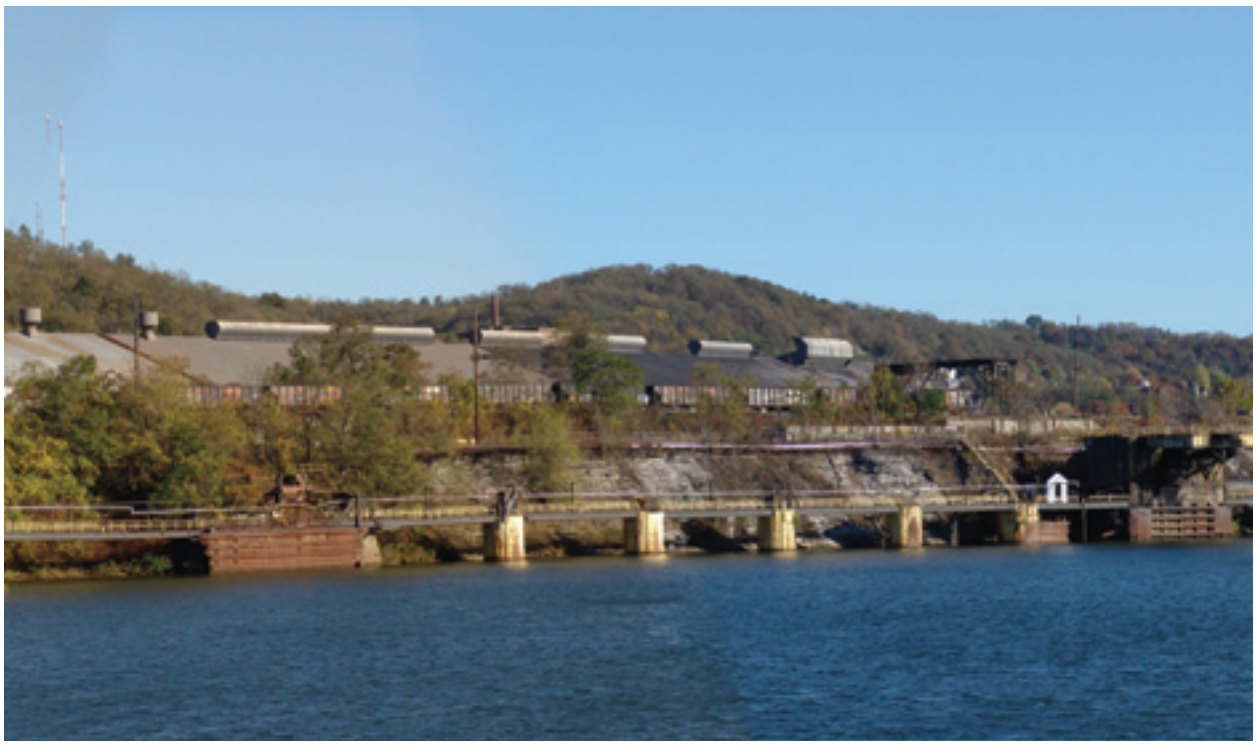
Remaking Hazelwood, Remaking Pittsburgh

a background study



Carnegie Mellon
School of Architecture

Remaking Hazelwood, Remaking Pittsburgh was prepared by Research Associates Elise Gatti and Kim Kinder, under the direction of Luis Rico-Gutierrez, Director of the Remaking Cities Institute.

The RCI would like to thank the Heinz Endowments for their generous financial support. Additional appreciation is owed to Bob Gradeck, Director of Community Projects, Carnegie Mellon Center for Economic Development and Jim Richter, Executive Director, Hazelwood Initiative, Inc.

For more information, please contact:

Luis Rico-Gutierrez
Director, Remaking Cities Institute/
Associate Dean, College of Fine Arts
Carnegie Mellon, School of Architecture
College of Fine Arts 201
Pittsburgh, PA
15213-3890 USA
[p]: 001 (412) 412-268-2349
[e]: lrico@andrew.cmu.edu
[w]: http://www.arc.cmu.edu/cmu/rci

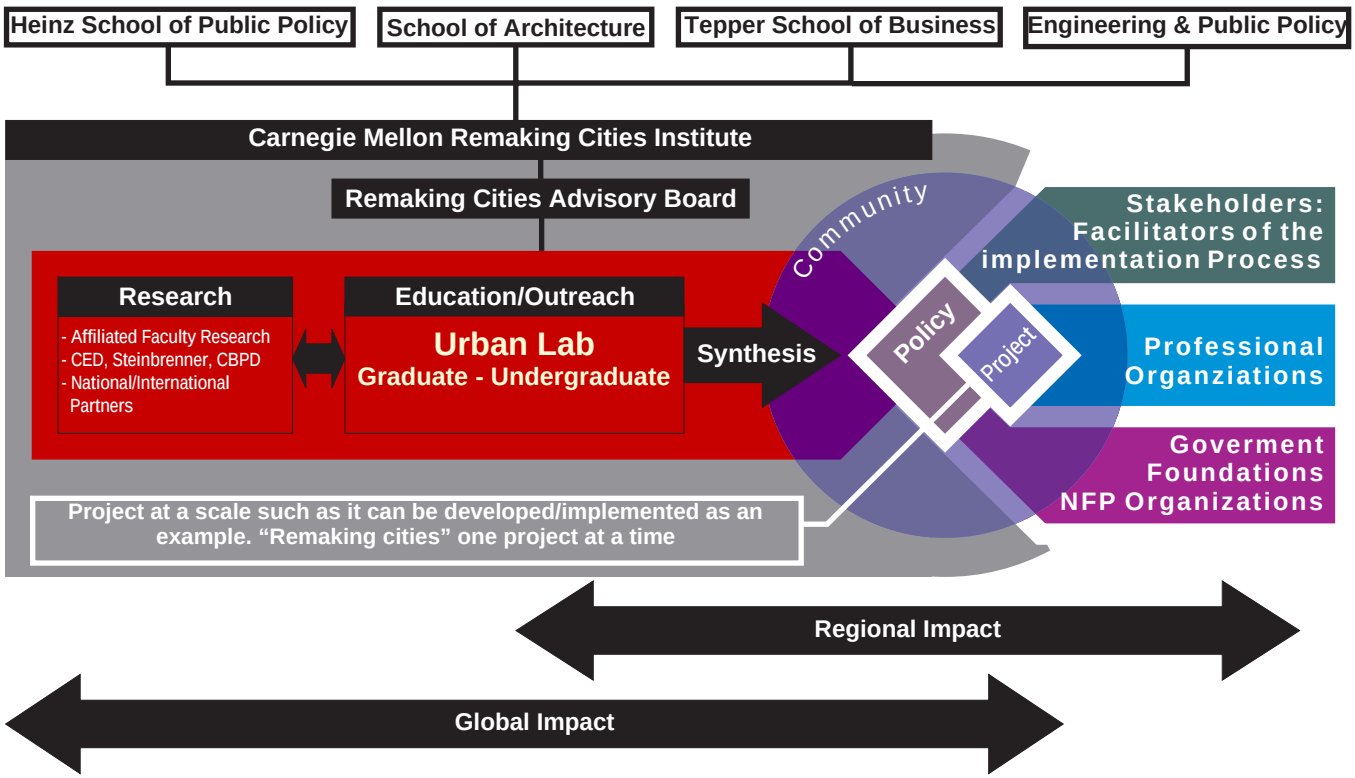
[CONTENTS]

[CONTENTS]

introduction: remaking hazelwood

RCI and the Urban Lab: Community-University Collaboration

The ability to capture and evaluate the conditions of neighborhoods and regions as well as the ability to deliver the basic tenets of a shared quality of life, and to envision futures that "regenerate" neighborhoods and regions, is a primary goal of the Remaking Cities Institute at Carnegie Mellon's School of Architecture. Building on over 15 years of successes in the Urban Laboratory, the Remaking Cities Institute is being created to ensure and expand the education, community visioning, and research efforts of Carnegie Mellon University, and to strengthen its partnerships in the Pittsburgh Region in order to stimulate the revitalization of urban regions, neighborhood by neighborhood. The mission of the Remaking Cities Institute is to catalyze sustainable urban futures and excellence in community design, and our vision is to be recognized internationally as the key resource for rebuilding urban communities, demonstrated through the revitalization of communities in the Pittsburgh region.



Ensuring sustainability and quality of life through urban and regional design requires both multidisciplinary expertise and exposure to participatory processes. Physical decisions about land-use, zoning, transportation and other infrastructures, mixed-use development, and neighborhood design are brought together with urban geography, economics, and policy at the core of the Institute. The centerpiece is a group of students and faculty from different disciplines working with neighborhoods, and political and economic decision-makers, to address the complex and multidimensional nature of sustainable cities and regions. RCI benefits from the strengths of the Center for Economic Development (CED), part of the H. John Heinz III School of Public Policy and Management. The seamless integration of their expertise in the work of RCI allows us to leverage academic resources to better understand key regional economic development issues.

RCI intends to expand efforts to develop visions leveraging the leadership position of the Pittsburgh region in research and development, and linking them to physical planning and ultimately to economic vibrancy and equity, environmental quality, health, safety and overall quality of life.

What if...?

The *Wall Street Journal* published an article in 1999 calling Pittsburgh "Roboburgh" for its local concentration of talent in robotics. Can this city, historically known as "Iron City," become associated with the incorporation of innovative technologies in our social, cultural, economical, fiscal and natural environments?

What if Pittsburgh becomes a worldwide reference again for something as central to our perception of "modernity" as steel has been for the last century? What if cutting edge technologies are embedded in the daily lives of our communities now? What if robotics spin-off companies settle in the region? What if through technology we can extend the productive participation of aging and disabled populations in the everyday life of our communities; and what if that becomes a major industry? What if the same happens with entertainment technology? What if major international companies are successfully attracted to open manufacturing and/or R&D activities in proximity to the before-mentioned activities? What if 1,000 students move into the Hazelwood area? What services will grow around them? What if Junction Hollow becomes a transit corridor? What if we develop programs for current residents to take advantage of the growing employment opportunities in some of those sectors? What if all this is done with a strong sense of respect for the ecological framework of the

region and with a commitment to diversifying the economic and cultural opportunities of the intervention?

These ideas only scratch the surface of the possibilities that could be created by aligning the creative energy of our universities, the motivation for new product development of firms, the principles of sustainable community design and the energy and leadership of our region.

The Remaking Cities Institute at Carnegie Mellon is being funded by the Heinz Endowments to convene, host and facilitate the interaction of a select group of technology visionaries to think about the future of the Pittsburgh region; and to put at their service our expertise in urban design and community development to translate their work into proposals for an intervention in the former LTV works site, Hazelwood and its connection to the innovative research centers in Oakland through Junction Hollow. Our goal is to demonstrate the proposition that university/industry/community collaboration can foster sustainable change – ecologically, economically and culturally.

The days are gone when two or three major industries could hold the region together economically, as steel, aluminum, and glass once did. The process by which wealth is generated and its impact is dif used through society has changed in fundamental ways in the last 20 years. In particular, economic growth is tied to rapid innovation in technology and its application in new market and organizational structures. Markets and organizations are truly global and the process of innovation springs from global networks which are dependent on highly mobile, high human capital individuals as much as they are on specific firms. Regions will thrive to the extent that they are able to provide sustainable technology environments that foster innovation for firms and individuals that are part of the global economic system. Communities will thrive to the extent that they can embed those innovative environments into the structure and fabric of neighborhoods and to link their citizens to the economic growth they create.

The economic future of the region must rest on realizing and exploiting existing assets, and it is not hard to envision Pittsburgh's leadership in the key technological fields already mentioned as primary sources of innovation and economic growth for the coming century – comparable to what steel, cars or computers were in the prior century. But that should be just the beginning: our goal should be the creation of a framework that allows our region to incorporate this and future innovations into sustainable growth opportunities. By marrying that demand with the opportunity to participate in educational and research programs integrated with the private sector and with local neighborhoods, we can build a truly sustainable community around innovation in the areas described above.

Connectivity and sustainability are vital to this framework. "Connectivity" must be defined as more than physical connections, to reflect how communities interrelate with each other economically, socially, politically, and culturally. The dynamics of these interrelationships are the bases of sound metropolitan policy and strategy. "Sustainability" is the second broad and important theme, and speaks to the state of our region's resources – land, air, water, infrastructure, and our built environment. Sustainable communities and regions ensure a shared quality of life that is built on access to economic opportunities, cultural development and a balanced interaction with the natural environment.

Luis Rico-Gutierrez
Director, Remaking Cities Institute

pittsburgh pennsylvania

The Hard Facts ... and Reasons for Hope

Pittsburgh continues to face demographic, physical, and economic challenges stemming from widespread industrial decline. The city has a shrinking population base, and the region is afflicted with fragmented governments and sprawling development patterns. Its high tech industry, although established, is struggling to increase its competitive position. Despite the challenges, local leaders and activists have achieved notable victories. Business investment and citizen participation measures are comparatively high, and economic growth strategies based on technological investment are achieving positive results. Several national publications have noted the city's image turn-around, recognizing successful initiatives to transform the gritty, dirty, industrial town of yesteryear into the digital, entrepreneurial, vibrant community of tomorrow. Although restoration costs and benefits are unevenly distributed, such activities nonetheless offer hope for those working to address social, economic, and ecological concerns.

Geographic location and natural features facilitated Pittsburgh's rapid rise to industrial power. Early industrialists and immigrant workers built extensive facilities around the coal-rich hillsides and navigable waterways. The region was a world-leader in steel, iron and coal production from the 1870s until the middle of the 20th century. Known as "Steel Valley" and the "Valley of Work", local mills forged much of the steel used to construct iconic structures around the world, including the Empire State Building, the Chrysler Building, the Brooklyn Bridge, and the Panama Canal locks. As a result, Pittsburgh's population swelled from 100,000 in 1850 to 320,000 in 1900 before peaking at 676,000 in 1950. Despite recurring clean up and modernization initiatives, the city was notorious for its gritty environment and poor living conditions, which contributed to suburban out-migration even before World War II.

Despite the region's long history of growth and productivity, economic activity declined substantially in the 1970s largely as a consequence of global trade realignment and deindustrialization throughout the Northeast and Midwest. The losses were catastrophic for many Pennsylvania mill towns, where unionized blue-collar jobs had once guaranteed middle class lifestyles for many residents. From 1970 to 1990, the Pittsburgh region lost 158,000 manufacturing jobs and the city lost over 289,000 residents. As a percentage of the total employment market, manufacturing jobs fell from 28% to 12%. By 2000, Pittsburgh's population had declined to 335,000, less than half of its 1950 count. In recent years, the region's demographic forecast has partially improved. By 2000, negative net migration rates had fallen to 2 per 100 1990-residents, compared to the 1990 rate of nearly 9 per 100 1980-residents. Between 1990 and 2000, the number of 35 to 39 year olds increased, a statistic likely explained by the region's affordable real estate and growing professional job market. The city still has difficulty attracting new residents domestically and internationally.

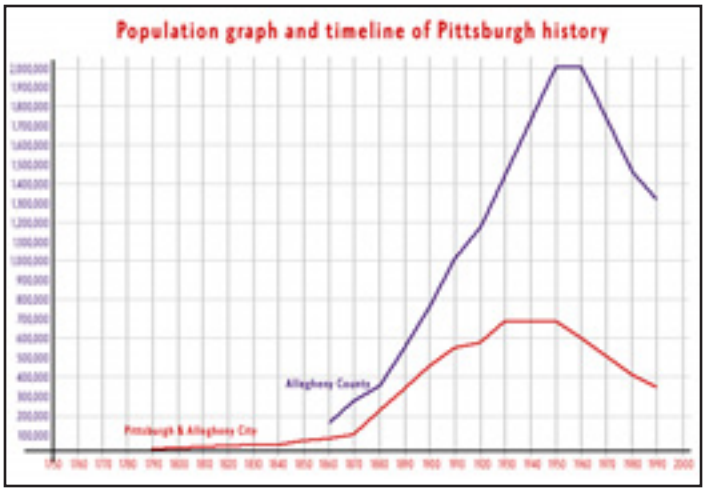
Pittsburgh is not alone in its struggle. Over the past 50 years, shrinking cities have become increasingly common worldwide. The Shrinking Cities international research project, funded by Germany's Federal Cultural Foundation (*Kulturstiftung des Bundes*), has found that, "despite all the expectations created by the scenarios of constant

Left: Map of United States. (Source: RCI, 2007)

Right: Shrinking cities around the world. (Source: Kulturstiftung des Bundes, 2007)

Below Right: Pittsburgh population trends, 1790-1990. (Source: WQED Pittsburgh)

Below: Pittsburgh, PA Metropolitan Statistical Area (MSA). (Source: US Department of Transportation)



growth, the number of shrinking cities has increased faster than the number of boomtowns." Western countries have been particularly hard-hit and former industrial powerhouses have experienced the greatest numerical losses. Almost 60 post-industrial American cities are shrinking, most of which are concentrated in the Northeast and Midwest. The numbers are nearly as troubling across post-industrial Europe, with 27 such cities in the U.K., 26 in Germany, and 23 in Italy.

Many of these cities, including Pittsburgh, simultaneously face population decline and rising sprawl, making maintenance activities and recovery initiatives especially challenging. A recent comparative study of American cities published in the *Quarterly Journal of Economics* identified the Pittsburgh, PA Metropolitan Statistical Area (MSA) as the most sprawling city in America. Within the area, only 1 in 10 residents live within Pittsburgh's city limits. This unplanned spatial growth can be attributed in part to the fragmented nature of government in the region: The Brookings Institute cited Pittsburgh as "a curiosity among the 50 largest metropolitan areas", because although the region's population declined 6.6% from 1982 to 1997, local officials maintained more than 414 local governments and developers urbanized more than 200,000 acres of land, a 39% increase in urbanized area. During the same period, the number of persons per urbanized acre dropped from 4.8 to 3.3. Vehicle miles traveled doubled from 1970 to 1990.

Depopulation, combined with institutional fragmentation and limited land-use regulations, pose several challenges to Pittsburgh's social, economic and ecological health. On the social and economic fronts, sprawl contributes to urban-suburban disparities, concentrates poverty and racial segregation, negatively affects public health, increases infrastructure costs, creates a mismatch between urban workers and suburban job centers, and destroys natural landscapes that could otherwise bolster tourism. Ecologically, low-density development fragments land, reduces biodiversity, increases air and soil pollution, and distorts natural functions and hydrological systems.

Despite the city's ongoing challenges, Pittsburgh is keeping pace with many urban prosperity metrics. The 2007 *CityVitals* report, recently published by the non-profit

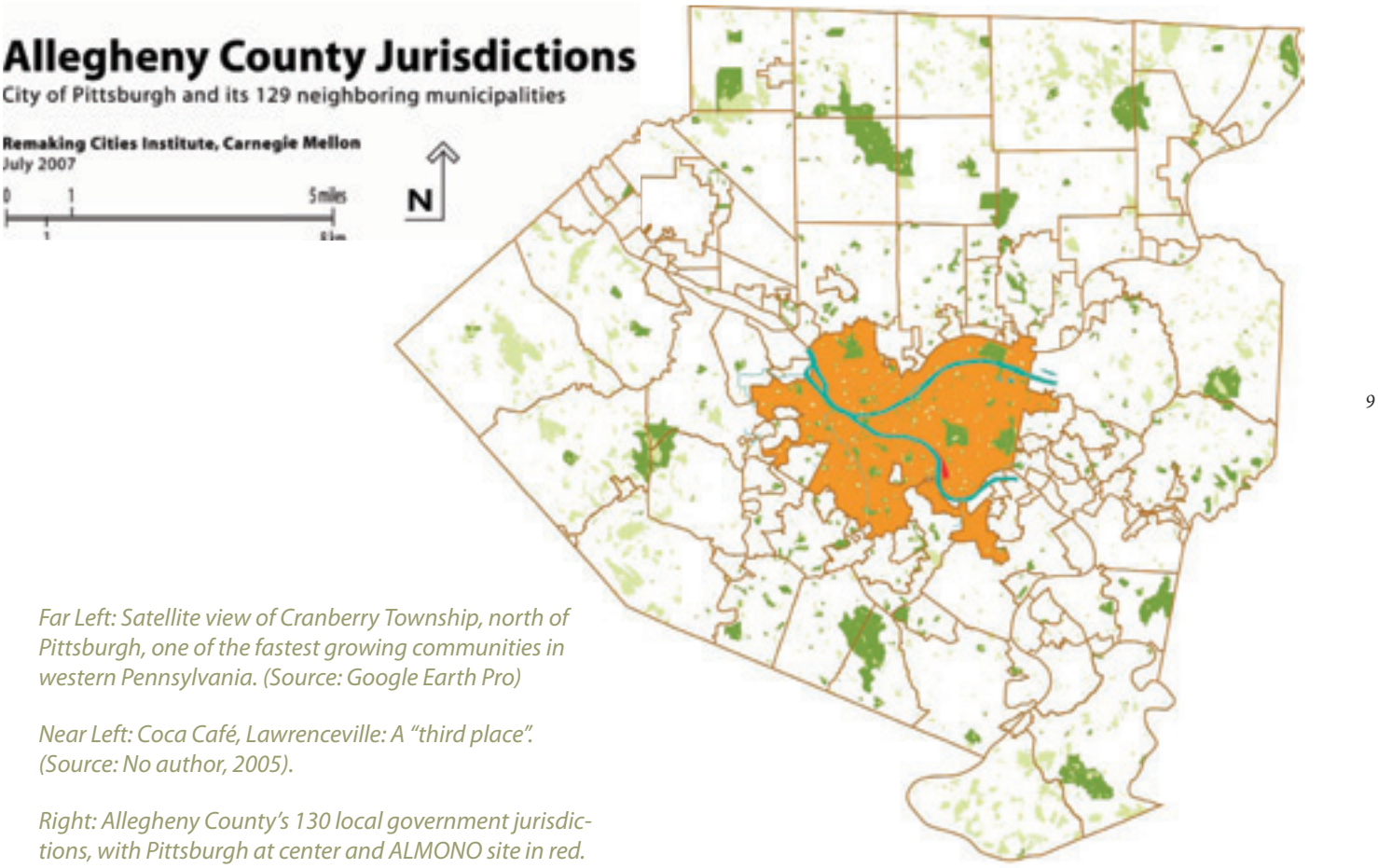
organization CEOs for Cities, measured four key dimensions of the new economy, including talent, innovation, connections, and distinctiveness. Using these measures, the report rated different cities for their relevance to the modern media and technology economy. Pittsburgh ranked near the median on most accounts within its cohort of the nation's top fifty metropolitan statistical areas (MSA).

Pittsburgh's relative competence as measured by business interests in the post-industrial economy suggests the city might be a good candidate for the Intelligent City movement. In the last two decades, certain cities and regions worldwide have begun aggressively pursuing a knowledge-based growth and development strategy. While university collaboration and public-private partnerships are not new, the Intelligent Cities movement shifts the planning focus away from the more traditional, suburban-style, ex-urban office parks and cultivates new links between vibrant research centers and urban-based cultural and business amenities. Intelligent City planners leverage the high growth rates in the research, technology, and media industries to boost the host city's economy and generate wealth. In return, these research and technology organizations gain access to cooperative networking and infrastructure amenities as well as urban quality-of-life benefits for local employees seeking culturally vibrant lifestyle environments. Planners also use technological innovation and knowledge-based development to bolster manufacturing and production activities that increasingly rely on digital and media inputs and distribution schemes.

Measurements of Pittsburgh's Intelligent Cities preparedness reveal mixed results. Compared to other MSAs, the *CityVitals* study found that the Pittsburgh region is solidly in the middle of the pack in regard to the percentage of workers employed as creative professionals, the number of utility patents issued, the availability of wireless Internet access, and the ratio of ethnic restaurants to fast food chains. The region fared better in terms of economic-spatial integration, coming in 7th across the nation, while ranking 13th for its high percentage of international students, and 14th in voter participation, as indicated by the number of residents who cast ballots for the 2004 presidential election. Despite these encouraging indicators, these strengths can be difficult to maintain over time. Attracting and retaining international talent has proven especially difficult. Only 6.1% of Pittsburgh residents are both college-educated and internationally born, which translates into a low 49th place ranking nationwide.

Despite the city's low retention rate, Pittsburgh's venerable learning and research institutions do attract international talent and are attracting Intelligent City investment attention. Carnegie Mellon and the University of Pittsburgh maintain a prominent international presence. In 2007, *Wired Magazine* ranked Pittsburgh seventh in its list of Top Ten Tech Towns, based in part on Carnegie Mellon's top-ranked School of Computer Science, the wide availability of free Wi-Fi internet access, and the large number of local robotics spin-off organization started by Carnegie Mellon graduates. Joel Kotkin and Ross DeVol's 2002 report *Knowledge-Value Cities in the Digital Age* lauded Pittsburgh as a "comeback city" based in part on high investment rates in communications equipment.

Some prominent technology firms have recently set up Pittsburgh offices for the express purpose of collaborating with local research institutions and personnel. Intel, Apple, and Google all maintain offices in Carnegie Mellon's Collaborative Innovation Center (CIC), and Seagate has offices in the SouthSide Works and on Washington's Island. Similarly, the University of Pittsburgh and the UPMC research and training program jointly attract



Far Left: Satellite view of Cranberry Township, north of Pittsburgh, one of the fastest growing communities in western Pennsylvania. (Source: Google Earth Pro)

Near Left: Coca Café, Lawrenceville: A "third place". (Source: No author, 2005).

Right: Allegheny County's 130 local government jurisdictions, with Pittsburgh at center and ALMONO site in red. (Source: RCI, 2007)

highly skilled professionals and large sums of research funding. For multiple years running, UPMC has ranked among the top 10 recipients in the United States for National Institute of Health (NIH) funding, and their neurosurgical research is internationally renowned.

Richard Florida cites Pittsburgh's inability to retain educated talent in his book *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life* (2002), a study of the workers who make up the media and technological economy. Florida, a long-time Pittsburgh resident, was wooed away from Carnegie Mellon by George Mason University in Washington, D.C. in 2004 and, in 2007, was recruited by the University of Toronto to be the academic chair of their new Centre for Jurisdictional Advantage and Prosperity at the Joseph L. Rotman School of Business. In his analysis, Florida cites the difficulties and shortfalls that local leaders face in the struggle to adopt "new organizational and cultural patterns" and criticizes officials who invest large sums of taxpayer revenue into sports complexes rather than using the resources to cultivate a diversified cultural scene. Despite these criticisms, Florida's assessment of Pittsburgh is overall positive. He argues that many of Pittsburgh's most outstanding assets are closely aligned with the interests of the creative class, including a strong high-tech industry, plentiful outdoor recreational amenities, and an older urban center.

Among the characteristics desired by the creative class, Florida also cites ethnic and sub-cultural diversity and vibrantly interactive social venues. His findings suggest that members of this group prefer cultural amenities where they can be active participants rather than passive spectators, as reflected by strong turnout rates at restaurants and festivals as opposed to sports stadiums. Various cultural writers refer to these venues as "third places," a term which connotes public and semi-public spaces such as cafes, bars, and parks where people can mix social and professional interests away from the pressures of home and work. These spaces are thus as critical to a city's economic vitality as its virtual and physical infrastructures. Pittsburgh has at least two professional networks that meet regularly in such locales: BioBuds, a "loose confederacy of [around 40] biotech entrepreneurs" who meet irregularly and informally, and Green Drinks, an international "organic,

Above Left: Engraving of downtown Pittsburgh in 1890. (Source: WQED Pittsburgh, 2000)

Above Right: Seventh Street Bridge, Pittsburgh. (Source: Pittsburgh Regional Alliance, 2003)

Left: Present day downtown Pittsburgh. (Source: About.com)

Near Right: ALMONO site, viewed from near the Hot Metal Bridge. (Source: RCI, 2007)

Far Right: ALMONO site, as seen from Lytle St, Riverside. (Source: RCI, 2007)

self-organizing network" of green building professionals and enthusiasts who meet monthly at local bars around Pittsburgh. Other groups, such as the Lawrenceville Corporation, an East End community development corporation, hold regular happy hours and meet-and-greet sessions that highlight various neighborhood bars.

Taken collectively, these trends suggest that, while Pittsburgh cannot escape the harsh reality of its situation, the city has competitive promise. Seven Fortune 500 companies are based in Pittsburgh, placing the city firmly in the top 10 nationwide. In 2006, *Expansion Management Magazine* ranked Pittsburgh as the 9th best metro area for future business locations. In 2007, Pittsburgh was named the "most livable city in the U.S." by the *Places Rates Almanac*, in part based on the city's extensive built heritage and diverse geographical features. The city was also given a first place ranking in 1985, during which the distinction was accompanied by the following accolade: "With its breathtaking skyline, its scenic waterfront, its cozily vibrant downtown, its rich mixture of cultural amenities, its warm neighborhoods and its scrubbed-clean skies, it no longer is the smoky, smelly, gritty mill town of yesteryear." Additionally, the city contains four large urban parks, totaling 1,531 acres, as well as many smaller green spaces and riverfront recreational amenities. The region is considered a Mecca for mountain bikers and Pittsburgh's three navigable rivers of er abundant opportunities for water sports and riverside trails. The city also has lush wooded hillsides, which have made a comeback in the wake of the decline of industrial pollution.

The city's successes stem in part from extensive ef orts both locally and regionally to counter lingering negative industrial degradation. Although Pennsylvania's industrial and mining heritage brought tremendous growth and prosperity to the area, these activities also resulted in 10,000-12,000 vacant brownfield sites throughout the state. These brownfields cover 100,000-120,000 acres in urban and rural locales, ranging from small corner gas stations to sprawling abandoned factories. To combat these blighted and economically unproductive sites, state officials have created several clean-up programs and incentive structures to spur remediation and revitalization activities.

There are numerous benefits to redeveloping brownfields, especially for struggling post-industrial cities. Most notably, such strategies clean up or neutralize pollution and reactivate economically underutilized land. In shrinking cities like Pittsburgh, remediation can restore ecological health and augment usable outdoor space. Urban and inner-ring suburban brownfields, as exemplified by the ALMONO site, often occupy prime waterfront real estate and are in proximity to city services, including public transportation and cultural amenities. Although urban redevelopment can be costly, the large and contiguous land areas of er unique advantages to developers. The adaptive reuse of former industrial buildings often brings considerable cachet to newly revitalized developments and, where new and existing communities are integrated, the new developments instantly have a more lived-in, established atmosphere, giving them an added advantage over greenfield sites.

From 2003 to 2006, the Pennsylvania state government invested nearly $230 million in brownfield remediation and restored roughly 950 abandoned industrial sites, totaling more than 6,000 acres. Between 1995 and 2006, nearly 2,200 contaminated and abandoned industrial sites were cleared under Pennsylvania's Land Recycling Program, 40% of which were completed since 2003. The Business in Our Sites Program, which stimulates economic development through brownfield remediation, spent $220 million to acquire, remediate, and prepare sites for new business development. Pennsylvania voters approved several other initiatives, including the $250 million PennWorks bond program to improve aging water and wastewater infrastructure on specific brownfield sites, and the $625 million Growing Greener II initiative, which provides continued funding for the reuse of abandoned industrial sites. The Pennsylvania Infrastructure Investment Authority provides low-interest loans for remediation activities and the Keystone Opportunity Zone program of ers state and local tax incentives for land development, including but not limited to, brownfield sites. The Brownfield Action Team (BAT), which streamlines the permitting processes and redevelopment ef orts for sites targeted as redevelopment priorities by local officials, has facilitated 33 projects in 22 counties (4,500 acres) since its inauguration in 2004.

Brownfield redevelopment is widely touted as of one of the most lucrative revitalization opportunities in post-industrial cities, although success measures vary from city to city and across development typologies. Despite Pittsburgh's continuing difficulties, officials and activists are taking steps to transform former industrial lands into clean, productive, multi-purpose districts. Several waterfront projects have already been completed, with various degrees of success, including SouthSide Works, The Waterfront, Station Square, Washington's Landing and the Pittsburgh Technology Center (located adjacent to the ALMONO site).

project stakeholders

Owners, Institutions, Community Organizations, and Research Groups

The ALMONO site is the last undeveloped brownfield of its size within Pittsburgh's city limits. Given its proximity to several vibrant Pittsburgh centers, diverse institutions, social groups and community organizations either have a vested interest in the site or would potentially be affected by or in a position to affect the site's redevelopment. These stakeholders hold information and resources that may be highly valuable and influential to the ALMONO process. A planning process that includes these stakeholders, understanding their operational constraints and future ambitions, can create a productive synergy of interests that engenders community buy-in, integrates development goals, and creates a better quality development.

Stakeholders hold valuable information that can influence a project from many directions. Knowledge sharing is a key component in participatory design processes and, even when practical concerns preclude shared decision-making, general communication can smooth development processes and generate innovative ideas and collaborations. Scientific knowledge may affect development costs, aesthetic decisions, or infrastructure placement. Instrumental knowledge about "what is possible" includes professional and technical know-how as well as political maneuvering and coalition building capacity. Ethical knowledge linked to local customs, beliefs, and values can bring unique flavor to development projects and tailor revitalization efforts to best serve existing needs. Aesthetic knowledge reflecting professional, community and lifestyle preferences can influence a range of planning factors, from streetscape aesthetic to circulation preferences.

Several groups have a stake in and hold knowledge regarding the ALMONO redevelopment project, including local land owners, neighborhood institutions and advocacy groups, community organizations, and the research and planning team driving the project forward.

ALMONO LP., Site Owners

The ALMONO Partnership owns and manages the former Hazelwood LTV Cokeworks site. This unique organization was formed in 2002 as a partnership between regional philanthropic foundations specifically for the purpose of purchasing and redeveloping the abandoned Hazelwood brownfield. The four funding partners are the Richard King Mellon Foundation, the Heinz Endowments, the McCune Foundation, and the Claude Worthington Benedum Foundation. ALMONO's fifth partner, the Regional Industrial Development Corporation of Southwestern Pennsylvania (RIDC), manages the property, making redevelopment decisions and assuming the associated liability.

The site's unusual philanthropic ownership creates several unique opportunities for its redevelopment. Although the foundations and RIDC expect the redevelopment process to generate an acceptable rate of return, the foundations are also committed to fostering redevelopment activities that reflect their broader philanthropic goals. The organizations' social and economic measures of success extend beyond the short-term, profit-oriented indicators that drive private development. Given ALMONO's composition and financial position, the organization can more easily pursue the highest and best use for the site as measured by social, environmental, and economic concerns on both the local and regional level, even if such schemes are associated with slightly slower turnover times and investment returns.

The four foundations have distinctive philanthropic missions that cumulatively reflect a wide range of economic and social concerns. Even on the issue of economic development, which is prominent for all four foundations, each group nonetheless retains a distinctive flavor. Based on past funding patterns, the R. K. Mellon Foundation is especially committed to economic development and environmental conservation issues. The Heinz Endowments share these interests, but focus more specifically on innovative development strategies and economically/socially integrated sustainability initiatives. The McCune Foundation supports economic development with particular emphasis on related community building programs and the Benedum Foundation's economic vision emphasizes local leadership and regional partnership.

The foundations' commitment to environmental protection suggests that extensive site remediation may be possible. Although extensive clean up requires time and money, such efforts would accommodate higher uses on the site and could improve the riverfront's health and accessibility. Restoration activities can also be integrated into other educational and community-building projects, perhaps by using the site as a demonstration project for robotic remediation or by integrating workforce-training programs into the rebuilding process.

Although the foundations are collaborating on the redevelopment process, each foundation nonetheless has its own funding strategies and objectives (see Fraser, 2004: a24). Both the Mellon Foundation and the McCune Foundation initially contributed to the project through financial gifts to RIDC or its affiliates. The Benedum Foundation donated funds as part of its annual grant making activities. The Endowments utilized funds from its investment portfolio and, therefore, sees the site and its profitability as part of its larger endowment package.

In 2003, as an early step towards generating a comprehensive redevelopment strategy, ALMONO retained the Pittsburgh-based Urban Design Associates (UDA) planning firm to develop a mixed-use master plan for the site. During this process, the foundations outlined their top four redevelopment goals. First, ALMONO hopes to

Above: Satellite image of Hazelwood and Oakland. (Source: Google Earth Pro)

revitalize Hazelwood by weaving the new development into the existing residential and commercial areas of Hazelwood. The redevelopment should create a "Great Urban Pittsburgh Place" that celebrates the cultural and industrial history of the site, Hazelwood, and Pittsburgh. The project should be sustainable, showcasing the best practices of industrial reuse while healing the site and being pedestrian/bike/transit friendly. Lastly, the redevelopment should connect the site to the region by supporting public transportation into the Monongahela Valley, connecting to the institutions and resources of Oakland and Pittsburgh, as well as providing public access to the river for recreation and commerce.

In addition to the UDA plan, a number of other organizations have put forward redevelopment visions for the area addressing the ALMONO site either directly or indirectly. Although many of these proposals continue to circulate, no plan has been fully developed or endorsed. ALMONO has also not yet formally hired a private site developer or architectural team.

Richard King Mellon Foundation, ALMONO Partner

One Mellon Center
500 Grant Street, Suite 4106
Pittsburgh, PA 15219-2502
412.392.2800
www.foundationcenter.org/grantmaker/rkmellon

> *"The Foundation makes grants for such purposes as, in the judgment of the Trustees, will be "in the public interest." Priorities included regional economic development, the quality of life in southwestern Pennsylvania, land preservation, and watershed restoration and protection with an emphasis on western Pennsylvania. Priority is given to projects and programs that have both clearly defined goals and plans to document progress and results. Foundation funds are committed almost exclusively to southwestern Pennsylvania."*
>
> *- Richard King Mellon Foundation, 2007*

The R. K. Mellon Foundation focuses its philanthropic activities on southwestern Pennsylvania. Within this region, it provides funding for programs addressing economic development, conservation, education, children and youth, and human services. In 2006, the foundation made grants totaling $87 million (total end of year assets: $2 billion), making it the largest of the ALMONO foundations in terms of annual gift giving.

Based on 2006 funding records, the Mellon Foundation considers regional economic development to be a top priority and gave 43% of its grant resources to related initiatives. Within this category, the foundation supports proposals that improve urban quality of life, attract and retain talented professionals, stimulate regional business climate, bolster rural economic development, and develop arts and culture amenities that generate economic activity. The foundation gave approximately 18% of its grants to conservation initiatives emphasizing land preservation, watershed protection and restoration, and environmental sustainability. Educational grants also comprised 18% of grant revenues and were awarded in support of non-public school systems, higher educational institutions, and workforce training programs. Children and youth initiatives, including early education and after-school programs, received 13% of the funds. The remaining 8% were dedicated to building the regional capacity of non-profit and human services institutions, especially targeting critical and strategic service providers.

The R. K. Mellon Foundation's initial contribution to the ALMONO partnership was in the form of a grant awarded to RIDC's Southwestern Pennsylvania Growth Fund. Given the Mellon Foundation's emphasis on regional economic development, high-tech institutional development plans that bolster the city's competitive advantage in that sector might be seen as especially appealing. The Mellon Foundation might also support neighborhood-oriented job training programs and awareness campaigns working to integrate the existing community into the new job market over the long-term. Although strict conservation on the site is an unlikely prospect, riverfront restoration efforts and green space amenities may also appeal to the foundation's core vision.

The Heinz Endowments, ALMONO Partner

30 Dominion Tower
625 Liberty Avenue
Pittsburgh, PA 15222
412.281.5777
www.heinz.org

> *"The Heinz Endowments is based in Pittsburgh, where we use our region as a laboratory for the development of solutions to challenges that are national in scope. Although the majority of our giving is concentrated within southwestern Pennsylvania, we work wherever necessary, including statewide and nationally, to fulfill our mission. That mission is to help our region thrive as a whole community - economically, ecologically, educationally and culturally - while advancing the state of knowledge and practice in the fields in which we work."*
>
> *- The Heinz Endowments website, May 2007*

The Heinz Endowments is a very active and visible foundation in the Pittsburgh philanthropic community. The Endowments give an average of $60 million in grants every year, most of which goes to support initiatives in southwestern Pennsylvania. Across the region, they support diverse interests targeting a wide range of issues.

Based on 2005 numbers, economic initiatives are a significant but not over-ridding area of interest. The Endowments devoted 27% of the funds to innovative economic development programs supporting research institution development, sustainable industrial growth practices, and workforce training opportunities for technology-based career paths. The next top three funding categories – arts and culture, children and youth, and environment – each received around 20% of allocation funds. Arts funding initiatives provided support for patrons, investors, developers, and catalyst activities. Children, youth, and family oriented programs support after-school activities, day care and health care initiatives, and home life improvements. Environmental programs emphasize Pittsburgh-based remediation and preservation activities centered on responsible land use development, sustainable building practices, and technological environmental innovation. The Endowments also make environmental contributions to social welfare initiatives where market forces alone are not sufficient to protect disenfranchised groups, such as repairing aging infrastructure and mitigating lead exposure. The remaining 13% were given to educational programs improving the quality of leadership and instruction in public schools and supporting a market-based approach to expand school choice and constructive competitiveness.

The Endowments' initial contribution to the ALMONO partnership was through a contribution to the site funded through their investment portfolio. This funding strategy suggests that the Endowments expect to see an appropriate return on their investment in the future and may therefore be particularly interested in promoting market-compatible development strategies. The Endowments have expressed their commitment to economic and environmental issues related to the site's redevelopment. Given their technological emphasis, they may respond favorably to a demonstration project that combines innovative economic, community-oriented, and riverfront regeneration strategies with high-tech building processes. In this vein, the Endowments have already expressed interest in a Carnegie Mellon proposal to use robotic technology to remediate soil contamination and assist with landscaping activities. The Endowments may also support educational and job-training programs to help community youth engage with the innovative economic growth in meaningful and productive ways.

McCune Foundation, ALMONO Partner

750 Six PPG Place
Pittsburgh, PA 15222
412.644.8779
www.mccune.org

> *"The mission of the McCune Foundation is to enable com-*

munities and nonprofit institutions to improve the quality and circumstances of life for present and future generations. In meeting these challenges, the Foundation employs flexible approaches and innovative strategies that are responsive to changing needs and new opportunities. The goal is to stimulate long-lasting and sustainable progress which contributes to community vitality and economic growth."

- McCune Foundation Website, May 2007

The McCune Foundation is dedicated to the strategic development of community and economic resources that are sustainable over time and make lasting positive contributions to all aspects of social life. In 2006, the foundation contributed $26 million in grant resources (total end of year assets $606 million) in support of economic, health, educational, and cultural initiatives.

Nearly half of 2006 grant dollars (46%) were earmarked for civic, community, and economic development projects. These donations funded initiatives to create economic opportunities, prepare young people for the workforce, and build healthy and economically viable communities to attract people to the city and region. McCune allocated another 26% of its budget to health and human service initiatives and 16% to educational activities. The remaining 15% of the budget was spent to bolster community vitality through arts, humanities, and religious initiatives.

When evaluating requests for funding, the foundation responds favorably to collaborative proposals that demonstrate longevity beyond the foundational funding period. To this end, the foundation supports projects that are realistic and persuasive, identity potential risks well as benefits, and acknowledge both the positive and negative aspects of the environment in which the proposed project will take place. Funding is only given to organizations with demonstrated organizational capacity to analyze performance and deliver results. The foundation rarely supports unsolicited proposals and prefers to maintain a low public profile.

The McCune Foundation's initial contribution to the ALMONO partnership was in the form of a financial contribution to the site through Strategic Developments, Inc., a $70 million private investment fund associated with RIDC. Since quality of life issues are paramount, and since the foundation is explicitly interested in attracting and retaining professional talent to the region, the organization may potentially respond favorably to redevelopment proposals to develop lasting and generative economic and community institutions on the ALMONO site. McCune may also have an interest in promoting recreational, artistic, and cultural activities that can help raise the community's profile and attract young professionals to the revitalizing area. Regeneration proposals should be collaborative and should help the current community transition to fulfill the economic and social needs of the redeveloped site.

Claude Worthington Benedum Foundation, ALMONO Partner

223 Fourth Avenue
1400 Benedum-Trees Building
Pittsburgh, PA 15222
412.288.0360
www.benedum.org

"Mission: To encourage human development in West Virginia and Southwestern Pennsylvania through strategically placed charitable resources"

- The Benedum Foundation website, May 2007

The Benedum Foundation has a regional focus on West Virginia and southwestern Pennsylvania. Within that region, the foundation supports proposals in economic development, education, health and human services, community development. The smallest of the ALMONO foundations, the Benedum Foundation's 2006 grants totaled $16.9 million (total end of year assets $420 million).

In its gift-giving practices, the Benedum Foundation emphasizes economic development and economic independence. Organizational literature emphasizes "helping people help themselves." To that end, Benedum donations support projects for economic growth that promote regional cooperation, encourage business development, and establish locational advantages through arts, tourism, and technological advancement.

As a secondary priority, the foundation promotes civic engagement across the region. The organization lauds efforts that cultivate individual and community creativity and leadership, especially among younger and older citizens. Although the foundation prefers to keep its regional emphasis narrow, it nonetheless supports projects crossing geographical and political boundaries to maximize regional access to services and economic growth. Similarly, the foundation supports collaborative efforts that bring together public, private, and nonprofit sectors, especially

when such efforts contribute to advancements in public policies. Lastly, the foundation is dedicated to advancing innovative practices with demonstrably measurable and sustainable benefits.

As an initial contribution to the ALMONO partnership, the Benedum Foundation made a contribution to the ALMONO site through program-related investment funding. Although the Foundation has made no official statements, site redevelopment activities create multiple opportunities for regional economic development and local community regeneration. Proposals that build community-based entrepreneurial opportunities into the regeneration framework may be especially attractive. Foundation personnel may also respond favorably to development proposals that bolster the entire city's competitive edge, perhaps through high-tech industrial expansion and professional-oriented quality of life amenities. Proposals for community leadership and job-training programs that empower the Hazelwood community may also find support.

Regional Industrial Development Corporation of Southwestern Pennsylvania (RIDC), ALMONO Partner

425 Sixth Avenue
Suite 500
Pittsburgh, PA 15219
www.ridc.org

RIDC is a private, non-profit development corporation. The organization was founded in 1955 to promote business and economic growth through strategic real estate development in southwestern Pennsylvania's nine counties. The group coordinates working capital provided by local, state and federal organizations and, as such, relies on governments and non-profit organizations for its development and operational revenue. Managing these assets, the group engages in various activities including environmental assessment and remediation, infrastructure development, and new building construction. The firm also administrates the Pennsylvania Industrial Development Authority's (PIDA) loan program for land and building acquisition and improvements.

Historically, RIDC specialized in suburban industrial office park developments. Many of these industrial parks are developed for or marketed to high tech companies as research facilities and corporate headquarters. They also finance, construct, and manage multi-tenant flex facilities, single-occupancy buildings, and incubator facilities. Over time, the group has gained experience working in urban brownfield conditions throughout Pittsburgh and Mon Valley communities.

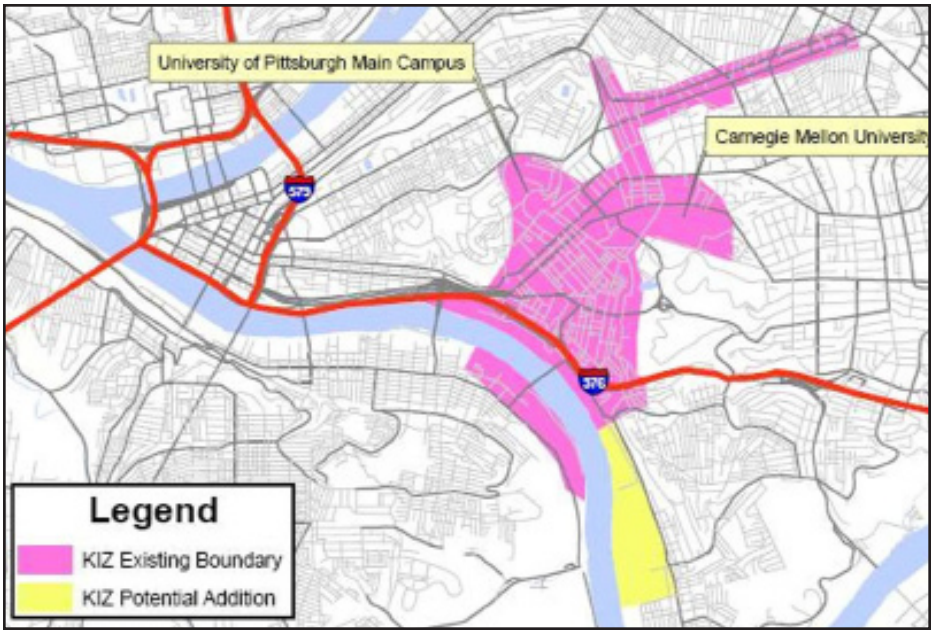
RIDC manages public interest projects in conjunction with churches, schools, hospitals, governmental units, and medical research organizations. For example, the group owns and manages the building housing Carnegie Mellon's Software Institute and was the financial manager for the university's Collaborative Innovation Center (CIC) development. RIDC also participated in the Pittsburgh Technology Center and the Washington's Landing brownfield revitalization projects. RIDC is a general partner in the ALMONO team working to redevelop the abandoned Hazelwood Cokeworks site. The organization will work primarily as an economic development service provider responsible for financial management and development decision-making. As the property manager, RIDC also assumes much of the development liability.

Oakland Business Partnerships

Greater Oakland Keystone Innovation Zone

> *The Greater Oakland Keystone Innovation Zone (GO KIZ) is focused on increasing technology company formation, location and growth in the region by leveraging the assets of the University of Pittsburgh, University of Pittsburgh Medical Center (UPMC) and Carnegie Mellon."*
>
> *- The University Partnership of Pittsburgh website, June 2007*

The Greater Oakland Keystone Innovation Zone (GO KIZ) was founded in 2005 to accelerate economic growth by leveraging the economic and technological strengths of Pittsburgh's primary healthcare and educational institutions. University of Pittsburgh Medical Center (UPMC) is clearly a regional economic driver – the organization is the region's largest employer and is experiencing ongoing and rapid growth. Similarly, University of Pittsburgh (Pitt) and Carnegie Mellon produced 34 private spin-off companies in 2002-2004. Hoping to translate these successes into broader economic growth, the GO KIZ initiative formed to promote greater collaboration between regional tech-based economic development organizations, trade groups, governmental agencies, and the universities. In addition to general research activities, the partnership



Map of GO KIZ zones. (Source: University of Pittsburgh Partnership, 2007)

uses incubation programs and tax credits to build "knowledge neighborhoods" on designated KIZ sites.

Traditionally, Pittsburgh's leading educational and healthcare institutions have concentrated their facilities in the Oakland community, located three miles east of downtown and just to the north of Junction Hollow. As Oakland's land area reaches capacity, continued growth in the area has become more challenging. Acquiring land in and near Oakland increasingly requires long-term and costly acquisition processes. Construction on these sites involves expensive urban demolition projects and extensive concessions for concerned or displaced community members.

In order to facilitate ongoing expansion, the Oakland institutions are increasingly looking to other neighborhoods for new construction projects. Reflecting these trends, GO KIZ "knowledge neighborhoods" have been designated throughout the city. Two recently redeveloped brownfield sites near the ALMONO land have already been added to the list, including the Pittsburgh Technology Center (PTC) located immediately downriver from the ALMONO site and the SouthSide Works facing the ALMONO site from the opposite shore. With easy access to Oakland and downtown, the PTC maintains especially close working ties with Oakland core offices and creates a technological anchor for extended development in Hazelwood.

The ALMONO site is the last undeveloped brownfield of its size within Pittsburgh's city limits. As such, the land represents an increasingly rare opportunity for a large-scale construction project. The GO KIZ partnership has already earmarked the ALMONO land as a potential GO KIZ addition. New infrastructure and access improvements to increase the site's connectivity with Oakland proper would only enhance the site's attractiveness. Assuming improved access, Carnegie Mellon has explicitly expressed interest in developing new high-tech research facilities on the ALMONO land. The University of Pittsburgh and UPMC have not yet stated their opinion on the matter, but working groups within the University of Pittsburgh are currently working in the Hazelwood community and are attending meetings with Carnegie Mellon personnel to discuss the site's growing potential.

Oakland Task Force

c/o The University of Pittsburgh
710 Alumni Hall
Pittsburgh, PA 15260
www.oaklandtaskforce.org

> *"Mission: To be a forum for Oakland community and neighborhood organizations, governmental entities, institutions and public agencies for the exchange of information, fostering relationships and to advocate for the resolution of issues that serve to improve the quality of life in the Oakland community for all of its stakeholders."*
>
> *- Oakland Task Force website, July 2007*

Left: Schenley Plaza, Oakland's main outdoor civic space. (Source: Greene, 2005)

The Oakland Task Force (OTF) "is a partnership of institutions, community organizations, businesses and public agencies working together, to improve [Pittsburgh's] Oakland neighborhood". The organization has twenty-four active partners, most of whom are civic or non-profit groups either based in Oakland or with larger city and regional interests influenced by Oakland development patterns. Oakland is already the third-largest employment center in Pennsylvania, after Philadelphia and downtown Pittsburgh, and the partnership actively promotes continued growth. To this end, the group advocates projects and policies that reinforce research activities, cultural development, and technology-based entrepreneurial activities. The OTF also prizes commercial and tourism activities and promotes mixed-income residential development.

In its 27-year history, the OTF has taken on several community and business development challenges. Broadly speaking, the partnership's four current initiatives include creating a sense of place in Oakland, improving transportation within Oakland and between neighboring communities, stimulating neighborhood revitalization, and fostering technology development. The group has devoted considerable attention to zoning ordinance and transit system improvements over the years and continues to lobby for strategic developments on these fronts. The group has successfully secured funding for pedestrian safety improvements, vehicular bridge repairs, and housing rehabilitation initiatives. The group also played an active role in the Schenley Plaza project, which converted a surface parking lot into a successful large public square.

The Oakland area is densely developed and, due to topographical barriers, future growth in the area is geographically limited. Although conveniently located and well served by mass transit, traffic congestion remains problematic. Large Oakland institutions, including the University of Pittsburgh, the University of Pittsburgh Medical Center (UPMC), and Carnegie Mellon have already begun developing fringe or satellite facilities in other areas of the city. Although no commitments have yet been made, an Oakland-sensitive development on the ALMONO site may of er the OTF new opportunities for continued growth.

Oakland Institutions

University of Pittsburgh Medical Center (UPMC)

200 Lothrop Street
Pittsburgh, PA 15213-2582
www.upmc.com

> *"UPMC'S mission is to provide outstanding patient care and to shape tomorrow's health system through clinical innovation, biomedical and health services research, and education."*
>
> *"UPMC will create a new economic future for western Pennsylvania – a future built on new ways of thinking about health care and sparked by leveraging the uniqueness of the integrated health enterprise. By exporting excellence nationally and internationally, and fueling the development of new businesses that emerge from UPMC's intellectual capital, core capabilities, and management expertise, UPMC will catalyze a regional economic renaissance. At the same time, UPMC will remain steadfastly committed to providing premier health care services to our region and contributing to this community."*
>
> *- UPMC Annual Report, 2006*

UPMC is the premier health system in western Pennsylvania and one of the most renowned academic medical centers in the United States. The organization, based in Pittsburgh, is a major life sciences anchor and economic driver region-wide. As the region's largest employer, UPMC maintained a 43,000-person workforce and created 1,800 new jobs in 2006. Collectively, the organization serves 4 million patients each year in its 19 hospitals

Left: Aerial view of UPMC, University of Pittsburgh in Oakland, with downtown in the background. (Source: University of Pittsburgh, 2005)

and hundreds of associated healthcare facilities dispersed throughout the 29 western Pennsylvania counties. UPMC manages internationally renowned centers in transplantation, cancer, neurosurgery, psychiatry, rehabilitation, geriatrics, and women's health, and also manages one of the nation's top ranked and fastest growing health insurance plans. Additionally, UPMC's 143 training programs enrolled approximately 1,300 active residents and fellows in 2006.

Already a leading economic catalyst for the region, UPMC is in a period of rapid growth. The organization generated $6 billion in revenue in 2006 (up from $3.4 billion in 2002) with a total direct/indirect impact of $11 billion. The organization also spent $288 million on charitable contributions and community-based healthcare programs. Its operations comprised nearly 50% of Allegheny County's total market share in 2006 (up from 43% in 2002) and 26% of market activity across the 29-county western Pennsylvania region. Although its capital expenditure budget fluctuates from year to year, the organization spent $396 million on capital improvements in 2006 ($300 million average over the past 5 years). The new Children's Hospital facility currently under construction in Lawrenceville is the largest building project in the Pittsburgh region. In 2006, UPMC also announced plans to co-develop another new research 10-story, 331,000 square feet biomedical research center in collaboration with the University of Pittsburgh.

In addition to its own in-house growth, UPMC has also invested tens of millions of dollars in new start-up companies and continues to attract talented professionals and technological firms to the Pittsburgh region. UPMC is a key regional purchaser of leading technology products and services and, through its educational partnerships, commercial ventures and industry collaborations, spurs both organizational growth and regional revitalization. In addition to the internal organizational goals stated in their 2006 Annual Report, the organization's executives express their intent to "make significant multifaceted contributions to enhance the region" in terms of resident health and economic vitality. The report pledges to leverage organizational expertise and investment to develop new businesses and job opportunities.

Although UPMC is an independent organization, it maintains close working ties with several regional universities, including the University of Pittsburgh (Pitt) and Carnegie Mellon. For multiple years running, UPMC has ranked among the top 10 recipients in the United States for National Institute of Health (NIH) funding, all of which is administrated by Pitt's medical research department. Additionally, in 2006, UPMC pledged to donate $328 million in training funds to Pitt over the next three years. UPMC is also evolving a working relationship with Carnegie Mellon, a leading technological institution with specialties in computer science, engineering, and robotics. The National Science Foundation gives Carnegie Mellon researchers more than $73 million annually for various technology initiatives, many of which have potential synergies with the health care industry.

In Pittsburgh's Hazelwood community, UPMC operates a small outpatient clinic one block away from the ALMONO site, on Second Avenue. The facility offers limited services related to general medicine, family planning, and women's health. The facility is open during the day on weekdays, is staffed one evening a week, and is closed on the weekend. The next closest UPMC facilities are located in the SouthSide Works area, directly across the river from the ALMONO site. The SouthSide complex is much larger than the Hazelwood facility, offering a range of comprehensive services in its hospital, doctors' offices, and sports medicine facility.

University of Pittsburgh (Pitt)

Pittsburgh, PA 15260
www.pitt.edu

> *"Founded in 1787 as a small, private school, the Pittsburgh Academy was located in a log cabin near Pittsburgh's three rivers. In the 220 years since, the University has evolved into an internationally recognized center of learning and research."*
>
> *- University of Pittsburgh website, June 2007*

The University of Pittsburgh is one of the oldest institutions of higher education in the United States. Initially a private institution, the school became a state-affiliated liberal arts university in 1966. The core 132-acre Pittsburgh campus is located in the heart of Oakland, three miles from the downtown business district, and four regional campuses serve outlying areas across western Pennsylvania. The University offers arts and sciences programs for undergraduate and graduate students with the larger goal of enhancing the lives and knowledge available to students, professionals, and government organizations throughout Pennsylvania.

In 2006, the school maintained approximately 12,000 employees and enrolled approximately 34,000 students. Nearly 80% of these students were enrolled on the Oakland campus and one third were graduate students. The institution's 2006 total revenues totaled about $1.5 million, most of which was furnished through grants and contracts (40%) and tuition fees (23%). Pitt's total assets that year exceeded $2.6 million.

Although the School of Arts and Sciences enrolls the largest number of students by far, the bulk of Pitt's funding underwrites medical-related research activities. For multiple years running, Pitt has been nationally ranked among the top 10 institutions in terms of the number of NIH research funding dollars received and also as measured by the number of related start-up companies created. Of the program expenses, nearly 40% were spent on medical research with another 35% used for researching public health, psychiatric care, and cancer treatment. The next largest category, Arts and Sciences, received only 7% of program revenue. The university's growing prestige in this area is in part an outgrowth of its strong partnership with the University of Pittsburgh Medical Center (UPMC), one of the nation's largest and most innovative regional healthcare networks. Together, these two institutions are driving Pittsburgh's economy forward and attracting new students and professionals to the region.

Left: Cathedral of Learning, University of Pittsburgh. (Source: University of Pittsburgh, no date)

In May 2007, Pitt unveiled an updated 12-year facilities master plan. The university expends to spend over $1 billion on modernization, construction, renovation, and infrastructure upgrades by 2018. Over 90% of those funds are earmarked for the Pittsburgh campus. Among the many additions and expansions, Pitt intends to "develop significant additional research laboratory facilities to support projected growth and to ensure the University's continuing competitiveness for external funding". Plans for a new $6.1 million nanofabrication facility are already in development. The university also hopes to expand student life space and athletic facilities. Hazelwood's ALMONO site has the potential to meet some of Pitt's research space needs.

University of Pittsburgh Community Outreach Partnership Center (COPC)
2017 Cathedral of Learning
Pittsburgh, PA 15213
www.pitt.edu/~copc

> *"The University of Pittsburgh's Community Outreach Partnership Center engages faculty, students, and staff in applied research and service-learning initiatives with community partners in neighborhoods surrounding the University. This effort addresses locally-identified issues in order to improve community conditions and build partner capacity in ways that also enhance learning experiences, scholarship and civic response across the institution."*
>
> *- COPC website, June 2007*

The Community Outreach Partnership Center (COPC) formed in 2000 to support community outreach initiatives among local educational institutions. The partnership was initially funded through a three-year grant from the US Department of Housing and Urban Development (HUD) and the University of Pittsburgh's Office

of University Partnerships (OUP). The COPC works in five Pittsburgh neighborhoods, including Hazelwood, on initiatives related to economic development, education, health and wellness, housing, job training, and neighborhood revitalization. The organization assists faculty and students working on community-related scholarship, works with community groups to identify issues and build response capacity, and coordinates activity among various community partners and academic groups. Additional funding was provided in 2004 for further work in the Oakland and Hazelwood communities. Although that funding expires in 2007, the group has secured an additional year of funding from Pitt and, during that time, will be pursuing additional resource opportunities as part of a continuing capital campaign.

The COPC has been working in Hazelwood since 2001, primarily with the Hazelwood Initiative community organization and with the community health services HI Hope office. In 2001, a group of graduate students analyzed the effects of past and ongoing public policies in the Hazelwood community, culminating in the *Hazelwood: Making New Connections* document. Based on their review of existing services, environmental quality, and workforce health, the group recommended policy changes to aid revitalization through increased regional connectivity, improved social services, and extensive training programs. In 2001 and 2003, student groups completed housing surveys based on vacancy, tax lien, and sales records. In 2005, the COPC completed *Hazelwood Community Asset Map: Assessing the Services, Needs, and Strengths of Hazelwood's Community Service Providers*, a study that reviewed the status of Hazelwood community and faith-based social service organizations. Based on their findings, there are pressing needs for jobs as well as improved housing, childcare, and social services. The COPC continues to maintain an active interest in the Hazelwood neighborhood and has begun collaborating with Carnegie Mellon's Remaking Cities Institute to explore the policy aspects of community revitalization and brownfield redevelopment.

Above: Carnegie Mellon campus. (Source: RWTH Aachen University, 2004)

Carnegie Mellon

5000 Forbes Avenue
Pittsburgh, PA 15232
www.cmu.edu

> *Carnegie Mellon is a global research university of more than 10,000 students and more than 4,000 faculty and staff, recognized for its world-class arts and technology programs, collaboration across disciplines and innovative leadership in education. At Carnegie Mellon, our core values — innovation, creativity, problem-solving and collaborative teamwork — provide the foundation for everything we do.*
>
> *- Carnegie Mellon website, June 2007*

Carnegie Mellon is one of Pittsburgh's leading research and educational institutions. The university's 140-acre main campus is located three miles from downtown Pittsburgh, just to the east of the University of Pittsburgh's central campus. The industrialist Andrew Carnegie established the facility as a technical training school in 1900. Since then, the institution has grown to include seven schools and colleges including: Carnegie Institute of Technology, College of Fine Arts, College of Humanities and Social Sciences, Heinz School of Public Policy and Management, Mellon College of Science, School of Computer Science, and the Tepper School of Business.

Above: Images from Sim Ops Studios, an ETC spin-off which focuses "on using the latest videogame technologies for training applications that will save lives". (Source: Entertainment Technology Center, 2007)

Right: Improving quality of life of the sight-impaired with technology. (Source: Quality of Life Technology Center, no date)

Carnegie Mellon's campus is located on the edge of Oakland and buffered to the south by Schenley Park. Like the other Oakland-based institutions, it is constrained for space. University officials have already developed small satellite facilities around the city. For instance, the world-class Robotics Institute research department maintains a facility along the Allegheny River, in the urban Lawrenceville neighborhood, and other research groups have moved to the Pittsburgh Technology Center downstream from the ALMONO site. Although these facilities are within the city, their dispersed locations make synergistic collaboration difficult.

Given the ALMONO site's convenient proximity to Oakland and extensive acreage, the land could potentially accommodate Carnegie Mellon's expansion and consolidation goals. Carnegie Mellon's interest in the site hinges on related infrastructure and transportation improvements that would provide a more direct connection between the Oakland campus and the Hazelwood facility. The Robotics Institute has proposed converting the existing freight rail lines into a light rail system. Bicycle infrastructure and shuttle bus improvements may also be necessary.

Robotics Institute, Carnegie Mellon
5000 Forbes Avenue
Pittsburgh, PA 15213
www.ri.cmu.edu
www.robotcity.org

> *"Even when robotics technologies were relatively primitive, their potential role in boosting the productivity and competitiveness of the United States was foreseen in the evolving global marketplace. The Robotics Institute at Carnegie Mellon University was established in 1979 to conduct basic and applied research in robotics technologies relevant to industrial and societal tasks. Seeking to combine the practical and the theoretical, the Robotics Institute has diversified its efforts and approaches to robotics science while retaining its original goal of realizing the potential of the robotics field."*
>
> *- Robotics Institute website, May 2007*

The Robotics Institute is considered to be one of the leading centers of robotics research in the world. It was established in 1979 as a division of the School of Computer Science and conducts basic and applied research in task-oriented robotics technologies. The Institute houses seven research centers totaling 463 researchers in 2004. That same year, the Institute received $40 million in funding from the Department of Defense (DARPA, Air Force, Army, Marines, and ONR), the National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF), and other unspecified federal and industry sources.

The Institute's research covers a range of social and technological research interests. Among their current projects, several researchers are working to develop remote mapping and exploration technologies for subterranean, underwater, lunar, and planetary applications. Others

specialize in autonomous ground and air navigation technologies or in sensor and communication technologies related to agriculture and to border patrol. Researchers are also developing human-robot interaction technologies for communication and development in dynamic or remote environments.

Since the Robotics Institute is currently over capacity, the Institute has partially renovated the former locomotive roundhouse on the ALMONO site in Hazelwood. The Institute is currently using this facility to house elements of the Field Robotics Center, one of the seven centers within the Institute. This group develops mobile robots for use in field environments, such as work sites and natural terrain. In this context, the robots use sensing and self-navigation strategies to perform non-repetitive tasks. The field robots are currently being used to remediate and cultivate the soil around the roundhouse.

To accommodate continued growth, Carnegie Mellon is considering developing a new "Robot City" facility dedicated to field robotics research either on the ALMONO site or elsewhere in the city. This new facility would provide much-needed space for robot-related development and testing. Institute researchers hope to use the process to demonstrate the effectiveness of autonomous technology in physical community development and human-robot cohabitation. ALMONO's Heinz Endowments has expressed its interest in the project and may provide funds to develop a planning proposal for the project.

Entertainment Technology Center, Carnegie Mellon
700 Technology Drive
Pittsburgh, PA 15219
www.etc.cmu.edu

> *"Leadership in education and research that combines technology and fine arts to create new processes, tools, and vision for storytelling and entertainment"*
>
> *- ETC website, 2007*

The Entertainment Technology Center (ETC) is a collaborative facility that demonstrates how computer scientists and artists can work together to create new forms of digital entertainment and media. The collaboration began in the 1990s as a cross-discipline project between the School of Computer Science and the School of Drama. Current research activities include developing educational and empowerment interactive gaming technology, developing gaming systems for industry recruitment and social awareness purposes, and improving general virtual interactive and experiential technologies. The Center houses approximately 50 graduate students in residence and acts as an incubator for related industry spin-offs.

Since the ETC is an incubation unit as well as an educational center, non-academic space is crucial to the Center's operational goal. Instead of locating these facilities on the core campus site, which is already pressed for space, the ETC is currently located in the Pittsburgh Technology Center office park on Second Avenue, just north of the

ALMONO site and the Robotics Institute's roundhouse activities. As the Center grows, it may be advantageous to relocate the ETC home office into a larger collaborative research complex on the ALMONO site. Increased proximity could increase synergistic collaboration between ETC and other Carnegie Mellon research groups and raise the facility's prominence in the Pittsburgh region and the technological field.

The ALMONO project may of er ETC researchers unique opportunities to integrate their virtual technologies and human-computer interfaces into physical community structures. Theoretically, research teams could develop and test job training and early education programs in the Hazelwood community helping to raise awareness of career prospects in technological fields. The ETC storytelling projects could be used to convey site history and environmental information to educational and recreational groups using riverfront amenities. The group's groundbreaking human-computer interaction strategies could be used to help integrate innovative robotics technologies into the community environment in constructive and non-threatening ways. The ETC's active presence on the site would not only provide students with unusual opportunities to engage with their audience, such activities could also attract private sector firms and government agencies to the site.

Quality of Life Technology Center (QoLT), Carnegie Mellon
5000 Forbes Avenue
Pittsburgh, PA 15213
www.qolt.org

> *The Quality of Life Technology (QoLT) Center is a National Science Foundation Engineering Research Center (ERC) whose mission is to transform lives in a large and growing segment of the population - people with reduced functional capabilities due to aging or disability.*
>
> *- QoLT website, 2007*

The Quality of Life Technology Center (QoLT) is a joint partnership between Carnegie Mellon and the University of Pittsburgh working to enable self-determinism for people with reduced functional capabilities. The Center is a National Science Foundation Engineering Research Center (ERC), created to integrate information, engineering, and biomedical innovations that help people prevent, cope with, and rehabilitate from ailments. The center's cross-disciplinary team of technologists, clinicians, industry partners, end users, and other stakeholders builds on research advances in intelligent system technologies, including machine perception, robotics, learning, communication, and miniaturization. Using this research base, the QoLT develops new technologies that measure functionality in ways that engage with and inform affected individuals thereby increasing the opportunities to improve their lives, wherever they are.

The group works to enable older adults and persons with disabilities to independently participate in the community both socially and economically. Research personnel develop technologies that assist professional and informal caregivers and that delay or prevent the manifestation of functional impairment. The group develops technologies that increase employability and productivity across the life span and that expand the range of environments in which people will be independently and safely mobile. The group also develops technology that expands the number of years individuals can live independently at home. In support of these goals, QoLT personnel are working to devise methods to measure the adoption and impact of these technologies. The center develops systems that can communicate naturally with people, especially those with impaired communication abilities. Team members work to design safe and gentle caregiver systems that are able to interact with people and their environment. Similarly, the center is developing monitoring and modeling technologies able to interpret people's environment and their physical, cognitive and behavioral states. The center also collaborates with the Blueroof Technologies non-profit organization on their "Senior Smart Technology" program, which promotes technological development that aids senior citizens to maintain independence in their daily lives.

University Center, Carnegie Mellon University. (Source: Wausau, 2006)

Ongoing QoLT research initiatives could make the group a particularly useful partner in developing an urban demonstration project that explicitly empowers older and disabled community members. As a new development, community buildings and infrastructure could potentially incorporate robot sensing and therapeutic technologies directly into the built environment. These initiatives would realize, in a real world setting, the center's mission to facilitate independent functioning and productive activity in at-risk groups within the community environment. As a demonstration project, the successes and shortcomings can be monitored and refined over the years, and can serve as a case study showcasing how these strategies can be implemented into general development patterns.

Carnegie Mellon Research Partners

Research groups at Carnegie Mellon are actively involved in the ALMONO redevelopment planning process. A new university facility on the site could benefit numerous research institutions. Behind the scenes, the Remaking Cities Institute is working closely with the Center for Economic Development, the Heinz School, and the School of Architecture to make these possibilities a reality.

Remaking Cities Institute (RCI)

5000 Forbes Avenue
Pittsburgh, PA 15213
www.arc.cmu.edu/

> *"The Remaking Cities Institute catalyzes sustainable urban futures and excellence in community design. In five years, the Remaking Cities Institute expects to be recognized internationally as the key resource for rebuilding urban communities, demonstrated through the revitalization of communities in the Pittsburgh region."*
>
> *- Remaking Cities Institute*

The Remaking Cities Institute (RCI) is a resource for the Pittsburgh region to promote an improved quality of life through carefully planned economic and community redevelopment. The RCI is an outgrowth of the School of Architecture's Urban Laboratory program, and builds on the Lab's several decades of community outreach success. The RCI was created to ensure and expand the education, community visioning, and research efforts of Carnegie Mellon University. The group also works to strengthen university partnerships in the Pittsburgh region to catalyze the revitalization of urban regions, neighborhood by neighborhood. The RCI and the Urban Lab partner with key Pittsburgh leaders in leveraging the energy and creativity of outstanding students to lay the foundation for professional engagement. Students assemble extensive project documentation while allowing communities to affordably explore a range of design ideas and implementation alternatives. The group's public processes generate strong enthusiasm and result in a core group of citizens that are better prepared to engage in the future implementation process.

Center for Economic Development (CED)

University Technology Development Center
4516 Henry Street, Suite 208
Pittsburgh, PA 15213
http://www.smartpolicy.org/index.php

The Carnegie Mellon Center for Economic Development (CED) provides information and solutions to improve community, regional, and workforce development. The group was established in 1987 as an applied research center exploring the ways academic resources can be leveraged for regional economic growth. During the 1990s, the CED worked primarily on the Regional Economic Revitalization Initiative. Together, these groups formed and implemented a broad-based economic visioning plan to create 100,000 new regional jobs by the year 2000. In its initiatives, the CED emphasizes entrepreneurship, technology, and innovation. Today, the CED is affiliated with the Heinz School of Public Policy and Management. Their basic objectives are to provide technical assistance in strategic policy analysis and economic modeling. The group also maps economic and demographic data and compiles performance benchmarking and evaluation reports, using its Community Information System data and software.

The CED has many projects currently active. Some personnel are developing Systems Synthesis projects in support of the Greater Oakland Keystone Innovation Zone (GO KIZ) effort to attract technology firms to the Oakland area. Others develop community facilities feasibility studies that examine the potential for synergy and efficiency in delivering community services across Pittsburgh's units of government. Other initiatives include database

Looking for Braddock's Field. (Source: RCI)

and modeling analysis to facilitate information exchange and correlate employment dynamics. CED groups are analyzing the mechanisms by which universities impact the regional economy through public-private interactions fueling development and competitiveness. The center is also compiling a Cluster-Based Community Development Strategies guidebook to help local areas connect with, and make the most of, regional cluster strategies.

The CED's interest in university-driven, high-tech economic development strategies makes it a useful ally in the ALMONO redevelopment project, especially if Carnegie Mellon develops a new research facility on the site. Based on CED's embedded knowledge, staf can provide valuable feedback shaping land use patterns and marketing strategies in order to optimize both neighborhood and regional benefits. If ALMONO does opt for an experimental demonstration project, the unique development patterns could serve as an ongoing case study and testing site.

H. John Heinz III School of Public Policy and Management

5000 Forbes Avenue

Pittsburgh, PA 15213
www.heinz.cmu.edu/

> *"The fundamental purpose that drives the Heinz School of Public Policy and Management is to advance the broad public interest through focused research and outstanding graduate education."*
>
> *- Heinz School of Public Policy and Management, 2007*

The Heinz School provides advanced education on policy, management and information technology. It was founded in 1968 through a $10 million grant from the R. K. Mellon Foundation for the study of urban and social issues. The school's extensive graduate students outreach programs provide real life experiences while simultaneously addressing immediate community needs. The School's current research strengths include: information technology, security policy, arts management, health care policy and management, criminal justice policy, policy analysis, finance, and environmental policy.

The Heinz School has several specific operational goals. Its personnel work to increase understanding of the causes of the social, economic and political issues challenging society. They work to integrate policy, management and information technology research in innovative ways and to improve the human condition through involvement in public service projects. The Heinz School also consciously serves as a model for others.

Heinz School graduates and instructors are currently working on the Carnegie Mellon collaborative to generate a redevelopment vision for the ALMONO site. Active personnel emphasize an analytical approach that is fiscally sound and sensitive to the needs of the existing Hazelwood community. Even before ALMONO acquired the site, Heinz students used the location and neighborhood as a seminar case study. In 2001 and 2003, student groups analyzed demographic trends, met with stakeholders, and generated policy recommendations for community regeneration. Using this built-up knowledge, graduate students could launch a redevelopment outreach project that provides students with much needed hands-on experience in community building that benefits local residents.

School of Architecture

201 College of Fine Arts
Pittsburgh, PA 15213
www.arc.cmu.edu/

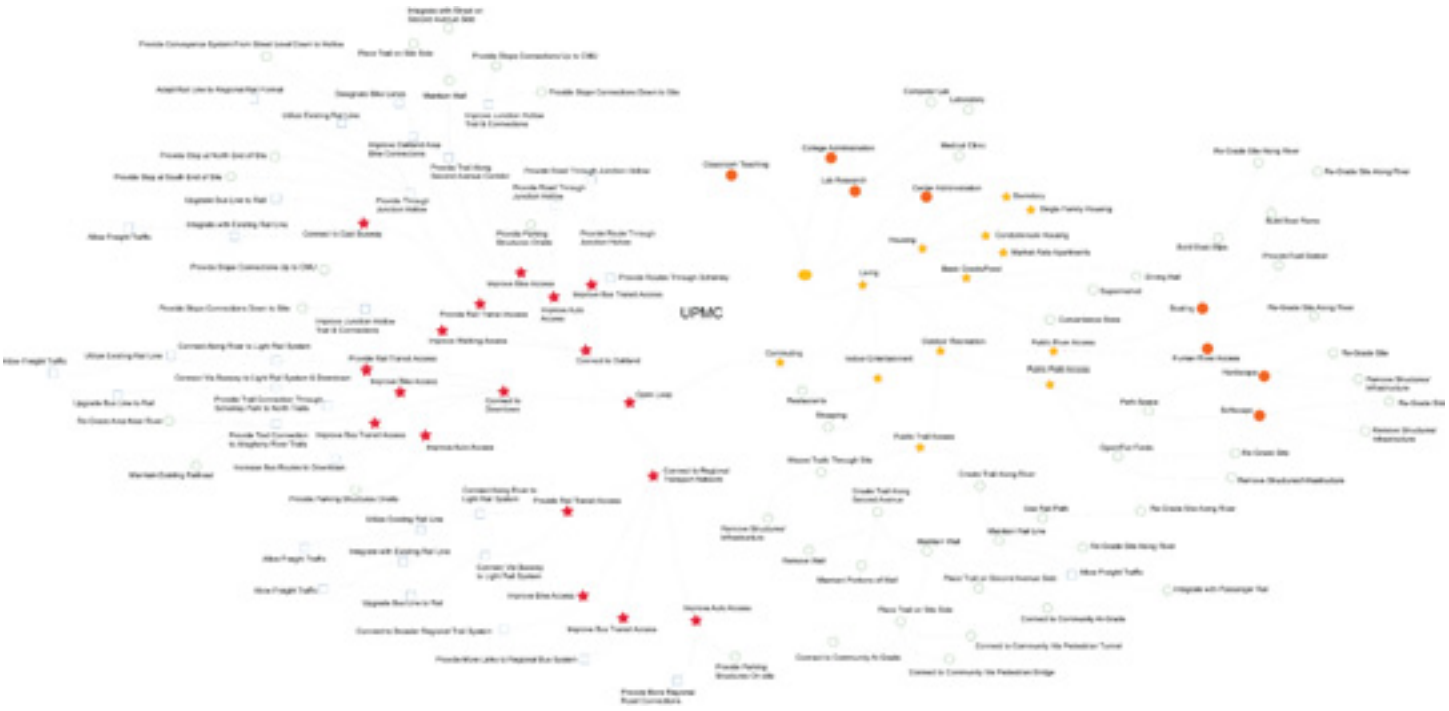
> *"We believe a hands-on laboratory setting in the design studio is unparalleled in teaching future professionals to deal with complex problems, multiple clients and indeterminate answers."*
>
> *- School of Architecture website, May 2007*

The Carnegie Mellon School of Architecture, founded in 1900, is dedicated to architectural design education. The school emphasizes integrated design education with specialties in sustainable design, advanced building systems technology, computational design, professional practice training, and urban design. Students build a diverse portfolio of professional projects and effective forms of communication, each motivated to improve the quality and richness of the built environment. Academic staff include registered architects, environmentalists, technologists, and research theorists.

Community outreach is a core programmatic element in the educational curriculum. The school sends students of all levels out into the community to develop site-specific project proposals. The Urban Laboratory, founded in 1963, is one of the school's most successful outreach programs. This program provides interdisciplinary education in a hands-on context. Students engage with public agencies, elected officials, private investors, and local citizens to jointly research community issues. The program encourages students to develop regeneration proposals for Pittsburgh's stressed communities, and has frequently used Hazelwood as a community of interest.

The School of Architecture and its Urban Lab are integral parts of the Remaking Cities Institute. Graduate students in the school's Urban Design program spent the 2006-07 academic year investigating the ALMONO site specifically. They explored redevelopment scenarios and analyzed decision-making frameworks. Building on their analysis, the 2007-08 Urban Lab is scheduled to engage with consultants and stakeholders to explore and develop site-specific redevelopment plans. The Remaking Cities Institute will house the interaction and facilitate the process.

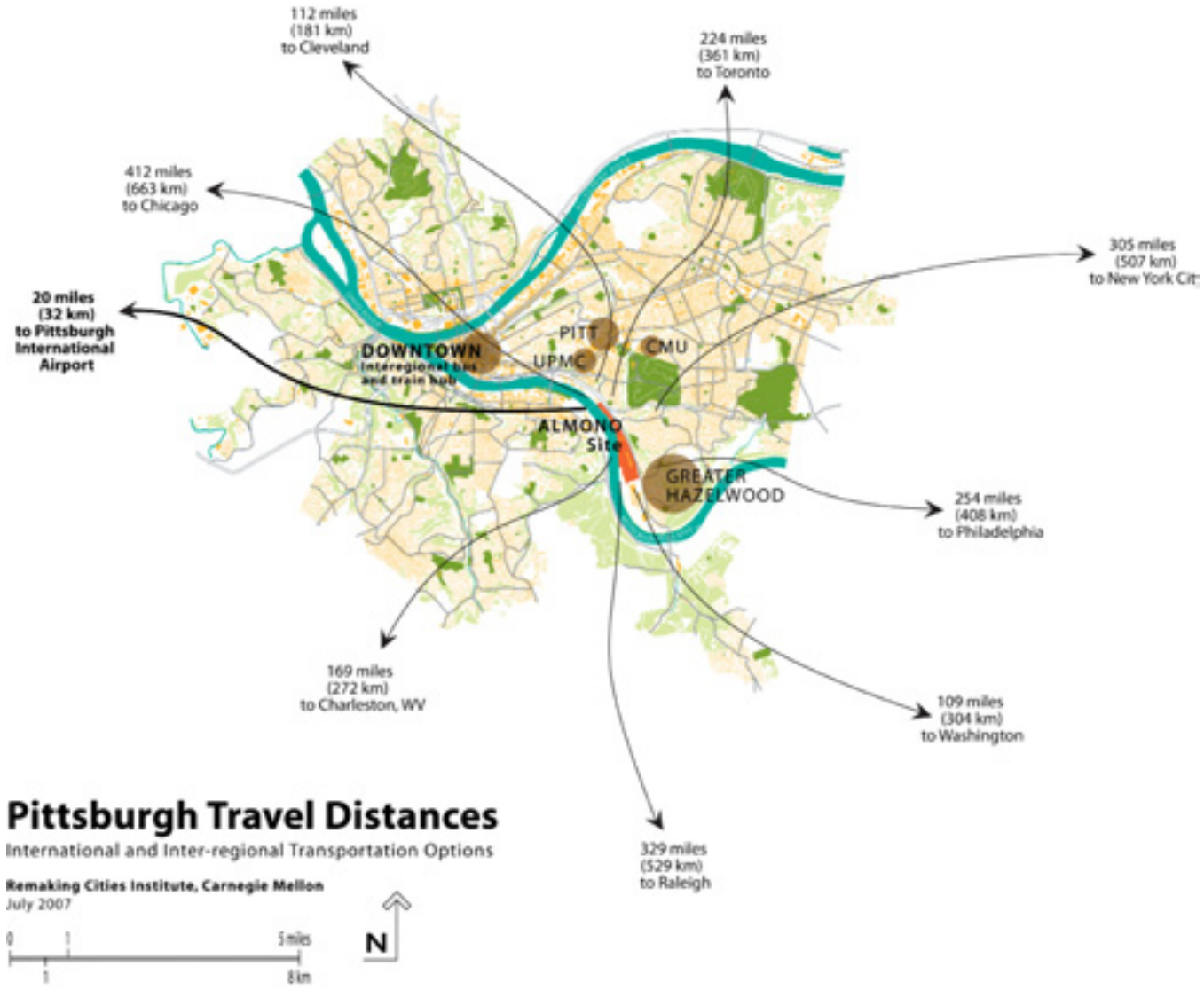
Below: Students mapped the "full decision field", noting the players, the outcomes they might influence and the programmatic implications for the ALMONO site. Urban Lab, 2005. (Source: RCI)



pittsburgh socio-geography

Regional Context & Development History

The City of Pittsburgh is spread across several valleys and hills on the Allegheny Plateau in southwestern Pennsylvania. The downtown business district is located on the "Golden Triangle", a flat piece of land where the Allegheny and Monongahela Rivers converge to form the Ohio River. The region is part of the North American "rust belt", a broad swath of once largely industrial cities and milltowns distributed across the coal-mining region of Southwestern Pennsylvania, West Virginia and Kentucky, and the heavy manufacturing centers located near the southern edge of the Great Lakes.



Pittsburgh & Hazelwood Overview

With a 2006 population of 312,819, Pittsburgh is the second largest Pennsylvanian city after Philadelphia (population 1,448,394). The Pittsburgh, PA Metropolitan Statistical Area (MSA) has 2.3 million residents, making it the 22nd most populous MSA in the U.S. The city is a hub for regional bus lines and a new downtown Amtrak/bus terminal is currently under construction. The Pittsburgh International Airport (PIT), located 20 miles outside of the city, and is the nation's 40th busiest airport, with 19 airlines operating 290 flights a day to 80 destinations.

The Greater Hazelwood Area includes Pittsburgh's Hazelwood neighborhood and three diverse neighboring communities, Glen Hazel, Glenwood and Riverside (known locally as "Below the Tracks"). The neighborhood is tucked into a deep and hilly bend on the northern shore of the Monongahela River, nearly 4 miles southeast of downtown Pittsburgh. Greater Hazelwood is roughly two square miles (1,280 acres) in size, nearly 3.5% of Pittsburgh's total land area (58.3 square miles). Its nearby neighborhoods include Greenfield, South Oakland, The Run, and, across the river, the South Side. The ALMONO site is located along Hazelwood's northwestern edge, on the flatlands between the hillside community and the Monongahela River.

History of the Hazelwood Community and the ALMONO site

According to CMU historian Joel Tarr, "human action as well as natural forces have shaped and reshaped the [Pittsburgh] landscape" (Tarr, 2002: 512). In his environmental analysis of Pittsburgh, Tarr explains that the city is built

on what was once an extensive uplifted plateau 1,200 feet high. Over 300 million years ago, the Pittsburgh area was covered by swamps in the landward part of a large deltaic system. Pittsburgh was close to the equator and had a hot, tropical climate in which plant life flourished. Once the plants died, they fell to the bottom of the still swamp water. Bacteria consumed the organic material until all oxygen was used and the water stagnent. The absence of oxygen combined with the presence of humic acid in the water killed the bacteria and the remaining vegetation was buried in the muck at the bottom. The layer of dead and partially rotted plant parts was eventually buried by sediment. Deep below the surface, it was squeezed and heated by geologic pressure, in essence "cooked" to nearly pure carbon (Tagg, no date).

Over the millennia, rainwater and rivers carved valleys and hollows out of the 16,000 feet (3 miles) of sedimentary rock, part of the Allegheny Plateau, that lies under Pittsburgh, resulting in the relatively consistent and hilly terrain that exists today. Considered part of the Appalachian Range, the plateau links the southern Blue Ridge Mountains to the northeastern Catskills. Bituminous coal is plentiful throughout the area and some natural gas and petroleum deposits have been discovered (*Ibid*.).

The geography of Greater Hazelwood echoes that of the broader region, and the neighborhood's steep topography is both a defining and a limiting feature. Steep slopes rise rapidly from the flatlands on either side of the Monongahela River, creating a dramatic green backdrop that belies the area's long coal mining history. The area contains some of Pittsburgh's steepest hillsides, with a 300-foot grade change from the river's edge to the Greenfield hilltop neighborhood above. Nearly 115 acres of Hazelwood's 1,280-acre total land area have a slope greater than 25%, much of which borders the ALMONO site and The Run community. Although the ALMONO land is only a few miles from Oakland, the steep hillsides prevent easy access from the Hazelwood community to the major employment center. In addition to the magnificent relief, Greater Hazelwood also includes four miles of shoreline and several acres of woodland area. The area is part of the Monongahela River sub-watershed.

The area's dramatic topography, rich resources, and extensive waterways have been a mixed blessing for local inhabitants, and over the centuries, human settlement and manufacturing has dramatically changed the face of the landscape for better or worse. Hazelwood's developmental history can be divided into four distinct phases: a pre-colonial and pre-industrial era lasting until about 1870, a period of remarkable industrial growth from 1870-1920, a relatively stable or slightly stagnating period from 1920 to 1950, and a period of decline after 1950 (Tarr and Di Pasquale, 1982).

Archeological evidence indicates that the Pittsburgh area has a long and rich settlement history. Early nomadic Paleo-Indians regularly passed through what is now Hazelwood proper, and their Native American descendents built burial mounds in the present day Scotch Bottom

Left: Map of the Allegheny Plateau. (Source: RCI, 2007)

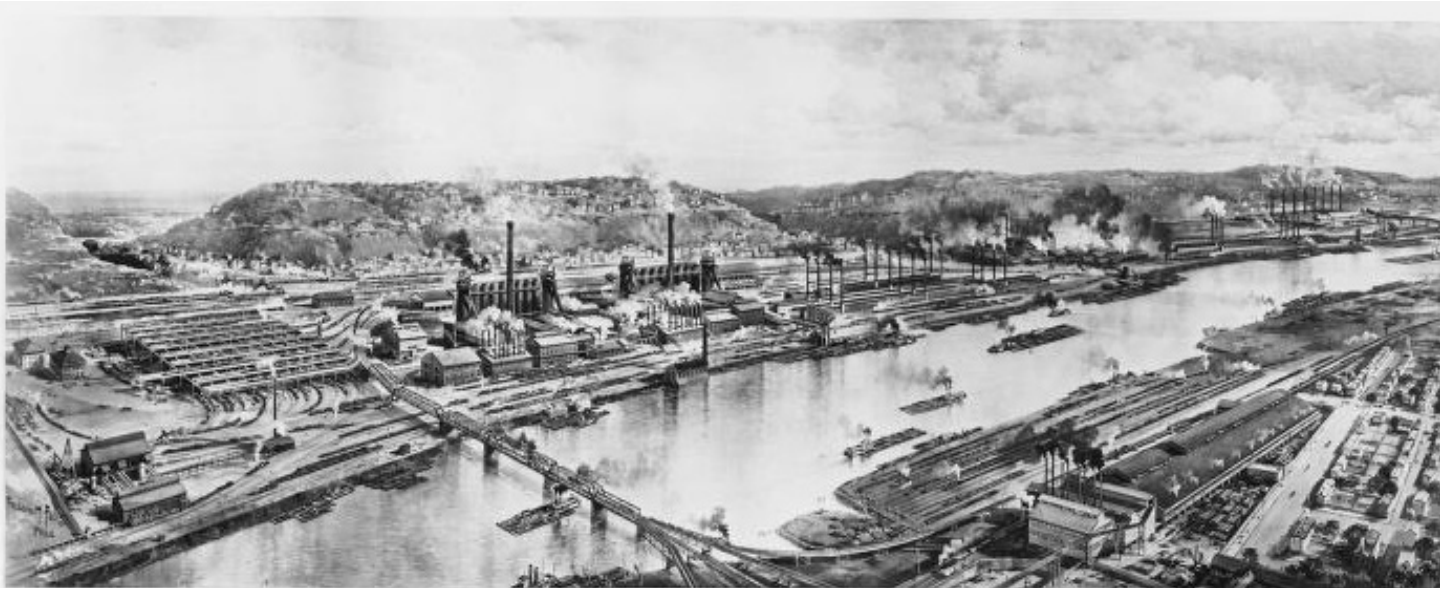
Below: Monongahela River in downtown Pittsburgh as it exists today. (Source: Beth Conant, 2006)


Land Grant: c. 1780
Hazelwood, Pittsburgh
Wm Thompson
172 ¾ As. & Allo.
Surveyed May 10, 1774
Warrant dated Jan. 17, 1774.
Patented Jan. 4,
Catharine Thompson
in trust. P-12-93.
Jacob Castleman
246 As. & Allow.
Warrant dated Nov. 14,
Surveyed Mch. 12, 1788.
Patent'd Dec. 10, 1788
to Warrantee
P. 14. 404.
"Castlemania"
James Ralph
262 ¾ As. & Allowance.
Surveyed Oct. 25, 1769
on Order N° 682.
Patented Sept. 5, 1781
to Eleanor & John Dehaas
and John Woods,
on Warrant to accept
dated Aug. 30, 1787
"Leisure Retreat"
P. 11. 186.
Thos.
Walker
255 As. & Allowance.
Patented Feb. 24, 1770
Warrant to accept


1872
Hazelwood, Pittsburgh


1904
Hazelwood, Pittsburgh


1930
Hazelwood, Pittsburgh



Above: J L Steel Corp.'s Eliza Furnaces and Coke Ovens in 1902. (Source: University of Pittsburgh, Pitt Digital Library, no date)

neighborhood. The earliest Caucasian settlers arriving in the 1750s subsequently destroyed the mounds and used the stones to build an early version of Second Avenue. Although little remains of the Native American heritage, Pittsburgh's three rivers – the Ohio, the Monongahela, and the Allegheny – were all named using indigenous lexicon. The Monongahela River, running along the western edge of the ALMONO site, is named after a Delaware expression meaning "high banks breaking off and falling down to place" (Albert and Goto, 2004).

The William Penn family acquired the present-day Hazelwood land area from the Iroquois tribe as part of the 1758 Treaty of Fort Stanwix. Surveyors charted and patented the area over the next three decades (1769-1789) and Scottish immigrants quickly established a settlement on Scotch Bottom's alluvial flatlands (the present-day ALMONO site). Wealthy Pittsburgh residents prizing fresh air, old trees, and spectacular views began moving to the Monongahela's lush lower hillsides and flatlands in the mid-1800s. Based on historic land grant maps, the ALMONO site was initially patented to three different owners, including Samuel Sample, W. M. Troup, and James Ralph. These early landowners and their neighbors selected pastoral names for their properties – such as Sampleton, Dukes Troup, Leisure Retreat, Vineyard, Green Woods, Castlemania, and Mt. Airy – which suggests that they intended to use their holdings as leisurely rural getaways. For a few decades, large mansions housed many of Pittsburgh's wealthiest families, including businessmen, bankers and riverboat captains, making Hazelwood one of the area's choicest suburbs.

Early historical maps indicate that open streams once flowed through Hazelwood, with four surface streams traversing the present day ALMONO site. The largest stream, Four Mile Run, emptied water from the present day Junction Hollow and Greenfield Avenue valleys into the Monongahela River. Two smaller streams were located near the present day ALMONO Roundhouse and Tullymet Street, and a fourth stream ran near the old Marion Station. Although the streams still appear on maps generated near the turn of the century, it is unclear whether developers had already begun burying portions of these streams at that time.

Hazelwood's strategic riverfront location, between the coalfields of Connellsville and the City of Pittsburgh, also appealed to large-scale industrialists. Six private dams and toll locks were constructed along the Monongahela River in the 1840s to counter variable water levels and make the river reliably navigable. The Pittsburgh and Connellsville Railroad, servicing Hazelwood and the present day ALMONO site, was completed in1861, opening the area for more intensive development. Lured by promising signs of growth, Pittsburgh city officials annexed Hazelwood in 1869 as Ward 23.

By 1870, Hazelwood held a mix of residences, civic structures, and small pre-industrial production facilities. The 1870 census counted 1,399 Hazelwood residents. At that

Left: From the 1886 Atlas of the Vicinity of the Cities Pittsburgh and Allegheny Pennsylvania; rail stations in Hazelwood are in place. (Source: University of Pittsburgh, Digital Research Library, no date)

Left Below: "Hell with the lid off": J&L company housing on Forbes Ave, engulfed in pollution, 1918. (Source: University of Pittsburgh, Digital Research Library, no date)

Below: Milk station mothers, 1922. (Source: University of Pittsburgh, Digital Research Library, no d ate)

time, the neighborhood-scale street grid extended across the present-day ALMONO site connecting the Hazelwood community directly to the Monongahela riverfront. The Jones & Laughlin industrial enterprise had been operating beehive coke ovens on the site since 1859 and would eventually become one of the largest employers in the Hazelwood area through the 1970s. In 1870, however, the firm owned only a few blocks near the southern end of the ALMONO site. Historical maps of the present-day ALMONO property clearly identify a small brickworks facility as well as a few blocks owned by Hays, perhaps some relation to the meatpacking and coal industry Hays. A single rail line ran through the community along Second Avenue. The Marion Station served the J&L and Hays properties and another station served the smaller Glenwood manufacturing facilities to the south.

The most transformative industrial expansion occurred from 1870 to 1920. During this period 40-year period, the site was transformed from an early suburban working class industrial community into a fully developed industrial center sporting iron and steel facilities, extensive railroad access, dock facilities, and boatbuilding trades.

By 1886, Hazelwood had six rail stations, four of which were located along the Second Avenue edge of the future ALMONO site. Although Laughlin's landholdings had expanded significantly by this time, the Elba Iron & Bolt Company also operated a small production facility there. Traditional street grids and block sizes still existed, and various estates (including the Hays property) remained interspersed in the budding industrial framework.

By 1904, the landscape had clearly begun to change. Beehive oven facilities, used to turn coal into coke used to fuel iron making blast furnaces, were developed in 1884 and, by 1906, the site held the largest concentration of these ovens in the world. In 1904, the U.S. Army Corp of Engineers successfully transformed the Monongahela River into the first fully navigable river in the U.S. Maps from this era also show extensive rail facilities, lines, and spurs throughout the site and along the rivers edge, including a large rail yard and the still existing round house. By that time, the Jones and Laughlin Steel Company (J&L) owned large tracts of land in the region, including most of the ALMONO site. The J&L Eliza Furnace plant was in full operation on the northern portion of the ALMONO

Right: Second Avenue Business District, 1957. (Source: University of Pittsburgh, Digital Research Library, no date)

Below Right: Community Day in Hazelwood, 1955 or 65 (Source: Source: University of Pittsburgh, Digital Research Library, no date)

Below: Second Avenue Business District, 1933. (Source: University of Pittsburgh, Digital Research Library, no date)

site and a rail bridge carried hot metal across the river to additional mill sites on the Monongahela River's south side. Most of the non-industrial buildings along the waterfront had been cleared to make way for plant expansions and the old Hazelwood street grid that once connected the community to its riverfront had been eliminated and the land and shoreline privatized.

The city improved the transportation infrastructure dramatically during the second half of the century. The aging Braddock's Field Plank Road was paved in 1870, formally establishing Second Avenue. The Baltimore and Ohio (B&O) Railroad ran trains through Hazelwood into downtown Pittsburgh, but ticket prices were too expensive for most residents. In 1885, the Glenwood Bridge was constructed, providing a link to Homestead and Duquesne, and the first electric streetcar operation began running down Second Avenue into downtown Pittsburgh in 1890.

As the manufacturing industries grew, Hazelwood's population boomed. By 1900, Hazelwood's workforce had grown to 2,870, a 796% increase from 1870. Almost 40% of workers held white-collar positions. Hazelwood residents were largely first- or second-generation immigrants from Ireland, Italy, Hungary, Poland, and the Slovakian countries. New immigrant residents quickly developed community organizations centered on the area's many churches, civic structures, and fraternal lodges. Small businesses and trades sprang up along Second Avenue creating a bustling commercial district and, by 1885, forty-three retail stores were listed in the area. The First Hungarian Reformed Church, built in 1890, was the first Hungarian church built in the United States. By 1910, there were fifteen churches in the 15th Ward.

By 1910, the basic industrial infrastructure that underpinned the next 80 years of production was largely in place, as was the city's notorious "Steel City" reputation. Pittsburgh was renowned for its high pollution levels and poor working-class housing conditions. Turn-of-the-century visitors described the city as hellish, comparing the city to "the outer edge of the infernal regions" full of "tortured spirits writhing in agony, their sinewy limbs convulsed, and the very air oppressive with pain and rage" (Lubove, 1969: 1). A journalists famously described the

Top: Dangerous work: Pittsburgh Steel Works. (Source: University of Pittsburgh, Pitt Digital Library, no date)

Middle: J&L Steel Corp. facilities on the South Side with the Hot Metal Bridge and the Hazelwood Works in the bakc-ground, 1954. (Source: University of Pittsburgh, Pitt Digital Library, no date)

Bottom: Modernized J&L Soho Works, upriver from the Hazelwood Works facility, 1952. (Source: University of Pittsburgh, Pitt Digital Library, no date)

city as "hell with the lid of ," decrying the area's extensive air, water, and soil contamination. According to Tarr (no date), extensive mining and associated acidic drainage has marred the land and contaminated groundwater. Industrial smoke filled the air until the mid-20th century when industrial decline and environmental regulations dramatically improved air quality. Typhoid fever was rampant and, from 1972-1908, Pittsburgh had the nation's highest typhoid mortality rate. Although sewer improvements dramatically improved public health, the city's combined sewer-overflow system continues to dump raw sewage into local waterways to this day. Although the area is now largely deindustrialized, the city continues to grapple with extensive brownfields, industrial landfills, and land and water contamination problems.

From the 1920 to the 1950s, Hazelwood's employment patterns remained relatively stable. In 1920, the two largest employers, the J&L Corp. and the B&O Railroad, jointly employed around 40% of the total 12,000 workforce. Although J&L expanded its industrial area slightly in the 1920s and 1940s, eliminating the last remaining residences and street networks on the site, the company primarily grew through upgrades to its existing facilities. Although employment, manufacturing, and housing construction dipped during the 1930s economic depression, the community had rebounded by 1950. Hazelwood's population boom also slowed during this period, rising from 27,976 residents in 1920 to 33,140 residents in 1950. The ethnic mix changed more substantially during this period. Although nearly a third of 1920 residents were foreign born, foreign immigration declined during the following three decades while African American in-migration increased. During this time, Hazelwood functioned as self-contained entity, a city within a city (Tarr and Di Pasquale, 1982: 1). Historians indicate that

Right: Arial photo of the ALMONO site and the surrounding Hazelwood community, looking towards Oakland, the Southside, and downtown Pittsburgh (Source: Calthorpe Associates et al., 2007)

Lower Right: Photo of the abandoned powerhouse shell, one of the last structures standing on the ALMONO site (Source: Calthorpe Associates et al., 2007)

Below: Vacant Urban Redevelopment Authority lands along the Second Avenue Business District, near Hazelwood Avenue. (Source: RCI, 2007)

Hazelwood kept a "provincial focus" until the automobile boom in the late 1940s, with nearly 70% of its residents living within 2 miles of their workplaces (*Ibid*., 7).

From the 1950s onward, Hazelwood's population levels and industrial activity steadily declined. In 1969, J&L began systematically disinvesting in their facilities and actively cutting employment and, by the 1970s, only a small percentage of Hazelwood employees still lived in the area. Despite of an influx of African Americans displaced by Pittsburgh's downtown urban renewal, Hazelwood's population nonetheless declined from the 1960s onward, a trend echoed throughout the deindustrializing city. In 1974, the LTV Corporation, a Cleveland-based coke works manufacturing firm, took over the Hazelwood Works site and other J&L facilities nearby. There were 3,600 employees working at the Hazelwood works at the time. The LTV Corp. maintained the previous owner's disinvestment patterns, closing down entire plant operations and selling the land. The Hazelwood Cokeworks site, now the ALMONO site, was the last Pittsburgh plant to close. By the late 1990s, the plant was no longer cost competitive, the infrastructure was deteriorating, and environmental performance was significantly impaired. LTV personnel shut the plant down in 1998, dismissing the remaining 750 active employees and clearing most of the land. At that time, only 6,000 residents remained in Hazelwood and, by 2005, the number had dwindled to 5,330. The LTV Corporation declared bankruptcy in 2000.

In 1999, the Knoxville-based Sun Coke manufacturing company proposed building a new $350 million coke plant on the former LTV Hazelwood site. Responding in part to community concerns over noise and air pollution, the city refused to of er Sun Coke tax incentives for development and the proposal was abandoned. In 2000, the Mayor's office and the Urban Redevelopment Authority of Pittsburgh (URA) considered purchasing the site for $10 million and spending an additional $12.7 on remediation costs, but the plan ultimately floundered. In 2002, the ALMONO non-profit partnership purchased the site for $9.94 million.

Above and Below: Tecumseh Street: Two views from the frontier between the ALMONO site and Hazelwood's Riverside community. (Source: RCI, 2007)

hazelwood: current conditions

Site Overview & Community Context

The ALMONO site is located near Pittsburgh's southeastern border on the northern flatlands of the Monongahela River, four miles from downtown. The 178-acre parcel is a long, narrow strip of derelict river-front land, geographically bound by the Monongahela River to the west and a steep hillside to the east. It extends from the Hot Metal Bridge at the northern tip to Tecumseh Street at the southern end. The land is jointly owned by the ALMONO partnership, a group of four regional foundations including the Richard King Mellon Foundation, the Heinz Endowments, the McCune Foundation, and the Claude Worthington Benedum Foundation. A fifth ALMONO partner, the Regional Industrial Development Corporation of Southwestern Pennsylvania (RIDC), manages the property, makes the development decisions, and assumes much of the associated liability.

Looking south onto the ALMONO site, from near the Hot Metal Bridge. (Source: RCI, 2007)

ALMONO site, looking north with the roundhouse in the middle-ground. (Source: RCI, 2007)

Looking south at one of the few remaining pedestrian bridges spanning the CSX railroad to the ALMONO site; the Bar Mill building is at right. (Source: RCI, 2007)

ALMONO Site

Existing Conditions

Currently, the site remains undeveloped. Two rail lines owned by the CSX Corporation run through the site, one along the riverfront and the other along Second Avenue. Although the inland line is still actively used, CSX is considering abandoning the riverfront spur altogether. Most of the above-ground infrastructure has been demolished and a substantial brick rubble pile stands on the southernmost portion of the site. One large industrial building, called the "Bar Mill" building, three small support buildings, including a pump house, and a former locomotive roundhouse remain in various states of decay. One dirt road and several circular paved roads also remain, along with the remnants of several service rail spurs. Three loading docks, a floating wharf, and some ice breakers are also still in existence and, unlike the rest of the remaining infrastructure, appear to be in decent condition. Carnegie Mellon's Field Robotics Center is the site's only current occupant. The Robotics Center partially renovated the locomotive roundhouse and, along with a recent Carnegie Mellon spin-of company (GTECH Strategies Inc.), is using portions of the heavily contaminated lands ("Area B") in front of the Bar Mill building as a testing site for robotic soil remediation research and automated vehicular navigation.

Although the LTV Corp. began remediation efforts, large portions of the site remain contaminated. Industry personnel began voluntary, site-specific remediation in 1997 and followed up with non-intrusive site investigations to identify potential environmental hazards in 1998. Based on more intrusive soil and water testing completed after the plant was closed, the Corporation identified several potential environmental problems including: VOC and sulfur dioxide expected near coal preparing areas and ovens; tar, ammonia, naphthalene, oils and ammonium sulfide expected near gas recovery systems; soil contamination exceeds residential standards. The LTV Corp. submitted a final remediation to the Pennsylvania Department of Environmental Protection (DEP) in 2001, but the plan was later withdrawn. Despite a DEP order to revise and resubmit the clean-up proposal, and to complete testing and basic remediation prior to any sale of the land, clean-up efforts were complicated by bankruptcy proceedings. The U.S. Bankruptcy Court approved the sale despite lingering environmental contamination.

Top: Gated entrance to Carnegie Mellon's Field Robotics Center operations on the ALMONO site. (Source: RCI, 2007)

Middle: The pumphouse, vintage unknown. (Source: Grocholsky, 2007)

Below: Carnegie Mellon spin-off GTECH Strategies Inc. is partnering with the Field Robotics Center to remediate the heavily contaminated "Area B". (Source: RCI, 2007)

Above: Context map. (Source: RCI, 2007)

Left: Site map. (Source: RCI, 2007)

Zoning

The City of Pittsburgh's Map Pittsburgh project has been updating its Urban Zoning Code through public hearings. Hazelwood's zoning was approved in 2005, and although the site is still zoned for General Industrial (GI) use, rezoning is likely to accompany the redevelopment process. The GI designation allows for basic low-density industrial development and support facilities as well as limited non-competing commercial activity. Adaptive reuse of any remaining industrial buildings is also permitted as-of-right. Pending approval, this designation would also permit the site to house facilities for communications, transit, waste management, and correctional uses. The current height limit for development is 75 feet, or approximately six stories (City of Pittsburgh, no date).

According to Jim Richter with the Hazelwood Initiative, a recycling facility opened around 2001. Although the facility is an as-of-right use in GI-zoned areas, local residents would like to see the area rezoned to prevent similar development in the future. Neighborhood residents are especially concerned that nuisance industries, such as incinerators or coke facilities, might develop in the GI-zone in the future and undermine local health and quality of life. Zoning changes must be approved by the city and will require appropriate levels of environmental remediation to restrict exposure to lingering industrial contamination. The partial remediation already completed does not currently meet the standards set by the Environmental Protection Agency (EPA) for a full range of office, retail, and residential activity. Housing development standards are the most stringent. However, since contamination is not evenly distributed across the site, certain portions of the site may be rezoned without requiring additional clean up pending future investigation and testing.

Above: This recycling facility near Riverside and the ALMONO site opened in 2001. (Source: RCI, 2007)

Left: View of ALMONO site (near) and South Side (far). (Source: RCI, 2007)

Below: Second Avenue and Saline Street intersection, with CSX rail bridge. (Source: RCI, 2007)

Location

Although the ALMONO site's southern tip directly abuts a Hazelwood residential area, it is largely disconnected from the surrounding community. The neighborhood-scale blocks that once extended from the Second Avenue business district across the site to the riverfront have long been demolished. The site is now isolated from the rest of the community, bordered by active rail lines, the Irvine Street/Second Avenue commuter corridor, steep hillsides, and industrial perimeter fencing. Topographically, it is possible to restore connections from the residential neighborhood to the site in the future, especially from the Riverside section of Hazelwood neighboring the site to the south. However, so long as the rail lines remain active, developers will have to incorporate additional safety measures and crossing controls.

The ALMONO site is located just south of the Oakland I-376 exit/entrance ramp, the refurbished Hot Metal Bridge connecting directly to the mixed-use Southside Works neighborhood across the river, and the heavily trafficked Bates Street leading directly into Oakland, Pittsburgh's second largest business district. The Pittsburgh Technology Center (PTC) abuts the site to the north and is home to several high-tech industrial and research facilities including satellite facilities operated by Carnegie Mellon and the University of Pittsburgh. The downtown Pittsburgh business district is about four miles away, directly accessible via Second Avenue.

Access

The Greater Hazelwood Area, which is nestled between the Monongahela River and a soaring Pittsburgh hillside, has only four primary vehicular access points: the Glenwood Bridge from the south, the Hot Metal Bridge from the west, Second Avenue from the north, and Hazelwood Avenue from the east. The elevated I-376 Penn Lincoln Parkway runs along the northern edge of Hazelwood and Greenfield and has an Oakland entrance/exit ramp at Bates Street near the Hot Metal Bridge. Second Avenue is the only north-south thoroughfare running the entire length of Greater Hazelwood and, as a major commuting artery, serves more than 15,000 daily commuters traveling between downtown, Oakland, and Monongahela River

Above: Neighborhoods surrounding the ALMONO site. (Source: RCI, 2007)

Left: Figure ground, street and rail network, parks (dark green) and woodlands (light green). (Source: RCI, 2007)

Valley suburban communities (Hazelwood Mainstreet, n. d.). The smaller Johnston Ave/Browns Hill Road sub-artery also connects Hazelwood to the south-eastern suburbs via Pittsburgh's Blue Belt.

The Port Authority operates several bus lines along Second Avenue and Greenfield Avenue. These routes provide steady connections to downtown Pittsburgh and the Homestead Waterfront retail complex as well as less regular connections to Oakland and Squirrel Hill. Para-transit also operates door-to-door, shared-ride service for disabled residents in accordance with the Americans with Disabilities Act (ADA). Cyclists can reach Oakland via the Panther Hollow bike trail, which connects to the Eliza Furnace Trail ("Jail Trail" in local parlance) and leads to downtown Pittsburgh. Additionally, as part of the Three Rivers Heritage Trail, the steel truss Hot Metal Bridge's second span is currently being converted for pedestrian/cyclist use, allowing users easy access to the South Side neighborhood and SouthSide Works mixed-use development (Grata, 2006).

Within Hazelwood, the grid street and alleyway system allows for easy pedestrian circulation in the flat portions of the neighborhood. A number of public steps are scattered throughout the hillside. Pittsburgh has more than 700 public stairs, 350 of which are considered streets (Regan, 2004). However, these steps are not regularly maintained by the City.

Site Context

Neighborhoods

The Greater Hazelwood Area includes two of Pittsburgh's 93 officially recognized neighborhoods, Hazelwood and Glenwood. Informally, however, these two neighborhoods contain many local, distinctive communities (City of Pittsburgh, n .d.).

The official Hazelwood neighborhood is draped over the lower hillside east of the Monongahela River. The neighborhood's two namesakes are John Woods, one of the first settlers to the area, and the Hazel Wood trees that once flourished on the hillsides. Aging, modest row houses and single-detached homes line the largely orthogonal,

tree-lined streets. More than 80% of Hazelwood's housing stock was built before 1960 (compared to 75% for the rest of the city) and 59% of its homes are worth less than $100,000 (versus 39% of Pittsburgh's general housing stock). This residential fabric is interspersed with architecturally notable institutional buildings, including churches, former schools and a fire station.

Glenwood is tucked into a hollow at the southern edge of the Greater Hazelwood Area. The area is primarily residential, containing mostly single-unit detached homes and row houses. Many of its original residents worked for the Baltimore and Ohio Railroad (B&O), whose rail yards and roundhouse were located at the foot of Glenwood Avenue.

The Riverside community, known locally as "below the tracks," is located on the flat land between the Monongahela River and Second Avenue. The community was reduced in 1952 when J&L collaborated with the URA to expand its Hazelwood Cokeworks facility. Riverside today is a lively and tight-knit enclave bordered by Second Avenue to the east, the ALMONO site to the north,

Opposite Page, Above Left: Riding along Panther Hollow Trail, in Junction Hollow; Carnegie Mellon is visible in the distance.

Opposite Page, Lower Left: Homes on Elizabeth Street, Hazelwood.

Opposite Page, Near Left: Giddings Street and public stairway, upper Hazelwood.

Upper Left: Mansion Street sloping towards the Mon River.

Upper Right: Gertrude Street, Hazelwood .

Lower Left: Rowhouses on Glenwood Avenue, Glenwood.

Lower Right: Dyke Street, Riverside, with CSX rail lines in the foreground. (All photos RCI, 2007)

light manufacturing operations to the west, and rail yards to the south. The area is primarily residential, with the exception of a few businesses, and continues to struggle with absentee landlords.

The Glen Hazel community is located on the sloping south hills of Greenfield. Its land area includes the 200-acre Calvary Cemetery, the largest of the cemeteries in the Roman Catholic Diocese of Pittsburgh. The community also includes two large public housing complexes, the Housing Authority of the City of Pittsburgh's 143-unit Glen Hazel multi-building low-rise complex and the 97-unit Bernice Washington Crawley High Rise.

Second Avenue Business District

The Second Avenue Business District functions as the Greater Hazelwood Area's "main street." The district is located along the Second Avenue transportation corridor and stretches nearly the entire length of Hazelwood, about three-quarters of a mile. The primary retail and community activities, however, are mostly concentrated along the six blocks between Hazelwood Avenue and Johnson Avenue. Local business stalwarts include Dimpero's Market and Jozsa Corner Hungarian Restaurant.

Over the past 30 years, the Second Avenue business district has suffered greatly from Hazelwood's decline. Once a thriving commercial street, many of the storefronts are now empty. A considerable number of buildings have been torn down in the northern section near Minden Avenue giving the street a "gap-toothed" appearance. A 2003 inventory of the 66 parcels comprising the primary six-block commercial area found that nearly 30% of the properties were listed as "for sale" and only 52% of the buildings were occupied. Only 44% of the buildings are in "excellent" or "sound" condition and 62% of the parcels had available off-street parking (Hazelwood Mainstreet, no date). In 2005, local design firm Loysen + Kreuthmeier Architects was hired to produce the *Hazelwood Second Avenue Design Strategy* to help guide future investment.

The district contains several large institutional buildings of architectural and historical interest, including the Episcopal Church of the Good Shepherd, the Pittsburgh Railways Building (now the "Car Barn" seniors' recre-

Opposite Page, Above: Second Ave near ALMONO site; used by 15,000 daily commuters.

Opposite Page, Far Left Bottom: Second Ave/Elizabeth St intersection; Sprout Fund community mural by Kip Herring.

Opposite Page, Near Left: Second Ave, as seen from American Street.

Right: The Run neighborhood is quietly situated below the elevated I-376 Penn Lincoln Parkway.

Below: View of downtown Pittsburgh from Greenfield.

Below Right: Winterbury St, Greenfield. (All photos RCI, 2007)

ational center), and the Keystone Grocery Building. A public garden at the corner of Johnston Avenue includes a perennial garden and gazebo, along with the Hazelwood Initiative's offices.

Neighboring Areas

Greater Hazelwood has four neighboring communities, including The Run, Greenfield, South Oakland, and Schenley Park/Junction Hollow. The Run is a stable residential neighborhood lying quietly in the Four Mile Run valley, nearly four miles from downtown Pittsburgh. The area is connected to Oakland by the Panther Hollow bike trail running through Junction Hollow and along Schenley Park's western edge. The Run is the oldest section of Greater Hazelwood and was first settled by a group of Scottish immigrant homesteaders and later by Slavic and Hungarian immigrant industrial workers. The J&L Corporation developed their Hazelwood Cokeworks industrial facilities on the neighborhood's land area west of Second Avenue, formerly known as Scotch Bottom. The remaining section to the east continues to be tranquil despite the looming presence of the elevated I-376 Penn Lincoln Parkway that runs overhead.

The Greenfield neighborhood is a longtime stable and close-knit community located just to the north of Greater Hazelwood. This hillside "suburb in a city" has recently begun attracting first-time homebuyers looking for affordable, centrally located, single-unit detached homes. The area's great views of the city are an added bonus. The first Greenfield residents were primarily immigrants from eastern European, Italy, and Ireland, and worked in steel mills in Hazelwood, Homestead, and Duquesne. Greenfield is close to several desirable commercial and employment districts, most notably Squirrel Hill, Shadyside, South Side, and Oakland, and is rich in recreational amenities. Greenfield has two active community organizations: Greenfield Organization, in operation since 1968, and the newer Connect Greenfield.

Schenley Park and Junction Hollow lie between Greater Hazelwood and its northern neighbors Oakland and Squirrel Hill. Junction Hollow, named after the Pittsburgh Junction Railroad, is the most recent addition to the Pittsburgh Parks Conservancy's (PPC) repertoire of

large urban parks. Rail tracks were first laid through the hollow in the 1880s and are still actively used by CSX Transportation, although these maintain an inconspicuous presence at the easternmost edge of the Hollow. The City of Pittsburgh owns the Hollow (with the exception of the railroad right-of-way) and, together with the PPC, co-manages and maintains the land. The Hollow runs north-south for nearly 2.5 miles and, although not fully auto-accessible, the valley provides the most direct cyclist link (Panther Hollow Trail) between Second Avenue and the upper-eastern section of Oakland containing Carnegie Mellon, the Carnegie Museum of Art, and the Craig Street business district. From Oakland, the Hollow passes south through the western portion of Schenley Park and makes a partial circuit around South Oakland before terminating at the Four Mile Run Park in The Run neighborhood. Junction Hollow is part of the Four Mile Run River Valley, though the stream remains buried.

The South Oakland neighborhood is wedged between the busy Boulevard of the Allies to the west and Junction Hollow/Schenley Park to the east. Its mainly residential streets are perched on a bluf overlooking the Monongahela River, Junction Hollow, and Schenley Park. The Oakland Planning and Development Corporation, a non-profit group representing the Oakland neighborhoods, is actively working to improve South Oakland's housing stock. The group purchases and upgrades South Oakland housing units and is working to prevent absentee landlords from increasing their foothold in the community.

Socio-Demographic Profile

Hazelwood's population has declined significantly since its peak in 1960. According to census data, 6,139 residents lived in Greater Hazelwood in 2000, a 58% decrease from the 1960 level. Females accounted for 56% of the population. Children and youth aged 5 to 19 years and people over the age of 65 each made up 21% of the population. The median age of Hazelwood residents was 43 years, a relatively high number compared to a state median of 32 years. Almost 60% of residents were "White" while 39% were "Black or African American"; the remaining 4% were "Latino" and "Other" (U.S. Census Bureau, 2000).

Of the residents aged 25 and older, barely half had at-

Opposite Page, Far Left: Panther Hollow Lake, Schenley Park, with the historic Panther Holllow Bridge beyond. (Source: Armstrong, no date)

Opposite Page, Near Left: CSX rail line and Boundary Street passing through Junction Hollow; Apple and Google occupy offices in CMU's Collaborative Innovation Center (CIC), to the right. (Source: Grocholsky, 2007)

Opposite Page, Below Left: Central Oakland extends into Junction Hollow near Boundary Street; beyond is Schenley Bridge. (Source: RCI, 2007)

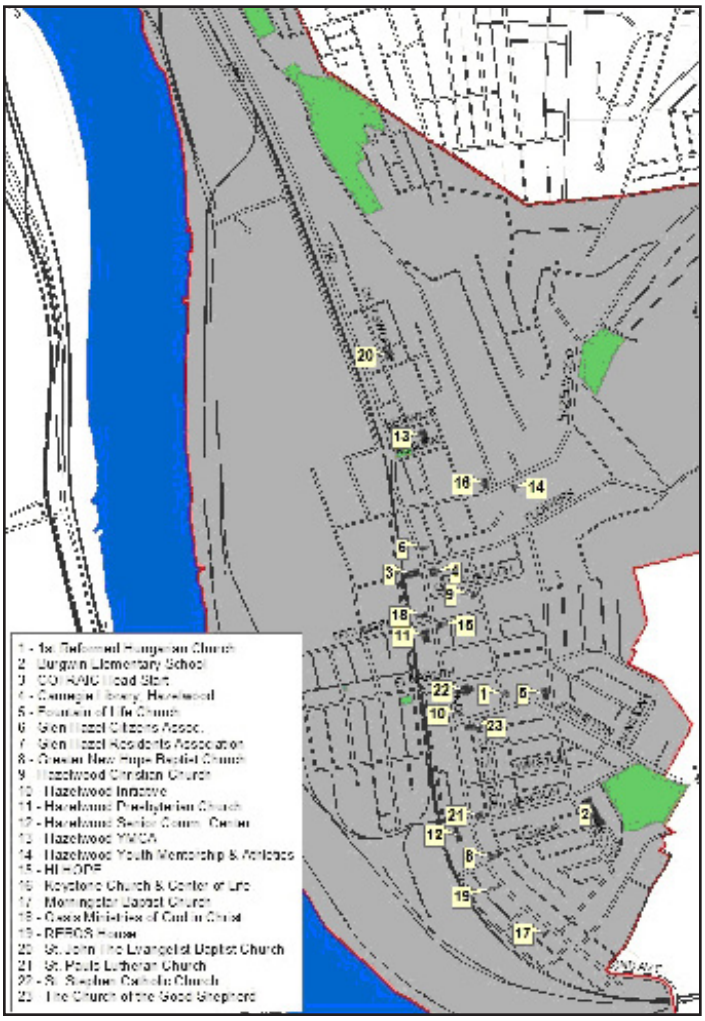
Right: Hazelwood Asset Map. (Source:Ulrich et al., 2005: 9)

tained a high school diploma or more and less than 1% held a bachelor's degree. Of the 1,475 families recorded in the 2000 Census, a quarter lived under the poverty level. The median household income of $19,513 was just under half of the state median. Female earnings are slightly higher than male earnings. The unemployment rate was listed as 6.2%, with three-quarters of employed residents split evenly among the management and professional sector, the service and sales sector, and office sector (*Ibid.*).

Hazelwood has a comparatively high proportion of homeowners compared to the rest of Pittsburgh. Consistently, 6% of all housing units were owner-occupied over the past several decades. In 2000, nearly 70% of homes in Greater Hazelwood were valued at less than $50,000. Gross rent as a percentage of household income was less than 25% for more than a third of residents, and more than 35% for another third.

Disinvestment and delinquency is a large and growing problem throughout Greater Hazelwood. As of July 2006, 40% of taxable parcels had a city or school district tax delinquency cumulatively totaling $2.5 million since 1985. Of taxable parcels, 27% had a delinquency of at least two years based on the 2006 tax bill. Of the properties that were delinquent in 2005, 71% increased in delinquency by the following year. Furthermore, 24% of taxable parcels had a municipal or water and sewer tax lien in 2006 (Gradeck, 2007).

Local residents also face ongoing problems with crime. Despite encouraging reviews of the 1996-2002 Weed and Seed initiative, violent crime continues to increase. Since the late 1990's, the total number of reported murders, robberies, and assaults has doubled. Many of these crimes can be attributed to the on-going drug trade well entrenched in the neighborhood.



In 2005, the University of Pittsburgh's Community Outreach Partnership Center (COPC) in cooperation with the local community development corporation Hazelwood Initiative, Inc., conducted a survey of forty community and faith-based social services in Greater Hazelwood (Ulrich *et al.*, 2005). According to their report, the bulk of service providers were concentrated along Second Avenue and the various organizational services rarely overlap. Some of the most utilized services and programs included food banks, after school programs, AA (Alcoholics Anonymous) support groups, tutoring and homework assistance, job search and training, meal services, halfway house amenities, music lessons, and information and referral services. Many of these programs were offered by or housed in the Hazelwood YMCA, the local Carnegie Library branch, local churches, and the now closed Burgwin Elementary School. Most local community groups and organizations also scheduled seasonal activities, such as summer programs, holiday dinners and an annual 5-K race.

Respondents to the study identified several social service shortfalls, expressing the pressing need for more youth

Left: Despite its challenges, Hazelwood maintains a small-town feel. (Source: RCI, 2007)

Right: Local organizers built a public garden with gazebo at Johnston and Second Avenues. (Source: RCI, 2007)

activities, job opportunities, and after-school childcare. Residents also felt that street maintenance and garbage collection services were insufficient and that the community would benefit from greater levels of community involvement and a stronger police presence. Housing rental and homeownership assistance programs were felt to be lacking and that condemned houses need to be torn down. The educational opportunities were felt to be sub-optimal. The study also found that respondents were sometimes unaware of planned community events until the day the event arrived, and were eager to improve community-wide collaboration. Despite the challenges, respondents felt confident that they could fill the service gaps. As an initial step, the Hazelwood Initiative now circulates a free monthly newspaper, called *Hazelwood Homepage*.

Respondents also identified several community strengths, including the area's geography and location benefits, free parking, mixed-age population, and small-town feel where everyone knows one another and generations mix easily. Respondents also appreciated Hazelwood's wide variety of churches and community organizations.

The COPC study also assessed Hazelwood's access to human services. Despite Greater Hazelwood's status as a distressed neighborhood, the study found that many providers, such as mental health/developmental disabilities, senior, children, youth and family services, did not maintain offices in Hazelwood. In order to improve resident access, the report recommended establishing a common space in Hazelwood that external service providers could use in an outreach capacity. It also recommended hiring a community-based broker or case manager to help residents identify services and secure adequate transportation. COPC also suggested establishing a formal network to coordinate local and external services in order to increase community access and combat the community's sense of isolation. Based on their findings, COPC authors recommended completing an additional investigation assessing residents' health needs and their use of existing services. As part of that study, homebound services and transportation alternatives to external services should be considered.

Community Amenities

Although Hazelwood's community amenities decreased dramatically over the past four decades and remain sparse to this day, some local strongholds are still active. Sixteen religious organizations maintain churches and educational facilities in Hazelwood and Greenfield. Many of these organizations either sponsor or house community outreach and social service programs, including foster care, professional development and home ownership programs, food banks and meal services, and licensed social services and emergency aid. Greater Hazelwood also contains an additional fourteen community service organizations catering to dif erent segments of the population. Although several of these organizations operate childcare, youth outreach, and educational programs, they nonetheless have difficulty meeting the community's total demand. These service organizations also sponsor community outreach and job training programs and provide space for public meetings and recovery services. Seven health service providers also maintain small offices in Greater Hazelwood, but the closest comprehensive facilities are located across the river in Pittsburgh's South Side.

Hazelwood contains several civic and municipal structures, some of which are still in operation. All public Hazelwood schools are now closed, including several facilities that were operational through the 1990s, and several of the large, historically interesting school structures are now

Above: Jozsa Corner, a local stalwart and part of Hazelwood's rich cultural heritage. (Source: RCI, 2007)

Above Right: Second Avenue businesses, near Tecumseh Avenue. (Source: RCI, 2007)

Right: Saline Street Parklet, The Run. (Source: RCI, 2007)

either abandoned or for sale. The Gladstone Elementary School land parcel, for example, is for sale by the Urban Redevelopment Authority under the KOZ program. Two small, private, religious schools remain open and enroll young and disabled children. One public elementary school is still open in Greenfield and its 467 students include Hazelwood children. The Carnegie Library of Pittsburgh has a local branch in the Second Avenue business district which remains open.

The city maintains a police station, firehouse, and social services office in the neighborhood. Unfortunately, the city also recently developed a large recycling center immediately adjacent to the ALMONO site and the Riverside community, despite local resistance.

The retail base in Hazelwood continues to struggle. Six food markets, grocery stores, and pharmacies are still active. The neighborhood also contains one bank and one Laundromat. Overall, there are around 50 businesses located in Hazelwood, more than a dozen of which are automotive- or construction-related.

Despite the area's dearth of social services, Greater Hazelwood has access to fourteen local and nearby parks and recreational facilities. Several small playgrounds are distributed throughout the community, in various states of repair, and many of the closed public schools' athletic fields remain intact. Informal playing fields and ball courts are located in the Run and in the Junction Hollow portion of Schenley Park. The Hazelwood Initiative also constructed a new community sitting garden and performing arts stage in 2002, in the Second Avenue Business District, at the Johnson Avenue intersection.

Historic Assets

Hazelwood is one of Pittsburgh's older suburbs with a long and influential industrial heritage. Unfortunately, many buildings have been demolished or suf er from years of neglect and abandonment. The Historic Review Commission of the City of Pittsburgh, the National Register of Historic Places, and the National Historic Landmarks program have officially recognized several structures for their heritage value. The Pittsburgh History & Land-

marks Foundation (PHLF) non-profit historic preservation group and the Young Preservationists Association of Pittsburgh (YPAP) have made similar progress identifying and advertising Hazelwood's remaining historic elements.

Although Hazelwood once contained several historically noteworthy residents, only one notable residence still remains. While most of the area's 19th century mansions have long been destroyed, the neighborhood does contain one of Pittsburgh's oldest remaining residences. The three-bay stone Woods House was built around 1793 on the bluf s overlooking the Monongahela River. It was built by surveyor John George Woods, considered to be a pioneer landowner in the area, and some believe the composer Stephen Foster wrote some of his more famous songs on the Woods piano. The Woods House was designated a City of Pittsburgh Historic Structure in 1977 and was listed on the National Register in 1993.

The Hazelwood Historic District is a 222-acre site designated in 1997 as an area eligible to be listed by the National Register. The Hazelwood Historic District includes commercial and religious structures. The most significant buildings include a two-story, red brick, L-shaped house with Italianate influences, built by James Barker in 1875, and the former D.L. Thomas dry goods store, built around 1895, which retains its original storefront and ornamental brickwork. Unfortunately, many other notable buildings along Second Avenue have been torn down since the 1970s.

Many of the area's historic civic buildings remain intact. The original Carnegie Library of Pittsburgh Hazelwood Branch opened in 1900. The building, now vacant, featured a 250-seat auditorium and stained glass dome. The library closed in 2004 when operations were moved to

a smaller space on the second floor of the new Second Avenue Sophia Plaza building. The area also contains several large, early 20th century school buildings, including Burgwin Elementary School, Gladstone Middle School, and Greenfield Elementary School. The first two are now closed, but the latter, built in 1916, remains open and is a registered National Historic Landmark.

Several historically significant places of worship have also survived the fray. The oldest First Hungarian Reformed Church built in the United States (1903) is located on Johnston Avenue, in Hazelwood. The art nouveau building was designed by a young Hungarian émigré, Titus de Bobula, and served a primarily East European immigrant clientele. De Bobula also constructed what is considered, in the Hazelwood context, an elegant U-shaped apartment building on nearby Elizabeth Street (Pittsburgh History & Landmarks Foundation, no date). The Episcopal Church of the Good Shepherd, built in 1891 by architect William Halsey Wood, catered to wealthier patrons, and, in the eyes of the Young Preservationists Association of Pittsburgh, is an "unprotected site." St. Stephen Church is also undesignated but is nonetheless a historically valu-

Opposite Page, Far Left: Gladstone Middle School is for sale under the KOZ program.

Opposite Page, Left: Burgwin Elementary School (closed).

Opposite Page, Below: Burgwin School in 1937. (Source: University of Pittsburgh, Digital Research Library)

Right: St. Stephen Church, Second Ave near E. Elizabeth St.

Below : Episcopal Church of the Good Shepherd, Second Ave and Johnston Ave.

Below Right: former B&O RR Roundhouse. (All photos RCI, 2007, unless otherwise noted.)

able landmark located on the corner of Second Avenue and East Elizabeth Street.

Junction Hollow and Schenley Park, located just north of Greater Hazelwood, are also prominent historical sites. Schenley Park was designated as a National Register Historic District in 1985 although its crown jewel, the Victorian glass Phipps Conservatory and Botanical Gardens (1893), has been registered since 1976. Phipps Conservatory is also a City of Pittsburgh Designated Landmark, as are other park features including the Neill Log House, the Panther Hollow Bridge (1897), and the Schenley Bridge (1897).

Despite Hazelwood's rich industrial legacy, few remaining vestiges of its great past still exist either on the ALMONO site or along Second Avenue. Although the ALMONO site was largely cleared in 1998, the former Baltimore & Ohio Railroad locomotive roundhouse, allegedly completed in 1883, is still largely intact. Although some argue the structure is younger, it appears on a 1904 Hazelwood plat map and so is clearly over a century old. The Carnegie Mellon's Robotics Institute has partially

renovated the roundhouse and currently uses the facility as a low-intensity testing site. There is also an old brick pumphouse of unknown vintage at the river's edge.

The former Pittsburgh Railways Building, built before the 1880s, is also present. Locally known as the "Car Barn," the building is now a seniors' recreational center. The structure harkens back to the day when Second Avenue had a streetcar line with five stations and when the Pittsburgh Railway operated eleven inclines in the city.

hazelwood planning initiatives

Recent Plans & Future Development

In the past decade, city officials, local organizations, and community leaders have assembled a multitude of studies scrutinizing the area's demography, history, community services, real estate and development potential. Greater Hazelwood activists and developers have made some headway in community revitalization efforts, and some limited new construction is underway. Although several redevelopment plans have been put forward for the ALMONO since the land was cleared in 1998, no plan has been implemented to date. Regional leaders coordinating economic development, transportation strategies, recreational planning, and ecological protection continue to move forward, directly and indirectly affecting Greater Hazelwood and the ALMONO site.

Community Revitalization

Several community plans have been created since 2001 but, to date, there has been no significant investment in Hazelwood since before WWII. In the past 10 years, community revitalization activities in Hazelwood have centered on crime reduction and prevention, economic development, employment initiatives, youth programs, and improvements to the built environment. While these efforts have helped clarify and catalyze broad community goals, these reports also identify several uncertainties hovering over the community, including the uncertain future of the large vacant ALMONO brownfield site and the potential destruction resulting from the planned Mon-Fayette Expressway construction through Hazelwood.

Recent efforts to reverse Hazelwood's decline began in earnest in 1994 when local community activists formed the Hazelwood Initiative, Inc. The group immediately began leveraging outside funds to help rebuild the community, starting with a $1.725 million grant from the U.S. Department of Justice's Weed and Seed Program. The program operated from 1996 to 2002 with the explicit goal of combating crime and developing crime-prevention programs. A third of the funds were spent on "Weed" activities, such as law enforcement that targets open air drug trafficking, and the remainder on "Seed" activities, such as neighborhood-based educational, social, and recreational projects that enhance quality of life. Significant outcomes during that time included reduced crime (11.6% reduction compared to citywide 5%) and reduced open air drug trafficking along the Second Avenue business district. While the initiative produced commendable results, Hazelwood's community image and quality of life remain troubled by persistent problems with drug trafficking, violent crime, and slum lording, as revealed by a three-year search of Pittsburgh's two major newspapers for stories of crime and violence in Hazelwood.

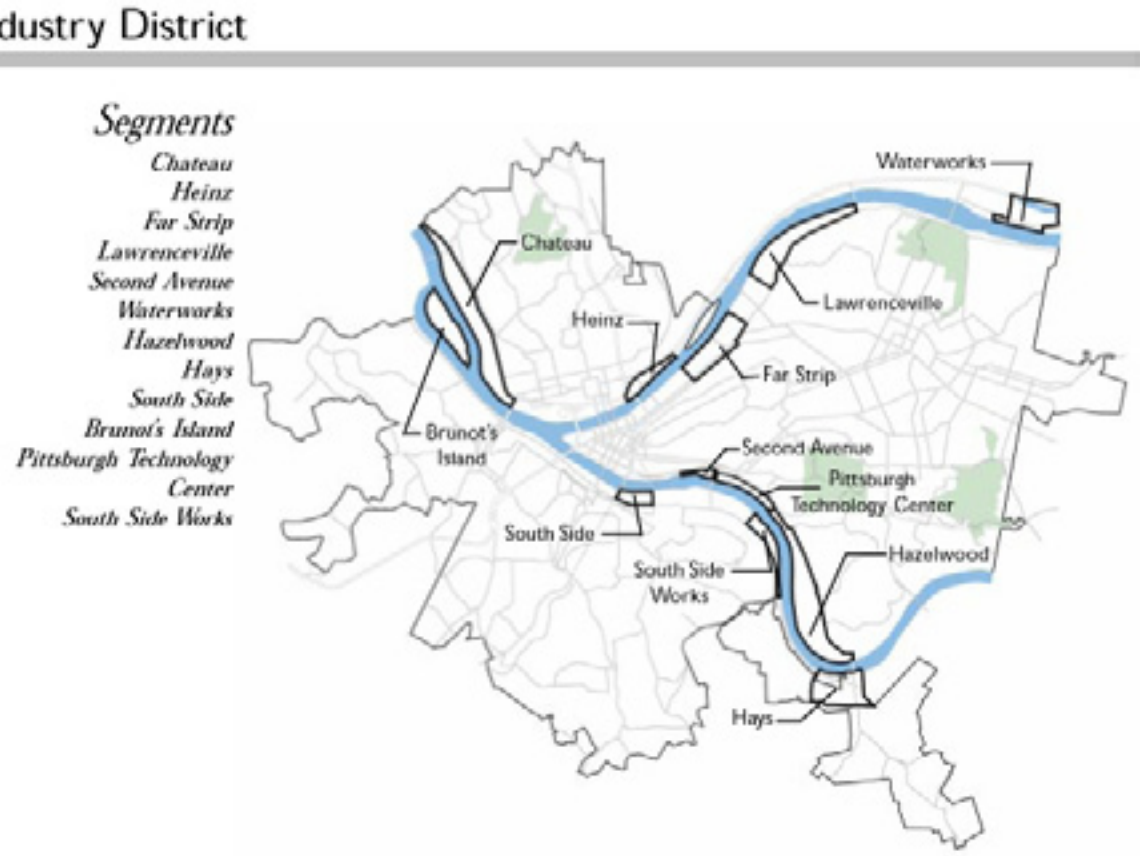
With crime levels reduced, the Hazelwood Main Street Taskforce (Hazelwood Mainstreet) successfully secured a state Main Street economic development grant in 2001. The "Main Street" program provides state funds to neighborhood economic development initiatives and has been used to aid several Pittsburgh projects and more than 1,600 communities nationwide. The Hazelwood Main Street initiative has sought to bring together local businesses, residents, neighborhood organizations, and corporate sponsors to revitalize the Second Avenue business district and strengthen the entire community.

Pennsylvania's state government has designated a significant portion of Hazelwood's commercial core as a Keystone Opportunity Zone (KOZ). The KOZ program is intended to increase the economic value of specific properties by abating virtually all state and local taxes until 2010. This real estate-based approach to community development affects 44 publicly and privately owned Hazelwood parcels, totaling 3 acres, along Second Avenue between Flowers Avenue and Minden Street, as well as the former Gladstone Middle School property on Hazelwood Avenue (closed in 2001).

In 2005, Hazelwood was selected as one of 22 BluePrint Communities. The program, funded by the Federal Home Loan Bank of Pittsburgh, PNC Bank, and Sovereign Bank, aims to serve as a catalyst for creating sustainable communities in Pennsylvania, West Virginia, and Delaware. Under federal law, the banks are required to give 10% of their profits to affordable housing projects. Grant funds provide a series of training sessions for teams of five members or more from each municipality, and can be used to help coordinate community-based, public-private investments. Hazelwood's BluePrint Communities Team included nine participants from local non-profits, businesses, and the Pittsburgh City Council.

The Greater Hazelwood Area receives flexible funding for social programs through the HUD's Community Development Block Grant (CDBG) program. The program is one of HUD's longest standing funding initiatives and annually provides revenue to 1,180 communities nationwide. Hazelwood can use CDBG funds to address a wide range of development needs, and community participation is required for all CDBG funded projects.

Homeowners can also apply for financial assistance from the Urban Redevelopment Authority's (URA) Homeowner Assistance program, which provides low-interest loans and grants for owner-occupied home improvements. The URA's Home Improvement Loan Program (HILP) is an FHA insured home improvement loan ($25,000 maximum loan amount) with a current fixed interest rate of 5.99% and a 20-year term and no income limit. The Pittsburgh Home Rehabilitation Program (PHRP) can be used to eliminate home lead based-paint hazards through a 2.5% fixed interest rate loan with a maximum 20-year term and a maximum $20,000 loan amount. The URA also offers construction management assistance throughout the PHRP loan process, and income limitations apply.



The Riverfront Development Plan. (Source: Pittsburgh Department of City Planning, 1998: 52.)

Through these and other initiatives, Hazelwood is seeing its first new construction in several years. In 2002, the Gombas Development Corporation, owner and operator of the nearby Hazelwood Dairy Mart, completed the new Plaza Sophia commercial development on the corner of Second Avenue and Flowers Avenue. The Plaza houses community and neighborhood-serving retail on the ground level and a Carnegie Library of Pittsburgh branch on the second story. In 2007, developers began construction on two new townhouses and six three-bedroom residences, the first new residential construction project in Greater Hazelwood in 15 years. The Pittsburgh Urban Redevelopment Authority (URA) is also developing a $1.5 million residential project containing four townhouses and two single-family homes. According to Jerome Dettore, the URA's executive director, the organization has been planning the project for six or seven years. The townhouses will be built on Sylvan Avenue, across from the long-vacant Gladstone School, and are expected to sell for $129,500. The single-family homes will be located on Monongahela Street and Homewood Avenue and should sell for $135,500 each. According to the mayor's office, two of the homes will be subsidized for buyers who make less than 80% of the area's median income, according to the mayor's office (Barron, 2007).

Local Redevelopment Visions

Since the Hazelwood Cokeworks closed its doors in 1998, city officials and community leaders have proposed several redevelopment visions for the site and for the community more generally. Combined, these efforts reveal the challenges and opportunities that lie ahead in enhancing the Greater Hazelwood Area and reintegrating it into the larger Pittsburgh economy. Three initiatives are especially relevant to the LTV site specifically and are notable for their comprehensiveness and their community process, including *The Master Development Planning in Hazelwood and Junction Hollow* (Saratoga Associates, 2001), the *Conceptual Master Plan for LTV Site* (Urban Design Associates, 2003) and the *Hazelwood Redevelopment: Reconnecting to the River* (Calthorpe Associates, Burt Hill, 2007). The results concluded that any new development on the

Far Left: Master planning development proposal for Hazelwood and Junction Hollow. (Source: Saratoga Associates, 2001: 31)

Left: Illustrative plan proposal for redeveloping the ALMONO site without the Mon/Fayette Expressway. (Source: Urban Design Associates, 2003: 7)

ALMONO site should provide for a mix of uses and a range of housing options, and should increase connections, both physical and economic, to the existing communities of Oakland and Greater Hazelwood Area.

In 1998, the Pittsburgh Department of City Planning issued *The Riverfront Development Plan*, which presented a coordinated, citywide land use vision for Pittsburgh's major waterways. The document proposed maintaining industrial designations along riverfront properties near the city's municipal edges, and included the former LTV Corp. sites in Hazelwood, South Oakland, and the South Side. Within this designation, the city recommended developing new, non-nuisance industrial parks catering to high-tech research and office activities. The plan also recommended integrating publicly accessible riverfront trails and strategically located shared open spaces into the new riverfront industrial complexes.

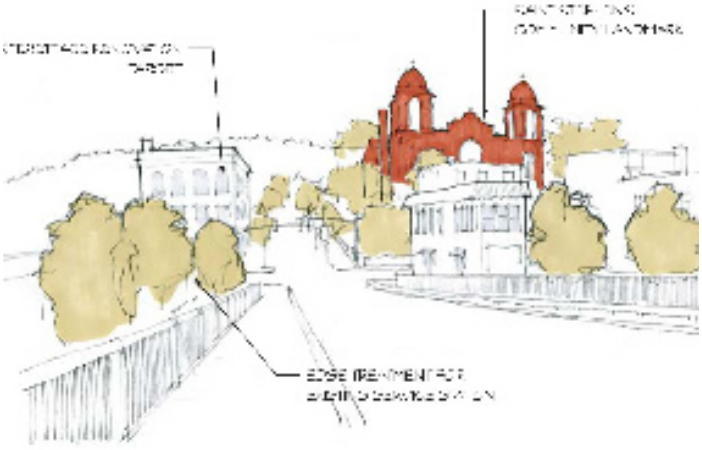
In 2000, Hazelwood Initiatives, Inc. and the City of Pittsburgh jointly commissioned a document entitled *Master Development Planning in Hazelwood and Junction Hollow*. Saratoga Associates completed the report in 2001 based, in part, on community input. Although the study's focus area was broad, the final report did make several recommendations regarding the ALMONO site, then owned by the LTV Corporation. Community members preferred a mixed-use redevelopment vision that bolstered the existing neighborhoods assets and improved the area's connectivity to Oakland and the riverfront. Planners and community members alike felt the proposed Mon/Fayette Expressway slated to run through the neighborhood would have a dramatic impact on the viability and typology of redevelopment schemes. Saratoga personnel recommended redeveloping the LTV site to include two new marinas, an office park, and two mixed-use development areas. The report also recommended extending the surrouding neighborhood's street grid into the site and up to the riverfront.

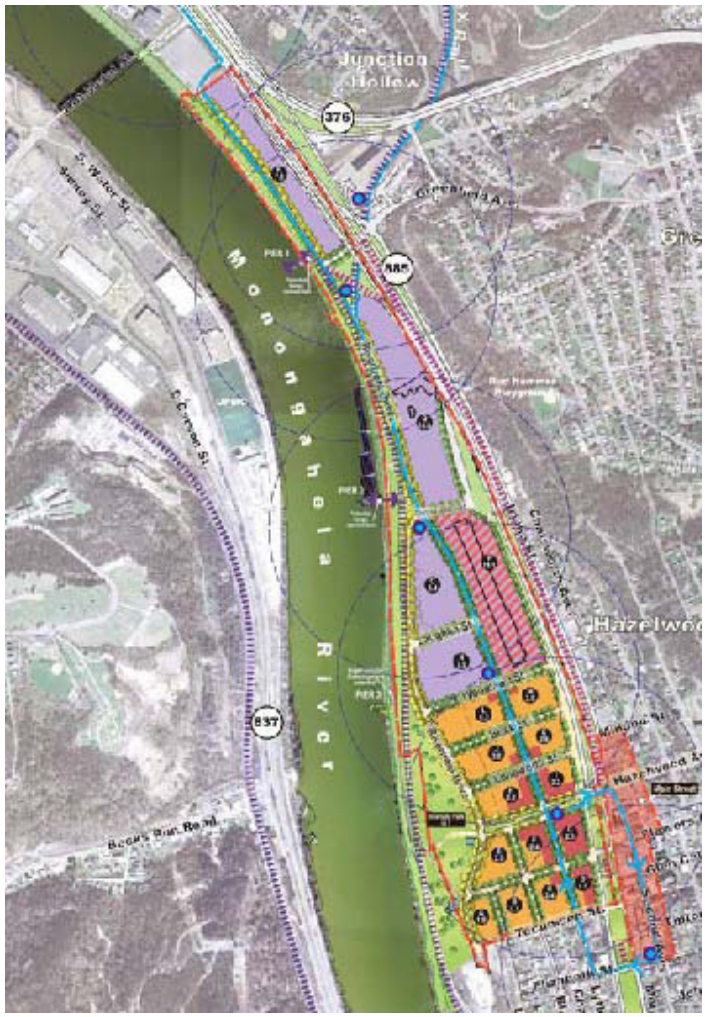
In 2003, the new site owner ALMONO LP retained the Pittsburgh-based Urban Design Associates (UDA) planning firm to develop a mixed-use master plan for their newly acquired site. The report concluded that, unless alternative action was taken, the rail lines, the proposed Mon-Fayette Expressway, and the existing contamination

Below: Proposed gateway between future commercial and residential neighborhoods. (Source: Loysen + Kreuthmeier, 2005: 16)

Right: Proposed connections across Second Ave. (Source: Loysen + Kreuthmeier, 2005: 17)

Far Right: Proposed ALMONO site plan. (Source: Calthorpe community presentation, 2007)





levels would reduce the 178-acre site to only 81 acres of developable land area. The UDA redevelopment vision emphasized extending the existing street grid across the site to accommodate mixed-use development for residential, commercial, and recreational uses. The riverfront vision included trail and bench amenities, some restaurants, a small marina, and some outdoor sports facilities.

In 2004, the ALMONO project received an economic development grant from the Pennsylvania Governor's office. The grant contributed $6 million for the construction of 1,000 new residential units and for a new 700,000 square feet research and development office facility. An additional $5 million was given to the Junction Hollow Research and Development Center Phase II project to develop an incubation technology center in the Pittsburgh Technology Center just north of the ALMONO site.

In 2005, the Department of City Planning commissioned Loysen + Kreuthmeier Architects to propose revitalization measures for the Hazelwood Second Avenue Business District. In their report, the *Hazelwood Second Avenue Design Strategy*, Loysen recommend several design features and planning mechanisms that could help spur the main street style retail area. Although the ALMONO neighborhood is located outside the primary study area, the team nonetheless evaluated the effect redevelopment activities might have on the business district. Loysen recommended that ALMONO developers locate future commercial uses along the Second Avenue corridor in order to reinforce rather than compete with existing neighborhood businesses. The authors also called for new neighborhood connections to the ALMONO site across the rail lines and from the Riverside community.

Most recently, Calthorpe Associates urban planners and Burt Hill architects joined forces to evaluate the redevelopment potential of the ALMONO site. The team will be releasing their report entitled *Hazelwood Redevelopment: Reconnecting to the River* later this year. Although the details are not yet publicly available, the report is premised on four core principles for their three development scenarios: a diversity and balance of housing types; human scale; conservation and restoration; and neighborhood and region. The three options for redevelopment focus on the area's connection to the river via open green spaces. Op-

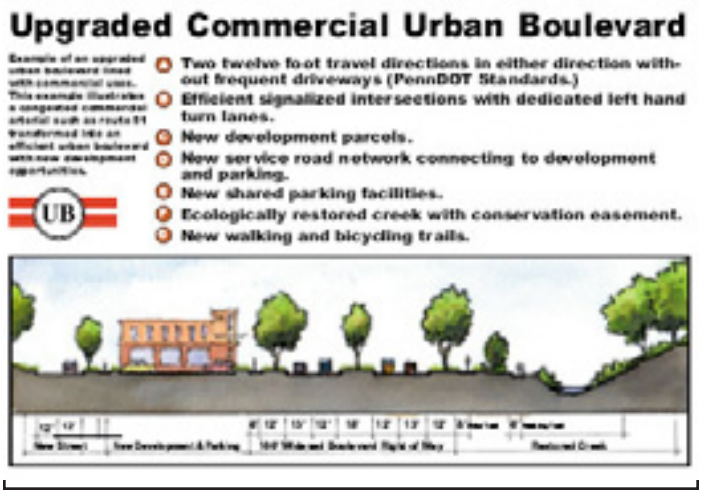
Left: Junction Hollow redevelopment plan. (Source: Pittsburgh Parks Conservancy, 2001: 97)

tion 1 is based on 6 triangular "View Parks", each of ering an outlook to the river and the north shore, with transit running along a riverside esplanade. Option 2, "Riverside Park", features an extended Hazelwood Boulevard and expanded riverfront park, with transit running through the center of the site. Option 3 is organized around "Hazelwood Park", a major civic park that runs perpendicular to the river along Hazelwood Avenue's axis. Transit is directed through the center of the site as in Option 2. Each option emphasizes the extension of Hazelwood Avenue to the waterfront, and each option retains the existing three piers and suggests the reuse of the existing brick Pump House. The Calthorpe/Burt Hill program includes 8 to 12 acres of open space and 3.9 to 4.0 million square feet of residential, commercial and mixed-use buildings, and has sustainability as a central concept.

Carnegie Mellon is currently using a portion of the ALMONO site to test new robot designs. In a collaboration with local spin-of company G Tech, university personnel are also using autonomous robot technology to replant the site and would like to use similar technologies to clean existing soil contamination. The University hopes to develop a new robotics research center on the ALMONO site and to use its robots to aid in the physical construction and landscaping process. ALMONO's Heinz Endowments has expressed its interest in the project and may provide funds to develop a planning proposal for the project.

The Pittsburgh Technology Center (PTC), which borders the ALMONO site to the north, is beginning a multi-year expansion initiative. Given the PTC's proximity and similar industrial zoning, the PTC's shifting land-use patterns and market pressures will influence the Hazelwood site's redevelopment potential. The last PTC building was completed in 2002 and, since then, the demand for research facilities in Oakland has continued to grow. The expansion will add up to one million square feet of new high-tech office space and supporting retail services. The city will finance infrastructure improvements and is recruiting private developers to manage building construction.

Regional recreational and environmental improvements are also underway in Greater Hazelwood's neighboring communities, bringing positive benefits to the entire area. The Pittsburgh Parks Conservancy (PPC) manages the city's four large urban parks and, as part of the *Pittsburgh's Regional Parks Master Plan* (2001), is restoring Panther Hollow's ecological integrity. The PPC is replacing invasive plants with native species, improving water quality, and stabilizing eroded slopes. Existing stone bridges and steps from the 1930s have been repaired and the trail system has been improved. Panther Hollow Valley's Phipps Run Stream empties into Panther Hollow Lake, located along the edge of Junction Hollow. The 80-acre Junction Hollow lies immediately north of Hazelwood and Greenfield and, although direct automobile travel is prohibited, the hollow provides cyclists with easy access between Oakland and Hazelwood. Ultimately, the PCC plans to expand Panther Hollow Lake and rebuild a boathouse near Junction Hollow. There are also plans to build athletic fields on the flatter area near Boundary Street. The PCC hopes to improve connections between Panther Hollow Lake and Oakland by possibly building a pedestrian bridge across the railroad tracks and Boundary Street.



Above: Mon/Fayette route map. (Source: Pennsylvania Turnpike Commission, 2005)

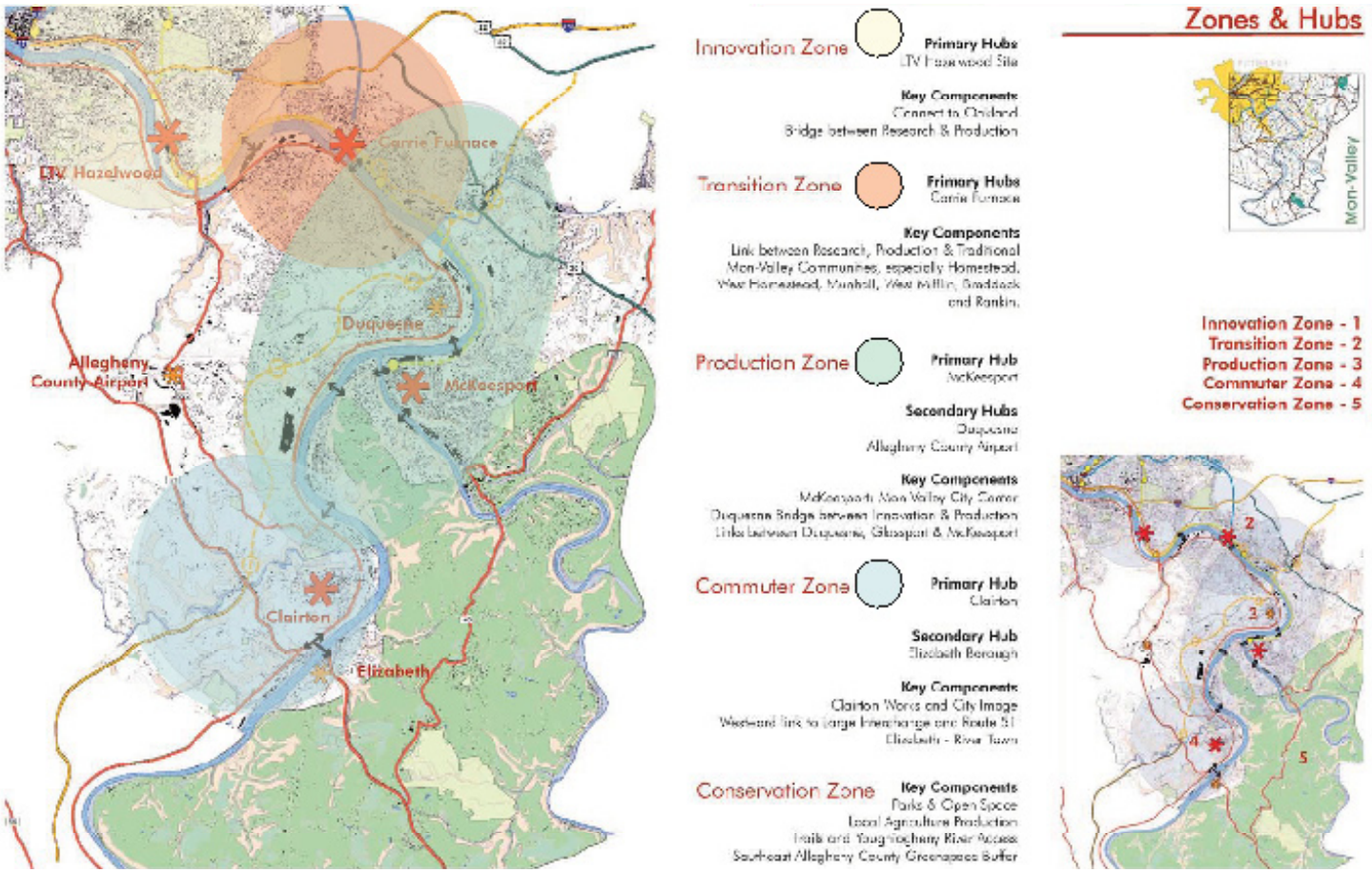
Above Right: Proposed Mon/Fayette route through Hazelwood. (Source: Loysen + Kreuthmeier, 2005)

Right: Alternative to the Mon-Fayette vision for Route 51, as proposed by the Citizens' Plan. (PennFutures, 2002: 9)

Regional Transportation Planning

The Pennsylvania Turnpike Commission has an on-going plan to develop the Mon/Fayette Expressway through Greater Hazelwood and along the eastern portion of the ALMONO site. The four-lane toll road was first proposed in the 1950s to facilitate industrial production and shipping in western Pennsylvania and West Virginia. The project has been the subject of much political debate and only 36 miles of highway have been completed since 1973. The last remaining segment – a 24-mile, $1.9 billion spur leading directly into downtown Pittsburgh – was placed on hold in 2007 due to a $1.6 billion funding shortfall. The spur is crucial to the Turnpike's regional business plan, since it is the last missing link between the rural communities and the City of Pittsburgh. Although many rural communities would clearly benefit from increased access, and although the link would provide the Turnpike Commission with revenues needed to pay for the entire Expressway's construction, some Pittsburgh and regional activists are resisting the measure fearing the project will degrade the city's quality of life and further drain its economic base. If completed, the Commission plans to route the Expressway through Hazelwood along the flatlands between Second Avenue and the Monongahela River. Interchanges would be provided at either extremity of Hazelwood, connecting the Expressway to the Parkway East (I-376) near Bates Street and to the neighborhood communities via the Glenwood Bridge.

In 2002, a coalition of local stakeholders, designers and environmental organizations, called PennFutures prepared a document entitled *The Citizens' Plan: An Alternative to the Pennsylvania Turnpike Commission's Plan to Complete the Mon-Fayette Toll Road*. The report was motivated by concerns that the proposed construction methods and routing path would consume significant amounts of otherwise developable land, undermine ongoing neighborhood regeneration efforts, and irretrievably isolate Hazelwood residents from their riverfront. The coalition argued that the project's planners had not exhausted the development options and presented a more community-friendly alternative. According to its authors, the Citizens' Plan is based on balanced multi-modal transportation, with an emphasis on urban design, offering commuters



Above: "Zones & Hubs" development strategy. (Source: The Mon Valley Economic Development Strategy, 2004: ix)

more choice and enhancing communities by integrating transportation infrastructure with the existing urban fabric. They also argue that the Citizens' Plan would cost less than the proposed toll road and associated arterial road upgrades and would result in greater overall value to the Monongahela Valley. The authors also recommend that Second Avenue be upgraded and that a new dedicated public transit system called the "Spine Line" be extended through Hazelwood.

In 2006, the City of Pittsburgh Port Authority released *Vision 20/20*, its regional vision for public transportation in southwestern Pennsylvania. In their report, officials recommended developing a light-rail or busway rapid transit connection through Hazelwood. The report also recommended using improved technology, such as an Automatic Vehicle Locator system, to provide riders with real-time travel information. Lastly, officials reiterated their commitment to improving existing bus stops, transit systems, and customer amenities.

Regional Economic Development Strategies

While the fate of the Mon/Fayette proposal remains undetermined, several other regional economic development plans are moving forward. In 2004, the Redevelopment Authority of Allegheny County commissioned the area's first comprehensive economic development strategy for the nearly 40 communities within its borders. The county worked with three firms, Impact Economics, Tripp Umbach & Assoc., and Perkins Eastman, to compile the *Mon Valley Economic Development Strategy* (MVEDS). The document recommends adopting five strategies to maximize returns on private, county, state, and federal economic investment throughout Allegheny County, the Monongahela Valley, and southwestern Pennsylvania. First, the authors recommend hub development, or concentrating investment to generate a critical mass of improvements at strategic locations and then leveraging hub growth to facilitate development in surrounding municipalities. The authors identified Hazelwood's ALMONO site as an optimal hub innovation zone for the local community and

for the larger Oakland area. Secondly, the authors recommended strategically enhancing transportation and infrastructure between key hub locations and, more specifically, recommended completing the Mon/Fayette expressway and providing reliable mass transit between downtown, Oakland, Hazelwood, and McKeesport. The group also recommended investing in people to bolster science and technology aptitudes, targeting business development to expand business capacity and maintain economic diversity, and centralizing leadership by creating a dedicated Monongahela Valley development organization.

The Battelle Technology Partnership Practice (TPP) also released a regional economic development vision in 2004. The Allegheny Conference on Community Development, in conjunction with the Oakland Investment Committee and RIDC commissioned the report *Advancing Southwestern Pennsylvania's Economic Future: The R&D Space Puzzle*. The report is based on the premise that Southwestern Pennsylvania faces a "research and development (R&D) space puzzle" or, in other words, that the region lacks a strategic development plan for future R&D expansion. Battelle was retained to create a "fact-based assessment" of the expected R&D spatial and locational demands until 2014. Oakland institutions, including UPMC, the University of Pittsburgh, and Carnegie Mellon, are driving research and technology in southwestern Pennsylvania. Their combined research base doubled in size between the 1990s and early 2000s, now totaling over 1 million square feet. Consequently, Battelle primarily assessed Oakland's space needs, using precedents in competing cities like San Francisco, Seattle, Portland, Chicago, and Raleigh, all of which are pursuing mixed-used planned campus expansions as a means to attract new talent and funding. Authors concluded that southwestern Pennsylvania has an R&D competitive edge in biomedical drug discovery, bioengineering, multimedia technology, cyber security, robotics, and multidisciplinary research.

The Battelle report estimated that, even in a conservative funding scenario, the city would need at least 1 million square feet of additional space for research and technological development by 2014. This number may rise to 3 million if southwestern Pennsylvania continues to increase its share of federal research dollars. Batelle suggested three strategies to accommodate this growth. One option is to cluster research and industry in multiple sites in and around Oakland as part of a "Pittsburgh Research and Technology Crescent." The scheme would require improved transportation, transit, and parking infrastructures connecting individual clusters. Alternatively, Battelle proposed developing a riverfront campus and technology park on Hazelwood's ALMONO site. Authors considered this the most "bold, yet realistic" approach and recommended integrating the new facilities with the existing Pittsburgh Technology Center and creating new mixed-use development around the two campus anchors. Lastly, Battelle conceded that new R&D buildings could be scattered throughout Oakland as part of a "hub and spoke" pattern, but authors felt this strategy would be the least effective.

The Milken Institute, in collaboration with the Greater Oakland Keystone Innovation Zone released the *Pittsburgh Technology Strategy* in 2006. In their report, the Institute evaluates Pittsburgh's strategic position in the new knowledge-based economy of high-tech industry. Although the report lauds research activity at Carnegie Mellon and University of Pittsburgh, the authors nonetheless conclude that Pittsburgh's technological development efforts are not keeping pace with other comparable cities nationwide and that the entire economy is suffering as a result. Authors compared Pittsburgh to several similar cities, including Baltimore, Indianapolis, Phoenix, Seattle and St. Louis, and, based on their findings, identified several problems and potential solutions to facilitate innovation and retain human capital. In particular, Milken recommended that Pittsburgh develop policies to leverage university talent by engaging students in startups and long-term research projects. Authors also suggested encouraging corporate venture capital investment and aggressively supporting local high-tech development to make Pittsburgh a favorable destination for expansion and relocation. Milken also recommended increasing university-level enrollment in technology and research programs and expanding scholarship programs and industry networks to facilitate regional growth.

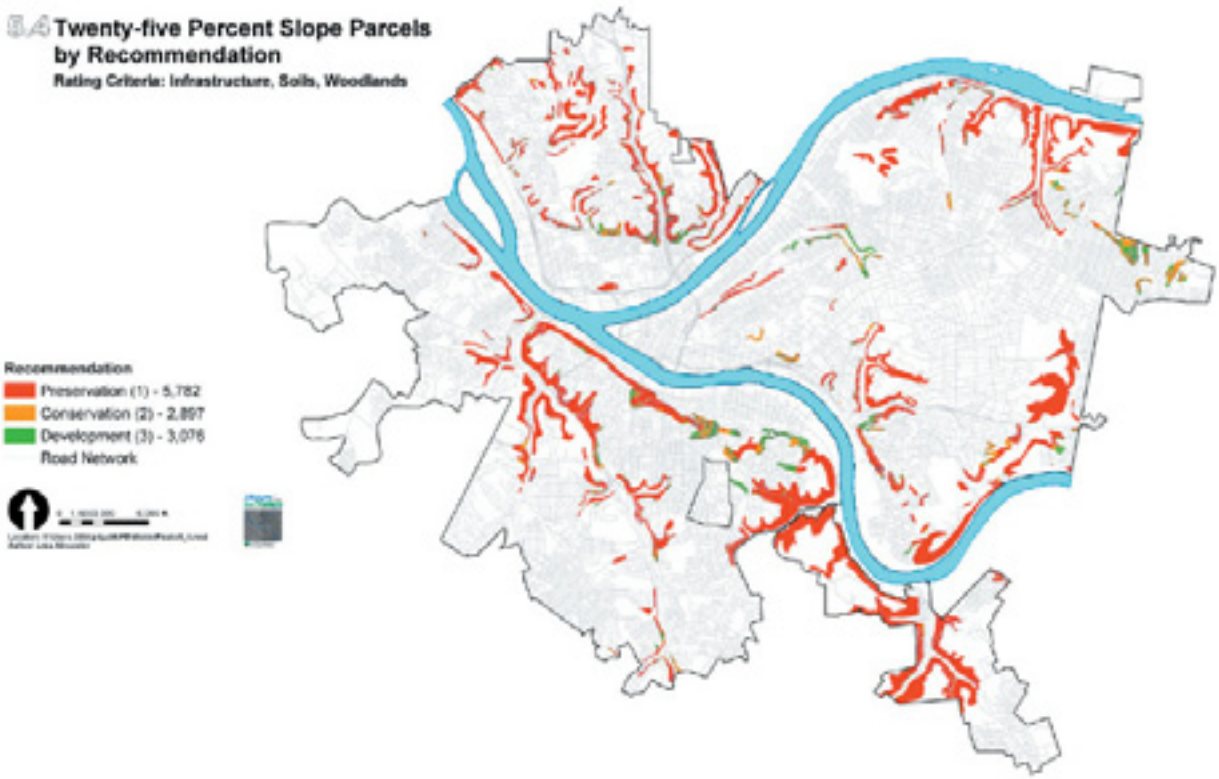
Ecological Health and Cultural Tourism

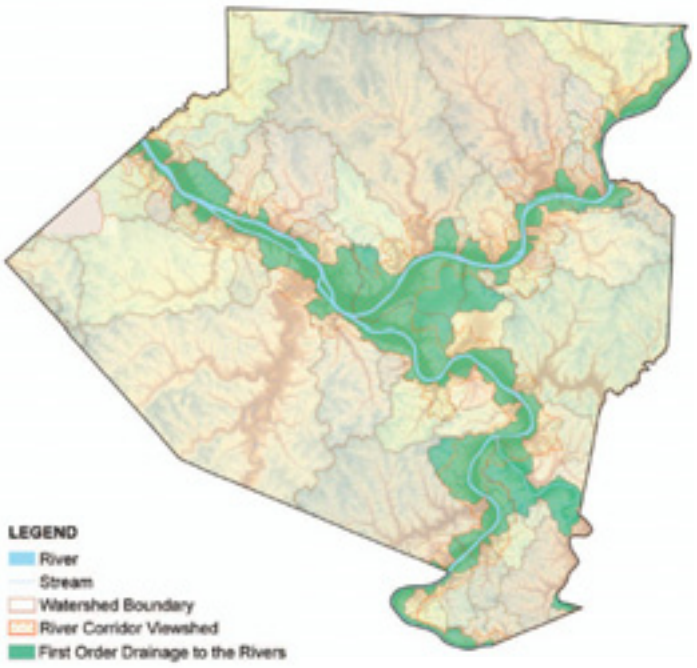
Several other regional leaders have commissioned regional development plans that integrate broad economic goals with other quality-of-life interests, such as recreational tourism, ecological health, and cultural heritage. In 2005, the City of Pittsburgh, the Department of City Planning, and the Allegheny Land Trust jointly commissioned the Hillside Steering Committee to complete a report called *Opportunities for Hillside Protection*. The report recommends several policy measures to protect Pittsburgh's hillsides and summarizes the findings of An Ecological and Physical Investigation of Pittsburgh Hillsides, prepared by Perkins Eastman Associates and the STUDIO for Creative Inquiry at Carnegie Mellon. The team assessed the appropriateness of current and possible future hillside zoning distinctions, the effect of current permitting development practices on regional preservation and conservation, and the appropriateness of adopting a city policy requiring the city to designate all publicly held hillside areas as officially zoned open space.

The Hillside Steering Committee concluded that Pittsburgh hillsides were not adequately protected, as measured by the potential aesthetic, environmental, and recreational benefits, and recommended stronger regulations that would protect hillside amenities as public assets. The authors also recommended distinguishing hillside development from other urban patterns by reinforcing hillside character at the city, hillside settlement, and property scales. The recommendations would maintain continuity of the natural landscape with development in a subordinate and supportive role. To comply with these recommendations, Greater Hazelwood should establish a

Above: Pittsburgh hills as backdrop and frame: Hazelwood across the Mon River. (Source: Collins et al., 2006: ix)

Below: Recommendation map regarding Pittsburgh's slopes from Opportunities for Hillside Protection. (Source: Hillside Steering Committee, 2005)





Left: Despite a century of pollution and artificially higher water levels, Allegheny County's riverbanks are showing signs of recovery. (Source: Collins et al., 2006: 66)

Above: First Order Drainage to the Rivers. Mapping river ecology in the study Ecology and Recovery, STUDIO for Creative Inquiry, Carnegie Mellon. (Source: Collins et al., 2006: 41)

protective Steep Slope Overlay District based on a slope of 25% or more, prevent development on slopes greater than 40%, and support these measures with more stringent landslide and stormwater management practices. Visible slopes should receive extra protection, and development patterns should concentrate around existing natural and built infrastructures and respect geological and soils limitations. The report received an American Institute of Architects (AIA) Pittsburgh Honor Award for Regional and Urban Design in 2005 and Perkins Eastman received an Institute Honor Awards for Regional & Urban Design in 2007.

From 2000 to 2005, Carnegie Mellon's STUDIO for Creative Inquiry led a five-year multi-disciplinary research project addressing the "meaning, form, and function of public space and nature in Allegheny County". The 3 Rivers 2nd Nature project included three programs of reserach: Aquatic Systems and Water Quality, Riverbanks and Watersheds, and River Dialogues and the Monongahela Conference. Their research is compiled in *Ecology and Recovery: Allegheny County* (2006).

Several groups have made progress on river-focused and ecologically oriented regional planning initiatives in recent years. The Friends of the Riverfront organization's Three Rivers Heritage Trail project continues to make progress, with the last several miles leading directly into downtown Pittsburgh still pending or under construction. When complete, the trail will be a 37-mile long pedestrian path and greenway system that runs along both sides of the Allegheny, Monongahela, and Ohio Rivers within Pittsburgh. The public path, which is nearly complete, brings cyclists, walkers, runners, and in some places rollerbladers, back in contact with one of Pittsburgh's greatest assets, its three rivers.

The Allegheny Trail Alliance maintains the Great Allegheny Passage, a 150-mile biking and hiking trail system that will eventually connect Pittsburgh to Washington, D.C. The project is primarily a rail-to-trail conversion and, on most segments, auto access is restricted. Although the project is largely completed, the last several miles use a portion of the Three Rivers Heritage Trail, which is not finished. The Steel Industry Heritage Corporation initiated the Steel Valley Trail Council in 1996, whose mission is to "assure quality construction and long-term stewardship of the Steel Valley Trail", the portion of the Great Allegheny Passage that runs from McKeesport to Pittsburgh along the Monongahela River.

The Great Allegheny Passage passes through the Rivers of Steel National Heritage Area, designated in 1996 by the U.S. Congress to recognize the region's long and rich industrial history. The Heritage Area encompasses 3,000 square miles in seven counties including Allegheny, Armstrong, Beaver, Westmoreland, Greene, Fayette, and Washington. Communities receive funding for historic preservation, cultural conservation, heritage education, recreational amenities, and resource development.

The Riverlife Task Force, a public-private partnership advocating for the redevelopment of Pittsburgh's riverfronts, released its *3 Rivers Park and Trail* vision document in 2000. Their vision is the creation of the Three Rivers Park, a grand urban waterfront park along the Allegheny, Monongahela, and Ohio Rivers. The park would provide a continuous green trail link between existing and future riverfront destinations and other park spaces, cultural amenities, and commercial destinations. At this time, the Three Rivers Park is not proposed to be extended into Hazelwood.

Above: Completed portion ("Jail Trail" or Eliza Furnace Trail) of the Great Allegheny Passage Trail with downtown Pittsburgh in the background. (Source: Allegheny Trail Alliance, 2006)

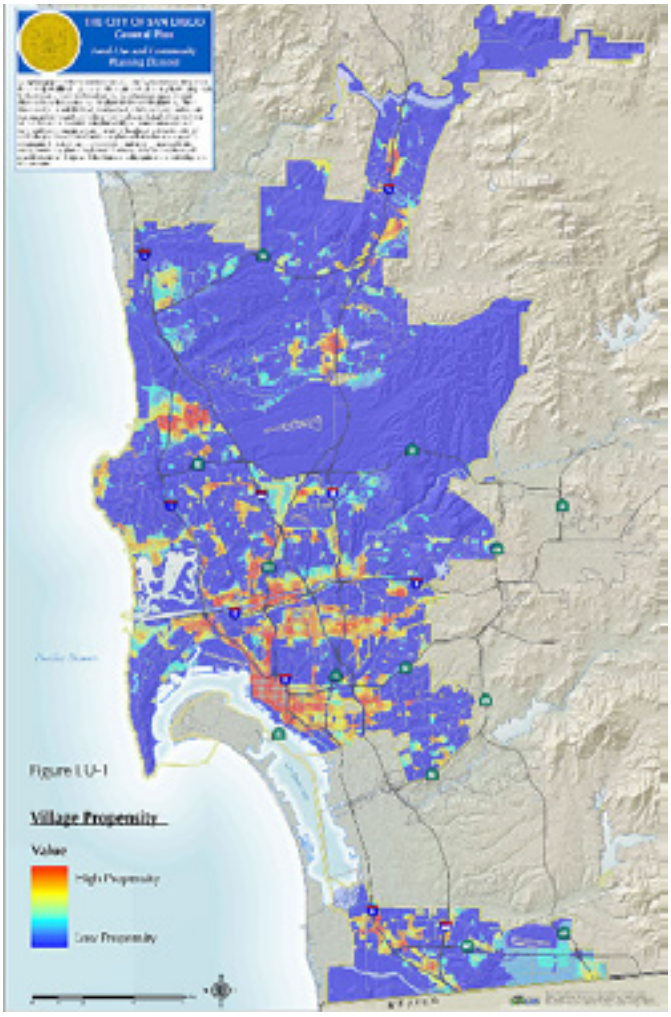
Left: Steel Valley Trail Map, a part of the Great Allegheny Passage. (Source: Steel Valley Trail Council, no date)

sustainable development initiatives

Sustainable Development & Eco-Urban Planning

Activists and industry leaders have established several sustainability frameworks to encourage, guide, and measure sustainable urban development. Although current sustainability discourses are not exhaustive, most integrate at least some key economic, social, and ecological interests into a combined planning model able to benefit all three. Programs such as the Smart Growth initiative and the Congress for New Urbanism promote sustainable land-use patterns and neighborhood design practices that benefit economic, ecological, and human conditions in core neighborhood areas. A new, related LEED rating system for neighborhood development will provided a quantitative framework for measuring the success of these regional development practices, and will also help integrate these concerns with more localized, building-scale green practices. Transit oriented development models encourage similar types of practices by emphasizing linkages between multiple core community nodes and between these nodes and a larger regional business and civic center. The LID Center promotes low-impact development strategies focused on hydrological performance measures that can be integrated into other sustainable development frameworks. Stream restoration activities augment surface water management strategies and are rapidly becoming a tool for urban ecological and economic recovery.

Above: Smart Growth in San Jose, CA. (Source: ITE, no date)



Right: A GIS map depicts the areas within San Diego, CA, that have smart growth potential. Red and orange areas have the highest values. (Source: Klein and Greer, 2006)

City Planning Initiatives

Smart Growth Network

c/o International City/County Management Association
777 North Capitol Street, NE Suite 500
Washington, DC 20002
www.smartgrowth.org

> *"In 1996, the U.S. Environmental Protection Agency joined with several non-profit and government organizations to form the Smart Growth Network (SGN). The Network was formed in response to increasing community concerns about the need for new ways to grow that boost the economy, protect the environment, and enhance community vitality. The Network's partners include environmental groups, historic preservation organizations, professional organizations, developers, real estate interests; local and state government entities."*
>
> *- Smart Growth Network website, July 2007*

The U.S. Environmental Protection Agency (EPA) Smart Growth program addresses "growing concerns that current development patterns -- dominated by what some call 'sprawl' -- are no longer in the long-term interest of our cities, existing suburbs, small towns, rural communities, or wilderness areas" (Smart Growth, no date). Smart Growth strategies are intended to support continued economic growth while mitigating negative community, environmental, and financial consequences. Although effective strategies vary from place to place, Smart Growth policies invest time and attention to restoring existing cities and older suburbs. Smart Growth strategies promote a town-centered and transit oriented approach, support mixed-use style developments, and encourage outdoor open space and environmental amenities. The EPA Smart Growth office conducts research, manages grants, and distributes information in support of these land-use strategies.

The EPA lists the following ten basic principles as guidelines to consider when planning and evaluating Smart Growth developments:

1. Mix land uses
2. Take advantage of compact building design
3. Create a range of housing opportunities and choices
4. Create walkable neighborhoods
5. Foster distinctive, attractive communities with a strong sense of place
6. Preserve open space, farmland, natural beauty, and critical environmental areas
7. Strengthen and direct development towards existing communities

Right: Eastwick community grocery funded in part through the Pennsylvania Fresh Food Financing Initiative. (Source: Ostroff, 2006)

8. Provide a variety of transportation choices
9. Make development decisions predictable, fair, and cost effective
10. Encourage community and stakeholder collaboration in development decisions

Smart Growth land use strategies and reinvestment schemes are intended to revitalize existing communities in situ rather than abandoning existing social capital and physical infrastructure in favor of new construction on greenfield sites. Design and policy principles, such as mixed housing types, diverse transportation alternatives, and walkable design features, encourage quality living, working, learning, worship, and leisure amenities accessible across disparate income and age groups. Smart growth advocates place a premium on community empowerment efforts and, through these strategies, hope to encourage local neighborhood stakeholders to generate their own values and aesthetic preferences. Transparency and predictability measures are also encouraged in part to create opportunities for democratic involvement and in part to make it easier for the private sector to pursue such strategies. Through these strategies, activists also hope to promote environmental protection, ecological health, and meaningful access to public outdoor space.

The University of Pittsburgh Greensburg campus, located approximately 35 miles outside of Pittsburgh, formed the nonprofit Smart Growth Partnership of Westmoreland County in 1999. Westmoreland County is located nex to Allegheny County and, like Allegheny, continues to battle sprawl development and piecemeal planning practices. The partnership, which is funded by various philanthropists and the Allegheny Power utility company, provides educational and technical assistance on economic growth and revitalization projects throughout the county. Given the group's proximity to Pittsburgh and its ongoing working ties with the Pittsburgh-based university and utility company, the partnership is a valuable model for smart growth advocacy throughout the Pittsburgh region.

Various organizations, including the EPA, confer recognition on projects that demonstrate smart growth principles in action. Although Smart Growth projects and case studies abound, these award schemes help raise awareness of the Smart Growth agenda and illustrate its concepts in diverse, real-world scenarios. Carnegie Mellon's Urban Lab received the 2004 Smart Growth Partnership award for a local redevelopment vision that the program developed in collaboration with the Heinz School (Heinz School, 2004).

More recently, the EPA awarded the 2006 "Overall Excellence in Smart Growth Award" to the Massachusetts Office of Commonwealth Development (OCD), a state office founded in 2003 to jointly address environmental, transportation, and housing policy. The organization has a $5 billion annual operating budget and uses a range of financial incentives to promote transit oriented development (TOD), general infrastructure reinvestment, public transit improvement, and brownfield redevelopment. Through these initiatives, the OCD credits its policies for developing over 3,000 new affordable housing units annually, constructing 37 million square feet of new TOD facilities, and protecting 35,000 acres of greenfield land.

The EPA also recognized the Pennsylvania Fresh Food Financing Initiative, a public-private partnership between the state and three non-profit organizations, for its successful Smart Growth policies and regulations. The organization uses financial grant and loan incentives ($21.9 million distributed across 22 projects) to attract supermarkets to underserved neighborhoods. According to the EPA, these initiatives reduce travel distances and

Left: Winooski River recreational amenity, Vermont. (Source: Martine, 2007)

Below Left: Winooski Downtown Redevelopment project, Vermont. (Source: Ostroff, 2006)

Below Right: Bethel Center provides employment services, child care, and banking in a "green" building on a former brownfield in the West Garfield Park neighborhood of Chicago, IL . (Source: Ostroff, 2006)

bolster the existing local economic base. The incentive program also encouraged other smart growth strategies, such as maintaining pervious surfaces for rainwater infiltration and redeveloping grey and brownfield sites, as well as healthy living strategies, such as pedestrian activity and affordable produce.

In terms of built projects, the EPA recognized the 40-acre Old Town district of Wichita, Kansas, for its extensive remediation and revitalization efforts. Through the 1990s, the Old Town warehouse district was largely abandoned, with dilapidated buildings, roads, and rail infrastructure. Extensive groundwater pollution and its associated liability and clean-up costs deterred redevelopment until the city purchased the land and assumed the remediation burden. Using special tax districts and public-private investment mechanisms, Wichita developed a pedestrian-oriented, semi-historic, mixed-use district with 315 housing units and 690,000 square feet of retail, office, and entertainment space. The city also developed outdoor parks, improved public transit options, and established an environmental stewardship outreach center.

The EPA also conferred a Smart Growth Small Communities award on the Winooski Downtown Redevelopment Project, a small-town historical revitalization project in the Burlington metropolitan area in Vermont. The 7,000-resident community secured $207 million ($38 million in public subsidy) for its downtown redevelopment project, which was carried out in accordance with smart growth principles. The historically sensitive project re-established a small-scale street grid, developed wider sidewalks and additional street parking, and, most dramatically, increased density in the new, transit-oriented town center. The project also "preserved or restored nearly 100 acres of natural habitat, returned vacant properties to productive use, created several neighborhood parks, and built the pedestrian-friendly RiverWalk" waterfront recreational amenity (U.S. EPA, 2007).

The last EPA Smart Growth 2006 award went to Chicago's Bethel Center project in recognition of its equitable development strategies. The Bethel New Life, Inc., a local faith-based non-profit organization, conceived the project as a strategy for bolstering economic revitalization in the West Garfield Park neighborhood. As the city prepared

Right: New urbanist-inspired plan for Long Beach, Mississippi. (Source: Ayers, Saint, Gross Architects & Planners, 2007)

to close the community's last remaining transit station, the community (population 23,000) rallied around Bethel New Life's vision of transit-oriented, green technology development anchored by a new affordable housing and community service facility. The Bethel Center facility was built on a brownfield site through a funding grant from the Chicago Department of Planning and Development. New affordable homes and train station improvements have also been completed, and new community services and training programs have been established.

Congress for the New Urbanism (CNU)

140 S. Dearborn Street, Suite 310
Chicago, IL 60603
www.cnu.org

> *"As outlined in the preamble to our Charter, CNU advocates the restructuring of public policy and development practices to support the restoration of existing urban centers and towns within coherent metropolitan regions. We stand for the reconfiguration of sprawling suburbs into communities of real neighborhoods and diverse districts, the conservation of natural environments, and the preservation of our built legacy."*
>
> *- Congress for New Urbanism website, April 2007*

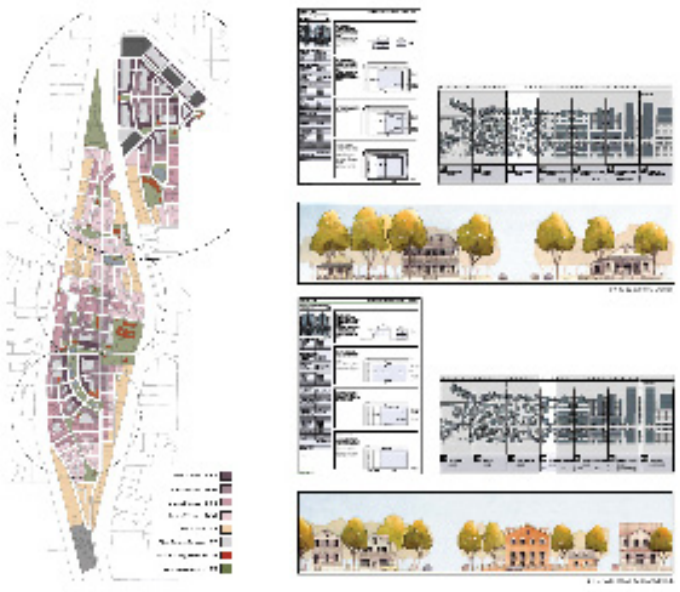
The Congress for the New Urbanism (CNU) was founded in 1993 as a proactive, multi-disciplinary organization dedicated to rebuilding neighborhoods, cities, and regions. Closely allied with the Smart Growth movement, the New Urbanism movement presents an alternative to conventional suburban development practices, growing automobile dependency, and sprawl. The group promotes a fix-it-first development strategy that emphasizes compact, mixed-use configurations and discourages sprawling, single-use, auto-oriented, greenfield development. The organization has 2,300 members in 20 countries and, since its inception, has recognized over 600 new urbanism projects within the United States.

In their charter, CNU outlines a series of design and policy guidelines addressing regional, neighborhood, and block-scale development practices. Regional scale priorities address transportation and land-use issues. The New Urbanism ideal promotes dense and bounded urban development that restores existing urban settings and preserves greenfield sites. The guidelines also promote mixed-use, mixed-income communities in village, town, and neighborhood-scale development clusters that respect historic patterns, precedents, and boundaries. Multiple transportation options and shared financial structures are also encouraged.

At the neighborhood level, New Urbanism principles promote compact, pedestrian-friendly, diverse communities with a clear sense of identity and civic engagement. Many housing and transportation alternatives should be developed to accommodate diverse ages, races, incomes, and mobility levels. Outdoor recreational areas and civic institutional structures should be provided.

At the block and building level, public areas should physically be well defined yet seamlessly integrated in a safe, accessible manner. Streets should respect pedestrians, accommodate auto traffic, and encourage walking activities and other neighborhood interactions. Buildings should reflect local climate, topography, and history. Civic structures in particular should reinforce a community sense of identity and democracy. Sustainable practices are encouraged.

Andrés Duany, one of CNU's co-founders, developed the "transect" concept to express the CNU-style relationship between various scales of development and to guide land-



Above: Transect plan illustrations for Saucier, Mississippi. (Source: Andrews University, 2007)

use decisions therein. Transects refer to zones or spatial gradations theoretically transitioning between urban and rural settings. Whereas modernist planning emphasized single-use zoning, Duany's model suggests that each zone or "transect" should contain a variety of uses and that the urban-rural transition should be based on changes in density and typology rather than use mixture. Instead of developing a downtown business district surrounded by bedroom community suburbs surrounded by rural farmland, Duany's transect model suggests that each transitional slice should contain a mixture of residential, retail, financial, and recreational facilities all of which should be within walking distance of one another. The new urbanism model therefore promotes a polycentric or multi-nodal urban pattern across development scales.

New Urbanism advocates recognize that their mixed-use, multi-nodal growth model is not necessarily compatible with many municipal ordinances and zoning codes. Although mixed land use is one obvious challenge, other laws mandating building placement or auto-oriented streetscape design are equally troubling. To counter these challenges, Duany and other CNU activists have developed an alternative set of codes and regulations that emphasize New Urbanism priorities. Their "SmartCode" development ordinance is based on transect-divisions rather than land-use zones and suggests development standards addressing both the environment and the built community.

The Congress for New Urbanism began holding an annual Charter Awards competition in 2001. The awards scheme recognizes planning projects in various stages of completion that epitomize the group's visionary goals. Multiple awards are granted each year recognizing accomplishments and innovations at the building, neighborhood, and regional levels. Although the award-winning projects are highly diverse, some projects are contextually similar to the Pittsburgh ALMONO project and therefore are especially informative case studies. In particular, the CNU has recognized projects that reconnect cities to their waterfronts, that utilize university or biotechnological investment in community revitalization, and that integrate residents with mixed income and occupational backgrounds into a shared neighborhood.

Several cities and states, including Camden, Milwaukee, Providence, and the Commonwealth of Massachusetts, are promoting innovative, new urbanism waterfront revitalization projects. The Cooper's Crossing project (2007) is located in downtown Camden, New Jersey, along the former industrial waterfront opposite Philadelphia. Modeled in part on the 1980s Baltimore Inner Harbor restoration project, Camden's 70-acre brownfield remediation will create a new 24-hour, mixed-use, tourist destination with 1,500 new housing units, 500,000 square feet of commercial office space, and 150,000 square feet of retail, dining, and entertainment space (total cost $200 million). City planners will extend the existing street grid across the old industrial wasteland thereby reconnecting the city with its riverbank. Future aerial tram and cross-river ferry services have been proposed and would provide a direct, cross-river link between Philadelphia and Camden. Although the project's urban infill and transit-oriented development aspects have been widely acclaimed, some critics have nonetheless disparaged the project's high degree of detachment from the existing, low-income neighboring communities (Gillette, 2005: 218-243).

City officials in Milwaukee demolished sections of their urban freeways to make way for pedestrian-scale redevelopment along formerly isolated urban waterfronts. The Park East Redevelopment Plan in Milwaukee, Wisconsin, removed an elevated freeway formerly located along the bank of the Milwaukee River. The neighboring residential community is being refurbished and new pedestrian scale mixed-use blocks are being constructed where the freeway once stood. Planners extended the existing residential streets through the new community all the way to the waterfront. The city also constructed a new riverfront

Left: Transect birds-eye illustrations. (Source: Duany Plater-Zyberk, 2005: 24)

Above Right: Providence, Rhode Island, downtown revitalization proposal. (Source: Congress for New Urbanism, 2007)

park and walkway and, to accommodate displaced traffic, built a wide urban boulevard passing through the newly constructed retail center.

The Providence, Rhode Island, Department of Planning and Development is also relocating an inter-city freeway thereby opening up 150-acres of central urban land for redevelopment. The city has been engaged in an extensive downtown rebuilding project for the past decade, involving extensive roadway reconstruction, urban stream daylighting, and retail revitalization. This next phase, which includes the freeway relocation, will revitalize an additional 1,200 acres of the city's post-industrial downtown by extending the downtown historic blocks across multiple brownfield sites to the newly recreated urban riverfront. The proposal emphasizes pedestrian and transit-oriented street patterns, calls for mixed-use development, and incorporates prominent civic structures and park amenities.

The Massachusetts Executive Office of Environmental Affairs (EOEA) has developed a statewide UrbanRiver Visions proposal (2003) targeted at its numerous, deindustrialized riverfront mill-towns. The state collaborated with seven such municipalities during the visioning process and intends to use the document to guide mill-town riverfront revitalization throughout the region. The vision not only emphasizes new urbanism form-based goals, such as walkability, mixed land use, and transit orientation, it also promotes community participation and environmental conservation. The EOEA has already provided $1.2 million in funding to six mill-towns revitalizing their riverfront city centers, and organizational leaders expect to make additional funding allocations in the future.

Several cities worldwide are incorporating new urbanism principles into projects that leverage academic and technological research activities for broader urban regeneration. The Innovista project (2007 award winner) in Columbia, South Carolina, is a public-private urban redevelopment project that will transform 500-acres of under-utilized land into a vibrant, technology-oriented, mixed-use office park catering to upper-income researchers and technology personnel. The University of South Carolina is pushing the project forward and will develop several new research facilities on the site rather than pursuing a more typical suburban greenfield development strategy.

LEED for Neighborhood Development

U.S. Green Building Council
1800 Massachusetts Avenue, NW, Suite 300
Washington, DC 20036
www.usgbc.org

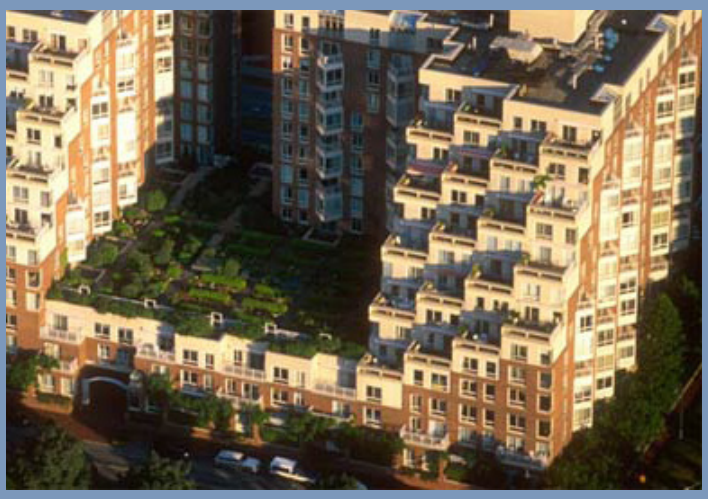
"The U.S. Green Building Council's core purpose is to transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life."

- U.S. Green Building Council website, April 2007

The U.S. Green Building Council (USGBC) is a non-profit coalition of building industry leaders working to develop more sustainable practices in their field. The group promotes buildings that are "environmentally responsible, profitable and healthy places to live and work" (USGBC website). To this end, the organization sponsors educational and advocacy programs to raise awareness of green building strategies. The coalition includes 8,500 members in 75 regional chapters.

One of the coalition's most successful programs is the LEED Green Building Rating System. LEED (which stands for Leadership in Energy and Environmental Design) is "a voluntary, consensus-based national rating system for developing high-performance, sustainable buildings" (USGBC website). The rating system is a national benchmarking tool used to gauge and document green design, construction, and operation strategies in building projects. The USGBC has developed several versions of LEED to accommodate the particular needs and challenges of different types of projects (e.g. new construction vs. renovation, commercial project vs. home owner, etc.). Based on performance measures in several categories – including sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality – owners can have their building certified for compliance and listed in a national registry.

The Congress for the New Urbanism is collaborating with the U.S. Green Building Council (USGBC) and the Natural Resources Defense Council (NRDC) to develop a neighborhood-based sustainable development rating system. In 1998, the USGBC launched its pilot Leadership in Energy and Environmental Design Green Building Rating System (LEED), a national benchmarking tool used to gauge and document green design, construction, and operation strategies in building projects. Based on performance measures in several categories, owners can have their building certified for compliance and listed in a national registry. Building on the program's success, the CNU and NRDC joined forces with



USGBC to develop a LEED system for Neighborhood Development (LEED-ND). Whereas traditional LEED systems focus primarily on individual structures, LEED-ND emphasizes New Urbanism style neighborhood-scale initiatives to improve land-use planning, physical design, and green technology.

The CNU and USGBC released a pilot version of the LEED-ND rating system in 2007. The LEED-ND certification process will evaluate project location, transportation alternatives, neighborhood development patterns and amenities, physical and economic accessibility, and building-specific green construction practices. Evaluation criteria are heavily based on Smart Growth and New Urbanism practices. Sustainability measures also incorporate findings from a USGBC report correlating community design practices with public health consequences, such as physical activity, traffic accidents, respiratory health, and mental health. LEED-ND strategies can be adapted to accommodate new tract development or neighborhood infill projects. The pilot phase will be completed in 2008 and, based on subsequent evaluation, the first official New Urbanism based LEED-ND Rating System will be released in 2009.

Above Left: Campus Åkroken project in Sundsvall, Sweden. (Source: Congress for New Urbanism, no date)

Above Right: Denver's Commons Neighborhood Plan. (Source: Congress for New Urbanism, no date)

A similar project has recently been completed in Sundsvall, Sweden, where the technologically savvy Mid Sweden University utilized new urbanism growth strategies for the benefit of both town and university. Sundsvall is a historic town located 350km north of Stockholm, has a population of 94,000, and accommodates 550,000 tourists annually. The Campus Åkroken project (2005 award winner) constructed a new university complex on former riverfront industrial land within walking distance of the city center. Planners rejected the modern, stand-alone campus model in favor of an urban infill model replicating the traditional Sundsvall city form, with its alleys, squares, bridges, and mixed housing. The project was intended, in part, to leverage the university's growing prominence as a biotechnology research center to improve local economic and business vitality. The complex contains trendy residential units and flexible research facilities, which accommodate university spin-of groups and provide space for new companies relocating to the area.

Several city officials throughout Ohio have incorporated new urbanism principles of economic and land-use diversity into their public housing policies. The Riverview HOPE VI Housing project (2002) in Cleveland is a mixed-use, mixed-income community on the banks of the Cuyahoga River. The Cuyahoga Metropolitan Housing Authority demolished public housing high-rise buildings (135 total units) to make way for the new Riverview neighborhood. Riverview was supposed to contain 81 af ordable rental units, 335 market-rate condominiums, and 10,000 square feet of retail space. However, since the land area proved to be physically unstable, city officials have since had to modify their plan by developing several of the planned housing clusters as infill projects in nearby neighborhoods. The City West project in Cincinnati (2004) is similar to the Cleveland project. Cincinnati officials also demolished an older superblock public housing project to make way for a more traditional-style residential community. The new mixed-income community, costing $151.8 million, will include 1,022 new townhouses, 434 of which are earmarked for the HOPE VI program. Both the Cleveland and the Cincinnati project create new, mixed-income, central residential communities with strong pedestrian and transit ties to existing economic and cultural amenities in nearby communities.

Transit Oriented Development (TOD)

Transit Oriented Developments (TODs) are compact communities built around high quality public transit systems. The goal of these developments is to reduce car dependency by providing a pedestrian environment for community needs and reliable, shared transit access to regional services.

The TOD model promotes a multi-nodal growth pattern of distributed and self-sustained communities linked together through well-established transit systems. Ideally, each core community should contain a mix of residential, retail and commercial services as well as some public open space. These amenities should be concentrated within a half-mile (10-minute) walking radius of the primary regional transit hub. Core community streetscapes should be comfortable, safe, convenient, and attractive to pedestrians and cyclists. A residential and low-intensity business zone generally surrounds the core TOD community. Peripheral streets leading to the center should accommodate

a range of transportation options, such as bicycles, scooters, rollerblades, trolleys, streetcars, light rail, and buses. Parking amenities should be reduced and concentrated so as to minimize the physical and visual impact on the pedestrian core. The various TOD communities should be connected via reliable public transit systems, such as trains or light rail systems. These systems provide access to larger regional nodes containing employment centers, art and educational facilities, and health services.

Although such development typologies have turn-of-the-century precedents, the contemporary TOD movement is largely a reaction against post-war problems of sprawl, traffic congestion, isolated suburban environments, and strip-mall style growth. Safe and pleasant pedestrian access to urban amenities extends benefits across age and income groups allowing greater independence for older, younger, and less wealthy community members. Successful TOD communities increase mobility and transit ridership while reducing traffic congestion, driving time, accident rates, and transportation costs. Pedestrian activity improves physical health and can increase economic activity in business areas. TODs potentially reduce air pollution, oil dependence, and infrastructure costs and, according to TOD advocates, help stabilize property values and maintain economic competitiveness.

Several cities and organizations nationwide have incorporated transit-oriented development strategies into their general policy framework. City officials in Boston were early converts, adopting the TOD model in the 1970s to combat industrial decline. The Davis Square revitalization project, which was planned in the early 1980s and completed in the early 1990s, was one of the city's first successful TOD-style redevelopments. As part of the project, the city extended its existing red line light rail from downtown into the inner-ring suburbs and adopted policies encouraging high-density, pedestrian-oriented redevelopment around new and existing stations. Old industrial buildings were either converted or replaced, and the city improved streetscapes and safety features within each station's walking radius. More recently, Boston officials created a special TOD-style "Smart Growth Corridor" along a 10-mile stretch of the city's underutilized Fairmont/Indigo commuter rail. The corridor connects downtown Boston with inner suburbs and runs through

Opposite Page, Far Left: Cleveland's Riverview HOPE VI Housing project . (Source: Congress for New Urbanism, no date)

Opposite Page, Below Left: Cincinnati's City West project. (Source: Congress for New Urbanism, no date)

Opposite Page, Near Left: Boston's transit oriented development "Smart Growth Corridor". (Source: Southwest Boston CDC, no date)

Right: Transit-oriented development in Boulder, CO. (Source: Pennsylvania Environmental Council, no date)

several brownfield sites and poor, underserved residential communities. To combat these environmental and social problems, officials used the Smart Growth Corridor plan to create new improvement districts around existing transit stations (approximately 5,000 acres total). Their plan calls for improvements to the transit system itself as well as for higher-density development of affordable housing and employment facilities within each station's vicinity.

Portland has also adopted a transit-oriented regulative approach, as illustrated by a 1992-98 case study of Portland's Westside MAX Light Rail TOD Program. Based on a 50-year growth vision, the city systematically coordinated local, regional, state, and federal policy mechanisms to establish a TOD-style transportation, land-use, and real estate regulatory framework within the metropolitan area. Growth regulations were justified on the grounds that better management would "reduce air pollution and vehicle miles traveled and obtain maximum return on the public investment in light rail" (Marcus). As part of the program, TriMet, the area's regional transit agency, constructed a new light rail line ($964 million) strategically locating new stations in grey and brownfield redevelopment areas. The city used tax-abatement strategies to promote high-density, mixed-use development around the individual stations. Planners also identified critical technological investment and research needed to make the multi-decade project feasible and, between 1994 and 1997, over $14 billion in public and private funds were spent on related initiatives.

City officials in Denver have likewise incorporated TOD-style practices into its growth policies in order to combat ongoing sprawl and rising highway costs. Since the early 1990s, the city has constructed several new light rail lines/extensions and has designated nearly 20 specific TOD project sites. Within the city limits, shuttles, buses, and the light rail system serve downtown "urban villages." Rail lines provide reliable transit between the downtown villages and outlying TOD communities and, in some cases, TOD hubs are being used to catalyze community revitalization. For example, Englewood's City Center project transformed a declining blue-collar community along the C&D rail lines into a mixed-use residential hub catering to downtown employees. Boulder, located 25 miles outside of downtown Denver, is also promoting small, mixed-use, infill developments with extensive bus service and inter-city ties. Most prominently, a 2,935-acre, mixed-use, TOD-style urban infill project is currently under construction on the former Stapleton International Airport site.

The Congress for New Urbanism (CNU) largely supports TOD-style development and has recognized numerous projects over the years through their Annual Awards programs. For example, the CNU commended Denver's *Commons Neighborhood Plan* (2003) to transform a 65-acre former downtown rail yard into a mixed-use, transit-oriented community. The CNU also lauded the *Getting it Right: Preventing Sprawl in Coyote Valley* report (2005) issued by an environmental-advocacy group in San Jose. In the document, the activists promote a TOD-style growth model in order to protect 6,800 acres of prime farming and watershed lands from city-planned sprawling suburban development. Similarly, community leaders in Concord, New Hampshire, developed the *Initiative for a 20/20 Vision for Concord*, a TOD-based planning document intended to protect regional farmland and river valleys from sprawl. The document specifically criticizes standard growth-ring restrictions as insufficiently protective of environmental resources and, in their place, designates six concentrated village hubs targeted for future development.

Left: Ecologically-sensitive hydrological development diagram. (Source: LID Center, 2007)

Water Management

Low Impact Development (LID) Center

4600 Powder Mill Rd, Suite 200
Beltsville, MD 20705
www.lowimpactdevelopment.org

> *"The Low Impact Development Center was established to develop and provide information to individuals and organizations dedicated to protecting the environment and our water resources through proper site design techniques that replicate pre-existing hydrologic site conditions."*
>
> *- Low Impact Development (LID) Center website, April 2007*

The Low Impact Development (LID) Center is a non-profit organization advocating for better stormwater management development practices and is especially interested in improving water management in urban contexts. The group supports urban growth and physical development but promotes development techniques that mitigate the negative impact such developments frequently have on aquatic resources. Their strategies emphasize surface and subterranean water management practices that reduce pollution and runoff with the ultimate goal of maintaining or restoring pre-development hydrological cycles in extensively developed urban centers. To this end, the Center provides research, training, and planning services related to natural resource use, infrastructure design, ordinance development, monitoring systems, and benchmarking measures.

LID strategies emphasize micro-scale interventions in lieu of large-scale engineering projects. Instead of discharging water as quickly as possible into stormwater infrastructure, location-specific management strategies can be used to reduce pollution, manage runoff volume and flow rates, and enable natural infiltration and evaporation processes. For example, bioretention, grass swales, vegetated roof covers, and permeable pavements control stormwater at its source. Design strategies that minimize the extent of impervious surfaces in streets, sidewalks, driveways, and parking lots can reduce pollution and runoff while, ideally, enhancing traffic safety and community aesthetics. Landscaping practices and massing strategies that reduce or cluster natural disturbance also preserve pervious open space and protect natural hydrological cycles. LID strategies are measured based on their hydrological performance and pollutant removal capabilities.

Over the past fifteen years, the LID Center has been involved in a number of case studies and demonstration projects around the country in both urban and suburban settings. Through this research, the Center has generated accumulated data that quantitatively demonstrates LID's hydrological effectiveness. These case studies illustrate how LID practices protect ecological and biological systems, improve water quality, and preserve trees, vegetation, as well as terrestrial and aquatic habitat systems in dense urban areas. Such strategies can also accommodate growth while protecting biodiversity and can reduce municipal infrastructure and utility maintenance costs. Land prepa-

Left: Allowing water to infiltrate the soil: Seattle's SEA Street Edge Alternative (SEA) Streets Project. (Source: LID Center, 2007)

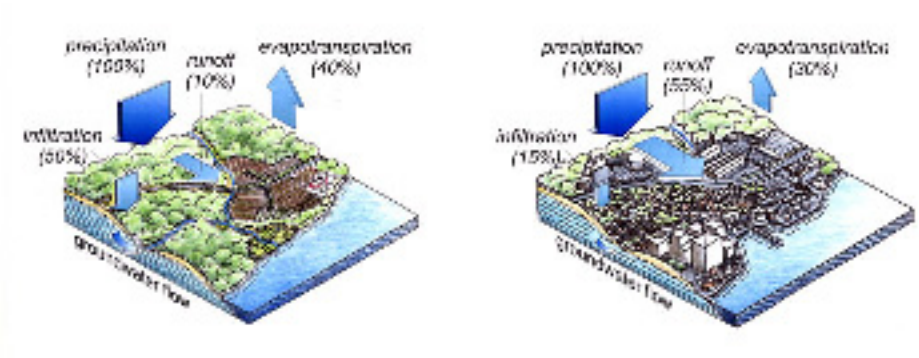
ration and infrastructure costs were often reduced, and the landscaping amenities often improved development marketability.

Despite potential benefits, several challenges must be overcome before the LID system can be widely adopted. Traditional ordinance restrictions pose several barriers. For example, roadway width mandates that are required in certain situations to maintain public safety are often excessively or indiscriminately mandated and therefore exacerbate problems of imperviousness without resulting in public safety gains. Similarly, prescriptive storm drain requirements undermine the cost eff ectiveness of infiltration alternatives. Even when local ordinances do permit LID strategies, the approach is often not promoted the way conventional systems are. Additionally, spatial limitations may unnecessarily reduce the eff ectiveness of some measures. In order to overcome these problems, the LID Center recommends customizing its strategies for each site and demonstrating performance-based compliance with code issues regulating health and safety.

The LID Center case studies illustrate the many LID strategies that could potentially be incorporated into the new Pittsburgh ALMONO development. For example, developers of the Somerset community in Maryland were among the first of their colleagues nationwide to explicitly integrate LID strategies into lot-level site design. The 80-acre, 200-unit residential community was constructed in 1995. Project developers integrated rainwater gardens, infiltration ponds, and other non-traditional impervious surfaces into the neighborhood's physical infrastructure. The strategies saved an estimated $900,000 and appealed to environmentally conscious homebuyers. LID advocates consulting on the project also organized a homeowner outreach program to educate homebuyers on the community's unique water management features and to suggest hydrologically sensitive landscaping and maintenance strategies.

Officials in Staff ord County, Virginia, integrated LID strategies into the county's standard building regulations through a five-year investigatory process from 1999 to 2004. The county began its LID investigation by developing and monitoring several small-scale demonstration projects and then, building on their successes, followed up with a countywide consensus-building and educational outreach program. Engineers and planning commissioners reviewed code-related issues and, in 2003, county officials released a new planning code containing several new incentives for LID development practices. These LID strategies became mandatory in 2004 and the county codes have since been used as a regulatory model for other regions considering LID-sensitive development regulations.

In 2001, Seattle completed a three-year SEA (Street Edge Alternative) pilot project designed to replace traditional urban street networks and sewer systems with more natural surface infiltration systems. The Seattle Public Utilities and the Seattle Department of Transportation collaborated on the project, which was initially conceived as a mechanism to reduce stormwater management costs and associated vehicular groundwater pollution. The team retrofitted several residential streets (660 linear feet total), narrowing street widths by four feet in order to create a two-foot wide curbless grass shoulder bordering the streets on either side. Parking was clustered between swales and the city added new vegetation (100 trees and 1,100 shrubs) to provide shade and absorb pollutants. City employees monitored the streets for three years and their data demonstrates a 98% reduction in stormwater runoff during that period. The project cost $850,000, though future projects are expected to cost substantially



Left: Images of LID across the U.S. (Source: Foss, 2005)

Above: Urbanisation increases stormwater run-off levels. (Source: Government of Massachusetts, no date)

less, and has been praised for its pedestrian-friendly quality of life benefits.

Stream Daylighting

City planners in Pittsburgh, throughout the U.S., and in Europe have been working to re-naturalize urban spaces for over a century: in the 1850s, Olmstead created Central Park in New York City, and the 1890s when Ebenezer Howard conceived of the suburban industrial garden. However, despite the ongoing push for urban green space, such practices were often incompatible with industry demands. Surface water in urban centers, for instance, was highly beneficial for manufacturing and shipping activities, but such assets were nonetheless accompanied by pollution, disease, and flooding risks. As such, from the 1850s onward, many urban streams and waterways were buried in culverts or walled in concrete channels. Such practices often improved public health and safety while simultaneously increasing the land area useful for large-scale manufacturing and decreasing the land available for squatting and other unregulated social activities.

Since the 1970s, however, urban waterfronts have been making a comeback. In the wake of rising deindustrialization and environmental activism, several cities, including Pittsburgh, are using environmental sustainability as an entrepreneurial marketing technique. Various "growing greener" development practices – which include urban parks, green rooftops, community gardens, tree-planting initiatives, auto emission reduction, public transportation alternatives, brownfield redevelopment, and habitat restoration – combat long histories of urban industrial nuissance and provide valued quality-of-life features for environmentally conscious residents. In this new, post-industrial, pro-outdoor-space context, stream daylighting is becoming increasingly common.

According to a study published by the Rocky Mountain Institute (RMI), stream daylighting is the deliberate exposure of "some or all of the flow of a previously covered river, creek, or storm water drainage [system]" (Pinkham, 2000: IV). In their optimistic report, RMI researchers argue that daylighting projects are good for ecology, good for society, and good for the economy. According to this analysis, ecological benefits include water quality improvements, habitat creation, and sewer-overflow mitigation. Economically, daylighting can increase property values, bolster foot-traffic (a benefit in retail areas), and expand hydraulic capacity to absorb additional runoff caused by continued development. The study claims daylighting strategies can save cities money because replacing deteriorated culverts with open waterways is less costly than constructing the culverts anew. Socially, daylighting can reconnect people with nature, provide recreational opportunities, teach urban residents about hydrological cycles, and strengthen civic demand for clean drinking water (Pinkham, 2000: 6). Daylighting efforts are frequently, though not always, combined with other Natural Drain-

Near Right: Stream daylighting project in Zurich, Switzerland. (Source: Pinkham, 2000: 54)

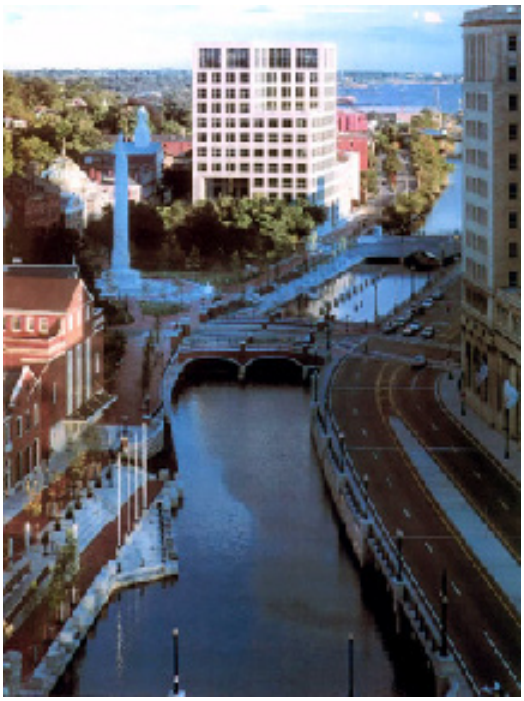
Far Right: Daylighting project in LongDale Park, Georgia, 10 years on. (Source: Pinkham, 2000: 25)

age Systems (NDS) or Low Impact Design (LID) strategies to re-establish pre-development ecological patterns through infiltration, slower runoff rates, filtering, and bioremediation.

As of 1999, 20 stream daylighting projects had been completed in the U.S. and 20 more were in planning stages (*Ibid*.: 21). The Strawberry Creek project in Berkeley, California, was one of the nation's earliest daylighting projects. The Berkeley area was settled in the early 1770s and the creek was immediately used for sewage conveyance. Large portions of the stream were buried throughout the late 19th century to mitigate chronic pollution and flooding problems, and to make way for industrial and rail development. Although activists began advocating for stream restoration measures in 1974, city officials concerned about maintenance, flooding, and public safety costs delayed physical reconstruction until 1987. Since then, large portions of the stream that were once buried in culverts below the former Santa Fe Railroad freight yard have been uncovered and renaturalized. Activists emphasized ecological health features throughout the reconstruction process and researchers continue to monitor the stream's ecological health. Based on their research, water quality and riparian diversity continues to improve (Pinkham, 2000: 18-19).

One of the most extensive urban daylighting projects has been underway in Providence, Rhode Island, since the early 1990s. Although most stream daylighting projects in the U.S. occur in semi-rural or suburban settings, the Woonsocket River project is changing the face of downtown Providence. The city was a leading manufacturing center during much of the 19th and early 20th century but, by 1980, was facing high vacancy rates, deteriorating infrastructure, and negligible retail activity (Bruner Foundation, 2006: 94). City officials began aggressively rebuilding Providence's downtown in the 1990s and constructed a new convention center, hotel, restaurant zone, amphitheater, office tower, and multistory shopping mall. The Woonsocket River daylighting project, however, quickly became the physical and symbolic anchor of the new downtown development. Roadways, buildings, and freeway systems were removed or relocated. In their stead, the once buried Woonsocket River was uncovered and rerouted to create a Venetian-style river waterway complete with refurbished bridges, gondola service, floating fire pits, and a distributed sound system. The river itself remains the area's largest draw, attracting hundreds of people a day during peak summer months (Bruner Foundation, 2006: 104), and has come to symbolize a new and vibrant future for this post-industrial city.

Pittsburgh developers recently completed a stream renaturalization project in the Nine Mile Run Valley near the stream's confluence with the Monongahela River. Between 1890 and 1920, large industries acquired almost all of the region's riverfront property for manufacturing and shipping purposes, thereby rendering large sections of the riverfront inaccessible to the general public (Tarr, 2002: 532; Muller, 2004: 128). By 1920, only one natural stream within the city limits remained open and unindustrialized. Residents lobbied to preserve the Nine Mile Run stream for its recreational and aesthetic value but, from 1922-72, the river valley was used as a landfill for industrial waste and byproducts (Tarr, 2002: 532-3; Thompson, 2001: 37). As part of Pittsburgh's post-industrial revitalization, city officials established a $60 million brownfield acquisition redevelopment fund (1994-2002), which it used to purchase 1,000 acres of contaminated land including the Nine Mile Run landfill. Although the city initially planned to push the refuse into the streambed and bury both indefinitely, local ecological artists based at Carnegie



Above: Woonsocket River daylighting project, downtown Providence, RI. (Source: Bruner Foundation, 2007)

Above: Renaturalized Nine Mile Run stream in Pittsburgh. (Source: Hecht, 2006: 4)

Mellon led a successful stream dayligthing and renaturalization campaign. Through funding from the Heinz Endowments, collaboration with the RMI, and technical assistance from the Army Corps of Engineers, the stream is now being restored as an open waterway, wetland area, and nature preserve. Infrastructure improvements will divert sewer overflow from the area and a new public pathway system will connect a newly constructed residential community to the revitalized riverbank.

Although many stream remediation projects can result in improved ecological health, some daylighting initiatives do not improve natural hydrological flow or restore riparian habitat. Urban waterfront property has become so highly valued that, in some cases, streams are being artificially introduced where they didn't exist before. For example, the developers of the Canal City Hakata open-air retail and entertainment center in Fukuoka, Japan, created an open "stream" channel running along the main interior pedestrian walkway. The mall was constructed as part of a citywide post-industrial brownfield redevelopment movement and was constructed in 1997 on the banks of the Chang Jiang River. Initially, planners intended to divert water from the river to create a hydrologically active streambed. However, due to funding constraints, developers instead opted to build a "stream" that was unvegetated, channelized, and fed through the city municipal plumbing infrastructure rather than engaging with natural hydrological processes. While these types of semi-artificial, newly minted springs may increase local foot traffic and raise public awareness of more distant or still-buried water resources, their ecological health aspects must nonetheless be critically evaluated.

Urban stream daylighting is rapidly becoming a widespread practice. Daylighting and renaturalization projects have been completed in major metropolitan areas including Toronto, Los Angeles, Seattle, San Francisco, New York, San Antonio, Chicago, Akron, Minneapolis, Chattanooga, Denver, Osaka, Fukuoka, Dubai, Rotterdam, Cancun, Tokyo, and Zurich, just to name a few (Desfor & Keil, 2004; Shaw, 2004; Pinkham, 2000; Harvey, 1990; Urban Land, 2001).

neighborhood energy generation

Local & Renewable Urban Energy Alternatives

Neighborhood energy generation combines alternative energy technologies with locally-based production and distribution systems. Although alternative energy technologies are not new, most early applications were either completed by individual activists or were developed on a very large production scale. While commendable, the independent systems were often costly and the large-scale systems frequently resulted in environmental nuisance. Advancements in system technology and management are increasingly bringing the sustainability benefits of alternative energy to urban, suburban, and rural communities in integrated and cost-ef ective ways. Neighborhood energy systems distribute small-scale production sites throughout the community. Power is then pooled and distributed through shared, community-scale infrastructure servicing individual households and public streetscapes. Shared local infrastructure can reduce the cost of going it alone, lessen the need for intrusive large-scale distribution systems, and contribute to local economic vitality and energy awareness.

Right: Promotional image showing a distributed neighborhood solar array. (Source: Judd, no date)

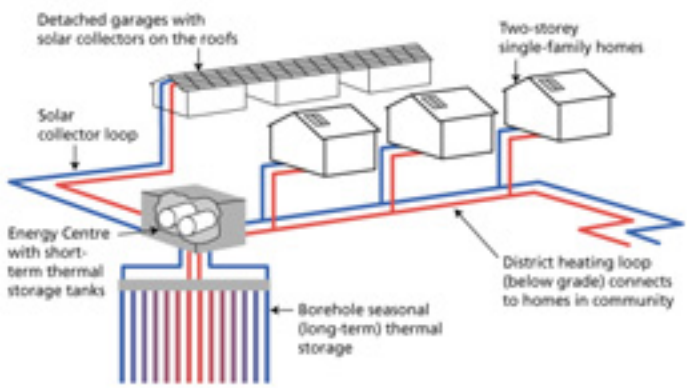
Several types of alternative energy have already been successfully adapted to suit neighborhood-scale distribution networks in complex urban and suburban environments. For example, community solar installations collecting energy from multiple rooftops dramatically reduce the cost of solar energy and making efficient use of an otherwise underutilized space. Micro-scale wind generation systems replace traditional, large-scale windmill fields with small, quiet turbines that can be mounted on numerous urban rooftops and utility polls resulting in an extensive, non-intrusive wind power network. Several demonstration projects around the world are exploring the applicability of neighborhood-scale hydrogen fuel cell networks working in tandem with distributed solar and wind arrays. Cost-competitive water cooling technologies common in industrial settings can now use cool lake and river water to meet urban air conditioning needs. Cogeneration and trigeneration systems that recover lost energy from traditional systems are increasingly common in campus-like settings and can be adapted to serve older cities and new urban communities. All of these strategies are viable in Pittsburgh and could potentially be used in isolation or in tandem on the Hazelwood ALMONO site.

Community Solar

Although solar energy in single building applications is becoming increasingly common, new innovations since the late-1990s are making such strategies more applicable on a community level. Community solar applications are similar to single-building systems in their functioning – such systems use renewable sun energy to generate electricity, and to heat (and cool) building spaces and water. Community applications, however, are becoming more cost-competitive. Whether the infrastructure is privately owned by multiple individuals within a group, or owned and operated by the group collectively, economies of scale can dramatically reduce installation and maintenance costs. Shared facilities of er greater savings since distributed generation can increase system efficiency. Although densely developed urban settings can increase the shared benefits of community solar installations, tall buildings containing multiple floor plates under a single roof may not be able to generate enough energy from the relatively small roof area to meet every floor's power needs.

The examples included in this study demonstrate a wide range of community solar applications. Community solar can be achieved through retrofit as well as new construction. In new construction, the energy benefits can be compounded through broader eco design strategies. Single-unit detached neighborhoods or larger shared multi-unit complexes can accommodate the shared systems. As the examples here show, community solar networks can be adapted to suit a price ranges from public housing to the luxury market. Shared systems can be concentrated in a single geographic area or distributed among several communities. These projects also reflect a range of commissioning agents, including homeowner collectives, government agencies, utility companies, and private market developers. As the benefits of community-solar become increasingly recognized, new rooftop leasing arrangements are springing up to manage such systems in a more coordinated manner. While community solar projects are becoming increasingly common in the United States and Canada, several such projects already exist internationally in an array of political and environmental climates.

California is rapidly becoming the nation's leader in community solar projects. These projects include new construction as well as retrofit projects. The average cost of a single-home solar conversion in California in 2006 was $15,000 after government rebates. The price has dropped even further with the California Solar Initiative, an ambi-



Left: Solar thermal systems map for the Drake Landing Solar Community. (Source: Drake Landing Solar Community, no date)

Left Below: Garage-mounted solar panels at Drake Landing. (Source: Drake Landing Solar Community, no date)

Below: Drake Landing residential street and rooftop solar panels. (Source: Natural Resources Canada, 2005)

tious solar program that will of er solar power rebates for projects constructed from 2007 to 2017.

The Portola Valley community made headlines in 2006 with its neighborhood-wide solar retrofit. Through a homeowner initiative, rooftop solar panels were installed on 68 local homes. By tapping into economies of scale, the total installed cost was reduced by 25-30% of the price of going it alone.

In 2007, the Lennar Corporation, a Miami-based building construction company, began constructing a new 650-home solar community in Roseville, outside of Sacramento. The new subdivision will integrate rooftop solar units into each house sized to meet 40-60% of each house's power load. The solar arrays will take advantage of Roseville Electric utility rebates but miss the California Solar Initiative begin date. Nonetheless, home prices remain comparable to non-solar regional equivalents, and early sales figures are strong.

The Portola Valley and Roseville communities represent only two of the many community solar projects in California. Other examples existing or currently under construction include: Bakersfield (239 homes in a single development), Orange County (599 homes in 5 developments), Sacramento area (744 homes in 5 developments, including Roseville's 49 phase-1 homes), San Diego (6 apartment buildings, 140 homes in 2 developments, proposal for 3,000 homes in Del Sur), San Francisco area (371 homes, 5 developments), Tulare County (48 homes).

Although California is clearly the nation's early mover, other states are beginning to follow suit. In June, 2007, U.S. Department of Energy announced that it will provide $2.5 million in funding over the next eight years to thirteen cities, including Pittsburgh, as part of their "Solar America Cities" program intended "to help accelerate the adoption of solar technology at the local level" (U.S. Department of Energy, 2007). As a "Solar American City," Pittsburgh will be eligible for to $200,000 in DOE financial assistance as well as technical assistance for city planning, technology selection, project financing, building codes, architectural review, and community outreach. Also in 2007, plans were announced for Colorado's first solar community, Bradburn Village. The 42 solar-powered

Above: Olympic Village solar community outside of Sydney, Australia. (Source: International Energy Agency, 2007)

Upper Right: Installing solar panels, Olympic Village. (Source: International Energy Agency, 2007)

Right: Sol 300 distributed residential solar array, Denmark. (Source: International Energy Agency, 2007)

homes will be located in Westminster, a suburb of Denver. A similar project, Johnson Square Village, is under construction in Brockton, Massachusetts, outside of Boston. This 26-unit development will get half of its energy consumption from a shared 18-panel solar array covering the seven multi-unit structures. The panels are funded in part by a government grant and, if successful, future phases of housing construction will expand the solar array to 450 panels.

As community solar becomes more established, utility companies and building owners are developing rooftop-leasing mechanisms that standardize distributed solar array installations and centralize their management. Under these leasing agreements, building owners or tenants may lease their pre-installation rooftop or their fully installed solar array to local utility companies in exchange for long-term stable energy prices.

For example, MMA Renewable Ventures and Recurrent Energy, Inc. are two private, San Francisco-based corporations that provide alternative energy power solutions throughout the area. Both companies operate rooftop-leasing programs; they finance, install, and maintain corporate-owned solar arrays installed on their clients rooftops distributed across the city, thereby turning otherwise vacant space into a valuable urban asset. Through Power Purchase Agreements, the client (tenant or owner) purchases the energy generated at rates that are competitive with local utility tariff s. Recurrent Energy also helps their clients take advantage of the public relations and marketing benefits of using solar energy.

As another example, the SunPower Corporation, which designs, manufactures and markets high-performance solar electric technology, has signed rooftop-leasing agreements with several Macy's and Wal-Mart facilities in California. Rooftop systems will be installed on eleven Macy's stores and another fifteen have committed to purchasing solar energy through a third-party financier. At Wal-Mart, the global financing firm Morgan Stanley will finance, install, and operate 8-megawatt SunPower solar arrays on seven Wal-Mart stores. These leasing arrangements will reduce peak electricity demand and take a load of overburdened grids.

This Page: 1 MW Project, solar community demonstration in Amersfoort, the Netherlands. (Source: International Energy Agency, 2007)

Community leaders and city planners can also take the lead coordinating rooftop-leasing systems. For instance, developers and residents of Coffee Creek Center, a 640-acre, mixed-use, pedestrian-oriented development in Chesterton, Indiana, are encouraging small local power plants to lease rooftop space for solar collectors.

Despite Canada's long, cold winters, developers of the Drake Landing Solar Community are demonstrating that solar collection can be adapted to suit local climate conditions and energy needs. Drake Landing is Canada's first solar neighborhood. The 52 single-family detached homes are located in Okotoks, a suburb of rapidly growing Calgary, Alberta, and was conceived by the governmental organization Natural Resources Canada (NRC). Construction is expected to be complete in 2007.

Given the region's harsh winter weather, heating and hot water demands produce 80% of the 6-7 tons of greenhouse gas emissions produced per household each year. To overcome these challenges, NRC conceived of a novel solar array that could store summer heat for winter consumption. Each house has two independent solar thermal panels sized to meet 60% of domestic hot-water needs. A much larger distributed system of 800 panels covers the garage roofs and meets 90% of the community's annual space heating load through a shared central district heating system. This distributed system is seasonally calibrated. Over the summer, the rooftop solar collection captures solar thermal energy and transfers the heat to borehole storage system located underground beneath a neighborhood park. The borehole field increases ground temperatures throughout the summer, peaking at 80 degrees Celsius (176 degree Fahrenheit). Over the winter, this heat is drained off through a direct heating loop that heats the residential community.

These two solar strategies are expected to reduce the community's residential greenhouse gas emissions by 5 tons per house per year (the average house produces 6-7 tons), for a total annual reduction of 260 tons. Other energy-reducing features in the newly constructed houses have helped to reduce energy consumption further. Although fossil fuel (natural gas) alternatives are less expensive, the economy of scale benefits reduce the cost substantially making it competitive with conventional electric sources.

Right: Gårdsten public housing retrofit, Stolkholm. (Source: Arkitektnytt, no date)

Below: ABZ Marchwartstrasse solar installations in Zurich. (Source: International Energy Agency, 2007)

Several more examples of community solar initiatives have been developed across the globe. For example, the Olympic Village solar community was developed as a demonstration project and showcased at the 2000 Olympic Games. The complex was commissioned by the Australian Olympic Co-ordination Authority and was originally used to house 15,300 visiting athletes and officials. The complex, consisting of 2,000 homes, was built on a brownfield site in the Sydney suburb of Newington. After the Games, the homes were then sold to private owners, with a stable population of approximately 5,000 residents. Since then, a handful of new homes have been added to the community in response to market demand.

This "clean green suburb" was developed as a demonstration project exemplifying the commercial viability of integrating renewable energy technologies into an entire urban residential development. This area of Australia receives an annual average of 5.5 hours of sun per day (Pittsburgh receives just under 3.5 hours). The new construction integrated a range of eco-friendly design initiatives and broke new ground for community solar arrays. The roof-mounted solar collection panels and shared inverter units generate enough energy to meet the total energy needs of every house. Pacific Power, a state electricity utility company, developed the initial 2,000-home complex and then sold the homes to individual owners at market rates after the Olympic Games. Development costs totaled around € 350 million (approx. $473 million) and homes were sold for € 210,000-320,000 each.

As part of a demonstration project, rooftop solar panels were installed on 300 existing residential structures in eight different cities throughout Denmark. The project, named Sol 300, was financed by the Danish Energy Agency and the Eltra utility company and was completed in 2000. The goals of the project were to measure and reduce energy costs, measure quality performance, and raise awareness of green energy alternatives. Developers also worked with panel fabricators to develop more flexible mounting systems that could be more quickly installed to a wider range of rooftop conditions. The effected buildings varied widely in size, architectural design, and rooftop orientation and were individually retrofitted with rooftop solar panels, distribution systems, and in-house monitoring devices. Based on monitoring data, the panels are generating enough energy to meet residential needs. Energy performance is improved where monitoring statistics are made available to residents in real-time, who have responded to sensor information by reducing their energy consumption rates to maintain an even balance of energy produced and consumed. Despite the wide geographic distribution, the project benefited from economies of scale. Since energy usage is measured by net metering, individual data is not available. However, as an average rate, the panels are providing energy at a competitive average rate including the design, material, and installation costs.

The 1 MW Project was constructed in 1999 as a solar community demonstration project in Amersfoort, the

Netherlands. The neighborhood, located in the Nieuwland community, consists of 500 newly constructed residences. Each house is equipped with an independent inverter that draws power from the shared decentralized rooftop solar array. The local utility company REMU commissioned the project to demonstrate the technological and architectural potential of new solar technologies, as well as to benchmark the reduced infrastructure costs achievable through economies of scale.

This area of the Netherlands receives 4.05 hours of sun per day annually. The total development cost €9.2 million (approx $12.4 million) and provides electricity at a rate of €1.15/kWh ($1.5/kWh) including all costs for project management, design, monitoring evaluation and dissemination. Based on the development process and performance data, the 1 MW project demonstrates the importance of efficient organizational coordination on a district level in order to facilitate and regulate community solar applications. A comprehensive public relations campaign was also necessary to educate residents, answer questions, and address concerns. Additionally, commissioners fine-tuned the system after installation and dramatically improved system performance.

The ABZ Marchwartstrasse project in Switzerland is a pilot project in Zurich completed by the power utility company Allgemeine Baugenossenschaft Zurich (ABZ). The company retrofitted two neighboring apartment complexes with a 410-square meter solar array. The company hopes to develop a comprehensive solar system across existing rooftops throughout the city in order to use these rooftop areas as an extension of its existing power plant. The two-building pilot phase cost €464,690 (approx $628,000), took two months to plan and install, and has been performing as expected. Although the area only receives an annual average of 3.6 hours of sun per day, similar to Pittsburgh, the company expects the fully built distributed solar plant to generate energy at a $0.70/kWh service rate.

As part of a major renovation campaign in Gårdsten, Sweden, a large residential complex was retrofitted in 2005 to accommodate a solar array. The seven-story, four-building complex was constructed in the 1970s and contains 2,700 public housing units. The total retrofit cost $2.9 million, including the solar array and other energy reducing improvements. The prefabricated rooftop solar panels have helped reduce the total energy and water costs by 40%. The complex's community perception has also improved dramatically and vacancy rates fell from 35% before the retrofit to 0% after the completed renovation. Similar retrofit projects have also been completed on the Holmen and Grynnan apartment buildings in Stokholm and on the eight-unit Lysande residential flats in Sickla Udde.

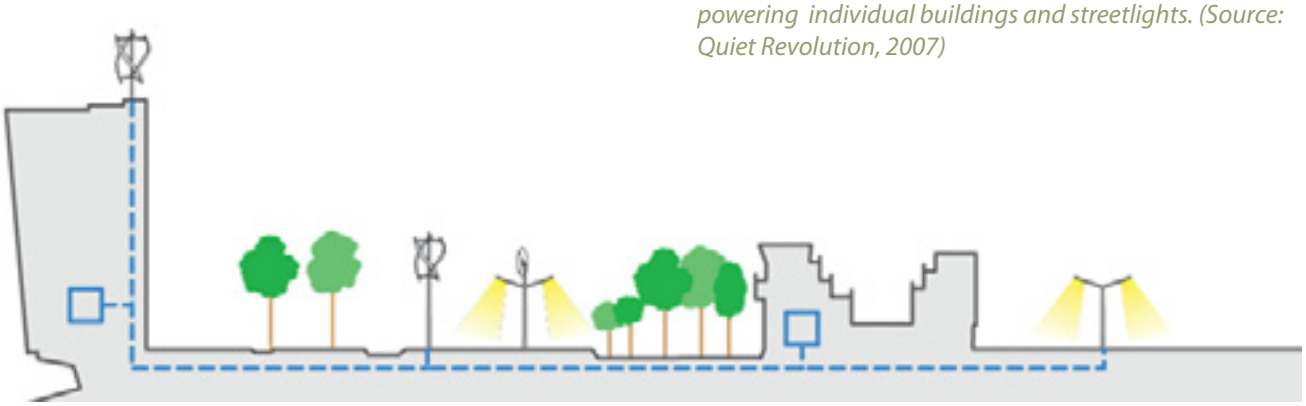
Small Wind

Wind generation systems have traditionally required vast open land areas with consistent air flow patterns, and produced negative noise pollution, ground vibration, and visual intrusion. As such, large-scale turbines and wind farms have generally been viable only in rural or remote areas. Technological advances in "small wind" systems are increasingly making micro-scale, distributed wind systems a realistic energy alternative for urban settings.

According to the American Wind Energy Association (AWEA), small wind, defined as 100kW capacity or less, has been growing 18%-35% annually in the U.S. over the past several years. New "micro" turbines using vertical rather than horizontal turbines generate energy without requiring consistent wind direction, which is an absolute necessity in urban areas experiencing unpredictable wind directions and air turbulence from neighboring buildings. New designs have nearly eliminated the noise and vibration of these units, which can now be mounted and architecturally integrated onto rooftops. Although smaller turbines are available, units ranging from 0.6kW to 50kW can provide electricity generation for individual houses and businesses, and sizes up to 2.5K can be installed on residential-scale rooftops, on streetlights and traffic

Below: Windwall micro-generation unit installed on a rooftop in Den Hague, The Netherlands. (Source: Zonnestroom Producenten Vereniging, 2007)

Below: Diagram showing distributed small wind turbine system installed on urban rooftops and light poles, and powering individual buildings and streetlights. (Source: Quiet Revolution, 2007)



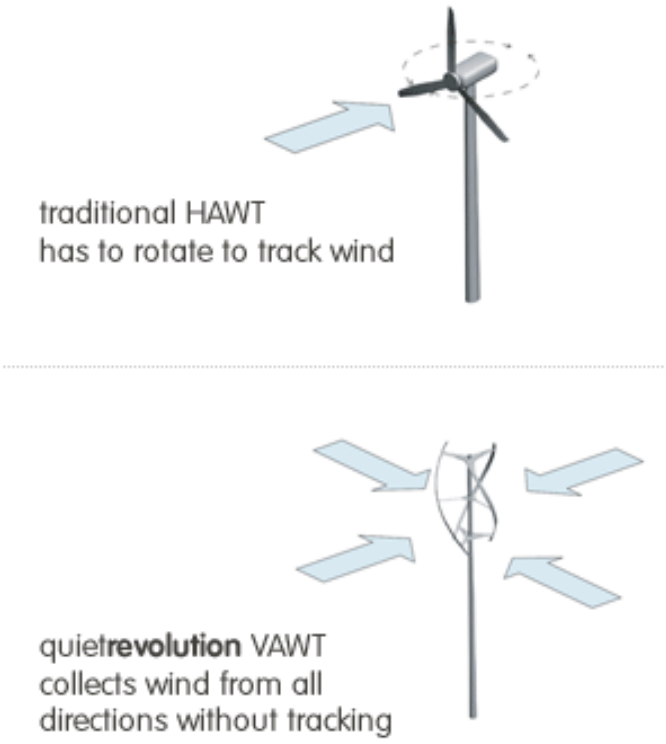
signals, and other landscape applications. These units can power batteries only, or can be tied into the shared community grid.

Although small wind systems have been installed in at least 17 states, their U.S. application still tends to be limited to rural farm or low-density suburban settings and still tends to favor larger, ground-mounted systems over the smaller distributed rooftop systems. The UK, by contrast, has started installing micro generation systems in cities and on rooftops as part a national initiative to replace 30-40% of its fossil fuel energy with renewable sources over the next four decades. The first domestic turbine in the greater London area, a 400-watt unit installed on a rooftop, was installed in 2003. London's Thames Valley University erected the first building-mounted wind turbines within the city limits in 2004. The two pilot turbines, mounted on 6.5-meter high masts on Westel House, produce a 5kW electrical output (2% of the building's annual electricity needs). The Westergate Business Centre, a 1,940 square-meter light industrial and office building near the UK's southern coast, installed a 5Kw free-standing turbine in 2005, which generates enough electricity to run the external and 'landlords' lighting system. Several other suburban and rural rooftop systems have been developed throughout the UK serving factories, schools, railway stations, churches, offices, and residences. Although school boards and housing associations have begun pilot projects, no community-scale distribution system has yet been identified.

Urban wind projects in France and the Netherlands are breaking ground even faster. Several industry leaders in

Above Left: Free-standing micro-turbine at Westergate Business Centre in Brighton, UK. (Source: Urban Wind Energy, 2007)

Left: Examples of micro-turbine installations on a church steeple at St. Martha's in Broxtowe, UK (upper left, Urban Wind Energy); on a Shrewsbury rooftop, UK (upper right, Source: Urban Wind Energy); the Simms' residence in Walls, New Jersey (lower left, Source: American Wind Energy Association); and a Windside turbine in an unknown location (lower right, Source: Intilligent Energy Europe).



Quietrevolution diagram depicting vertical turbines. (Source: Quietrevolution, 2007)

the U.S., U.K., and Europe have begun researching and marketing "architectural" micro-generation units. For instance, California-based AeroVirnoment is developing a fan-box shaped unit that can be mounted on big-box retail store roofs. Chicago-based Aerotecture is developing 10-foot cylindrical units that they hope to test on Chicago's skyscrapers and underneath San Francisco's Golden Gate Bridge. Finland's Windside is developing extreme-weather micro turbines, and the Netherlands' Ecofys is developing small-scale urban turbines that can be integrated into the architecture of modern cityscapes. U.K. companies like Windsave and Renewable Devices are developing similar commercial units.

Hydrogen & Fuel Cells

Hydrogen power can be generated in two ways, through combustion or through fuel cell conversion. Combustion processes burn hydrogen in much the same way as natural gas or gasoline. Fuel cells produce electricity by combining hydrogen with oxygen. A replenishing supply of hydrogen is required for both systems. Hydrogen can be acquired through a distribution system of fueling stations or pipelines (the U.S. currently has 700 miles of hydrogen pipeline serving industry production in Texas and Louisiana) or can be produced onsite by electrolyzing water to separate the oxygen and hydrogen molecules. Natural gas has typically been used to fuel the electrolysis process, but renewable sources such as solar and wind power can be used as well. When renewable sources are used, the only emissions are water and oxygen.

Although hydrogen energy initiatives are most prevalent in transportation industries, hydrogen can also be used as a co-generation fuel in industrial production and to generate heat and electricity in the built environment. Hydrogen is volatile, heavy, and requires a large footprint, all of which can be more easily accommodated in a building than in a vehicle. Although vehicular hydrogen more directly reduces greenhouse gasses, fixed hydrogen can reduce fossil-fuel electricity consumption, and, since it is a direct current (DC) system, is often more efficient than the fossil-fuel counterparts. Electrolysis systems, which generate the hydrogen onsite, can reduce power line infrastructure without requiring an alternative citywide fuel distribution system. The Proton Exchange Membrane (PEM) fuel cell, a modular and quiet unit suitable for both mobile and stationary applications, can be easily placed in offices, health, lodging, and educational buildings. Despite these many possible benefits, hydrogen fuel is currently very expensive relative to traditional alternatives and the cost is only marginally affected by economies of scale. Research activities at Plug Power, IFC, Fuel Cell Energy, and Siemens-Westinghouse are all focused on developing a more economical hydrogen fuel cell alternative.

Despite the challenges, a handful of groundbreaking demonstration projects can be found worldwide that integrate hydrogen energy into the built environment. As of 2005, two residential structures are powered in part by hydrogen. The first example, completed in 2004, was developed in conjunction with the University Kebangsaan in Malaysia. Powered by a solar-hydrogen system, the house uses an American made PEM pressure electrolyzer hydrogen

Left: Computer rendering of the world's first hydrogen-powered office building is currently under construction in Methil, Scotland. (Source: The Hydrogen Office, 2007)

Left Below: Hydrogen House, Scottsdale Arizona. (Source: Arizona Solar Center, no date)

Below: Computer rendering of the H2PIA urban hydrogen community demonstration project planned for Herning, Denmark. (Source: Health Industries Research Companies, no date)

generator to power the stove, water heater, and household appliances. The second house, completed in 2005, is in a rural mountain setting outside of Scottsdale, Arizona. In commissioning this luxury single-family home (6,000 square feet, $2 million), owner Bryan Beaulieu had natural gas systems replaced with hydrogen alternatives. The hydrogen is stored in a high-pressure tank and is used to fuel cooking activities, heat the house and domestic water, and fuel the family's car. The hydrogen also fuels a generator to power lights and other household appliances.

The world's first hydrogen-powered office building is under construction in Methil, Scotland, 40 miles north of Edinburgh. The Hydrogen Office & Demonstration Center (1,000 square meters, £2.77 million) is a collaborative effort between Scottish Enterprise, Scotland's main economic development agency, and Business Environment Partnership, a group providing free environmental assistance to Scotland's business community. The building integrates hydrogen technology with micro-wind turbines, solar panels, and a geothermal system. Hydrogen is produced onsite using rainwater and wind/solar electrolysis, and is used to power fuel cells that can provide three days of power for dark and windless days. The Methil building is scheduled to open by the end of 2007.

The most ambitious project by far is the H2PIA urban hydrogen community demonstration project planned for Herning, Denmark. The initiative will construct a complete and brand-new community entirely fueled by renewable hydrogen processes. Every single and multi-unit residence will have its own solar panels and micro wind turbines to run the hydrogen-producing electrolysis process needed to operate the residential hydrogen fuel cells. Shared large-scale solar and wind units will provide energy to retail facilities and denser housing areas where individual site generation is more difficult. The entire community will also have access to a shared storage facility that will collect excess energy during peak periods to power the community on dark and windless days. Hydrogen will also be used to power individual cars, public transit trains, and municipal service vehicles. Construction is expected to begin by the end of 2007, will cost DKK 2.5 million (approx. $460,000), and will be funded by EGJ Udvikling and the County of Ringkjøbing.

Water Cooling

Industries have long relied on water to remove heat from manufacturing processes, combustion engines, and electricity generators. Plants and refineries still draw on rivers for most of their water cooling needs, bringing water into their facilities and releasing it again either through evaporation or by returning the heated water to the waterway. Large urban centers facing rising air conditioning demands may be able to adapt these water cooling strategies to the city environment and thereby decrease electricity consumption in urban spaces.

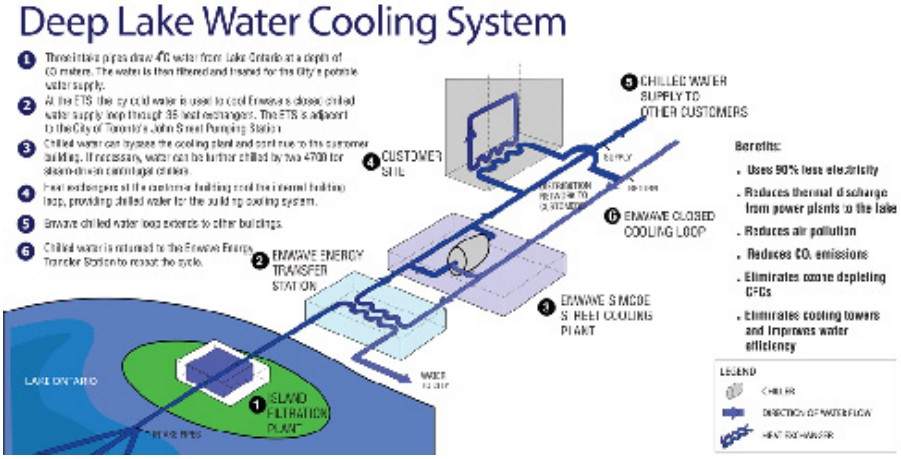
The Enwave Energy Corporation and the City of Toronto have teamed up to create an innovative, renewable water cooling system for Toronto's downtown core. The strategy presents an alternative to conventional fossil-fuel based air conditioning systems and is clean, price competitive and energy efficient. Water for the system is drawn from a permanent layer of icy-cold (4°C, 39°F) water 83 meters (272 feet) below the surface of Lake Ontario and 5km (3 miles) away from the shoreline. The naturally cooled water makes its way to the city's John Street Pumping Station, where heat exchangers facilitate the energy transfer between the cold lake water and Enwave's closed chilled water supply loop. This closed loop is then used to cool office towers and sports and entertainment complexes within Toronto's financial district and can be adapted to serve future waterfront developments. Once the energy transfer if complete, lake water continues on its natural path into the city's potable water system.

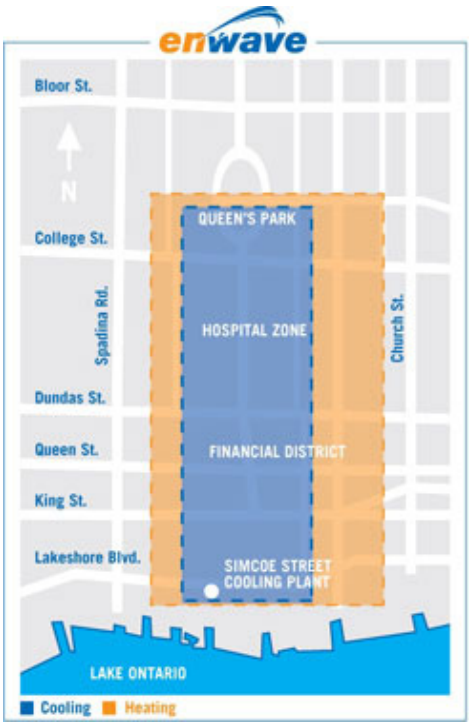
The water cooling system is integrated into Toronto's existing infrastructure, complementing Enwave's pre-existing district cooling network. Project developers had to add only two other components for the water cooling system: new intake pipes extending into Lake Ontario and a closed energy transfer loop linking the John Street Pumping Station with Enwave's Simcoe Street Cooling Plant. The intake pipes are made of high-density polyethylene (HDPE) and follow the natural slope of the lake leading into the city's Island Filtration Plant. The resulting Enwave chilled water capacity provides 75,000 tons of refrigeration, which is enough to air condition 100 office towers or 3.2 million square meters (34.5 million square feet) of building space capacity -- the equivalent of 6,800 homes.

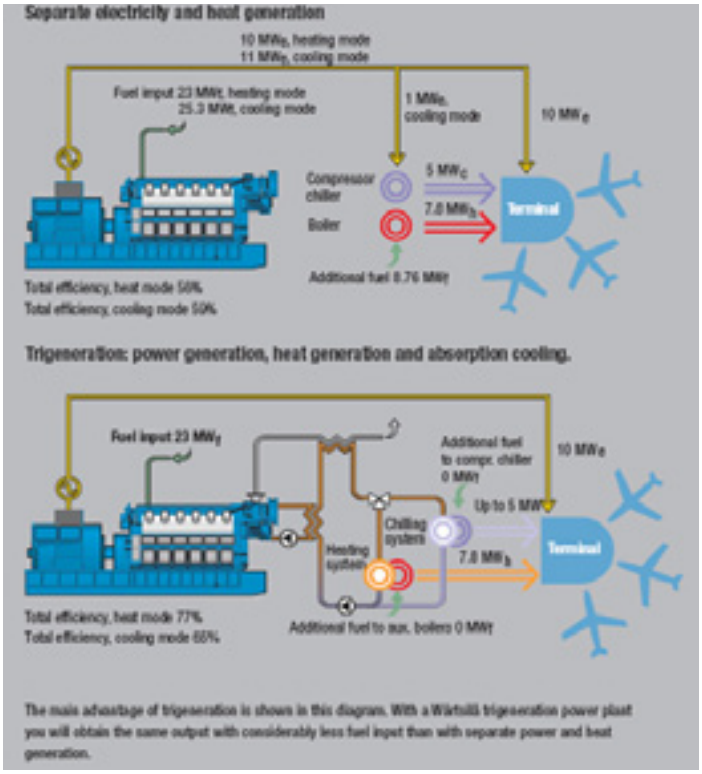
The Enwave water cooling system has many environmental benefits. The system uses 90% less electricity than conventional chillers and eliminates more than 61 megawatts from Ontario's electricity grid. Water cooling also removes 79,000 tons of carbon dioxide from the air, which

Below: Enwave systems diagram depicting Toronto's water cooling system. (Source: Enwave, no date)

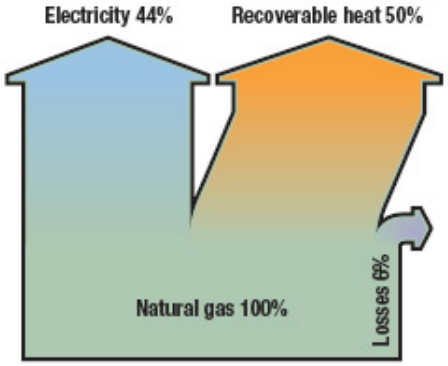
Right: Map showing city blocks conditioned through Enwave's water cooling system. (Source: Enwave, no date)







Left & Below: Trigeneration systems analysis diagrams. (Source: Wartsila, 2007: 5)



Principal heat balance of a Wârtsilä gas engine.

is equivalent to removing 15,800 cars from the road. The system reduces ozone-depleting refrigerants (CFC's and HCFC's). These sustainable, renewable benefits encourage good corporate citizenship and are achieved while maintaining price competitiveness. Unlike traditional cooling, Enwave's cooling strategy mitigates potential price increases that are likely to result from more stringent CFC regulations in the future.

Toronto residents also benefit from the new water cooling practices. The system supplies residents with cleaner air and a cleaner source of cool public drinking water. It reduces noise, pollution, and humidity generated by conventional chillers, fans, and cooling towers on building rooftops. These benefits improve public health thereby reducing the burden on social services and medical facilities. The innovative water cooling system is also enhancing Toronto's world-class reputation as a high-quality place to live and a leader in sustainable solutions.

Pittsburgh developers may be able to incorporate water cooling technologies into future building projects, especially those located along the riverfront. On the Hazelwood ALMONO site, technically feasibility should be studied in order to assess the applicability of river water for cooling, depending on the volume of water flow. The water-based cooling technology would replace cooling towers and could potentially reduce electricity costs by 15%. To determine the full feasibility and cost implications of urban water cooling in Hazelwood, ALMONO developers should join forces with local officials, engineers, utility companies, and water transit authorities to investigate the joint benefits and investment opportunities that such an initiative would generate.

Cogeneration and Trigeneration

Cogeneration, or combined heat and power (CHP), is a highly efficient and technologically proven form of electricity generation that recovers and reuses excess heat normally lost under traditional power combustion methods. A cogeneration system uses a central plant or other heat source, such as geothermal system or industrial waste heat, to warm air and water for several buildings near the central plant. Roughly 10% of the electricity used in the United States comes from cogeneration sources.

Trigeneration, or combined heating, cooling, and power generation (CHCP), is similar to cogeneration but adds an absorption chiller to cool water. In this way, the recovered heat can be used for heating or cooling, depending on the season. Trigeneration may be up to 50% more efficient than cogeneration and is especially useful in climates with high air conditioning loads.

Cogeneration or trigeneration systems can be used as a district energy system, which means that a single system serves multiple buildings through a shared distributed

network. District or integrated energy systems are typical on hospital or university campus, military bases, or industrial complexes. Shared systems help conserve energy, reduce local emissions, provide a more secure power supply, and reduce the need for new transmission lines. Since cogeneration and trigeneration plants must be locally situated, they also benefit the local economy and create neighborhood employment opportunities.

Once established, a cogeneration or trigeneration system can be integrated with other heating or cooling systems, thereby taking advantage of the waste heat or water cooling resulting from incidental neighborhood activities. Although fossil fuels can be used to run the system, renewable sources such as agricultural waste, fuel cells, and wind turbines, are also viable fuel sources and further reduce pollution.

The city of Helsinki, Finland, has maintained a cogeneration municipal district energy system since the end of World War II. The program began in the post-war era when fuel was expensive and difficult to obtain. Finland is now one of the world's biggest energy consumers when measured on a per capita basis. The region's high demand stems from the large heating requirements during the long cold winter. Helsinki has expanded its cogeneration infrastructure over the years and district systems now meets more than 90% of heating demand in Helsinki and 45% of the demand nationwide. Helsinki uses low-sulphur coal and natural gas to fuel its four main district energy plants, and, in recent years, some critics have disparaged the system's reliance on fossil fuels. Despite these criticisms, the city was awarded the United Nations Environmental Prize in 1990, recognizing the city for its extensive success at conserving energy.

Cogeneration and trigeneration are attractive energy alternatives given the increasing frequency of energy blackouts worldwide, and airports are among the global early movers adopting such systems. The Finnish company Wärtsilä develops trigeneration power plants for airports and recently installed a cogeneration system at Spain's busiest airport, the Barajas Airport in Madrid, resulting in a total efficiency of 74%. Six dual-fuel (natural gas and light fuel oil) engines generate a continuous supply of electricity, heating, and cooling according to the season. The Detroit Metro Airport recently expanded its Midfield Terminal, which is now heated and powered by three Wärtsilä engines. The Detroit system has a 57% total efficiency and the plant's owner sells excess electricity back to the national grid.

Left: Barajas Airport, Spain, partially powered by Wärtsilä trigeneration power plant. (Source: Wartsila, 2007: 7)

Below: Map of Helsinki's district heating cogeneration infrastructure. (Source: Pierce, no date)

benchmarks: urban innovation

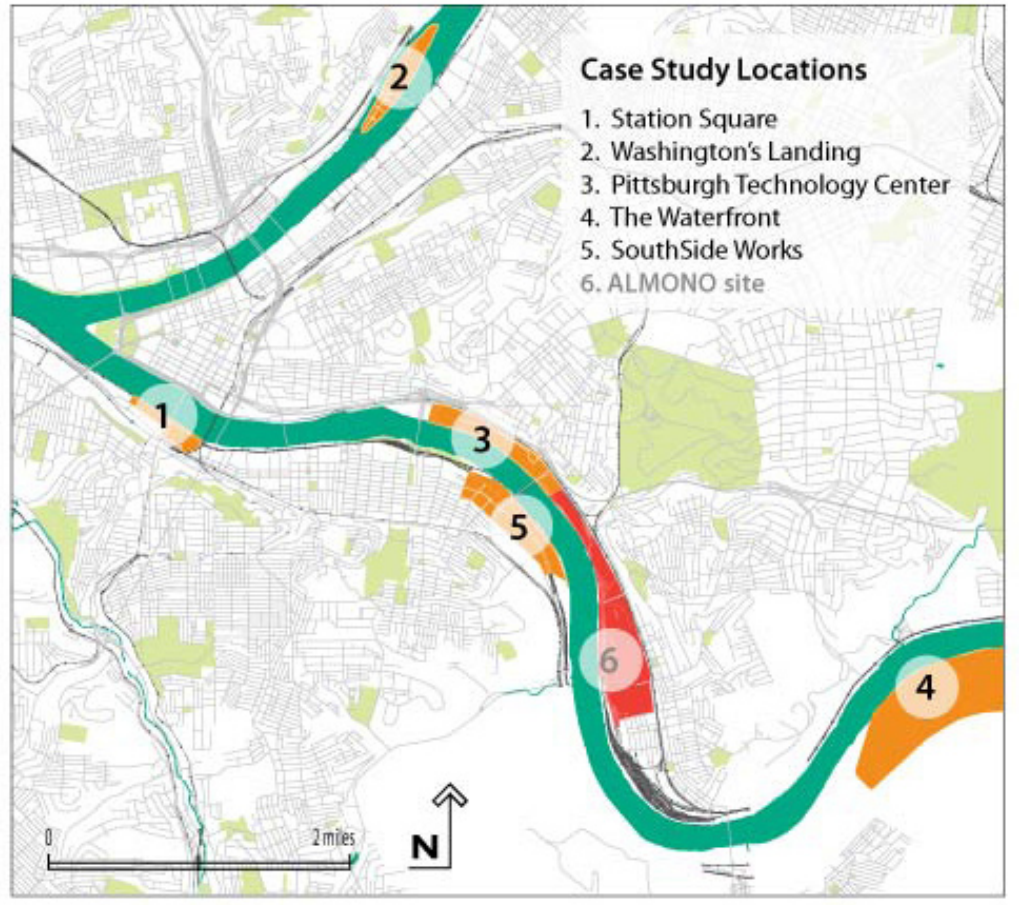
Pittsburgh's Post-Brownfield Riverfronts & Innovative International Benchmarks

Innovative urban development projects worldwide demonstrate a wide range of ecological, technological, and economic benchmarks that can guide and inspire future growth in Pittsburgh. The city has already invested considerable energy in local riverfront brownfield redevelopment and, by reviewing these past projects, the ALMONO development team can gauge the local effectiveness of various design and management strategies. On a global scale, recent demonstration projects reveal new extents in innovative urban practices and their ability to positively shape urban economic, ecological, social, and technological ambitions.

Pittsburgh's Brownfield Riverfronts

	Year began	Site Size	Development Agency	Development Typology	New Floor Area	Development Cost	Turnover Time*
Station Square	1976	52 acres	Initially non-profit, later private	Upscale shopping, nightlife entertainment	275,000 sq. ft. + hotel	$100 million base restoration, $70 million in phase 2	8 yrs
Washington's Landing	1983	42 acres	Public	Residential village, office complex, sports entertainment	246,500 sq. ft. plus 100 residential units	$79 million	10 yrs
Pittsburgh Technology Center	1984	48 acres	Mostly public, some private followed	Research and technology office park	876,400 sq. ft.	$147 million	10 yrs
Waterfront	1992	260 acres (430 acres total)	Private	Commercial retail, residential	1,100,000 sq. ft. + 217 residential units & industrial facility)	$300 million (plus $122 million for the industrial facility)	6 yrs
Southside Works	1993	34 acres central site (123 acres total)	Public Private Partnership	Mixed use entertainment retail, office, residential	1,420,000 sq. ft. + 354 residential units (total: 2.4 million sq. ft.)	$330 million	7 yrs
Hazelwood LTV Site	2002	178 acres total	Nonprofit private partnership	n/a	n/a	n/a	n/a

**Time measured from year of acquisition until first buildings occupied*



Pittsburgh Brownfield Riverfront Benchmarks:

Pittsburgh leaders and developers have invested substantial resources revitalizing local industrial sites over the past three decades. The Hazelwood ALMONO site is the last undeveloped riverfront brownfield of its size within the city limits. City officials, private developers, and non-profit organizations already redeveloped several brownfields along Pittsburgh's main waterways, including Station Square (begun in 1976), Washington's Landing (1983), Pittsburgh Technology Center (PTC) (1984), The Waterfront (1992), and SouthSide Works (1993). By understanding these five projects, and their successes and shortcomings, the Hazelwood redevelopment team can better assemble a project vision that is well informed, financially realistic, and regionally integrated.

Pittsburgh leaders began reclaiming large sections of its industrial riverfront in the 1970s. The Pittsburgh Urban Redevelopment Authority (URA) managed three of the five projects – Washington's Landing, PTC, and SouthSide Works – through public-private partnerships and funding agreements. The Station Square project, however, was managed by a local foundation dedicated to historic preservation. As the oldest of these five redevelopment initiatives, Station Square was a valuable demonstration project not only for its emphasis on historic reuse, but also for its groundbreaking brownfield restoration efforts more generally. The project also illustrates how foundation involvement in such projects can broaden the range of redevelopment possibilities to include social values not reflected in standard market scenarios. By contrast, the Waterfront project, which is located just outside the city limits, was privately managed. This project had the shortest turnover time of any of the projects considered here and arguably brought the least direct benefits to the adjacent Homestead community.

Although these projects reflect a range of final uses, retail is a prominent component in four of the five case studies. Three of the projects – Station Square, Washington's Landing, and SouthSide Works – were explicitly planned as mixed-use developments from the beginning, with varying pairings of retail space with office and/or residential construction. The Waterfront, by contrast, was almost exclusively retail in its first years of operation, although developers have continued to expand the site's residential and office amenities over time. The PTC is unique in that it was exclusively developed as an industrial office park.

As the PTC enters a new investment phase, however, its public-private development team anticipates the need for limited retail services catering to business needs.

The ALMONO site is 178-acres, making it the largest riverfront brownfield redevelopment project within the city limits. The three oldest projects – Station Square, Washington's Landing, and the PTC – involved relatively small footprints, ranging between 30 and 50 acres. Although the 123-acre SouthSide Works site was larger, the redevelopment team subdivided the land for quasi-independent and phased development. The project's most dense, mixed-use area is concentrated in a 34-acre core and the rest of the site was given over to larger and more sprawling institutional and recreational amenities which were developed on a slower time table. The 430-acre Waterfront site lying just outside the city limits is much larger than the ALMONO site. Planners developed commercial retail and, eventually, mixed-use facilities on a 260-acre portion of the site. The rest of the land is designated for light industrial use.

In addition to variations in total site area, the five case studies also range in the total new square footage developed. The total square footage of new development has generally increased with each sequential project, regardless of variations in actual site acreage. The earliest two projects – Station Square and Washington's Landing – hovered around 250,000 square feet of new floor space. The Station Square project, however, was significantly expanded during a later round of development under a new owner. The subsequent projects jumped chronologically to approximately 880,000 square feet at PTC, 1.1 million square feet at The Waterfront, and finally 2.4 million square feet at the SouthSide Works. As such, the total redevelopment costs of younger projects have tended to increase over time as well, ranging from $79 million spent at Washington's Landing to $330 million spent at SouthSide Works. Even though total costs are rising, the ratio of public subsidy per project has tended to decrease both over the life of each individual project and as a percentage of total costs in each subsequent project.

Despite growing square footage and investment costs, the total redevelopment time has tended to decrease over time. This decrease in turnover time may be caused in part by growing confidence in the viability of brownfield redevelopment projects in general. It can also be because later projects have involved more private investment which is influenced by market pressures to generate an expedient return on investment. The Waterfront project, which

was managed entirely by a private developer, had the shortest turnover time despite being the largest site (260 acres). On average, the turnover time for these projects is approximately eight years, as measured from the year of acquisition until the first buildings were occupied. The full build-out of these sites has taken longer.

Station Square (South Side)

The Station Square project was one of the first riverfront brownfield restoration projects undertaken in post-industrial Pittsburgh. The project is unique in that its first phase of redevelopment was completed by a local foundation rather than by a private firm or governmental organization. This 52-acre site is located on Pittsburgh's Southside between the Monongahela River and Carson Street. The property runs along the riverfront opposite the downtown business district in between the Smithfield Street Bridge to the Fort Pitt Bridge. Station Square's revitalization was completed in two phases: the Pittsburgh History and Landmarks Foundation completed the base restoration and the Forest City Enterprise developers completed a subsequent round over a decade later. These two restorations transformed the site into an upscale shopping and nightlife entertainment center. The total redevelopment process cost $171 million.

The Pittsburgh and Lake Erie Railroad (P&LE) first developed the station square site in the late 1800s. The site was originally the Pittsburgh Station Yard and was primarily used for freight operations. Over time, the P&LE also developed its company headquarters on the site, as well as several train sheds and freight houses. As the demand for train services declined in the 1960s, the P&LE services fell into disrepair and the site became available for redevelopment.

The Pittsburgh History and Landmarks Foundation (PHLF), a local non-profit historic preservation group, acquired the site in 1976. Using grant funds provided by the Allegheny Foundation and the Scaife Charitable Funds, the PHLF restored the site and its structures as part of a demonstration project promoting the adaptive reuse of historic structures. Between 1976 and 1984, the Foundation restored and adapted five historic industrial buildings into office and retail spaces. The former P&LE headquarters building was converted into a 75,000 square feet office building. The former passenger waiting room was converted into a restaurant. An old warehouse was converted to office building. The former Freight House train shed was transformed into a 145,000 square feet retail space. Historic trolley cars were restored and integrated into the site's landscaping, complete with interpretive placards. The PHLF also developed some new amenities to support their larger historic adaptation project. They developed a new hotel, a Gateway Clipper dock, a summer concert venue, and an outdoor "Riverwalk" trail celebrating the site's industrial past. All told, this first round of restoration cost $100 million. In its final design, the

Opposite Page, Far Left: View of Mon River and the South Side, 1937. (Source: Carnegie Museum of Art)

Opposite Page, Above Right: P&LE Yards and Terminal Warehouse, 1937. (Source: University of Pittsburgh, Digital Images Library)

Opposite Page, Below: Station Square water fountain and public plaza. (Source: no author, no date)

Above: View of Herrs Island (date unknown). (Source: Urban Redevelopment Authority of Pittsburgh, no date)

Above Right & Below: Washington's Landing in its redeveloped condition. (Source: URA, no date)

restoration emphasized the adaptive re-use of industrial buildings and exhibited industrial artifacts both inside the renovated structures and outside in the landscape. It was also the first Pittsburgh development to create a riverfront for people rather than for industry and was home to the first public docks and walking trails.

In 1994, PHLF sold Station Square to Forest City Enterprises, a Cleveland-based development firm hoping to convert the site into a casino location in the future. The site was sold for $25.5 million. As part of the sale agreement, Forest City created an endowment to support on-site historical education programs and committed itself to maintaining the historical adaptations already completed. In 2000, Forest City invested an additional $71 million in the site to develop a hotel addition, additional restaurant and retail amenities, and a new riverfront plaza and marina. The company also used a $5 million state grant to improve pedestrian access to a public transit stop nearby. Despite these investments, the city declined to grant the site a casino license in 2007. Historic educational programs and tours are still regularly held on site.

Washington's Landing (Herr Island)

Washington's Landing, formerly known as Herr's Island, is a 42-acre island located of the north shore of the Allegheny River, two miles from downtown Pittsburgh, below the 31st Street Bridge. The island is a former brownfield that was purchased by the Urban Redevelopment Authority (URA) and redeveloped as a residential village, office complex, and sports entertainment area. The total redevelopment cost $79 million and was heavily subsidized by state and local redevelopment programs.

Herr's Island was once used as a non-permanent Native American encampment. Early settlers cleared the land in 1797 to accommodate farming and livestock activities. After railroad access to the site was developed in 1903, the livestock production expanded into an industrial stockyard that thrived for nearly five decades. When the railline was re-routed in 1966, the packing companies closed and activity on the island ceased.

In 1976, the Regional Industrial Development Corporation (RIDC) proposed enlarging the island's land area to

Above Left: Kayaking along the Monongahela River, between Herr's Island and the North Shore. (Source: Gatti, 2005)

Above Right: View of downtown Pittsburgh from the pedestrian bridge to Herr's Island. (Source: Gatti, 2005)

70-acres and converting the site into an industrial park and marina. The proposal would cost an estimated $32.4 million, would create 2,500 jobs, and would provide $1.3 million in annual tax revenue.

Using the RIDC proposal as a framework, the URA began purchasing and clearing the island in phases in order to pave the way for private development. In 1978 and 1979, the URA acquired 20.5 acres on the island for office park redevelopment and, in 1981, the state purchased an additional 2.8 acres for a riverfront park and marina. Pittsburgh's City Council formally approved the Herr's Island redevelopment plan in 1983 with the proviso that new construction accentuate the island's natural riverfront and view corridors. As part of a marketing campaign, Herr's Island was renamed Washington's Landing in 1987, celebrating the legend that General Washington had slept on the island in 1753. The URA purchased and cleared the rest of the island in 1989. The entire island was also rezoned as Specially Planned District (SPD) introducing additional oversight and quality-control measures into the design process.

The URA completed major infrastructure improvements on the island between 1979 and 1985, spending $4.3 million on road and access improvements and an additional $1.3 million on general site preparation activities. Traffic and housing studies were completed in 1987 and, between 1988 and 1993, an additional $4.1 million was spent on environmental remediation activities. An initial environmental investigation revealed hazardous soil contaminants as well as non-toxic but odorous waste materials and contaminated drinking water. The site was remediated through encapsulation measures costing $3.4 million, plus an additional $0.7 million in hauling expenses for uncovered organic waste.

The major new construction activities occurred between 1989 and 1998. The first new facility, the Three Rivers Rowing Association facility ($1.5 million) opened in 1989, and, the following year, construction began on the river marina ($3 million, completed in 1996) and recreational tennis complex (completed in 1993) located on top of the encapsulation site. In 1992, the URA finished completed construction on the new public streetscape. The first office building (74,500 square feet, $2.4 million) was completed that same year, occupied in part by the Pennsylvania Department of Environmental Protection. A second office building (30,000 square feet, $2.9 million) was completed in 1993. The same year, construction began on the Village at Washington's Landing, a new 100-townhouses residential community ($21 million, all sold by 2000). Also in 1993, the Sports Technology Group completed its manufacturing and office building (37,000 square feet, $3.3 million). In 1996 and 1997, the fourth and fifth office buildings were completed (30,000 square feet each, $2.6 million and $2.9 million respectively). The first retail facility on the island also opened in 1997, a restaurant catering to boaters docking at the new marina.

A high-tech prototype single-family home was completed in 1997 as a demonstration project and three more similar homes followed. The last new building, an office facility for Automated Healthcare Inc, was completed in 1998 (45,000 square feet, $4.6 million). The total cost for new construction was $44.1 million, $26.5 million (60%) of which was publicly subsidized.

Pittsburgh Technology Center (South Oakland)

The Pittsburgh Technology Center (PTC) complex was developed on an old industrial strip along the Monongahela River. Located in Hazelwood below the South Oakland bluf , the 48-acre site lies between the Monongahela River and Second Avenue, west of the Hot Metal Bridge. The redevelopment project, managed by the Pittsburgh Urban Redevelopment Authority (URA), converted the brownfield site into a research and technology office park providing specialized research facilities for biotechnology, bioengineering, artificial intelligence, robotics, and computer applications. The total redevelopment cost $147 million.

The PTC site was first developed for industrial production in 1852. It originally accommodated a copper smelting facility that was later converted for steel production. Some housing was located on the site until 1930 when the Jones and Laughlin Steel Corporation expanded their Soho Works/Hot Strip Mill facility across several miles of riverfront property. After the plant was closed in 1979, the Park Corporation, a Cleveland-based industrial company who has purchased and demolished other similar facilities throughout the city, tearing down the existing buildings to sell as scrap metal, purchased the site and later sold it to the URA for redevelopment in 1983. Between 1983 and 1993, the URA completed a major environmental remediation of the site costing $18 million and funded by state and local government subsidies. The initial site assessment and market analysis was completed in 1984 and, based on that assessment, the URA completed roadway improvements and site preparation work by the early 1990s.

The first round of new construction on the site was completed between 1993 and 2002, resulting in 876,400 square feet of new development (80% office, 20% research/lab, 0% vacancy rate). The first new buildings were completed in 1993 and 1995, one for the University of Pittsburgh Center for Biotechnology and Bioengineering (91,000 square feet, $14 million) and another for the Carnegie Mellon Research Institute (87,000 square feet, $17 million). Both projects were entirely funded by government subsidies. In 1995, ALMONO partner RIDC

Above Left: Soho Works, now the Pittsburgh Technology Center, immediately adjacent to the present day Almono site, 1954. (Source: University of Pittsburgh, Digital Images Library)

Above Right: Union Switch and Signal, Inc. building. (Source: Santoro, 1996)

Right: Aerial view of PTC under construction (Source: URA, no date)

completed a 175,000 square feet building to house Union Switch & Signal Corporation research and engineering activities ($20.5 million, funded through public & private sources). To support the Union project, the URA developed an associated 174,000 square feet parking garage funded through a $7.5 million Tax Increment Finance (TIF) package. In 1996, RIDC completed the Oakland Consortium building, a 68,000 square feet multi-tenant structure for advanced technology companies ($8.5 million). Later that same year, the major outdoor public open spaces were completed including plazas, landscaping, signs, pedestrian amenities, and riverfront planting.

The following year, the Sunoco Chemical Corporation completed an 80,000 square feet facility for its Polypropylene Business Unit for a total cost of $25 million ($16 million funded by government subsidy). To accommodate increased traffic flow, the Monongahela Connecting Bridge was opened to vehicular traffic in 2000 providing a new connection between the PTC site and the SouthSide Works redevelopment across the river. In 2001, TelCove completed a 30,400 square feet telecommunication general office and switching facility ($4.4 million) and in 2002 the biotechnology firm Cellomics completed a 153,000 square feet building housing corporate offices, wet laboratory and assembly space. ($20.5 million total, $3 million in public subsidy). The total redevelopment cost $147 million and, in its current state, the complex generates just over $1 million in annual local tax revenues.

The URA currently has plans for a second round of development on the PTC site. The last building in the Phase 1 development plan was completed in 2002, and, since then, the demand for research facilities in Oakland has continued to grow. According to the URA-approved master plan, an additional one million square feet of development space could be built on eleven sites scattered across the site in between existing buildings. The new development is broadly supported by the Greater Oakland Keystone Innovation Zone (GO KIZ), a collaboration committed to expanding the amount of space for high tech start-ups and corporate research centers in close proximity to the universities. The infill strategy is intended to increase the Center's density, making it feel more urban and helping it to sustain supporting services such as dry cleaners and restaurants that may be developed to serve those working there.

A mix of public and private resources will fund the PTC expansion. The URA will coordinate the development process and provide infrastructure improvements ($43 million for general infrastructure development plus a $25 million TIF package for shared parking garages). Actual building design and construction will be privately managed. Of the eleven approved development sites, only two remain unclaimed. Cleveland-based Ferchill Group (developer for the Cellomics building) has committed to developing the first new building in the Phase 2 expansion. Their 150,000 square feet facility Bridgeside II will contain wet lab facilities and office space for university-affiliated tenants. The new facility will cost $46 million and will be supported by a URA-funded parking garage.

The Waterfront (Homestead)

The Waterfront site is located along the Monongahela River below the Hi Level Bridge upstream from the Hazelwood LTV site. The site is in Homewood, just outside of Pittsburgh's city limits. The redevelopment was privately managed, though remained heavily subsidized, by the Columbus-based firm Continental Retail Developer. Also as a consequence of its private ownership, the site was redeveloped in only six years, a record low among the benchmarks included in this study. The large, 260-acre site (half of the total 430-acres) was redeveloped in phases as a mixed-use retail, office, and residential zone. New development totaled 2.4 million square feet and cost $300 million.

The waterfront was first developed as a suburban steel industrial facility around 1880. Andrew Carnegie, who founded the U.S. Steel Corporation in 1901, acquired the site early on, just before the historic 1892 Homewood Pinkerton labor strike. The plant gradually expanded over the next five decades and, during World War II, 8,000 residents were displaced to make room for further expansion. The plant boomed through the 1970s but ended the decade with sudden and massive layoffs. The plant was closed in 1986 and the Homestead neighborhood began a long slow deterioration. In 1988, the site was sold to the Cleveland-based Park Corporation who cleared the industrial buildings and sold the remnants as scrap metal. In 1992, the state declared Homestead a "distressed community" making it eligible for revitalization funding and government programs.

The redevelopment effort began in earnest in 1995 when the Munhall, Homestead and West Homestead boroughs agreed to jointly finance a $25 million TIF package to support transportation infrastructure improvements. The three boroughs agreed to split all future tax benefits and maintain a collaborative zoning practice over the site. The

AboveRight: U.S. Steel Corporation facility in Homestead, 1925. (Source: University of Pittsburgh, Digital Research Library)

Above Right: The Waterfront after redevelopment. (Source: Continental Real Estate Companies, no date)

Right: Vestiges of past use. (Farrell, 2007)

Park Corp. retained ownership during these improvements and then sold the improved site to the Columbus-based Continental Real Estate Companies in 1998.

Between 1998 and 2002, Continental redeveloped the site as a "lifestyle center." The first phase of development, opened in 2000, included 700,000 square feet of big box retail and an additional 400,000 square feet of high-end chain retailers and entertainment venues. In the second phase, Continental added 217 luxury apartments, bringing the total new development cost to $300 million. In 2005, Siemens Westinghouse Power Corp. committed to building a $122 million fuel cell plant on a large portion of the undeveloped site. Although most of the historic structures were razed, a dozen smokestacks were salvaged, as was the Munhall pump house and an old rail station at Amity Street. In 2007, Homestead's the distressed classification was lifted. The revitalization effort, however, has been widely criticized as uneven and the old main street business district, which is only two blocks away from the Waterfront shopping center, has continued to decline.

SouthSide Works (South Side)

The SouthSide Works site is located in the South Side neighborhood, between the Monongahela River and Carson Street. The original brownfield site was 123 acres, 34 of which have been revitalized as the central SouthSide Works development with the rest of the site redeveloped in a more gradual and piecemeal manner. The Pittsburgh Urban Redevelopment Authority (URA) owns the site and managed its redevelopment into a residential, retail, and office mixed-use district. The new development area totals 2.4 million square feet and cost $330 million, of which $103 million was financed through public subsidy.

The Jones & Laughlin Corporation first developed the riverfront site for industrial steel production at the end of the 19th century. The plant was active until the mid-1980s when ownership was transferred to the LTV Corporation. The plant was permanently closed in 1993, and then sold to the URA. The following year, the URA purchased the Hot Metal and MCON Bridge structures connecting the SouthSide Works site to the Pittsburgh Technology Center across the river.

Left: Aerial view of the former Jones & Laughlin Pittsburgh Works site (currently the SouthSide Slopes site) taken sometime between 1930 and 1950. (Source: University of Pittsburgh, Digital Research Library)

Below Left: Present day Southside Works brownfield redevelopment project. (Source: Urban Redevelopment Authority of Pittsburgh, no date)

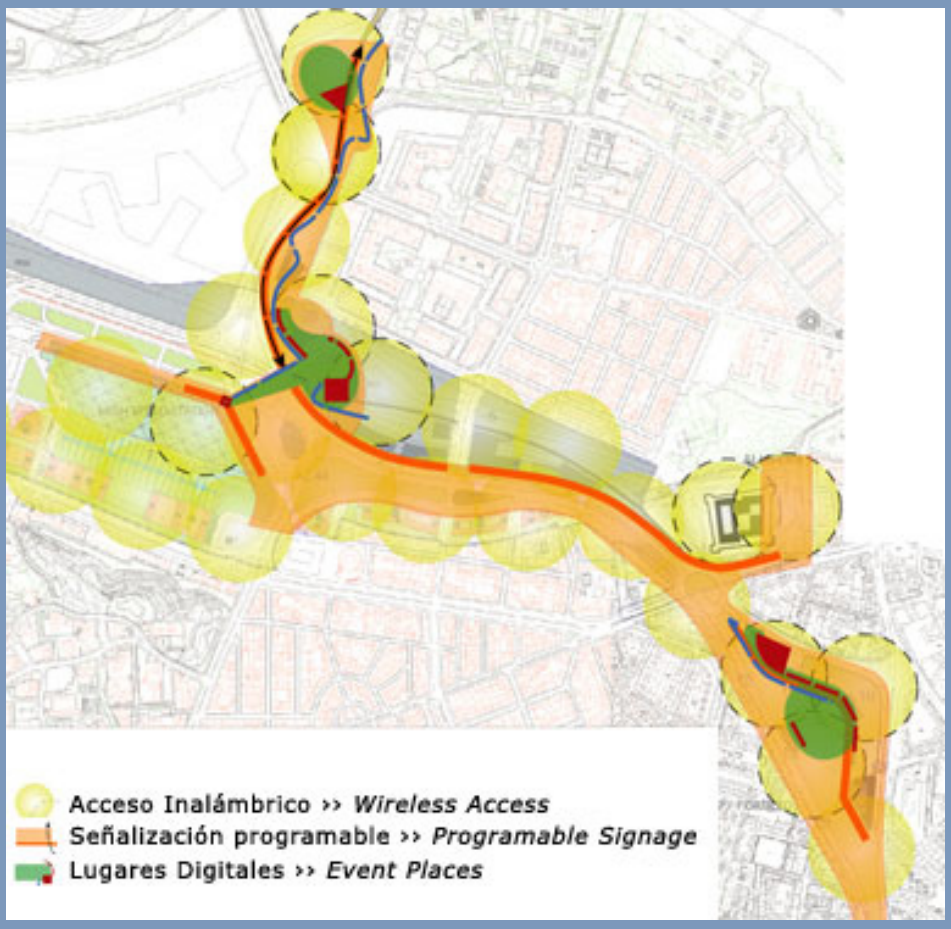
Below Right: View of the redeveloped SouthSide. (Source: General Dynamics, 2007)

The initial redevelopment efforts focused on the entire 123-acre site. In 1995, the URA completed a full site assessment and market analysis and, from 1996 to 1998, undertook infrastructure improvements and basic environmental remediation, releasing all future developers from environmental liability. Between 1998 and 2005, the URA invested an additional $25 million in TIF financing in bridge and roadway improvements readying the site for privately managed development. Between 2000 and 2002, several new buildings were completed onsite including the UPMC Sports Performance Complex (260,000 square feet, $30 million), the IBEW Regional Headquarters which relocated from the North Shore and Strip District (125,000 square feet, $18 million), the FBI Regional Offices which relocated from downtown Pittsburgh (83,000 square feet, $20 million), and the Life Sciences Center biomedical incubator (45,000 square feet , $7 million). In addition, a Riverfront Masterplan was completed in 2000 with riverfront trail improvements completed in 2001.

The core SouthSide Works site began in 1998 when the URA cleared the site for development. Between 2000 and 2003, the URA built a $10 million parking garage and spent an additional $8 million on roadway and utility infrastructure improvements. During this same period, four office buildings were completed including Quantum I (160,000 square feet, $18 million), Rivertech Center (47,000 square feet, $5mil, plus an additional $0.8mil URA utility improvements), Quantum II (187,000 square feet, $22 million plus a URA-funded garage), and Colliers Penn Real Estate (32,500 square feet, $4.7 million). Three mixed-use complexes were completed: an office/retail structure (39,000 square feet, $4.9 million); a retail and residential complex called The Lofts (123,522 square feet, $15.5 million, plus a URA funded parking garage costing $7.15 million); and the largest complex, developed by the Soffer Organization, which includes a cinema, retail spaces, upper-level office space, and a public square (333,000 square feet, $27.7 million). New development also included the Matcon Diamond manufacturing plant (14,000 square feet.) and a 270-unit apartment complex ($29 million). Large parcels of the site remain undeveloped and the URA has already approved plans for a fitness center, additional office space, a hotel, a concert pavilion, and luxury condominiums.

Innovative International Benchmarks

	Year began	Site Size	Development Agency	Development Typology	New Floor Area	Development Cost	Turnover Time*
Digital Mile, Zaragoza	2004	330 acres	Public, Institutional	An urban space of creativity and innovation	n/a	n/a	4 years
Arabianranta, Helsinki	1999	210 acres	Public	Mixed-use, emphasis on arts and digital technologies	n/a	n/a	13 years
Beddington Zero Energy Development, London	2000	n/a	Non-profit	Carbon-neutral eco-community	99 residences + 1,405 sq. m. commercial space	£15 million ($29 million)	2 years
Mission Bay, San Francisco	1999	303 acres	Public, Institutional, and Private	Research, residential, retail, and civic	8 million sq. ft.	$4 billion (expected)	20 to 30 years
Innovista, Columbia	2007	500 acres	Non-profit and Public	Innovation District	5 million sq. ft.	$141.2 million phase 1 ($250 million (total expected cost)	15 to 20 years



This Page: Projects, such as the Digital Mile in Zaragoza, Spain, are demonstrating innovative approaches to urban planning and design. (Source: Frenchman et al., 2006)

Innovative International Benchmarks

Brownfield remediation, riverfront revitalization, and innovative development practices are on the rise worldwide. While Pittsburgh benchmarks provide valuable and locally specific information about market forces, political assets, and stakeholder preferences, benchmark projects from more distant locales demonstrate a wider range of economic, ecological, social, and technological innovation. The Digital Mile project in Spain integrates innovative digital technology into existing urban infrastructure, public space, and service systems. Developers of the new Virtual Village project in the Arabianranta district of Helsinki, Finland, are also integrating virtual digital technology into their brownfield redevelopment project. The BedZED brownfield remediation integrates socially conscious housing development with low-energy and ecologically responsive development strategies. San Francisco's Mission Bay brownfield redevelopment project will convert an extensive portion of the city's post-industrial waterfront landscape into a mixed-use community partially dedicated to university-related technological research. The Innovista project goes a step farther and explicitly leverages university technological research activity for broader urban revitalization. Although these projects reflect a diverse range of planning interests and local contexts, each case demonstrates a valuable takeaway lesson for ALMONO planners and illustrates the type of innovative growth that could be achieved.

The Digital Mile (Zaragoza, Spain)

The city of Zaragoza is one of Spain's oldest and most populous urban areas. It is scenically located on the Ebro River, in the autonomous community of Aragon (Comunidad Autónoma de Aragón) in northeastern Spain, about 200 miles from both Madrid and Barcelona.

In 2003, the state constructed a new inter-modal regional transportation station (Estación Intermodal de Zaragoza – Delicias) in Zaragoza's Las Delicias sector. The new station provides a modern terminal for the new high-speed commuter rail line connecting Zaragoza to Madrid and Barcelona. The Delicias station replaced the former "El Portillo" rail station, freeing up 23 acres (nearly 1 square kilometer) of prime real estate in the heart of the city.

In 2008, Zaragoza will be hosting the global International Exposition (started in 1851) and, in preparation, city officials are undertaking several urban improvement projects. City officials have teamed up with the Massachusetts Institute of Technology (MIT) to redesign 330 acres of urban land. The resulting Digital Mile (*Milla Digital*), promoted as "an urban space of creativity and innovation," uses communication technology to add value to public space and is intended to raise the city's global, high-tech, entrepreneurial profile during Expo 2008.

The general design concept of the Digital Mile is to link physical and digital frameworks into a network of facilities and public spaces that can be used for multiple community and educational purposes. The physical elements -- dubbed the Paseo del Agua -- are organized along a pathway consisting of three major event places: the El Portillo node, one of the city's most historic and culturally significant areas and location of the Museo de la Milla; the Almozara neighborhood, a highly visible area connected to Las Delicias by way of a pedestrian bridge; and the Ebro Rivergate, the main entrance to the Expo 2008 grounds and future gateway of Zaragoza's high-tech business sector and recreational amenities. The Paseo del Agua is accessible by subway and bus.

The project's digital elements include extensive digital infrastructure. Users can manipulate new intelligent street and building light networks, along with digital menus and maps, according to their needs and whims. The Digital

Left: Interactive waterwall, Zaragoza, Spain. (Source: Frenchman et al., 2006: 63)

Above: The Graffiti Gateway, Zaragoza, Spain. (Source: Frenchman et al., 2006: 9)

Mile features ambient technology amenities, including a ubiquitous free wireless network and location-based services accessible to subscribers. The project also features digital public places and amenities which engage users and create dynamic public places. The Adaptable Bus Stop is an interactive feature that digitally provides information and maps by touch or mobile phone according to the users wishes while simultaneously serving as a wireless hotspot. The Smart Parking program allows drivers to digitally assess local parking availability. Digital awnings, which are essentially movable fabric screens mounted on the buildings adjacent to the digital plaza and promenade in El Portillo, respond to climate and people's movements.

The Digital Mile is being constructed on recently vacated land in the El Portillo and Las Delicias neighborhoods, and the Paseo del Agua area that lies between the two. The new AVE neighborhood in Las Delicias will cover almost 247 acres, a quarter of which will be green space. Nearly half of the smaller 23-acre El Portillo site will also be dedicated to public green space. The 60-acre Paseo del Agua area will lead to the main Expo 2008 entrance point and will connect the other two neighborhoods to the Ebro River. The umbrella initiative, the Digital Mile Campus, combines the Digital Mile's long term strategic aims with two additional cultural facilities, the Milla Museum/Mediateque in Portillo and the Centre for Art and Technology in the Almozara Park. The Campus also includes three digital public spaces located in the El Portillo node, the Almozara neighborhood, and the Ebro Rivergate.

The Department of Science and Technology of Zaragoza City Council, the City of Zaragoza, and MIT are spearheading the project. The MIT project team includes the university's Department of Urban Studies and Planning, the Department of Architecture, the Media Lab, and the Center for Real Estate. Additional partners include an inner-city redevelopment agency, the state government, the University of Zaragoza, and the Zaragoza "Ciudad del Conocimiento" Foundation. A Committee of Experts of Zaragoza City Council, which includes Manuel Castells, Saskia Sassen, and William Mitchell, is also participating.

Arabianranta (Helsinki, Finland)

Arabianranta is a new mixed-use development centered on the themes of art, design, culture and technology. The project's guiding vision is to "make Arabianranta the leading center of art and design in the Baltic area" (Helsinki Virtual Village). The 210-acre Arabianranta site is located on the shore of the Vantaa River in the Vanhakaupunki district on a former brownfield site. The site neighbors the Viikki ecological redevelopment that includes the University of Helsinki's basic and applied biological research and teaching institutes. Arabianranta is one of Helsinki's largest redevelopment projects, and completes the neighborhoods of Arabia and Toukola. The project was begun in 1999 and is expected to be completed by 2012.

Nearly 70% of the land area in Helsinki is municipally owned. The city of Helsinki plans new developments, allots municipal land for private developers, and provides infrastructure and municipal services for new developments as needed. The City Real Estate Department allocated all development sites in Arabianranta for private contractors through open site competitions. The city established mandates as part of the bidding process by placing price caps on the majority of the housing units, allocating 1-2% of site acquisition costs for artwork, designating green spaces, and connecting all housing to a unified local broadband (MAN) network, as part of Helsinki Virtual Village.

Although public sector officials initiated the Arabian-

Left: Arabianranta, Helsinki. (Source: Mannila, no date)

Above: Arabianranta plan. (Source: City of Helsinki, no date)

ranta project, the city is collaborating with several private partners. The largest partnership, the Art and Design City Helsinki Ab Oy (ADC Ltd.), formed in 1999 to manage the development interests of the National Ministry of Trade and Industry, the University of Art and Design, the city of Helsinki, local landowners, and private developers.

The University of Art and Design Helsinki and its audio-visual center will be one of Arabianranta new tenants. The new Art and Design City Helsinki will provide a major national campus for art, design and media schools, and roughly 300 small and medium size firms in related fields. Arabus, a local business incubator, and other business development facilities will also be located on-site, as well as several factories producing furniture and household objects by leading Finnish designers. Other institutions include the Arabia pottery factory, known for its ceramic and glassware design and products, Aralis Library and Information Centre, the Hackman Group, the Arabiakeskus shopping center, and the Portaali Business Park. Developers expect the project will provide 8,000 jobs by 2012.

The residential component of the project includes accommodations for 10,000 to 12,000 residents by 2012, mainly in apartment blocks. Bus and tram service will connect residents to Helsinki's city center with an average 10-minute travel time. The area also contains a national reserve that is popular with bird watchers.

The Arabianranta Helsinki Virtual Village (HVV) will be "both a cyber-community and a physical community" (MIT Center for Real Estate). The HVV network will provide state-of-the-art wireless infrastructure to Arabianranta's projected population of 6,000 students, 12,000 residents, and 8,000 daytime workers. Community members will be able to access the seamless, ubiquitous system using cell phones, handheld computers, digital televisions, and personal computers. Each new housing unit will contain a 1 Gbps HVV network connection, each of which will be connected to a main fiber optic cable, provided by the Helsinki Energy utility company and the Real Estate department of the City of Helsinki.

Several ITC companies are collaboratively developing the HVV network and are using Arabianranta as a "real-world experiment" in community networking. Researchers will investigate the social effects of this new technology and the usability of the applications. Incoming residents will be able to build social networks via online groups and web portal discussions. Local EU research projects include IntelCities, researching e-participation, and Innovative Cities for the Next Generation (ICING), measuring citizen use of position technologies.

Left and Far Left: Beddington Zero Energy Development carbon-neutral eco-community, London. (Source: International Energy Agency, no date)

Below: Water treatment plant housed within a greenhouse, BedZED. (IWA Publishing, no date)

Beddington Zero Energy Development (BedZED) (London, U.K.)

The Beddington Zero Energy Development (BedZED) eco-village is the UK's first carbon-neutral eco-community. Built on a former urban brownfield site in south London, this multi-award winning development is marketed as "one of the most coherent examples of sustainable living in the UK" (BioRegional Development Group). The mixed-use development operates on a "net zero fossil energy" policy, which means that the community generates its total energy needs from renewable sources. The mixed-tenure, energy-smart housing extends the benefits of eco-living to upper-income residents as well as lower-income social housing candidates. According to a review published by the Massachusetts-based Innovation Valley organization, BedZED demonstrates that eco-communities "are practical to cold weather climates, they're modern, they work, the residents are happy, and, from a business standpoint, they're viable" (Itzkan, 2006).

The Peabody Trust commissioned the project as part of its larger charitable campaign to reduce poverty in London through affordable housing reform. BedZED was built in 2002 in the London suburb of Wallington, in the London Borough of Sutton. Prior to construction, the London Borough of Sutton owned and operated the land as a contaminated sewage-spreading site. In exchange for assuming remediation responsibilities, Peabody acquired the site at a reduced cost. Working as a non-profit developer, the trust hired Bill Dunster Architects and the environmental consultants BioRegional Development Group to design a comprehensive community addressing environmental, social, and economic needs. Peabody provided 95% of the total £15 million project cost (approx. $29 million), and, although much of the development targeted social housing clients, Peabody recouped its investment by selling a portion of the housing at market rates. The European Union, the Energy Savings Trust, and the Environmental Action Fund provided the remaining funds.

The BedZED community is a mixed-use, mixed-tenure development. The newly constructed neighborhood includes 82 residences, 17 live-work apartments, andapprox. 15,125 square feet of commercial and exhibition space. The new residential structures accommodate a range of market price points. One third of the residences (34 units) were sold outright on the private market. Another 40% of the units are managed as part of the social housing program with 23 units financed through shared ownership agreements and another 15 units reserved for low-income renters. The remaining 10 units are reserved for key workers under a part rent and part buy agreement. The neighborhood also contains an 18-hectare Ecology Park with a wetlands area, willow coppice woodland, and several lavender fields. An onsite visitor and exhibition center manages regular tours of the facility and operates an awareness initiative helping residents take full advantage of the community's eco opportunities.

The site and building designs reflect a range of low-tech eco-initiatives related to housing, transportation, and food acquisition. To reduce energy demand, building designs incorporate passive solar and passive ventilation system, super-insulation and building thermal mass, and water and energy conservation design features and appliances. The community meets its remaining energy demand through shared renewable sources including a combined heat and power plant, which is fueled by community tree clippings, and an integrated community solar array. During the construction process, BioRegional optimized trade-of s where possible to balance life-cycle energy considerations. For example, since domestic household energy consumption accounts for 29% of the UK's total CO2 emissions whereas building construction materials contribute only 2-3%, the design team prioritized eco-features that targeted long-term energy efficiency during use even if such strategies required special non-green construction materials.

The BedZED developers also instituted the UK's "first legally binding Green Transport Plan as a condition of planning permission" (Peabody Trust, no date). Residents have direct access to public rail, bus, and tram systems as well as an onsite carpool program. Drivers with private electric automobiles can charge their vehicles for free at a solar-powered community charging point. Mixed-use structures include local retail and the community runs a food-delivery service that specializes in home-delivered organic and locally-grown produce. Integrated recycling and composting programs, as well as a community-based clothing and furniture swap shop are also present.

Since BedZED's completion, BioRegional has continued to monitor building performance and residential satisfaction. Heat, electricity, and water savings goals have largely been met, or in some cases vastly exceeded, as have recycling and composting objectives and car mileage reduction goals. The Peabody Trust distributes a handbook to new residents and, for the first year of residency, BioRegional employed a Green Lifestyles Officer to provide resident training and support for the eco-initiatives. New homeowners demonstrated a consumer willingness to pay up to a 20% premium for innovative design and 'green' features (variable by housing type), have exceeded the recycling and green transport expectations, and continue to respond favorably to BioRegional's satisfaction surveys. BedZED's public successes has inspiring similar projects around the globe, including a demonstration project in Johannesburg for the United Nations Earth Summit in 2002.

Below: Mission Bay Land Use Plan (Source: San Francisco Redevelopment Agency, 2007)

Mission Bay redevelopment (San Francisco, CA)

Mission Bay is a 303-acre, mixed-use waterfront redevelopment anchored by the University of California San Francisco (UCSF) Research Campus and the corporate Mission Bay Life Sciences Campus cluster. The Mission Bay project is San Francisco's largest urban development project since the Golden Gate Park project begun in the 1870s. It is also the largest recent expansion of biomedical research at any university in North America. Mission Bay is one mile from San Francisco's financial district and is located between the San Francisco Bay and the I-280 highway. The land is accessible by car from the I-280, or from the Muni Light Rail (new 3rd Street station constructed in Mission Bay), two bus lines, and the Caltrain commuter rail. The area also contains a public port launch at Pier 54, along Terry Francois Boulevard, and is connected to the Bay Trail. Until recently, the land was used for industrial manufacturing, shipping, and rail yards.

The city Board of Supervisors established the Mission Bay North and South Redevelopment Project Areas in November 1998. Development is controlled through the

Above: Aerial View of UCSF Mission Bay Campus. (Source: Wiegman Aerial, 2002)

Left: Genentech Hall, UCSF Mission Bay Campus. (Source: Majed, 2003)

Right: Koret Quad, backed by a new community center, UCSF Mission Bay. (Source: Defeo, 2004)

Redevelopment Plans and Designs for Development, Owner Participation Agreements between the Redevelopment Agency and private developers, and Interagency Cooperation Agreements responsible for integrating all city departments into the Mission Bay Infrastructure Plans. The Catellus Development Corporation was the site's private master developer and a landowner until 2004.

In its fully redeveloped state, Mission Bay will contain several new research, residential, retail, and civic structures. The site will house the new 45-acre UCSF research campus, the 289-bed UCSF hospital, and 5 million square feet of corporate biotech labs and offices in the Life Sciences Campus. It will contain 6,000 units of market rate and affordable housing, hotel and conference facilities, 750,000 square feet of city and neighborhood-serving retail space, and 49 acres of parks and open space. Numerous civic buildings and institutions will also be constructed, including an elementary school, a senior's complex, police and fire stations, a public library, and a community center designed by renowned Mexican architects Ricardo and Victor Legorreta. The project is expected to create over 31,000 permanent jobs.

Innovista (Columbia, South Carolina)

Several cities worldwide are leveraging academic and technological research activities to bolster development and regeneration in core urban locations. The Intelligent Cities movement exemplifies these trends, and several recent planning reports and official statements indicate that Pittsburgh may be well positioned to capitalize on such strategies. The Innovista project in Columbia, South Carolina, illustrates the type and scale of change that is possible when universities and cities collaborate for mutual and regional growth.

The University of South Carolina is a 200-year-old public institution with a strong research reputation in hydrogen fuel cells, environmental science, biotechnology, nanotechnology, international business, and public health. In 2007, city and university officials began a joint project to redevelop a 500-acre riverfront industrial brownfield into a new, technology-oriented, mixed-use community. According to project advocates, the new Innovista neighborhood will extend and augment a neighboring "Innovation District," a term used to describe local knowledge-based

communities catering to research and development activities. These districts are intended to concentrate the city's research activity thereby catalyzing broader economic and urban redevelopment.

In its search for land to host new research facilities for its expanding high-tech programs, USC sought to invest in its own urban back yard. The Innovista community will be built across several city blocks between the university campus and the Three Rivers Greenway linear park bordering the Congaree River. A now-defunct mill facility covers a large portion of the site, and the rest of the land contains underutilized commuter parking lots, light industrial uses, suburban-style office buildings, and other miscellaneous vacant property. The Innovista project will replace these low-level uses with a more dense and vibrant urban community explicitly marketed to young, well-educated researchers. The development vision is loosely based on a 1786 historic city plan and is being marketed as "a destination for living and playing" complete with art galleries, cultural events, sporting and entertainment venues, green spaces, and river access.

The Innovista master planning process began in 2005 as a public-private partnership with official backing and funding support from the city of Columbia, Richland County, and the state government. Once complete, the $250 million investment will create 8.5 million square feet of new development containing several research buildings, restaurants, retail services, and residences. The city has committed $30 million in infrastructure improvements, mostly in the form of parking garages, and the state will provide an additional $122 million to the university's three major research centers to recruit top faculty experts and endowed chairs. Federal funding will also be provided through bond measures earmarked for research infrastructure expenses.

Through this investment, the city and university hope to attract talent to Columbia and to induce university graduates and spin-of companies to maintain a long-term presence in the area. Officials are explicitly marketing the new Innovista community to companies specializing in nanoelectronics, polymer nanocomposites, brain imaging, and hydrogen fuel cells. The investment is expected to create several new jobs, most of which will cater to well-educated and well-paid employees. Duck Creek Technologies, a software technology firm, will be Innovista's first private tenant. Information on potential social service and community benefits for lower-income community members is not readily available.

Above: Innovista's waterfront park will connect to the existing Three Rivers Greenway. Images by Sasaki Associates. (Source: University of South Carolina, no date)

digital modeling tools

Urban Spatial Analysis in the Digital Age

Urban planners and policy makers are increasingly integrating computer technology into their decision making frameworks. Researchers and industry leaders have dramatically improved the capacity of digital analysis tools and pattern recognition software to analyze urban spaces and communicate effectively with the non-technical public. Space Syntax researchers and practitioners in the U.K. are refining software programs and plug-ins that are increasingly able to generate urban connectivity measures which, in turn, provide valuable information for social, physical, and economic developers and service providers. In the U.S., the INDEX software package is gaining a reputation across the nation for its land-use planning and transportation features. Industry leaders have also praised the program for its community engagement features and sustainable development matrices. Although researchers continue to improve these programs' applicability and effectiveness, the software already provides useful analytical tools for urban regeneration projects. Given Pittsburgh's technological emphasis, and the high degree of computational proficiency at Carnegie Mellon and across the region, the ALMONO redevelopment process may be a prime opportunity to test and showcase these new digital tools.

Space Syntax

Space Syntax Laboratory
Bartlett School of Graduate Studies
University College London
Gower Street
London WC1E 6BT
United Kingdom
www.spacesyntax.org

> *"Space syntax is a set of techniques for the analysis of spatial conf gurations of all kinds, especially where spatial conf guration seems to be a signif cant aspect of human af airs, as it is in buildings and cities. … It has been extensively applied in the f elds of architecture, urban design, planning, transportation and interior design. Over the past decade, space syntax techniques have also been used for research in f elds as diverse as archaeology, information technology, urban and human geography, and anthropology."*
>
> *- Space Syntax Laboratory website, June 2007*

The goal of the "Space Syntax" project is to quantitatively characterize the way people move through space. Professor Bill Hillier at University College London's Unit for Architectural Studies (now the Space Syntax Laboratory) began the project in the 1970s. At the time, Hillier's group began researching Britain's failing public housing projects as part of larger research initiative exploring connections between spatial design and social functioning. The group hoped that, through this case study, they would be able to discern a quantitative relationship between spatial factors and social malaise. Instead of focusing on traditional design elements, such as materiality or style, the group explored spatial arrangements (e.g. sight lines, intersection nodes, nested spaces) and the associated opportunities for visual and physical interconnection.

The team's research goals changed in the 1980s when the group unintentionally discovered "a link between properties of spatial layouts and patterns of pedestrian and vehicular movement" (Space Syntax, 2004). The group discovered that they could use pattern recognition tools developed in the Artificial Intelligence sector to decipher seemingly universal patterns in urban landscapes. By quantifying these patterns, the group was able to accurately predict circulation flows. This discovery implied not only that fundamental global laws of space exist, but also that these laws autonomously organize human movement. Since circulation levels are statistically linked to urban social conditions – such as economic health, environmental development, civic engagement, traffic safety, and crime – the group's new discovery implied that a mathematical expression of these spatial laws would accurately predict social consequences of development.

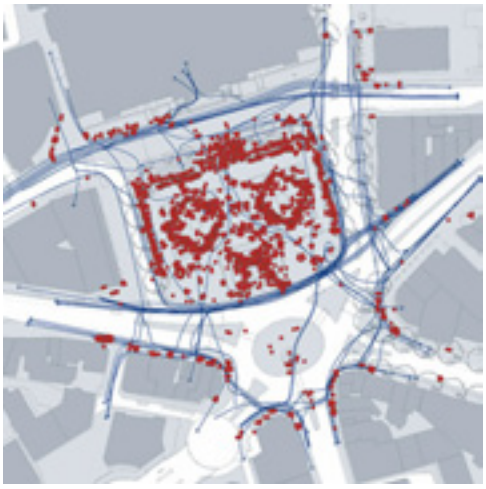
After discovering this link between configuration and circulation, the group began searching for the theorized spatial laws more explicitly. The premise of this work is that fundamental laws of space exist independently of particular architectural developments and that local architectural and urban development strategies play themselves out within the constraints of these underlying spatial laws. This theory suggests that, as a result of these underlying spatial laws, every object, partition, and circulation route developed in urban settings has an automatic, globally predictable ef ect on traffic flow and, by extension, community health. By using computational computer technologies to analyze existing settlements, analysts hope to discern these spatial laws and to express them as mathematical "if-then" statements linking spatial strategies with development consequences.

In order to decipher these laws, the syntactic researchers have adapted pattern recognition techniques used by colleagues in the natural and social sciences. Researchers use city maps as raw data and use non-discursive computer technologies to decipher quantitative patterns in these settlements. By repeating this process for numerous cities of varying sizes across locations and epochs, researchers have built up mathematical relationships based on real world urban forms. This approach is more ef ective at revealing unforeseen information than previous purely mathematical strategies that imposed an idealized mathematical formula over an existing map to measure its "fit". The result is a quantitative "morphic language" which appears to govern global spatial production.

A "morphic language" is a hybrid between "natural" languages, which describe the world as it appears, and mathematics, which generates its own internal structure irrespective of an external reality. Rather than treat urban forms as an agglomeration of building blocks, the language approach expresses cities in terms of grammatical formulas governing spatial development. This linguistic approach gives primacy to the syntactic rules over the particular lexicon since it is the grammatical rules that dictate (rather than describe) the way objects can be placed and arranged. In support of this approach, the UCL group has completed many research projects demonstrating that building processes seemingly autonomously aggregate into well-formed global patterns over time.

Near Right: Space Syntax analysis of current pedestrian activity in Trafalgar Square, London. (Source: Space Syntax Limited, 2006)

Far Right: Photo of new central staircase at Trafalgar Square, London. (Source: Space Syntax Limited, 2006)



Based on their syntactic analysis, Hillier's group postulates that spatial form is governed in part by historical development and in part by immnent, invariant spatial laws. Several examples of these laws that seem to apply across cultural settings and settlement scales have already been published. For example, researchers have uncovered mathematical patterns in relative street lengths, intersection patterns, and block sizes that are globally consistent and logarithmically normalized across settlement sizes. Although the exact nature and causes of these spatial laws are still being clarified, Hillier (2001) suggests they operate through socio-cultural factors in less developed areas and through micro-economic factors in more fully developed settings. Additionally, research groups have already begun developing micro-scale quantitative adjustment techniques to explain local variations and cultural texturing.

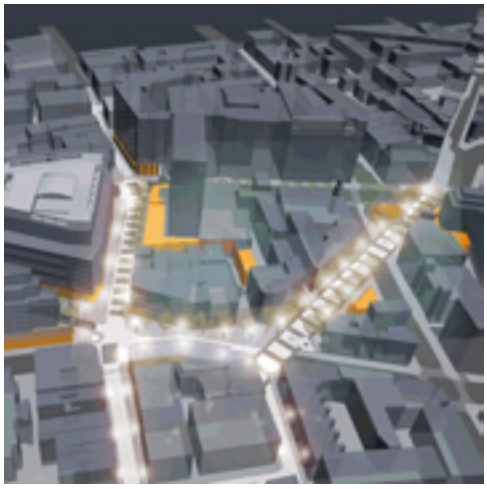
Early successes demonstrate that, by quantifying street networks based on the number of turns and connecting streets, researchers can accurately predict movement patters in a wide range of urban typologies and geographical areas. The strong correlation between urban grid patterns and associated movement flows counters standard planning assumptions that movement is purposive and guided by the actor's perfect knowledge of the available options. Based on empirical analysis, the "random next-step" rule that predicts movement based on immediate visual cues proved to be a stronger predictor of pedestrian traffic flow than other expected factors, such as the traveler's origin, destination, or personal preferences. A further round of empirical research confirmed that, as a result of the preeminence of visual sight lines, the number of turns and cross-sections in a street grid is a better indicator of movement flow and social vitality than distance or destination measures.

The Space Syntax Laboratory has developed mapping analysis software that incorporates their emerging knowledge of spatial laws into an urban analysis tool for industry use. The software generates an axial algorithm of actual urban street networks by drawing sight lines through open urban spaces. Since visual cues are paramount, the longest lines possible are mapped first and the shorter lines follow. The resulting axial map is then quantified to express how well particular streets are integrated into the overall urban grid. Hillier's publications provide detailed descriptions of the software's mathematical processes and justifications.

Propelled by early successes and rising demand, the UCL Space Syntax group formed the spin-of consulting company Space Syntax Limited. According to their business platform, this London-based organization hopes to act as a "conduit between the academic world of fundamental research and the industrial world of architectural practice" (Space Syntax website, Academic Background). Consultants collaborate on building and urban planning projects and operate an educational outreach program.

As a central business premise, the group uses its pedestrian forecasts to analyze the "livability of cities" with special emphasis on crime mitigation, market analysis, and social desegregation. As projects are completed, Space Syntax Limited professionals feed their work back to the UCL Space Syntax Laboratory as fodder for further research and development.

Space Syntax Limited has documented many of its completed projects for marketing purposes. For instance, in 1996, Space Syntax Limited collaborated with the Westminster City Council and the Greater London Authority on a master plan for central London's Trafalgar Square. The Square, "although of supreme historic importance,



Left: Space Syntax movement analysis at Princes Circus. (Source: Space Syntax Limited, 2006)

Below Left: Space Syntax aerial view looking South from the British Museum towards Covent Garden. (Source: Space Syntax Limited, 2006)

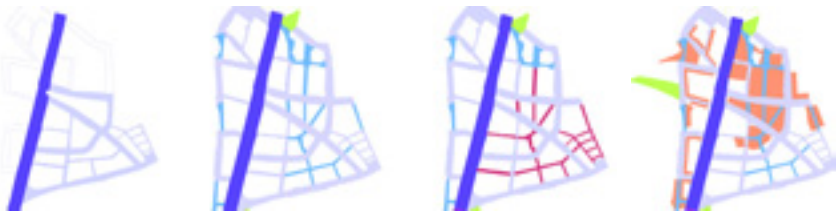
Below Right: Spatial integration analysis exploring urban connectivity. (Source: Space Syntax Limited, 2006)

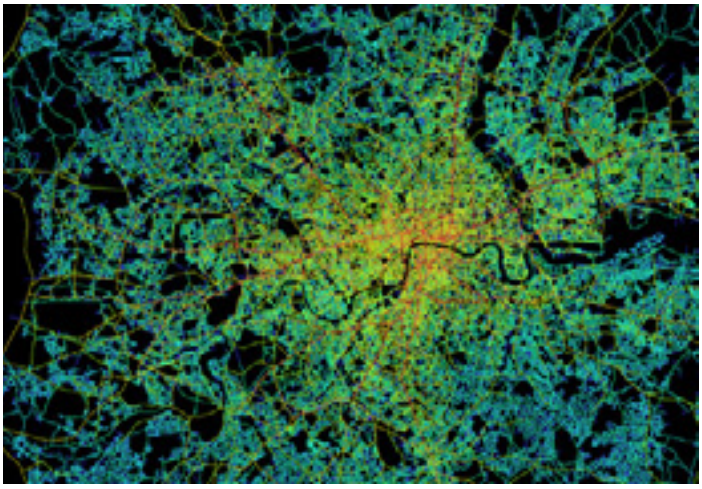
was perceived to be unpleasant, unsafe, and dominated by traffic." Using syntax software, the group analyzed pedestrian circulation routes and identified problem areas. They then collaborated with planners to simulate the effects of various redevelopment scenarios. Redevelopment began in 2003 and, according to Space Syntax Limited, tourist and resident pedestrian movement levels have since increased by thirteen times.

As another example, the London Local Authority retained the Space Syntax team to suggest innovative redevelopment strategies to encourage more commercial investment in Brixton, a dynamic but persistently troubled South London neighborhood. The Space Syntax group's pedestrian modeling study revealed highly uneven circulation patterns creating congestion problems along some corridors and contributing to high crime rates in more isolated areas. Based on their analysis, it was recommended that modifications to the urban street grid be made in order to create more evenly distributed circulation patterns and thereby "unlock the area's investment potential".

The Space Syntax group also collaborated with the Camden Council on the Princes Circus project to mitigate dangerous vehicular-pedestrian intersections connecting Covent Garden and the British Museum. Using syntax software, the group identified spatial configurations contributing to aggressive vehicular traffic and confusing pedestrian crossings. These obstacles discouraged foot travel, undermined local economic activity, and encouraged anti-social activities. Syntax professionals reconfigured traffic routes and landscaping strategies in order to buffer pedestrians from vehicular flows and to establish clearer visual cues orienting the pedestrian environment.

Space Syntax Limited has two major projects currently on the boards. As part of a larger UCL research initiative, the group is compiling a London Pedestrian Routemap to encourage walking in London "by providing a simple, memorable picture of key walking routes" and by identifying strategic improvements needed to facilitate increased foot travel. The group is also currently working with the London Borough of Southwark to "develop design proposals for a major, mixed-use development in one of London's most blighted urban centres" (Space Syntax, 2004).





Above Left: Space Syntax plan development strategy analyzing connectivity improvements at Brixton, London. (Source: Space Syntax Limited, 2006)

Above Right: Illustrative sketch of the Civic Square, Elephant and Castle, London. (Source: Space Syntax Limited, 2006)

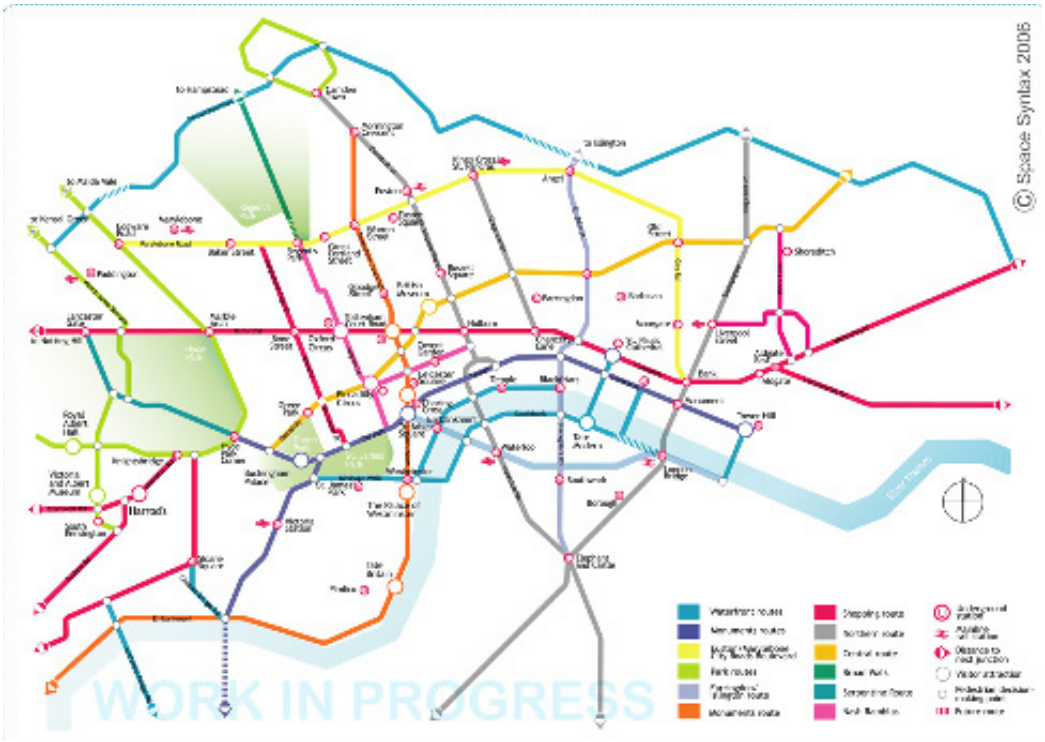
Left: Greater London, Spatial Accessibility Model. (Source: Space Syntax Limited, 2006)

As design scenarios are developed, the group reviews the alternatives and suggests alternative strategies that can help the new development integrate more effectively with neighboring commercial and civic activities.

Around the globe, Space Syntax Limited professionals have consulted on a wide range of projects in a range of fields including archaeology, information technology, urban and human geography, and anthropology. Since 2001, Space Syntax Limited has also opened offices in Sydney, Brussels, Stockholm, South Africa, and the United States. The United States branch was founded in 2006, is located in Cambridge, Massachusetts, and is headed by Noah Raford, who also works as a Research Scientist at MIT's Laboratory for Mobile Learning.

Despite scientific advancements and growing industrial applications, the Space Syntax strategy is not without controversy, especially in academic circles. The simplified axial map used as the cornerstone of syntactical analysis is based exclusively on the way streets connect with each other. These maps assigns all streets equal loading, which is to say the analytical software assumes all streets are characterized by equal building densities, transit access, road widths, sidewalk conditions, and land use. In their defense, researchers have amassed some evidence that these excluded conditions coincide with certain street configuration patterns. Nonetheless, the syntax modeling process frequently requires data "fixes" in order to more accurately reflect real-world increased traffic rates in retail areas as well as pattern anomalies resulting from unique social, economic, or technical development considerations. Additional "fixes" are required where height changes and local texturing provides visual cues that are perceived by pedestrians on the ground but which are nonetheless indecipherable in the two dimensional mapping surface. Although these fixes are not inherently problematic, the process is highly arbitrary and runs the risk of post-rationalization.

These theoretical challenges are compounded by data inconsistencies that result from the analytical process itself. Producing the axial map is not an innocent procedure. Depending on the way the boundaries are defined, the local picture may vary dramatically. Similarly, since axial lines reflect straight-line visibility paths, very slight



Left: A Space Syntax concept image for a user-friendly pedestrian map of London, based on a network of key routes, some existing and some with future potentials. (Source: Space Syntax Limited, 2006)

changes in street angle result in dramatic shifts in modeling output that do not coincide with the more graduated empirical reality. Additionally, in certain cases, assumptions about travel direction change circulation predictions in ways that make the software's output self-contradictory. Moreover, since the mathematical process quantifies street relations based on changes in direction without regard to travel distance, destinations that require two turns are treated identically whether the destination is around the corner or miles away thus resulting in inaccurate pedestrian flow predictions. Lastly, since the morphic language expresses only internal logic, the syntactical models of different cities have to be normalized through a highly arbitrary process before they can be compared with each other.

Despite growing successes, these challenges continue to plague Space Syntax researchers working to bring their computer-generated predictions closer in line with actual urban forms and empirical circulation counts. Researchers hope that advances in mathematical procedures and computer technology will overcome many of these shortcomings. Nonetheless, many academics remain skeptical that any such analysis can effectively measure cognitive and experiential understandings of urban form. Furthermore, although the Space Syntax tool may serve a valuable predictive function, its use as a prescriptive strategy remains highly controversial.

Keeping the cautionary principles in mind, the ALMONO redevelopment initiative could nonetheless benefit from the syntax software's analytical and predictive strengths. Since the site is large, highly undeveloped, and extremely isolated, planners are less able to rely on normal contextual cues when devising quantitative and qualitative circulation strategies. Syntactical analysis can provide valuable feedback during the planning process, checking layout scenarios for trouble intersections and segregated areas. Such feedback would be especially useful to predict how well the new development will integrate and engage with the existing Hazelwood community.

Despite these many potential benefits, syntactical analysis would also introduce new challenges to the redevelopment process. To ensure accurate predictions, planners must first generate an accurate axial map of adequate scope and boundary definition. Similarly, while such analysis could help gauge benefits to neighboring communities, the site's empty slate largely defeats the central purpose of the pattern recognition process. The lack of existing patterning makes it more likely that the software might be misused in a prescriptive rather than a predictive manner. Planners may also have some difficulty integrating syntax software and plug-ins with their standard software toolkits. Since syntax software is still in a developmental stage, not all standard software packages are accommodated and not all plug-ins are consistent or reliable.

INDEX

Criterion Planners, Inc.
725 NW Flanders Street, Suite 303
Portland, OR 97209-3539
www.crit.com

> *"Criterion is an urban and regional planning firm specializing in sustainable community development. Established in 1979, the firm has become a nationally-recognized leader in formulating strategies and tools that help achieve environmental quality, economic prosperity, and community livability. From integrated land-use and transportation planning to wastewater recycling, Criterion's experience and commitment is focused on resource solutions that are both innovative and practical."*
>
> *- Criterion Planners website, June 2007*

Criterion Planners, a Portland-based firm founded in 1979, develops planning support systems for communities, including software tools for land-use, transportation, and environmental analysis. In 1994, the company released the GIS-based INDEX software package for land-use and transportation planning. According to INDEX literature, the software "support[s] the entire process of community planning and development" and can be can be "used to benchmark existing conditions, create alternative scenarios, evaluate alternatives, and monitor change over time". The program uses a number of built-in indicators, or yardstick measures that quantify performance in different areas, in order to quantitatively evaluate existing conditions and compare possible development scenarios. The 80 indicators cover both physical planning and policy-related issues that quantify demographics, land-use, housing, employment, recreation, environment, and travel. The software tries to assure quantitative consistency so that different projects and cities can be directly compared against each other or against known benchmarks. Since its inception, the INDEX package has been registered with over 150 organizations in 35 states, including the Southwestern Pennsylvania Commission for Regional Growth Planning.

The INDEX package includes a community process feature intended to facilitate public participation in planning processes. The program can be operated "on-the-fly" to facilitate real-time modeling processes at public meetings and working sessions. More significantly, the software can be hosted on a publicly accessible and user-friendly website that allows concerned citizens to review and modify proposed planning features. To make the data more accessible, the INDEX software generates charts, graphs, and

3D images in addition to the standard 2D maps. The goal of these measures is to allow planners to collaboratively generate development scenarios embodying stakeholder values and priorities and to evaluate the alternative courses of action based on community goals.

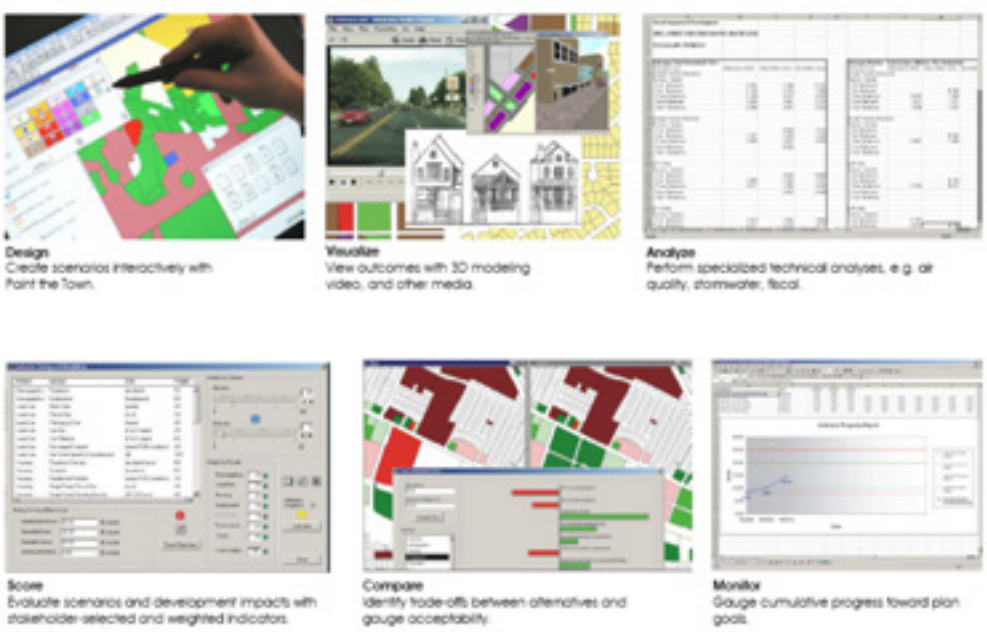
Criterion Planners has collaborated with the U.S. Green Building Council (USGBC) and U.S. Environmental Protection Agency (EPA) to customize their INDEX planning software to support "smart growth" sustainable planning.

The USGBC hired Criterion Planners as a consultant and certification reviewer for their Leadership in Energy and Environmental Design program in Neighborhood Development (LEED-ND). Criterion personnel provided technical assistance during the program's development phase on issues related to land-use patterns, neighborhood design, and related technologies. INDEX indicators already reflected many of the LEED-ND sustainability measures and have since been further customized and tested for particular project typologies and locales. Criterion is also a primary certification reviewer for the LEED-ND program. In this capacity, Criterion personnel will be reviewing data and confirming reports submitted by for specific projects requesting certification.

Criterion's interaction with the EPA has been even more extensive. The EPA has been exploring and promoting "Smart Growth" strategies since the mid-1990s and, in 2000, began working with Criterion to develop an analytical tool able to "quantitatively demonstrate the environmental, transportation, and quality-of-life benefits of smart growth projects". The resulting Smart Growth INDEX (SGI) package is a GIS-based "sketch" tool that simulates the environmental effects of land-use and transportation patterns. The program provides quick, order-

Previous Page: INDEX computer generated map showing prioritized pedestrian intersection improvements for Sacramento, California. (Source: Criterion Planners, 2004)

Right: Basic INDEX application steps. (Source: Criterion Planners, 2004)



of-magnitude feedback on "what if" scenarios. Although these "sketch" applications do not replace subsequent more intensive analysis, this approach can provide on demand feedback for working sessions and community meetings and, as such, can help a diverse group easily understand the general implications of design decisions and weigh the rough values of possible alternatives.

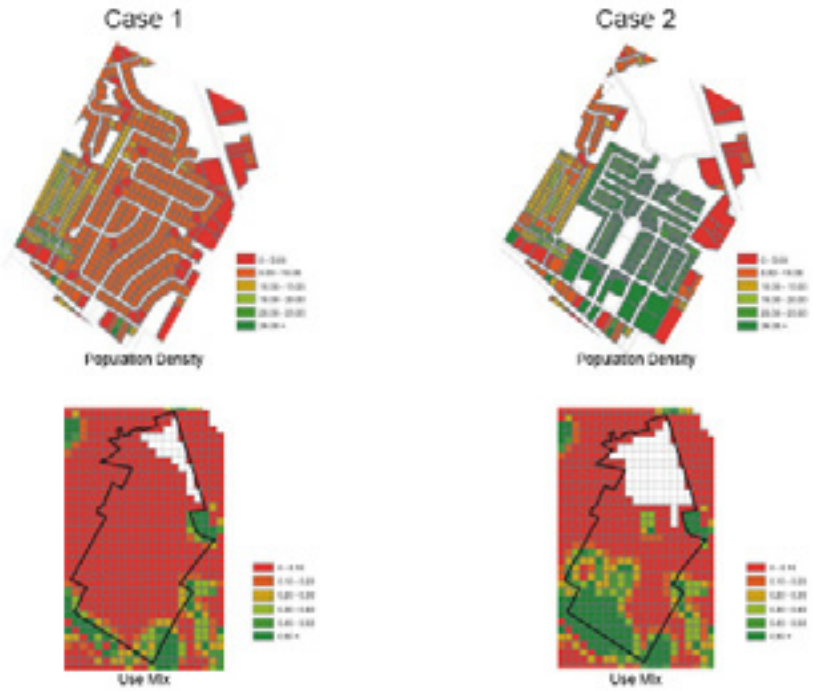
In its sketch application, SGI software can benchmark existing environmental and community conditions and then compare the benchmarks against various user-defined alternative scenarios. Compared to the standard INDEX software, the SGI program gives added emphasis to "Smart Growth" indicators such as land consumption, pollutant emissions and other environmental consequences, housing and employment density, proximity to transit, and travel costs. The program has been tested in small- and large-scale planning contexts and generates environmental and community impact reports using simple and easily understood graphics and 3D images.

In 2000, the EPA completed its first pilot program testing the SGI software in real-world redevelopment projects. The software was licensed to 20 organizations nationwide. To receive the license, organizations had to demonstrate that their "planned project could achieve environmental benefits through smart growth approaches" and the "potential for a 'win-win' development outcome". With these caveats in place, each project was monitored to test the feasibility, benefits, and shortfalls of the SGI software. According to the EPA, results were largely positive. Criterion has since developed a new version of SGI to better suit the EPA's Smart Growth agenda.

Criterion Planners and the EPA both publish INDEX-related case studies online, several of which suggest ways that INDEX software might be useful in the ALMONO redevelopment initiative.

The Wilmington Area Planning Council (WILMAPCO) used the SGI software for a brownfield remediation project in 2000. Wilmington, Delaware, is an older industrial port city with a burgeoning suburban perimeter in a traditionally rural landscape. WILMAPCO generated three redevelopment scenarios with varying land use patterns and build-out densities and then used the SGI software to compare the environmental and transportation implications of each scenario. WILMAPCO also used the software to garner public support for redevelopment during a multi-day design charrette and a series of public outreach meetings.

The Boston Metropolitan Area Planning Council (MAPC) used the SGI software as part of the Hudson stakeholder initiative "I-495 Technology Corridor Initiative/Campaign for Shared Solutions". Hudson is 40 miles outside of Boston, along the I-495 corridor, and has been experiencing rapid residential and high-tech commercial growth, accompanied by increasing traffic congestion and instability within the existing community. MAPC used SGI software to evaluate two development proposals, one that would expand an existing Intel Corporation complex



Above: Indicator Mapping using INDEX. (Source: Criterion Planners, 2004)

Right: INDEX computer generated images illustrating phased infil development for Edgemoor , Delaware. (Source: Wilmapco, 2003: 5)

Infill development on strip shopping center site. Source: www.jointventure.org

to accommodate an additional 2,000 plus employees, and another to develop 150 new residential condominiums. MAPC used SGI output to compare the proposals' associated land use and transportation implications and to generate visual graphics for public distribution.

In South Weymouth, Massachusetts, architects from SMWM and developers from the Lennar Corporation collaborated with the EPA on a project to redevelop a former 1,450-acre military base. Working collaboratively, the group used SGI software to compare the effects of seven redevelopment scenarios on wetland preservation and transit orientation. Each scenario reflected a discrete design approach (main street, transit-oriented, village, etc.), use mixtures, and development densities. Focusing on two goals, wetlands preservation and transit orientation, planners were able to quantitatively compare the scenarios based on SGI's predicted implications for demographics, land-use, housing, employment, recreation, environment, and travel.

The INDEX package, and especially its Smart Growth variant, may be a useful design tool for the ALMONO developers. The program's demonstrated success in facilitating public participation and predicting ecological performance reinforce ALMONO's socially and environmental goals. The technological aspect also plays nicely into Pittsburgh's more general push to establish the region as technologically savvy. Even if the program's use was restricted to the analytical or academic planning aspects, the project would nonetheless provide a valuable test case for INDEX applicability in the region, demonstrating its shortcomings and providing a feedback loop to the software developers. Since INDEX personnel are already on the Remaking Cities Institute board of directors, student researchers may be able to gain relatively easy access to the software. Despite these benefits, software use does involve a learning curve. While the software can provide valuable planning feedback, the data input process can be cumbersome.

References

Pittsburgh, Pennsylvania. The Hard Facts… and the Reasons for Hope

_____. (2007, April 30). Fortune 500: Cities with Five or More Fortune 500 Headquarters. Fortune. Retrieved June 21, 2007, from http://money.cnn.com/magazines/fortune/fortune500/2007/cities/

_____. (2005). Coca Cof ee Lounge. Pop City Media. Retrieved August 1, 2007, from http://www.popcitymedia.com/neighborhoods/eatanddrink/cocacafe.aspx

About.com. (n. d.). Pittsburgh, PA. Retrieved June 1, 2007, from http://pittsburgh.about.com/

Allegheny County. (n. d.). Municipality Map. Retrieved July 25, 2007, from http://www.alleghenycounty.us/munimap/index.asp

Battelle Technology Partnership Practice. (2004). Advancing Southwestern Pennsylvania's Economic Future: The R&D Space Puzzle. Pittsburgh, PA: The Allegheny Conference on Community Development

Burchfield, M., Overman, H., Puga, D., and Turner, M. (2005). Causes of sprawl: A portrait from space. Quarterly Journal of Economics, 121(2): 587-633. Retrieved June 27, 2007, from http://ideas.repec.org/a/tpr/qjecon/v121y2006i2p587-633.html

Cortright, J. (2006). CityVitals: The Formula for Urban Success. Chicago, IL: CEOs for Cities. Retrieved July 9, 2007, from http://pimaculturalplan.org/pcc/pdfs/CityVitals.pdf

Fitzpatrick, D. (2007, July 23). Former CMU Prof Florida Leaves U.S. for University of Toronto. Pittsburgh Post-Gazette. Retrieved July 23, 2007, from http://www.post-gazette.com/pg/07197/802112-100.stm

Frazier, R. (2007, June 27). The Bonding of BioBuds. Pop City Media. Retrieved June 21, 2007, from http://www.popcitymedia.com/features/0627biobuds.aspx

Gradeck, B. (2003, November). The Root of Pittsburgh's Population Drain. Pittsburgh, PA: Centre for Economic Development, Heinz School of Public Policy and Management, Carnegie Mellon University. Retrieved July 7, 2007, from www.smartpolicy.org/pdf/pop_drain.pdf

Impact Economics, LP, Tripp, Umbach & Associates, and Perkins Eastman. (2003). Mon Valley Economic Development Strategy. Retrieved July 3, 2007, from http://www.monvalleystrategy.com/main.htm

King, B. (2006, August 15). 2006 Mayor's Challenge: Where Are the Best Metros for Future Business Locations? Expansion Management Magazine. Retrieved June 19, 2007, from http://www.expansionmanagement.com/smo/newsviewer/default.asp?cmd=articledetail&articleid=17713&st=3

Komninos, N. (2002). Intelligent Cities: Innovation, Knowledge Systems and Digital Spaces. New York: Spon Press.

Kulturstiftung des Bundes. (N. d.). Shrinking Cities. About Us. Retrieved June 27, 2007, from http://www.shrinkingcities.com/ueberuns.0.html

Kulturstiftung des Bundes. (2007). Shrinking Cities. Retrieved June 27, from http://www.kulturstiftung-des-bundes.de/main.jsp?applicationID=203&articleID=158&languageID=2

Paytas, J., Andrews, L. and Haakensen, A. (2004, April). Sinking Ships: Municipalities in Fiscal Distress. Pittsburgh, PA: Center for Economic Development, Heinz School of Public Policy and Management, Carnegie Mellon University. Retrieved July 07, from http://www.smartpolicy.org/pdf/sinking.pdf

Steins, C. (2007, May 7). Almanac Publishes New List of 'Most Livable' Cities. Planetizen. Retrieved July 9, 2007, from http://www.planetizen.com/node/24318

Takemoto, N. and Lydon, M. (2006, November 13). How Cities Compete In The Media Economy. Planetizen. Retrieved July 9, 2007, from http://www.planetizen.com/node/21866

The Brookings Institute. (2006, August). Pittsburgh, PA MSA. Retrieved June 27, 2007, from http://www.brookings.edu/metro/pubs/20060810_Pittsburgh.pdf

Wong, P., Yeo, B., and DeVol, R. (2006, November). Pittsburgh Technology Strategy. Milken Institute. Retrieved June 2, 2007, from http://www.milkeninstitute.org/publications/publications.taf?function=detail&ID=585&cat=PBriefs

WQED Pittsburgh. (2000). WQED Multimedia, Pittsburgh History Series Teachers Guide. Retrieved June 1, 2007, from http://www.wqed.org/ecrc/pghist/

U.S. Department of Transportation. (n. d.). Pittsburgh, PA MSA graphic. Retrieved August 1, 2007, from http://www.fhwa.dot.gov/ctpp/jtw/profile72.jpg

Project Stakeholders. Owners, Institutions, Community Organizations, and Research Groups

Blueroof Technologies. (2006, February 21). Retrieved May 14, 2007, from http://www.bluerooftechnologies.com/

Carnegie Mellon (n. d.). Retrieved July 26, 2007, from http://www.cmu.edu

Carnegie Mellon, Center for Economic Development. (n. d.). Retrieved July 26, 2007, from http://www.smartpolicy.org/index.php

Carnegie Mellon, Department of Architecture. (n. d.). Retrieved July 26, 2007, from http://www.arc.cmu.edu/

Carnegie Mellon, Entertainment Technology Center. (n. d.) Retrieved July 26, 2006, from http://www.etc.cmu.edu

Carnegie Mellon, Heinz School of Public Policy and Management. (n. d.). Retrieved July 26, 2007, from http://www.heinz.cmu.edu/

Carnegie Mellon, Quality of Life Technology Center. (n. d.). Retrieved July 26, 2007, from http://www.qolt.org

Claude Worthington Benedum Foundation. (n. d.). Retrieved July 26, 2007, from http://www.benedum.org

Commonwealth of Pennsylvania, Department of Environmental Protection. (2006, February 9). Governor Rendell Announces $1 Million Grant to Spur Development, Create 1,600 Jobs on Pittsburgh's East Side.. Retrieved June 18, 2007, from http://www.depweb.state.pa.us/news/cwp/view.asp?a=3&q=518465

Commonwealth of Pennsylvania, Department of Environmental Protection. (1997, July 11). Ridge Administration Awards Grants for Cleanup Projects. Commonwealth of Pennsylvania. Retrieved June 18, 2007, from http://www.dep.state.pa.us/dep/DEPUTATE/POLYCOMM/UPDATE/07-11-97/071197u6.htm

Community College of Allegheny County. (2003, June 10). CCAC dean named to RIDC Board of Directors [Press Release]. Retrieved June 18, 2007, from http://www.ccac.edu/default.aspx?id=146030

DaParma, R. (2003, 17 April). Robinson to retire as RIDC president. Pittsburgh Tribute-Review. Retrieved June 18, 2007, from

http//:www.pittsburghlive.com/x/pittsburghtrib/s_129671.html
Emerging Solutions, Inc. (2005). Case Study: The Collaborative Innovation Center at Carnegie Mellon University, Pittsburgh, Pennsylvania. Retrieved June 18, 2007, from http://images.autodesk.com/adsk/files/Carnegie_screen.pdf
Fraser, J. (2004). Philanthropic Field. h Magazine, 4(4): 20-27. Retrieved April 25, 2007, from the Community-Wealth.org Website: http://www.community-wealth.org/_pdfs/articles-publications/pris/article-fraser.pdf
Greene, J. (2005). Image of Schenley Plaza. Retrieved August 1, 2007, from Pop City Media Website: http://www.popcitymedia.com/features/25schenleypark.aspx
Heinz Endowments. (n. d.). Retrieved July 26, 2007, from http://www.heinz.org
McCune Foundation. (n. d.). Retrieved July 26, 2007, from http://www.mccune.org
Oakland Task Force. (n. d.). Retrieved July 26, 2007, from http://www.oaklandtaskforce.org
Pennsylvania Biotechnology Association. (2007). Retrieved June 18, 2007, from http://www.pennsylvaniabio.org
Pittsburgh Business Times. (2002, 19 July). RIDC gets state loan for Lawrenceville Technology Center. Pittsburgh Business Times. Retrieved June 18, 2007, from http://www.bizjournals.com/pittsburgh/stories/2002/07/15/daily47.html
Pittsburgh Technology Council. (2007). About Us/Alliances. Retrieved June 18, 2007, from http://www.pghtech.org/AboutUs/alliances.asp
Putaro , S. & Weisbrod, K. (1998). Washington's Landing: Site Information. Retrieved June 18, 2007, from Carnegie Mellon University, Department of Civil and Environmental Engineering Website: http://www.ce.cmu.edu/Brownfields/NSF/sites/Washland/INFO.htm>
Regional Industrial Development Corporation. (n. d.) Retrieved May 1, 2007, from http://www.ridc.org
RWTH Aachen University. (2004). Aerial image of CMU campus. Retrieved August 7, 2007, from http://www.lpt.rwth-aachen.de/Teaching/exchange.php
Richard King Mellon Foundation. (n. d.) Retrieved July 26, 2006, from http://www.foundationcenter.org/grantmaker/rkmellon
Robot City. (n. d.) Retrieved July 26, 2006, from http://www.robotcity.org
Robotics Institute. (n. d.) Retrieved July 26, 2006, from http://www.ri.cmu.edu
Ruttenberg, L. & Chaffin, J. (2003, November). On the Cutting Edge: New American Textile Company facility indicates trends. TEQ Magazine. Retrieved June 18, 2007, from the Pittsburgh Technology Council Website: http://news.pghtech.org/teq/teqstory.cfm?id=1115
University of Pittsburgh. (n. d.) Retrieved July 26, 2006, from http://www.pitt.edu
University of Pittsburgh. (2007). Fact Book 2007. Retrieved June 18, 2007, from http://www.ir.pitt.edu/factbook/index.htm
University of Pittsburgh. (2005, March 24). News. Retrieved May 14, 2007, from http://mac10.umc.pitt.edu/m/FMPro?-db=m&-lay=a&-format=r.htm&-find
University of Pittsburgh, Community Outreach Partnership Center. (n. d.). Retrieved July 26, 2007, from http://www.pitt.edu/~copc
University of Pittsburgh, Department of Anesthesiology. (2005). Image of UPMC and Oakland. Retrieved August 1, 2007, from University of Pittsburgh Website: http://www.anes.upmc.edu/Archive/aboutus/missionstatement.html
University of Pittsburgh, Department of Psychiatry. (n. d.). Image of Cathedral of Learning. Retrieved August 1, 2007, from University of Pittsburgh Website: http://www.wpic.pitt.edu/education/residency_training/Residency_Training_videos.htm
University of Pittsburgh Medical Center. (n. d.) Retrieved July 26, 2006, from http://www.upmc.com
University of Pittsburgh Partnership. (2007). Retrieved June 18, 2007, from http://www.universitypartnership.com
University of Pittsburgh Medical Center. (2006). UPMC 2006 Annual Report. Retrieved June 18, 2007, from http://www.upmc.com/Pdf/AnnualReport.pdf
Urban Redevelopment Authority of Pittsburgh. (n. d.). Showcase Projects: Pittsburgh Technology Center. Retrieved June 18, 2007, from http://www.ura.org/showcaseProjects_techCenter3.html
Urban Design Associates. (2003), Conceptual Master Plan for LTV Site. Pittsburgh, PA: Urban Design Associates.
Wausau. (2006). Image of Carnegie Mellon University. Retrieved August 1, 2007, from http://www.wausauwindow.com/images/galleryLg/Carnegie-Mellon.jpg
Zylstra, S. (2006, November). Solving the Paradox: Greater Oakland KIZ to take leadership role in growing the region's technology industry. TEQ Magazine. Retrieved June 18, 2007, from the Pittsburgh Technology Council Website: http://news.pghtech.org/teq
Zylstra, S. (2005, Jan/Feb). Harnessing Innovation: The New Greater-Oakland KIZ Aligns Resources to Strengthen Both Pittsburgh and the Region's Technology Industry. TEQ Magazine. Retrieved June 18, 2007, from the Pittsburgh Technology Council Website: http://news.pghtech.org/teq/teqstory.cfm?id=1297>

Pittsburgh Socio-Geography. Regional Context and Development History

_____. (2001). Hazelwood: Making New Connections. Pittsburgh, PA: University of Pittsburgh, Graduate School of Public and International Affairs.
Aurand, A. (2003). Hazelwood Housing Study Supplement. Pittsburgh, PA: University of University of Pittsburgh, Community Outreach Partnership Center.
Albert, J. and Goto, R. (2004). History of Pittsburgh's Riverfronts. Urban Watersheds/Water Quality in Allegheny County Ecology and Environmental Education Report. Pittsburgh, PA: 3 Rivers 2nd Nature, STUDIO for Creative Inquiry, Carnegie Mellon University.
Allegheny Trail Alliance. (2006). Map 1: Pittsburgh, Homestead. Retrieved June 2, 2007, from http://www.atatrail.org/maps/map1.cfm
Aurand, A., Beres, J. and Hwang, S. (2001). Hazelwood Housing Study. Pittsburgh, PA: University of Pittsburgh, Community Outreach Partnership Center.
Barron, J. (2007, April 11). $1.4M Hazelwood Homes project to start this spring. Pop City Media. Retrieved July 02, 2007, from http://www.popcitymedia.com/developmentnews/56hzwd1970.aspx
Calthorpe Associates, Burt, Hill and Forest City. (2007, April 10).

Hazelwood Redevelopment: Reconnecting to the River [Unpublished].
Conant, B. (2006). Bridges on the Monongahela River (Pittsburgh). Retrieved July 31, 2007, from http://pittsburgh.about.com/gi/dynamic/of site.htm?site=http://www.pbase.com/image/404850
Kussart, S. (1925). The Early History of the Fifteenth Ward of the City of Pittsburgh [Electronic Version]. Bellevue (Pittsburgh), PA.: Suburban Printing Company. Retrieved May 4, 2007, from http://ftp.rootsweb.com/pub/usgenweb/pa/allegheny/history/local/
Lubove, R. (1969). Twentieth Century Pittsburgh. New York: John Wiley and Sons.
Moxley, S. (n. d.). From Rivers to Lakes: Engineering Pittsburgh's Three Rivers. Retrieved July 16, 2007, from the Carnegie Mellon, STUDIO for Creative Inquiry Website: http://3r2n.cfa.cmu.edu/history/engineer/index.htm
Pittsburgh International Airport. (2007). Retrieved June 18, 2007, from http://www.flypittsburgh.com/AboutUsServlet?option=pit_background
Tagg, J. P. (n. d.). The Geological History of Pittsburgh. Retrieved August 2, 2007, from the University of Pittsburgh Website: http://www.geology.pitt.edu/PAgeo/mappag.html
Tarr, J. (n. d.). Pittsburgh's Environmental History. Pittsburgh Green Story online. Retrieved July 1, 2007, from www.pittsburghgreenstory.org/html/history.html
Tarr, J. (2002). The Metabolism of the Industrial City. Journal of Urban History, 28(5): 511-45.
Tarr, J. and Di Pasquale, D. (1982) The Mill Town in the Industrial City: Pittsburgh's Hazelwood. Urbanism Past and Present, 7(1): 1-14.
Ulrich, C, Soska, T., and Richter, J. (2005). Hazelwood Community Asset Map: Assessing the Services, Needs, and Strengths of Hazelwood's Community Service Providers. Pittsburgh, PA: University of Pittsburgh, Community Outreach Partnership Center.
University of Pittsburgh, Digital Research Library. (n. d.). Historic Pittsburgh Image and Maps Collections. Retrieved May, June and July, 2007, from http://digital.library.pitt.edu/pittsburgh/
University of Pittsburgh, Pitt Digital Library. (n. d.). Historic Pittsburgh Image Collections: Frederick T. Gretton Collection, J&L Steel Corporation Collection (HSWP), and Pittsburgh City Photographer (ASP). Retrieved June, 2007, from http://www.library.pitt.edu/articles/digpubtype/images.html
U.S. Census Bureau. (2007). Metropolitan and Micropolitan Statistical Areas. Retrieved July 18, 2007, from http://www.census.gov/population/www/estimates/metroarea.html

Hazelwood: Current Conditions. Site Overview and Community Context

Armstrong, R. (n. d.). Image of Panther Hollow Lake. Retrieved May 16, 2007, from http://www.pittsburghneighborhoodtours.com/pr13/img/gallery_lg/oak/oak203j0516.jpg
City of Pittsburgh. (n. d.). City of Pittsburgh Maps. Retrieved May 18, 2007, from http://www.city.pittsburgh.pa.us/cp/html/neighborhood_map_list.html
City of Pittsburgh. (n. d.). Code of Ordinances. City of Pittsburgh, Pennsylvania. Retrieved May 19, 2007, from the Municode Webside: http://www.municode.com/resources/gateway.asp?sid=38&pid=13525
Collins, T., Kline, J., Vallianos, K., Fox, C. (2006). Ecology and Recovery. Allegheny County. Carnegie Mellon, STUDIO for Creative Inquiry. Pittsburgh, PA. Retrieved August 3, 2007, from http://3r2n.cfa.cmu.edu/policy/landUse/index.htm
Connect Greenfield. (2007). Retrieved May 4, 2007, from http://www.connectgreenfield.org
Hazelwood Initiative, Inc. (n. d.). Retrieved May 4, 2007, from http://www.hazelwoodhomepage.com/
Hazelwood Main Street. (n. d.). Community. Retrieved May 2, 2007, from http://www.hazelwoodmainstreet.org/community.html
Hazelwood Main Street. (n. d.). Financial Resources. Retrieved May 2, 2007, from http://www.hazelwoodmainstreet.org/finance.html
Hazelwood Main Street. (n. d.). Why Hazelwood Works for You. Retrieved May 2, 2007, from http://www.hazelwoodmainstreet.org/why.html
Historic Review Commission of Pittsburgh and the City of Pittsburgh Department of City Planning (2005, October). Designated Historic Buildings, Structures and Sites Located in the City of Pittsburgh. Retrieved May 20, 2007, from the City of Pittsburgh Website: http://www.city.pittsburgh.pa.us/cp/assets/historic_review_commission/05_Designated_Bldgs_and_Structures.pdf
Housing Authority of the City of Pittsburgh. (2003). Glen Hazel. Retrieved May 19, 2007, from http://www.hacp.org/housing/facilities.jsp?pageId=12700000000011052935924879 and from http://www.hacp.org/housing/facilities.jsp?pageId=12700000000011052935924874
Gradeck, B. (2007, June). Hazelwood Statistics [unpublished]. Carnegie Mellon, Heinz School of Public Policy and Management.
Grata, J. (2006, May 15). Hot metal span gets new life as link for trails. Pittsburgh Post-Gazette. Retrieved July 12, 2007, from http://www.post-gazette.com/pg/06135/690269-140.stm
Greenfield Organization. (2004). Retrieved May 4, 2007, from http://www.greenfieldorg.com
Grocholsky, B. (2007). Image of Junction Hollow. Field Robotics Center, Robotics Institute, Carnegie Mellon University.
GTECH Strategies Inc. (2007). Retrieved May 4, 2007, from http://www.gtechstrategies.com/team.htm
Oakland Planning and Development Corporation. (2007). Retrieved May 2, 2007, from http://www.oaklandplanning.org
Pittsburgh History and Landmarks Foundation. (n. d.) Retrieved April 20, 2007, from http://www.phlf.org/
Port Authority of Allegheny County. (n. d.). Retrieved June 16, 2007, from http://www.portauthority.org/paac/default.aspx
Regan, B. (2004). The Steps of Pittsburgh. Pittsburgh, PA: The Local History Company.
Rodgers, N. (n. d.) The Former LTV Coke Oven Plant Hazelwood, Pittsburgh Pennsylvania. Western Pennsylvania Brownfields Center. Retrieved April 20, 2007, from http://www.ce.cmu.edu/Brownfields/NSF/sites/hazelwood.htm
Tannler, A. (2003, January 19). Architecture with a dash of paprika: Titus de Bobula in Pittsburgh. Retrieved June 21, from the Pittsburgh History and Landmarks Foundation Website: http://wordpress.phlf.org/wordpress/?p=387
Ulrich, C., Soska, M. and Richter, J. (2005, December). Hazelwood Community Asset Map: Assessing the Services, Needs, and Strengths of Hazelwood's Community Service Providers. Retrieved May 11, 2007, from University of Pittsburgh, Com-

munity Outreach Partnership Center Website: http://www.pitt.edu/~copc/Hazelwood_Asset_Map.doc.
University of Pittsburgh. (n. d.). Historic Pittsburgh Image Collections, Digital Research Library, University of Pittsburgh. Retrieved May, June and July, 2007, from http://digital.library.pitt.edu/pittsburgh/
Wikipedia. (2007, June). Calvary Cemetery, Pittsburgh, Pennsylvania. Retrieved June 18, 2007, from http://en.wikipedia.org/wiki/Calvary_Cemetery,_Pittsburgh,_Pennsylvania
Young Preservationists Association of Pittsburgh. (2006). Unprotected Pittsburgh: Preservation Priorities & Resources for Preserving Pittsburgh's Historic Landmarks. Pittsburgh, PA: Young Preservationists Association of Pittsburgh. Retrieved June 17, 2007, from http://youngpreservationists.org/downloads.php?a=dl&fid=64

Hazelwood Planning Initiatives. Recent Plans and Future Developments

Battelle Technology Partnership Practice. (2004). Advancing Southwestern Pennsylvania's Economic Future: The R&D Space Puzzle. Prepared for the Allegheny Conference on Community Development.
Blueprint Communities. (n. d.). Appendix A: Demographics. Retrieved May 28, 2007, from http://www.blueprintcommunities.com/pa/locations/profiles/Appendix%20A-%20Greater%20Hazelwood%20FINAL.pdf
Blueprint Communities. (n. d.). Community Profile: Greater Hazelwood Area, City of Pittsburgh. Retrieved May 28, 2007, from http://www.blueprintcommunities.com/pa/locations/profiles/Greater%20Hazelwood%20FINAL.pdf
Citizens for Pennsylvania's Future (PennFuture). (2002). The Citizen's Plan: An Alternative to the Pennsylvania Turnpike Commission's Plan to complete the Mon-Fayette Toll Road. Retrieved May 18, 2007, from http://www.pennfuture.org/UserFiles/citizensplan_82702.pdf
City of Pittsburgh, Department of City Planning. (1998). The Riverfront Development Plan.
City of Pittsburgh Port Authority. (2006). Vision 20/20. Retrieved May 29, 2007, from http://www.portauthority.org/PAAC/News/TransportationStudies/2020Vision/tabid/313/Default.aspx
Friends of the Riverfront. (n. d.). Heritage Trail. Retrieved May 16, 2007, from http://www.friendsoftheriverfront.org/new_pages/heritage.htm
Goto, R., Lucas, V. and Pandazidou, M. (2000). Urban Water Sheds and Brownfields: Case Study: Nine Mile Run Watershed. Retrieved June 24, 2007, from the Carnegie Mellon, STUDIO for Creative Inquiry Website: http://3r2n.cfa.cmu.edu/education/index.html
Hillside Steering Committee. (2005, March). Opportunities for Hillside Protection. Final Report. City of Pittsburgh, Department of City Planning and the Allegheny Land Trust. Retrieved May 18, 2007, from http://www.city.pittsburgh.pa.us/cp/assets/05_opportunities_hillside_protection.pdf
Impact Economics, LP and Tripp, Umbach & Associates, Inc.and Perkins Eastman. (2004). Mon Valley Economic Development Strategy (MVEDS). Prepared for the Redevelopment Authority of Allegheny County. Retrieved June 2, 2007, from http://www.monvalleystrategy.com/main.htm
Loysen + Kreuthmeier Architects. (2005, January). Hazelwood Second Avenue Design Strategy
McCumber, M. Image of view from Observatory Hill. Retrieved August 3, 2007, from http://www.michaelmccumber.com/pictures/brief_2001-pittsburgh05/
Pennsylvania Turnpike Commission, 2005. PA Route 51 to I-376 – Welcome. Retrieved May 27, 2007, from http://www.paturnpike.com/MonFaySB/51to376/51to376.htm
Pittsburgh Parks Conservancy. (n. d.). Retrieved May 18, 2007, from http://www.pittsburghparks.org/
Saratoga Associates. (2001). Master Development Planning in Hazelwood and Junction Hollow.
The Steel Valley Trail Council. (n. d.). Map of the Steel Valley Trail. Retrieved August 1, 2007, from http://www.steelvalleytrail.org/trail.htm
Urban Design Associates. (2003, June). Conceptual Master Plan for LTV Site.
Urban Redevelopment Authority of Pittsburgh. (n. d.). Retrieved June 21, 2007, from http://www.ura.org/
Wong, P., Yeo, B., and DeVol, R. (2006, November). Pittsburgh Technology Strategy. Milken Institute. Retrieved June 2, 2007, from http://www.milkeninstitute.org/publications/publications.taf?function=detail&ID=585&cat=PBriefs

Sustainable Development Initiatives. Sustainable Development and Eco-Urban Planning

Andrews University. (2007). The Saucier Town Plan - Land Use/Master Plan. Retrieved August 3, 2007, from the Congress for New Urbanism Website: http://www.cnu.org/node/805
Ayers, Saint, Gross Architects & Planners. (2007). Long Beach Mississippi – Aerial. Retrieved August 3, 2007, from the Congress for New Urbanism Website: http://www.cnu.org/node/872
Bruner Foundation. (2006). 2003 Silver Medal. Providence River Relocation. Retrieved June 24, 2007, from http://www.brunerfoundation.org/rba/index.php?page=2003/river
Carnegie Mellon University. (2006). Congratulations! Retrieved May 8, 2007, from http://www.heinz.cmu.edu/whatsnew/archives/2004/congrats.html
City of Cincinnati, Community Development and Planning. (n. d.) City West. Retrieved June 24, 2007, from http://www.cincinnati-oh.gov/cdap/pages/-3850-/
Congress for New Urbanism. (2007). Retrieved June 24, 2007, from http://www.cnu.org/awards
Desfor, G. and Keil, R. (2004). Nature and the City. Tucson: University of Arizona Press.
Duany Plater-Zyberk & Company. (2005). SmartCode 6.5. Retrieved August 1, 2007, from Town Paper Publications Website: http://tndtownpaper.com/images/SmartCode6.5.pdf
East Baltimore Development, Inc. (n. d.). We're Building Baltimore's New EastSide! Retrieved June 24, 2007, from http://www.ebdi.org
Environmental Protection Agency. (2007). Combined Heat and Power Partnership. Retrieved June 4, 2007, from http://www.epa.gov/chp
Eurotowns. (n. d.). Sundsvall. Retrieved June 24, 2007, from http://www.eurotowns.org/?q=node/57
Farbstein, J., Axelrod, E., Shibley, R., Wener, R. (2003). Creative Community Building: 2003 Rudy Bruner Award for Urban Excellence. The Bruner Foundation. Retrieved July 26, 2007, from

http://www.brunerfoundation.org/rba/index.php?page=2003/book
Foss, A. (2005, May/June). Low Impact Development: An Alternative Approach to Site Design. Pas Memo, American Planning Association. Retrieved July 24, 2005, from the Partnership for Advancing Technology in Housing Website: http://www.pathnet.org
Fried, B. (n. d.). The Road Ahead: How context-sensitive solutions will change our streets. January 2004 Newsletter. Retrieved June 18, 2007, from the Project for Public Spaces Website: http://www.pps.org/info/newsletter/Jan2004/Jan2004_Feature
GE Energy. (2007). Trigeneration. Retrieved June 4, 2007, from http://www.gepower.com/prod_serv/products/recip_engines/en/cogen_systems/refrigeration.htm
Gillette, H. (2005). Camden After the Fall: Decline and Renewal in a Post-Industrial City. Philadelphia, PA: University of Pennsylvania Press.
Government of Massachusetts. (n. d.). Water Resource Management. Retrieved July 21, 2007, from http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-water-resourcehtml.html
Harvey, D. (1990). The Condition of Postmodernity. Cambridge, MA: Blackwell.
Hecht, R. (2006, November 15). Nine Mile Rebirth. h Magazine. Retrieved June 18, from the Heinz Endowments Website: http://www.heinz.org/UserFiles/Library/h-F06-9milerebirth.pdf
Helsingin Sanomat (2006, September 19). Comparison of Nordic cities shows Helsinki has worst gas emissions. Helsingin Sanomat. Retrieved June 4, 2007, from http://www.hs.fi/english/article/Comparison+of+Nordic+cities+shows+Helsinki+has+worst+gas+emissions/1135221731560
Helsinki Virtual Village. (n. d.). Retrieved June 12, 2007, from http://www.helsinkivirtualvillage.fi/Resource.phx/adc/inenglish/index.htx
Japan Guide Online. (n. d.) Canal City Hakata. Retrieved July 26, 2007 from http://www.japan-guide.com/e/e4800.html
Klein, M. and Greer, K. (2006). "America's Finest City" Locates Potential Growth Areas with GIS Smart Growth in San Diego, California. ArcNews. Retrieved August 3, 2007, from ESRI Website: http://www.esri.com/news/arcnews/fall06articles/smart-growth.html
LaQuatra, J. and Bonci, F. (2001). Slag Heap No More. Urban Land, 60(7): 32.
Low Impact Development Center. (n. d.). Retrieved July 26, 2007, from www.lowimpactdevelopment.org
Markus, H. S. (n. d.). Retrieved June 18, 2007, from the Transit Oriented Development Advocate Website: http://todadvocate.com
Martine, M. (2007). North Branch of the Winooski River. Retrieved August 3, 2007, from http://www.flickr.com/photos/michaelmartine/50392534/
MIT Center for Real Estate. New Century Cities: Case Studies – Arabianranta. Retrieved July 27, 2007, from http://web.mit.edu/cre/research/ncc/casestudies/arabianranta.html
Muller, E. (2004). Industrial Suburbs and the Growth of Metropolitan Pittsburgh, 1870-1920. In Lewis, R. (eds). Manufacturing Suburbs. Philadelphia, PA: Temple University Press
Ostrof , T. (2006). EPA Lauds Five Smart Growth Projects. AIArchitect, 13. Retrieved July 3, from http://www.aia.org/aiarchitect/thisweek06/1117/1117n_epa.cfm
Pennsylvania Environmental Council (n. d.). Denver: Using Light Rail and TOD to Combat Sprawl. Retrieved August 3, 2007, from http://www.pecpa.org/_final_pec/html/TOD_case_study_Denver.htm
Pierce, M. (1996). District Heating in Helsinki. University of Rochester. Retrieved June 4, 2007, from http://www.energy.rochester.edu/fi/helsinki
Pinkham, R. (2000). Daylighting: New life for buried streams. Old Snowmass, CO: Rocky Mountain Institute. Retrieved July 13, 2005, from the Rocky Mountain Institute Website: http://www.rmi.org/images/PDFs/Water/W00-32_Daylighting.pdf
Pinkham, R. (1999). 21st Century Water Systems: Scenarios, Visions, and Drivers. Old Snowmass, CO: Rocky Mountain Institute. Retrieved July 20, 2007, from the Rocky Mountain Institute website: www.rmi.org/images/PDFs/Water/W99-21_21CentWaterSys.pdf
Puget Sound Action Team. (n. d.). Natural Approaches to Stormwater Management. Retrieved August 3, 2007, from http://www.psat.wa.gov/Publications/LID_studies/amended_soils.htm
San Francisco Bay Area Section of the Institute of Transportation Engineers. (n. d.). Image of San Jose Smart Growth. http://www.sfbayite.org/pastevents/
Shaw, C. (2004). Building the greenest city in America. Newtopia Magazine. Retrieved July 24, 2005, from http://www.newtopiamagazine.net/archives/content/issue17/features/greencity.php
Smart Growth Online. (n. d.). Retrieved July 26, 2007, from www.smartgrowth.org
Smart Growth partnership of Westmoreland County. (n. d.). Smart Growth. Retrieved May 8, 2007, from www.smartgrowthpa.org
Southwest Boston Community Development Corporation. (n. d.). Fairmont/Indigo Line Collaborative. Retrieved June 18, 2007, from www.swbcdc.org/fairmountindigoline.html
Tarr, J. (2000). The Metabolism of the Industrial City. Journal of Urban History. 28(5): 511-45.
Telesis Corporation. (n. d.). Riverview, Cleveland, Ohio. Retrieved June 24, 2007, from www.telesiscorp.com/Projects/Riverview.htm
Thompson, I. (2001). Nine Mile Run. Landscape Design. 299(4): 37-8.
University of Pittsburgh, Heinz School of Public Policy and Management. 2004. What's New. Retrieved June 18, 2007, from http://www.heinz.cmu.edu/default.html
University of South Carolina. (2007). Innovista. Retrieved June 24, 2007, from http://innovista.sc.edu
U.S. Environmental Protection Agency. (2007). 2006 National Award for Smart Growth Achievement. Retrieved May 8, 2007, from www.epa.gov/smartgrowth/index.htm
Wärtsilä. (2007). Trigeneration. Retrieved June 4, 2007, from http://www.wartsila.com/Wartsila/global//docs/en/power/media_publications/energy_news/18/trigeneration.pdf
Wärtsilä. (2007). Wärtsilä Trigeneration: Solutions for Airports. Retrieved June 4, 2007, from http://www.wartsila.com/Wartsila/global/docs/en/power/media_publications/brochures/wartsila_trigen_solutions_for_airports.pdf
Washington Regional Network. (n. d.). Making the Most of Metro: Community Building through Transit. Retrieved July 27, 2007, from Washington Regional Network www.commuterpage.com/ART/villages/linkvillage.htm
Weber, C. (2002). Steeling Home. Builder, 25(12): 100-106.
Zirkle, J. (2007). Boston's Newest Smart Growth Corridor: A Collaborative Vision for the Fairmount/Indigo Line. Retrieved June 18, 2007, from the Congress for New Urbanism Website: www.cnu.

org/node/209

Neighborhood Energy Generation. Local and Renewable Urban Energy Alternatives

Arkitektnytt. (n. d.). Images. Retrieved June 17, 2007, from http://www.arkitektnytt.no/

American Wind Energy Association. (2007). Small Wind. Retrieved June 6, 2007, from http://www.awea.org/smallwind/

Arizona Solar Center. (n. d.). Image of Hydrogen House. Retrieved August 3, 2007, from http://www.azsolarcenter.com/arizona/tours/2005/beau/image1.jpg

Associated Press. (2005, May 21). Scottsdale man creates a home that runs on hydrogen. Retrieved June 6, 2007, from KVOA.com Website: http://www.kvoa.com/Global/story.asp?S=3374631

BBC. (n. d.). Average Conditions. Pittsburgh, USA. Retrieved August 3, 2007, from http://www.bbc.co.uk/weather/world/city_guides/results.shtml?tt=TT001110

BioRegional Development Group. (n. d.). BedZED & Eco-Village Development. Retrieved June 1, 2007, from http://www.bioregional.com/programme_projects/ecohous_prog/bedzed/bedzed_hpg.htm

BioRegional Development Group. (n. d.). Publications. Retrieved June 1, 2007, from http://www.bioregional.com/publications.htm#housing_reps

British Wind Energy Association. (2007). Small Wind Systems. Retrieved June 6, 2007, from http://www.bwea.com/small/index.html

Building and Social Housing Foundation. (n. d.). Projects. Retrieved June 1, 2007, from http://www.bshf.org/en/to.php/about/dih/projects.php?pID=293#

Center for Building Performance and Diagnostics. (2001). BAPP: Building as Power Plant. Retrieved June 1, 2007, from http://www.arc.cmu.edu/bapp/Workshops/workshop_handout.FINAL.pdf)

De Zonnestroom Producenten Vereniging. (2007). Image. Retrieved July 24, 2007, from http://www.zonnestroomproducenten.nl/

Drake Landing Solar Community, Okotoks, Alberta. (n. d.). Retrieved June 1, 2007, from http://www.dlsc.ca/index.htm

Ecofys. (n. d.). Renewable Energy Technologies. Retrieved June 6, 2007, from http://www.ecofys.com/com/areasofexpertise/renewableenergytechnologies.htm

Engström, D. (n. d.). Widespread Exploitation of Building Integrated Photovoltaics in the Northern Dimension of the European Union (PV-Nord). Retrieved June 1, 2007, from www.pvnord.org

Environment California. (n. d.). Solar Home Developments. Retrieved June 1, 2007, from Environment California Website: http://www.environmentcalifornia.org/energy/million-solar-roofs/solar-home-developments

Enwave Energy Corporation. (n. d.). Deep Lake Water Cooling. Retrieved May 8, 2007, from http://www.enwave.com/enwave/dlwc/

H2PIA. (n. d.). World's First Hydrogen City. Retrieved June 6, 2007, from http://www.h2pia.com/com/h2pia/

Hotchkiss, A. (2007, 15 January). World leading demonstration project announced for Scotland. Retrieved June 6, 2007, from the Scottish Enterprise Website: http://www.scottish-enterprise.com/sedotcom_home/news-se/news-fullarticle.htm?articleid=192010

Hove, A. (2007). Water World: Powering the Nation with Hydrogen. Retrieved June 6, 2007, from the RAND Corporation Website: http://www.rand.org/scitech/stpi/ourfuture/GameChangers/hydrogenfuel.html

Hydrogen Innovation & Research Centre. (2007). Hydrogen House. Retrieved June 6, 2007, from http://www.hirc.dk/Default.aspx?ID=181 and http://www.hirc.dk/Default.aspx?ID=110

International Energy Agency. 2007. Case Studies. Retrieved June 1, 2007, from IEA Photovoltaic Power Systems Programme Website: http://iea-pvps.org/cases/cases.htm

Johnston, I. (n. d.). Another Day at the Hydrogen Powered Office. Retrieved June 1, from the Green Building Press Website: http://www.newbuilder.co.uk/news/NewsFullStory.asp?of set=10&ID=675

Keefe, B. (2007, April 01). California Spearheading a Solar Power Revolution. Cox Newspapers Washington Bureau. Retrieved June 1, 2007, from http://www.coxwashington.com/hp/content/reporters/stories/2007/04/01/BC_SOLAR_ADV01_COX.html

Kiesling, L. (2003, March 27). Hydrogen-Powered Buildings. Retrieved June 6, 2007, from the Reason Public Policy Institute Website: http://www.rppi.org/hydrogenpowered.html

Kilduf , P. (2007, January 6). Going solar as a neighborhood group can make installation more af ordable. San Francisco Chronicle. Retrieved June 1, 2007, from http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/01/06/HOGVMNCB361.DTL

Kliment, S. (1999, December 1). Green Giant. Planning. Retrieved July 25, 2007, from http://www.allbusiness.com/professional-scientific/architectural-engineering/357348-2.html

LaMonica, M. (2006, February 10). 'Micro' wind turbines are coming to town. Retrieved June 6, 2007, from CNET News.com Website: http://news.com.com/Micro+wind+turbines+are+coming+to+town/2100-11398_3-6037539.html

Makower, J. (2006, December 26). Wal-Mart's Solar Energy Vision. Retrieved July 25, 2007, from http://makower.typepad.com/joel_makower/2006/12/walmarts_solar_.html

MRV Renewable Ventures. (2007). Energy Programs: Solar. Retrieved July 25, 2007, from http://www.mmarenewableventures.com/Programs/Solar.html

Natural Resources Canada. (2005, April 15). Drake Landing Solar Community Backgrounder. Retrieved June 1, 2007, from Natural Resources Canada Website: http://www.nrcan.gc.ca/media/newsreleases/2005/200520a_e.htm

Organ, J. (n. d.). Beddington Zero Energy Development (BedZED). Retrieved June 1, 2007, from the UK Sustainable Development Commission Website: http://www.sd-commission.org.uk/communitiessummit/show_case_study.php/00035.html

PESWiki(2007, 19 May). Index of recommended energy alternatives for home and small business self-generation of power. Retrieved June 6, 2007, from http://peswiki.com/energy/Directory:Home_Generation

Peters, B. (2007, April 5). Largest solar-powered neighborhood in Colorado! Retrieved June 1, 2007, from YourHub.com, http://denver.yourhub.com/Westminster/Stories/Business/Real-Estate-Deals/Story~289629.aspx

Pita Communications Press Release. (2004, June 10). HOGEN® RE hydrogen generator plays important role in Eco-house. Retrieved June 6, 2007, from AZoBuild Information

Quiet Revolution, Ltd. (2007). Retrieved June 6, 2007, from http://

www.quietrevolution.co.uk/
Recurrent Energy, Inc. (2007). Retrieved July 25, 2007, from http://www.recurrentenergy.com
Renewable Energy Access. (2006, December 30). SolarCity Collective Solar Power Program Exceeded Goal. Retrieved June 1, 2007, from RenewableEnergyAccess.com Website: http://www.renewableenergyaccess.com/rea/news/story?id=46914
Rious, P. (2001, June 26). Largest Solar Community Proposed. International Real Estate Digest. Retrieved June 1, 2007, from http://www.ired.com/news/2001/0106/solar.htm
Sweeney, E. (2006, June 22). Solar power to the people. The Boston Globe. Retrieved June 1, 2007, from http://www.boston.com/news/local/massachusetts/articles/2006/06/22/solar_power_to_the_people/
The Hydrogen Fuel Cell Letter. (2004, July). Malaysian Researchers Build Experimental Solar Hydrogen House. Retrieved June 6, 2007, from the Hydrogen and Fuel Cell Newsletter Website: http://www.hfcletter.com/pub/XIX_7/stories/147-1.html
UK-Sweden Initiative on Sustainable Construction. (2006). Gårdsten, Göteborg. Retrieved June 1, 2007, from http://www.ukswedensustainability.org/projects/gardsten.jsp
US Department of Energy. (2004). Fuel Cells. Retrieved June 6, 2007, from http://www.eere.energy.gov/buildings/info/components/electricity/fuelcells.html
US Department of Energy. (2007). Hydrogen Delivery: Current Technology. Retrieved June 6, 2007, from http://www1.eere.energy.gov/hydrogenandfuelcells/delivery/current_technology.html
US Department of Energy. (2007). Solar America Cities. Retrieved July 26, 2007, from http://www1.eere.energy.gov/solar/solar_america/sai_cities.html
Wärtsilä. (2007). Images. Retrieved July 25, 2007, from http://www.wartsila.com/
Wind Energy. (n. d.). A guide for Urban Wind Energy in the UK. Retrieved June 6, 2007, from http://www.urbanwindenergy.org.uk/
Wind Energy Integration in the Urban Environment (n. d.) WINEUR Project. Retrieved June 6, 2007, from http://www.urban-wind.org/index.php?rub=3
Woody, T. (2007, June 6). Macy's Solar Shopping Spree. Retrieved July 25, 2007, from http://blogs.business2.com/greenwombat/2007/06/macys_solar.html

Benchmarks in Urban Innovation. Pittsburgh's Post-Brownfield Riverfronts and Innovative International Benchmarks

_____. (n. d.). Image of Station Square fountains. Retrieved August 2, 2007, from http://www.stationsquarepittsburgh.us/images/station_square_pittsburgh_fountains.jpg
Ackerman, J. (n. d.) A place for steel? Pittsburgh Post-Gazette. Retrieved April 20, 2007, fro http://www.riversofsteel.com/ros.aspx?id=153&h=78&sn=88
Ayuntamiento de Zaragoza. (n. d.) Milla Digital. Retrieved July 26, 2007, from http://www.milladigital.es/ingles/home.php
Baron, J. (2007, February 21). Development News: New $46M Bridgeside II coming to Pittsburgh Technology Center. Pop City Media. Retrieved April 20, 2007, from http://www.popcitymedia.com/developmentnews/49ferch.aspx
Belko, M. (2005, September 25). City hopes to meet space demands: Major expansion planned for tech center. Pittsburgh Post-Gazette. Retrieved April 20, 2007, from http://www.post-gazette.com/pg/05268/577412.stm
City and County of San Francisco. (n. d.) Mission Bay. Retrieved July 26, 2007, from http://www.sfgov.org/site/sfra_page.asp?id=5597
Commonwealth of Pennsylvania. (2004, August). Governor Rendell Presents $73 Million for Allegheny County Development Projects. Retrieved April 20, 2007, from http://www.state.pa.us/papower/cwp/view.asp?A=11&Q=437839
Continental Real Estate Communities. (n. d.) Lifestyle Centers: Streets of the Waterfront. Retrieved April 20, 2007, from http://www.continental-communities.com/retail/projectDetails.cfm?pID=23
Defeo, M. (2004). Image of UCSF community center and Koret Quad. http://pub.ucsf.edu/missionbay/imagedb/index.php?searchword=commctr
Elliot, S. (2001, November 2003). Can Mon Valley make the most of Waterfront development? Pittsburgh Business Times. Retrieved April 20, 2007, from http://www.bizjournals.com/pittsburgh/stories/2001/11/26/story3.html
Farell, M. (2007, January 31). Tending the Brownfields. Retrieved June 12, 2007, from http://www.popcitymedia.com/features/46brownfields.aspx
Frenchman, D. and F. Rojas. (2006). Zaragoza's Digital Mile: Place-Making in a New Public Realm. Places 18(2): 16-25.
Frenchman, D. and Mitchell, W. J. (2006, March). Zaragoza Milla Digital: Designing a New Century Public Realm [Electronic Version]. Massachusetts Institute of Technology and the City of Zaragoza. Retrieved May 13, from http://www.milladigital.es/ingles/home.php
Gatti, E. (2005). Images of Herr's Island.
General Dynamics. (2007). SouthSide image. Retrieved August 2, 2007, from http://www.gdc4s.com/content/8A776E9D-D341-455A-A58C-E0EF289C3B9B/images/viz_facility.jpg
Innovista, University of South Carolina. (2007). Recreation: Waterfront Park. Retrieved July 20, 2007, from http://innovista.sc.edu/map/noflash/detail.aspx?poi=33
Itzkan, S., Michitson, J., Crimmin, D. (2006, May 3). The British Are Coming! UK-based Innovations Have Application in the Merrimack Valley. Retrieved May 8, 2007, from Innovation Valley Website: http://www.ivalley.org/blog/?p=43
IWA Publishing. (n. d.) Image of BedZed ponds. Retrieved August 2, 2007, from http://www.iwapublishing.com/cms/ewebeditpro5/uploaded_images/Bedzed_002.jpg
Janowitz, M. (2007, February). Metro Spotlight: Columbia, South Carolina. Retrieved July 27, 2007, from http://www.businessfacilities.com/bf_07_02_metro1.php
Majed. (2003, May). Genentech Hall. Retrieved May 14, from the University of California, San Francisco Website: http://pub.ucsf.edu/missionbay/imagedb/index.php?searchword=genentech
Mannila, L. (n. d.). Arabiastranden: En bydel som merkevare. Retrieved June 15, 2007, from, http://www.arkitektnytt.no/page/detail/article/10831/news-4-774.html
Peabody Trust. (n. d.). BedZED (Beddington Zero Energy Development) factsheet. Retrieved June 1, 2007, from http://www.peabody.org.uk/pages/GetPage.aspx?id=179
Pittsburgh History and Landmarks Foundation. (n. d.) Retrieved April 20, 2007, from http://www.phlf.org/

Reynolds, D. (2005, April 29). Fund targets industrial sites: Nonprofit seeks $15M to revitalize brownfields. Pittsburgh Business Times. Retrieved April 20, 2007, from http://pittsburgh.bizjournals.com/pittsburgh/stories/2005/05/02/story1.html
Roth, M. (2006, July 30). Homestead Works: Steel lives in its stories. Pittsburgh Post-Gazette. Retrieved April 20, 2007, from http://www.post-gazette.com/pg/06211/709449-85.stm
San Francisco Chronicle. (2007, April 16). A San Francisco campus rises. Retrieved July 26, 2007, from http://www.sfgate.com/cgi-bin/article.cgi?file=/chronicle/archive/2007/04/16/EDG9DP7TT11.DTL
San Francisco Redevelopment Agency. (n. d.) Looking for Affordable Housing in San Francisco? Retrieved July 26, 2007, from http://www.sfraaffordablehousing.org/
San Francisco Redevelopment Agency. (2007). Mission Bay Land Use Plan. Retrieved May 14, from http://www.sfgov.org/site/uploadedfiles/sfra/Projects/MB%20Land%20Use%20Plan%20Map_11.05
Santoro, C. (1996.) Image of Union Switch and Signal. Retrieved August 2, 2007, from the URA Website: http://www.ura.org/images/large/PTC.jpg
Sofer Organization. (n. d.) Retrieved April 20, 2007, from http://www.soferorganization.com/sub%20pages/SSWretail.html
University of California, San Francisco. (n. d.) UCSF Mission Bay. Retrieved July 26, 2007, from http://pub.ucsf.edu/missionbay/
University of South Carolina. (n. d.) Innovista. Retrieved July 26, 2007 from http://innovista.sc.edu
University Partnership of Pittsbrugh. (2006, March 21). Expansion of Pittsburgh Technology Center Moves Forward. Retrieved April 2007 from http://www.universitypartnership.com/news.php?id=20
Urban Redevelopment Authority of Pittsburgh. (n. d.) Showcase Projects. Retrieved April 20, 2007, from http://www.ura.org/showcaseProjects.html
Western Pennsylvania Brownfields Center. (n. d.) Case Study: Pittsburgh Technology Center. Retrieved April 20, 2007, from http://www.ce.cmu.edu/Brownfields/NSF/sites/ptc/info.htm
Western Pennsylvania Brownfields Center. (n. d.) Case Study: Washington's Landing. Retrieved April 20, 2007, from http://www.ce.cmu.edu/Brownfields/NSF/sites/Washland/INFO.htm
Wiegman Aerial. (2002, August). Aerial Graphic of UCSF Mission Bay Campus. Retrieved May 22, from the University of California, San Francisco Website: http://pub.ucsf.edu/missionbay/imagedb/images/2002-10-24-02a.jpg
Wikipedia. (April, 2007). Southside Works. Retrieved April 20, 2007, from http://en.wikipedia.org/wiki/Southside_Works

Digital Modeling Tools. Urban Spatial Analysis in the Digital Age

Criterion Planners. (n. d.). Retrieved July 26, 2007, from http://www.crit.com
Criterion Planners. (2006, December). INDEX Plan Builder Planning Support System Release 9.1.9 User Notebook.
Criterion Planners. (2004, August). Case Study: Using INDEX to Prioritize Pedestrian Improvements in Sacramento, California. Retrieved July 1, 2007, from from http://www.crit.com/index/documents.html
Criterion Planners. (2002, November). Smart Growth INDEX: A Sketch Tool for Community Planning, v2 Introduction.
Hillier, B. (2001). A Theory of the City as Object: Or, How Spatial Laws Mediate The Social Construction Of Urban Space. [Electronic version]. Third International Space Syntax Symposium. Atlanta, GA. Retrieved June 8, 2007, from http://undertow.arch.gatech.edu/homepages/3sss/
Hillier, B. (1985). The Nature of the Artificial: The Contingent and the Necessary in Spatial Form in Architecture. Geoforum 16(2): 163-178.
Hillier, B., Leaman, A., Stansall, P. and Bedford, M. (1976). Space Syntax. Environment & Planning B, 3: 147-185.
Penn, A. and Turner, A. (2002). Space Syntax Based Agent Simulation. Proceedings of the 1st International Conference on Pedestrian and Evacuation Dynamics, University of Duisburg, Germany. (pp. 99–114). Berlin: Springer.
Ratti, C. (2004). Space Syntax: Some Inconsistencies. Environment & Planning B, 31, 487-499.
Space Syntax Limited. (2006). Retrieved May 31, 2007, from http://www.spacesyntax.com
Space Syntax Laboratory. (2004). Retrieved May 31, 2007, from http://www.spacesyntax.org
United States Environmental Protection Agency. (2003, February). EPA's Smart Growth INDEX 20 Pilot Communities: Using GIS Sketch Modeling to Advance Smart Growth. Retrieved May 28, 2007, from the US EPA Website: http://www.epa.gov/smartgrowth/pdf/Final_screen.pdf
Wilmapco. (2003, February). Case Study: Delaware Transit Oriented Development Analysis. Criterion Planners. Retrieved July 1, 2007, from http://www.crit.com/index/documents.html.