Applied Research in the Design Studio

DARIUS SOLLOHUB
New Jersey Institute of Technology

The Master of Infrastructure Planning program at the New Jersey School of Architecture at NJIT is structured around a funded research studio that undertakes real, comprehensive problems of infrastructure planning and design. The studio's pedagogical method seeks to reinvigorate the relationship between academic disciplines involved with infrastructure and between those disciplines and their respective professions. To achieve this, the program applies principles of team, interdisciplinary and practice-based learning in the studio. A dynamic team-based system stresses the development of collaborative and leadership skills. Interaction with infrastructure academics and professionals furthers interdisciplinary collaboration and broadens the scope of planning and design opportunities. Enabled by grant funding, the studio fosters a practice-based environment that provides logistical support for comprehensive research, promotes interaction with real clients, and provides communities with useful planning and design products. Using specific examples of funded research, this paper describes the structure of the studio and evaluates the successes, challenges and unexpected outcomes of this pedagogic structure.

MASTER OF INFRASTRUCTURE PLANNING PROGRAM

As described in the NJIT catalogue, the Master of Infrastructure Planning (MIP) program

> *focuses on the natural environment and on public space, roads, transportation, services and utilities as interacting physical and spatial systems, as well as on parks, schools, housing and civic institutions of all kinds. The purpose is to develop operational strategies that integrate the broadest possible range of planning and design policies, methods and actions for improving human settlements; and to resolve in environmental terms the larger social and political issues that affect the quality of life in our communities. Capitalizing on NJIT's multidisciplinary resources and location at the center of the nation's greatest regional concentration of urban infrastructure, the MIP program incorporates applied research and realistic problem solving in its curriculum . . .*[1]

Fig. 1. Aerial photo of Riverside (NJDEP photo).

The program applies a multidisciplinary method, by which students focus on the interrelationships between elements to develop holistic strategies for integrally planned and designed infrastructure.[2] In doing so, the program transcends the traditional identification of different infrastructure components with separate professional disciplines. Instead, it stresses a unified, coordinated approach that prioritizes the quality of the overall built environment over the efficiency of any one part. The program prompts students to take a lead, coordinating role in resolving and synthesizing the many often-conflicting ele-

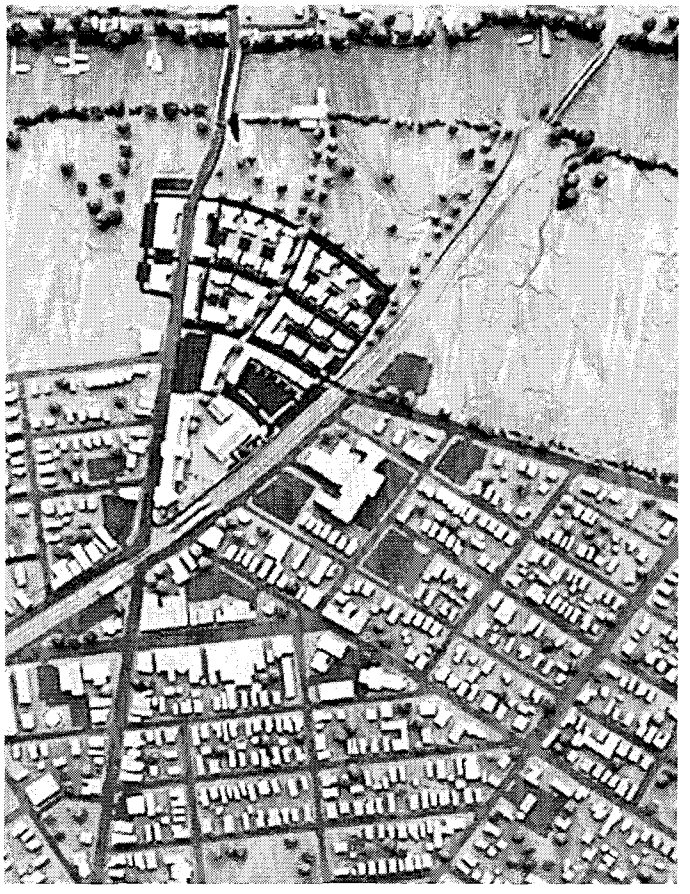

Fig. 2. Studio Model.

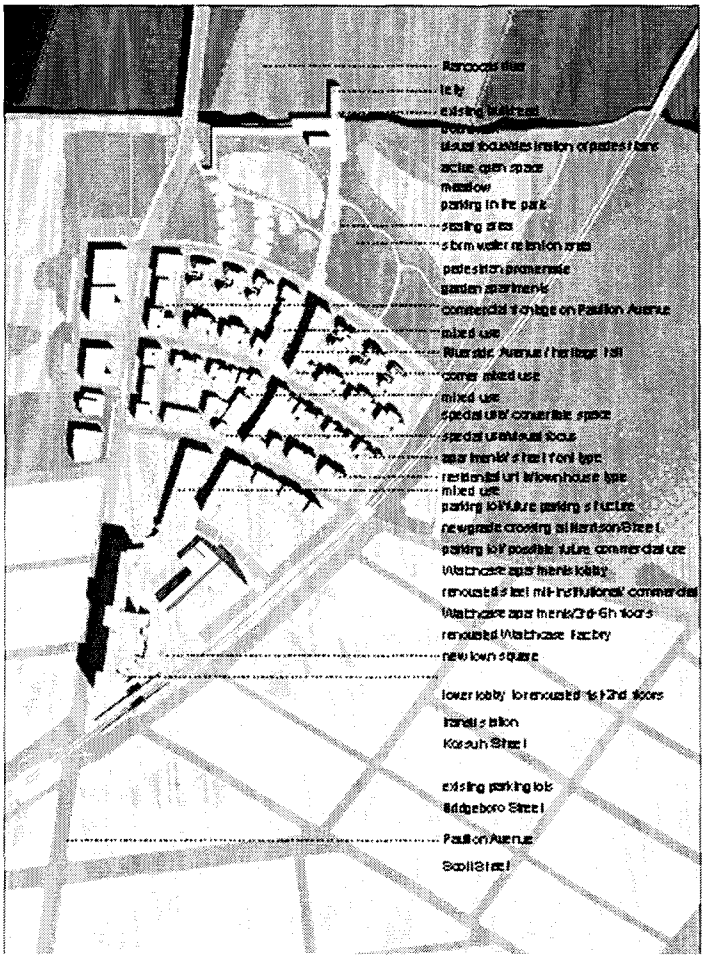

Fig. 3. Proposed Redevelopment.

ments of infrastructure to deal more effectively with the critical problems of development. The MIP program seeks to restore planners and designers as decision makers to the center of the infrastructure planning and design process.

The School of Architecture at NJIT launched the MIP program in 1996 during a period in which architectural education, and design education in general, was being re-examined.[3] The Boyer Report, issued in 1996 by the Carnegie Foundation, recommended that architecture expand its scope and re-engage with allied disciplines. It also recommended a related re-engagement between the design academy and the profession.[4] The report cites and builds upon Donald Schon's recommendations made in the books *The Reflective Practitioner* of 1983 and *Educating the Reflective Practitioner* of 1990 to bridge the fundamental discontinuity between academic and professional knowledge. Subsequent criticism of training students to be solitary, heroic designers, instead recommended pedagogy that stresses teamwork, interdisciplinarity and a keener awareness of community needs.[5] Responding to the same issues that prompted these critiques, the MIP program pedagogy seeks similar goals: a re-engagement between disciplines; a re-invigorated method that stresses teams, communication, and community involvement; and a renewed integration between academic research and professional planning and design.

The one year, post-professional program offers the studio as the applied laboratory for course-based historical and theoretical learning. Typically, all work in the studio is team based. Interdisciplinary learning[6] reverberates throughout the studio as academics and professionals lead seminars in their respective disciplines and help coordinate the larger effort. To prepare students for professional careers, each studio simulates conditions of practice. Since the program's inception, the studio has focused on infrastructure-related planning and design problems with real sites and bona fide clients, and since 1999, grants from local, state or federal government agencies have funded the program, with studio-generated products the primary component of the final project findings. These funded projects assist communities that are grappling with infrastructure-related challenges in both suburban and urban contexts. As a form of applied research, these projects address an important and emerging need in the planning and design process in New Jersey, complementing the efforts of state agencies, design professionals and developers in supporting well planned community initiatives statewide.

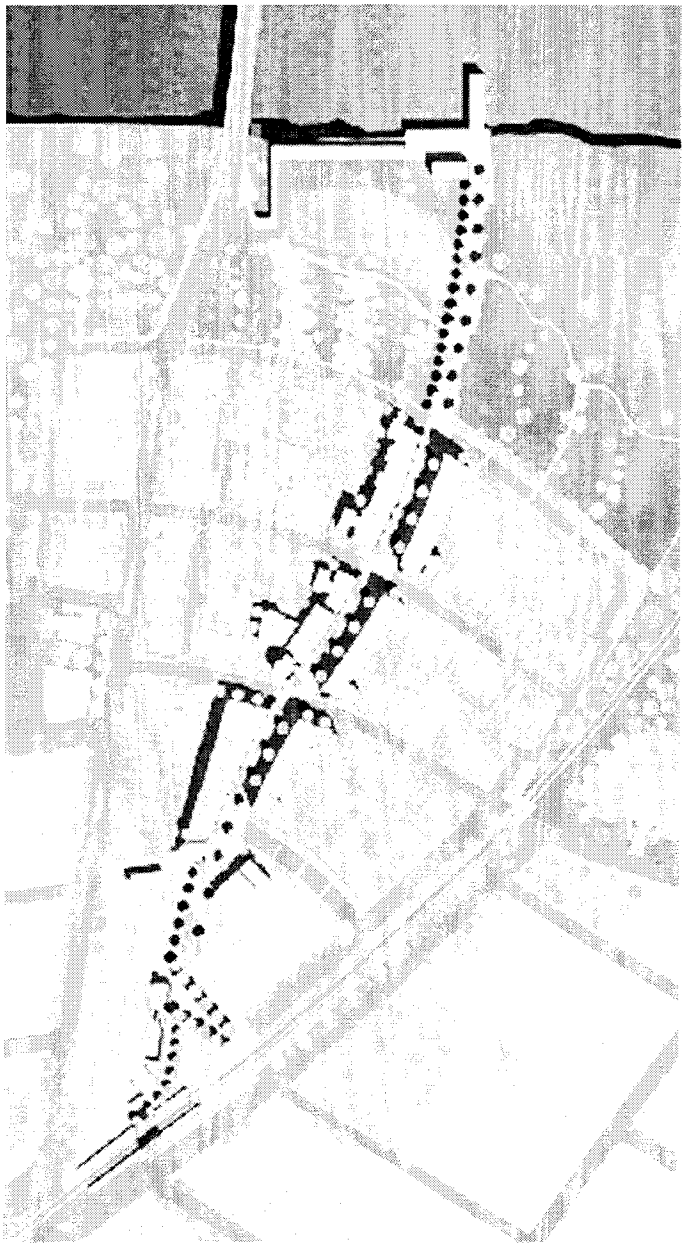

Fig. 4. Commercial Spine.

EXAMPLES OF FUNDED RESEARCH

The MIP studios have focused on a variety of infrastructure-related projects such as transit centers, multi-use sports and entertainment facilities, waterfront development, transportation corridors, and suburban and urban planning and design. Two funded projects, one suburban, The Riverside Transit Village Project, and one urban, the Ironbound Research Project are described in greater detail here. Both projects featured two sequential studios: the first in the fall semester followed by a second in the spring. The studio teams delivered an illustrated report and made a digital presentation to the communities and sponsors at the end of each semester. Each project addressed suburban and urban 'villages' respectively; a village describes a

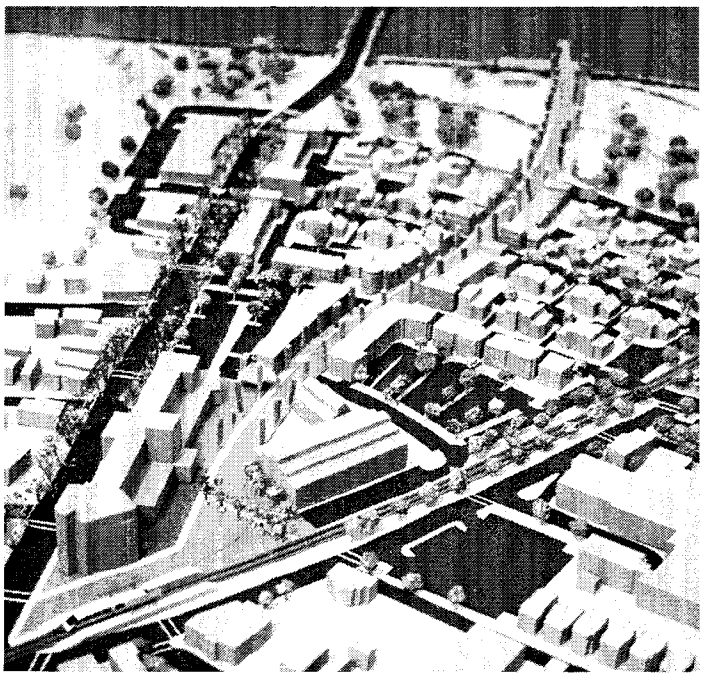

Fig. 5. Transit Center.

fully formed community with a diversity of population, built form and infrastructure. State agencies funded both projects, with each responding to the guidelines of the New Jersey Development and Redevelopment Plan and its implementation of Smart Growth[7] planning policy.

Begun in 1999, the Riverside Transit Village Project anticipated the impact of light rail service on Riverside, New Jersey and offered alternative design proposals for a 32-acre former factory site adjacent to the train station. The challenge of Riverside was to overcome the community's skepticism of the light rail project, as the residents felt they had been excluded from the decision making process. The studio achieved this through extensive outreach, explaining through well-articulated design proposals the beneficial impact the project could have for the town. Phase One assessed local and regional existing conditions. Of primary importance were contamination and flood-plain issues, and the array of transit, vehicular, bicycle and pedestrian mobility networks. Local high school students were polled regarding Riverside's future. Their views surprised the governing body and were particularly useful in formulating design strategies. Phase One culminated in three divergent development strategies. The Phase Two team reviewed these strategies with community leaders to develop a comprehensive urban design framework for development. The resulting Phase Two development proposals all feature a new arterial, multi-modal street that serves as the neighborhood's spine, linking the downtown to the waterfront, or as a slogan of the studio stated: puts the "river" back in Riverside. The proposals incorporate existing historical structures and the planned rail station, and presented options for various uses, including: retail, commercial, housing and open space. Students presented the

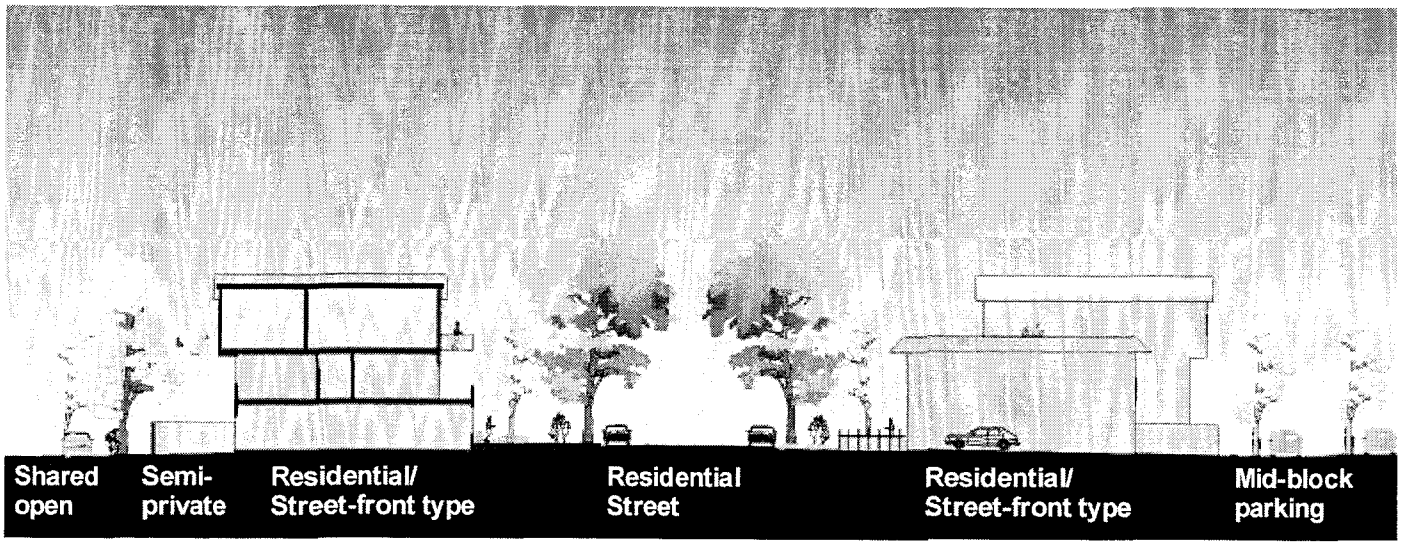

Fig. 6. Typical.

results of the entire process, using multimedia presentations and physical models, to various community groups, at two transportation conferences and to the County Board of Freeholders. Unanimous support for the process at the county level gave a strong boost to the project and private developers are currently developing the site.

The Ironbound Research Project began in the summer of 2001 and is currently in a third phase of development. The project's goal is to provide the Ironbound community in Newark, New Jersey a strategy for responding to significant development outside its borders, both adjacent and regional. Phase One of the project studied the relationship between the complex linear city along the New Jersey Turnpike (I-95) and the thriving urban district of the Ironbound, part of Newark's East Ward. The I-95 (vehicle) and the northeast (rail) corridors bisect the East Ward, which also includes Newark International Airport, the Port of Newarkand heavy industrial facilities such as refineries and incinerators. Because of its proximity to this extensive infrastructure, traffic, pollution and industrial development threaten the Ironbound's fine-grain residential neighborhoods. The consequences of a projected threefold increase in port traffic over the next several decades further threaten those neighborhoods. Phase One appraised these regional factors and proposed design strategies to buffer the community from the negative impacts of industrial development while at the same time integrating land use types to maximize economic development for the Ironbound. The second phase developed an urban design framework for the dense core of the community surrounding Ferry Street, the district's retail spine. Issues studied included land uses – residential, commercial, institutional and industrial – parking and all modes of circulation: pedestrian, vehicular, bicycle, truck, bus and rail. Based on traffic simulation models of existing conditions on Ferry Street and comparisons with an alternative range of traffic schemes, several streetscape design options were offered. Alternative planning and design proposals were made for the area around Penn Station, an important regional rail hub on the Ironbound's western edge, along the Passaic River waterfront, and for of a second node of development to complement Penn Station in the eastern part of the district. The studio presented the findings of the project to the community through focus groups, presentations and on local television. The Ironbound Business Improvement District, the project's client, is proceeding with the proposals developed in Phase Two for a redesigned 'gateway' park and market under the Amtrak rail viaduct and for rebuilding the streetscape of Ferry Street. Phase Three will model truck and automobile mobility throughout the district and immediate region and use the model to develop pedestrian and vehicular networks throughout the district. Recommendations will be made to the city engineer on behalf of the Ironbound community based on the findings of Phase Three.

Fig. 7. Port Newark.

Fig. 8. New Jersey: I-95 and the Ironbound.

STUDIO STRUCTURE

Consistent with traditional architectural education, the MIP studios are time-intensive both in and outside the classroom. They are also the primary engine of funded research. As in both the Riverside and Ironbound projects, two sequential studios are typically engaged; the first deals with research and applications related to the larger systems involved, and the second with the urban design or architectural opportunities those systems create. Composed of 12 to 15 students, each studio provides a para-professional, practice-based learning[8] experience for students, simulating the actual workaday environment of a planning and design office with real deliverables as final products. Because of the breadth of scope that the multidisciplinary method requires, students typically work in groups, following team-based learning[9] methods. Based on individual preference, students divide into teams, which continually re-form throughout the semester, eventually subdividing (sometimes down to the single individual) in order to produce design alternatives by semester's end. The studio critic adjusts and manages these teams to ensure an equitable balance. Students are encouraged not only to pursue their own interests, but also to take the opportunity of the para-professional experience and its team-based environment to develop new skills. The program draws graduate students from varied backgrounds that include architecture, planning, engineering, policy and other allied disciplines. A close-knit team environment allows exposure to these disciplines in a way that facilitates learning, and forms multidisciplinary synergies. Team-based learning advances collaboration, coordination and leadership skills, all essential to practice at the scale of infrastructure. The studios also diversify by area and level of study. In addition to MIP students, studios often include third year Master of Architecture (M.Arch) and upper level Bachelor of Architecture (B.Arch) students.

TEAMS

The semester typically divides into thirds, punctuated by presentations to faculty, agency representatives and community members. The first section is critical to the efficacy of the entire undertaking and involves a comprehensive assessment of existing conditions. This includes an analysis of systems impacting a community at the broadest range of scales from the local to the regional and beyond.[10] The process places current conditions in the context of prior and ongoing studies, applicable theories and relevant precedents. Teams inspect the site and conduct interviews, surveys and focus groups with the community. Typical team assignments might focus on circulation, land uses and existing conditions, community outreach, and pertinent research and theories. To expand the interdisciplinary scope, professionals familiar with the issues of the community and research academics give seminars as part of the assessment. The second section begins with reorganization into new teams that focus on sorting out the amassed information, searching for relationships – patterns, linkages, overlaps and contradictions – that often only become apparent when viewed holistically.[11] Based on prioritizing variables, the teams develop planning strategies that lay the foundation for design development. The teams produce base maps and models at this time. Students devote the final portion of the semester to design. Teams re-organize one last time according to site or program to develop alternative design propositions. These designs vary in specificity and might focus on urban form, streetscape, landscape, typology and specific building design.

At semester's end, students prepare a final presentation that includes physical models and present it to participating faculty and professionals, agency representatives and community stakeholders. This presentation corresponds to the final review for which students are graded. A final report, which describes the process and design alternatives, culminates each studio. Where two sequential studios are part of the same research project, the project ends with a comprehensive presentation that chronicles the entire undertaking and makes recommendations for specific implementation. As each project requires, subsequent presenta-

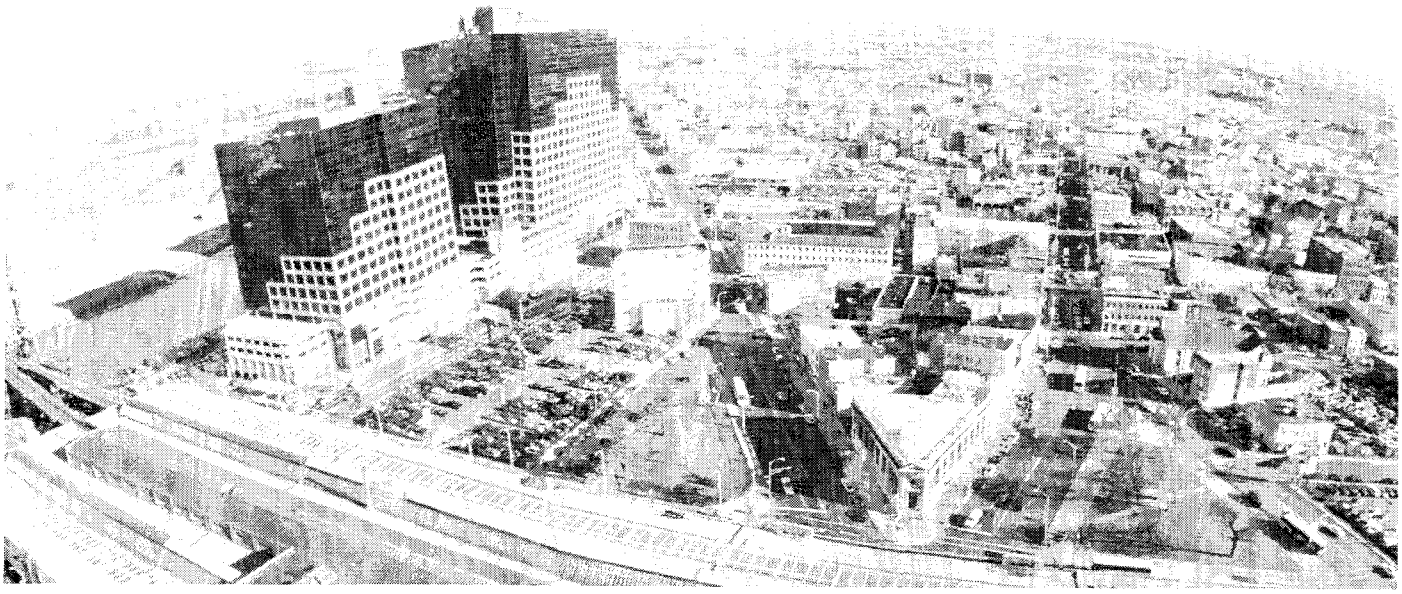

Fig. 9. Ironbound from a downtown skyscraper.

tions are given at town meetings, conferences, hearings and other venues. Student participation in these presentations is extra-curricular and voluntary. The final project report covers both studios and typically comes with a CD-ROM that includes digital copies of the presentations and reports.

CLASSROOM FORMAT AND MEDIA

The MIP studios make extensive use of projected digital graphics. Most studio classes are structured more as a combination of seminar and review than desk-side critiques. From the outset of the semester, students prepare visual presentations, which are reviewed each class. During class, both the critic and students continually reformulate the material of these presentations in a manner visible to the entire class. Access to the internet affords opportunities to reference other information as part of class discussions. Even if the interval between each class is short, an effective division of labor allows each session to have substantially revised presentations. This iterative process[12] firmly establishes the rationale for planning and design by semester's end.

The regular use of a digital format prepares students to present effectively to other disciplines, agencies and the community. Students typically use slideshow software such as Microsoft PowerPoint or web-based packages such as Macromedia Dreamweaver and Flash.[13] These software programs provide a flexible armature for the organization of analytic and synthetic data, allowing the tailoring of presentations for specific audiences. Presentations are constrained to 25 minutes, forcing students to refine description and use animation extensively to graphically display information. In this way, graphic invention replaces verbal description.[14] This constraint also forces students to continually re-evaluate and pare down information to the most critical aspects of a problem. As in the production of a feature film, the final product of the studio represents a fraction of the actual 'footage' produced. To emphasize collaborative structure, several students give scripted and rehearsed presentations, with verbal delivery closely coordinated with visual events on the screen. As the semester proceeds, successive iterations give students the confidence to address large groups.

ROLE OF CRITIC AND STAFF

Throughout the process, the critic maintains a role as mentor and teacher, but also serves as manager, facilitator, and mediator. Using experience and knowledge, the critic focuses the undertaking and maintains the professional quality of interdisciplinary collaboration. The critic's management responsibilities include preparing all relevant project materials, scheduling the integration of experts from other disciplines to check the accuracy of student analyses, coordinating community outreach, and maintaining a realistic, goal-oriented production schedule. External funding is critical to the timely and successful completion of the project. It provides summer pay for both student researchers and faculty to prepare the studio to be operational from the outset and for the editing and publishing of the final products. To aid in day-to-day operation of the studio during the semester, funding provides tuition and stipend for graduate assistants, who are typically students in the class. Funding also covers expenses, such as purchase of plastic for laser-cut models, travel, publications, software and printing.

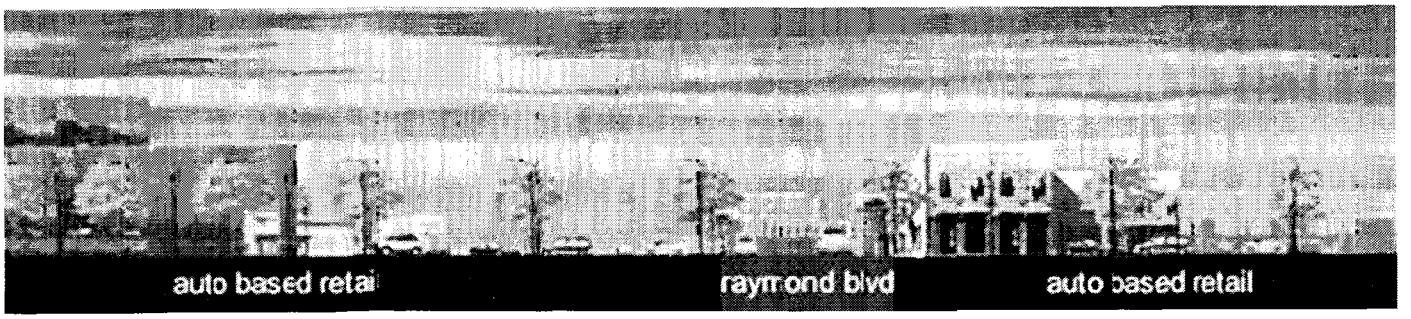

Fig. 10. Raymond Boulevard Streetscape.

EVALUATION

The MIP Program recently underwent the university's required examination of new programs after five years in existence; the results were favorable. This paper continues with the description of some successes, challenges and surprises revealed through the application of planning and design pedagogy based on team, interdisciplinary and practice-based learning.

Because each problem is new and unique, the critic is often learning about specific information in parallel with students. The critic soon begins to share the role of teacher with the students as students report to the team. This blurs the traditional distinction between teacher and student and generally has an empowering effect on the students. In order to succeed, they must learn to rely on themselves and their colleagues. In the team-basedenvironment of the MIP studio, the adage that "students learn more from their peers than from their professors"[15] rings entirely true. The success of the projects is proof that the team-basedenvironment works. Two concrete examples provide further evidence for this.

The first example is that students develop their computer skills well beyond what they were when they set out. This is particularly remarkable given the MIP program offers no formal computer training beyond a course in GIS (Geographical Information Systems). In some cases, students who entered the studio with no computer literacy at all emerged capable of advanced web-site development. While this may be a typical phenomenon in computer studios, students working by themselves have also been known to closely guard techniques. When goals are shared, information flows more freely. In a team environment, it is far more effective to ask teammates how to execute a computer command than it is to either consult a manual or use the help function. The rapid development of computer skills is also attributable to the constant use of digital media in an iterative process that parallels the beta-testing method of continual refinement critical to the computer software industry. In this regard, especially in the highly dynamic world of information technology today, students discover new ways to use software, often ahead of both the critic and the design profession.[16] To be regarded as an industry pioneer, especially as a student, can be powerfully motivating.

The second example is the effect the program has consistently had on students with engineering backgrounds. By definition, an engineering discipline is one that focuses on identifying and solving for the essential physical forces of a problem in which aesthetic, cultural or social attributes are secondary. When introduced to a team environment, engineers have consistently become strong, collaborative leaders who quickly grasp the multidisciplinary method, giving all attributes equal measure, including the aesthetic or traditionally 'soft' aspects. What causes this is unclear, but it seems that the team-based environment accelerated this rapid expansion of a new outlook.

The successes of interdisciplinary learning described above are rooted in the team-based aspects of the MIP studio. Team-based learning hones the basic communication skills required to practice with other professionals in an integrated manner. The use of discipline specific jargon is either eliminated or made universal. Open communication and mutual respect

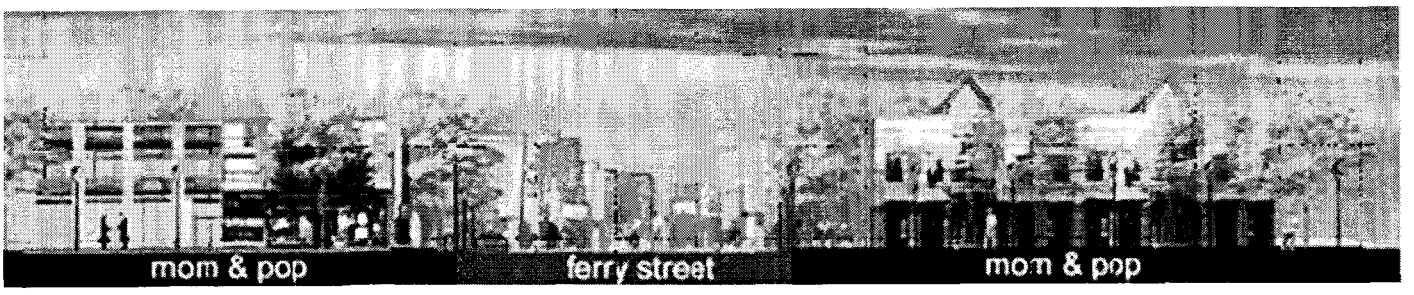

Fig. 11. Ferry Street Streetscape.

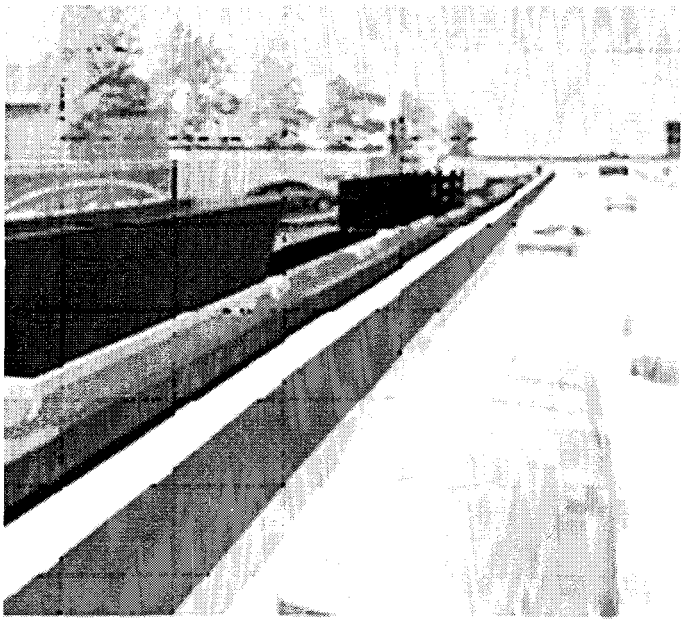

Fig. 12. View from Jabez Street.

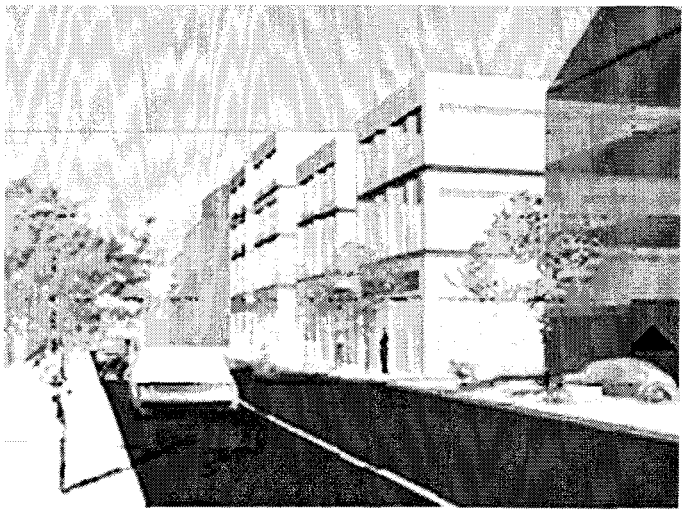

Fig. 13. Section Through Flex Building and Container Wall.

among disciplines create opportunities as students recognize that rather than being restrictive, the integration of infrastructure can be enabling. If form follows function, comprehensive understanding of a new domain of function expands the opportunity for formal exploration and can be powerfully motivating. If engineers have tended to quickly adopt the multidisciplinary method, architects have tended to seize the opportunity to expand the possibilities for formal investigation.

The greatest challenge to the program for both team and interdisciplinary learning methods is to maintain excellence of design in collaborative work. The mediocrity of compromise and the moniker of "design by committee" constantly loom. It is a continuing challenge to remind students that very little design today is solitary and that collaboration is a requisite part of the profession. Having to continue to argue the merits of design to the ever-enlarging ring of critics – one's team, the studio, the greater community – is not an exercise in compromise, but one of leadership.

Practice-based learning allows students to transition from a secure sheltered academic environment to a professional one. Internships have traditionally provided for this, but students often complain of the alienation they feel in the professional world after the warm cocoon of academia. Providing a transition through funded research merges the academic and the professional within the safe and secure domain of the university. Practice-based learning gives students a gradual sense of empowerment that they are pursuing real work that matters for real people. The studio gives a shot of professional adrenaline, but with a safety net. This perhaps explains why undergraduates typically excel in the MIP studio, emerging as leaders amidst older and more advanced graduate students. After four or five years of theoretical undergraduate studios, find themselves invigorated by the challenge of real problems.

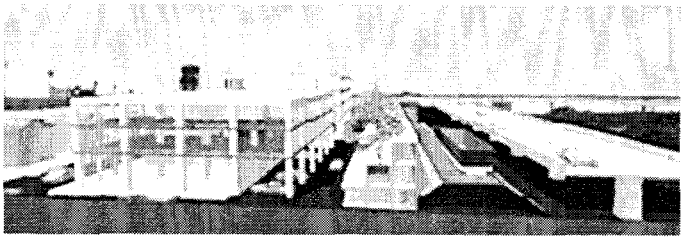

Fig. 14. View from Highway.

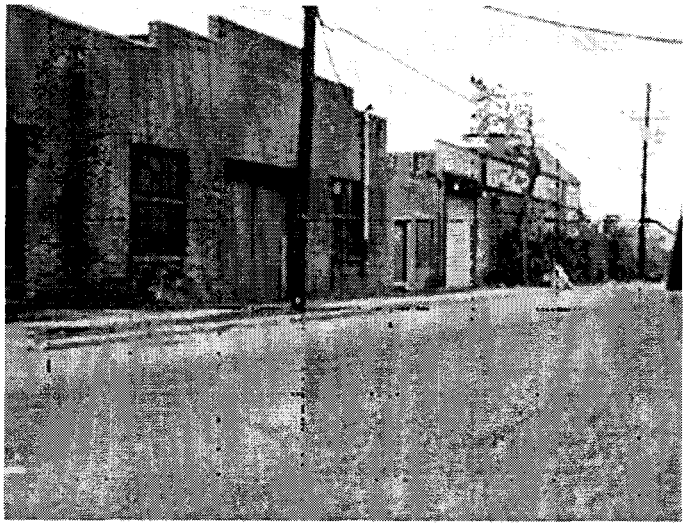

Fig. 15. Existing.

The overlay of professional constraints also includes challenges. In one of its early studios, the program learned the lesson of schedule adherence. Given the intractability of the academic schedule, any delay can cripple a project. At a university, the clock chimes figuratively three times per year, at the beginning and end of each semester. A studio looses its cohesive synergy

after the end of term. If the schedule slips, complications result and deliverables are left incomplete. With the contractual obligation of deliverables that funded research brings, it became necessary to identify a primary point person as the community and agency counterpart to the studio critic. Success or failure hinges on the abilities of this individual. Their responsibilities are myriad; they must facilitate contact, expedite necessary resources, act as advance political scouts and sometimes perform tirelessly as project booster, often to a skeptical or indifferent audience. To seek out someone to fill this role for each project is an enormous challenge

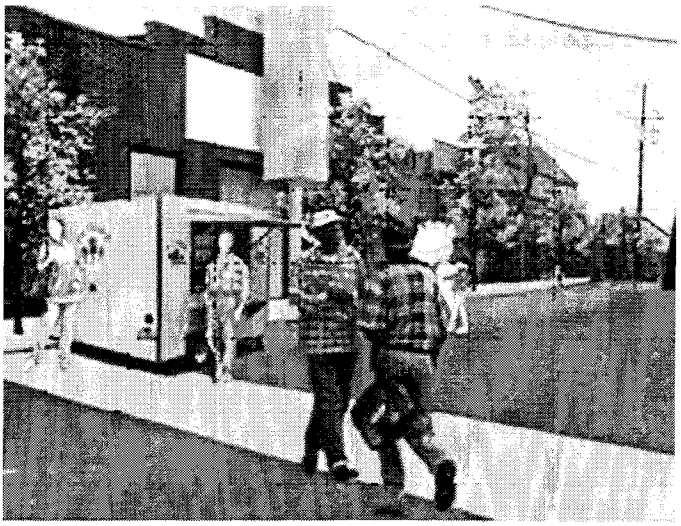

Fig. 16. After Folly Intervention.

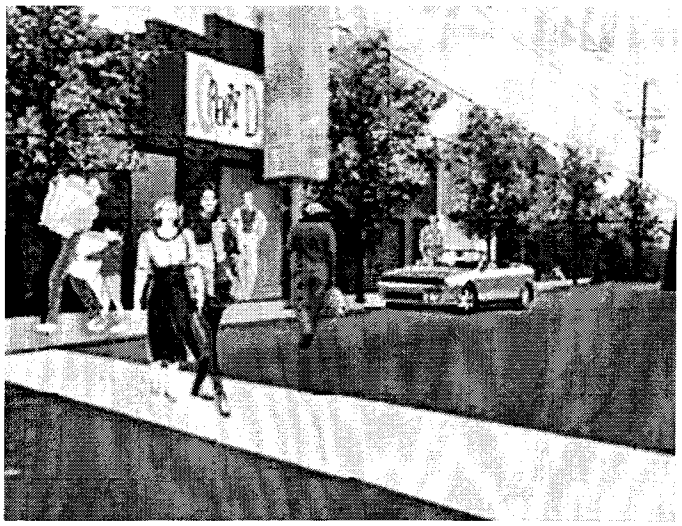

Fig. 17. After Five Years.

The MIP program is continually challenged to clarify its relationship to the profession. The program stresses that it does not compete with the profession; rather, it argues the contrary, that it launches projects that would not have commenced otherwise, projects that professional planners and designers can then take further toward implementation. The program argues that it adds value by doing what universities are good at: research and education. While the studio brings a project to a high level of design and its methods simulate practice, it never pre-empts practice. As part of a large research university, the program uses the knowledge of its extended community and its knowledge base to understand professional practice as it relates to a theoretical and historical continuum, an understanding that can clarify the planning and design opportunities for a community. A professional firm rarely is given a budget to perform research of this scope. By working in concert with the program, firms can craft the right solution for a community, often overcoming impasses to beneficial development, as the example of Riverside proved. In this process, the products of the studio are never proprietary; any community can use the products in any way it sees fit. If a professional firm takes the research and designs the project as the studio images it, then the program regards imitation as simply the highest form of flattery.

A university's success hinges on its ability to educate. The planning and design process at its most fundamental is a reciprocal form of education. As part of the studio process, students must learn everything there is to know about a community: both good and bad, reconcile that knowledge with larger physical and theoretical issues, and present to the community the pertinent issues affecting it. This cycle recurs many times throughout the process, leading to an effective and appropriate planning and design strategy. It parallels the classroom methodology of the studio and through the continual telling and retelling, clarifies the issues. The program trains students to be not just designers, but teachers and communicators. By educating a community, the studio greatly enhances a community's decision-making abilities.

Perhaps the greatest value the program adds, which comes as an unexpected surprise, is the effectiveness of students in catalyzing the development process. Students act as the primary contact with the community, regularly presenting their work in a thoughtful and professional manner. The community knows that oversight of the students' work by academics, professionals and agency representatives maintains the accuracy of information and methods. By the end of a project, after the community has met with them repeatedly, students earn a community's trust. Professionals, on the other hand, are often seen as allied with development interests, while academics, by themselves, as impractical. In New Jersey, the domain of the libertarian tradition of "home rule"[17], state agency officials are often viewed by communities with suspicion if not outright contempt. In contrast, students carry no ulterior motive and are somehow blessed with an inherent ingenuousness. For a local governing body, a state-funded, student driven project is free of political liability as typically no local taxes are spent. And if for some reason, political or otherwise, a community must officially reject a plan, it can simply invoke that it is after all student work or far too "theoretical" (although this escape clause has yet to be

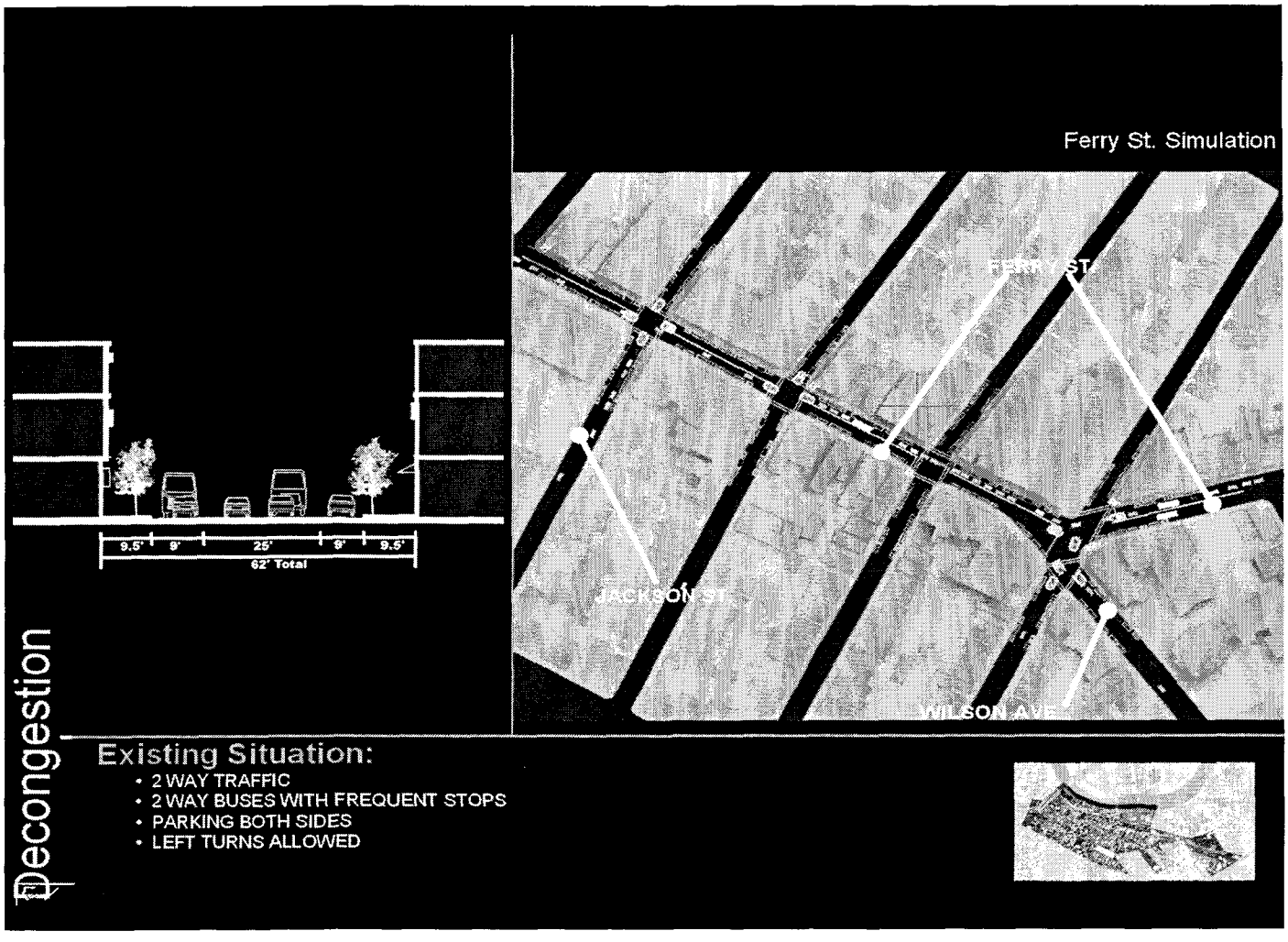

Fig. 18. Ferry Street Traffic Simulation.

used). Because it is student work in the form of multiple solutions done by teams, its authorship is not proprietary. It is not the "consultant's" or the "agency's" plan. By reorganizing different alternatives, it can readily become the mayor's, the town council's, or simply the town's plan. This phenomenon has worked consistently, catalyzing the development of projects[18] and forging new partnerships between the academy, state agencies and the profession.

NOTES

[1] NJIT Course Catalog

[2] Multidisciplinary planning as a methodology grew out of the socially based Chicago school and economically driven New Deal Planning initiatives. After the war, it blossomed as an interdepartmental urban design program at the University of Pennsylvania under Dean G. Holmes Perkins and coordinated by David Crane. This interdisciplinary "Philadelphia School" integrated architecture, landscape architecture and city planning and included Edmund Bacon, Britton Harris, Louis Kahn, Ian McHarg and Melvin Weber. The method was later applied in Boston under reform mayor John Collins through the Boston Redevelopment Authority (BRA), administered by Edward Logue and directed by Crane. The pinnacle of its effectiveness was the collaborative effort in 1968 between the New York Urban Development Corporation (UDC) and the Penn Planning Program, sponsored by Senator Robert Kennedy, to plan the Bedford-Stuyvesant neighborhood in Brooklyn NY. Multidisciplinary planning was undermined by the dismantling of the federal funding structure in the early 1970's as part of a larger decentralizing, smaller government agenda. For more about multidisciplinary planning in general, see **Peter Hall**, *Cities of Tomorrow: An Intellectual History Of Urban Planning And Design In The Twentieth Century*; (Cambridge, MA: Basil Blackwell, 1990)

[3] The MIP program was developed at NJIT by Professor Tony Santos under Dean Urs Gauchat. In the program's five year review, Professor Santos discusses the academic climate in which the program emerged: "The need for such a program at the regional, national and international level was recognized by the NJIT in the early 1990's. The emphasis on physical planning and urban design in the urban and regional planning degree programs had decreased noticeably in the previous twenty years. The curricula of most planning programs were predominantly based on the social sciences and oriented towards non-physical aspects of the environment, and none of those that retained a physical orientation stressed the interdisciplinary relationship with infrastructure engineering and technology. Urban design, on the other hand, had tended to become an extension of the traditional design professions of architecture and landscape architecture." From the *MIP Program Review Report*, 2.1 "History of the Program", (February 2002)

[4] Boyer, Ernest L., and Mitgang, Lee D., *Building Community : A New Future for Architecture Education and Practice: A Special Report*, (Princeton, NJ: Carnegie Foundation for the Advancement of Teaching, 1996)

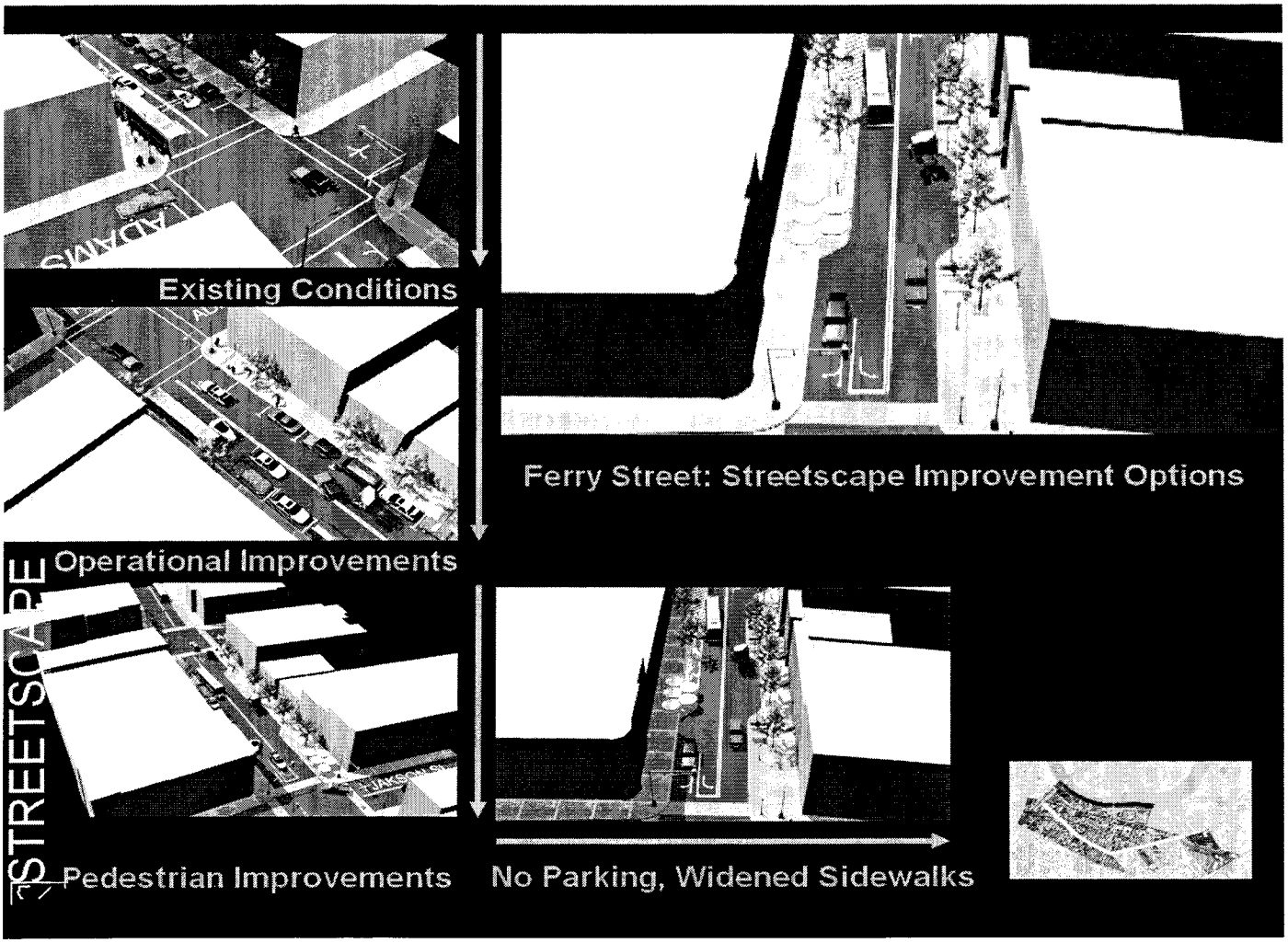

Fig. 19. Ferry Street Streetscape Options.

[5] Leslie Kanes Weisman "Resisting the Patriarchal Norms of Professional Education" in Diana Agrest, Patricia Conway and Leslie Weisman, *The Sex of Architecture* (New York: Harry N. Abrams, 1996). See also Rachel Sara, *Feminizing Architectural Education?* (The Centre for Education in the Built Environment Conference Proceedings, August, 2001).

[6] A good background for the discussion on interdisciplinary education is Joseph Kockelmans ed., *Interdisciplinarity and Higher Education* (University Park, PA: The Pennsylvania State University Press, 1979). Recently, the feminist critique of architectural education cites lack of collaboration and other failings of interdisciplinarity. The MIP seeks to redress many of the failures cited.

[7] In its *Policy Guide*, American Planning Association (APA, 2002), the APA describes the principles of Smart Growth as fostering "compact, transit accessible, pedestrian-oriented, mixed use development patterns and land reuse." Many contemporary planning initiatives often advocate Smart Growth as reactive and not initiatory, cautioning communities to resist the laissez-faire, market-driven forces that result in "sprawl", which the APA defines as an "automobile dependent, single use, resources consuming, and discontinuous, low-density development pattern". Locally, Smart Growth Policy is steered by *The New Jersey* Development and Redevelopment Plan, New Jersey Planning Commission, 2001, whose goals are to promote "quality of life, historic preservation, environmental protection, and economic prosperity."

[8] For a discussion of the inter-relationship and disconnects between the epistemological structure of the university and the practical world of the profession see Donald Schon, *The Reflective Practitioner*, (New York: Basic Books, 1983). For a specific discussion of studio based learning, see also Donald Schon, *Educating the Reflective Practitioner*, (American Educational Research Association Annual Meeting; published paper. Washington, DC, 1987).

[9] Larry K. Michaelsen, Arletta B. Knight, and L. Dee Fink, ed.; *Team-Based Learning: A Transformative Use of Small Groups*, (Westport, CT: Greenwood Press, 2002, in press) for articles in .pdf format on team-based learning see www.ou.edu/idp/teamlearning.

[10] As "a comprehensive, long range, region-wide blueprint for the future" see *The Regional Survey of New York and its Environs*, The Regional Plan of New York and its Environs, (New York, The Regional Plan 1929). It is the first master plan of the metropolis produced, and in the plan's spatial and temporal breadth, it is the meta-document for all regional planning. While not necessarily endorsing each finding, the curriculum acknowledges the importance of the plan's three gestations. Robert D. Yar0 and Tony Hiss, *A Region At Risk : The Third Regional Plan for the New York-New Jersey-Connecticut Metropolitan Area* (Washington, DC: Island Press, 1996) is required reading in each studio for its critical assessment of the metropolitan area's current challenges.

[11] At the fundamental level, the expansive comprehension of infrastructure as the connector between the city and its region is rooted in the organic holism of Patrick Geddes. See Patrick Geddes. *Cities in Evolution/Patrick Geddes*. (London: Williams & Norgate, 1949).

[12] The iterative process as a term has evolved to mean the process of continually refining software through user interaction. The development of the Linux operating system has become a legend for this methodology. The repetitive presentations of the MIP studio parallel this method. For more, see Richard

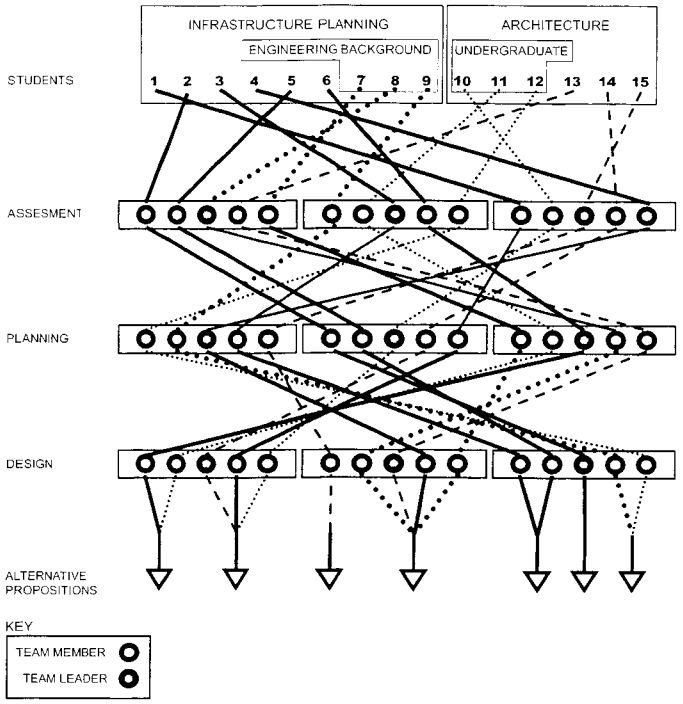

Fig. 20. Schematic Studio Team Structure: showing phases, interdisciplinary integration and vertical (undergraduate/graduate) integration.

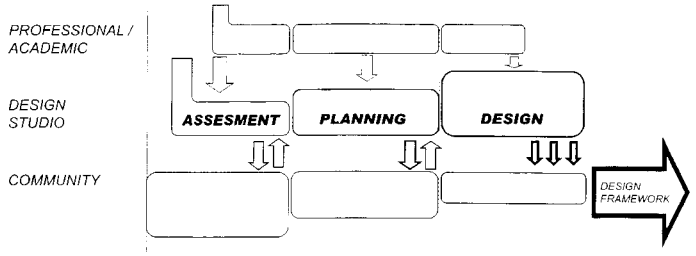

Fig. 21. The Studio Design Process; showing interactions between professional and academic disciplines, the studio and the community.

Opperman and Christopher Thomas "Learning and Problem Solving as an Iterative Process:" (User Interfaces for All (UI4ALL) Conference Paper, 1995 European Research Consortium for Informatics and Mathematics. http://ui4all.ics.forth.gr).

[13] The difference between the two softwares is fundamental. Microsoft PowerPoint, very easy to learn, is linear and necessarily narrative. Macromedia Dreamweaver and Flash are like the web, non-linear and offer a far more diversified method of organizing information, but the Macromedia programs are far more difficult to learn. The program has employed both; a balance between learning time and the end product must be made at the beginning of each project.

[14] The trilogy of books by Tufte is continually referenced in the studio. See Edward Tufte *Envisioning Information*, (1990); *Visual Explanations : Images And Quantities, Evidence And Narrative*, (1997); And *Visual Display Of Quantitative Information*, (2001); (all by Graphics Press, Cheshire, CT).

[15] Wilbert J. McKeachie, *Teaching Tips: Strategies, Research, And Theory For College And University Teachers*, (New York: Houghton Mifflin Company, 1999).

[16] One of New Jersey's large agencies asked its consultants to adopt the MIP program's presentation methods.

[17] Sullivan, Brian: *Restraints on the New Jersey* Legislature in Formulating Urban Policy: Home Rule and the Property Tax. (1974).

[18] Drake, Diana Lasseter, "Next Stop Transit Villages". In *New Jersey Business News*, (Vol. 14, No. 42, pp 28-29).

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