover an absence of knowledge related to a high potential industrial/commercial enterprise that could exist due to demand and the existence of an available natural resource that has not been tapped. Due to the high multiplier effect resulting from the use of such a resource, potentially producing many secondary and tertiary business potentials within the region, we refer to this effort as the development of **trigger industries**.

According to The World Watch Institute, "At the current growth rate of 2.5% yearly - a half again as fast as world population - the number of people living in cities throughout the world will double in the next 28 years." It is clear that if we dare to tackle the issue of sustainability which we must - we must admit to working in the urban environment. It seems that one of the most exciting prospects for the type of developments needed in the private and public sectors could lie in the concept of a new generation of industrial / commercial centers at our urban fringe that we, in our shop, like to refer to as **City Gates**.