Reinvention Through Reuse:
Strategies for the Adaptive Reuse of Large-Scale Buildings

by

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B.A., Architecture, Columbia University, 2001
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ABSTRACT

The practice of adaptive reuse has grown in popularity in the United States over the past few decades, with now about 90% of architect-commissioned work involving some interaction with an existing structure. While the practice of reuse has existed informally in the form of garage-as-guest house or barn-as-garage conversions and so on, it is only since the late 1960s that architects and engineers have begun to approach it critically, as a design problem. It is often lauded for fostering the development of a sustainable built environment, however, it has its unique challenges. This thesis traces a brief history of the designer's role in the sustainable development discourse, with focused attention paid to the adaptive reuse solution. Furthermore, it attempts to identify the challenges and discuss how they each pertain to the architect, the preservationist, and the engineer. Through the examination of reuse case studies, a coarse classification of project typologies.

The second portion of the thesis tackles a specific reuse problem in the Old Post Office in Chicago, Illinois. The Post Office was selected because of its heavily planned context, its historical and cultural significance, the real interest that has been expressed in its reuse, and its size. The thesis builds on the earlier classification system to propose an integrated strategy with which to approach the redevelopment of the building.

The final part of the thesis briefly describes a few environmental evaluation methods that might be used to judge the sustainability of the reuse project. The proposed solution is analysed to see if the design decisions made with environmental sustainability in mind can be quantified.

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Thanks

To my family, without whom none of this could have ever been possible. My parents for the constant love and support. My brother for his words of encouragement. Thank you.

To my advisors, who helped me muddle through a challenging project and most of all, kept me calm. Thank you.

To my friends, both near and far, whose comforting words and actions pulled me through many a desperate moment. Thank you.

And finally, to Todd. You know how important you've been. Thank you.

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The History of Designing for a Sustainable Built Environment

The last four decades of environmentalist, conservationist, and socio-economic discourse have resulted in the development of what Tomas Maldonado identified in 1970 as a "critical ecological conscience."[1] According to Maldonado, the successful implementation of this conscience lies in the hands of the designer – political, industrial, architectural or otherwise. As creators of the physical world we live in, architects, engineers, and planners have especially critical roles. Unthinking moves in the design process can lead to environmental degradation through such things as energy use or toxic leaching, economic strain due to operation, repair and maintenance costs, and social inequity through choice of location, organization and accessibility. In addition, since buildings are normally designed for 50- to 75-year life spans, often standing for years beyond that (fig.1), many of these damages, once in place, continue to exist for generations. This fact has not escaped policymakers and designers, as demonstrated in the growing global interest in ecologically conscious and integrated design.

Over the past twenty years, the term *sustainable development* has become increasingly popular in a variety of disciplines. International policy, spearheaded by the United Nations, has led the discourse, influencing the business, manufacturing, and design disciplines and spurring such concepts as the 'triple bottom line', 'lean thinking', and 'green design,' all of which propose that the environment should be on equal footing as costs and profits. First coined by the Brundtland Commission in 1987, "sustainable development" was originally defined as:

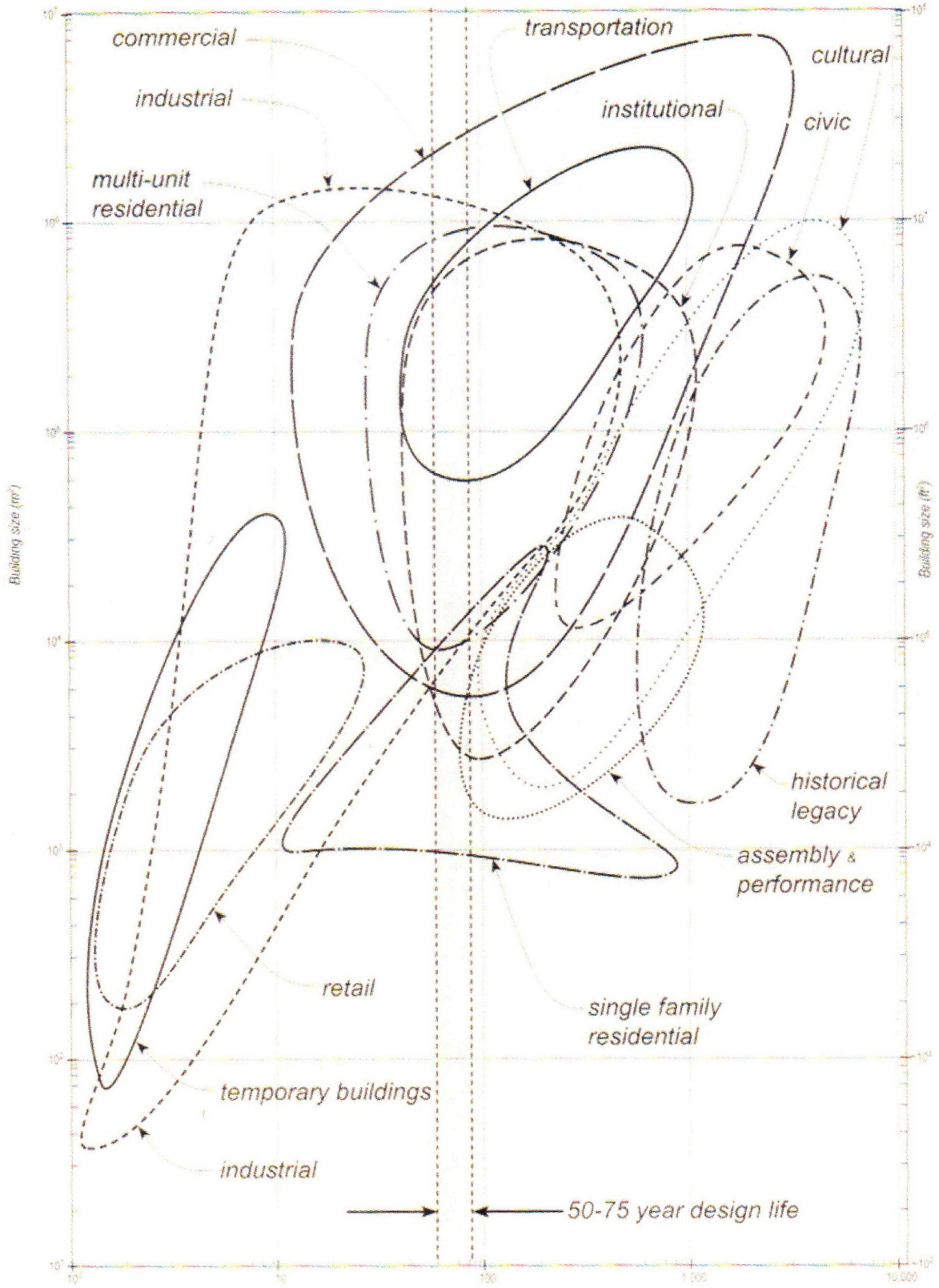


fig.1
Chart showing the typical design life of buildings against the typical duration of their occupancies by type.

> Development that meets the needs of the present without compromising the ability of future generations to meet their own needs...It contains within it two key concepts: the concept of *'needs'*, in particular the essential needs of the world's poor, to which overriding priority should be given, and the idea of *limitations* imposed by the state of technology and social organization on the environment's ability to meet present and future needs.[2] (emphasis added)

This definition was initially influential because it was both explicit and vague enough to serve the often opposing agendas of economists and environmentalists, developed nations and developing nations. However, the following fifteen years proved that the same flexibility in definition that attracted various parties to take on the charge of sustainable development, was also responsible for the inconsistent strategies of implementation and the consequent uncomfortable compromises that came out of the UN Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992. Developed countries, championing the concept of *limitation*, expected to see tighter global environmental regulation and protection measures, while developing countries focused on their right to grow economically, thereby contributing to sustainable development by meeting the *needs* of the poor. Despite these differences, one of the important achievements of the conference was the drafting of Agenda 21, a would-be technical manual outlining strategies for all countries to use in achieving the universal ideal proposed by the Brundtland Commission. While Agenda 21 has continued to guide countries in their efforts toward sustainable development, the ambiguous language of the document once again, "[acknowledged] both sets of goals, without attempting to resolve the contradictions between them."[3] These contradictory interpretations of the term 'sustainable development' ultimately led to the almost complete failure of the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002.

It is difficult, and perhaps ultimately unsatisfying to speculate on how the political world might continue to dance around the ideal of sustainable development in the near future. Many of the individual policy decisions that are made depend on highly specific and often unpredictable circumstances such as the party politics and financial alliances of those in a position to call the shots. It is more tempting to investigate the roots of this now ubiquitous concept and trace its development over time, especially as it relates

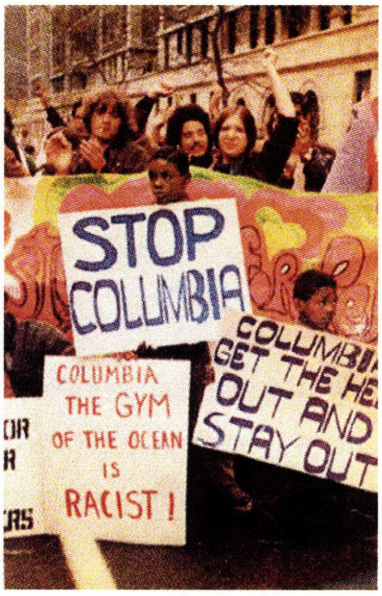


fig.2
Columbia student protests, 1968.

to the design disciplines. Such an investigation may reveal a larger pattern of thought that transcends minor fluctuations in environmental philosophy and brings into focus significant paradigm shifts instead.

The 1960s: Seeds of a new philosophy

Sustainable development shares some of its most fundamental tenets with the sub- and counter-cultures of the 1960s. Early environmental activists called for the protection of nature. Protesting students demanded social responsibility on both local and global scales.[4] Women's rights groups fought for economic equity. It was a heated decade, leading up to 1968, the explosive year which saw increasingly violent protests (fig.2) around the globe (in the United States, France, Mexico, Japan, etc.) and revealed the shared environmental, social and economic concerns of the era. As the seeds of sustainable development were being planted in society and politics, the realization that the human environment was but a portion of the larger environment was beginning to affect architects' and planners' approaches toward building and consumption.

Before the 1960s, the environment was seen as something to manage or control for the comfort of human use. The ecology to which Reyner Banham refers in *Los Angeles: The Architecture of Four Ecologies*[5] is the "totality or pattern of relations between organisms and their environment,"[6] where the organisms are exclusively human beings, and their environment is the anthropocentrically modified one. Over the course of the decade,

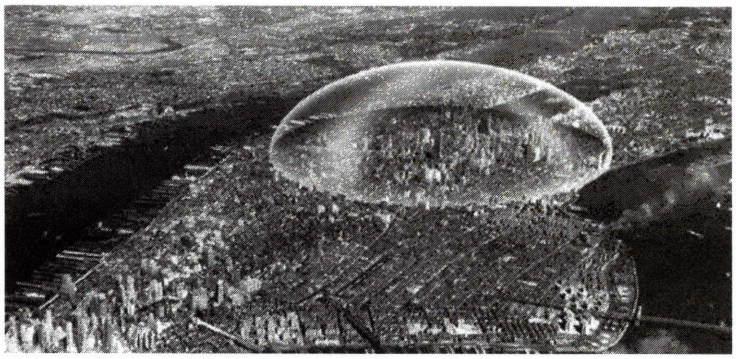


fig.3
Buckminster Fuller's plan for a dome over Manhattan.

one notes a discernable shift from 'man as subject,' to 'man as a participant' in a larger set of interrelated global systems. By the end of the decade, books such as *Design for the Real World: Human Ecology and Social Change,* by Victor Papanek and *Design, Nature and Revolution: Toward a Critical Ecology,* by Tomas Maldonado proposed that "in this age of mass production...design has become the most powerful tool with which man shapes his tools and environments (and by extension, society and himself),"[7] and that "it is important to see that physical systems do not exist merely *in* an environment; they exist *by means* of an environment," [8] respectively.

Still, some inconsistencies remained. For example, in 1965, Buckminster Fuller, considered by many ecologically-minded designers to be the grandfather of environmental design in the United States and Europe, theorized the construction of a massive dome over a portion of Manhattan (fig.3). The dome, while intended to improve the city's environmental performance by stabilizing energy flows across the dome membrane,[9] was undeniably anthropocentric and insensitive toward the balances of naturally occurring processes. In addition, one can easily imagine that if such a dome were constructed, the membrane would undoubtedly significantly alter not only the natural environment, but also the social and economic environments of the city. Despite this hiccup, one of Fuller's stronger notions of the world as a set of open and interdependent systems stuck in the environmental conscience, leading many designers to begin considering their work in light of the complex ecology surrounding them. One result of this kind of holistic thinking is Stewart Brand's *The Whole Earth Catalog,* an almanac with a little bit of almost everything, from knitting, to calculators, to anthropology.

The 1970s: Environmental politics

By the end of the 1960s, the environmental cause had gained so much popular

fig.4
President Nixon at the swear-in of the EPA's first administrator, William Ruckelshaus on Dec. 4, 1970.

momentum that on October 20, 1969, in his New York Times editorial titled, *Man – The Most Endangered Species,* Robert Bendiner expressed his belief that, "call it conservation, the environment, ecological balance, or what you will, it is a cause more permanent, more far-reaching, than any issue of the era--Vietnam and Black Power included."[10] Apparently, the U.S. government concurred and on January 1, 1970, President Richard M. Nixon enacted the National Environmental Policy Act (NEPA), a first move intended to establish a national policy for the environment.[11] In July of the same year, he presented Congress with a plan to reorganize and consolidate into one new agency – the Environmental Protection Agency (EPA) – the scattered portions of the government that had previously dealt with health and the environment (fig.4). He explained the need for such consolidation thus:

> As concern with the condition of our physical environment has intensified, it has become increasingly clear that we need to know more about the total environment--land, water, and air...The Government's environmentally-related activities have grown up piecemeal over the years. The time has come to organize them rationally and systematically.[12]

Clearly a watershed year for the U.S. government's attitude toward the environment, 1970 set the tone for the following decade of politicized environmentalism and conservation. It was a decade of increased political involvement and lobbying by local and global conservationist groups such as the Sierra Club[13] and the WWF (originally, the World

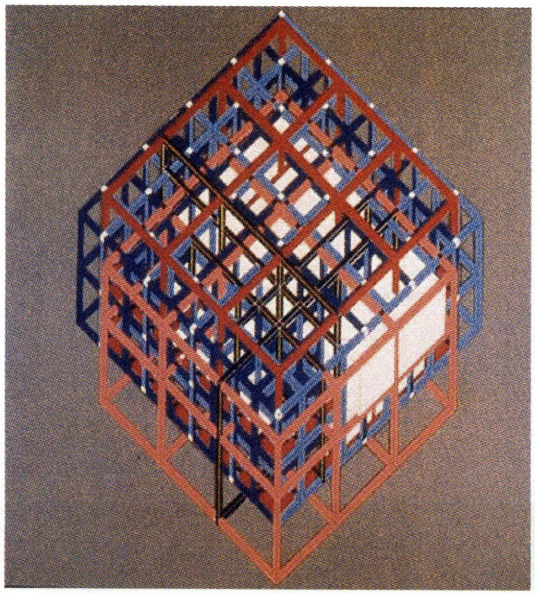


fig.5
Eisenman, House VI, 1976.

Wildlife Fund, now the World Wide Fund for Nature due to its expanded activities and goals). Most of the policies enacted during this first decade of the EPA's existence were concerned with setting environmental standards and restrictions on pollution in the hopes of stalling, if not completely stopping man's degradation of the environment.

It is evident that the train of thought pervading environmental policy was similar to that of designers who perceived the world as a "total environment," a collection of interrelated systems. What it most interesting is that this register of environmental complexity did not unequivocally lead all designers to produce works that were sensitive to the health of the natural environment or that were socially or economically aware. While early 'sustainable' architecture did exist (typically concerning itself with thermally efficient siting, passive interior conditioning methods, local or salvaged materials, and solar energy generation), this was not the architecture that dominated architectural design discourse of the 1970s and early 1980s. Instead, Reinhold Martin notes, at precisely this moment of history, when politics seemed to threaten the autonomy of designers through the imposition of standards, some architects withdrew "into a protectionist, disciplinary autonomy."[14] This autonomy was achieved through an abstraction of the environment. Martin cites Peter Eisenman's declaration that:

> Most environments, whether they be linguistic, biological, social or physical have a structure. That is, they have a series of elements which have both definable properties and definable relationships between these elements.

fig.6
Photo spread from Venturi Scott Brown's *Learning From Las Vegas.*

> The structure of a linguistic environment, or more explicitly a language can be said to exhibit similar characteristics to a physical environment – and in this case to an architecture.

This abstraction allowed Eisenman to pursue architecture and design *in vacuo*, shifting his conception of space from being a response to the limitations of physical necessity to being a product of semantic intention (fig.5). Along the same lines, Venturi and Scott Brown lauded the 'landscape' of Las Vegas (fig.6), a city described by Maldonado as "among the most brutal, degrading, and corrupt that consumer society has ever created."[15] Thus, while the dominant architectural discourse shared its vocabulary with the champions of ecologically sensitive design, it transposed the subject from the physical environment to the conceptual or intangible one.

The 1980s: Reparations

In 1980, the EPA began the task of repairing past destructive behavior with the implementation of the Comprehensive Environmental Response Compensation and Liability Act (commonly known as Superfund). The policies of the prior decade had concentrated on developing preemptive measures to protect the environment, and while by 1980 the degradation of the environment had by no means been arrested, the EPA shifted its focus toward the cleaning and rehabilitating of previously contaminated lands. This process began by identifying abandoned or underutilized industrial sites,

then testing them for contaminants and partially funding any clean-up efforts that were necessary. The EPA's main impetus for implementing Superfund was the growing outrage concerning irresponsible toxic waste disposal practices and their damaging effects on public health.[16] Many of the nearly 500,000 "brownfield" sites that were identified were located in relatively developed areas, and in many cases, once they were cleaned up and safety tested, were considered optimal sites for redevelopment.

Also in 1980 Kenneth Frampton published his influential book, *Modern Architecture: A Critical History,* in which he noted:

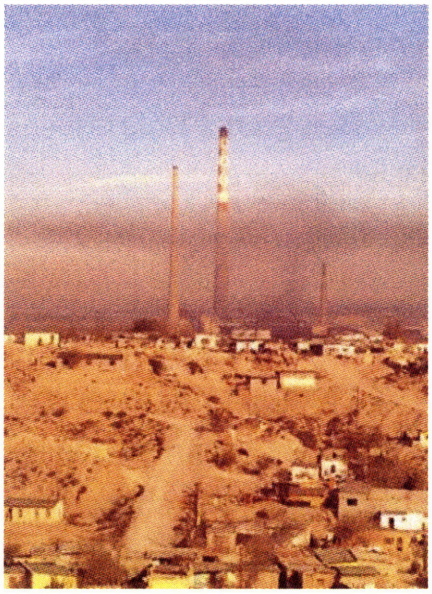
> From a human, economic and ecological standpoint, there is perhaps no area of human activity that is more in need of a new relationship with nature than our current mode of haphazard suburban development; the random wasteful subdivision, the strip, the shopping mall and the untold acres of relatively open landscape lost each year to urban sprawl.[17]

It has been proposed that the antidote to urban and suburban sprawl is Smart Growth, or "economic growth that consciously seeks to avoid wastefulness and damage to the environment and communities."[18] The Superfund initiative provided the design community with vacant lots, located within already existing networks of roads, electric lines, pipelines and sewers. These urban sites were highly attractive to architects interested in mitigating the effects of sprawl through their work, and they provided interesting sets of existing conditions to contend with and respond to in their design proposals. By the end of the decade, this serendipitous overlap in theory and practice helped slightly narrow the gap between projects driven by environmental philosophy and those insulated by architectural theory. In addition to reusing existing infrastructure, brownfield developments often revitalized depressed portions of cities, bringing economic and social benefits as well.

The 1990s: An era of integration

By the late-1980s, the questions of economic and social equity became increasingly relevant to the environmental movement. While the U.N. responded with the establishment of the World Commission on Environment and Development, in July of 1990, EPA Administrator William Reilly responded by forming an EPA Environmental

fig.7
Uncontrolled pollution from one of the many maquiladoras that have been build in Mexico since the enactment of NAFTA.



Equity Workgroup "directed to assess the evidence that racial minority and low-income communities bear a higher environmental risk burden than the general population, and consider what the EPA might do about any identified disparities."[19] Reilly also wrote in a 1993 Statement on the North American Free Trade Agreement, that "NAFTA will help improve the quality of the environment throughout North America. This is the most environmentally sensitive, the 'greenest' free trade agreement *ever negotiated anywhere*. Because it integrates economic and environmental concerns to an unprecedented degree, it marks a watershed in the history of environmental protection."[20] There are numerous reasons to disagree with his assessment (fig.7); however, it is clear that environmental policy was no longer seen as divorced from the social and economic policy. Similar trends in thought, calling for the integration of environmental concerns into social and economic policy occurred in Europe[21] and Asia as well.

These changes in policy and ideology set the stage for increased interdisciplinary efforts focused on material and energy efficiency in the building design and manufacturing industries. Seminal texts supporting this new philosophy of design were *Factor 4 - Doubling Wealth, Halving Resource Use; Natural Capitalism: Creating the Next Industrial Revolution;* and *Lean Thinking: Banish Waste and Create Wealth.*[22] All three books encourage increased resource productivity and reduced waste based on the belief that conventional industry is mistaken in seeing priorities in economic, environmental, and social policy as competing, and that it is often not a balance, but an integration of these

three goals that offers the best solutions.

The Designer's Role

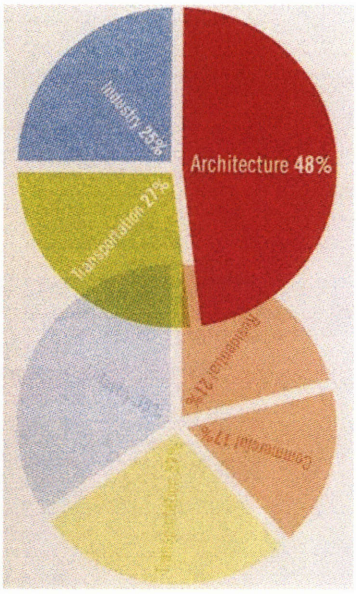
Given this model of resource productivity and disciplinary integration, architects, who are by some accounts responsible for just under half of America's energy consumption and half its greenhouse gas emissions (fig.8) should feel some sort of responsibility for the reduction of global consumption levels and the promotion of social and economic well-being through their work[23]. A handful of designers have begun espousing new working and assessment methods toward this end. For example, architect William McDonough collaborated with chemist Michael Braungart in writing *Cradle to Cradle,* a book calling for the transformation of human industry through ecologically intelligent design.

Yet it is not just the feeling of responsibility, but also the knowledge that the design skills of architects and planners are particularly tuned toward collaboration and integration that have prompted designers to take on the challenge of practicing sustainability as defined by the Brundtland Commission. One of the case studies presented in *Natural Capitalism* is that of Curitiba, Brazil, a city with "better levels of education, health, human welfare, public safety, democratic participation, political integrity, environmental protection, and community spirit that its neighbors, and some would say than most cities in the United States."[24] This success is attributed to the farsighted and pragmatic leadership of architect and urban planner Jamie Lerner, who was elected mayor of Curitiba in 1971, and treated the city and his political leadership as a design problem. Reliance on wide public participation ensured that solutions to development obstacles received overwhelming support from the public and ultimately benefited them socially, economically, and environmentally.

However, as Maldonado had pointed out in 1970,

> The discussion of nondesign is an intellectual luxury of consumer society, a perogative of well-to-do peoples, the rhetorical pomp of peoples saturated with goods and services. Peoples submerged in indigence and need cannot permit themselves that luxury. For them the will to survive is identical with the will to design, because for them, designing means supplying themselves with the basic weapons against the repressive hostility of indigence. For them

fig.8
Pie chart showing architects' impact on energy consumption, as redefined by Edward Mazria in the October 2003 edition of Metropolis.



> designing means conceiving of structures that will allow them on the one hand to maximize the scant resources available, and on the other to minimize the factors that could contribute to the waste of those resources.[25]

The implementation of innovative design solutions in Curitiba was to some degree, a matter of necessity. Increasingly, there is a scientific consensus that global environmental conditions are overstressed, and that consumption-rich countries such as the United States, must commit to address resource use and waste generation with thoughtful design. Ultimately, in any market-based business or society, it is demand that drives change, and this is no less the case in the traditionally conservative building industry. Renewed interest in "green" design has influenced clients to demand ecologically responsible design, so much so that "green" clauses have begun to be written into architectural contracts.[26] Many architects fear that environmental policies might limit their design possibilities; however, projects like Norman Foster's Commerzbank Tower in Frankfurt, Germany (fig.9) and Behnisch & Behnisch's Genzyme Center in Cambridge, Massachusetts demonstrate that this need not be the case. Rather, in these two cases, the restrictions were catalysts for innovation, and have led to the creation of office buildings that are truly enjoyed by their occupants and stand as examples of 'best practice' in architecture.

Furthermore, a number of prominent architects have taken on rehabilitation and

fig.9
Commerzbank headquarters in Frankfurt, Germany.

redevelopment projects, nurturing a growing discourse about the relationship between old and new architecture, and the challenges and opportunities it presents beyond mere preservationism.

> A nation deep in denial loves the imitation, pastiche, and sameness of look-alike architecture. Additions made with the brain engaged, however, build on the truth that what matters is not looks but meaning. What matters is what the new and the old in their differing expressions say together about their evolving subject matter, the way the new and the old are brought to collaborate across their difference to make vivid what needs to be realized today.

Some of the earliest examples of large-scale post-industrial reuse can be found in the Ruhr Valley of Germany. Crippled by the energy crisis of the 1960s and 1970s and pressured by increasing concerns for the environment, many of the coal mines that had been the major source of employment and income in the area were closed down. In the decades since their closing, a number of the buildings that used to house energy related activities have been redeveloped for cultural purposes. This has led to the diversification of the economic base of the area, and has resulted in a much more stable and increasingly urban environment. These changes were necessary for the region to survive, but it is notable that the fundamental character and historic fabric of the area was not compromised to achieve economic, social, and environmental sustainability.

Reuse projects have become interesting in their environmental, social, ethical, and

consequently design implications because of a renewed regard for the existing context and the traces of the past that they can reveal. As reuse projects can vary in size (from a single-family home to a large factory complex), in materiality (from brick to steel), and in physical context (from rural to urban), the designers' attitudes toward reuse must be reconceived on a per-project basis.

(Endnotes)

[1] Maldonado, T. *Design, Nature and Revolution: Toward a Critical Ecology.* Harper and Row Publishers: New York. 1972 pg.77. Maldonado explains that the kernel of a critical ecological conscience is what remains after the "fashion of ecology" fades. Maldonado believes that at the time that he is writing, this consciousness is yet immature. "For the moment, it is still an inconsistent conscience, without roots, easily eradicable. But we can imagine that once the fashion passes, it will be possible to take up once again the efforts that will lead to an essentially critical ecological conscience – critical toward the scandal of society."

[2] Purvis, M. and Grainger, A. *Exploring Sustainable Development: Geographical Perspectives* Earthscan Publications, Ltd.: London. pg.6. The Brundtland Report is often shortened to include only the first sentence and taken out of context to serve the purposes of its user; however, it is important to note that the goals of the Commission were originally (and remain so in the political world) environmental, economic and social in nature, and that only through interpretation do those goals translate into tangible design and planning goals.

[3] Purvis, M. and Grainger, A. *Exploring Sustainable Development: Geographical Perspectives* Earthscan Publications, Ltd.: London. pg.7

[4] One of the first student protests occurred at Columbia University in late April, 1968. From the Columbia Strike Committee's publication, *Why We Strike*, "A single theme dominates the Columbia strikers' six demands: the struggle for self-determination. We demand that construction of the gym cease so that the community, not the Columbia Administration, can decide what is done with their land. We demand that Columbia sever all ties with the Institute for Defense Analyses, which developes [sic] counterinsurgency projects for both foreign and domestic use, so that Columbia's resources are not used to develop the techniques that prevent oppressed people at home and abroad from gaining control over their own lives." (for a first hand account of events, see http://www.columbia.edu/acis/history/1968.html)

[5] Banhan, R. *Los Angeles: The Architecture of Four Ecologies.* The Penguin Press: London. 1971. pg. 109. It is hard to comprehend, given present environmental ideology, the casual way in which Banham refers to the destruction of a native ecology through mountain cropping for the sake of expansion. "Such large-scale triflings with the none-too-stable structure of an area of high earthquake risk seems more portentous as a direct physical risk to life and limb than as a lost ecological amenity. Naturally one regrets the disappearance of Southern California's attractively half-tamed wildernesses, but short of a social revolution or major economic disaster they were going to get built on anyhow. The worry is that these extensive human settlements have been constructed on sands that have been shifted once by an outside agency, and may decide to shift for themselves at any time."

[6] Merriam-Webster's Collegiate Dictionary, 10th edition. Definition of ecology

[7] Papanek, V. *Design for the Real World: Human Ecology and Social Change.* Van Nostrand Reinhold Company Inc.: New York. 1971

[8] Maldonado, T. *Design, Nature and Revolution: Toward a Critical Ecology.* Harper and Row Publishers: New York. 1972 pg.117

[9] Fuller, B. *The Case for a Domed City*. 1965

[10] Taken from: Lewis, J. "The Birth of EPA" *EPA Journal.* November 1985.

[11] In his article "Environment, c.1973" *Grey Room* vol. 14, Winter 2004, Reinhold Martin echoes historian Leo Marx's suspicion that Nixon's motivation for enacting NEPA was largely "an attempt to distract attention from the war in Viet Nam and to neutralize the increasingly frustrated civil rights and antiwar movements with the palliative of environmental activism converted into government policy." (pg.81) Even if this is, in fact, the case, there is no doubt that the introduction of a national environmental policy gave non-governmental interest groups a forum within which

to address their concerns with the government and lobby against policies that went against their environmental ethos.

[12] Reorganization Plan No. 3 of 1970, July 9, 1970 *Public Papers of the Presidents: Richard Nixon, 1970*, on pages 578 through 586 (taken from EPA website)

[13] The Sierra Club has existed since 1892, but a quick look at the Club's history reveals that until the 1970s, its main focus tended to be national park procurement and protection. In 1971, the Sierra Club founded its Legal Defense Fund, and from then on, has been an active lobbying group, fighting for the ban of DDT, defending the Clean Air Act in opposition to the auto-industry, and in general, spreading its scope of interest beyond simple conservation. In 1976, the Sierra Club formed SCCOPE (Committee on Political Education), a political action committee, thus beginning its involvement in election campaigns.

[14] Martin, R. "Environment, c.1973" *Grey Room* vol. 14, Winter 2004, pg.79

[15] Maldonado, T. *Design, Nature and Revolution: Toward a Critical Ecology.* Harper and Row Publishers: New York. 1972. pg.60

[16] The Love Canal, NY toxic dump scandal and the public disgust and outrage that it elicited was largely responsible for President Carter's decision to push forward the enactment of Superfund. This neighborhood was built I the late 1950s, over a massive toxic waste dump that had been in operation until 1953. In 1978, after record rainfalls, residents began noticing puddles of noxious substances that had leached and bubbled up into their yards and basements. People complained of illness, and there was a shocking increase in birth defects. Eventually, the U.S. government evacuated and relocated the entire neighborhood, tore down the uninhabitable houses, and fenced the area off and labeled it a hazardous site.

[17] Frampton, K. *Modern Architecture: A Critical History.* Third Edition. Thames and Hudson Ltd.: London. 1992. pg. 342

[18] Kiefer, M. "Suburbia and its Discontents: Notes from the Sprawl Debate," *Harvard Design Magazine.* No. 19, Fall 2003/Winter 2004

[19] Environmental Equity: Reducing Risks for All Communities. EPA Office of Policy, Planning and Evaluation. June 1992

[20] Riley, W. *Statement on the North American Free Trade Agreement.* Aug. 1992. The environmental benefits of the agreement were as follows: "First, NAFTA safeguards existing U.S. health, safety, and environmental standards by allowing any party to deny entry to products that do not meet its national standards. Moreover, NAFTA protects states rights. It allows regional subdivisions in NAFTA countries--like our states--to enact standards tougher than national standards. NAFTA also includes a voluntary process to make environmental standards more compatible among parties, but that process will *not* lead to lower U.S. standards. In fact, NAFTA includes explicit language encouraging parties to "harmonize upward," to work toward compatible standards that are *more* protective, not *less*." This is not terribly convincing, as all environmental standards would have to be voluntarily imposed by the businesses involved in trade, and unless they had reason to believe that they would benefit financially through (or despite) these impositions, it is unlikely that they would insist upon them.

[21] "The 1995 Environmental Programme for Europe recommended that participants should *integrate* environmental considerations into all decision-making processes, taking into account environmental costs, benefits and risks, applying the precautionary and 'polluter pays' principles, and promoting partnerships between government, parliaments, businesses and nongovernmental organizations." (my emphasis) Taken from "Europe's Environment: The Third Assessment," Environmental Assessment Report no.10, European Environment Agency, May 2003 pg.272

[22] von Weizsaecker, E. *Factor 4 - Doubling Wealth, Halving Resource Use.* Earthscan Publications, Ltd.: London, 1997; Hawken, P. Natural Capitalism: Creating the Next Industrial Revolution.

Little, Brown and Company: Boston, 1999; Womack, J. *The Machine That Changed the World: The Story of Lean Production.* New York: Rawson and Associates, 1990.

[23] Hawthorne, C. "Turning Down the Global Thermostat" *Metropolis*, October 2003. pg.102. This figure was found by architect and environmental activist Edward Mazria. He added the energy use of the commercial and residential sectors to the energy used to build (embodied energy) and operate industrial buildings.

[24] Hawken, P. Natural Capitalism: Creating the Next Industrial Revolution. Little, Brown and Company: Boston, 1999. pg. 288

[25] Maldonado, T. *Design, Nature and Revolution: Toward a Critical Ecology.* Harper and Row Publishers: New York. 1972. pg. 30

[26] http://www.aia.org/cote_rfps

Since the early 1980s, the United States has seen the concept of adaptive reuse develop into a normative model for urban revitalization. Major American cities such as Chicago, Detroit, Los Angeles – to name a few – have promoted this model in the hopes of spurring a redensification of their urban cores. Nick Cordell, executive director of the National Center for Preservation Technology and Training of the National Park Service noted in 2004 that already 90% of construction involves existing structures, many of which are historic. This trend does not look to be waning. In fact, the president of the AIA stated in a conference on Historic Preservation and Architecture Education, that "it is imperative that we teach the core tendencies of historic architecture to architects."[1] This now formal approach to planning is one born out of a storied past of the push and pull between urban development and historic preservation since the mid-1800s to the present. This chapter looks to uncover the roots of adaptive reuse in general, as well as to examine the reasons for which adaptive reuse has become the favored mechanism for urban revitalization today.

According to James Marston Fitch – a central figure in the U.S. historic preservation movement and founder of the School of Preservation at Columbia in 1964 – adaptive use should be considered just one of a range of historic preservation models available to architects and planners. Fitch defines seven such models, organized in levels of increasing physical intervention as: preservation; restoration; conservation and consolidation; reconstitution; adaptive use; reconstruction; and replication. Preservation "implies the maintenance of the artifact in the same physical condition as when it was

received by the curatorial agency," while restoration defines a "process of returning the artifact to the physical condition in which it would have been at some previous stage of its morphological development." Significantly, he defines adaptive use as, "often the *only economic way in which old buildings can be saved*, by adapting them to the requirements of new tenants."[2] (emphasis added)

Marston's definition above begins to suggest that the reason for which adaptive reuse has become so popular is purely economic. While this does ring true to some degree, a deeper look at the shifting relationships between historic preservation and urban planning in the United States over the past 150 years reveals that there are really two key factors that have affected the evolution of adaptive reuse. First, the changing social climate has had an effect on what types of buildings were considered worthy of protection or preservation at any given time. These considerations were often colored by shifting views on race, culture, historical significance, and progress. Second, as Marston notes, the economic climate affected how viable rehabilitation or remodeling projects were from the developer's point of view. In his book *Rethinking Architecture*, Neil Leach quotes twentieth century Marxist sociologist Henri Lefebvre in noting that the current popularity of redesign could be seen as an obvious result of a socio-cultural history that constantly negotiates between destruction and reconstruction but is ultimately driven by economic ambitions.

> If advantage or profit is to be found in [doing] it, then the old is swept away. Later, however, [it will be discovered] how much such spaces may be pressed into the service of cultural consumption...When this happens, everything that they had so merrily demolished during the belle époque is reconstituted at great expense. Where destruction has not been complete, "renovation" becomes the order of the day, or imitation, or replication...[W]hat had been annihilated in the earlier frenzy of growth now becomes an object of adoration, and former objects of utility now pass for rare and precious works of art. [3]

With these arguments in mind, I hope to show that neither social change nor economic change alone can account for the recent proliferation of adaptive reuse as a mechanism for urban revitalization. Rather, it is the interaction of these two factors over generations that has led to the current state of affairs.

fig.10
Mount Vernon, Virginia.

Restoration: Preserving the Historical Patrimony as Living Museum
1850s to the early 20th Century

In the mid-1800s, as America finally became old enough to look back at its history, the American Historical Preservation Movement began in 1853 with the efforts of the Mount Vernon Ladies' Association to protect and preserve for posterity the personal home of George Washington (fig.10). For the remainder of the century, only buildings that were tied to a historical event or figure were considered for preservation, and it is clear that the primary intent of the movement was to restore and upkeep the *historical* patrimony of the country by protecting and maintaining representative edifices as museological artifacts. The endeavor was privately funded, with no help from the government, and carried with it an explicit message blaming progress for the destruction of sites of historic import. Anne Pamela Cunningham, who spearheaded the Mount Vernon Ladies' Association, stated in her farewell speech, "Let no irreverent hands change it; no vandal fingers desecrate it with the touch of progress."[4] This conservationist attitude, as well as private female stewardship, was a trend that would continue on into the early twentieth century with the preservation of Jefferson's Monticello and Jackson's Hermitage.

With the conservationist seed sown, local historical preservation councils began popping up across America. However, the pinnacle of this museological phase of historic preservation is arguably the creation of Colonial Williamsburg (fig.11). In 1926, J.D. Rockefeller Jr. had the idea to preserve Williamsburg as it was in the pre-revolutionary days, and the project of preservation, restoration and reconstruction has been going on

fig.11
Old fashioned horsecar showing tourists around Colonial Williamsburg.

ever since. While the project has involved incredible archival and archeological research, with the goal of providing an 'authentic' pre-revolutionary experience, the fact of the matter is that at no point in time did Williamsburg actually look like Colonial Williamsburg does today. This is in large part due to the extremely well-maintained nature of the town which imbues a false purity to the place – a purity that Ruskin would argue is "the most total destruction which a building can suffer: a destruction out of which no remnants can be gathered: a destruction accompanied with false description of the thing destroyed."[5]

What is notable in the creation of Colonial Williamsburg is the extent to which the pursuit of historical authenticity has eliminated any trace of a continuing culture or society in the town, reducing it to a living museum, frozen in time and devoid of any real dynamism or relation to the present. Written in 1849, Ruskin's words were directed at old Medieval churches and palaces, but as will be discussed later, they (along with the socially and economically unsustainable realities of the proliferation of museum towns) become important to the arguments made by the Critical Preservationists in the 1970s.

At the same time, the economic climate was one in which zero inflation and low wages meant that demolishing old buildings and erecting new ones in their place was financially more attractive than modifying existing buildings to accommodate new uses. It is not surprising, then, that the preservationist agenda was at complete odds with contemporary patterns of urban development.

fig.12
Plan Voisin of Paris.

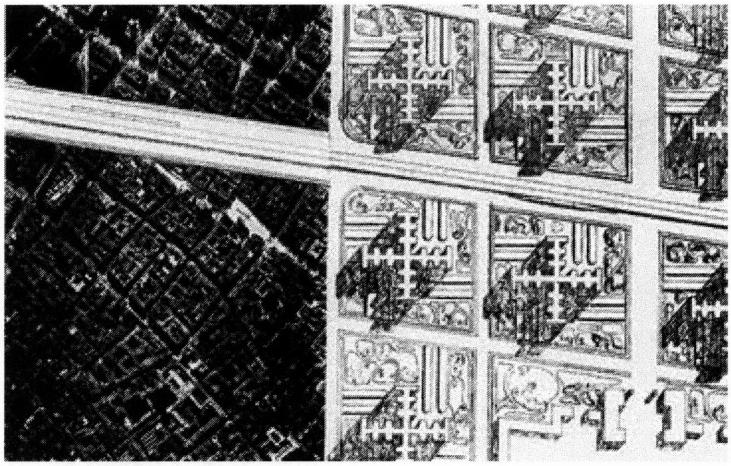
Progress: Depression-Era and Post-War Pursuits of a Better Future

Early 20th Century to the 1960s

With Industrialization in full swing and the arrival of the machine age, the first two decades of the 20th century saw the rise of a new approach to architecture and urbanism. In Europe, prominent architects including le Corbusier, the Italian Futurists, the German Functionalists, and the Russian Structuralists (to name a few) began to promote a new aesthetic based on the perceived efficiency of modern machines. In 1922, Le Corbusier proposed the Plan Voisin for Paris – a plan in which all of the old fabric of the city was eliminated in favor of sixty-storey glass and steel towers with multi-level vehicular and pedestrian routes, as well as natural and commercial amenities at ground level (fig.12). The irreverence with which his drawings wipe out entire blocks of the existing city is indicative of the Modernist progressive attitudes of the time. Aerodynamic forms were preferred over the more stylized and ornamental buildings of the past, and there was no question that progress should replace rather than add to the existing form of the city (fig.13). Adolf Loos famously noted:

> The evolution of culture is synonymous with the removal of ornament from utilitarian objects...The speed of cultural evolution is reduced by stragglers. I perhaps am living in 1908, but my neighbour is living in 1900 and the man across the way in 1880...Happy the land that has no such stragglers and marauders. Happy America![6]

fig.13
Detail of the abrupt interface between the old and new city in Corbusier's Plan Voisin.



America was not quite as progressive as the above quote suggests. In fact, there was quite a strong cross-current of preservationism brewing and a growing number of buildings being considered for protection. Reflecting back on this time, architecture critic Walter Muir Whitehill noted that "the first phase of historic preservation was concerned with the associative value of buildings; the second was quite as much concerned with their inherent architectural significance, irrespective of what had or had not taken place within their walls."[7] It became important to the identity of an area to maintain and protect these edifices that, while not historically significant, formed part of the national cultural patrimony.

Indicative of the tug-of-war between progress and preservation was the establishment of the Historical American Building Survey in the 1930s, whose charter it was to record (not protect) buildings deemed important to America's cultural and historical patrimony. By 1960, one-fifth to one-quarter of the listed structures had been demolished in the name of progress. Since all buildings were required to be at least a century old to be listed, these statistics do not include the destruction of any younger buildings that today might be considered to have historical, cultural, or social worth. Following a general lull in building during the Great Depression of the 1930s, much of this destruction happened as a result of the construction boom after World War II. This boom was a result of artificially low interest rates that counteracted increasing wages and promoted new growth.

In addition, three Federal initiatives were launched after World War II that would play major roles in altering the existing fabric of America's cities as well as the patterns of economic

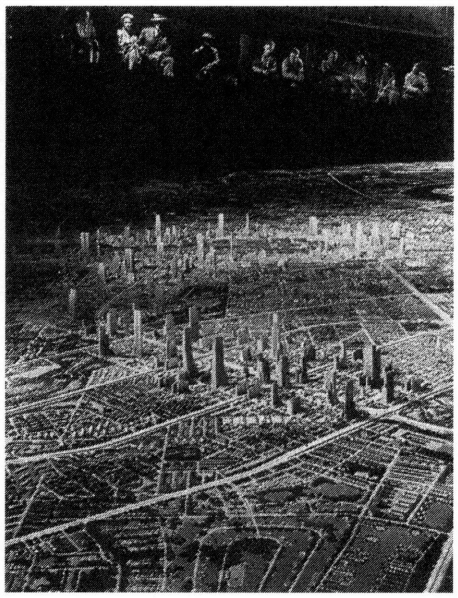
fig.14
President Roosevelt signs the G.I.Bill of Rights.

and social growth. First, the GI Bill of Rights, formally known as the Servicemen's Readjustment Act of 1944, encouraged home ownership by providing low interest rates to returning soldiers and their families (fig.14). This resulted in further decentralization of already somewhat depopulated American cities. Also, due to racial biases in the system, it led to huge demographic shifts in cities and their surrounding suburbs. Middle class and upper-middle class Caucasians could afford to move out to the newly developing suburbs, while minority and low-income families were left behind in increasingly vacant urban cores with decimated tax bases.

Second, the Housing Act of 1949 was passed with the intention of providing decent homes and suitable living environments for every American. Title 1 of this act championed slum clearance as a mechanism for urban redevelopment and renewal. It gave city governments eminent domain over any portion of their downtowns that could be classified as blighted. In some cases, the cities used this power to demolish entire neighborhoods and rebuild (or not) with no regard for the environment or society that existed there before.

Third was the Federal Highway Act of 1956, whose seeds were planted in 1938 by Roosevelt and by the seductive imagery in GM's Futurama Exhibit of the 1940 World's Fair (fig.15). This Act was to provide a massive, Federally funded interstate roadway system for the country. The construction of this system would often require the demolition

fig.15
GM's Futurama exhibit at the 1940 World's Fair in New York.



of significant structures, but more critically, it would further decentralize the downtown cores of American cities and facilitate the decay of formerly culturally and socially rich neighborhoods.

Critical Preservationism: A New Historical, Environmental, and Social Awareness

Mid-1960s to the present

The tide began to turn on this so-called progress in the mid-1960s, as minority groups and other activists started to react against the racially biased slum clearance practices that were leaving many destitute and homeless. Urban renewal was casually known as Negro removal, and often meant clearing entire city blocks of socially and culturally vibrant (albeit often old and rundown) neighborhoods. There were a number of riots that resulted from the frustration with this situation, notably in Newark, New Jersey (1967) and in the Lower West Side of Manhattan. In the face of these threats to the remaining fabric of American cities, a new form of preservationism arose that was not merely conservationist as it had been in the 1850s and early twentieth century. This Critical Preservationism (also called New Urbanism) viewed progress not as the opposite of historical preservation, but as its partner. One of the great champions of this movement was social critic Jane Jacobs, who in an interview with James Howard Kunstler noted:

> There is no new world that you make without the old world.[8]

fig.16
Jane Jacobs with Philip Johnson, protesting the demolition of Penn Station. New York, 1963

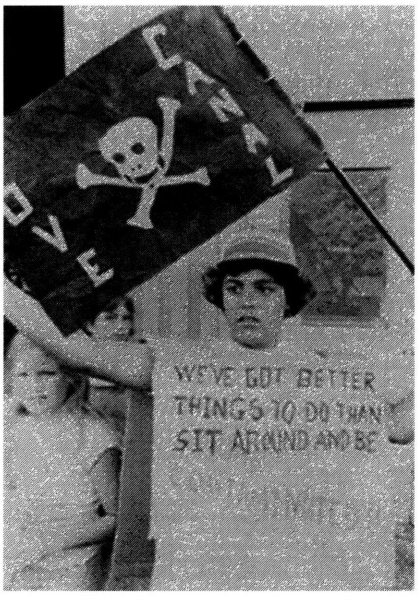
The goal of New Urbanism was to promote more comprehensive and less destructive approaches to redevelopment (fig.16). It invested local groups with greater political power and influence over the fate of their neighborhoods, and in many ways, was compatible with the growing grassroots efforts of minority groups to counteract Federally encouraged racial prejudice.

As Jane Jacobs' writing influenced the academic world and suggested new ways of thinking to architects and planners, Ada Louise Huxtable popularized these ideas in the New York Times. Huxtable was the architecture critic of the New York Times from 1963 to 1982, and often used her columns as a forum to mourn the destruction of American urban cores and to encourage planners not to wish the existing city away but to work with its assets. She was not against new building; rather, she believed that new buildings that considered their surroundings more holistically – not just physically, but culturally and socially, too – were stronger as a result.

> The contrast of new and old, of scale and history is one of the richest and most breathtaking of urban experiences, with a style in lower Manhattan that exists nowhere else on earth. It is not expendable.[9]

James Marston Fitch also opposed the urban renewal strategies adopted by many cities in the 1950s and '60s, arguing that, architectural distinction notwithstanding, structures should sometimes be preserved and appreciated simply as valuable representations of

fig.17
Love Canal protester



the cultures that erected them. At the same time, however, Fitch appreciated that cities inevitably grow and change, and did not seek to preserve buildings merely by virtue of their age. By the 1970s, this view had gained widespread acceptance in planning circles, and began to appear in the official planning and redevelopment policies of cities such as New York, Chicago and Los Angeles. In 1966 the National Historic Preservation Act was passed, stating as its aim that, "the historical and cultural foundations of the Nation should be preserved as a *living part* of our community life and development in order to give a sense of orientation to the American people." (emphasis added) This sentiment is echoed in the New York State Board of Historic Preservation's Historic Resources Manual, which defines the role of preservation as "preserv[ing] the evidence of a region's overall historical development in its proper context and in such a way that it will play an economically viable role in the contemporary scene."

These new policies were also well coupled with the growing environmental consciousness of the 1970s. The Environmental Protection Agency was formed in 1970 as a result of protests in Love Canal, New York (fig.8). Also at this time, a number of influential books, including *Silent Spring* by Rachel Carson, were published. When the oil embargo of 1972-73 hit the United States, the effects of sprawl and wasteful building on the environment and the economy were becoming increasingly apparent. By this time, the post-war boom was over, and financially it was not always preferable to raze and rebuild as had been done previously. When the Tax Credit Program for Historic Building

Rehabilitation was passed in 1976, it was a welcome incentive for developers to target abandoned properties in their redevelopment plans. Also, since the scope of buildings that were considered eligible for protection under the umbrella of Historic Preservation or Rehabilitation had increased from merely the historically significant to include also the culturally or socially significant, it meant that almost any abandoned property could receive the benefits afforded by this tax credit.

Some preservationists have responded negatively to the results of the popularization of adaptive use, stating that often the preserved buildings are so changed in their function that the essence for which they were preserved is lost. While this argument is compelling to some degree, it is tempered by the fact that many of these buildings were abandoned because they had become functionally obsolete and were no longer financially viable actors in the local economy. As noted by Kevin Lynch in his book, *What Time Is This Place?:*

> To preserve effectively, we must know for what the past is being retained and for whom. The management of change and the active use of remains for present and future purpose are preferable to an inflexible reverence for a sacrosanct past. The past must be chosen and changed, made in the present. Choosing a past helps us to construct a future.[10]

By saving the exterior form of a building, at least the scale of the neighborhood can be maintained and its essential character and history along with it. Since the 1980s, architects have engaged in numerous debates regarding how one should approach a reuse project – whether to be deferential to the existing style or to challenge it through stark contrast. Whichever approach is chosen, however, architects are encouraged to be responsive to the historical, social and cultural context of the original building. As such, adaptive use is considered a much more appropriate (and now financially attractive) alternative to demolition and new construction.

Urban Revitalization: The Local Dimension

Why is it the best choice for neighborhoods?

Thus far, this chapter has examined the national trends in historic preservation and redevelopment strategies. It has provided the background necessary to understand why it is significant that adaptive use has become a normative model for urban revitalization

in the United States. While the overarching picture is extremely important, it is necessary to now examine adaptive use on the local scale in order to understand how it works, and specifically, how it affects the economic and social contexts of the areas being redeveloped.

According to an article published by the U.S. Department of the Interior in 1978, rehabilitation and reuse projects promote local growth and jobs more than new construction because they create two to five times as many jobs for a given expenditure of money[11]. This is largely due to the fact that reuse projects tend to be 75% labor intensive (as opposed to 50% for new construction) and therefore, more of the money invested in such a project ends up in the hands of local residents instead of non-local material manufacturers. Reducing the capital spent on construction materials results in a higher rate of local recirculation of the invested funds. Given the history of urban depopulation and white flight, many areas that have adaptive use as a viable choice for revitalization tend to be impoverished and suffer from a high rate of unemployment. Rehabilitation projects can provide these areas with labor opportunities and often they provide on-site training that gives laborers the specialized skills they need on the job. These skills can then be taken to a next job, thereby multiplying the benefits received from the project. As a result of this localized development, the urban tax base grows, enabling city governments to further improve their residents' quality of life. Furthermore, the promise of increasing property values encourages these governments to set regulations and incentives to further attract redevelopment.

Adaptive use is also seen as a potential remedy to sprawl. It promotes resource efficiency, not just in terms of construction materials as noted above, but also in terms of the infrastructure needed to support an economically vibrant neighborhood. This infrastructure includes not just the roadways, sewer systems, etc., but also the cars needed to use the roadways, increased funds to maintain new sewers or build new treatment plants, etc.. Therefore, choosing to reuse already developed areas which tend to be well-linked by public transport, pedestrian in scale, or already part of a larger municipal wastewater network falls neatly under the heading of "smart growth." Beyond making financial sense, according to Jane Jacobs, who argued that the street was the

ultimate social generator, the protection and promotion of the neighborhood even within a larger metropolis is crucial to the well-being (both social and cultural) of a region.

After the disastrous attempts by the Federal government to orchestrate urban renewal in the 50s and 60s, efforts for revitalization have often been the result of a grassroots reaction to the potential loss of community. After the gas shock of the early 1970s, urban living began to gain popularity, many impoverished areas began to increase in value due to their centrality, and consequently, local residents had reason to fear that gentrification would soon price them out of their own neighborhoods. Many groups recognized the potential that adaptive use had for kickstarting local economies, leading to numerous public-private partnerships that provided a stable financial base for the revitalization efforts. Through these partnerships, neighborhoods were able to maintain their own unique identity, history, and richness of place while providing for future growth. In many cases, such as the Bronzeville district of Chicago, revitalization efforts have resulted in the creation of unique tourist areas that are still vibrant and - as Gertrude Stein might put it - have a there there.[12]

Concluding Thoughts

Adaptive use has been a normative model for urban development in parts of Europe for quite some time. In the United States, on the other hand, it was not until the late 1970s that adaptive use was considered as an attractive option for growth. The easiest explanation, of course, is to simply state that the free-market economics of the building industry dictates how redevelopment is pursued. However, a closer look at the history of historic preservation in America does reveal a little more complexity. Over the past century and a half, the preservation movement has gone from acknowledging only individual historic buildings as being worthy of protection to now designating entire neighborhoods as significant landmarks. The preservation movement has largely been spearheaded by private individuals, with the passage of the National Historic Preservation Act and various federal tax incentives occurring as the result of public demand. As such, it is meaningful to examine not just the economics of the period in question, but also the significant social changes that took place. Through this chapter, I have attempted to show that while economics did play a significant role in the popularity of adaptive use as a tool for revitalization, it is impossible to separate the method's popularity from the

development of an increasingly critical social and environmental consciousness in the latter quarter of the twentieth century.

(Endnotes)

[1] Hopkins, Eugene C. quoted in The Newsletter of the Historic Resources Committee, in a synopsis of notes from the *Historic Preservation and Architecture Education: A Dialogue* Conference of Nov. 19-21, 2004. American Institute of Architects, March 27, 2006

[2] Fitch, James Marston. . *Historic Preservation: Curatorial Management of the Built World.* McGraw-Hill Book Company: New York, 1982. p.46-47

[3] Henri Lefebvre, The Production of Space, quoted in Leach, Neil. *Rethinking Architecture*. Routledge: London and New York, 1997. p.143

[4] Fitch, James Marston. *Historic Preservation: Curatorial Management of the Built World.* McGraw-Hill Book Company: New York, 1982. p.89

[5] Ruskin, John. *The Seven Lamps of Architecture*. 1849, obtained online from Project Gutenberg, Selections From the Works of John Ruskin, e-text no. 15200

[6] Loos, Adolf. "Ornament and Crime" in Conrads, Ulrich. *Programs and Manifestoes on 20th-Century Architecture.* The MIT Press: Cambridge, MA 1971. p. 21

[7] Special Committee on Historic Preservation, U.S. Conference of Mayors, *With Heritage So Rich,* 1996. p.40. The quote continues: "This change of direction is explicit in William Sumner Appleton's statement of the purpose of the Society for the Preservation of New England Antiquities, which he organized in 1910 as 'to save for future generations structures of the seventeenth and eighteenth centuries, and the early years of the nineteenth, *which are architecturally beautiful or unique,* or have special historical significance. Such buildings once destroyed can never be replaced.'"

[8] http://www.kunstler.com/mags_jacobs.htm

[9] *Lessons in How to Heal the City's Scars*, New York Times, May 27, 1973

[10] Lynch, Kevin. *What Time is This Place?* MIT Press: Cambridge, 1972. pg.64

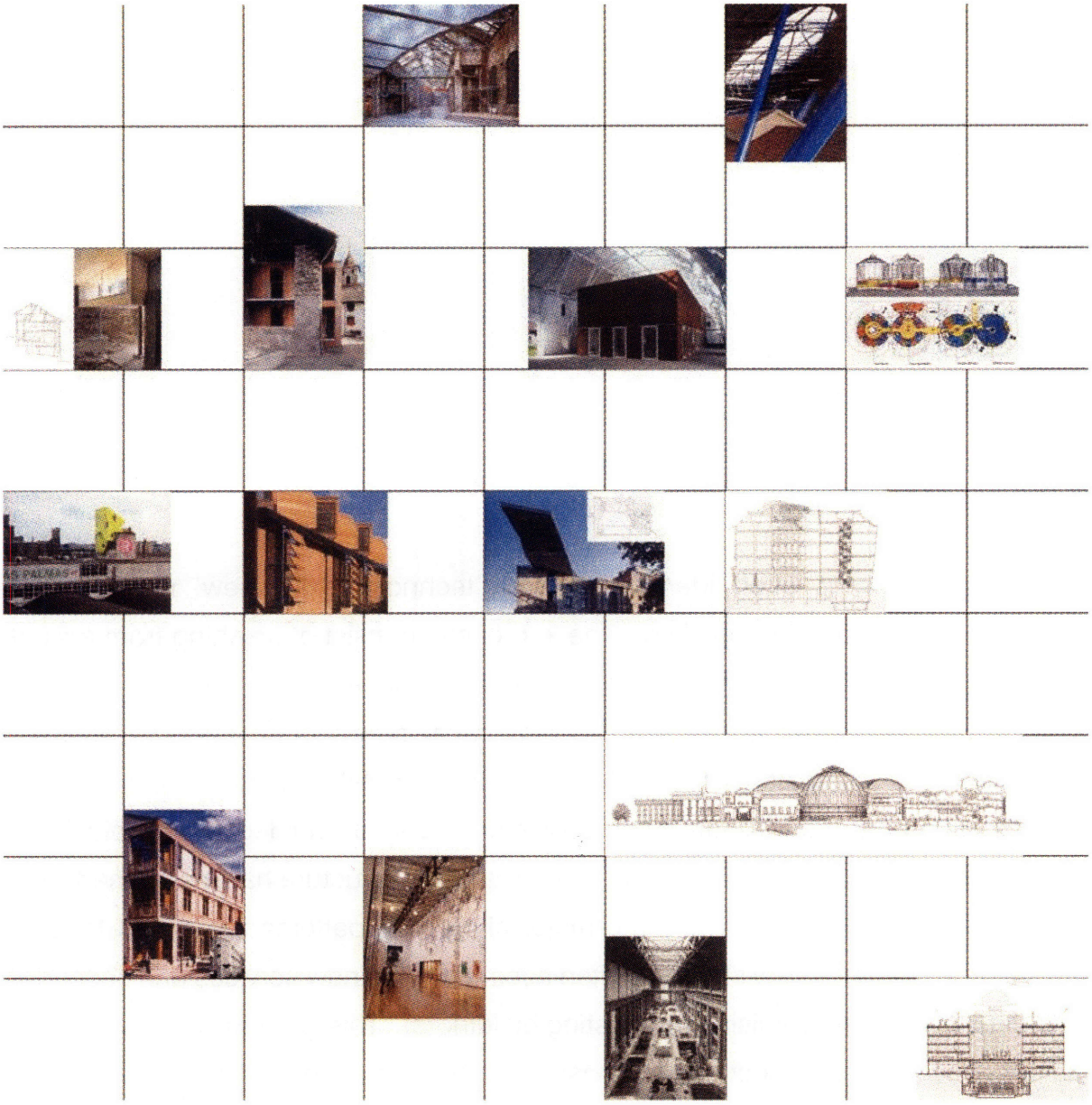
[11] Bever, Thomas D. *Economic Benefits of Historic Preservation*. U.S. Department of the Interior, Washington, D.C., 1978, p.9 in Readings in Historic Preservation: Why? What? How? ed. Williams, Norman, Jr.

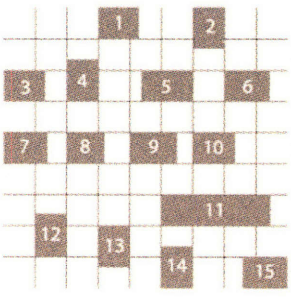
[12] This refers to a line in Stein's book *Everybody's Autobiography*, Ch. 4, in which in referring to her hometown of Oakland she says, "What was the use of my having come from Oakland it was not natural to have come from there yes write about if I like or anything if I like but not there, there is no there there."

Precedent Studies

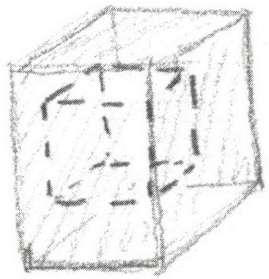
Four Reuse Typologies

Many adaptive reuse projects have now been realized, and although the solutions proposed by their designers have varied widely depending on the inherent characteristics of the particular building in question, a broad-brush categorization is possible. Identified here are four such categories: old kernel - new shell; old shell - new kernel; addition/ incision; and integrated infill. Using a couple of case studies per category, this section investigates how a project's size, program, context and historical significance might affect the appropriateness of a given typology or design approach. Conclusions derived from this investigation will be applied toward the proposal for reuse of the Old Chicago Post Office, later in this document. The matrix to the right shows a handful of projects, most of which will be discussed in more detail in this section. They are roughly organized in rows by typology – top to bottom, in the order mentioned above. Within each typology, the projects increase in size from left to right.





1) Media Centre, Hamburg
2) Le Fresnoy, Lille
3) House and Studio Building, Sent
4) Duplex House, Bergun
5) Community Center, Schwindkirchen
6) Gasometer Housing Project, Vienna
7) Parasite, Rotterdam
8) Odessa Wharf, London
9) Document Center, Nuremburg
10) ING and NNH Bank, Budapest
11) British Museum, London
12) Camera Press Building, London
13) Mass MoCA, North Adams
14) Tate Gallery, London
15) Lingotto Factory, Torino



Old Kernel - New Shell

This typology is most often identifiable by a technologically 'new' roof structure constructed over an existing building. The kernel can consist of anything from a single building to a larger complex. Existing structural elements may maintain their structural function in their reincarnated lives, but in many cases they require some retrofitting to do so (if not for structural stability, then to meet current code requirements). As a result, major circulation patters through these projects tend to be guided by the old fabric. This approach is best suited to cases where the existing structure has maintained much of its structural integrity and where the major circulation patterns are suited to future organizational needs. A new shell can often accommodate new services and secondary circulation without compromising the existing building(s). This typology is not well suited to historic preservation projects as it almost inevitably alters the outward appearance of the structure, unless the new roof is entirely contained within the boundary of the historic skin.

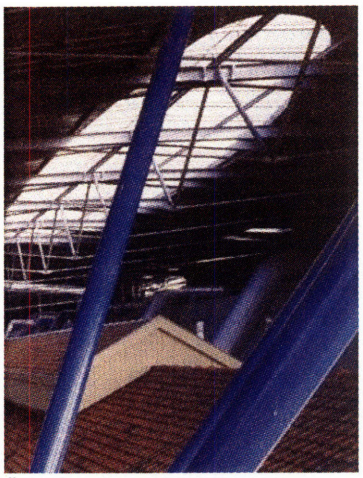


fig.18

National Studio For Contemporary Arts
Le Fresnoy, Lille, France
Bernard Tschumi Architects, 1991-1998

Originally: *Factory workers' social complex*
Currently: *Post-graduate school for film and visual arts*
Size: *452,000 sq.ft.*

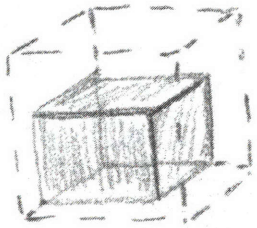
Major ground level circulation patterns are directed by the walls of the existing buildings. However, the superimposed megaroof provides a new plane of habitation sandwiched between the new and the old, thereby calling attention to the contrast. This space has its own circulation and spatial logic as well. The overlaying of these two systems animates the interstitial spaces and is critical in tying the old buildings together into a single experience.

fig.19

Media Center
Hamburg, Germany
me di um architekten, 1983-1992

Originally: *Zeise ship propeller factory*
Currently: *Film and Theatre Institute, restaurants, shops, offices, apartments*
Size: *90,500sq.ft.*

The existing brick structure of this factory had been allowed to deteriorate quite dramatically before plans for reuse were drawn up. During redevelopment, all of the fallen debris was cleared to accommodate new uses. The existing walls, which continue to fulfill their structural function, were left bare and rough as a reminder of what the building had been in the past. Again, the contrast in the material technologies of the old and new is blatant, and has become the defining aesthetic character of the place.



Old Shell - New Kernel

This typology is seen in situations where the existing building presents a structurally uninterrupted space of some significant size. Similar to the Old Kernel - New Shell typology, the space between the old and the new is often highlighted as an expressive element of reuse. Other projects take advantage of this space to provide a climatic buffer between the exterior of the old shell and the interior of the new. Due to the physical attributes and conditioning opportunities of this typology, it is quite well suited to former utilitarian or industrial buildings that often do not have any provision for human habitation inherent in their design. It is also a quite popular approach to historically protected landmarks, as it enables a modern deployment of interior grammars without compromising the external image of the building. Since many of the old shells that can be tackled by this design typology have very few internal structural elements, there are often no limitations to the form of the new kernel. As a result, this typology tends to yield varied looking results.

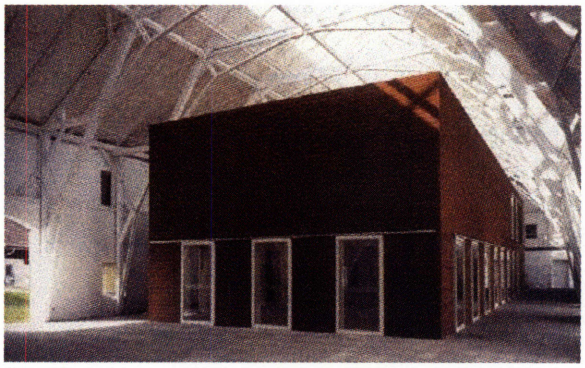


fig.20

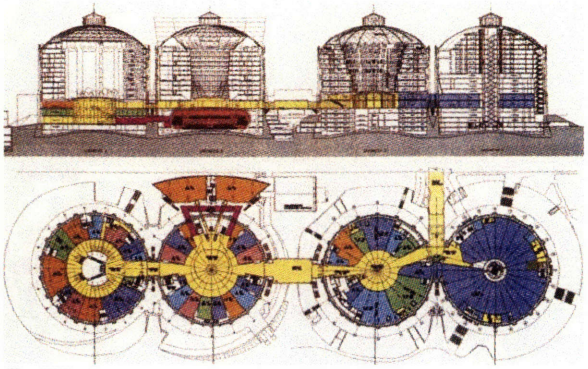


fig.21

Church Community Centre

Schwindkirchen, Germany
arc Architects, 2001

Originally: Barn
Currently: Parish community centre
Size: 10,300 sq.ft.

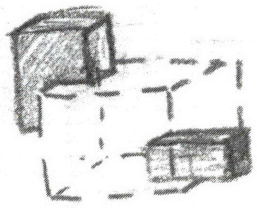
This is a fairly small project, notable in its intelligent use of a newly created buffer zone between the original barn wall and the new center for climate regulation and consequently, pleasant human habitation. The ridge of the barn was originally supported by a line of columns, which were removed during reconstruction and replaced by a slender steel supporting structure that hardly impinges on the interior space. As the barn structure is now a secondary envelope and does not need to meet any thermal comfort requirements, the walls are simply whitewashed and left bare, with no extra layers of insulation material to detract from the simplicity of the original structure.

Gasometer Housing Project

Vienna, Austria
Jean Nouvel, Coop Himmelblau, Manfred Wehdorn, Wilhelm Holzbauer
1995-2001

Originally: Vienna municipal gas works
Currently: Apartments, offices, entertainment
Size: 4 tanks of roughly 1 million cu.ft. each

This enormous mixed-use project gutted four massive cylindrical spaces and redesigned the interiors while (mostly) maintaining the exterior brick of the original edifice unaltered. Each tower was designed by a different architect, and the combination of responses demonstrates the wide range of options is available even when working within the same typology. Due to the large diameter of these tanks, each tower contains large atrium spaces, which allow natural light to penetrate the buildings and provide a comfortable living and working environment. The lowest six or so floors of each of the towers are interconnected and contain cultural and commercial activities such as cinemas, restaurants, and retail. This mixed use ensures that the complex is vibrant with activity at all hours of the day, and as such, is a self-sustaining urban community.



Additions/Incisions

Reuse projects that fit into this category are often either pedestrian results of a need for more space or physical manifestations of a designer's polemic. The pedestrian projects are usually simple additions, sometimes interesting due to a specific choice of material or configuration, but more often hardly befitting of the categorization as reuse projects because of their detachment from the original building. The polemical projects, on the other hand, can be quite emotionally charged, and are usually not the result of spatial or economic need; rather, they are the results of social, cultural, and historic commentary. As such, the interventions that they propose are succinct and pointed, often affecting the reading of an old space much more than its actual fabric. These projects tend to go beyond mere contrast to outright confrontation to ensure the clarity of their message.

fig.22

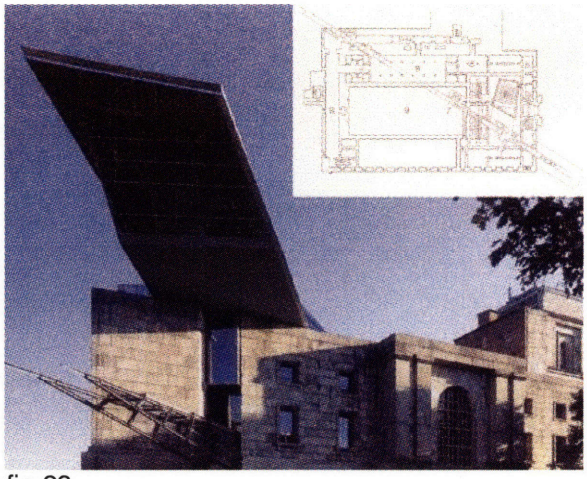


fig.23

Parasite
Rotterdam, The Netherlands
Korteknie Stuhlmacher Architects, 2001

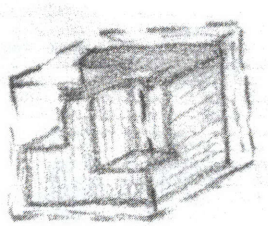
Base: Abandoned industrial workshop
Addition: Office and exhibition space
Size: 900 sq.ft.

This is a tiny project, designed as part of an exhibition of a group of temporary, low-cost urban structures during the Rotterdam's year as a culture capital. The architect's challenge was to create a small urban space that would take advantage of existing elements in the city to meet its needs (hence its name). The Parasite was located on the rooftop of an old factory building from which it borrowed water, sewage, and power capabilities. It was designed to be quick to assemble and dismantle, and was a commentary on the opportunities present in currently underutilized areas in the city.

Documentation Center
Nuremberg, Germany
Günther Domenig, Graz 2001

Base: Unfinished Congress Hall
Incision: Circulation
Size: roughly 500 sq. ft.

The architect for this project equates his incision to a stake driven through the flesh of the building. This violent description belies the true purpose of this reuse project: to destroy the building in order to be able to inhabit it once more. Originally a structure built for the Nazi government, it is now a museum and document center. The stake's function is to undermine and disrupt all attempts at heroism and monumentality in the original design and is symbolic of Germany's confrontation of a particularly ugly part of its past.



Integrated Infill

Most successful adaptive reuse projects fall under the category of integrated infill, in which much of the original building's skin and structure is kept unaltered, while the internal configuration of spaces is revamped, sometimes significantly. These projects tend to rely less on overt contrast than do the projects in the previous three typologies, and are often able to isolate and heighten some fundamental essence of the original structure while updating it to meet modern needs. Surprisingly, it is often the spaces that seem most 'authentic' that have been most altered. In these cases, it is a testament to the designers' ability to look beyond the immediacy of the physical artifact to find the structure's potential. This is especially important in projects where the programmatic function is vastly different before and after redevelopment.

fig.24

Camera Press Building
London, England
Panter Hudspith Architects, 1992-1993

Originally: 1960s warehouse block
Currently: Photographic agency offices
Size: 10,500 sq. ft.

This old warehouse in Southwark was converted into a large office facility for a budding small business for about $70/sq.ft., which is much less than what a new building of comparable size and location would have cost. The original concrete frame was retained because of its structural integrity, but all of the external brick infill walls were removed and replaced with wood panels and glazing. The bottom floor is a fully glazed gallery space that opens out to the street, welcoming visitors where the warehouse had presented a closed face. Despite the full retention of the structural frame, the nature of the building has changed dramatically because of the choice of materials used and the increased accessibility.

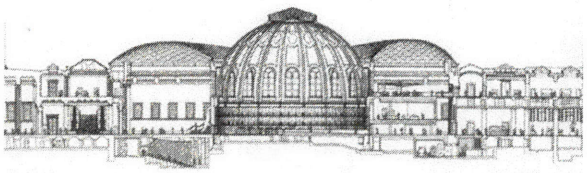


fig.25

Great Court at the British Museum
London, England
Foster and Partners, 1994-2000

Originally: Unused courtyard
Currently: Central area with information and commercial functions
Size: 87,000 sq. ft.

This adaptive reuse by Foster and Partners sports a state-of-the-art roof, but is in fact the realization of the original architect's vision for a central area about which the museum is organized. Between the time of original construction and the redevelopment, the central reading room and a number of storage and office spaces, had been added, filling the courtyard haphazardly, and making navigation through the museum quite complicated. Though the redesigned court is not planted with trees or open to the sky as originally planned and retains the large central reading room, it now fulfills its function as a central point of congregation and activity for the museum.

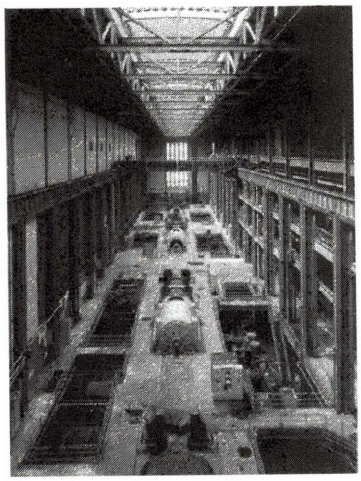


fig.26

Tate Gallery of Modern Art
London, England
Herzog + de Meuron, 1994-2000

Originally: Power station
Currently: Art gallery
Size: 120,000 sq.ft.

The winner of an international design competition, Herzog + de Meuron's proposal was selected because it best captured the essence of the building's character. The exterior of the old Bankside power station was kept largely intact except for the notable additions of a glowing penthouse space and a glowing cap for the chimney. The interior, on the other hand, called for an almost complete gutting. The photo above shows the Turbine Hall before redevelopment. Most of the floor shown was removed and the roof was replaced when it was found to be structurally compromised. Rather than detract from the experience of the space, these changes successfully enhanced its scale and monumentality.

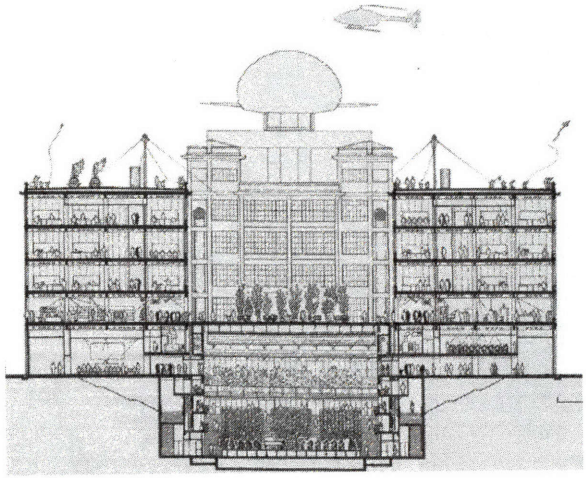


fig.27

The Lingotto
Torino, Italy
Renzo Piano Building Workshop
1988-1997

Originally: Fiat factory
Currently: Cultural and commercial complex
Size: 2.5 million sq.ft.

The architect's approach to this project was to consider the iconic Fiat factory a template into which part of the city of Torino could be programmed. As such, his plans called for enclosed gardens, cultural facilities, office spaces, leisure spaces, commercial spaces, etc., all within the same complex. The regular grid and structural integrity of the concrete frame gave him a relatively flexible base upon which to build. Larger facilities that could not be accommodated within the rules of the column grid were inserted into the central courtyards, often buried somewhat underground to ensure that the basic vocabulary of the original factory was not lost behind the new additions and alterations.

The Architectural Problem

The Old Main Post Office
Chicago, Illinois

In this chapter of the thesis, I propose to consider a scheme for the adaptive reuse of Chicago's Old Main Post Office, located between the Central Loop and the Near West Side neighborhoods. Originally designed by Graham, Anderson, Probst and White, the building is located along the southern spur of the Chicago River. At first a much more modest building (fig.28), it was added onto in 1932, becoming the largest post office complex in the world, measuring approximately 800ft x 345ft at its base, and rising to 14 storeys (215 ft) in its corner towers (fig.29). Its links to transportation infrastructure are unique as it straddles the Congress Expressway at ground level and sits atop a bundle of railway lines heading to and from Union Station, two blocks north.

In 1996, the United States Postal Service moved out of the building citing building related inefficiencies, and the edifice has been lying empty ever since. Because of its iconic Chicago Style architecture, the Commission on Chicago Landmarks has placed this building on its list of buildings to be protected. Encompassing a usable floor area of more than 2.5 million square feet, the empty building has been the focus of a number of city-sponsored design competitions in the past decade, the results of which have not been embraced. Some of the problems with past proposals have been their singular functions (eg. a parking structure; a mausoleum), their insensitivity to the existing structure (eg. a proposal to demolish 75% of the existing structure), and their general lack of consideration for local community need.

fig.28
The original Post Office Building designed by Graham, Anderson, Probst & White, 1921.

fig.29
A current view of the Old Post Office, from the downtown Loop.

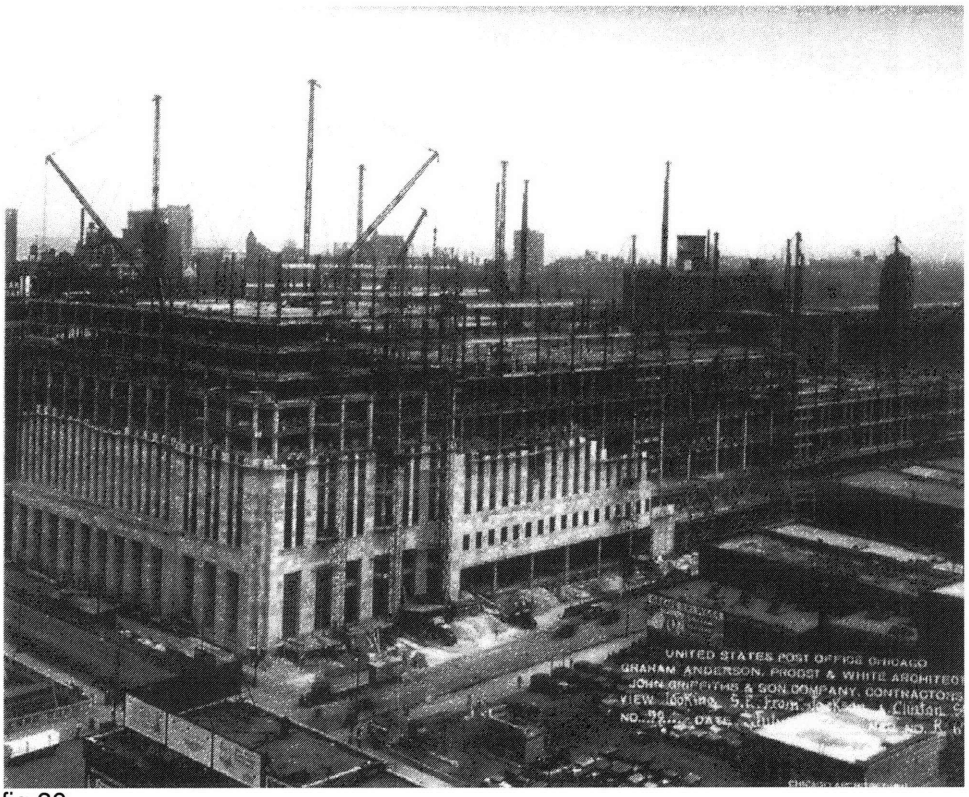


fig.30
The Old Post Office during construction, 1932.

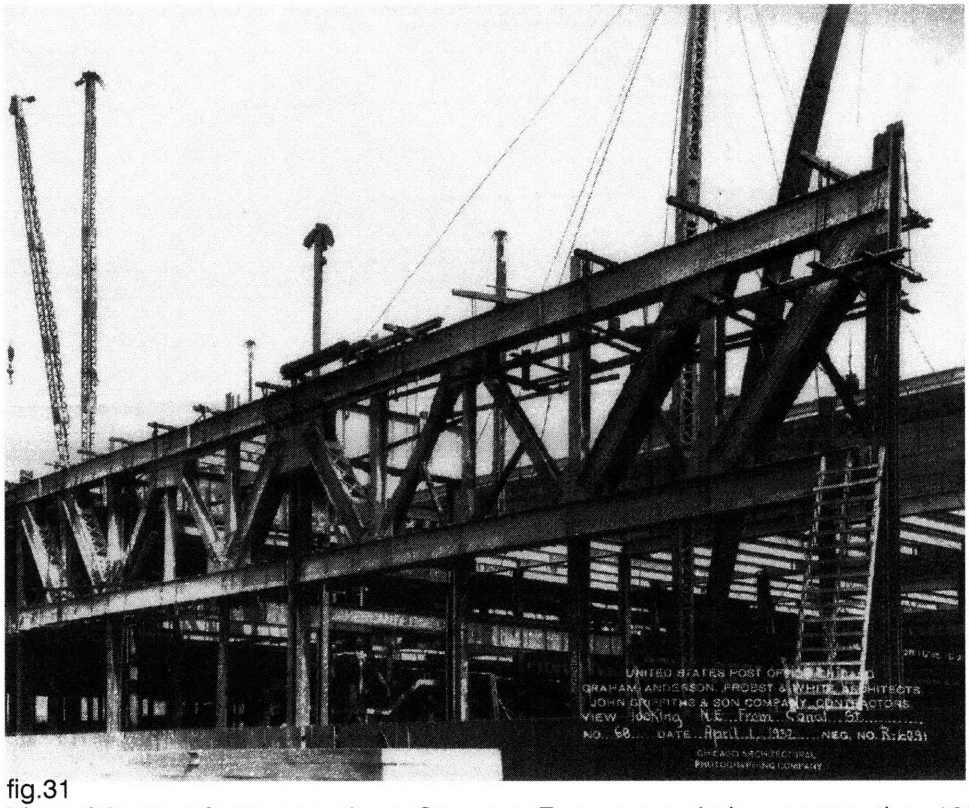


fig.31
View of the transfer trusses above Congress Expressway during construction, 1932

I will consider the possibilities for reuse, couched within the historical and cultural context of the neighborhood, the economic geography of the place, and a critical environmentalist attitude toward building and infrastructure reuse. I will also attempt to evaluate the sustainability of my proposal within a Life Cycle Assessment framework, and begin to discuss how such an evaluation methodology might influence the design process.

The first step in developing an attitude toward the Old Post Office is to understand the challenges it presents. The most apparent challenge is the building's size and configuration, which may have been appropriate for Post Office use in the early 20th century, but is no longer desirable for anything other than large-scale warehousing. Given the potential land value associated with the building's location, warehousing is not an economically attractive option. However, it is clear that if people are to comfortably inhabit the space, the building fabric will have to be altered to accommodate the shift from a machinery-heavy, bulk product floor configuration to a more humane one. The challenge, then, is to make this change without damaging the essence of the existing structure. In affecting these alterations, it is also important to keep in mind the urban context within which the building sits, both physically and economically. These considerations should be informative in determining the scale of any intervention, as well as the projected function of the adapted building.

Before proposing any changes to the Old Post Office it is imperative to understand the physical artifact as it currently stands. It will be important to have a sense of how the building is presently organized, what structural system it uses, what circulation mechanisms it has already in place, and what interior spaces (if any) require preservation.

Chicago's Historical Society has a collection of about 100 photographs taken by the Chicago Architectural Photographing Company over the course of the Old Post Office's construction. These photos show that the building has a dense structural steel frame with concrete-encased columns on the perimeter (fig.30). The density of the beams and the construction sequence suggest that fireproofing for the floors was achieved through the use of hollow ceramic blocks, a technology of common use during the time of this

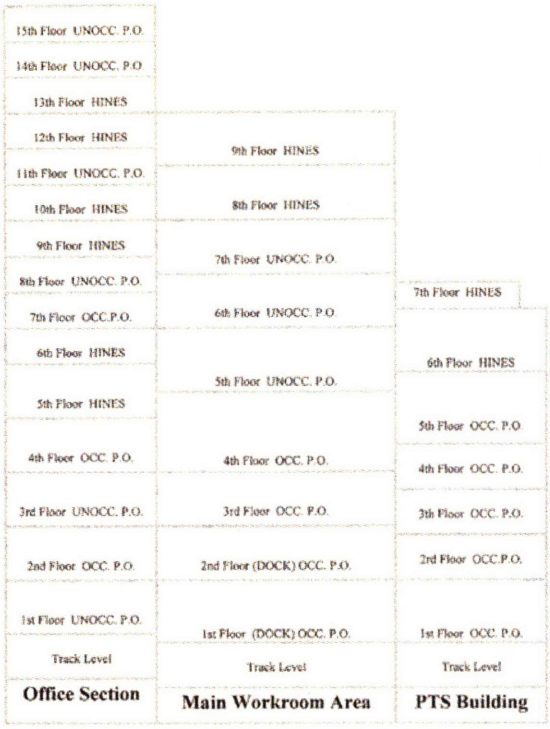


fig.32
Diagram showing the floor-to-floor relationships within the Old Post Office.

fig.33
The historic lobby.

building's construction.

Since most of the building's interiors are fairly consistent from floor to floor, structural patterns repeat except for some notable exceptions. Where the Congress Expressway enters and exits the building on the east and west facades, there are massive transfer trusses (fig.31), behind which the structural beam and column pattern remains the same. Also, the building can be grossly divided in to 3 separate areas: the PTS building; the office wing; and the workrooms. The PTS building consists of what remains of the original 1921 building, and in plan one can read the vestiges of the original double-loaded corridor layout. The office wing is a section of the building, about 45 feet wide that runs along the entire north face of the Post Office. Here, a light well interrupts the top ten floors, with double-loaded corridors on all sides. The workspaces are generally expansive with typical column spacings at 30 feet on center in one direction and 45 feet on center in the other. Because of the differences in intended function, the tree sections of the Old Post Office have varying floor-to-ceiling heights, making for a few odd connections throughout the building (fig.32). Note that the only fully continuous floor is the second.

The building, in general, is in mild to severe disrepair despite the current property management firm's best efforts. The interior climate is conditioned to minimize fatigue and cracking relating to temperature differentials and thermal cycling, which cost the post office millions of dollars annually. Still, the north and south faces of the building which have no offset from the street have had to be scaffolded to avoid the possibility of pedestrian injury due to falling glass or stone. The sections of the facade that are not cracked or rusted are still quite dirty, and a comprehensive rehabilitation effort would be required to restore the historically protected facade.

The building's interior spaces have fared much better than the exterior, with some areas in need of little else than a repainting and cleaning. The historic lobby is one such space (fig.33). With a ceiling height of about 28 feet, the lobby is an impressive example of what civic architecture was expected to look like in the early 1930s. Marble floors, terracotta cladding, and stylized gilded mosaics and graphics adorn the space. The ceiling needs

fig.34
Interior view of workspaces.

fig.35
Interior view of workspaces. Note the density of spyways, ductwork, and lighting, above.

to be replastered and some terracotta tiles replaced, but it would not be too difficult to restore this space to what it originally was.

In contrast to the grandeur of the lobby is the simple utility of the workspaces (figs.34,35). With floor-to-ceiling heights of about 20 feet and a fairly regular and generous 30 foot by 45 foot column grid, one expects a sense of openness. However, it is surprisingly lacking except for right at the perimeter of the building due to the incredible depth of the plan and the vast amounts of machinery, ductwork, spyways, and light fixtures hanging from the ceilings. With floor plates measuring about 350 feet by 700 feet, occupants of the workspaces would have rarely been within viewing distance of a window. The floors are mostly asbestos tile, which though in relatively good shape, would have to be abated during construction. In places were the floor is wood, water damage has caused buckling and rot, also necessitating removal during future construction.

It is quite clear, having toured the Old Post Office, that for it to become a viable player in Chicago's downtown culture, the interior fabric of the building will have to be significantly modified to allow deeper penetration of light and air into the building. It is also quite clear that almost any programmatic function *could* be accommodated spatially. The challenge will be to find one that has the most to gain from and give to the reuse proposal. The following are studies of the building context, scale, and potential program.

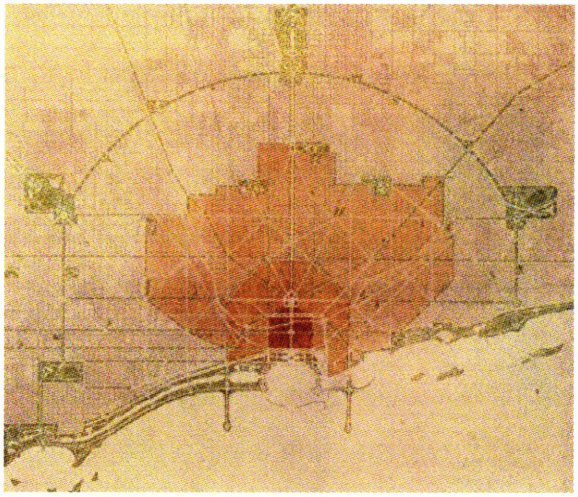
fig.36
Map of Chicago showing the area destroyed by the Great Fire.

Before the Great Chicago Fire of 1871, Chicago had been rapidly developing into the most prominent city of America's Midwest. The urban population had increased from 5000 to 300,000 inhabitants in the 33 years between 1837 and 1870, and construction had kept close apace. After the famous two-day blaze left an enormous portion (2000 acres, or 3.5 square miles) of Chicago's central business district in ruin (fig.36), developers quickly rebuilt the city into a thriving metropolis. The tabula rasa that the catastrophe left in its wake was immediately reinhabited. Within two months of the blaze, 214 brick and stone buildings were in the process of being erected within the downtown loop,[1] and there was plenty of other more temporary construction besides. Many of the cellars and basements of the buildings that were previously standing were used as springboards for new construction, and the new metropolis became in many ways, a technologically more advanced and only slightly zonally altered version of it's old self.

It was not until 1893, by which point Chicago had once again refilled its city blocks, that the first inkling of a formalized plan for a portion of the city was proposed in the context of the World's Columbian Exposition. Managed by architect Daniel Burnham, the temporary buildings built for the fair were designed in the Classical style and arranged within Frederick Law Olmstead's landscape plan to achieve a sense of monumentality and civic importance. Many cite this to be a seminal example of the City Beautiful movement in city planning.

In 1909, Burnham applied many of these ideas of composition, balance, order and monumentality to an overall Chicago City Plan, the first such proposal for the city (fig.37).

fig.37
The Burham Plan for Chicago, 1909.



Overlaying his plan of 1909 onto the contemporary city fabric, the Haussmannian nature of the plan is revealed. Large avenues extend radially from a fountain in Grant's Park, cutting through the existing city fabric and suggesting the unapologetic destruction of everything in their way. The primary east-west corridor proposed in this plan was Congress Street, which at the time was a non-continuous set of short alleyways. However, because of its position of symmetry relative to the development pattern of the city, it was to identified as the idea location for the city's grand axis, housing civic buildings, cultural institutions, and places of retail. It is clear that the Burnham Plan was largely an exercise in compositional planning, fueled by the belief that such planning could and would lead to a unified and organic city. And yet, unlike Haussmann in Paris, Burnham allowed for flexibility in the execution of his plan, admitting that while his plan as drawn was the ideal, there may be reasons to deviate from it.

> Indeed, the aim has been to anticipate the needs of the future as well as to provide for the necessities of the present: in short, to direct the development of the city towards an end that must seem ideal, but is practical. Therefore it is quite possible that when particular portions of the plan shall be taken up for execution, wider knowledge, longer experience, or a change in local conditions may suggest a better solution; but on the other hand, before any departure shall be determined upon, it should be made clear that such a change is justified.[2]

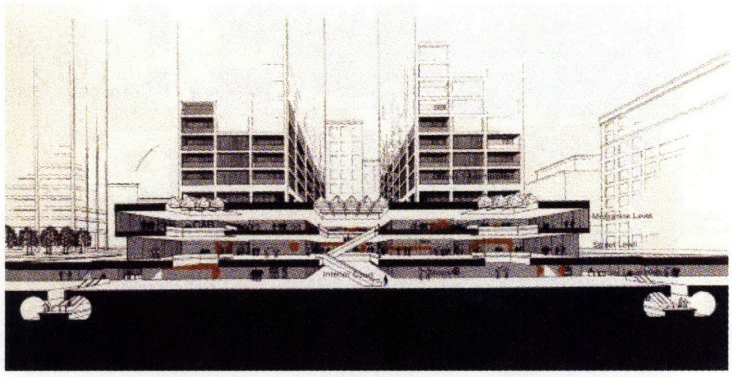
While not much of Burnham's original plan has executed exactly as he envisioned, his plan for the city set the trend for a continuing interest in city planning in Chicago. Over the course of the 20th century, no less than 4 major central area planning documents

were produced, each reflecting contemporary national trends, while maintaining some reference to the original Chicago Plan of 1909. One of the most notable inclusions, for example, is the development of Congress Expressway, which is now legitimately one of the major east-west axes of the city and happens to run directly through the first floor of the Old Post Office. Also pursued was Burnham's allocation of recreational green space along the shores of Lake Michigan.

Under the leadership of Mayor Richard J. Daley, who held office from 1955 until his death in 1976, two city plans were proposed – the Central Area Plan of 1958, and Chicago 21 of 1971. Both of these plans show the growth of the city westward, across the Chicago River, and southward, following the path of its realigned southern spur. Since much of the suggested redevelopment was proposed under the guise of urban renewal, some of the more dilapidated areas surrounding the downtown Loop were targeted for redevelopment first. There is a significant body of work that questions the fairness of many practices of urban renewal that became the norm in the 60s, some of which has been touched on earlier in this document, but which cannot be fully treated within the scope of this thesis. What will be examined here are the stated and implicit goals behind the direction and structure of the proposed growth models inasmuch as they may reveal the historical background within which building in Chicago occured.

The main objectives of the two plans were to improve vehicular and pedestrian mobility by refining and adding to the existing framework, to eliminate blighted areas through targeted re-zoning, to provide more desirable residential areas at the immediate edges of the central business district, and to improve the access and quality of lakefront recreational areas. An important improvement to the Chicago 21 plan was the expansion of the study area to include the dozen or so communities immediately adjacent to the Loop whose characters could be affected by proposed changes in the central business district. Each neighborhood was treated with an eye towards the specific needs of its populace, which, given the diverse social and economic make-up of Chicago, meant that the planning document was in many ways a collection of smaller, independent but linked neighborhood plans.

fig.38
New development prototype encouraging vertical mixed-use planning.



Another significant difference between the two plans is that by 1971, the desire for mixed-use development, which had been at best implicit in the earlier document, is made explicit and central to the concept for the future city.

> Future urban form should be more heterogeneous and complex. Residence, work, recreation, goods and services should be brought closer together. The life support systems of the City will thus become increasingly efficient in their use of resources and in their distribution of services and benefits to people.[3]

Coupled with this shift in zoning ideology was the increased interest in the vertical integration of functions within and across taller buildings. A new development prototype suggested that new buildings should be designed as networked spaces, with public functions such as commerce and entertainment on the lower levels and offices, then apartments above (fig.38). Where possible, these building microcosms would connect via skywalk to each other, thereby expanding the urban network. The hope was that this multi-use approach to buildings would foster a new urban vitality by bringing non-business hour activities into the downtown Loop.

Nestled in this discussion of new construction is a small section discussing the historic preservation of culturally and historically significant buildings and neighborhoods. The document identifies only two areas worthy of protection within the Loop: the stretch on Michigan Avenue that faces Grant Park and the lake; and the LaSalle Street corridor, where many Chicago Style buildings still stand in jeopardy of being razed in the name of progress.[4] A handful of other areas in the surrounding communities are noted, but without any specific instruction or future goals.

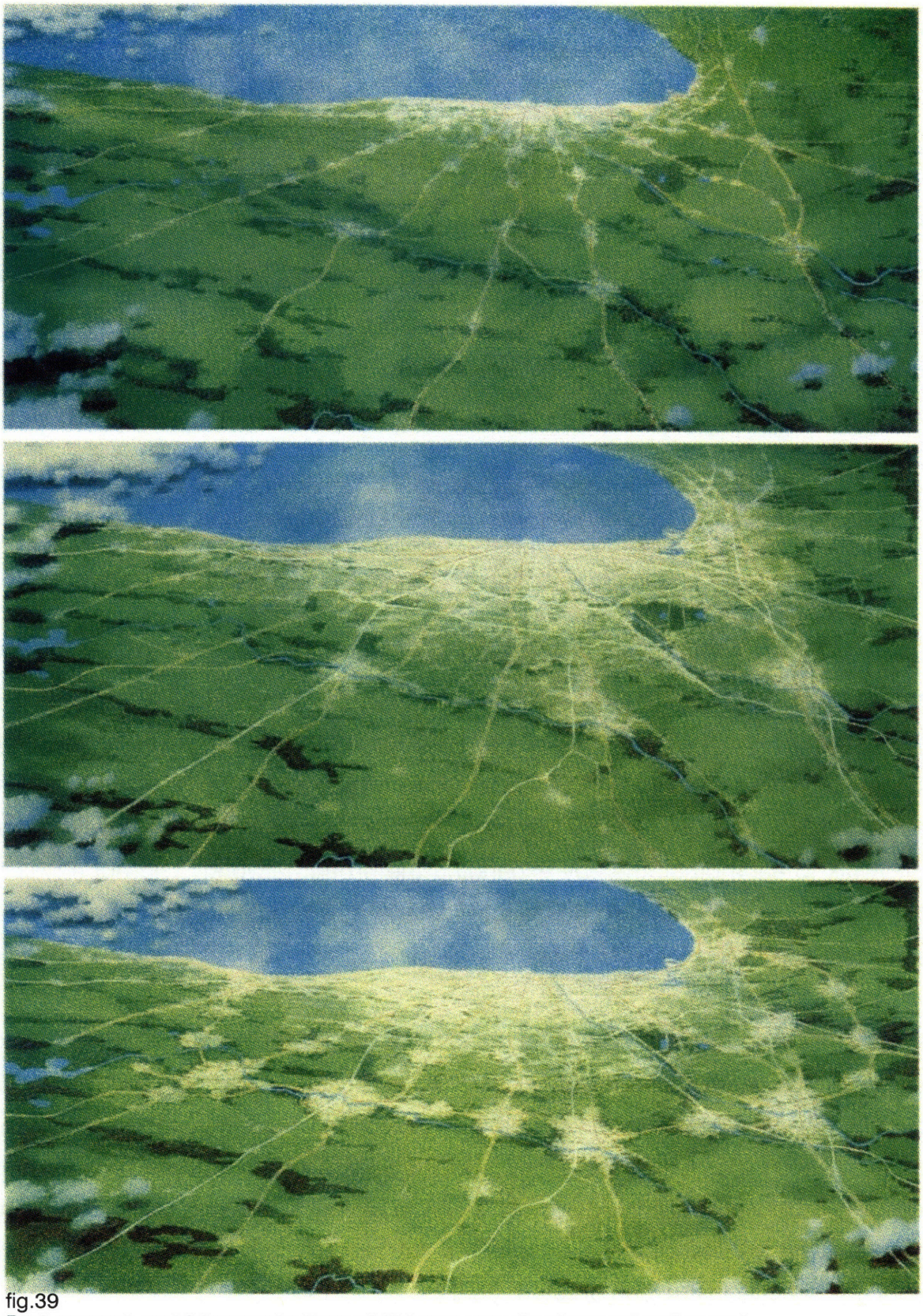


fig.39
Past, present, and future projections of Chicago-area development and sprawl.

Skipping forward three decades to the most recent Central Area Plan for Chicago, this time under the mayoral leadership of Richard M. Daley, reuse and preservation have become much more important tactics for the city's development. One of the major guiding themes of this plan is a commitment to the environment – a commitment that shapes the issues of transportation and mobility, open spaces, and land zoning management. The Plan notes that in the 30 years between the two plans, many of the industrial facilities near the Loop had become obsolete and had already been converted into new uses such as residential, commercial, and so on. The benefits of reinhabiting these sites are encouraged as they ensure that the boundaries of the city do not expand uncontrollably, leaving vacant lots and shriveled tax bases behind (fig.39). While the plan suggests that most new development should target infill sites, the 20 year projections show a general growth of the Loop beyond its current boundaries.

The Near West Side, which is the neighborhood directly adjacent to the Loop across the southern spur of the Chicago River is targeted for loft-style development and continuing adaptive reuse strategies. Unlike the urban prototype presented in the Chicago 21 Plan, the current approach to community building is based much more on the street. This is especially true with regards to the renewed efforts made towards the promotion of a riverside green walk, urban pocket parks, and the lakefront park system. Also stressed in the city plans is a focus on cultural development within the city.

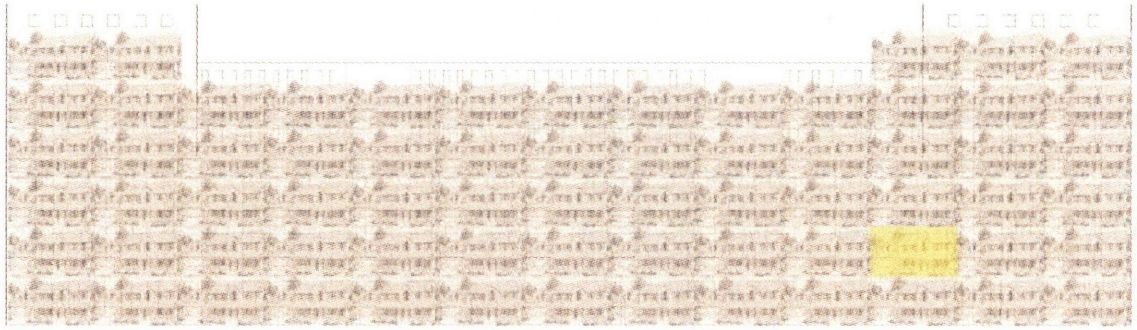
The context study shows that the Post Office is located in a very complex location. It is sandwiched between two very different urban typologies (tall vs. residential) and is itself a third (monumental). It straddles a major urban axis and is a literal gateway to the city. These factors must be considered when proposing a plan for reuse. Also, the values of the city and its residents – reflected in the successes and mistakes recorded in the plans of the last century – should be heeded.

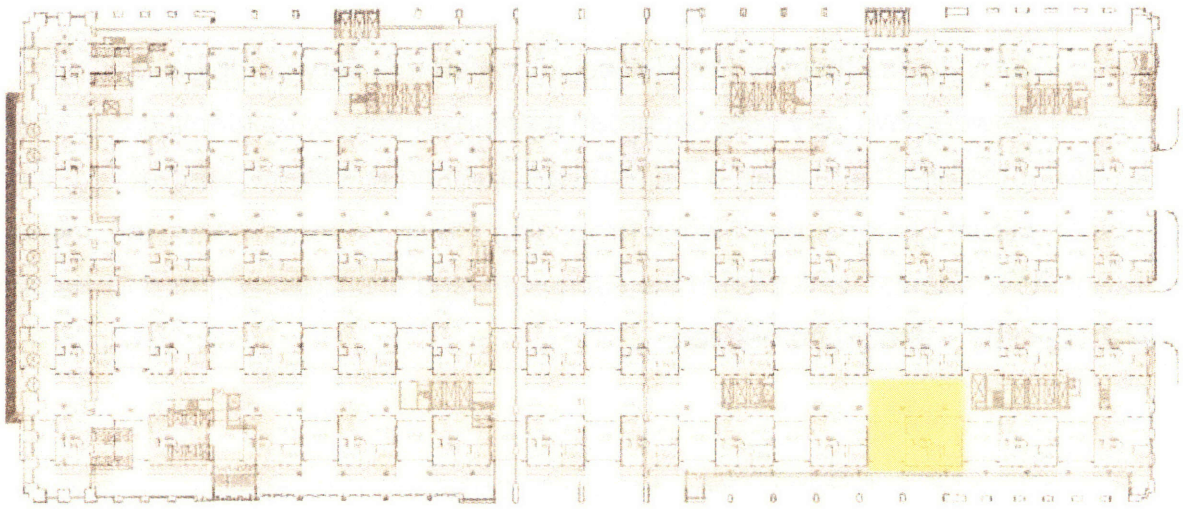
[1] The Great Chicago Fire In Eyewitness Accounts and 70 Contemporary Photographs and Illustrations. Compiled and edited with an introduction by David Lowe. Dover Publications, Inc.: New York, 1979. pg.86
[2] Burnham, D. and Bennett, E.. *Plan of Chicago*. Da Capo Press: New York, 1970. pg.2
[3] *Chicago 21: A Plan for the Central Area Communities, a summary*. Chicago, 1973. pg.10
[4] Chicago 21. pg.85

Scale Studies

In an attempt to understand the scalar implications of designing about 2.5 million square feet of space, conducted a few qualitative tests, overlaying some familiar objects onto the Old Post Office's plan and section. The results of these tests are shown below.

The Typical American Home





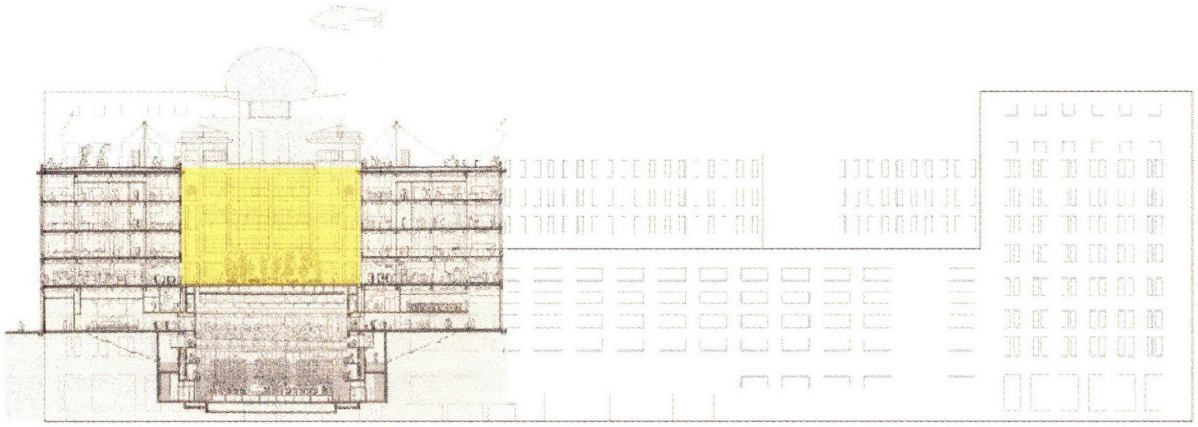
I was able to roughly overlay 780 typical American homes onto the 2.5 million square foot Post Office. The average home accommodates three residents in 3200 square feet. Under these conditions the Post Office could house about 2350 people, more than doubling the population of the Vatican City. If each unit were to sell for the going rate in this area of Chicago, the redeveloped building would be worth about $300 million.

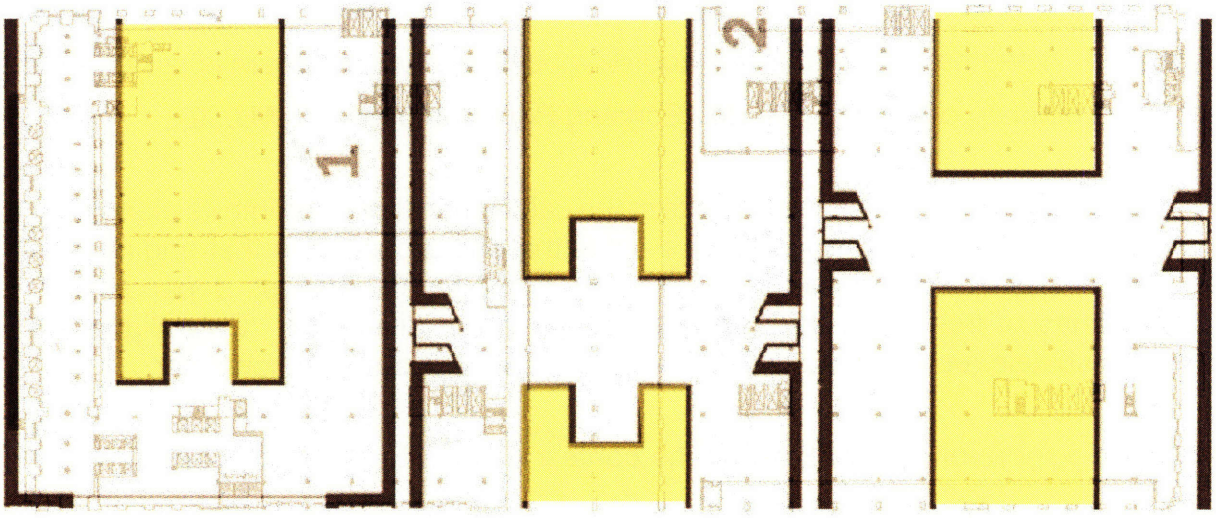
What this analysis most shows, however, is the undesirable monotony and overcrowdedness that would result from redeveloping this building in the model of the loft conversions that dot the northern spur of the Chicago River and parts of the Near West Side. It seems clear that a well-coordinated diversity of program is essential when tackling a building of this magnitude. Echoing Rem Koolhaas in *S,M,L,XL*:

> A paradox of Bigness is that in spite of the calculation that goes into its planning – in fact, through its very rigidities – it is the one architecture that engineers the unpredictable. Instead of enforcing coexistence, Bigness depends on regimes of freedoms, the assembly of maximum difference. Only Bigness can sustain a promiscuous proliferation of events in a single container.

Given the opportunity to work within the context of such Bigness, any design proposal should take advantage of the potential for this kind of diversity.

The Lingotto Factory, Torino



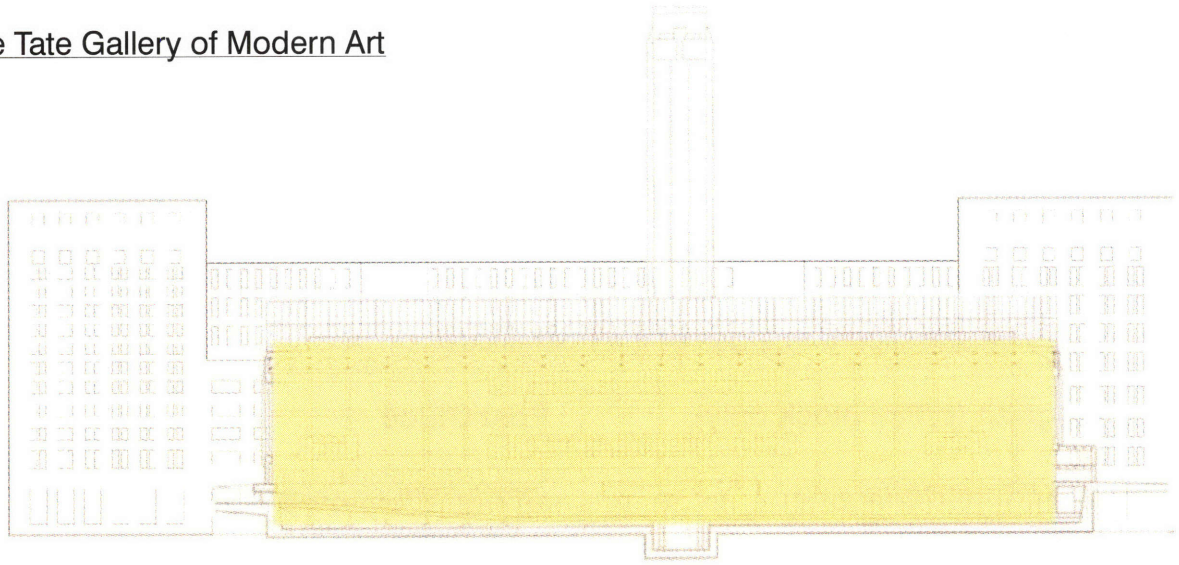


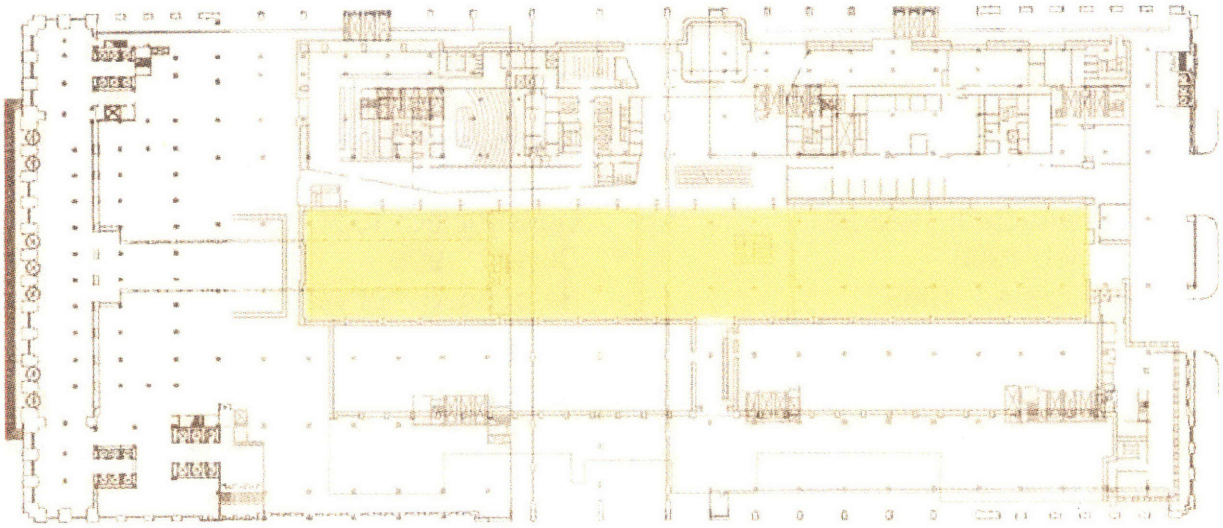
When analyzing the overlay of Renzo Piano's Lingotto in Turin, it is helpful to compare some of its vital statistics with those of the Post Office.

Lingotto (office block only)	**Post Office**
18'x18' structural grid	45'x30' structural grid (varies)
c. 35 million cu ft	c. 50 million cu ft
Length = 1663 ft	Length = 781 ft
Width = 262 ft	Width = 341 ft
Height = 86 ft (above ground)	Height = 186 ft
Typ. floor height = 15 ft	Typ. floor height = varies 12' - 28'
c. 32% floor area is void	c. 1.5% of floor area is void
Employees: 30,000	Employees: 4,500
Constructed: 1922-23	Constructed: 1921, 1932
Closed 1982	Closed: 1996
Re-opened: 1989	Re-opened: not yet

If the Post Office is to be redeveloped for human use, about 30% of the building should be voided to allow for light and air penetration. In order to make these voids or light courts more effective, the height of the Post Office should be carefully altered. That is to say, functions that do not require natural light (i.e. parking, theatre-going, film screening, etc.) should be located in such a way as to "boost" up all other spaces.

The Tate Gallery of Modern Art





The analysis of the Tate Modern, designed by Herzog + de Meuron, demonstrates the importance of leaving room for the approach into a grand space. The overlay shows that the Tate fits amply into the shell of the Old Post Office, and in fact, the interior volume of the Post Office is about 13 times that of the Turbine Hall. However, as any visitor to the Tate will aver, the experience of the Turbine Hall does not begin at the wall of the building. The long downward ramped approach from the western plaza plays a large part in drawing the visitor in through relatively low doors, then dramatically opens up into an enormous space, 520 feet long, 70 feet wide, and about 100 feet tall. The choreographed urban landscape, despite its position outside the walls of the museum, are clearly indispensable to the experience of the space. The bigness of the Post Office provides the opportunity to design a monumental space, and the importance of the surrounding urban landscape in guiding the experience is something to keep in mind.

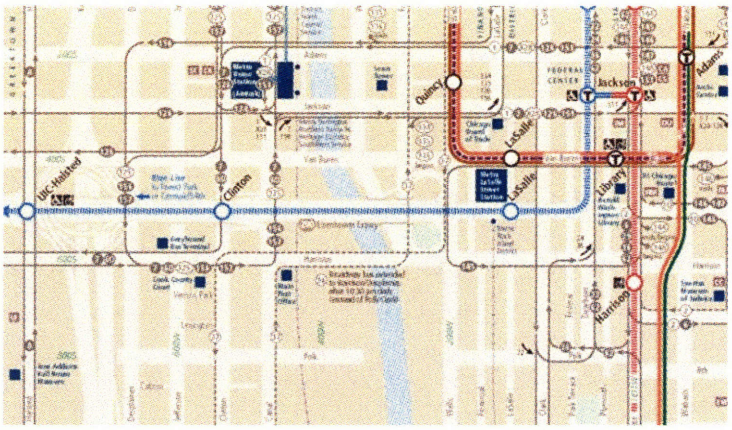
Program Considerations

The major factors to be considered in the programming of the Old Post Office for reuse are economic viability and social sustainability. One way to investigate what sorts of activities will be successful in the revamped space is to look at the goals that Chicago has set for itself with regards to the businesses it supports and the cultural activity it promotes. There is no question that a project of this size must be of mixed use if it is to become an active participant in downtown life both day and night. The challenge now is to suggest a more specific model for development.

With a project of this size, the biggest hindrance to redevelopment is funding, both in terms of starting capital and steady income once built. Greg van Schaack, Senior Vice President of the Hines Property Management Group – currently responsible for the maintenance and development of the Old Post Office – noted that while there are some companies who have expressed interest in having a stake in the redevelopment of the space, none have committed financially because of the uncertainty involved. Because of the historic nature of the building and the need for asbestos abatement, the redevelopment time frame is not as clear-cut as new construction would be. Also, each company is hesitant to fully commit to the project without knowing exactly whom they will be sharing the building with.

Given Chicago's booming business and tourism sectors, the most reliably profitable program elements would be a hotel and office spaces. The site is ideal for both due to its

fig.40
A map of public transportation links in the neighborhood of the Old Post Office.



proximity to Union Station two blocks to the north and plenty of CTA bus and train stops within walking distance. Also, the Post Office is big enough that a portion of it could be reserved for parking purposes. As far as accessibility is concerned, the building is ideal.

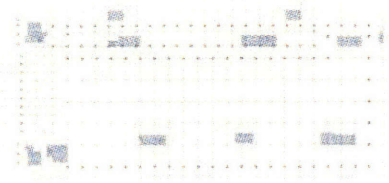
For the redeveloped Post Office to be a vibrant part of the local community, however, it will need to provide services not just to the temporary visitor and the commuter. Therefore, some other programmatic element – commercial, cultural or educational – that engages permanent Chicagoans is required. A look at Chicago's business and entertainment communities reveals an interesting link between the two that suggests a potential candidate.

The Arts and Business Council of Chicago "supports hundreds of non-profit arts groups by strengthening the management of their organizations through educational programs and business services."[1] Established in 1985, this group provides volunteers from the business sector to help nurture non-profit groups that focus on the arts. The Arts Bridge goes a step further and is an arts-related business incubator, that offers affordable furnished spaces for lease, lessons in marketing and grant-writing, and general technical support for budding arts businesses. Providing a home for these groups in the Old Post Office would help diversify the program greatly, as the artistic production of these arts groups could engage the local community in the form of theatre performances, film screenings, gallery shows, and commercial spaces.

[1] http://www.artsbiz-chicago.org/

The Design Strategy

A Plan in Seven Moves



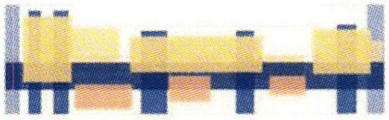
Existing Plan

Structural Perimeter

Elevator Cores

'Thick' Roof

Towers



Performance Spaces

Circulation w/i Roof

Public Circulation

Proposed Plan

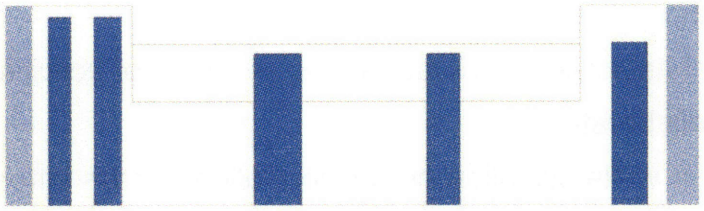
This design proposal takes an urbanistic approach to the reuse of the Old Chicago Post Office. The seven steps shown here can in some regard be equated to the laying out of major and minor roadways as well as public and private function in a small town. The primary goals of the resulting master plan are:

- ... that the proposal be sensitive to the historic nature of the building not merely by preserving its skin, but also by maintaining some of its scale and monumentality.
- ... that the proposal afford a point of transition between the two very different urban typologies found in the Loop and in the Near West Side.
- ... that the plan take advantage of its scale to facilitate a diverse range of activities and present the potential for collaboration.
- ... that the plan invite the public in while still allowing for controlled access where needed.
- ... that the plan be aware of its social, economic, and environmental impact on its surrounding community during its construction and use.
- ... that the plan allow for phased development.

These seven steps are a conceptual template and an amalgamation of the four reuse typologies discussed earlier in this document.

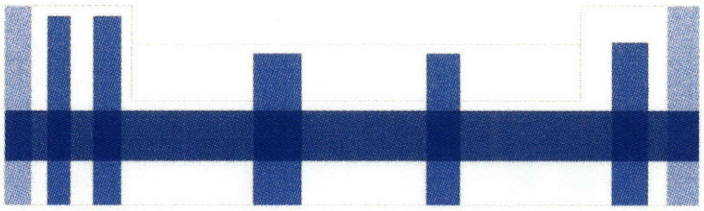
Structural Perimeter

The structural perimeter is maintained to provide a supporting frame for the historic facade. This frame may require strengthening to sufficiently account for wind loads. This step creates a buffer zone between the old fabric of the building and any new spaces proposed. As such, it follows the old shell – new kernel typology and accordingly may afford increased climate control to the interior spaces without need for heavy modifications to the facade.



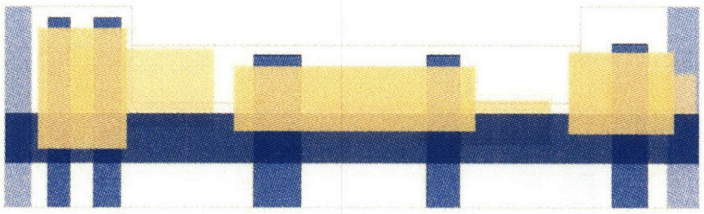
Elevator Cores

The elevator cores are kept as the primary vertical circulation mechanisms for the building. They are in good working order, well distributed across the plan of the building, and they also serve the important structural function of shear resistance. Additionally, it is expected that this decision will have beneficial environmental and economic impacts on the project by reducing the amount of new material that will have to be invested in the redevelopment.



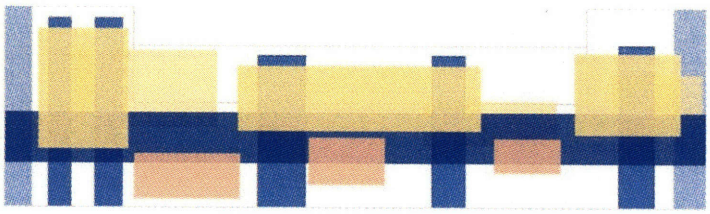
'Thick' Roof

The building is divided vertically into three zones, each intended to have its own spatial and functional logic. The central zone is the 'thick' roof. The top surface of this roof is 100 feet (with slight variations up and down) above street level and provides a new landscaped ground plane within the walls of the old building. The lower surface varies in elevation from as low as 20 feet to as high as 80 feet. All functions open to the public are housed below this roof volume, where the existing structure is retained except for a large atrium about 130 feet wide and almost the length of the Post Office. Access to the spaces above the new roof, on the other hand, are controlled. The public area mimics an old kernel – new shell typology, whereas the private areas take on a vocabulary that is more akin to the typology of addition.



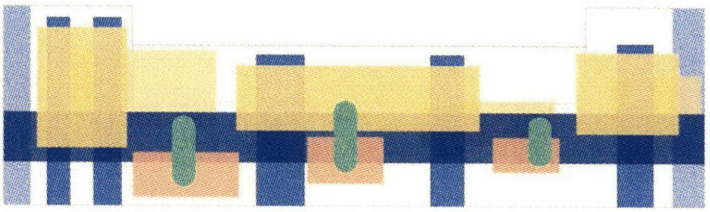
Towers

Above the new roof plane, new tower volumes are circumscribed, and all the original steel that does not fall within their boundaries or within the boundaries of the structural perimeter is removed. This results in an interior urban landscape, dotted with vertical towers, bridging the urban typologies of the Chicago Loop and its environs. These towers are partially suspended in the volume of the thick roof below at various depths and each includes one or two elevator cores. This ensures that each tower is sufficiently serviced by the building's major circulation networks.



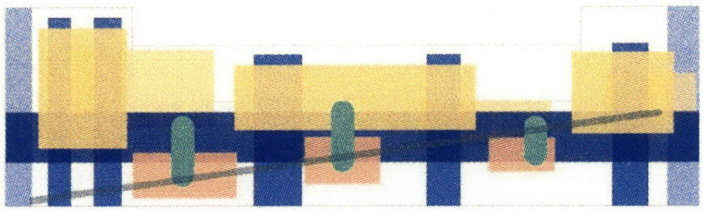
Performance Spaces

The theatres, gallery and public congregation spaces are in turn suspended below the roof volume, positioned in the gaps between the towers above. Their locations place them within the public domain and access to them is provided from the large central atrium. Back-of-house access which may require the moving of large objects such as set pieces, works of art, costumes, and so on are serviced by freight elevators.



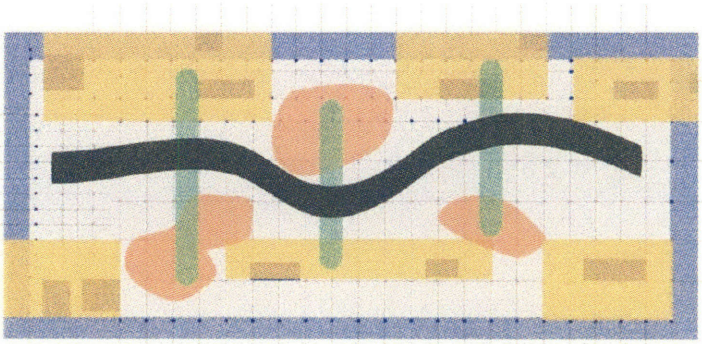
Circulation Within Roof

The purpose of the thick roof volume is to provide access between the public and cultural spaces below it and the private towers above. It facilitates a transition between the monumentality of the original fabric and the more intimate spaces above. The direction of movement is perpendicular to that of the large atrium below, running east-west across the shorter length of the building. Where the towers meet the roof, lobbies, restaurants and interior gardens can be planned to help navigate and inhabit the space, thereby potentially fostering collaborations between users.



Public Circulation

Intended as the continuation of the public street, this path of circulation begins in the historic lobby on the north side of the building, opens out into the large central atrium, and rises up through the roof volume until it reaches the new landscape above. Along the way, the public visitor has access to all of the performance and commercial spaces that line the atrium. Below the public corridor on the south side, parking facilities are provided.



Master Plan

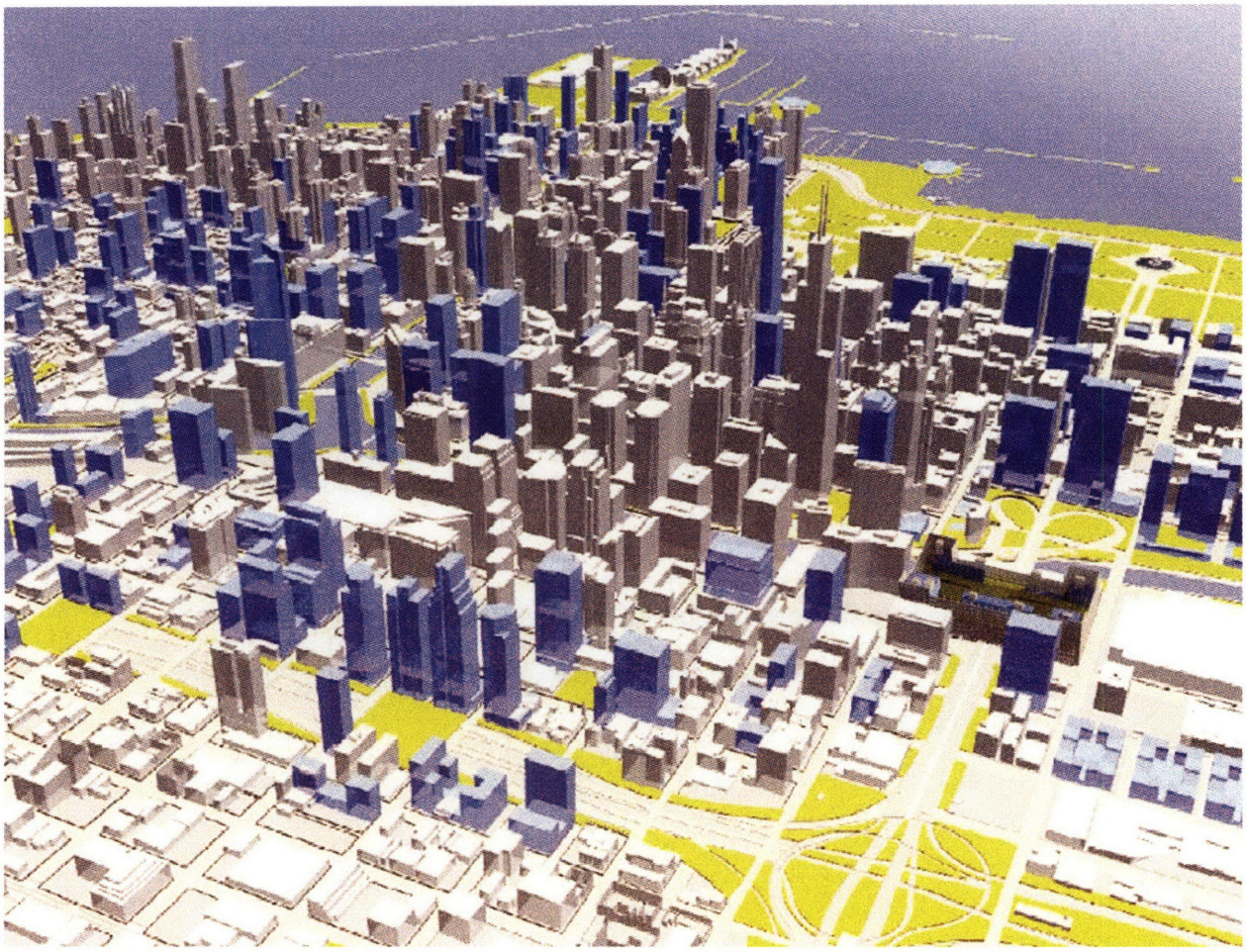
This image finally overlays the previous steps to reveal the spatial logic of the proposal as a whole and in plan view. Circulation is available in all three exes, and the concentration of function is immediately apparent. The nature of the towers as far as material enclosure or use remains flexible, allowing for the possibility of a phased and gradual completion of the project, which is critical to any project of this scale.

The Proposed Solution

Diagrams, Plans, Sections, and Views

This section contains the design documents developed using the strategy outlined above. The aim of each is outlined below.

- The bird's eye view of the redeveloped project shows the Post Office negotiating between two scales of urbanity.
- The exploded axonometric articulates in three dimensions, the forms of the elements proposed in the strategy.
- Each zone of the building (below, in, or on the roof, as well as within the structural perimeter) has a particular spatial characteristic, shown.
- The plans reveal a shifting structure, enclosure, and direction of movement as they move vertically through the building.
- The sections demonstrate the nature of habitation of the thick roof volume in both the long and short axes of the building, segmented in the former and continuous in the latter.
- The interior views highlight the difference in scale and experience provided by the new roof.
- Model photos show how the parking spaces, public spaces, performance spaces, and towers nestle into the existing structure of the building, creating differentiated spaces within the regular grid.



Redeveloped Post Office inserted into the predicted Plan of Chicago, 2010

Towers

New Construction Organized Around Existing Elevator Cores
Distinct Discipline Domains
Engage New Roofscape at Various Levels

Historic Skin

Existing Construction
Perimeter Structural Bay Retained for Structural Integrity
Buffer Between Old and New

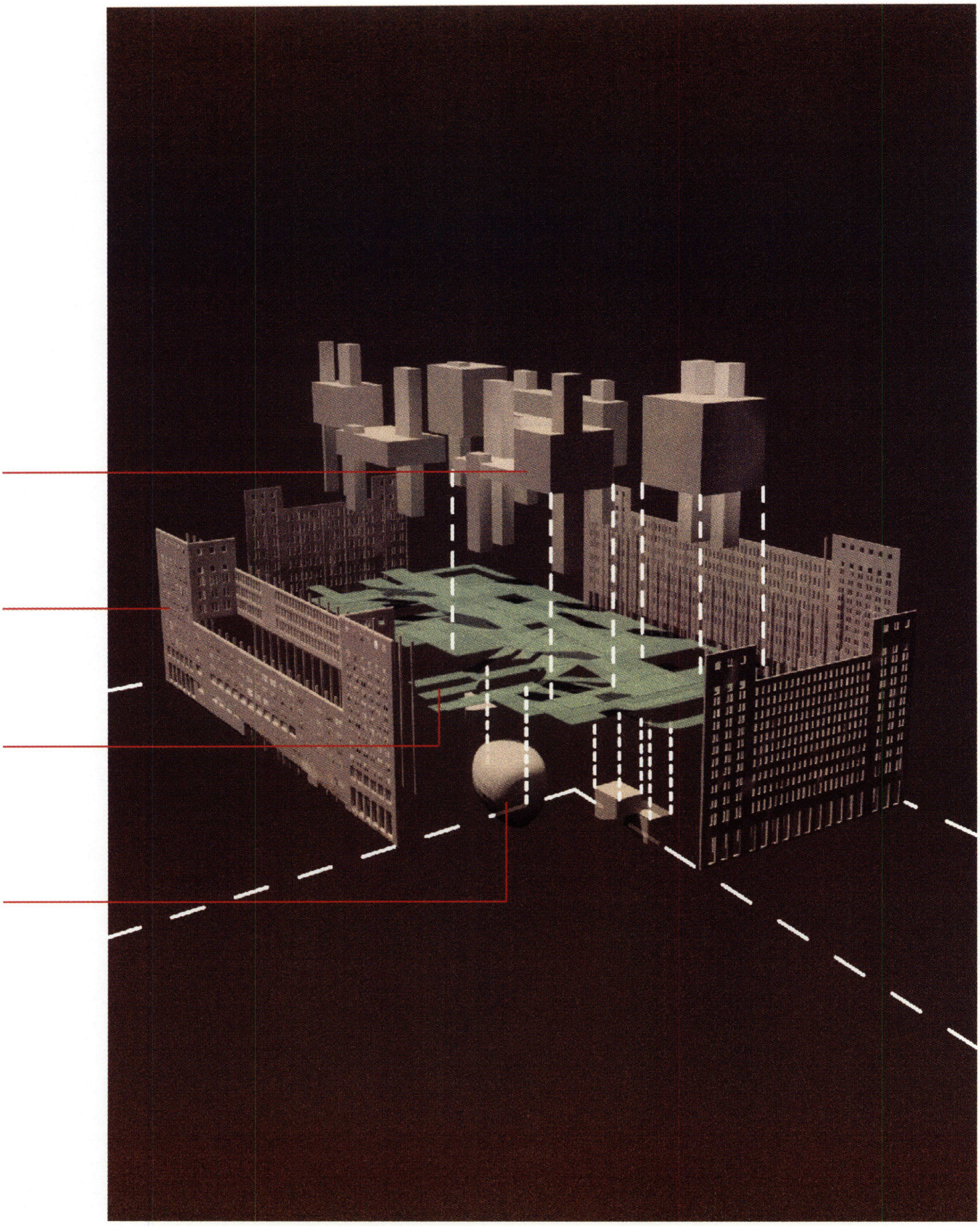
Inhabitable Roof

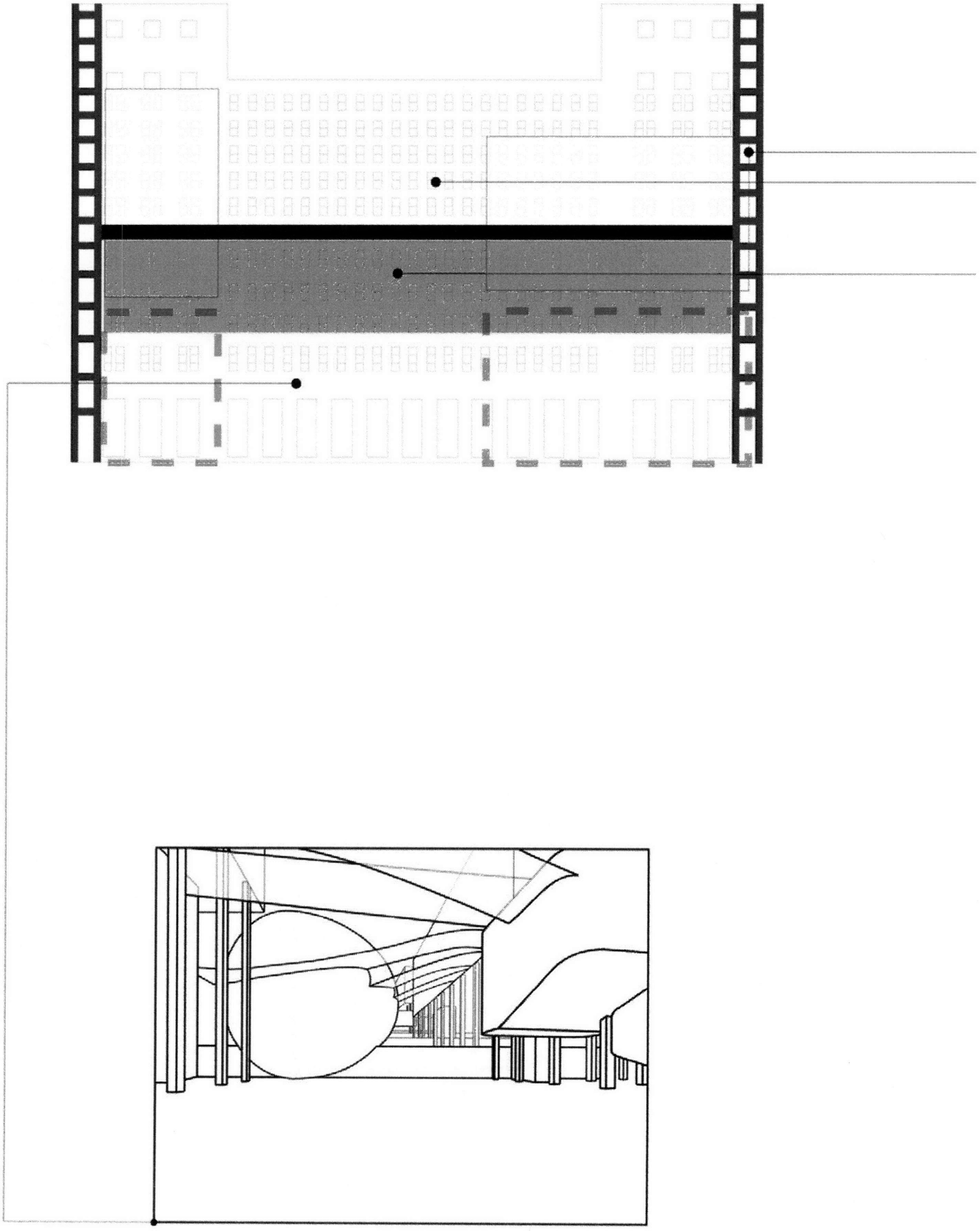
Top of New Roof at ~100ft
Roof Cavity Acts as Circulation Membrane
Undulations in Roof Strips Allows Access Between Components
Secondary Datum Allows Perception of Shift in Scale

Performance Spaces

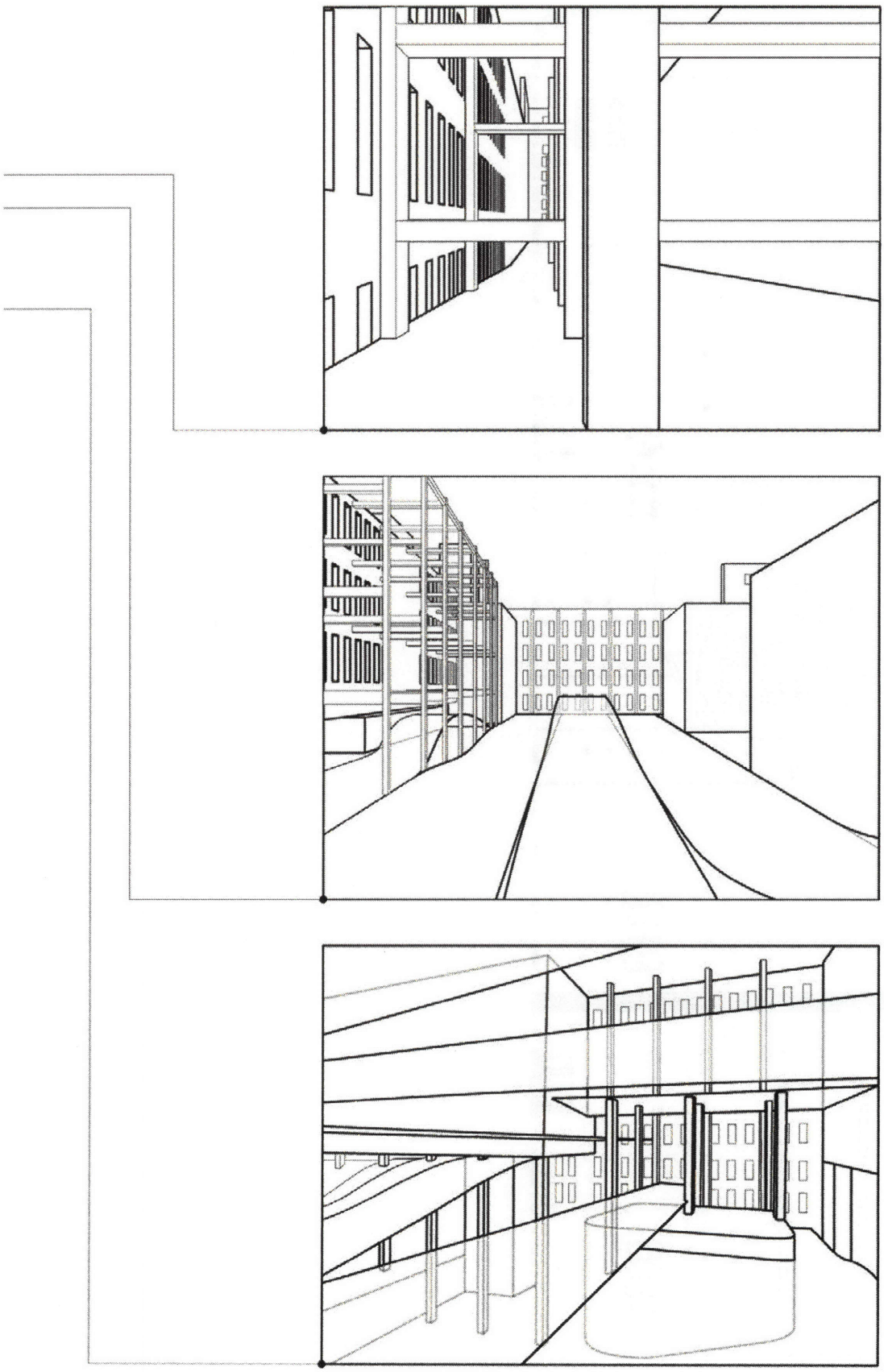
Embedded Between Discipline Domains, at Level of Public Access
Engage with Thick Roof
Facilitates Interface Between Disciplines and Public

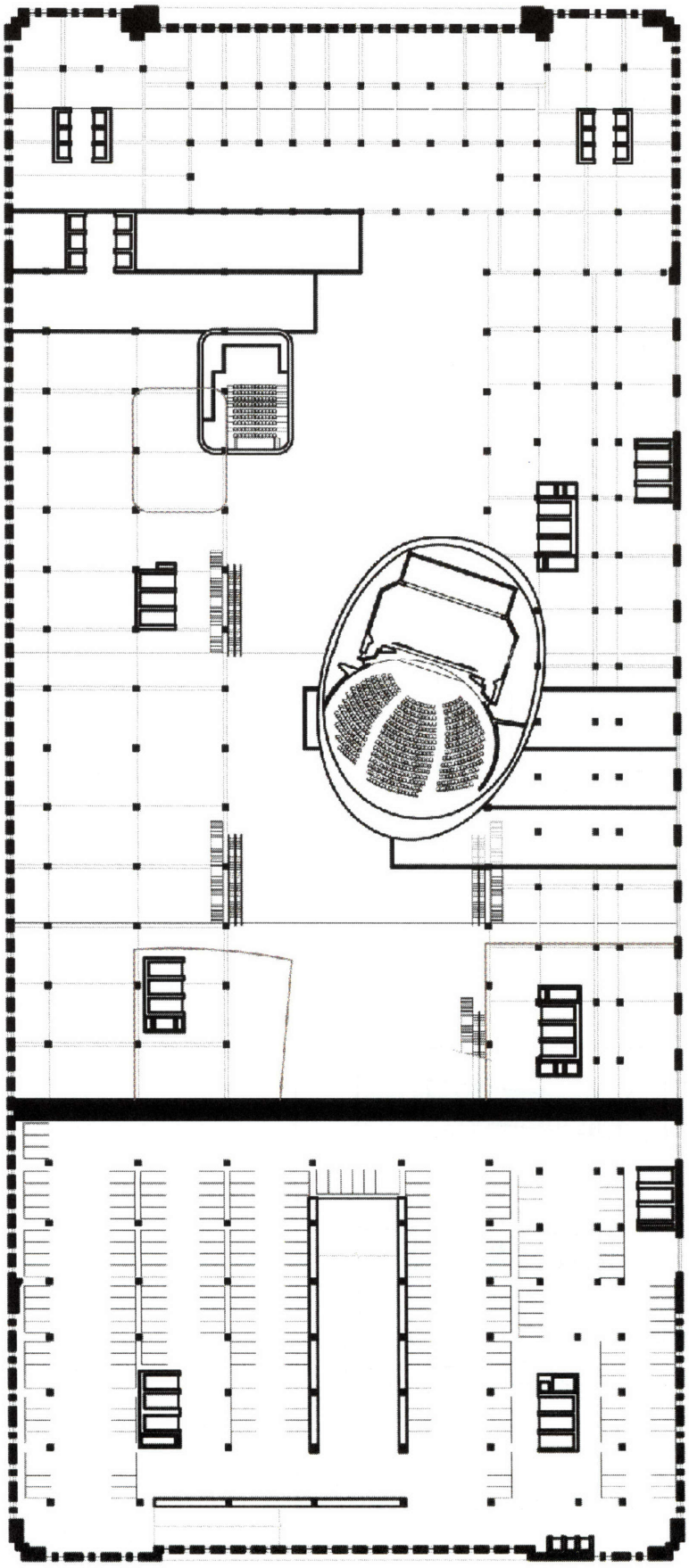
Exploded Axonometric Showing Proposal Components



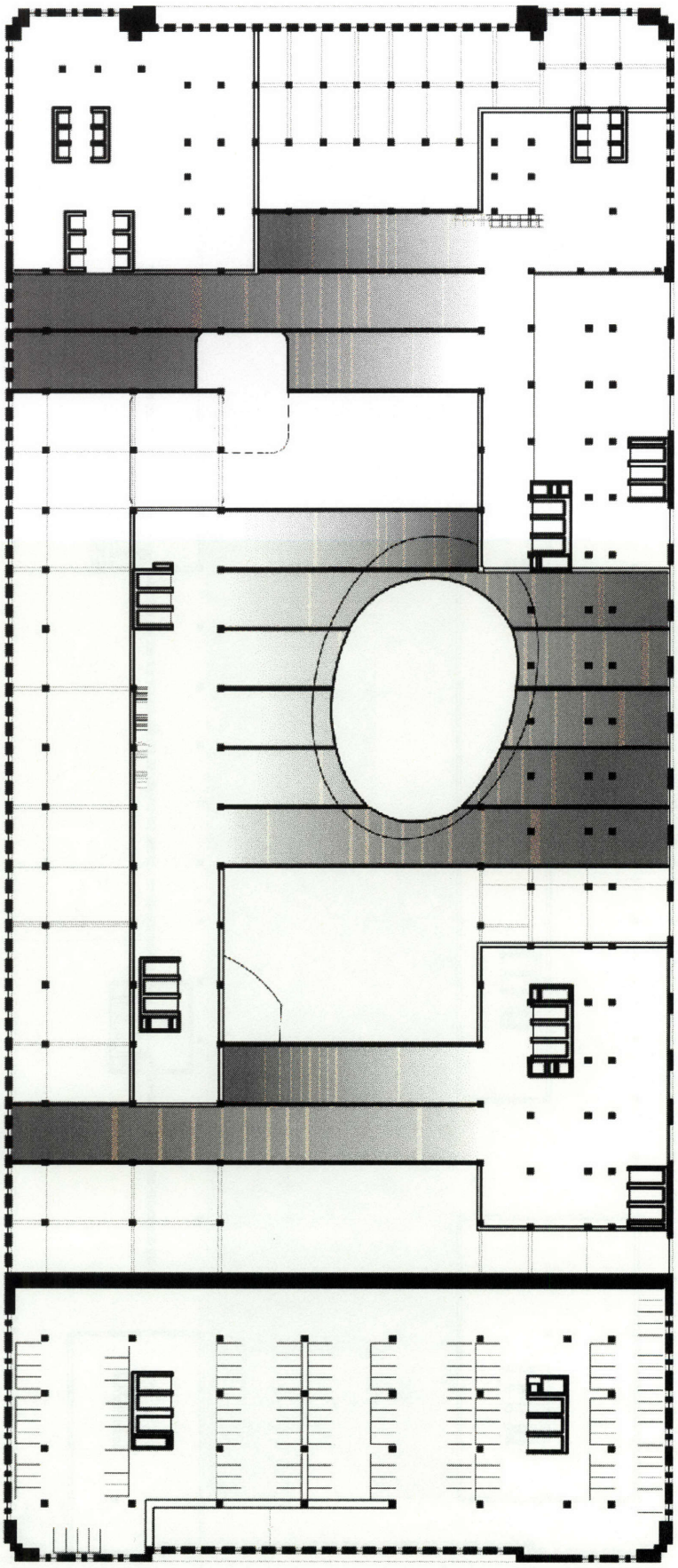


Typical Interior Views

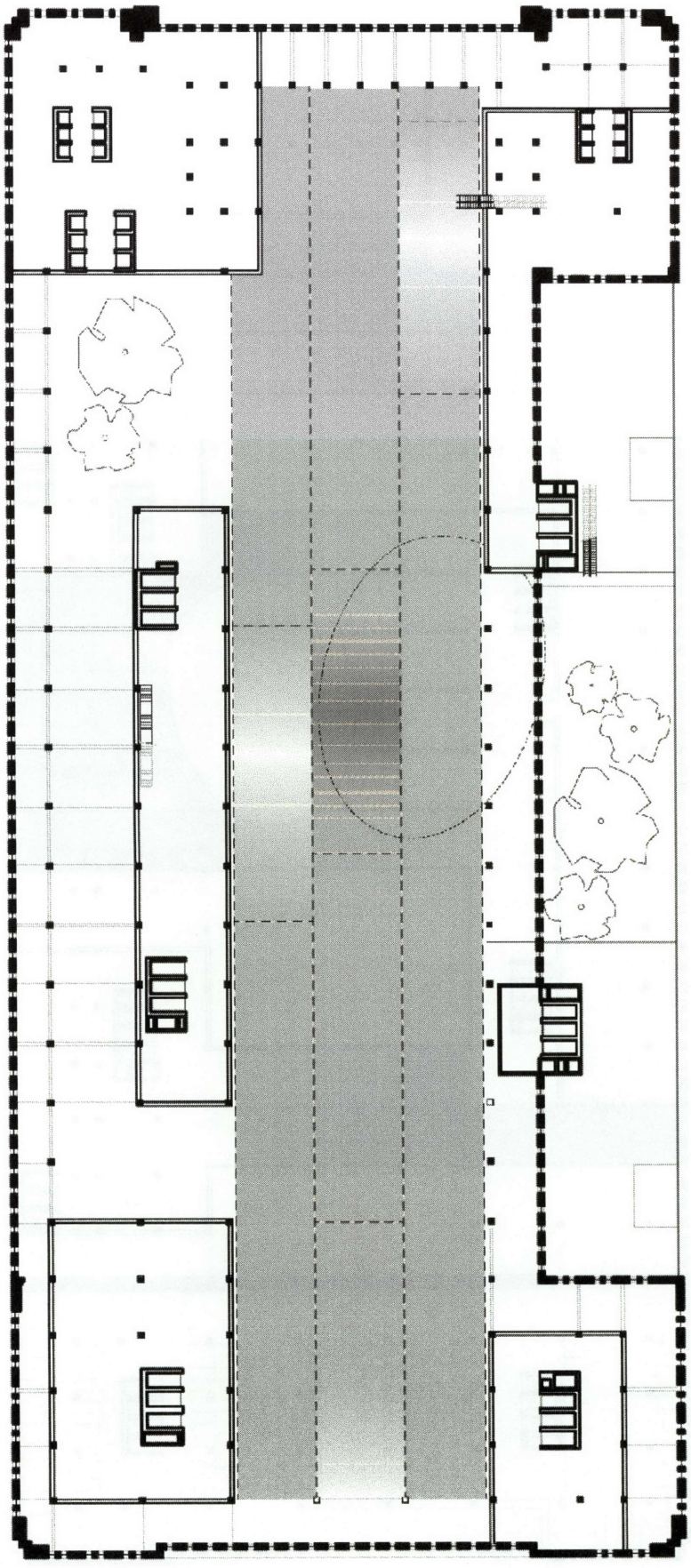




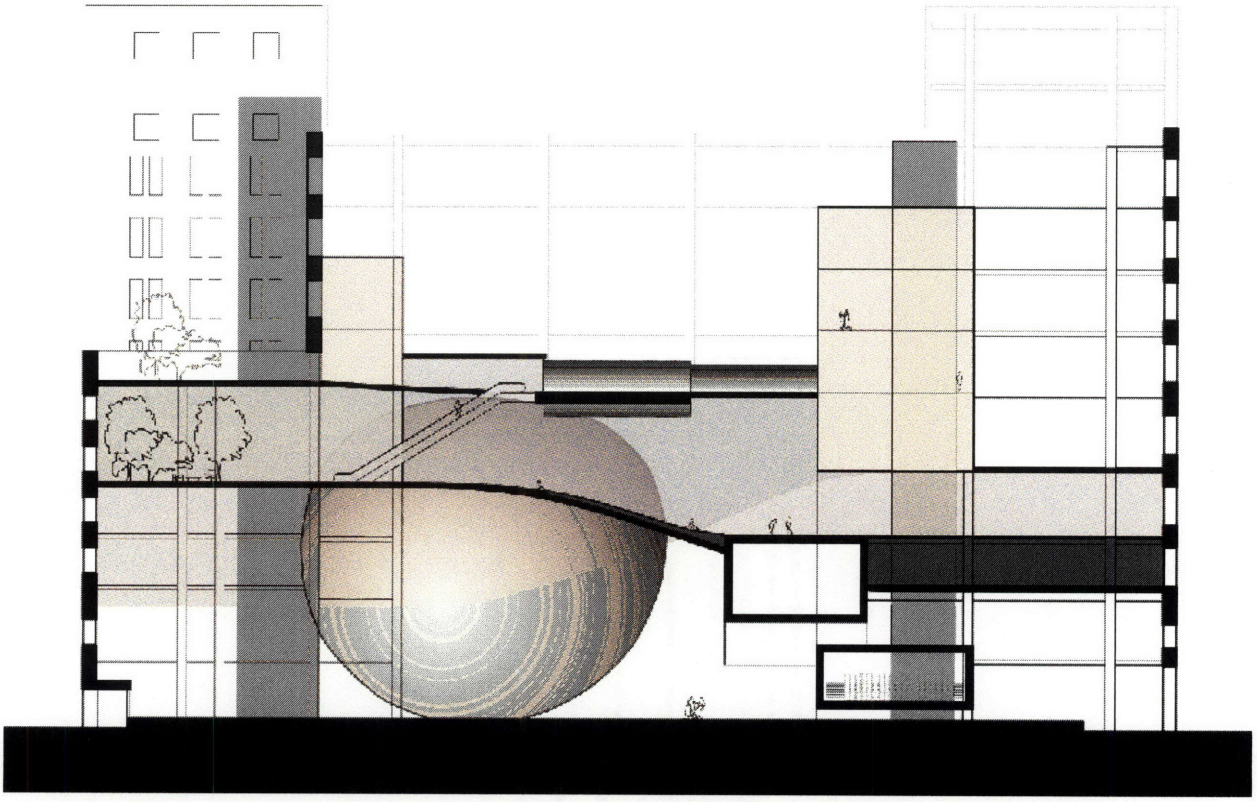
Lower Level Plan



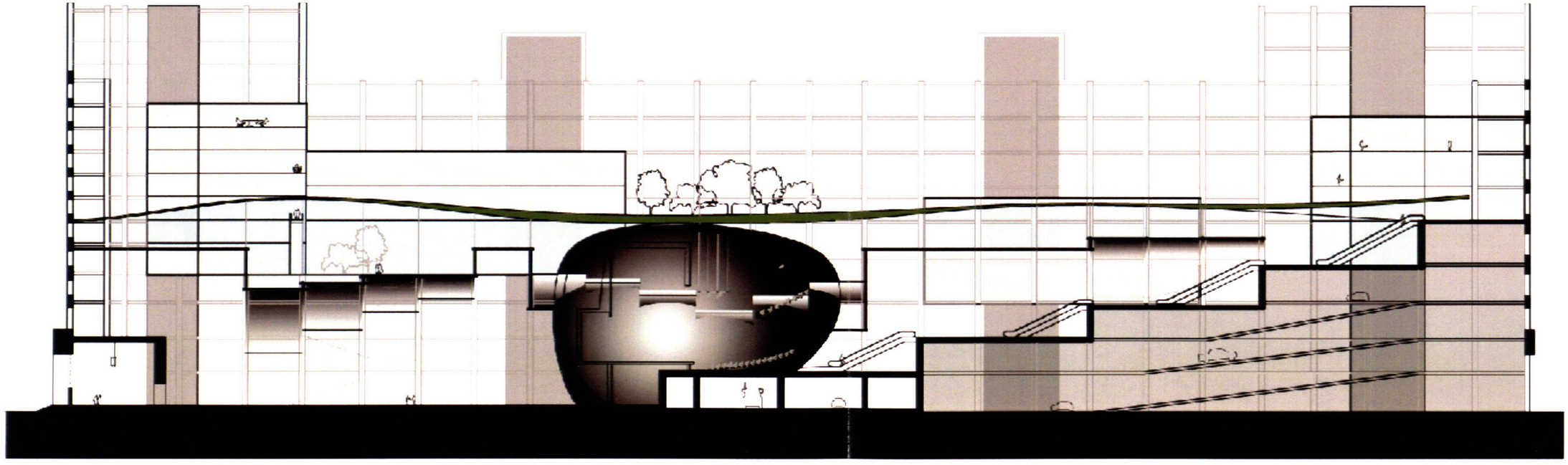
Plan w/i Thick Roof



Upper Level Plan

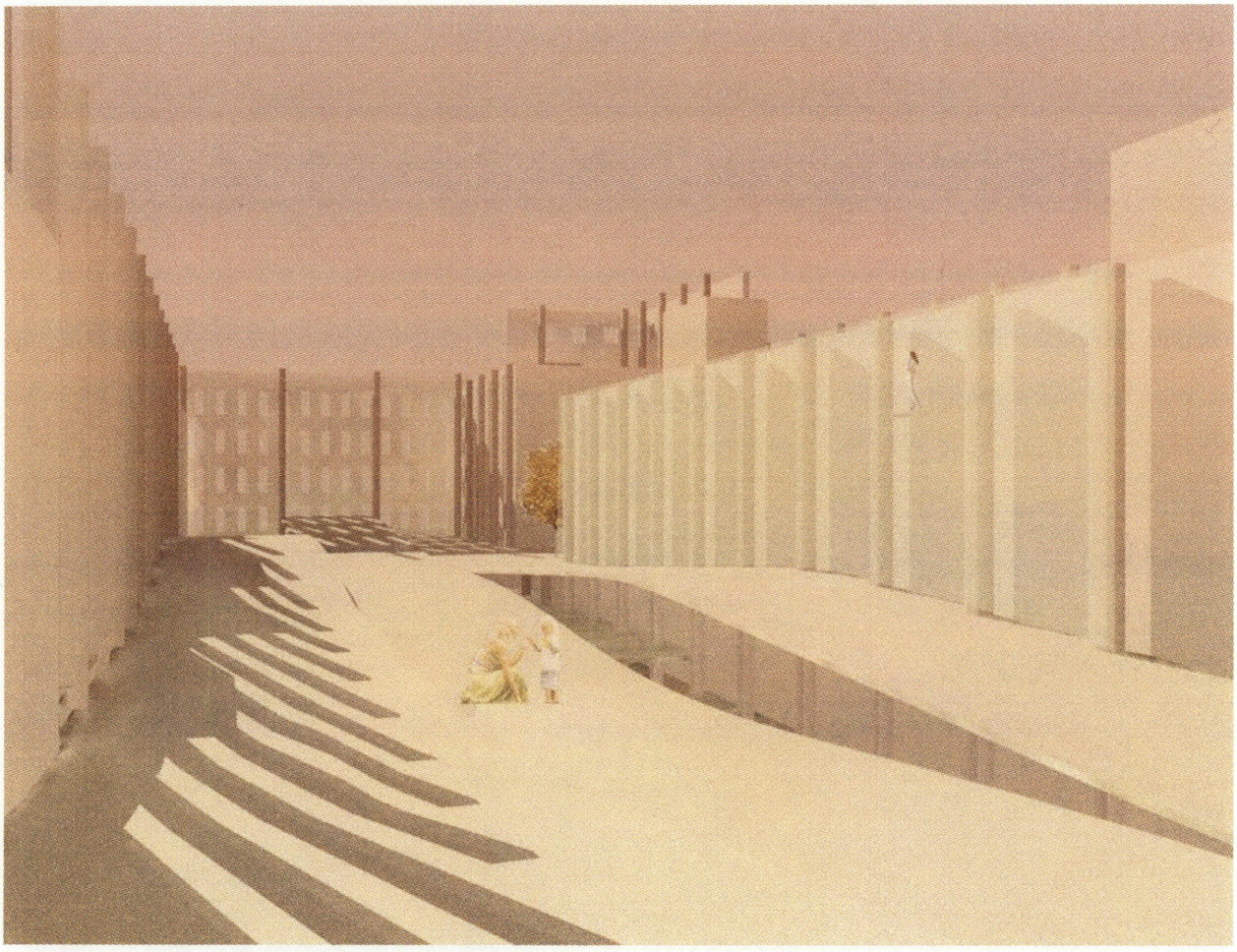


Short Section

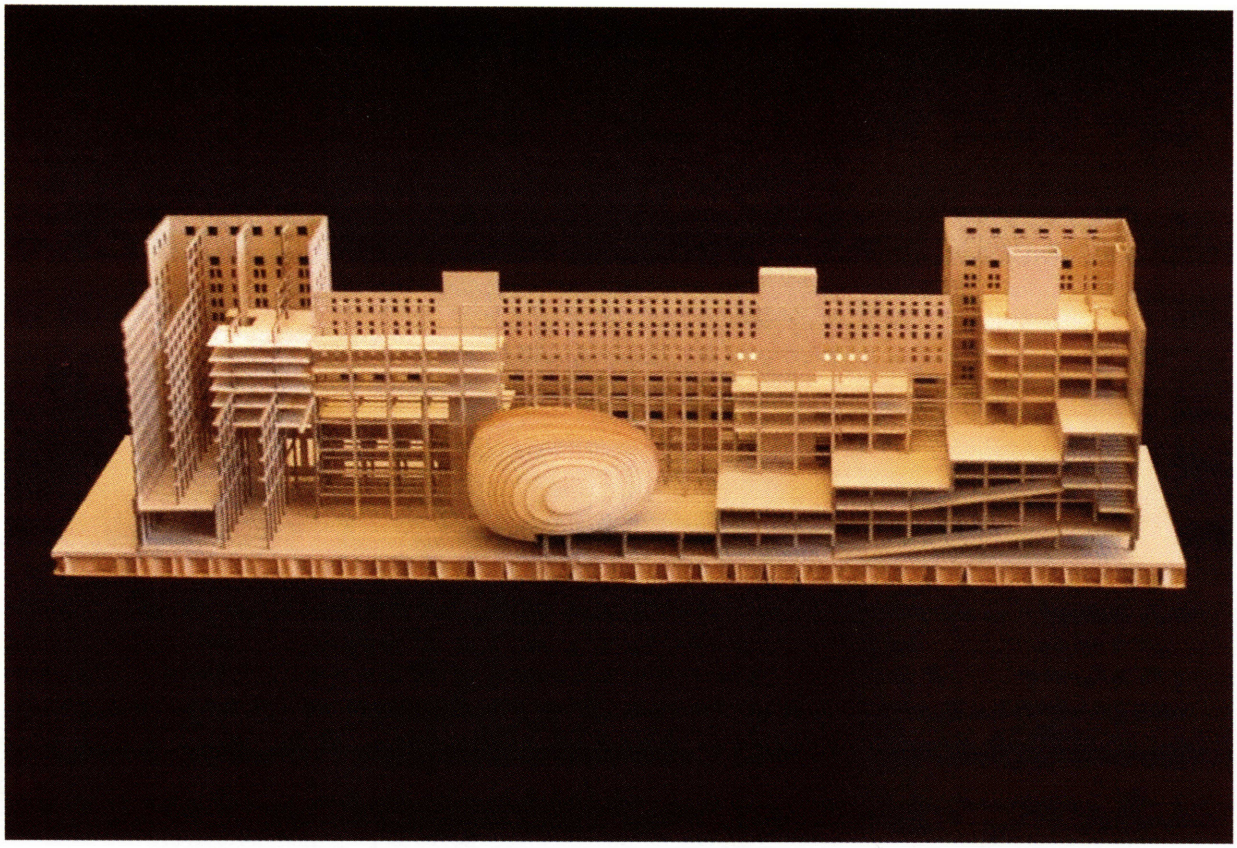


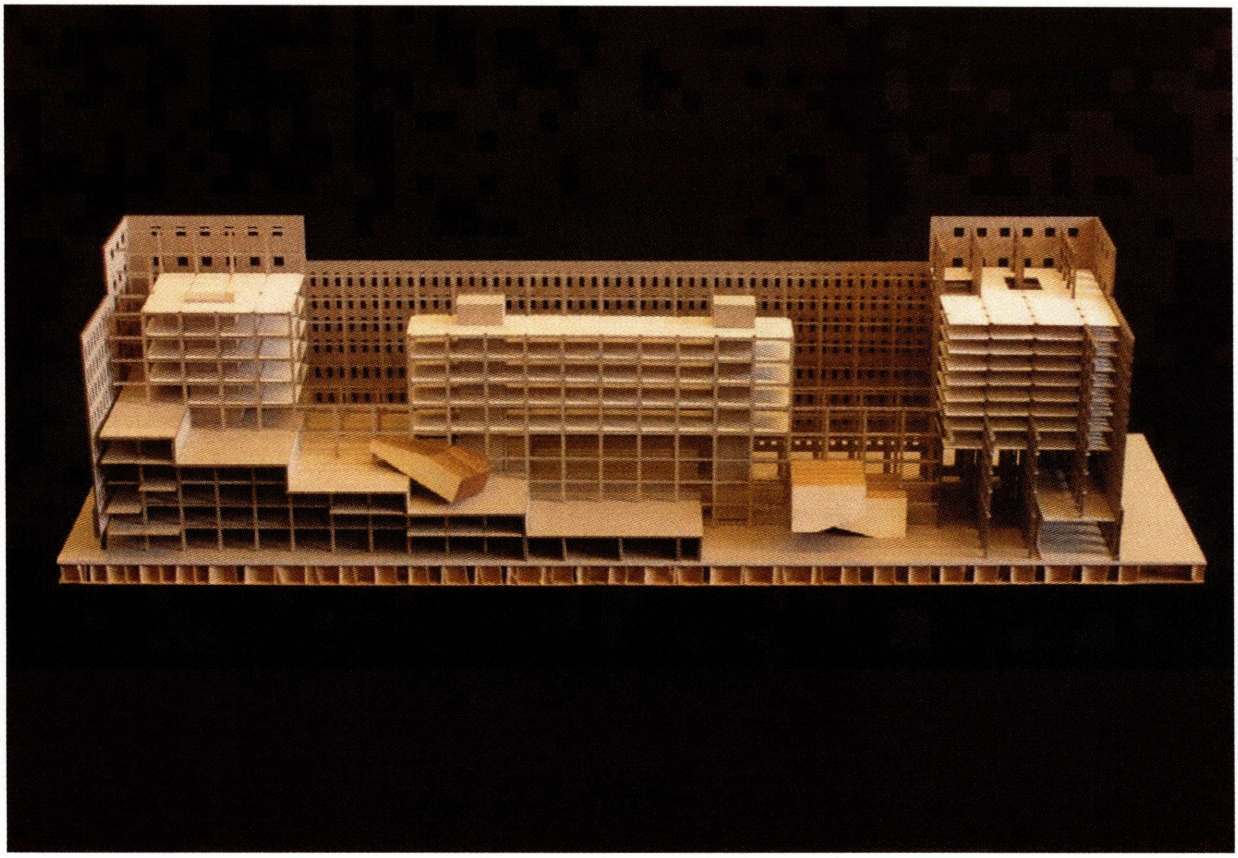
Long Section

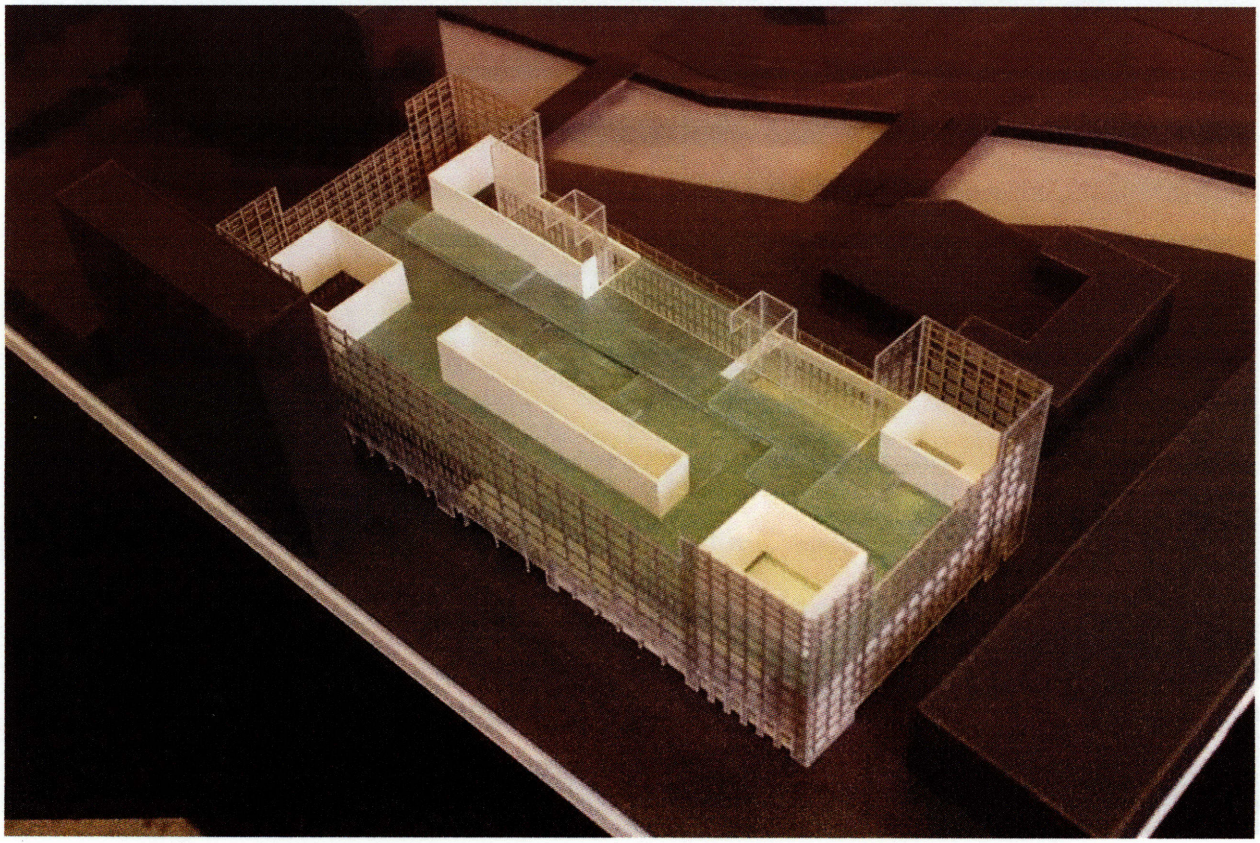
Interior View Within Thick Roof

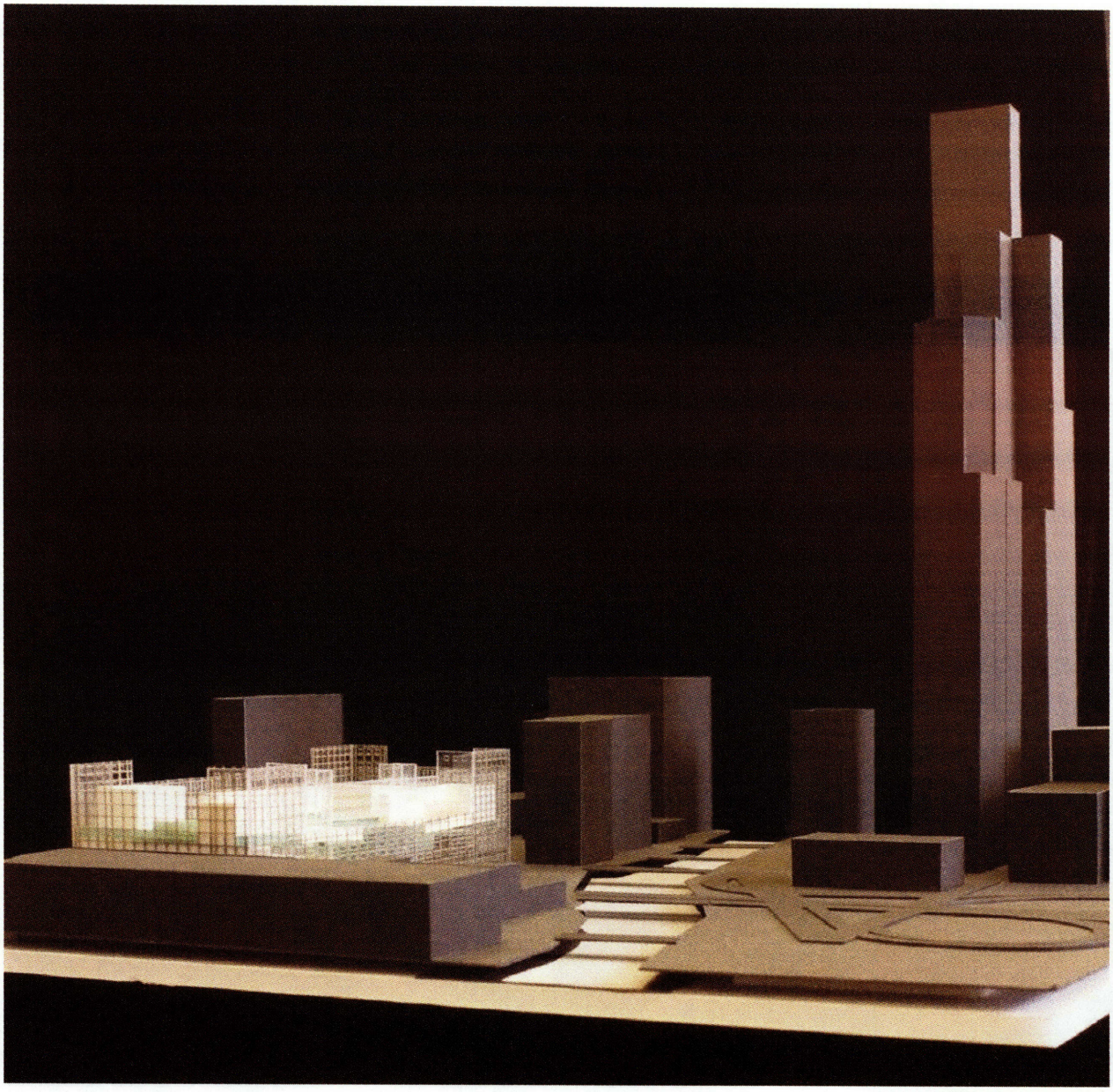


Interior View at Top Surface of New Roof









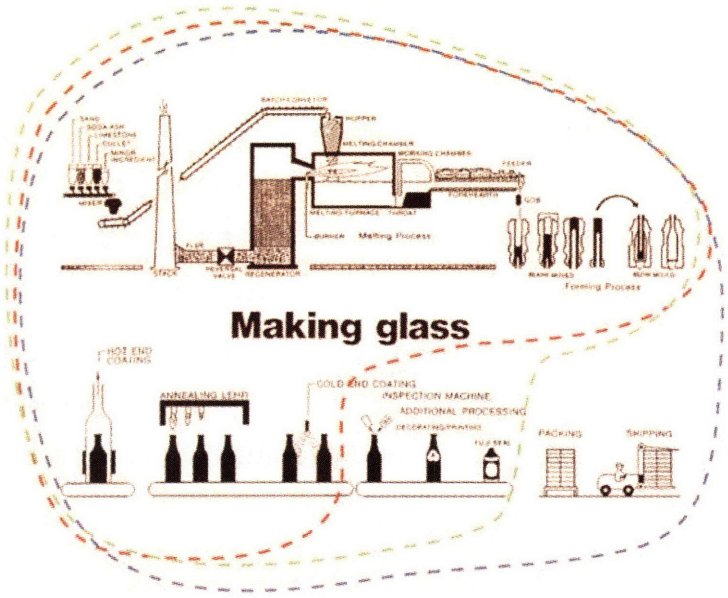
The Engineering Problem

Accounting for Reuse

Having gone through the exercise of devising an overall master plan for the reuse of the Old Post Office, it is useful to now look back at some of the original assumptions made about the environmental sustainability of the endeavor and try to quantify their effects. The qualitative argument for reusing a structure is that the energy and materials already present in the building are kept in service, thereby avoiding the generation of new material and energy burdens to achieve the same goal. The USGBC (United States Green Building Council) confirms this argument by assigning points to building reuse under the heading of *Materials + Resources*.[1] However, it can be argued that reuse may not *always* be the less impactful option over razing and redeveloping from a purely environmental (i.e. neglecting the social and economic) point of view. The particular case of the Old Post Office in Chicago cannot be extracted from its social, economic, and historical implications, but a typical large building that has no specific cultural or architectural significance can. Depending on the methods of demolition, the reusability of the component parts, the embodied energies of the existing materials, and so on, calculations may show that the avoided environmental burden of reuse is not significant enough to warrant the added coordination efforts required and the potential material and energy expenditures associated with that extra coordination. With this generic possibility in mind, this section estimates the avoided burden of the Post Office reuse proposed in the previous chapter.

There are a number of standards by which a building's environmental burden can

fig.41
The glass making process with three possible system boundaries shown.



be quantified. The most rigorous and internationally accepted one is the Life Cycle Assessment method, which compares equivalent products by tallying all environmental inputs and outputs that result from the production, transport, use, and disposal of those objects or assemblies. An LCA is typically very data-heavy and requires a significant effort to arrive at any sort of conclusion. While SETAC has defined some basic steps for conducting an LCA[2], it is critical to note that this methodology is still in its relative infancy.

> There is no single method for conducting LCA studies. Organizations should have flexibility to implement LCA practically as established in this International Standard, based upon the specific application and the requirements of the user.[3]

One of the most contentious aspects of the LCA methodology is that there is a lack of strict protocol, which allows an analyst to vastly influence test results to fit his or her needs by modifying the system boundaries or functional units of the problem, as well as by weighting the resulting output values according to subjective measures.

A perfect system boundary tallies all of the environmental effects resulting from the production of the object or assembly in question, going as far back as original resource extraction and as far forward as final disposal. In reality, pursuing a perfect system boundary is impossible, and many LCAs strike a closer boundary to reduce the actual

scope of the investigation (fig.41). Adopting the LCA methodology to assess buildings – which are essentially complex collections of multiple sub-assemblies – complicates the boundary issues significantly. Comparable building products may have radically different LCA outputs due to their method of production, their distance from job site, the machinery used during production and installation, and so on, rendering industry average data values inexact. Also, the way in which a building is designed and constructed can have enormous effects on energy use over the life of the structure. Should the analyst include the burden of future energy use in his LCA, or should he limit his scope to the materials that go into (and eventually out of) the structure?

A functional unit is the comparison criterion used in the LCA methodology. It is often based on function rather than product, and usually includes some measure of time. An example for a functional unit comparing different types of paint might be: one square foot of interior painted surface, over 20 years[4]. Life Cycle Assessments rely on well-formulated functional units to establish sensible comparative baselines against which to compare various product or project alternatives. When analysing an entire building, it is very difficult to define a single functional unit. Is it defined by the amount of material invested in the building over the building's life? Does one evaluate each assembly individually? Or does one try to define the functionality of the building as a whole? Ultimately, the analyst will choose the functional unit that best addresses the intentions of the LCA.

Once the boundary and functional unit of the analysis are determined, the next and most tedious step is to inventory all of the relevant processes and their effects. This requires industry data, some of which is available for a fee from a number of sources, listed below along with the region for which the provided data is relevant.

- Athena Institute (North America)[5]
- EcoInvent (Europe)[6]
- Franklin Associates (North America)[7]

These databases list all the outputs to air, water, and land for a variety of building materials and activities. All of them use a graphic user interface to simplify the process and to compile the results. Once the inventory is taken, the analyst can evaluate the impact of the object or assembly in question with regards to environmental concerns

such as ozone depletion, greenhouse gas emissions, human toxicity, etc.. These can then be weighted according to their environmental importance. While the method is mathematically straightforward, this step is often questioned because of the subjectivity that it inevitably introduces.

A lot of detail is needed to conduct a complete LCA, and it is clear that the master plan developed in the previous chapter does not have enough information in it to yield a meaningful analysis. At this early stage of design, we must look to other, more global measures of environmental burden to make a quantitative assessment of the proposal. Two relevant measures are embodied energy and volume of waste avoided.

The embodied energy of a material is the total amount of energy that was spent during its production. It is in essence a simplified Life Cycle Assessment that only tallies the *energy* burden of a product rather than all associated environmental burdens. Embodied energy is an absolute value, usually noted in MJ/kg; therefore, a direct comparison between two products is only informative if the two products fulfill similar functions. In the context of the Chicago Post Office, the embodied energy of the materials conserved through reuse will be calculated and be noted as an avoided burden.

The second measure – volume of waste avoided – is relevant because of the growing shortage of landfill space in the United States. The Illinois Environmental Protection Agency issued in 2004 a report that the Chicago metro area only has eleven more years worth of waste storage capacity[8]. With tipping fees at about $45 per ton, there is also an economic incentive to avoid the generation of non-essential construction waste.

One of the first decisions made during the architectural design process was that the existing elevator and attached railway exhaust shafts would be retained as the primary vertical circulation mechanisms. It was thought that this would be desirable both in terms of spatial organization and material conservation, as the elevators are in good working order, are scattered fairly evenly across the floor plan, and act as shear cores for the building. Also, as the cores are surrounded on all sides and at each floor by the dense structural grid, they would be very difficult to demolish without damaging

ELEVATOR SHAFTS

	Approx. Area (ft^2) (from plan)	Approx. Height (ft)	Approx. Volume (ft^3)	Approx. Weight (lb) (use $\rho = 145lb/ft^3$)	Approx. Weight (kg)
1	224	220	49280	7145600	3241244
2	260	220	57200	8294000	3762158
3	272	180	48960	7099200	3220197
4	336	180	60480	8769600	3977891
5	350	180	63000	9135000	4143636
6	348	220	76560	11101200	5035504
7	128	220	28160	4083200	1852140
8	280	115	32200	4669000	2117858
9	414	180	74520	10805400	4901329
10	404	180	72720	10544400	4782940
11	280	115	32200	4669000	2117858
12	220	220	48400	7018000	3183365
			643680	93333600	42336121

Embodied Energy of Concrete = 2.0MJ/kg
Therefore, the total embodied energy of the elevator shafts is about **$84x10^6$ MJ**

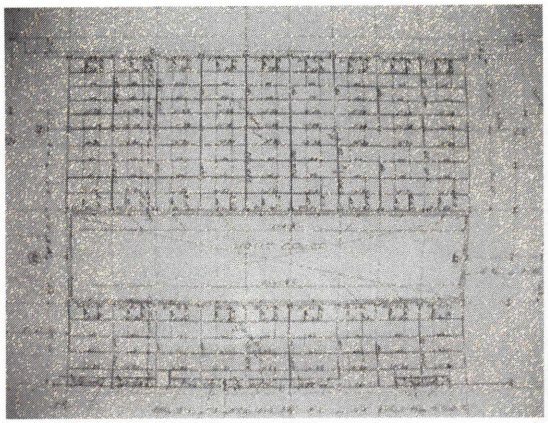
surrounding structural members. Given the dimensions of these shafts, we can roughly calculate the material volume and corresponding embodied energy retained in the building through this design decision. Published literature[9] indicates that the embodied energy of a kilogram of concrete is about 2.0MJ. The table above shows a series of simple calculations approximating the total volume of concrete in the shafts and its corresponding environmental burden.

Comparing the final energy figure (84 million MJ) with more familiar data, we see that it is equivalent to:

- the energy in 14,000 barrels of oil (assuming 6120 MJ per barrel[10])
- the energy consumed in about 2,600 typical American households in one year (assuming 9,000 kW-hr annual usage per home[11])

On a regional scale, these energy figures do not seem significant. However, the volume of waste avoided is substantially so. 47,000 tons of concrete is equivalent to 1.3% of the annual landfill haul for the Chicago metro area in 2004 and would cost over $2 million to discard. Recycling may be an option, but only if there is no chance that the concrete is contaminated.

Another decision made during the design process was to maintain as much of the existing structural steel as possible while thinning out the structure enough to allow for light and



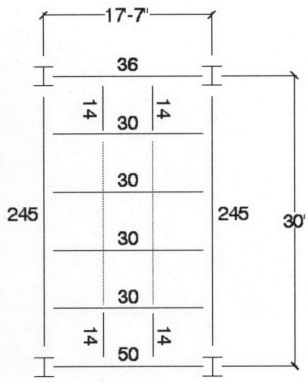


fig.42
Partial structural plan (left) and representative portion thereof (right).

air penetration into all parts of the project. In the lower public space below the new roof, three central bays were partially cleared to emphasize the monumentality of the space and to allow natural light. In the towers above, floor-to-ceiling heights were maintained as found to enable in-situ reuse of major structural elements. To get a sense of how much steel is in the Post Office currently and how much of it would remain in the proposed plans, an approximation was made based on a partial structural drawing obtained from the Hines Property Management group's collection (fig.42). A representative portion of the floor is reproduced above. The section measures 510 sq. ft., and the values noted represent the beams' weight per linear foot. With this information in hand, we can calculate that there is just under 18,500 lbs of steel in this typical floor area, or 36.25 lbs/sq.ft.. Published values for the embodied energy of virgin steel range from about 32 to 59 MJ/kg[12], which when multiplied with the total weight of steel in the building yields an embodied energy of 1.9×10^9MJ to 3.6×10^9 MJ. The total area of existing steel structure that is retained in the Old Post Office proposal is about 60% of the total, suggesting that the avoided energy burden due to reuse is 1.2×10^9MJ to 2.1×10^9MJ.

Once again, comparing these figures with more familiar data, we see that they are equivalent to:

- the energy in about 200,000 to 340,000 barrels of oil
- the energy consumed in about 37,000 to 65,000 typical American households in one year

These values are much more significant than those for the elevator shafts partially because of the sheer volume of steel present in the existing building (fig.43), but also because virgin steel is very energy intensive to manufacture. I use the value of virgin steel rather than recycled steel in this calculation because at the time of the building's

fig.43
Photo of the Old Post Office during construction, showing the density of steel in the structure.

construction, all steel sections were manufactured from virgin ores. The benefit of steel over concrete, at least with regards to demolition, is that the 40% or so of the steel that is removed from the project is likely to be recycled and will not burden the already stressed landfills. If planned properly, it is conceivable too, that some of the removed steel could be recycled and re-placed into the reconceived Post Office building.

The above comparison brings up an interesting point with regards to the relative burdens of concrete versus steel in reuse scenarios. Concrete is not an easy material to recycle into new structural uses. Demolition waste is at best ground up and downcycled into engineered fill and at worst simply dumped into landfills (fig.44). Often embedded steel reinforcing bars or contamination (in the form of slag or fly ash) prevents the recycling from occurring at all. However, it requires significantly less energy to produce, and therefore conserving concrete does not result in as significant an avoided energy burden. Steel, on the other hand, when compared pound per pound with concrete, is much more energy intensive to manufacture, even when using recycled sources. Yet, the material's potential to be recycled with a fraction of the original embodied energy and maintain its structural strength time and time again makes it worthwhile to recycle. So much so, that the construction industry regularly recycles about 97.5% of all structural steel sections and about 65% of reinforcement steel from demolition projects[13]. For both architects and engineers, understanding the nature of these two common structural materials in the use and disposal phases of their lifetimes is critical to the development of an intuition towards

fig.44
Concrete debris.

reuse projects that is based on a material sensitivity which can then influence the formal design decisions towards less environmentally impactful ends.

This basic analysis shows that the intuitive decisions analysed were, in fact, well founded with regards to the reduction in material and energy intensity achieved by keeping the elevator cores and the bulk of the existing structural steel in place. A different option – say, the complete gutting of the original interiors – may have provided the opportunity to update the interior structure, potentially achieving the same form and organization proposed using newer, sleeker, and lighter technologies, while still keeping the building's historic facade intact. However, it is doubtful that the materials and energy saved by using these new technologies would come close to making up for the waste of embodied energy and material volume already present in the building. It is also possible that the gutting option may have allowed for faster demolition, thereby reducing the duration of the job and consequently, its cost. But the benefit gained from time and money saved could be eliminated by the resulting increase in trucking and tipping costs.

In all of the above discussion, it is assumed that the structure being considered for reuse is in good shape and that its structural design capacity is sufficient to accommodate new programmatic function. In these cases, the option to reuse seems obviously good from a material, energy, and project cost point of view. The choice becomes less obvious when a building requires any significant structural upgrading or retrofitting to fulfill code and service requirements, as steps taken to update the structure may negate the benefits earned from keeping it.

Steel structures can be strengthened quite simply by welding extra material where needed.

If a particular section is too damaged to salvage, it can be removed and replaced with a new column or beam. Concrete structures are less straightforward to retrofit as they tend to require the introduction of a new material for reinforcement. It is not unusual to see steel wraps or FRP (fiber reinforced polymer) wraps in these scenarios, but there is some uncertainty with regards to the strength and longevity of the bond between the concrete and the reinforcing material. In either case, new materials must be brought in to achieve the required design strength, reducing the avoided burden achieved by the decision to reuse. If a structure is severely compromised, the additional material investment may be substantial. Ultimately, it is the responsibility of the designer to decide whether such a building is indeed worth saving. An evaluation of the environmental effects of reusing versus tearing down and rebuilding may show that starting from scratch is the least environmentally impactful option.

It is clear that some quantitative evaluation is needed to weigh the benefits and detriments of a project and finally determine the desirability of reuse on a case-by-case basis. The analysis of the proposal for the Old Post Office shows that the conceptual design stages can already reveal major benefits or drawbacks to certain design approaches. This suggests that basic environmental evaluations can be introduced very early in the conceptual design process to shape the ultimate form of a reuse proposal. As the project is developed and more material and construction information is known, more sophisticated evaluation methods (eg. LCA) may be introduced in the detailed design process to refine the proposed solution.

(Endnotes)

[1] LEED-NC Version 2.1 Registered Project Checklist, available at www.usgbc.org

[2] *A Technical Framework for Life-Cycle Impact Assessment*. SETAC Foundation for Environmental Education: Pensacola, 1991

[3] ISO 14040:1997

[4] *Life Cycle Assessment: what it is and how to do it*. United Nations Environment Programme: Paris, 1996. pg.49

[5] http://www.athenasmi.ca

[6] http://www.ecoinvent.ch

[7] http://www.fal.com/

[8] *Nonhazardous Solid Waste Management and Landfill Capacity in Illinois: 2004*. Illinois Environmental Protection Agency: Springfield, 2005.
(available online at http://www.epa.state.il.us/land/landfill-capacity/2004/index.html)

[9] Glover, Joanna. *Which is Better? Steel, Concrete, or Wood: A Comparison of Assessments on Three Building Materials In the Housing Sector* (available online at www.boralgreen.shares.green.net.au/research3/contents.html), citing Lawson, Bill. ***Building materials, energy and the environment : towards ecologically sustainable development.*** Red Hill, A.C.T.: Royal Australian Institute of Architects, 1996. and Buchanan, Andrew H. and Honey, Brian G. ***Environmental impacts of the New Zealand building industry.*** Dept. of Civil Engineering, University of Canterbury, Christchurch, N.Z., 1992.

[10] Definition for *barrel-oil-equivalent* from http://en.wikipedia.org/wiki/Barrel_of_oil_equivalent

[11] Average value from data found at http://hypertextbook.com/facts/2003/BoiLu.shtml

[12] Glover, Joanna. (see above for full citation)

[13] Data obtained from Steel Recycling Institute

Concluding Remarks

The practice of adaptive reuse has grown in popularity in the United States over the past few decades, with now about 90% of architect-commissioned work involving some interaction with an existing structure. While the practice of reuse has existed informally in the form of garage-as-guest house or barn-as-garage conversions and so on, it is only since the late 1960s that architects and engineers have begun to approach it critically, as a design problem. This thesis has traced a brief history of the designer's role in the sustainable development discourse, with focused attention paid to the adaptive reuse solution. Through the study of already completed adaptive reuse projects, a coarse classification of typologies was proposed.

With the intention of investigating the specific problem of rehabilitation and reuse of large-scale urban structures, the Old Chicago Post Office was selected as a site for redesign. The size of the Post Office and the diversity of program desired within its walls suggested that an urban planning approach to the problem was most appropriate in the early conceptual design stages. With the conceptual design in hand, a basic environmental analysis was performed and a model for further analysis proposed.

A few conclusions can be drawn from this thesis.

Even the limited analysis performed on the design was informative with regards to evaluating the environmental soundness of particular design decisions. As a general

rule, affecting the environmental performance of a structure becomes more difficult as a project advances in the design and construction process. Given that reuse projects begin with spatial restrictions, it is critical that the issues of performance (in terms of material and energy intensity) be addressed early. Global evaluation methods are sufficiently telling in early decision-making, but as the project goes on, more detailed methods based on Life Cycle Assessment should be implemented to refine the proposed solution.

Despite the popularity and documented benefits of successful reuse projects, architects and engineers should examine each reuse opportunity critically to determine whether or not it is desirable. Ultimately, reuse projects should not be driven only by feelings of nostalgia for the past. Buildings do have finite lives, and it is not always possible to extend the life of an obsolete building. It is important to remember that reuse is not the same as preservation.

Large-scale buildings provide a unique opportunity for mixed-use programming, but they also present increased levels of coordination and complexity. As Koolhaas states in *S,M,L,XL*, "Only Bigness instigates the regime of complexity that mobilizes the full intelligence of architecture and its related fields." In redesigning the Old Post Office, I chose to approach the problem urbanistically to ensure that an overall logic of massing and circulation was in place before any detailed decisions were made. The formal resolution that resulted within this thesis is by no means unique, as the logic set out by the master plan can accommodate a variety of design tastes.

With increasing attention being paid to urban redensification and smart growth initiatives, one can only imagine that the adaptive reuse model will continue to be a popular option for growth. If this is indeed the case, simplified evaluation methods and design strategies must be developed to help guide architects and engineers in their decision-making process. Eventually, it is hoped that designers will gain an intuition for reuse, much like they have for conventional projects. This thesis, for me, has been a first step.