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ON THE CONSTRUCTION OF RESEARCH-BASED DESIGN: A COMMUNITY HEALTH CENTER

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A case study in research-based design is presented in which key steps in the building delivery process are discussed, from project inception, predesign analysis-programming, and site selection to design, construction, and post occupancy evaluation, for a community-based healthcare center. The case study is an extension of a multi-year statewide initiative by the client agency, the State of Louisiana Department of Health and Hospitals, to upgrade its network of 138 facilities through strategic capital improvements through a mix of site-specific facility replacement, renovation, and adaptive use interventions. Compared to the traditional building delivery process, this case study is atypical insofar as the research and design steps in the process are accorded equal weight. The building is presented, architecturally, as a walk-through from the patient and visitor's perspective; this is followed by its evaluation by its users. Additionally, lessons learned and the general procedure are outlined for the benefit of design practitioners and facility planners. Strengths, weaknesses, and opportunities are delineated. The work is discussed as an alternative paradigm to the current mainstream practice of architecture, and the current, frequently disjunctive, ad hoc relationship between research and design in architecture.

INTRODUCTION

It has been over a quarter century since the emergence of the field widely known as environment and behavior studies. In its early years, the social scientists, planners, and designers who banded together shared a nearly singular, common goal of improving the quality of the built environment through research and design which maximized the degree of fit between the designed environment, human needs, and aspirations. The transactional nature of this relationship has resulted in numerous theoretical perspectives, studies of specialized user groups, and the examination of the impact of specific design attributes such as the impact of color, materiality, the relationship between spatial configuration, and wayfinding, as well as work on aesthetic meaning, perceived spaciousness, dimensions of privacy, and territoriality, to name but a few areas where significant contributions to existing knowledge have been made. As the field has matured it has come to appreciate and celebrate its inherent diversity, and the difficult task of delineating an overview of the numerous streams of work within the field has been attempted (Moore, *et al.*, 1991). However, a disjunctive relationship between research and design continues to persist in the architectural profession.

One area of discourse within the expansive body of work in environment-behavior has focused on the generation and application of environment and behavior research findings in the actual design and construction of buildings. In the present discussion this topic is referred to as *research-based design*. Research-based design is characterized by various streams, subdividable into specialized areas of study: user needs analysis; programming theory and technique; the scope, content and format of design guidelines; and post occupancy evaluation theory and technique are grouped beneath this umbrella. In this body of work, few systematic attempts have been made to follow through from the earliest phases of a project to its actual construction and occupancy within a single paradigmatic framework, by the *same team* (Refuerzo and Verderber, 1989).

The typical sequence of events has been that the individual or team charged with generating the predesign programming criteria on the front end of a capital improvement project hands the information off to others who actually design the building or portion thereof. A similar lack of continuity typically occurs on the other end of the spectrum: the individual or team conducting the post occupancy evaluation of the completed building or portion thereof differs from those who designed it, if an evaluation occurs at all. Robinson (1990), Sutton (1992), and others have argued for a synthesis between the discipline of architecture and the profession of architecture, where the latter is predicated upon the former. Much earlier, Stringer (1975) argued for the demystification of the design process and a corresponding inclusion of empirically-based knowledge about design. He alluded to the dangers of relying too much on myth and how it contributes to public misperception and unsubstantiated judgment on the part of the architect.

By contrast, a completed building is presented below based on an integrative research-based design framework. A single team was responsible for the background contextual research, the completion of post occupancy evaluations of typologically similar existing buildings as part of the predesign phase, the delineation of specific planning and design guidelines, the programming of a specific prototype, its design, construction, and post occupancy evaluation. This is followed by a brief assessment of the entire protocol. The two objectives of the present discussion are therefore: 1) to summarize the main findings, or outcome, of the research-based design, construction, and evaluation process vis-à-vis a walk through of a built prototype — a community-based healthcare center; and 2) to discuss the process itself in terms of its costs-benefits.

PROJECT BACKGROUND

In the fall of 1990, the client, the State of Louisiana Department of Health and Hospitals, Office of Public Health, contracted with the research-based design team to help the agency take inventory of the status of its aging network of 138 community health centers, regional laboratories, and allied support facilities across the State's 64 parishes. Prior to this the client did not have an overview of the

age of its facilities, their condition, nor the degree to which a given program site provided environmental-architectural support for its users. Matters were compounded by two glaring, chronic shortcomings in the delivery system. First, a series of new programs had been created in recent years. One of these new programs called for the installation of computer hardware for the computerization of each patient's medical case history. The clinics, however, lacked space to house the computers; this created mass confusion. In one clinic the computers were operated for months from the tops of cardboard boxes. Second, each parish, as mandated by the State constitution, is responsible for the design, construction, and upkeep of its clinic(s), although each is staffed by State-paid and managed personnel. This resulted in serious inconsistencies over the decades in the quality and age of buildings across parishes. The problem of lack of statewide minimum design and construction standards has been compounded further by the client agency's establishment, and understandably so, of highly consistent programs and services across the parishes. Hence, this mismatch between a haphazardly decentralized network of facilities lacking quality control in design and facility management was fundamentally at odds with the requirement of maintaining a highly consistent palette of services across program sites.

In terms of patients served, the majority are eligible for the federal Medicare program. Others pay a partial amount for care on a sliding scale relative to ability to pay, i.e. immunizations, nutritional education (WIC), STD and HIV-AIDS and TB testing and early detection treatment. Routine treatment for common illnesses such as influenza, and coordination of locally-based environmental health services including food and water quality monitoring and the granting of permits, are also done by staff housed in the typical community public healthcare center in Louisiana. The agency has experienced a series of budget cutbacks in recent years and is now beginning to recover somewhat from the economic downturn which resulted from the "oil bust" of the mid-1980s.

The work has been a source of empowerment for staff and patients at the local level, has fostered improved communications between the parishes and the central administration office in New Orleans, and to some extent has enhanced the image of the agency itself (Verderber and Refuerzo, 1993). A five volume report was developed as the first phase of the work (1990-91).[1] The second phase (1991 to present) has consisted of implementation, with the research-design team able to retain control over the complete building delivery process in a number of parishes. Various aspects of the work have been reported elsewhere (Refuerzo, Verderber, and Burkart, 1991; Refuerzo and Verderber, 1991, 1992, 1993).

A COMMUNITY HEALTHCARE CENTER

Near the completion of the abovementioned reports in 1991 the team was approached by the Office of Public Health and officials in Ouachita Parish, Louisiana, to plan and design a 12,500 square foot replacement facility in West Monroe. West Monroe is located in the Northeast portion of the State. The new facility was to replace one of the most antiquated, obsolete clinics in the state; it had been housed nearly forty years in a building built in the 1930s with minimal renovation. The project team met at frequent intervals with staff and local officials, interviewed patients at the old clinic, assisted in site selection, and carried out all predesign programming. The research-design team affiliated with a local architectural firm to follow through with the construction documents and with construction administration.[2]

Translation of the Research

The cornerstone of the first phase of the work was the staff-reported post-occupancy evaluation of each facility. Staff at each program site evaluated their own facility, based on detailed instructions. The completion of the survey was required of every program site. The 138 surveys were subjected to data analysis; a series of twelve tables were reported.[3] One of these tables, Table 1, contains data on the functional inventory of the facilities, collectively in terms of the various room types, their average quantity, size, if multiple functions are carried out routinely in these rooms, if they are lockable, and

TABLE 1. Functional space inventory assessment: All comparable OPH clinics in state (62) compared to design case study.

Room Type	Average Quantity	Average Size[1]	Multiple Functions(%)	Lockable (%)	Evaluation		Case Study POE[3].	
			Y[4]	Y[4]	X	S.D.	X	S.D.
Entry/Reception	1.3	1,045 (49)	30.4 (9)	3.3 (8)	2.66 (48)	.82	3.69	.41
Waiting Room	1.5	768 (59)	35.7 (20)	29.1 (16)	2.86 (50)	1.08	3.71	.27
Staff Offices	8.2	1,942 (59)	35.6 (21)	66.7 (38)	2.43 (56)	.96	3.22	.66
Medical Records	1.2**	411 (59)	31.0 (13)	75.6 (31)	2.13 (51)	.82	3.17	.29
Conference Room	1.8**	450 (48)	70.5 (31)	60.5 (13)			3.90	.46
Staff Lounge	1.1	245 (39)	34.3 (14)**	35.3 (12)	2.62 (29)	.77	3.93	.42
Classroom	1.0	376 (41)	85.0 (17)	65.0 (13)	2.27 (38)	.92	3.79	.22
Staff Washroom	2.2	135 (58)	12.1 (7)	82.8 (48)	2.40 (50)	.80	3.41	.79
Patient Specimen Washroom	1.5	74 (29)	27.6 (8)	82.8 (24)	2.79 (29).	.86	3.62	.60
Public Washroom	2.3*	149 (56)	7.7 (4)	67.9 (38)	2.86 (54)	.84	3.16	.81
Storage	3.8	486 (60)	17.5 (10)	79.3 (48)	2.51 (48)	.90	2.94	.26
Waste Storage Room	1.0	157 (4)	50.0 (2)	75.0 (3)	2.32 (3)	.96	2.75	.32
Custodian's Room	1.2	65 (39)	27.0 (10)	66.7 (26)	2.69 (31)	1.01	3.15	.61
Exam Rooms	5.1*	571 (60)	54.4 (31)	71.4 (40)	2.64 (59)	.79	3.65	.37
Laboratory	1.2	157 (48)	46.9 (23)	68.2 (28)	2.37 (30)	.78	2.87	.19
Kitchen/WIC Education	1.2	291 (50)	56.3 (27)	60.9 (28)	2.73 (44)	.95	3.05	.25
Immunology Room	1.2	189 (31)	50.0 (9)	66.7 (12)	2.67 (29)	.98	2.77	.32

[1]Square feet (number of comparable facilities reporting shown in parentheses).
[2]Assessment of occupant satisfaction with the architectural environment. These data are a summary mean computed across survey items contained in the 1990 Statewide DHH-Office of Public Health Facility Survey.
[3]Denotes case study design post occupancy evaluation.
[4]Y=Percentage and number of Yes responses to question.
*Significant Regional Difference, p< .05.
**Significant Regional Difference, p< .001.

the collective assessment of each room type on a four point satisfaction scale ranging from *not at all satisfied* to *very satisfied.* It was learned that a surprisingly high percentage of rooms were too small relative to the current demands placed on them; these rooms were overburdened with two and sometimes four activities occurring simultaneously, and in some cases a high percentage of rooms requiring security were not secure.

Concurrently, twenty-five program sites were evaluated by the research-design team in the field, across the State. These post occupancy evaluations (POEs 1-25) yielded a wealth of useful information for transportation into programming and design. They provided resonance to the information provided in the surveys, and provided the team the advantage of first hand testing or verification of the written information. Each on-site POE included numerous interviews with staff and patients, behavior setting observation and diagraming of patterns of use. Floor plans contained the flow analysis and drawings of key behavior settings, linked with key strengths, weaknesses, and opportunities for improvement (Figure 1).

Next, the survey data and the 25 POEs were translated into a set of 140 planning and design guidelines for community healthcare centers. These were presented in eight sections in volume three of the multi-volume report.[4] In the period of time subsequent to the adoption of the guidelines as policy, each has been applied in various ways to the forty-one projects statewide. However, due to limitations of space, suffice to say, eight specific findings of the research, as filtered through the guidelines, found their way into the design of the West Monroe community health center. These were:

- There is no *correct* or standardized footprint insofar as successful examples of cross plans, box clinics, courtyard clinics, and multi level clinics were documented. The particular needs of the staff result in a configuration best suited to their needs.

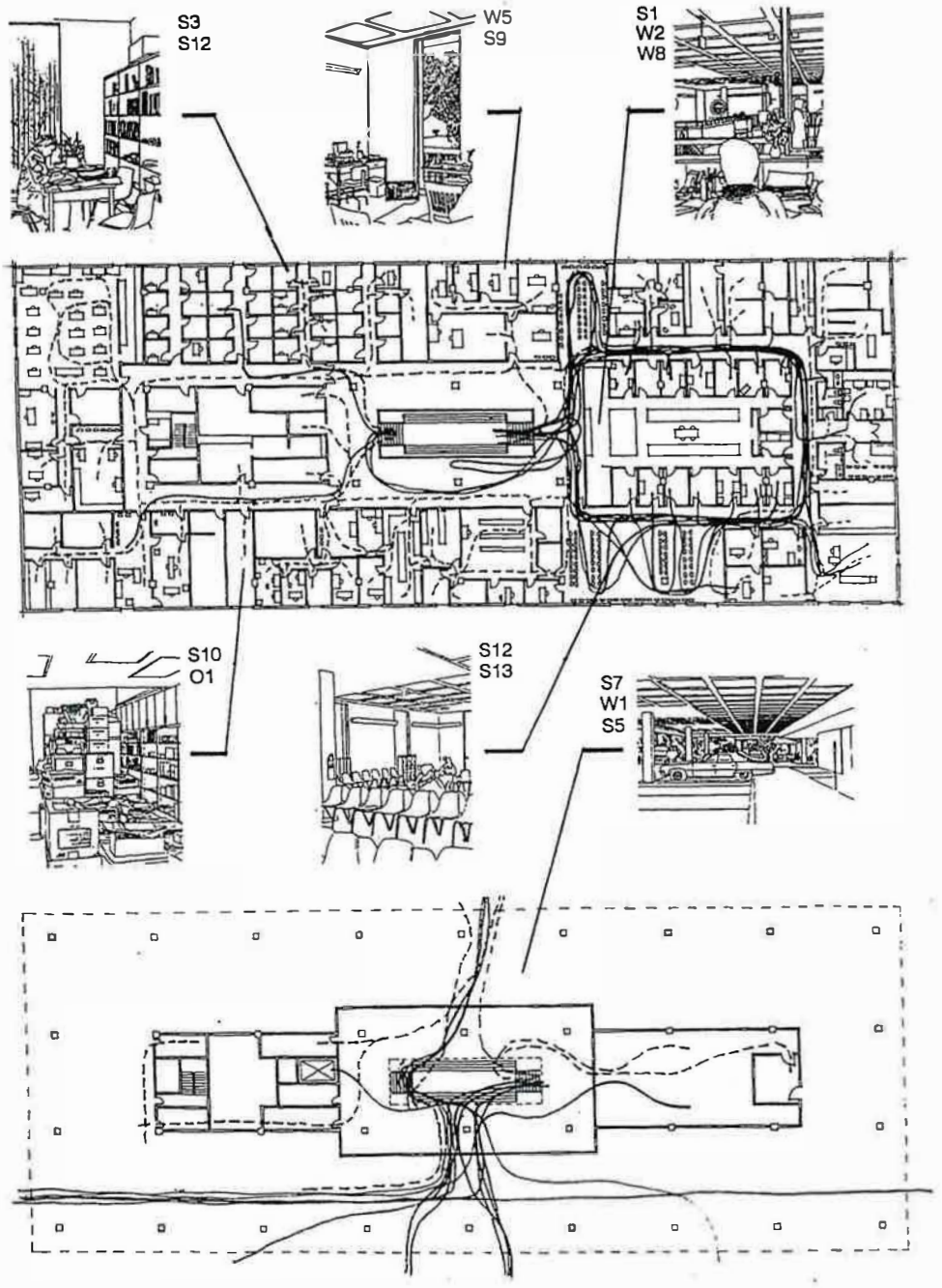


FIGURE 1. Predesign case study.

- Functional zoning internally is a necessity; clinical areas should be separated from clerical zones, and waiting areas should be zoned to centralize noise and patient flow.
- Natural daylight is a desirable ingredient. Full height windows and the creation of room to room transparency is desired by users.

- Residential imagery is highly desirable to staff and patients.
- Flexible rooms provide much more amenity than single-function rooms. This concept is applicable to every space within the facility.
- Children need their own spaces within the facility. This translated into play rooms and outdoor play yards, and for infants, changing tables in the restrooms, and breastfeeding alcoves for mothers.
- Innovative approaches to patient confidentiality, data management and retrieval were urgently needed. This translated into records rooms with rolling file units, the creation of intake rooms opening onto a clerical zone, and portable, modular furnishings.
- Clearly identifiable yet separate entrances and parking areas for staff and patients are a necessity.[5]

The completed building, presented below, therefore is the end product of type-specific research, and research-based programming, design, construction, and evaluation as an internally consistent process.

Site/Parti

A 2.5 acre site was chosen as the site of the new community health center. It is linear, narrow on the north and south edges. Its south edge fronts a two lane road. An east-west interstate and a major interchange is to the north. In response to the need for parking for up to 65 autos on-site, and for establishment of a strong, identifying feature from the street-drive access point to the site, a porte cochere was incorporated to function as the "front door." This required that the parking areas be pulled to the "rear" portion, nearest the interstate. The access drive draws visitors and patients to the covered drop off/pick up point, with the option to drive directly to the parking area on the other side of the building. Parking for persons with disabilities is provided next to the porte cochere at the front side of the building.

Conceptually, the building-site was viewed as a series of contiguous, linear bandwidths each housing a discrete domain or core functional component of the clinic. The six elements were sliced and shifted accordingly in response to the narrowness of the site, internal functional adjacency and circulation requirements, parking and access drive determinants, and expansion possibilities. The six bandwidths are, reading from left to right (with north orientation up): 1) the main waiting room/multipurpose space, including an outdoor play area for children and related support spaces; 2) the main arrival/departure axis, passing north-south its entire length and penetrated by two east-west circulation axis; 3) the clinic and administrative bandwidth, also housing the regional environmental health staff in a second level "loft"; 4) the core bandwidth at the midpoint of the parti, housing medical records, nutritional education programs, and the subwaiting room; 5) the clinic and administrative bandwidth (continuation); and 6) the nursing and staff support bandwidth.

In its horizontal axis (east-west), the building is zoned with administrative functions housed on one side and clinical functions housed on the other side (Figure 2). On the second level, the environmental health programs are housed in enclosed loft space, with vertical circulation connections. Approximately 40% of the loft is currently shell space for future use. The building's *T parti* is expandable to become an *H* in plan: a wing housing clinic expansion to the north, and a future administration/program support wing to the south. Volumes are hierarchically arranged corresponding to a public-to-private gradient. Daylighting strategies are fundamental to the conceptual strategy of the parti and its siting.

An architectural vocabulary is incorporated evocative of regional residential and industrial buildings in terms of scale, color, the relation of interior to exterior, materiality, hierarchical massing of volumes, and the abovementioned emphasis on natural daylight. Particular emphasis is placed on the

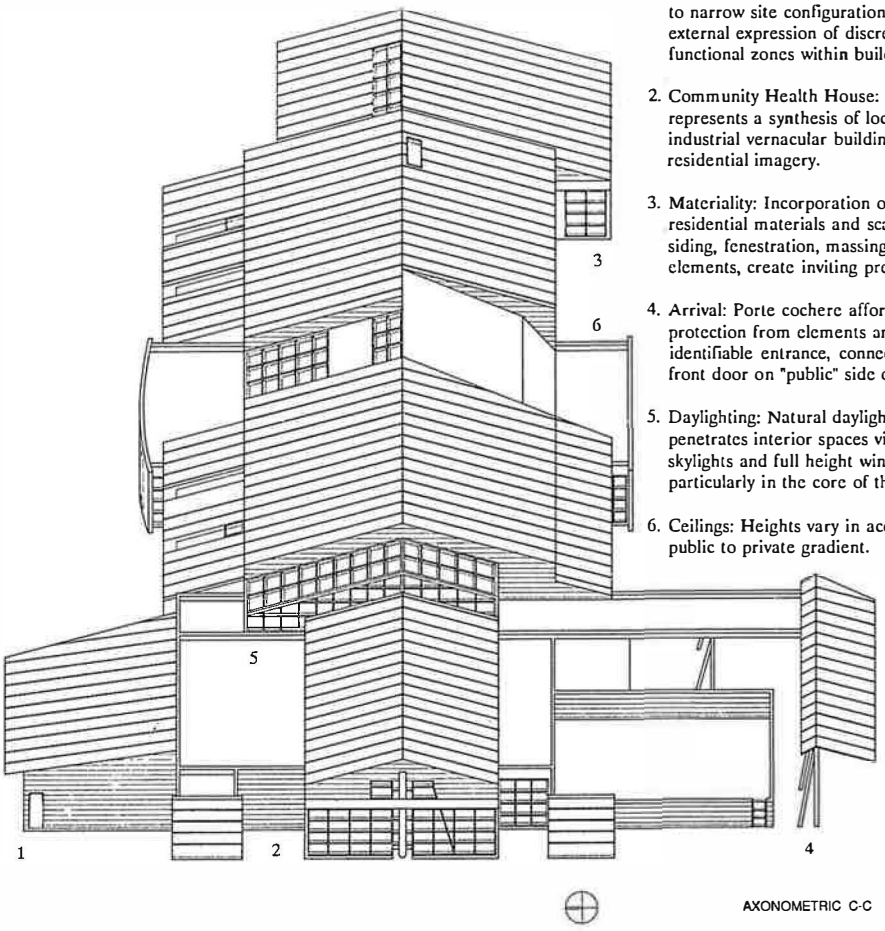


FIGURE 2. Axonometric view facing west.

experience of the child: children represent nearly 50% of the building's users. For the child, and for the community at large, the design intent was for the health center to be a welcoming environment — a community health *house*.

The program called for six exam rooms, a laboratory, subwaiting room, nutritional education kitchen, staff offices for nursing, medical, clerical, social work, STD, and environmental health staff. Between 28-30 staff are housed on-site, and nearly 1100 patients use it per month. The four types of staff housed in the facility are physician and nursing staff, counselors, administrative-clerical, and environ-

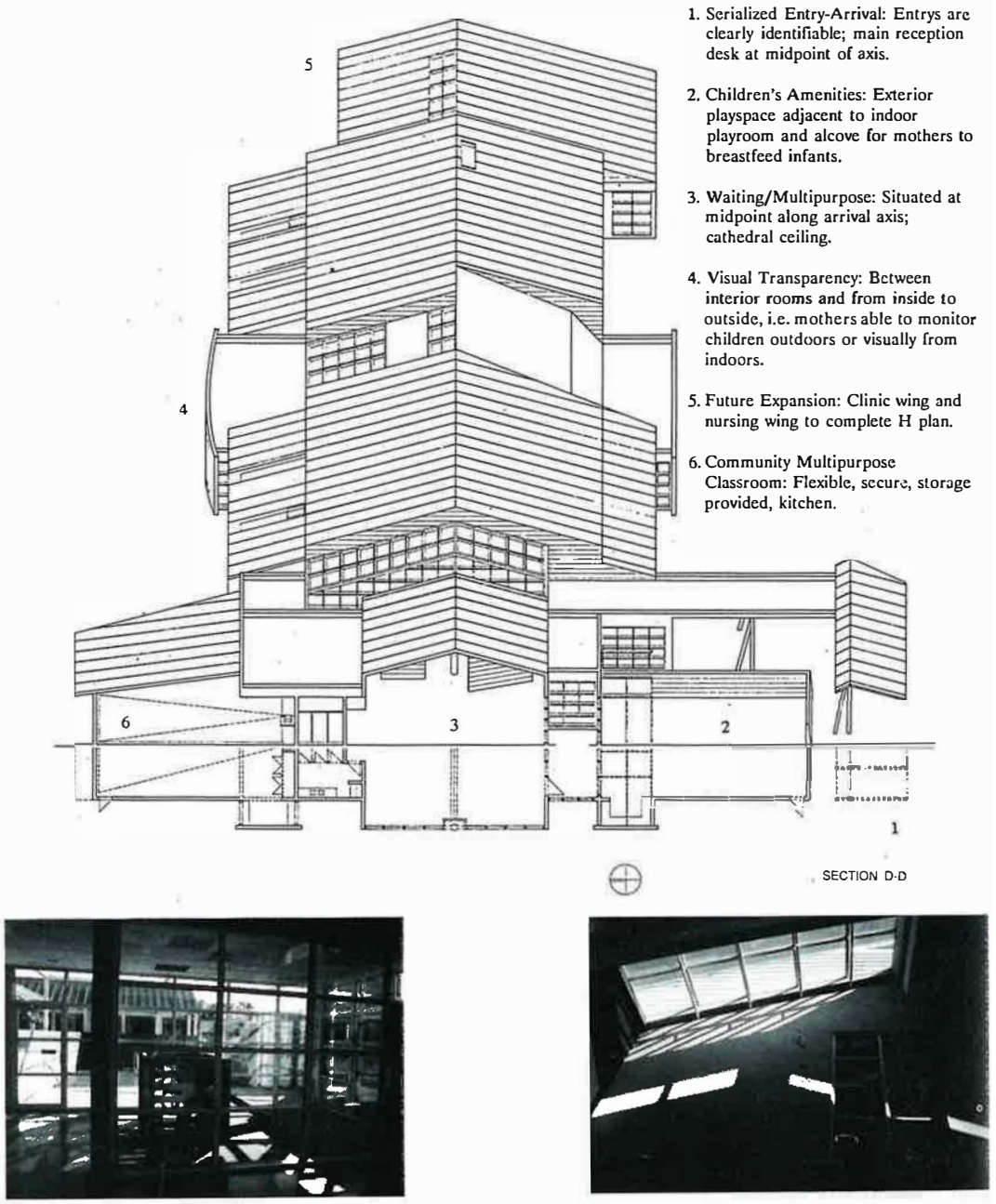


FIGURE 3. Axonometric view of community outreach-arrival axis.

mental health staff. The intake and reception areas include five semi-private rooms to insure patient confidentiality. A staff lounge, conference room, multipurpose room, main waiting room, children's indoor and outdoor play areas, medical records room, and various storage spaces for equipment and supplies were required.

Behaviorally, the program was driven by a desire on the part of the staff to break down the symbolic and physical barriers that in the past unnecessarily separated them from their patients. This limitation

had permeated their former, obsolete clinic, resulting in an extremely low level of patient confidentiality, with patients forced to divulge sensitive information through a small hole in a walk-up window. All rooms, including exam rooms, were seen as isolated cells, lacking visual or other symbolic connection to one another. Administrative and clerical staff were hidden away in one corner, clinical staff in another, and so on. Second, a strong directive to the research-design team was for a clear patient and staff circulation flow pattern, avoiding the "functional spillover" and bottlenecks which plagued their former facility. Third, the staff sought *age appropriate* spaces for children, as they would continue to be a key user group. Fourth, the staff deemed a non-institutional, inviting, non-threatening image as essential, with emphasis on positive yet soothing colors, natural daylight, and spaces that would be seen as dignified and as a source of positive reinforcement to patients, most of whom are from low income communities. A synoptical walk-through of the health center follows primarily from the perspective of the patient and visitor.

Reception/Intake

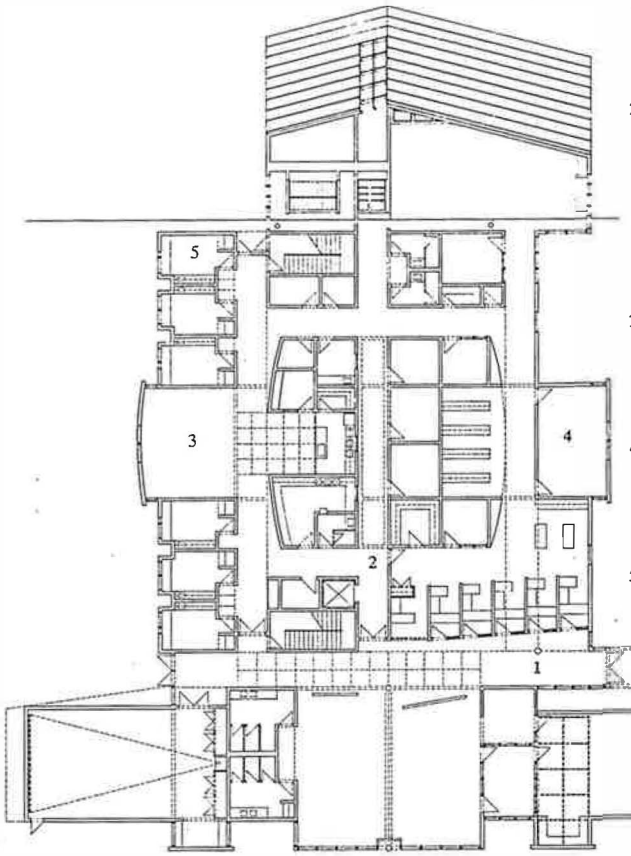
The main reception desk is at the midpoint of the north-south circulation axis which runs the length of the building (Figure 3). It is clearly visible from either the porte cochere main entrance or the opposite entrance (from the parking area). From the north entrance the multipurpose classroom is to the immediate right. From the canopy entrance side the five intake interview rooms are to one's immediate right. The main waiting rooms is at the midpoint, situated across from the reception desk. The intake rooms have floor to ceiling glass on the "public" side and are open on the "staff" side: each contains a desk and side credenza, computer hardware, and seating for two or three patients; each room opens directly into the open clerical workspace. A high level of visual transparency exists based on the staff goal of demystifying — revealing — functions traditionally hidden from public view. The main waiting room adjoins the children's play room and the play room opens onto an outdoor play yard. An alcove for mothers to breastfeed infants and/or to monitor children is adjacent to the indoor playroom.

The main waiting room is flexible for use as a seminar space for educational programs. Its cathedral ceiling, and the two-level height wall on the reception desk-intake side contains a full length window visually linking the second level environmental health suite with the public "heart" of the building — the clinic on the level below. Compartmentalized restrooms equipped with wall-mounted drop-down infant changing tables are adjacent to the main seating area. Large windows connect the public, arrival realm with the outdoors. Visitors to the environmental health offices are directed from the reception desk to the elevator or stairs a few feet away.

Clinic

For clinic patients the subwaiting room is the next stop. This space is situated at the heart of the clinical realm, flanked by three examination rooms on each side, arranged along the north side of the clinical hallway "spine" (Figure 4). Each examination room is scaled to appear as a small *house* — this is expressed internally in terms of side, colors, ceiling heights, and fixtures, and on the building exterior each is given individual expression (Figure 5). The double height volume of the clinical spine contains clerestory windows. Patients are called from the subwaiting room to one of the examination rooms, or to the nutritional education kitchen across the hall. The seating area and demonstration kitchen is visually connected to the subwaiting room. The kitchen is a double height volume with a skylight above. The skylight facilitates transmission of natural light into rooms at the center of the clinic, spaces which would otherwise be windowless. The kitchen is equipped with a cooking island, pantry, charting alcove, sink, residential cabinetry, counter, and an adjacent office for the full time nutritionist.

The east-west axis at the center of the building demarcates the clinical and staff support domains. The offices of the physician, social workers, STD counselors, and storage spaces are situated along this hall. Patients are directed to these offices from the core clinic spaces, for counseling and treatment. Depending on the nature of the patient's visit, one might return to the subwaiting prior to an appoint-



1. Intake: Five intake room/alcoves afford confidentiality; transparency achieved via full length glass on public side; open on staff side.

2. Wayfinding: Paths zoned to demarcate and differentiate staff and patient flow patterns. Result: Staff zones and patient care zones--a "quiet", non-chaotic ambiance. Minimal reliance on directional graphics. Natural light and spatial transition afford respite and legibility.

3. Clinic: Subwaiting room flanked by exam room "houses" along clinic spine. WIC demonstration kitchen at heart of clinic, visually connected to subwaiting area.

4. Support: Administrative and records realm bisected by center axis, terminates in staff lounge, connected to nursing open plan workspace and conference area.

5. Spatial Legibility: Spaces vary in shape, volume, ceiling configuration, color, materiality,

SECTION F-F

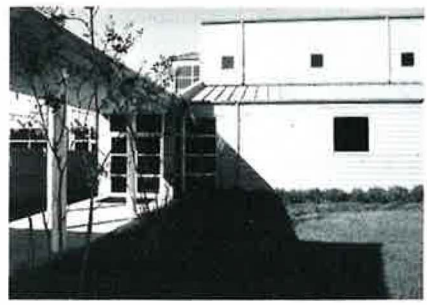


FIGURE 4. Clinic and clinic support areas.

ment with another specialist, or return to the reception desk to make another appointment, if warranted.

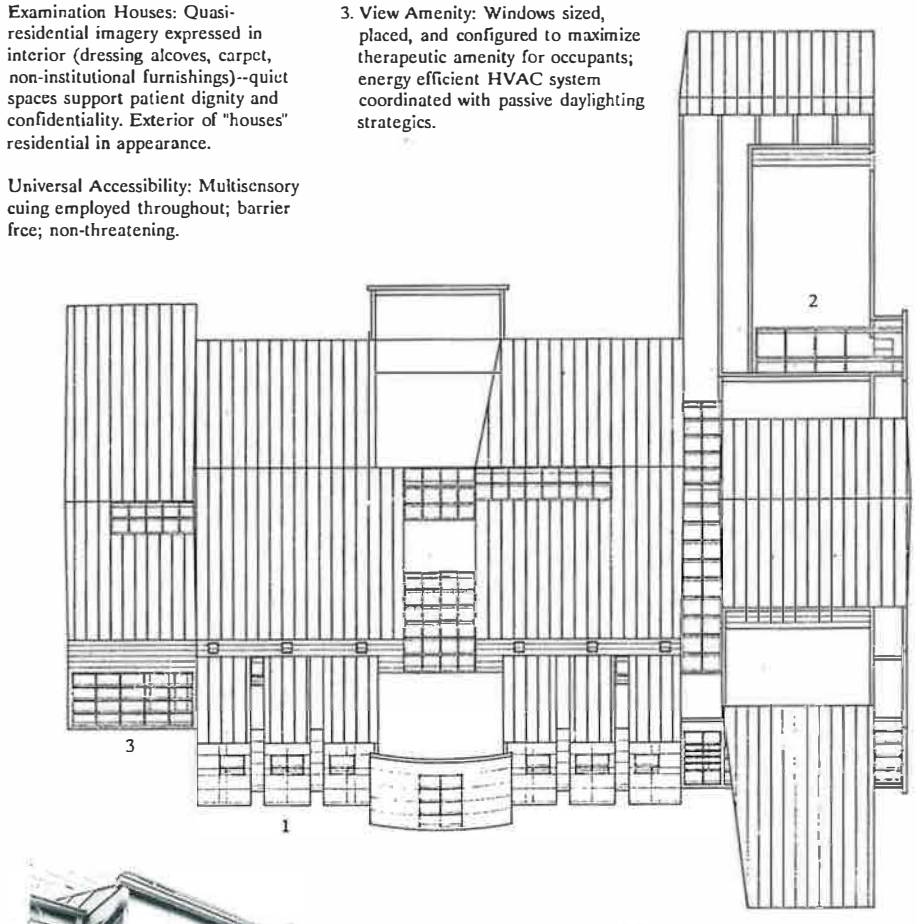
Staff Support

Staff support spaces are clustered on the first level in a progression from semi-private to most public in nature. The nurses' offices are at the semi-private end of the bisecting axis. The staff lounge is adjacent to the nurses' offices. The lounge contains a full kitchen and lockers for staff personal belongings. A patio is adjacent to the lounge and full height windows provide full views. The medical

1. Examination Houses: Quasi-residential imagery expressed in interior (dressing alcoves, carpet, non-institutional furnishings)--quiet spaces support patient dignity and confidentiality. Exterior of "houses" residential in appearance.

2. Universal Accessibility: Multisensory cuing employed throughout; barrier free; non-threatening.

3. View Amenity: Windows sized, placed, and configured to maximize therapeutic amenity for occupants; energy efficient HVAC system coordinated with passive daylighting strategics.



AXONOMETRIC B-B

FIGURE 5. Axonometric view facing north.

records room is situated opposite the staff conference room, at the center. The clerical, and administrative support, and intake nodes are at the most public end of this continuum. These zones correspond to the various bandwidths which comprise the parti. Visual transparency characterizes the intake side of this zone and visual separation the nurses' offices. Full height windows afford expansive views to the wooded, semi-rural landscape.

TABLE 2. Assessment of facility and site context: All comparable clinics in state (62) compared to design case study.

Response Item	Statewide (Staff)[1] X	S.D.	Case Study (Staff)[2] X	S.D.	Case Study (Non-Staff)[3] X	S.D.
Community Context:						
Access to Public Transportation	2.38 (61)[1]	.79	2.44	.27	2.29	.61
Location Within the Parish	3.43 (60)*	.66	2.93	.44	2.77	.57
Distance from Home	3.27 (62)*	.81	2.90	.37	2.62	.66
Appearance of Immediate Neighborhood	2.47 (41)*	1.03	2.72	.81	2.88	.77
Building/Site:						
Perceived Safety on Site	2.71 (60)	.92	2.96	.77	3.09	.52
Amount of Parking On-Site	2.08 (62)	.84	3.71	.62	3.27	.69
Proximity of Parking in Relation to Main Entrance	2.11 (59)	.77	33.2	.21	3.41	.77
Appearance and Upkeep of Grounds	2.30 (44)	.62	3.44	.17	3.62	.41
Outdoor Playspace for Children	2.41 (9)*	.88	3.61	.26	3.26	.92
Image of Clinic from Outside	2.46 (61)	.96	3.41	.44	3.33	.60
Directional Signage (Exterior)	2.16 (58)	1.04	3.06	.52	2.70	.44
Directional Signage (Interior)	2.11 (58)	.90	2.60	.42	2.89	.70
Staff Characteristics:						
Effect of Facility on Staff Reputation	3.16 (60)	.88	2.52	.27	--	--
Effect of Facility on Morale of Staff	2.55 (56)	.71	2.93	.34	--	--
Effect of Facility on Staff Retention	2.46 (54)	.62	3.77	.66	--	--

[1]Number of comparable facilities reporting statewide shown in parenthesis.
[2]Number of staff respondents = 19.
[3]Mumber of patient/visitor respondents = 34.
*Significant Regional Difference, $p < .05$.

On the second level the environmental health suite and unoccupied shell spaces are situated along an east-west axis, as on the level below. The reception area overlooks the main waiting room below and the surrounding landscape. A conference room at the midpoint of the corridor axis overlooks the nutritional education kitchen below, and a large skylight provides view and transmits light. The eleven staff required their domain to be separate from the other portions of the facility, visually, with an entrance easily accessible to the dozens of visitors they receive each week.

Post Occupancy Evaluation

The facility opened in January of 1994. A period of nine months passed prior to the evaluation in order to allow for the move in and initial fine tuning phase to take place, and for the "halo effect" to wear off somewhat. Staff respondents totaled 19, and patient and visitor respondents totaled 34. Each staff respondent evaluated their own work area and the spaces common to all staff. In addition, a number of patients were interviewed. The questionnaire, identical to the one used to evaluate the clinics statewide in 1990-91, addressed interior and exterior spaces in terms of four major areas: maintenance and upkeep, aesthetics, patterns of use, and environmental control systems/human comfort. The information was complied according to the identified strengths, weaknesses, and opportunities for improvement in relation to the above criteria. Table 2 contains the results statewide in comparison to the assessment of the case study facility by staff, patients and visitors.

In addition to the interview data, patterns of use were documented. The method was the same as utilized in the twenty-five POE site visit case studies conducted early on in the statewide facility initiative. Photos were taken of key behavior settings (Zeisel, 1981). Before-after comparisons between design intentions and the resultant completed buildings were recorded (Figure 6).

The response to the fifteen survey items related to community context, building/site, and staff characteristics are reported in Table 2. In addition, Table 1 compares statewide assessment of key room types; these findings are compared with the case study POE data. However, due to space limitations these findings are not discussed individually. The interview data, on the other hand, is briefly summarized: staff-indicated weaknesses consist, in terms of maintenance and upkeep, of the challenge of keeping the building clean and maintaining the grounds, due in large part to the increased size of the new facility. The parish has since improved the landscaping and building maintenance schedule. Second, a chronic roof leak in one of the exam rooms had been difficult to trace and repair, and was a source of frustration for the nursing staff, as one of the six exam rooms was periodically unusable due to the problem. At this writing the needed repairs have been made. Patients interviewed did not report any weaknesses in terms of maintenance and upkeep. Strengths reported included the durable materials and furnishings, and the level of care the staff and patients give to keeping the facility clean, compared to the old facility.

In terms of aesthetics and the symbolic "messages" conveyed by the facility, no weaknesses were cited by staff nor by patients interviewed. Strengths cited include the exterior color of the facility (blue-grey), its composition, siting, the relation of parking areas to the entrances, the views out the numerous windows, and the amount of natural daylight in the interior.

With respect to patterns of use, weaknesses cited consisted of the lack of signage at key hallway intersections, a conference room deemed too large in terms of its current level of use, a cooking island in the demonstration kitchen in need of additional work space, and a play yard lacking in equipment. The spaces were considered flexible and generally adaptable with only minor modification needed in light of the probable addition of primary care services in the facility. Strengths cited included the absence of noisy spaces, the separation of activities into discrete rooms that previously had shared a single space, i.e., the creation of children's play areas apart from the waiting room, the inclusion of a subwaiting room, and a dedicated staff lounge not shared with the WIC kitchen.

In terms of environmental control, a weakness cited by staff on the second floor was difficulty in maintaining proper comfort levels. This was also a concern of nursing staff with respect to their open plan office area. Staff and patients who use other portions of the facility indicated comfort levels are adequate, and in many cases cited this as a strength.

Opportunities for improvement, overall, across the four principal areas evaluated consisted of increasing the maintenance schedule, monitoring of roof repairs to avoid leakage reoccurrence, increasing the work area at the cooking island in the demonstration kitchen, and improving comfort levels through minor retrofitting of the HVAC system in some parts of the building. It is the view of staff that the building is flexible and would support the addition of primary care healthcare services in the near future.

SUMMARY AND DISCUSSION

A case study has been presented on the construction of research-based design. This process consisted of numerous steps — many of which have, unfortunately, traditionally been considered as mutually exclusive by design professionals and by environmental design researchers alike. A project for the planning, design, and construction of a community-based healthcare facility for a public sector agency was described in terms of the various steps from project inception to the evaluation of the completed building. This process consisted of a statewide strategic facility assessment process, development of design guidelines, predesign analysis, site selection, programming, schematic design, design development, construction documents, bidding, construction, occupancy, and post occupancy evaluation. A single team carried out each of these phases in consort with other professionals, providing continuity, and a close-working relationship.

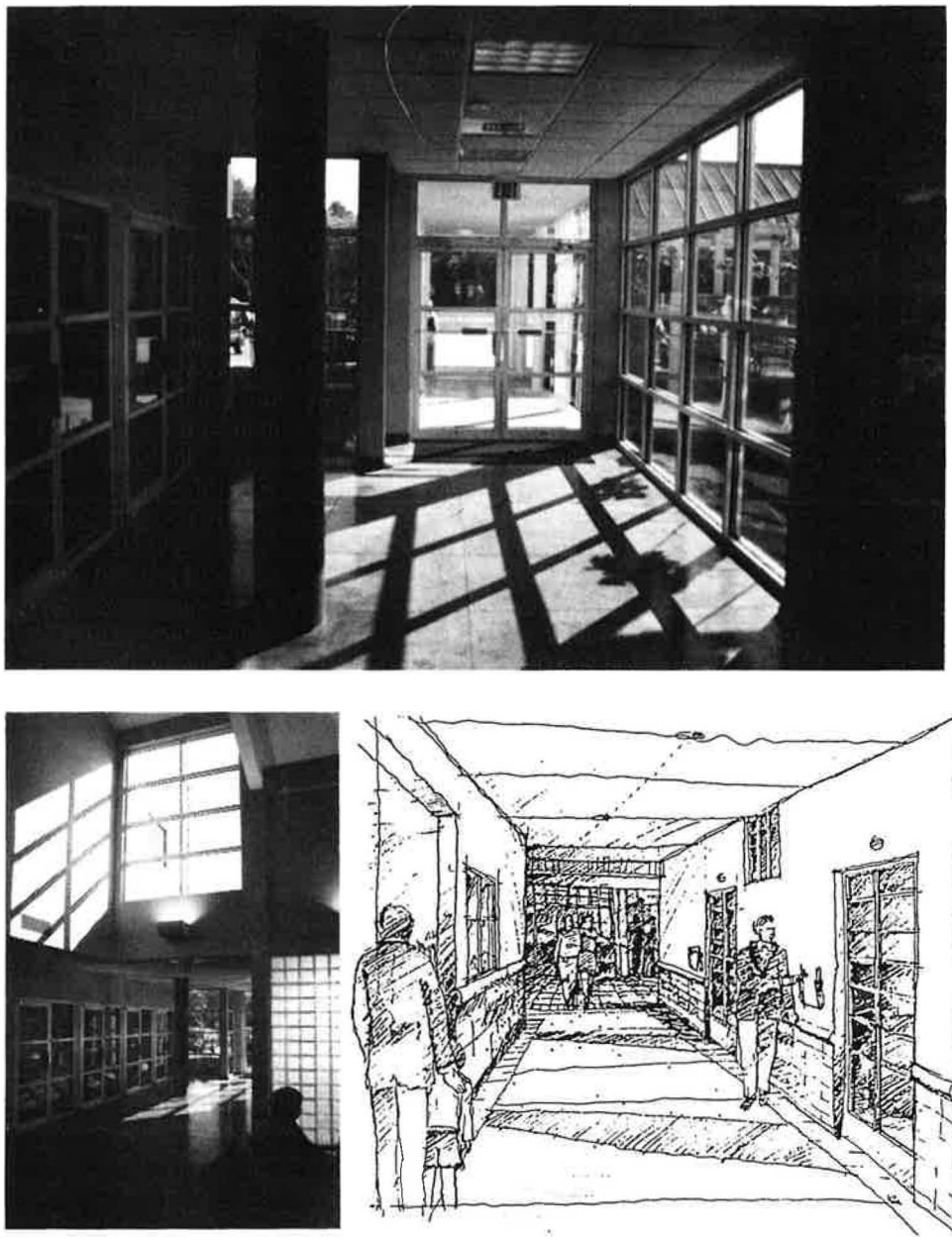


FIGURE 6. Comparative assessment of schematic design to completed building.

For others interested in the method, it is important from the outset to lay the groundwork to build upon. First, it is imperative that the client appreciate the enormous cost savings down the road in terms of not having to reinvent the wheel for each new clinic. Staff can begin the planning and design process much higher on the learning curve than would otherwise be the case, from the point of *how do we want to adapt this body of knowledge to our new clinic?* rather than *where do we start?* Second, it is recommended that the approach be *concurrently* both from the bottom up and from the top down. In other words, spend time working directly, site specifically, with the end users and balance this with the overview afforded through large scale activities across settings, such as through questionnaires. In this manner one will be able to delineate the big picture without forgetting the

details. Third, use multiple methods to gather information in the field to create a blend of written and visual information. This makes the process user friendly to non-designers without compromising the critical translation of empirical data into design.

Pitfalls to avoid include the tendency to gather too much empirical information and then be unable to distill it into a set of simple yet coherent architectural design principles. One reaches a point of diminishing returns and when this occurs built in checks and balances must be activated so one does not become overwhelmed. Another potential problem is the tendency to repeat past successes without probing ones own data further. It is important to approach each situation as a unique opportunity to push the database — the research-based design envelope — a bit further than before, in a search for new ways to translate research into design.

The results have been of use to private and public sector healthcare organizations in Louisiana and have generated wide interest. The advantages of this unified approach include the obvious continuity achieved when the same individuals follow through on the building delivery and evaluation process from beginning to end. Albeit, it is a difficult challenge to critically evaluate one's own buildings, with the fruits of one's labor held up to self-scrutiny. This is perhaps a major reason why so few architects systematically evaluate their own work. Nonetheless, even when evaluating others buildings it can be a challenge to reconstruct the history of a building project from its inception to occupancy. Unless the whole *story*, or narrative, of the building is revealed one remains hamstrung, unable to probe beyond superficial issues, beyond the self evident, or worse, remain limited to observation of patterns of use without direct corroboration by the building's users due to political constraints or other impeding external parameters placed on the evaluator(s).

The vast majority of post occupancy evaluations to date have been done from the inherently disadvantageous perspective of the outsider: the researcher pieces together the story much as a news reporter without any guarantee that what he/she finds will be used by anyone. Despite the considerable amount of knowledge on specific building types and user groups gained over the past two decades through the well-established modus operandi of the post occupancy evaluation, in architecture it is unfortunate how remarkably little of this information has had a sustained, direct impact on the actual design of buildings (Lang, 1987).

In the realm of architecture for health, Carpman and Grant (1993) advocate a proactive role for design research and for the design researcher in facility planning and design. In their view the design professions need to include the role of facility research and evaluation as a criterion for formal recognition in design awards programs. Why not extend beyond this to require that the submitting team be responsible for documenting the project's narrative, the self-evaluation of its own work with input from the building's users and other key decision makers who influenced the outcome, and then report the results and the building' impact as part of the awards program submission? This would have many implications revolving around a heightened emphasis on research and its role in design. More specifically, research and design would be seated at the main table for the *first time*. Of course, critics claim that these approaches are too costly and that clients are unwilling to pay for them, or that they get in the way of good design. Part of the dilemma faced by the architectural profession in the 1990s has stemmed from its lack of accountability in the eyes of the general public. It has lost a sizable share of its confidence in the profession. One way to regain and extend the public trust in the profession is to use research-based design as a vehicle to present itself as a *discipline* based in part on science and in part on aesthetics rather than, at the extreme, singularly as an art form.

As for the schools of architecture, it is hoped that a broad perspective that embraces the knowledge-generative scope of the discipline of architecture as well as the core activity of design can be integrated in studio teaching and in the reflective practice of architecture, and not, as Robinson (1990) has cautioned against, merely appreciated as knowledge per se but as a genuine tool for "explaining and verifying the validity of designs" after the fact. This echoes Stringer (1975) who concluded, "If verification is to be a part of architectural creativity, it must be carried out by the architect himself [herself]."

Despite optimistic prognostications put forth nearly a quarter century ago, the impact of research in architectural practice has been minimal. Few are being cross-trained in both research and in architectural design. Integrative paradigms are few. Models are needed in which the theoretical and applied aspects of research are accorded equal weight to design theory and the tectonics of built form (Refuerzo and Verderber, 1989, 1990, 1993a, 1993b). Perhaps *research-based design* is one way that the architectural profession can begin the long process of reversing its eroding position within contemporary culture.

NOTES

1. The initial phase of the work (1990-91) resulted in a five volume report, consisting of a statewide facility survey, facility performance criteria (Part One), post occupancy evaluations of 25 representative clinics in the state (Part Two), delineation of 140 planning and design guidelines (Part Three), schematic design of a prototype community public health clinic in an abandoned oil field industrial warehouse, a functional space program cross referenced to the guidelines, and an annotated bibliography (Part Four), and a summary and protocol for the implementation of the contents and recommendations of all five parts of the work (Part Five). As of November 1990 sixty-six percent of the OPH facilities statewide had been in operation in their present building *30 years* or longer. To say that the worst of these were (in some cases still are) obsolete would be a gross understatement. However, much progress has been made in the past five years to improve the clinics through relocation to new quarters or on-site renovations and/or expansions. By the end of 1995 forty-one capital improvement projects statewide were completed or underway as a direct result of the work, i.e. the reports and follow through consultation in the field, produced by the research-based design team. In most cases the team has consulted with local officials and those responsible for design and construction (and no two cases have been alike). The result of this strategic facility improvement program has been to, as mentioned, provide oversight and architectural quality control, which did not exist prior to 1990. To this end, the work is a model of a baseline of minimum architectural and facility performance criteria for a specialized building type.

2. Hugh Parker and Associates, Inc., an architectural firm in Monroe, Louisiana, was hired to serve as the architect-of-record in terms of implementation of the design and supervision of the construction phase.

3. The tables contained data on the average age of facilities, their maintenance costs on an annual basis, if renovation requests had been submitted and if so when, locational variants, size, number of rooms and type of rooms, and the rating of each facility in terms of a series of architectural and site characteristics. These consisted of image, overall exterior and interior condition, parking, exterior and interior informational signage, furnishings, spatial amenity, security, staff and patient flow, priorities for improvement in the short term, and the overall assessment of each facility's level of functionality, or dysfunctionality.

4. These eight sections were Community Context, Strategically Planned Facilities, Site Environs, Clinical-Support/Environmental Health/Outreach, Regional Support Services, Total Environment, Cost Containment, and Phased Implementation. The guidelines, each one page, consisted of a title, narrative, and drawings. These have been updated periodically to account for new treatment programs and changes in federal policies.

5. The total project budget was 1.3 million. This amount included land costs, equipment, furnishings and landscaping. The building committee of the Ouachita Parish Police Jury served as main client entity, in conjunction with the State of Louisiana Department of Health and Hospitals, Office of Public Health, Region VIII Office. The clinic was designed to also support the addition of primary healthcare, and pediatric services in particular, in conjunction with a local HMO (Health Maintenance Organization) provider. These additional services occurred in 1996.

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