The American Indian Housing Initiative:
Marking Turf Under the Big Sky

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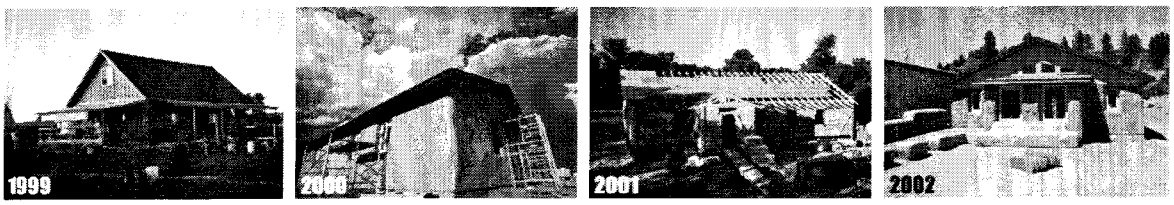
BEYOND BOUNDARIES, WEAVING CONNECTIONS

The American Indian Housing Initiative (AIHI) is a national collaboration between Penn State and the University of Washington with Chief Dull Knife College and the Housing Authority of the Northern Cheyenne Reservation.[1] The program integrates research and education in the area of sustainable community building practices with hands-on interdisciplinary experiences for students, faculty and design professionals. The program focuses on the housing crises endemic to American Indian reservations and promotes economically and environmentally sustainable design strategies. Established in 1998, the academic program concentrates students and faculty in the design disciplines of architecture, architectural engineering and landscape architecture, but also includes students with diverse backgrounds such as nutrition, biology and education. The yearlong, three-part design-build service learning course pivots on a summer design-build program situated on tribal lands where faculty and students are joined by practitioners and the Northern Cheyenne community in the construction of housing and community facilities. Projects constructed to date include an adult education literacy center, a community meeting hall and three privately owned residences. Bridging the academy and the profession, practitioners with backgrounds in architecture, historic preservation, landscape design, engineering, construction management and various building trades join with students in the planning and construction of loadbearing strawbale buildings and associated landscapes. Spurred by *Building Community* (The Boyer Report), the AIHI creates a collaborative, interdisciplinary, active learning environment linking students and practitioners across the country and across generations in a common pursuit of an ethical basis for the work. Combining innovation in architectural and engineering design with projects of social consequence, AIHI broadens all participants understanding of environmentally responsive technologies through research and the inclusion of an underrepresented population through the application of that research.

HOUSING CHALLENGES: MARKING TURF UNDER THE BIG SKY

Marking turf is a contemporary reality for the Northern Cheyenne Indian tribe. Federal resettlement 100 years ago on a portion of their native lands on the upper plains of eastern Montana separated the Northern Cheyenne from their nomadic building traditions. Traditional design strategies for nomadic life have shifted to the making of permanent settlements. With the reality of stasis on the reservation and in the absence of relevant building traditions, marking territory, arranging exterior space and rooting buildings into the ground sheltered from extremes of wind, heat and cold are not familiar forms of building for the Northern Cheyenne. As a result, U.S Department of Housing and Urban Development (HUD) housing and the accompanying planning strategies are poorly conceived and



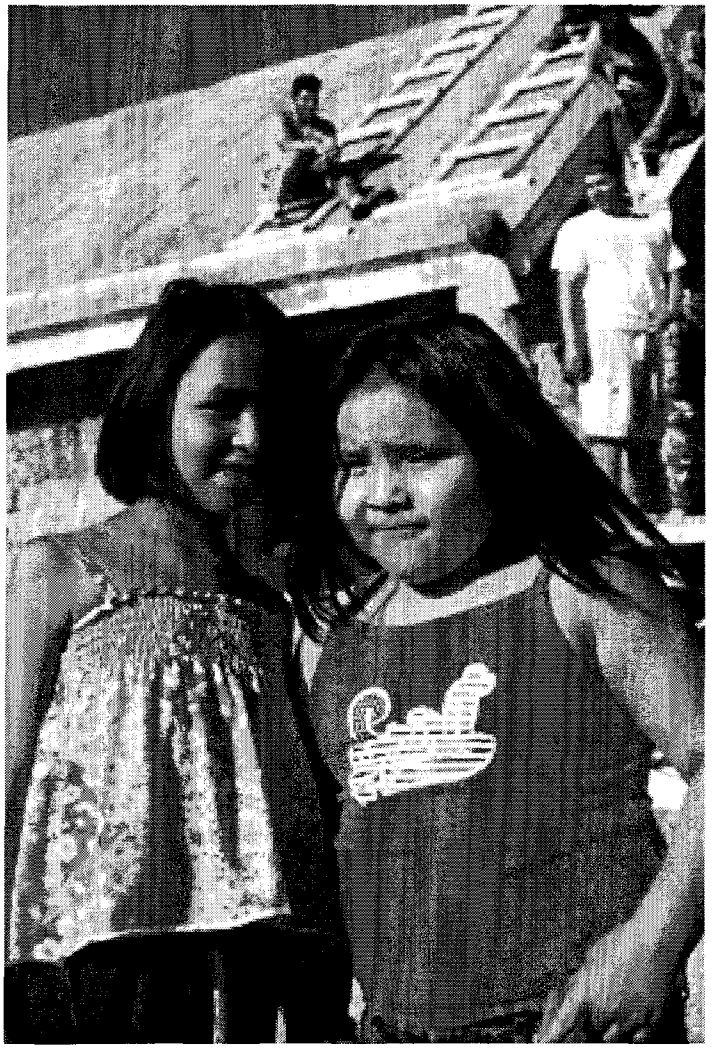
shoddily built with little forethought and even less of a future. Statistics illuminate the tribal housing crisis on American Indian reservations:

- American Indians represent by far the most poorly housed sector of the U.S. population,[2] with only 25% of the national population having acceptable housing.[3]
- Sixty-nine percent of native Americans in tribal areas must "endure severely overcrowded conditions in which 18, 20, or even 25 persons are jammed together in small two-bedroom houses."[4]
- In tribal areas, over 32 percent of homes are overcrowded and have serious physical deficiencies. In comparison, in the United States as a whole, only 4.9 percent of households are overcrowded.[5]
- The average life span of a Plains Indian is 45 years.[6]

Historically, federally subsidized housing programs addressing the tribal housing crisis have failed due to lack of education, commitment, tribal involvement, or acceptance. Short-lived and limited, HUD housing programs often ignore cultural and social values of the tribes, utilize inefficient, modular housing technologies, and import labor and materials into communities where both able labor populations and indigenous building materials exist.

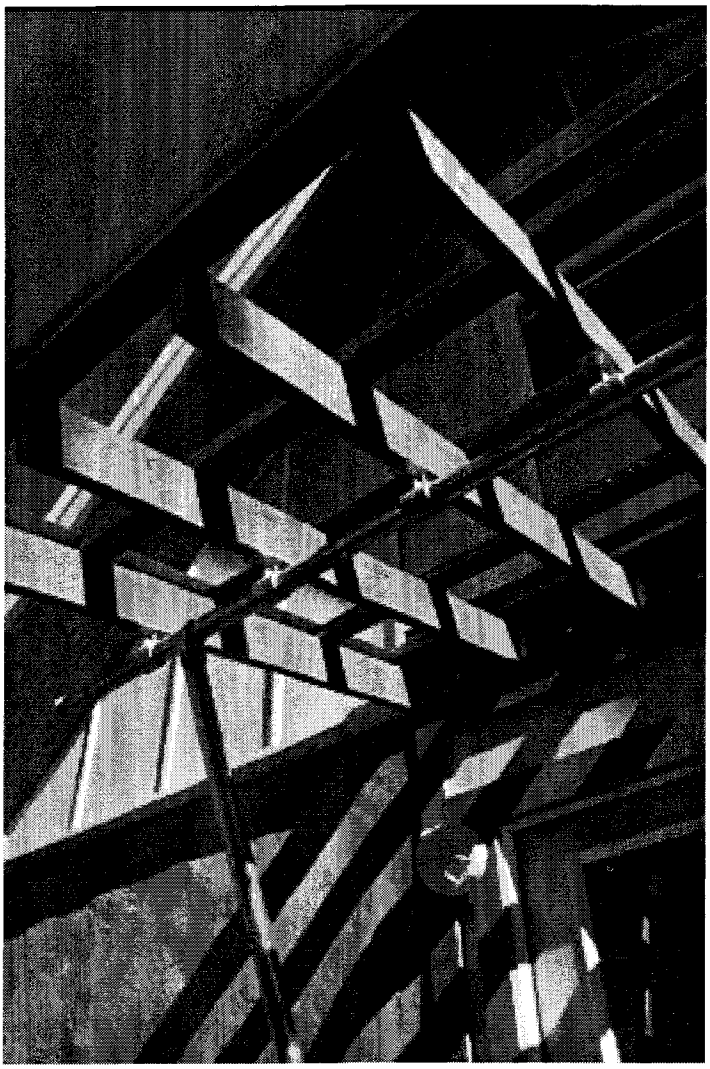
AN ALTERNATIVE APPROACH: WORKING FROM THE INSIDE OUT

AIHI's commitment to the Northern Cheyenne community, with our central partner, Chief Dull Knife College, is directed toward local improvements with the potential for national application. Working from the inside out, AIHI allows the Tribe to utilize the research, expertise and technical assistance of faculty and design professionals in defining their own terms of sustainable development. In an effort to diminish tribal dependency on federal programs, AIHI explores alternative solutions to the housing crisis through the utilization of regionally appropriate materials, green design strategies, and community-centered construction processes in the creation of community facilities and homes that reflect the Tribe's culture, values and vision of sustainability. In collaboration with AIHI, the Northern Cheyenne Housing Authority has developed an apprenticeship program in which tribal members will work side-by-side with students, faculty and practitioners to learn how to build utilizing strawbale construction and other sustainable building technologies. In turn, these indigenous apprentices will apply their gained skills to the construction of additional housing units, educating more community members in the process and working towards a model of community-built sustainable housing.



AIHI THREE-PART COURSEWORK: PREPARE, PARTICIPATE, REFLECT

AIHI coursework (ARCH 497H: Community-Built Sustainable Housing) introduces students studying architecture, engineering, landscape architecture and a range of other disciplines to emerging sustainable technologies, and applies these technologies in a public context, engendering issues of ethics, ethnicity, economy, and politics into their work. Students of all experience levels are represented in the course, ranging from first-year to graduate students. The coursework provides an opportunity for students to take part in the application and evaluation of strawbale technology through the design and construction of a building on the Northern Cheyenne Indian reservation. Past building projects include private and community-owned houses, a community center, an adult education literacy center and landscaped courtyard. The course objectives for students are to: (1) recognize affects of cross-cultural interaction and ethics as applied in the development of a housing program for American Indians, (2) assess the application of sustainable and community-built housing methods on an Indian reservation,



and (3) understand the attributes and limitations of strawbale building methods. The course is implemented in three parts:

Part 1 (Spring Semester): Preparatory Activities

Students review existing applications of strawbale construction with a specific emphasis on housing in marginalized communities. The attributes and limitations of loadbearing strawbale technologies are presented, and a test wall is constructed to introduce building methods and evaluate the strawbale wall system. Concepts of cross-cultural intervention and the affects of culture on the design of buildings are presented, with a specific emphasis on American Indian culture. Workshops include cooking native foods, building mock-ups and discussing Cheyenne culture with artists, tribal leaders and educators invited to Penn State. Community design and development concepts are introduced and linkages are explored between housing and larger community capacity building issues. Students are introduced to project partners and web-based tools for collaborative exchange of design ideas with their peers in a similar course at our partnering academic institution, in addition to project advisors from the Northern Cheyenne tribe. Students and faculty consult with practitioners experienced in construction documentation, material specifications and ordering, construction scheduling and management in preparation for the summer construction phase.

Part 2 (Summer): Participatory Learning Experience

The class travels to the Northern Cheyenne reservation to participate in the construction of a strawbale building, working side-by-side with tribal members, alumni practitioners and peers from our partnering academic institution. While on-site, they take part in workshop presentations, study circles and other social and ceremonial activities with tribal members. Students visit previously completed projects to assess the performance of the strawbale walls and the functionality of previous designs based on inspection and post-occupancy interviews. Students are required to document their on-site experience on the reservation through drawings, photography and writings, and make observations about the application and viability of sustainable building technology in the region, and plan for the future implementation of projects the following year.

Part 3 (Fall Semester): Reflection and Recording

Students compare their expectations of the building process and on-site experience with their actual observations. Students record their experiences and work through photographic and video compilations and as-built drawings and models of the project outcome. They offer suggestions for improvement of the design, construction process, collaborative activities, and interaction with the tribal members and summarize the results of the project for inclusion in the informational website. The course concludes with a public presentation of the yearlong effort to the university community.

RESULTING KNOWLEDGE, COMPETENCIES AND SKILLS

Students gain first-hand knowledge of one of many emerging sustainable building technologies, and a working knowledge of the capabilities and limitations of this technology. Having applied concepts of sustainability to a real situation, they acquire a multi-dimensional understanding of the tensions and tradeoffs that can exist between design options. By working in groups and collaborating with students in other disciplines, they develop communication and team problem-solving skills. The hands-on components of designing and building allow students to develop competencies in working within the physical constraints of material properties and gravity as they negotiate intercultural sensitivity and the ethics of design and construction.

PRACTITIONER ENGAGEMENT IN AIHI

Weaving the academy and the profession, alumni practitioners with diverse backgrounds in architecture, historic preservation, landscape architecture, interior design, engineering, construction management, various building trades, art education, filmmaking and teaching join with students in the planning and construction of strawbale structures during the summer. The participants are recruited with information flyers sent out by the universities' alumni organizations, promotional videos and booklets, announcements in architecture newsletters, through program feature stories in print and media, and personal contacts. Professionals pay a program fee, partially offsetting student expenses on-site. Approximately ten practitioners from across the country participate annually, joining fifty students and five faculty members.

Architects, engineers and contractors with expertise in construction documentation, material specifications and ordering, construction scheduling and management are consulted by students and faculty late in the spring semester in preparation for summer construction. During the summer, practitioners join students on-site for the duration of the building phase of the work. The roles of student, teacher and professional dissolve as construction commences and leaders emerge from all the participatory groups. For the students, working alongside design professionals and builders, opportunities for learning are distinct from the lessons gained from summer office internships. The free exchange of ideas made possible through the social act of building allows students to more comfortably project their own futures on to the professional participants. As educators and professionals alike seek venues for constructive interchanges between the students and practitioners, AIHI offers a worthy middle ground, poised between the academy and the profession. The shared territory, beyond boundaries, creates positive linkages between students and practitioners. On this ground all participants practice what Thomas Fisher, in his address to the AIA Board of Directors advocated, that is, our "core skills involve not just and understanding of building design, materials, and technology, but an ability to see relationships, resolve conflicts, embrace ambiguity, and envision the future."[7&ft]

RESPONDING TO SUSTAINABLE DESIGN IN ARCHITECTURE AND THE BUILDING INDUSTRY

The AIHI course series responds to the rapid shift currently taking place promoting the design and construction of buildings that are healthier for occupants, more energy-efficient and have minimal negative impact on the environment. Buildings and their construction processes represent significant contributors to energy depletion and natural resource consumption, accounting for one-sixth of the world's freshwater withdrawals, one-quarter of its wood harvest, and two-fifths of its material and energy flows, in the United States alone.[8] Considering that "54% of the U.S. energy consumption is directly or indirectly related to buildings and their construction" and that energy costs continue to rise, the need to minimize the effect of buildings on the environment becomes increasingly relevant.[9] A widely accepted concept in green building design and construction is a shift away from linear and sequential design processes towards an integrated process allowing for greater system efficiencies. The roles and contributions of multiple disciplines must be recognized simultaneously to achieve success. An integrated design process requires new formulations defining how design and construction teams operate in a collaborative design environment. The AIHI course series offers a means of preparing students from varied design disciplines to function productively on integrated green design teams.

EXPANDED VISIONS OF ARCHITECTURAL EDUCATION AND PRACTICE

The AIHI course series provides a distinct pedagogical hybrid of collaborative learning and public scholarship. In addition to developing skills and a research body in a specified field, students in a collaborative learning environment gain an appreciation for the dynamics of integrative process in which a student's disciplinary skills inform a greater interdisciplinary effort. When the research a student performs in the lab informs the work carried out in the public realm, the borders of collaborative learning expand to include a real-life client and community. In the culturally rich and historically devastated context of the Northern Cheyenne community, issues of ethics, culture, history, economy, politics, race and the unknown become matters of practical concern. The development and survival of AIHI is dependent upon the flexible working

relationship of all colleagues involved, a relationship that is collaborative in its truest sense – a "co-laboring." Each summer, on-site in Montana, the roles of all participants are dynamic. For instance, a landscape architect with experience working with community non-profits may find himself networking with tribal advocacy groups one day, and working on the design of green space the next. A graduate student in architecture might divide her time in Montana between meetings with tribal housing authority members in determining solutions to housing needs, working as a crew-member on the construction site, and driving the student van on field trips to Medicine Wheel, a Wyoming rodeo, or a pow-wow at a nearby reservation. The Vice President of the tribal college could be working with a grant-writer on a budget for a USDA proposal in one hour, and in the next, making a trip for more water jugs at the construction site. Essentially, each person's role is fluid, and the success of each project depends upon the understanding that everyone is a key contributor to a greater effort, and that leadership *is* collaboration.

In his book *Learning by Building: Design and Construction in Architectural Education*, William Carpenter explains the advantages of this type of public scholarship:

> "With the recent focus on redesigning the way an architect learns, construction studios are an ideal vehicle to synthesize complex areas of knowledge...Construction studios offer a way to learn in a practical sense without sacrificing a high caliper of design...[and] can offer students the opportunity for cross-disciplinary approaches and projects that reach out to the community groups who are in need. Most of all, students learn the ability to communicate with teammates and actual clients...and that architecture is a collaborative effort and not an exercise in isolation. Both in school and in practice, the ethic of giving back to society can be encouraged."[10]

As an ambitious pedagogical model, the AIHI course series seeks to enhance the quality and meaning of integrated research, education and outreach in the greater academic community. The three-step process of experimentation, application and assessment serves as a model for other programs in the university community seeking to integrate teaching and research and deploy valuable research results.

TECHNICAL RESEARCH: REFINEMENT AND DEPLOYMENT OF STRAWBALE BUILDING MATERIALS

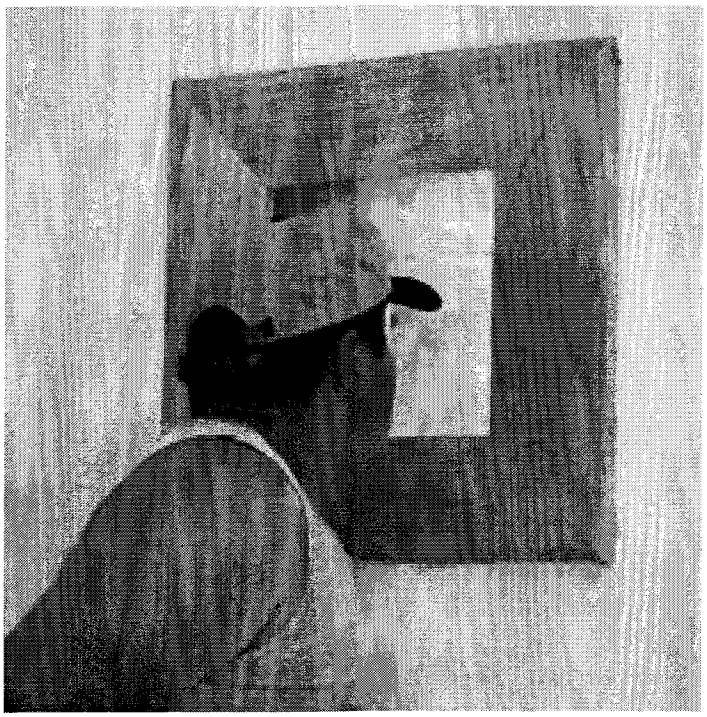
The primary building technology employed on AIHI projects is loadbearing, "Nebraska-style" strawbale construction. Developed on the Plains over a century ago, strawbale construction utilizes an agricultural waste product that is abundant and available on the Northern Plains, and has been successfully established as an appropriate alternative building material in the region. The bales are strapped to each other and to the foundation, then finished on the exterior and interior with a durable, portland cement based three-coat stucco on metal lathe. The three key benefits of strawbale are: (1) the utilization of an agricultural waste product for the building structure in lieu of wood framing, (2) the volunteer-friendly nature of the building process that fosters community involvement: and (3) the durable and energy efficient performance that dramatically reduces maintenance and heating costs. Two key performance questions that challenge strawbale applications are the loadbearing capacity and insulating value of strawbale walls. The absence of this data results in highly conservative values to be used in structural design and energy modeling, limiting roof spans for strawbale structures and constraining life-cycle cost analysis of energy savings. Our course research focuses on the optimization of mechanical and thermal behavior of strawbale wall systems and their compatibility with solar and wind energies.

Under the guidance of faculty, research assistants and practitioners, students from various disciplines build wall sections and building assemblies in an instructional laboratory to prepare them for on-site construction. These projects are used as test specimens for experimentation by the class with the structural and thermal properties of strawbale walls and related green technologies. Specific research objectives assess the loadbearing capacity and insulating properties of strawbale walls-two properties for which little formal research and experimentation has been performed. Laboratory structural testing of mock-up walls is ongoing. Embedded energy temperature and humidity sensors were installed in our recent project to monitor long-term building performance predicted through energy modeling software. As this much-needed research develops, students and faculty will be able to integrate results into experiments that explore the most effective relationship of strawbale walls with wind and solar energies in sustainable building systems.

DESIGN RESEARCH: THICK & WET VS. THIN & DRY

The most recent constructed project, the Northern Cheyenne Transitional House, combines loadbearing strawbale construction with an insulated concrete formwork (ICF) foundation and structural insulated panel (SIP) roof and end gable walls and radiant heating in the floors. The house is composed of two fundamentally different building systems. The strawbale walls come from a local resource, with minimal environmental impact. The "wet" construction system involving strawbale stacking metal lathe and stucco is labor intensive in which value is added at the site of construction. The finishes of the walls communicate the highly handcrafted nature of the construction process. In contrast, the ICF foundation, SIP roof panels, engineered wood products, and composite fiber-cement

board and plastic composite decking are highly industrialized, universal materials, pre-assembled with value added in the factory. Recognizing the unemployment rate of 70% on the reservation, the design attempts to keep work at home through on-site labor intensive activities. Architectural design research occurs at the junctures of these bi-polar systems: Wet vs. dry, thick vs. thin, local vs. global, handcrafted vs. machined. Details at the wall to floor junctures and wall to beam attempt to amplify these distinctions. The windows are pushed flush to the exterior wall plane creating two-foot deep window sills ornamented by children's ceramic tiles. The deep wall, uncommon in industrialized construction systems, allows for the literal inhabitation of the wall volume. Window placements frame distant views and emphasize the wall's protective depth.



THE FUTURE OF AIHI AND PUBLIC SCHOLARSHIP

With lead collaborators in Pennsylvania and Washington, the AIHI collaboration is challenged by geographical distance, and compensates for this distance with a collective sense of leadership. Stretched across the country, AIHI has progressively developed an identity separate to, yet dependent upon, the institutions it joins. Attracted to the grassroots, bricks-and-mortar, hands-on nature of AIHI, collaborators see in its structure the potential to not only make learning active and research meaningful, but also-the potential to change lives. The program seeks productive working relationships, actively addressing social *and* pedagogical priority, while benefiting all who participate. Public scholarship programs such as AIHI put "knowledge in the service of a more realized democracy."[11]

It is our goal for AIHI's Community Built Housing Program to serve as an alternative planning model for tribes across the country looking for affordable solutions to housing shortages. Work is being disseminated through peer networking and programs such as the Interagency Conference on Strategic Planning in Indian Country, Native eDGE, Code Talk and the NAIHC Leadership Institute. The unique academic collaboration between Penn State and the University of Washington with Chief Dull Knife College can serve as a viable working model in inter-collegiate collaboration and educational exchange, and motivate other tribal colleges and state universities to join forces in forming educational initiatives that join public scholarship with social priority. Finally, through this collaboration of the tribal community and university community, lines of educational exchange will soon be established, enabling tribal students from Chief Dull Knife College to continue their undergraduate studies in the graduate programs at the applicant universities.

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