Sustainable Low-Income Housing:

case studies & design strategies

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1.0 introduction

The traditional approach to sustainable low-income housing (to the extent that a "traditional" approach exists) begins with the question "what sustainable strategies can be implemented cheaply?" This approach, however, neglects the important design issues that surround designing in low-income communities. The result is often strong ecological sustainability coupled with questionable social sustainability.

This paper takes the stance that sustainable low-income housing must first and foremost be appropriate for low-income users, otherwise it is little different than sustainable design in general. Therefore, this paper will begin by exploring the needs of low-income communities. (When possible, it has been made specific to the Cincinnati area.) The paper then explores design implications, including elements of sustainable design that are supportive of and compatible with these needs. In order to further elucidate the implementation of sustainable strategies in the design of low-income housing, several examples from around the world are presented. Finally, these case studies are analyzed under the dual lenses of ecological and social sustainability. Cost is, of course, an important part of this analysis (the question of "how can sustainable be made affordable"), but it is not the only (or even primary) element. If the architecture does not work for the users, sustainability makes little difference.

The intent is: (1) to understand the needs of low-income families, and (2) to understand how sustainable design can be made affordable, including both low-cost design strategies and funding sources. The result is a strategy for sustainable design for low-income communities, rather than just inexpensive (or publicly-funded) sustainable design.

This paper does not elaborate on the requirements of sustainable design in general as there is already a large body of literature and knowledge on the subject. The question here is how to effectively apply these existing ideas to low-income housing.

2.0 demographic analysis

Needs of Low-Income Users

The “needs” of low-income families are perhaps best understood in a cultural context, as conditions that support the cultural economy and social interactions of low-income communities. Halperin (1998) calls these cultural elements “livelihood strategies” because most of them are related to making ends meet on little income. Low-income communities are in a sense determined by their low-income status, and have adapted socially to this condition. Designers working in this context must understand these social adaptations in order to meet the needs of low-income communities—or (better yet), to exceed these needs in ways that end the cycle of poverty.

Common livelihood strategies of low-income communities and possible design responses are explored below.

2.1 Community, Extended Family & the Informal Economy

One of the most important livelihood strategies is increased reliance on extended family and community networks, and the “informal” economies implicit in such networks. Extended family and community members often provide a wide range of free services: help and advice with childcare; assistance with employment, housing, education, finances, and social services; instrumental help with things such as transportation and shopping; and emotional and spiritual support (Bromer, 943). When formal arrangements are made for things like childcare, family members are more likely to tolerate unreliable payments, accept payment in a variety of forms (including reciprocal favors), adjust payment amounts, and even forgive payments in times of hardship (944).

These social networks are perhaps the primary factor in low-income families’ ability to makes ends meet. According to Bromer, Social support from informal networks has been associated with less material hardship in economically disadvantaged families and may serve as a buffer against the stresses of poverty […]” (944).

Social networks are recognized as important to the health and vitality of a community. A 2004 study of African American fathers in low-income neighborhoods found that many were worried about growing isolationism within their neighborhoods, and wanted to rebuild networks of community support. The report suggests, among other things, encouraging community members "to share in the collective parenting that formerly characterized many impoverished African American neighborhoods" (Letiecq, 730).

Fostering and promoting community serves as a buffer against crime, increases quality of life, and serves as an important livelihood strategy to "make ends meet". The elements of community, family, and the informal economy form the foundation for many of the more specific livelihood strategies listed below.

2.2 Childcare

Childcare and early childhood education are of prime importance for several reasons. First, childcare is a huge liability for working parents. Second, providing high-quality childcare (and access to it) is one of the ways of breaking the cycle of poverty that plagues so many low-income communities. Much childcare is provided by community and relatives (as mentioned above), but formal childcare services are also important, especially for single parents.

According to Barrie Thorne (2004), "The federal welfare reform legislation of 1996 forced impoverished single mothers to take on full-time jobs… But the legislation did not provide adequate support for the care of these mothers' children" (166). The result, he says, is a crisis of childcare for low-income communities. Childcare must be both adequate and accessible. Ideally, it should also be high-quality, because high-quality care (typically, education-oriented childcare) helps break the cycle of poverty.

In fact, the long-term benefits of high-quality childcare seem to be disproportionately greater for low-income or "high risk" children. Vandell (2004) states that "high-quality center-based care confers cognitive and academic benefits for children who are at risk for school failure" (405) and that it buffers young children "from the negative effects of family poverty" (396). At-risk children who participated in high-quality childcare demonstrate enhanced language skills, higher cognitive test scores, higher academic achievement in both reading and math, and greater likelihood to attend college (Lombardi, 61). Such academic success lays the groundwork for overcoming poverty.

2.3 Alternative Transportation

Many low-income families rely on public transportation, walking, and/or biking as inexpensive alternatives to owning a vehicle. In order to be a viable strategy, these forms of transportation must satisfy two conditions: first, in the case of public transportation, they must be easily accessible from low-income housing; and second, they must provide access to all basic services—grocery stores, schools, banks, libraries, etc.

Ideally, there should also be easy access to government services. Many members of low-income communities participate in some kind of federal aid program (be it welfare, employment services, early childhood programs, etc.) and consequently need to access to appropriate offices and/or caseworkers. The easier it is to reach these places, the more likely it is that residents will make use of them. In fact, one of the reasons that low-income individuals

do not participate in more programs is simply that they are unaware of their options (Huston, 147).

2.4 Regular Expenses

One of the most obvious livelihood strategies for dealing with the low-income condition is to reduce regular payments on rent, vehicles, utilities, etc. Housing must be, above all, affordable. Halperin spells out in no uncertain terms what this means:
Affordable housing must be just that—affordable. This means that rental units must be between $200 and $250 per month for two-bedroom units and $300 and $350 per month for three-bedroom units (218).

Halperin was writing about Cincinnati, Ohio, in 1998. In 2006 dollars, these rents are equal to $248.47 to $310.58 for a two-bedroom unit and $372.70 to $434.82 for three-bedroom units (Consumer Price Index Calculator). If low-income housing is to be achieved, it must meet this criterion.

Despite its low cost, low-income housing must not compromise on important design features. Equipment such as air conditioning (or a passive equivalent) and washing machines are not optional. According to Halperin, “Affordable housing must be designed for humans in hot, humid Cincinnati summers; builders must not make assumptions about what is necessity and what is luxury” (218). Low-income housing must be inexpensive, but it must not be sub par.

2.5 Accommodations for Special Needs

Because members of extended families often live together, accommodations must be made for the very old, the very young, and the disabled. This includes ADA accessibility, childproofing, and additional consideration of responses to climatic conditions, especially in the summer when extreme heat can threaten the health of young children and the elderly.

3.0 implications for design

3.1 Minimum Requirements

Given the livelihood strategies and requirements listed above, design for low-income users should, at a minimum, do the following:

1. have low rent and utility bills (see above for specific numbers);
2. accommodate extended family sizes;
3. provide access to public transportation;
4. be located nearby, or have easy accessible via public transportation to: public services, childcare facilities, public schools, and grocery stores;
5. be heated and cooled to a comfortable level;
6. accommodate the disabled, the elderly, and the young; and
7. provide on-site washing machines.

3.2 Additional Goals

Additional design goals to consider include:

1. fostering a sense of community (ultimately to facilitate social networks and informal economies);
2. creating a sense of ownership and pride;
3. designing for security and community observation of public spaces;
4. providing access to specifically high-quality childcare (see Vandell 2004 and Huston 2004 for more on “high-quality childcare”); and
5. being durable and easy to maintain.

3.3 Possible Design Strategies

Some possible ways of achieving the goals listed above might include:

1. modest accommodations (efficient floorplans, multiple uses of spaces);
2. multi-bedroom units, with a variety in the numbers of bedrooms;
3. spaces with varying degrees of privacy;
4. energy efficiency and passive strategies to lower utility bills;
5. easier or cheaper construction, based upon modular planning, formal characteristics (shared walls, fewer corners), and/or material selection (cheap, free, or salvaged); and
6. specification of durable materials and systems for easy maintenance.

3.4 The Overlap of Sustainability and Low-Income Design

Sustainable design can provide a means of achieving a number of the above low-income design requirements. Most obviously, passive strategies (passive solar, natural ventilation, daylighting, and water-efficiency systems) can dramatically reduce—and in some cases eliminate—utility bills by heating and cooling buildings with free energy. Renewable energy (when cost effective) can also lower utility bills. Access to public transportation helps decrease fossil fuel consumption and greenhouse gas emissions. Building in urban areas reduces construction in pristine areas. Low-maintenance, durable design can reduce the amount of materials consumed over the lifetime of the building. Efficient floorplans reduce square footage, and therefore reduce energy consumption (for heating and cooling), as well as increasing development density. These are the strategies that have the most in common with design for low-income communities; therefore, these are the strategies that should be pursued first in this context.

Many other sustainable strategies are compatible with low-income design. The main obstacle to additional sustainable strategies is increased cost, especially for strategies that do not provide paybacks to users, such as environmentally-friendly materials and services such as additional commissioning and construction waste management. These could become feasible, however, with additional funding. Indeed, many of the case studies demonstrate the vital importance of grants and public funds in sustainable low-income design.

4.0 case studies

BedZED: Hackbridge, UK 08

Chestnut Court: West Oakland, CA 10

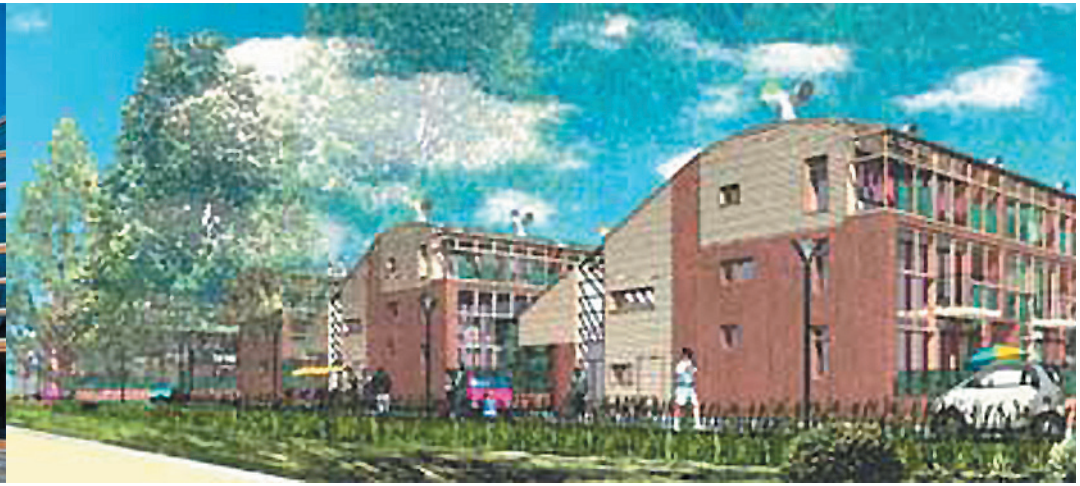
Colorado Court: Santa Monica, CA 12

Folsome Dore: San Francisco, CA 14

Gold Dust: Missoula, MT 16

GreenHOME 2: Washington, DC 18

Traugott Terrace: Seattle, WA 20



4.1 BedZED (Zero Emission Design)

Location: Hackbridge, UK
Number of units: 82 units
Units per acre: "dense" (density unknown)
Cost per s.f.: total cost: £15.7m ($29.7m)
Cost of unit: £110,000 for 1-BR
Completed: 2001

This "mixed development urban village" (ZED-Factory) includes 82 dwelling units of various types (flats, maisonettes, and town houses) as well as 2500 s.f. of workspace / office space, a health center, nursery, organic café, and sports club house. It was designed by the innovative and highly-sustainable Bill Dunster Architects (AKA the "ZED [Zero Emission Design]) Factory.

Sustainable strategies:

1. brownfield redevelopment
2. mixed use: compact development reduces sprawl
3. alternative transportation
4. daylighting: all flats have daylighting and direct access to outdoor space
5. passive cooling: wind-driven ventilation with heat recovery
6. passive heating: passive solar direct-gain design (floors and walls are thermal masses)
7. super-insulation
8. renewable energy: solar photovoltaics power 40 electric cars, of which some are exclusively for carpools, some are taxis, and some are private
9. greywater systems: on-site grey- and blackwater treatment; rainwater collection and reuse
10. blackwater systems: on site grey- and blackwater treatment
11. green roof
12. sustainable materials: renewable or recycled materials, most from within a 35-mile radius

Strategies for cost reduction:

1. emissions trading: In the UK, developers can trade emissions credits for approval of larger developments, which translates into higher returns. "With the environmental performance parameters defined in advance, it is possible for developers to trade energy efficiency and emissions targets with local planning authorities in return for

permission to build more accommodation of all types" (Bill Dunster Architects).

2. salvaged material prefabrication: A unique process helps to make salvaged materials economic: on-site assembly-line style "prefabrication" of building elements. Raw materials enter, are cleaned, and are assembled using simple jigs.

Design response to needs of low-income users:

Ultimately this design is not even slightly low-income: the rent is far too high, even for London. This misunderstanding demonstrates a common semantic problem with the term "affordable houseing": this housing is "affordable" only when compared to similar housing in London proper. The rent and lifestyle-conscious program makes it clear that the target demographic is not low-income.

Overall successes:

- Excellent sustainable strategies—a veritable list of BMPs
- The design makes sustainability sexy … people want to live here

Overall failures:

- Not at all low-income.

Other: Resident Education

It is interesting to note that residents need to learn how to use the building properly: "You must learn how many windows to open and close, and how to adjust the chimneys, to maintain a particular temperature" (Dyckhoff 2003, 68). This is likely a common issue for sustainable design.

4.2 CHESTNUT COURT

Location: West Oakland, CA

Number of units: 72 (see type below)

Units per acre: 26 units per acre

Cost per s.f.: total cost = $8,750,0000 / cost of unit = $312,500 (cost per s.f. unavailable)

Cost of unit:

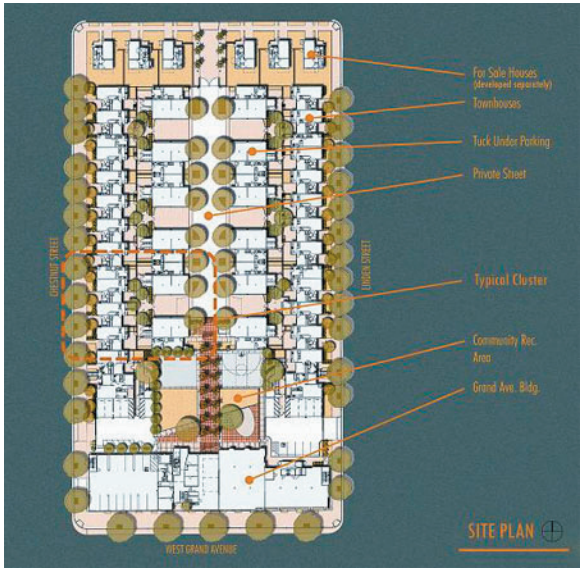
Type	#Units	Size (sf)	Rent
1BR	4	735	$660 - $754
2BR	34	905-1189	$790 - $904
3BR	26	1191	$904 - $1098
4BR	8	1341	30% AMI

Completed: 2004

Chestnut Court is a three-story mixed-use complex that replaces a deteriorating public housing project. It has a strong focus on the social aspects of low-income design.

Sustainable strategies:

1. compact development and mixed-use
2. alternative transportation: easy access to public transportation
3. daylighting: from both sides of each unit, and from skylights
4. passive cooling: natural ventilation strategies (cross ventilation and stack ventilation via operable skylights) are so effective that they eliminate the need for mechanical cooling
5. high performance windows: double-glazed low-E windows
6. superinsulation: 2x6 exterior walls w/ R-19 insulation
7. energy efficiency: Energy Star appliances; 75% fluorescent bulbs; 94% efficient central hot water heating system; well-sealed ductwork
8. renewable energy: photovoltaic panels generate 65% electricity for common spaces
9. water-efficient landscaping: drought-tolerant and resistant landscaping
10. sustainable materials: fly-ash concrete, recycled content carpet, low VOC paint, etc.
11. construction waste reduction: eliminated 50% construction waste (waste separated on-site and recycled)



Strategies for cost reduction:

1. equipment reductions: huge cost savings achieved by eliminating mechanical cooling equipment
2. construction: very standard: OSB sheathing, 2x6 studs, open wood truss floor
3. funding and grants:
   a. HUD: HOPE VI Grant
   b. Redevelopment Agency of Oakland (loan)
   c. Oakland Housing Authority (local funds)
   d. CalHFA HELP (loan)
   e. FHLB Affordable Housing Program (loan)
   f. World BRIDGE Initiative (loan)

Design response to needs of low-income users:

1. low rent: 30% AMI (area median income) to moderate income
2. mixed income: both rental units and townhomes
3. child care
4. support services:
   a. computer learning center
   b. job training and placement
   c. financial planning
   d. after-school tutoring
   e. senior care
   f. on-site laundry
5. easy access to public transportation
6. ownership: protected community spaces lends a sense of ownership and privacy and serves as a deterrent to crime: "Each dwelling unit in the complex is designed to be as individually identifiable as possible, most with front doors opening onto the street and each with private outdoor space" (US Department of Housing and Urban Development)
7. community interaction: porches and entries encourage neighborhood interaction "By creating eight unit clusters that share an entry patio area and pleasant common gathering spaces, we create a strong sense of community, safety and social sustainability for residents" (US Department of Housing and Urban Development)

Overall successes:

• Excellent community design.
• Excellent low-income design strategies.

Overall failures:

• Sustainability could have been taken further.
• Durability of standard construction is questionable.
• How "affordable" is 30% AMI?

Other:

Design process: The design process included extensive community involvement (including neighbors, potential tenants, city officials, developer, maintenance and management staff). The result is highly effective.

Sustainable strategy: "Creating double aspect and double height units provides exceptional natural ventilation and daylighting and improves the overall indoor environmental quality" (US Department of Housing and Urban Development).

4.3 COLORADO COURT

Location: Santa Monica, CA
Number of units: 44 studio units
Units per acre: 128 units per acre (high due to small unit size)
Cost per s.f.: $40 (soft cost)
$155 (hard cost)
Cost of unit: $337 - $386 per month
Completed: 2002

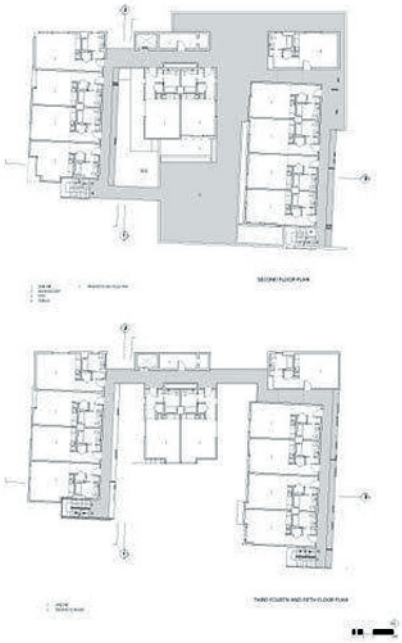
This housing complex in downtown Santa Monica was conceived as a sustainable showcase for the city. It includes 44 studio units.

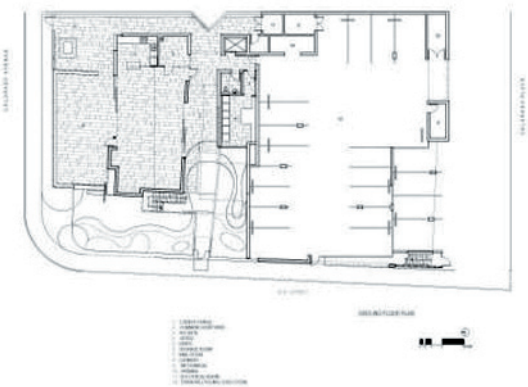
Sustainable strategies:

1. development density: downtown site
2. reduced heat island: reflective roof; underbuilding parking with preferred vanpool parking
3. alternative transportation: proximity to public transit, jobs, and necessary amenities
4. daylighting
5. passive cooling: natural ventilation (so successful that AC only needed in small office area); shading on south windows; minimized glazing on west
6. high performance windows: double-pane low-E, krypton-sealed
7. renewable energy: almost 100% power generated by on-site photovoltaic panels and gas turbine (designed to return energy to the grid
8. stormwater management: permeable paving and stormwater retention
9. water efficient landscaping: native plants & groundcover
10. sustainable materials: recycled and locally produced preferred (carpeting, cabinets)

Strategies for cost reduction:

1. equipment reductions: huge cost savings achieved by eliminating mechanical cooling equipment; however the designed noted that it was difficult to convince the mechanical engineers to downsize mechanical/electrical/plumbing equipment
2. lower utilities: energy savings of almost $10,000 per year (= $225 per apartment); payback time is less than 10 years
3. materials: concrete floors (with throw rugs) originally proposed for thermal mall, reduced IAQ problems, and low cost; but





ultimately replaced with carpeting due to perceptions of comfort and soundproofing concerns

4. financing:
   a. $500,000 for energy-efficiency measures split by City and Regional Energy Efficiency Initiative (REEI)
   b. stormwater system paid for by City of Santa Monica Public Works Dept.

Design response to needs of low-income users:

1. low utilities: energy savings of almost $10,000 per year (= $225 per apartment)
2. low utilities: no electricity costs (if can sell back to grid)
3. loan guarantees (public and private)
4. encourages community interaction (street-level community space, garden)
5. low-maintenance: natural materials w/ naturally modeled finishes show less wear and abuse = lasts longer, looks better
6. quality of space: high ceilings, large windows, IAQ

Overall successes:

• Public policy activism (see below)
• Garnered lots of awards (AIA/COTE, etc.)

Overall failures:

• studios not appropriate for low-income demographic
• rent too expensive given square footage of studios
• development ultimately not selected for tax credits for low-income housing

Other:

City involvement: the impetus was the city's involvement in Regional Energy Efficiency Initiative (which supports municipal energy-efficiency demonstration projects). This generated interest and commitment at a high level in the government.

LEED Gold: LEED was integrated into the design process early on.

Policy activism: Colorado Court lobbied successfully for legislation allowing net metering, getting tax credits for environmental measures, and adding energy-efficiency language to the Multi-Family Housing Program; and is lobbying for the Public Utilities Commission to change the definition of an "eligible customer". In other words, it is working to get the incentives changed in the favor of sustainability.




4.4 FOLSOM DORE

Location: San Francisco, CA
Number of units: 98
(33 studios / 57 1BR / 8 2BR)
Units per acre: 169 units per acre
Cost per s.f.: total cost = $26,500,000 / cost per unit = $270,408 (cost per s.f. unavailable)
Cost of unit: monthly rent:

Studio:	$438 – 1038
1 BR:	$469 – 1272
2 BR:	$562 – 1526

Completed: 2005

Folsome Dore was a collaborative project between Citizens Housing Corporations (CHC) and the City of San Francisco to create apartments for low- and very low-income residents with a variety of special needs.

Sustainable strategies:

1. brownfield redevelopment: on the site of an abandoned warehouse and parking lot
2. mixed-use: compact development, mixed-use neighborhood
3. parking capacity: parking decreased 70% (30 spaces for 98 units)
4. alternative transportation: preferred Car-Share parking, bike racks, within 1 block of several bus lines and within 3 blocks of regional subway
5. daylighting
6. passive cooling: operable windows and passive exterior ducts eliminate the need for active AC systems
7. high-performance windows
8. superinsulation: walls = R-21 / roof = R-38
9. energy efficiency: Energy Star appliances; low-flow fixtures; hydronic system provides heat & hot water
10. renewable energy: photovoltaic system (sloped roof)
11. water-efficient landscaping: in pots w/ bubbler irrigation
12. sustainable materials: recycled carpet, gypsum, carpet pad, and vinyl; wheat board cabinets; fly-ash concrete
13. durable materials: concrete base @ ground floor; commercial-grade windows; polished concrete flooring in community space; exterior stucco
14. construction waste reduction: 70% reduction in construction waste

Strategies for cost reduction:

1. equipment reductions: huge cost savings achieved by eliminating mechanical cooling equipment
2. alternatives for green specs = choices for contractor given budget
3. funding sources:
   g. City of San Francisco
   HOME funds
   h. Apollo Housing Capital: 4% LIHTC
   i. Citibank: Tax Exempt Bonds
   j. Federal Home Loan Bank: Affordable Housing Program Funds
   k. State of California: MultiFamily Housing Program
   l. Pacific Gas and Electric: Multifamily Comfort Home Program
   m. California Energy Commission: Solar Rebate

Design response to needs of low-income users:

1. low utilities: sustainable strategies = low utility bills for residents
2. alternative transportation
3. resident profile: 25% low-income, 65% AMI
4. active social environment: community meeting room
5. additional services:
   a. social service case management
   b. computer learning center
   c. youth and adult education / support services
   d. on-site laundry
6. encourage community interaction: outdoor common areas; degrees of privacy

Overall successes:

• Process: worked closely with neighborhood residents and businesses
• Excellent sustainable strategies
• Excellent design responses for low-income users (very affordable, given the San Francisco location)

Overall failures:

• Not widely applicable: funding came from state and local agencies
• Not enough multi-bedroom units (demographic is mainly special needs, not families)

Other: Ongoing Education

Ongoing education of residents and maintenance staff a must



4.5 GOLD DUST APARTMENTS

Location: Missoula, MT
Number of units: 18
(1 studio / 14 2BR / 3 3BR)
Units per acre: 40 units per acre
Cost per s.f.: cost per s.f. = $140
cost per unit = $134,087
Cost of unit: monthly rent:

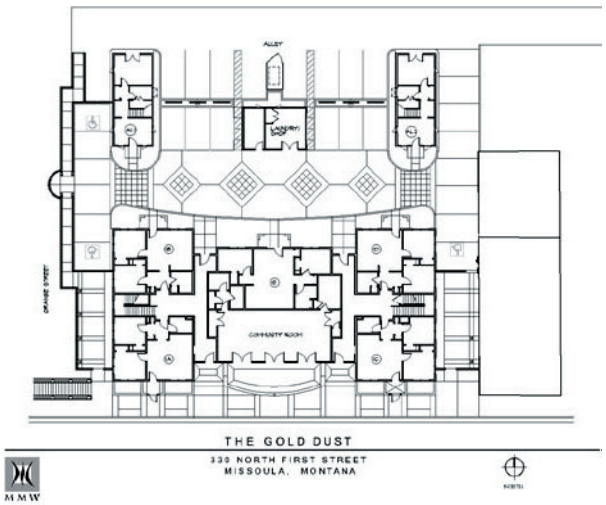
Studio:	$240
2 BR:	$360 – 624
3 BR:	$525 – 809

Completed: 2003

The Gold Dust Apartments provide an example of how to design for a specific demographic—in this case, affordable housing for artists. Also included in the program are community spaces and a community art gallery. The development has been hailed as bringing new life and culture to a neglected neighborhood of Missoula.

Sustainable strategies:

1. compact development: urban intill
2. parking capacity: architects obtained a variance to undersize parking; three units are reserved only for non car-owners
3. alternative transportation: near public transit; covered bike racks provided; the development specifically targets people who do not own cars
4. daylighting
5. passive cooling: operable windows for cross ventilation; solar shading (awnings & trellises); interior thermal mass
6. passive heating: interior thermal mass: exposed concrete floors
7. high performance windows: double glazed, low e
8. energy efficiency: Energy Star appliances; energy efficient heating (radiant floor system with high efficiency boilers)
9. renewable energy: photovoltaic panels (15kW)
10. stormwater management: green roof, filtration (oil & water separator) and on-site infiltration
11. water-efficient landscaping: low-water plants, drip irrigation
12. green roof: inhabitable
13. sustainable materials: efficient use of materials: studs 24” OC = less wood, better insulation



14. construction waste recycled
15. maintenance: continual inspections assure proper function of all systems

Strategies for cost reduction:

1. low-cost material: creative use of inexpensive materials (corrugated metal, concrete)
2. low operation costs: sustainable strategies + durable materials = low operation & maintenance costs
3. funding:
   n. The Allen Foundation for the Arts: public art
   o. Home Depot: donated laundry building
   p. ATR: grand for public art
   q. Enterprise Social Investment Corporation: Tax Credit Syndicator
   r. Fannie Mae Corporation
   s. First Security Bank: loan
   t. Herbergers: public art
   u. HUD: special purpose grant
   v. Montana Arts Council: public art
   w. Montana Board of Housing: Revolving loan funds
   x. Montana Home Investment Partnership Program: HOME funds
   y. NorthWestern Energy: $100,000 grant (used for photovoltaics, energy efficient lighting, energy efficient appliances)
   z. Salomon Smith Barney: public art

Design response to needs of low-income users:

1. Participatory design process
2. Live/work space to encourage working from home
3. Alternative transportation access
4. Community room
5. Additional facilities: art gallery along streetfront, and workshop space for resident artists
6. On-site laundry
7. Multi-bedroom units: Two townhouses (for bigger families) were made possible because of reduced parking
8. Low rent: due in part to modest size units
9. Durability: concrete floors, metal siding, industrial strength cabinet hardware, wheatboard
10. Gardens: roof gardens provide opportunities to grow food; all trees are fruit-bearing
11. Services: proximity to social service agencies

Overall successes:

• Process: the design began with a charette in which over 70 low-income families, neighbors, artists, and elected officials participated; sustainability consultants included from beginning
• Beginning of neighborhood revitalization—iconic, inspiring
• Emphasis on “community-based living and working”
• Fits will with historic neighborhood (setbacks, scale, stylistic references)
• Parking variance = more units, more sustainable (civic involvement)

Overall failures:

• Was AC eliminated thru passive ventilation?
• Is this an appropriate target demographic for “affordable housing”?

4.6 GREENHOME-2

Location: Washington, D.C.
Number of units: 1 (2-bedroom single-family residence)
Units per acre: 22 units per acre (1100 s.f. home on a 2000 s.f. lot)
Cost per s.f.: $82 per s.f.
Cost of unit: unknown
Completed: 2002

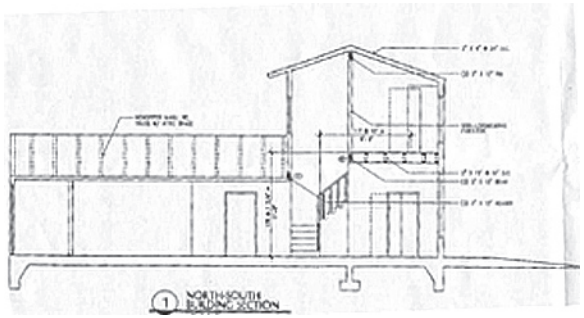
This two-bedroom single-family home was built by GreenHOME, a volunteer organization similar to Habitat for Humanity. Much of the material, money, and labor for the project was donated for free.

Sustainable strategies:

1. compact development: urban infill
2. daylighting: light well, light tube
3. passive heating: passive solar
4. energy efficiency: energy efficient hydronic heat
5. stormwater management: rainwater collected & reused; French drain provides on-site infiltration; “rain garden” installed
6. sustainable material: Autoclaved Aerated Concrete (AAC) block (weight 1/2 standard conc. block, high insulation capacity, 70% flyash); rebar salvaged from deconstruction of DC convention center; 100% of lumber salvaged from deconstruction projects (structure, interior, flooring); salvaged windows (2 years old, double-glazed); recycled aluminum shingle roofing; kit. & bath floors are ceramic tile from recycled glass; cellulose (newspaper) insulation
7. construction wastes recycled

Strategies for cost reduction:

1. volunteerism: design and construction implemented by a volunteer organization, GreenHOME (= free labor and materials)
2. salvaged materials: primarily from deconstruction projects
3. funding from contributions of money, materials, and labor
   a. Ability Awareness (non-profit org.): helped obtain sponsorship
   b. Christopher Reeves Paralysis Foundation: financial sponsor
   c. DC Habitat for Humanity: provided fund-



ing & volunteers

d. Habitat for Humanity International: volunteer recruitment & PR

e. Nutech Systems: provided discount on HVAC/air-heat exchanger

f. The Hartford: financial sponsor

g. United Airlines: financial sponsor

Design response to needs of low-income users:

1. Low-maintenance materials (AAC block, hardiplank siding)
2. Affordability: due in part to modest size design
3. ADA accessible (long lot, primarily one floor)

Overall successes:

- Volunteer project = also built community
- Built with virtually no cost
- Excellent use of salvaged materials

Overall failures:

- Fairly ugly & uninspiring (looks low-income)
- Low income demographic needs not met: only 2 bedrooms, questionable public transportation access



4.7 TRAUGOTT TERRACE

Location: Seattle, WA
Number of units: 50 (12 single-room occupancy / 16 studio / 22 1BR)
Units per acre: 227 units per acre
Cost per s.f.: cost per s.f. = $106 / cost per unit = $130,000 / total cost = $6,500,000
Cost of unit: monthly rent:

SRO	$642
Studio	$642
1 BR	$781

Completed: 2003

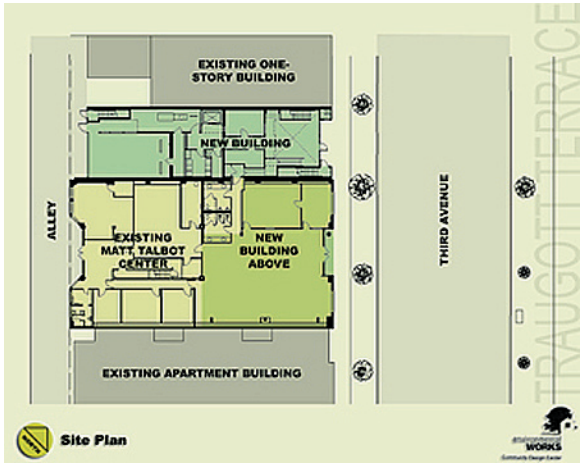
Traugott Terrace is the first LEED certified affordable housing project in the United States. The 50-unit project is build above the existing Matt Talbot Center, a social services facility that offers Seattle's homeless population recovery programs to stop substance abuse. The complex includes both transitional and long-term housing.

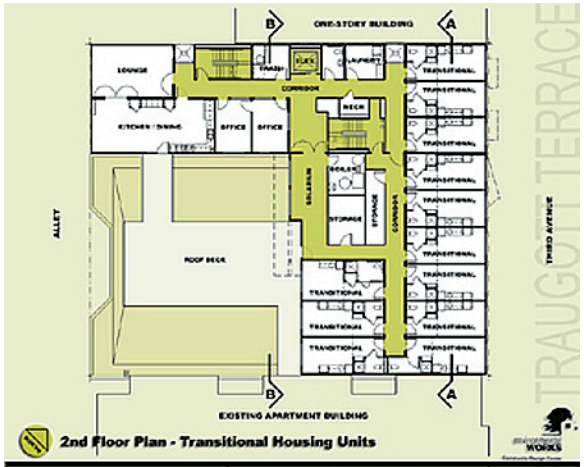
Sustainable strategies:

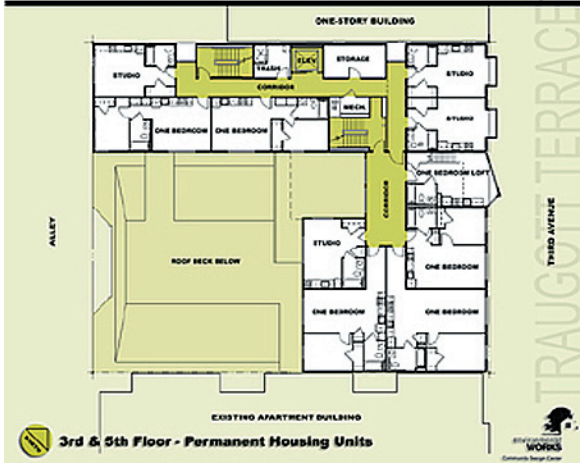
1. development density: urban infill
2. parking capacity: no parking; covered bike racks
3. alternative transportation: project area served by over 27 bus routes
4. daylighting: L-shaped plan w/ courtyard guarantees outdoor access regardless of expansion
5. passive cooling: effective passive ventilation means that no AC is required
6. high performance windows
7. superinsulation: R-21 walls, R-49 roof, R-30 floors
8. energy efficiency: Energy Star appliances
9. water efficiency: water-efficient appliances & fixtures
10. sustainable materials: recycled content metal siding, carpet, gypsum wallboard, insulation, acoustic ceiling panels, and plastic wood decking; fly ash concrete; FSC certified wood; linoleum flooring; bamboo deck rails; 59% of materials manufactured locally (within 500 mi.)
11. construction waste recycled

Strategies for cost reduction:

1. funding:
   a. Seattle Office of Housing: loan
   b. Washington State Housing Trust Fund: loan







c. Washington State Housing Finance Commission: allocation of tax credits
d. Homestead Capital: equity investment of tax credits
e. Impact Capital: loan
f. Seattle City Light Built Smart rebate (provides incentive money for envelope, system and lighting upgrades that reduce electric consumption)
g. Seattle LEED Development Funding: grant

Design response to needs of low-income users:

1. additional services: new unites built above existing Matt Talbot Center, a social services facility that offers substance abuse recovery programs
2. unit type: includes both transitional and long-term housing
3. transitional housing:12 Single Room Occupancy (SRO) on second floor serve Matt Talbot Center; shared common kitchen, lounge, and deck
4. on-site laundry facilities
5. durable, low-maintenance materials: corrugated metal siding, sealed concrete, synthetic wood decking
6. mixed-income neighborhood: also has expensive condos

Overall successes:

- Very low-income residents
- Very livable, high quality

Overall failures:

- No passive solar design (= missed opportunity)

Other: Key Players

This project was accomplished through cooperation of Beacon Development Group, Seattle's Archdiocesan Housing Authority, and Matt Talbot Center.

5.0 analysis of case studies

NOTE: generalities are not universally applicable. Demographic research is centered on Cincinnati, while the case-studies are from a wide range of locales. Therefore, it may be difficult to evaluate the relative successes or failures of these developments objectively. However, it will still be possible to determine the relevance of these strategies to design in Cincinnati—that is, whether or not a given strategy could be effectively employed here.

5.1 Overall Successes & Failures

The case studies represent a wide range of users and housing types. One important note is that many projects that purport to be "affordable" or even "low-income" are clearly not—either because they are too expensive or fail to provide for the additional needs of such a demographic.

They also demonstrated a wide range of quality. Some were inspiring, making creative use of inexpensive materials, while others were simply depressing. Halperin (and others) would certainly contend that low-income housing must be livable and even uplifting.

The most highly successful projects from a socio-cultural perspective (including Folesome Dore, Chestnut Court, and Gold Dust) all exhibited a highly participatory design processes that incorporated all stakeholders in the initial programming of the building (rather than allowing designers to make assumptions about user needs). Such stakeholders included potential users, neighborhood goups and community members, city officials, and often representatives of institutions that provide additional services to low-income residents. This process appears to be key to successful low-income housing.

5.2 Low-cost Sustainable Strategies

A number of sustainable strategies were common among most of the low-income projects studied. Many of these strategies are low-cost, or even no-cost, which makes them ideal for low-income housing.

Urban Site: An urban location helps to achieve a number of important strategies, including development density and alternative trans-

portation access. Additionally, urban property is, in some cities (including Cincinnati), much cheaper than non-urban property.

Compact Development: Small unit sizes help to keep prices down while also keeping rent down.

Salvaged Materials: Material reuse is an excellent low-cost sustainable strategy, especially when combined with some sort of systematic on-site “prefabrication.”

Passive Strategies: Many passive strategies can be low- or no-cost. Daylighting, passive solar, and passive ventilation can be seen primarily as a matter of strategic placement of openings and thermal mass. These strategies can greatly reduce utility bills for low-income residents.

5.3 Sources of Funding

One of the primary ways that sustainable strategies could be incorporated while keeping costs down was through funding from outside sources. By far the most common sources of funding were local, coming from local or state agencies, programs, or initiatives. Particularly important were local or regional initiatives to support green building, energy efficiency, LEED development, etc.

Local businesses were also key players. While they did not always contribute financially, many businesses agreed to donate particular systems, such as photovoltaic panels. Electric utilities often provided funding for energy efficiency measures.

Another important source of “funding” was volunteerism. Whether or not the project was officially a volunteer endeavor, extra labor was typically contributed by designers to get the projects completed, whether in the form of additional time spent lobbying governments for policy changes or variances, or additional time trying to convince engineers of the viability of passive systems.

Finally, there were a number of grants from national and international agencies and organizations. Specifically, the US Department of Housing and Urban Development (HUD) provided a number of grants for the real low-income projects. Other non-profit funding agencies included the World BRIDGE Initiative, Apollo Housing Capital, and the Fannie Mae Corporation.

6.0 conclusion

Strategies for low-income sustainable design

A number of general strategies for sustainable low-income housing emerge from the research presented above. These include design processes, demographic requirements, low-cost sustainable strategies, and funding sources.

1. Design Process: Successful sustainable low-income design involves all the stakeholders. This includes the users, community members, public officials, and support services. Consider partnering with existing support agencies to make the project even more successful.

2. Demographic Requirements: It is important to identify all the needs of the target demographic—not just architectural ones. The design must respond to all of these needs. Some typical requirements are: low rent and utilities, multiple-bedroom units, durability and easy maintenance, access to alternative transportation, and access to additional support services (when applicable). Ideally, the design should aim to go beyond these minimum requirements in order to emphasize livability, community, and ownership and to break the cycle of poverty.

3. Sustainable Strategies: Begin with appropriate site selection. A good site can simultaneous provide residents access to basic necessities and help to achieve sustainability. Second, focus on passive strategies. These are typically low-cost, and they have the direct effect of lowering utility bills. Third, consider salvaged materials. These are often no-cost, are highly sustainable, and when used creatively can enliven a design. Finally, look for funding sources to pay for other more expensive sustainable strategies.

4. Funding Sources: Start local. This begins with involving local officials, organizations, and community members. Also look for public or private funding that aims to support sustainable design or energy efficiency in general. Finally, involve local businesses, either as financial sponsors or

for the donation of particular materials and systems.

Sustainable design and low-income housing are highly compatible. But the design process cannot be approached the same way as “traditional” sustainable design. It must, first and foremost, respond to its social and political context: to the needs of the users, to the wider community, and to local and regional institutions. Only then can designers creating housing that is simultaneously socially responsible, inspiring, and ecologically sustainable.

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