HIGHWAY RESEARCH RECORD

Number 220

Team Concepts for Urban Highways and Urban Design

6 Reports

Subject Area

81 Urban Transportation Administration
82 Urban Community Values
84 Urban Transportation Systems

HIGHWAY RESEARCH BOARD

DIVISION OF ENGINEERING NATIONAL RESEARCH COUNCIL
NATIONAL ACADEMY OF SCIENCES—NATIONAL ACADEMY OF ENGINEERING

Washington, D.C., 1968

Publication 1566

Price: $1.80

Available from

Highway Research Board
National Academy of Sciences
2101 Constitution Avenue
Washington, D.C. 20418

Department of Urban Transportation Planning

(As of December 31, 1967)

Pyke Johnson, Chairman
Washington, D.C.

HIGHWAY RESEARCH BOARD STAFF

James A. Scott

Frank N. Barker
Kurt W. Bauer
Fred J. Benson
Donald S. Berry
Siegfried M. Breuning
E. Wilson Campbell
J. Douglas Carroll, Jr.
F. Stuart Chapin, Jr.
John J. Cummings
Leo Cusick
Harmer E. Davis
Alfred Eisenpreis
John R. Hamburg
Robert L. Hardin, Jr.
Thomas J. Hart
Frederick O. Hayes
Patrick Healy
Bernard F. Hillenbrand
E. H. Holmes
William L. Hooper
Edgar M. Horwood
John T. Howard
Richard Ives
J. E. Johnston
Peter A. Lewis
Burton W. Marsh
J. O. Mattson
Robert E. McCabe
J. B. McMorran
William L. Mertz
Charles L. Miller
Robert B. Mitchell
Walter S. Rainville, Jr.
Clifford F. Rassweiler
Carlton C. Robinson
Paul W. Shuldiner
Merlin Smelker
Warren F. Smith
Wilber E. Smith
Francis C. Turner
Alan M. Voorhees
Edward G. Wetzel
C. R. Wilder
F. Houston Wynn
Charles J. Zwick

Foreword

The reports in this RECORD are divided into two parts. Part I provides an overview of some of the activity currently under way in this country in the development of multidiscipline teams and approaches to the planning and designing of limited access highway systems. Part II presents the result of a team effort in urban design undertaken in an interdisciplinary systems course at Massachusetts Institute of Technology. The MIT project proposes various solutions to the problem of building at high density while still preserving adaptability. The two parts are somewhat dissimilar in that Part I reports on current activities under way in some of our urban communities, whereas Part II represents a problem effort undertaken in a systems course. However, striking similarities can be noted. For example, the concepts of interdisciplinary approaches to the development of solutions to the problems of transportation and design of both land use and transportation are emphasized in both parts. Perhaps much more important is the fact that new ideas, concepts, and various approaches to our urban transportation and land-use problems are being stimulated and advocated from a multitude of sources including government, industry, and universities. Future trends along these lines are anticipated.

The remarks by Lowell K. Bridwell, Federal Highway Administrator, before the Pennsylvania Department of Highways Seminar this past February lead off the reports in Part I. The inclusion of these comments is most appropriate as the overall philosophy of the Federal Highway Administration is succinctly stated by Mr. Bridwell. The need for new concepts and approaches to our urban solutions such as the design team concept is emphasized by Mr. Bridwell when he states: "I am not aware that God granted all wisdom to any particular discipline. What I am aware of is that no single discipline represents all of the talent and training and experience necessary for the task we face." Mr. Bridwell's comments certainly underscore the need for multidiscipline approaches to our urban problems.

Following Mr. Bridwell's remarks are the reports from Andrew Euston on "Design Concepts for the Future," and the various examples of current work as reported by Norman Klein on the "Baltimore Team Concept," Milton Pikarsky on the "Chicago Joint Venture," and Archibald Rogers on the "New York Linear City."

Part II, which is more appropriately labeled "Project Romulus," includes an introduction by Dr. Siegfried M. Breuning, which emphasizes the various parameters under which the graduate student project was conducted. Following the introduction, the report on "Project Romulus" includes separate presentations. William Verplank discusses the physical systems from land use to structures to transportation. Anthony Kettaneh concludes the report with a discussion of the nonphysical aspects—the needs for such a city and the fiscal and political decisions necessary for its implementation.

Contents

Remarks Before Pennsylvania Department of Highways Seminar, February 28, 1968, Harrisburg

LOWELL K. BRIDWELL, Federal Highway Administrator

•THE mobility of the American people and their private and public institutions is greatly aided by the transportation system—obviously including highways. It is not necessary to comment about how valuable highways are, or how much of a contribution they have made to the economic, social, and cultural growth of America. The contributions are obvious and only the narrow-minded would contend otherwise. Instead, it is time to discuss more thorough, more detailed, and more effective ways to integrate highway development with present and future economic, social, and cultural growth.

In this day of restlessness, questioning, and dissent, we are bombarded with tired old cliches. We are regularly given so-called simple solutions to complicated problems. Too frequently we are told—and we tell ourselves—that we face only stark, bare, black and white alternatives.

This is nonsense. What we really face is a challenging opportunity—an opportunity to transform highway transportation into an economic, social, and cultural development tool far beyond anything available up to now.

The highway facilities in the United States have materially and substantially aided in making possible the opportunities we enjoy every day. Starting with the grandfather of limited-access highway facilities—the Pennsylvania Turnpike—we have learned how to build superior facilities for the fast, relatively safe, economic and convenient movement of people and goods by motor vehicle.

However, the planning, locating, and designing of facilities for highway transportation is not good enough for today, and it certainly is not good enough for tomorrow. Yet, what is planned and built today will exist for many years to come.

Anyone who pays attention to the public must realize that the restlessness, the questioning, and the dissent that pervade our society are equally applicable to highway transportation. Dissent and opposition take many forms, but they are implicit when people talk, even inarticulately, about the "urban crisis," about the "quality of the environment," about "urban design," and many other phrases that connote the problems associated with masses of people living, working, and playing in relative congestion.

The dissent and opposition are explicit in such phrases as "Chinese wall," and "concrete monster," and "big ditch." Another complaint is that a highway would be a "biological barrier" because it would disturb the ecological balance of the area it traversed.

These phrases contain both truth and fiction. For those who are blind and resistant to the will of the public—even the minority—these phrases are dismissed as complete fiction. For those who are too timid and afraid to face the disquieting challenge of the future, they are accepted as truth equal to Holy Writ. However, these phrases must be accepted for what they really are—expressions of relative degrees of dissatisfaction, expressions of challenge to do better, and expressions of public belief that the development of highway transportation and its facilities must be much more closely related to a whole range of other public and private policies being developed simultaneously.

The following is an admittedly oversimplified analogy: Imagine an engineer or an architect designing an elevator shaft and carriage without any concern for the building

Paper sponsored by Department of Urban Transportation Planning.

it is to serve—ignoring not just the number of square feet in the building, but all of the human activities that will take place.

In the final analysis, an elevator is a vertical expression of a transportation facility that can be likened to a horizontal facility in the form of a highway. The building the elevator serves is not unlike the bigger, broader, and more complicated area served by the highway facility.

Elevators are commonly designed as part of the buildings they will serve. In too many instances, the close relationship necessary between a highway facility and the neighborhood it serves is not adequately evaluated and analyzed and planned in terms of the intimate human activities that take place in and around that neighborhood. This is the fundamental reason why in city after city, real, intense, meaningful opposition has developed to the planning and construction of certain highway facilities. They are becoming all too numerous. Boston, New York, Philadelphia, Washington, Atlanta, New Orleans, Nashville, Memphis, Cleveland, Chicago, Baltimore, San Francisco, and Seattle represent only a partial list.

The situations in these cities are neither isolated nor unusual. They are symptoms of what has popularly been called the "Anti-Freeway Revolt." The "revolt" itself, however, is also a symptom. It is the manifestation of a breakdown in coordination of the values and assumptions and goals of urban dwellers on one hand with those of highway developers on the other hand. It is the manifestation of a failure on both sides to enter into the kind of communications that would close the gap. The results can be wasteful and costly delay in the provision of needed transportation facilities, and painful and unnecessary degradation of non-transportation urban values. Is the situation so deep-seated as to defy solution? Or, as recent events in a few cities indicate, can it be resolved in favor of better cities and better highways?

Both are obtainable if substantial modifications in methods of doing business and, more importantly, in attitudes are made.

Highway planning, notwithstanding all of its highly diverse and complicated engineering detail, is not and cannot be a completely quantifiable process in which all elements can be measured and tested, and assigned numbers representing cost, capacity, and other criteria going into the decision process. To do that, we almost certainly would be ignoring, or at least not giving adequate weight and value to, the unqualifiable elements that are equally important.

How do you measure the social viability of a neighborhood? How do you assign a number value to the social maturity and stability of a residential area? How do you test and assign a cost to the convenience of children going to an established school district, or parishoners to their church?

Lacking that ability to measure and test and quantify, we can weigh these factors properly only if we bring the right kind of talent to bear on the subject—talent able to dig deeply enough into all of the social, cultural and economic factors to thoroughly understand them and then evaluate them with the attitude that the highway facility is only one element or thread in the fabric that represents the city, neighborhood, or area concerned.

We are not choosing between a highway facility and the quality of the environment. Instead, we are analyzing, evaluating, and making decisions within our policy and program responsibilities that will have consequences for good or bad in an influence area far beyond the edge of the right-of-way.

In order to accomplish this difficult and complicated task, we need the kind of talent, training, and experience that is represented by several disciplines. The design of a highway is an engineering task. The planning and location of a highway facility involves many considerations other than engineering.

Recently, a witness before a Senate committee characterized highway engineers as about equal to plumbers—an obvious intended insult. All the gentleman really accomplished was to show his own stupidity and prejudice.

I am not aware that God granted all wisdom to any particular discipline. What I am aware of is that no single professional discipline represents all of the talent and training and experience necessary for the task we face.

It was this recognition that led to the formation for Baltimore of a multidiscipline team to plan and conceptually design the city's limited-access highway system. The team is, in effect, a prototype. How well it will work remains to be seen. The specific institutional arrangements, which we label the "Baltimore Design Concept Team," may or may not be the best way to go about the job. The development of the Team is, however, a recognition that the tasks are so complex that various talents are needed to work on them. It is not the only method; others will be tried in other locations.

The Team, which represents engineers, architects, sociologists, urban planners, economists, and others, was assembled to examine the highway corridor, and location and design alternatives within it—and all of this in the framework of overall community goals and plans. On the basis of its analysis, the Team will recommend to the city and the state a program for the development of highways and other community improvements to achieve identifiable opportunities in the broadest range of community values.

The Team is subdividing its activities into three time frames: development of its conceptual framework, followed by feasibility and schematic studies, followed by actual design of the programs it will recommend.

Within each time frame, smaller "teams" are assigned specific tasks. One team is undertaking analysis of the entire transportation system, present and projected, as a basis for coordination between that system and the planned highway segment. Another is conducting in-depth study of the broad area through which the corridors pass, determining the qualities, quantities, and values of its social, economic, structural, historical, and open space characteristics. This Team, which is spending much of its time talking with and listening to groups and individuals in the corridor, ultimately will be looked to for identification of neighborhood hopes and needs that should be fulfilled in the resulting projects.

A third team is exploring the opportunities for "joint development" (multiple use of space) above, below, and along the highway presented by the project. Their work ranges from abstracting pertinent zoning laws to analyzing current and needed housing, industrial, and school development plans. At a later point in the planning process, they will also become concerned with structural design questions presented by potential joint development opportunities offered by the highway.

How could fragmented and uncoordinated programs and funds of three levels of government and the private sector be pulled together into the cohesive force necessary to translate the planner's products into applied programs? The job of a fourth team within the "joint venture" is to find the answers to that question.

A fifth team is concerned with the design of a harmonious highway facility that will meet the highest attainable engineering, safety, operating, and esthetic standards. A sixth provides close and constant liaison between the joint venture and governmental programs. Finally, a monitoring team carries oversight responsibility for the entire process.

At dozens of points, formal review and coordination will be required between and among the various small teams. In addition, they work together on a day-to-day basis, sharing talents and resources whenever necessary. At key intervals they will submit progress and planning reports for review by the city and the state.

Public meetings to discuss the project already have been held in neighborhoods and communities along the corridors, in addition to scores of less formal contacts between the planners, city and state officials, and citizen and business interests. The joint venture and neighborhood groups will maintain local offices in neighborhoods along the corridor, at which personnel and material will be available to explain details of the planning process and to listen to the views of residents and businessmen.

There has been some grumbling, of course, from those who believe that the system has been needlessly and expensively delayed by the planning process. One cannot deny there have been delays. But do not overlook the alternatives to this kind of delay—alternatives that include a poorly designed and disruptive highway through the city; a loss of irreplaceable community values; a missed opportunity to substantially improve the quality of living in the city; possibly, placards and court suits; possibly, no highway at all.

Perhaps most important of all, the city, state and federal governments, the businesses, churches, schools, and the whole community will know that full resources were brought to bear on the program. In the final analysis, the success of the highway program—or any public works program—in any city will depend on the initiative of the people to identify and articulate their own future. As highway developers and as citizens, we must do everything within our power to foster that initiative.

Design Concepts for the Future

ANDREW F. EUSTON, Jr., AIA, Director of Urban Programs, American Institute of Architects

NEW CONCEPTS FOR RESPONSIVE DESIGN

•THREE panelists sharing this platform today are responsible for creating multidisciplinary design teams—a concept for the future that may determine the future well-being of our country's largest cities. Norman Klein leads the urban highway design team for Baltimore, Joseph Passoneau for Chicago, and Archibald Rogers for Brooklyn.

These men are charged with the responsibility of developing a responsive design process that may make urban highways responsive to the needs of people and vehicles alike. Before describing new concepts common to their separate roles in the emerging processes of multidiscipline urban design, let us look back to the conditions out of which these concepts grew.

THE NEED FOR RESPONSIVE DESIGN

The need for responsive urban design is due basically to the great catalytic impact that large-scale public works like highways have in creating opportunities and destroying existing values as they cut into the urban fabric. Although it is too late for many of our cities, we are now beginning to see urban highways as unacceptable if they are to become "Chinese walls" or mere ditches.

Senator Jennings Randolph (1), Chairman of the Senate Public Works Committee, remarked, when he announced his historic series of urban transportation policy hearings now under way in Washington, that "In many of the cities of our country, great controversy has developed over the route locations and design of segments of urban highways. Experience in New Orleans, San Francisco, New York, Chicago, Seattle, San Antonio, Memphis, Minneapolis, and elsewhere shows either that the laws are inadequate to encourage the full utilization of the opportunities presented by the highways or that the legislative intent to do so is not fully being realized in the highway planning process."

FAILURE AT RESPONSIVE DECISION-MAKING

Failure in basic decision-making lies at the beginning of nearly all the highway controversies. These failures neglect to take into full account the economic and social values to be created or destroyed. Nashville, Tennessee—just one of several hundred American cities to make front page news of their highway disputes—is a city that illustrates the need for a responsive urban highway decision-making process.

The "Washington Post" (2) reported that "A group of Nashville Negroes won a temporary delay in the Supreme Court yesterday blocking construction of an interstate highway which they claim would wipe out Negro commerce in the city. Justice Potter Stewart issued a brief order that froze construction of a three-mile stretch of Interstate 40 within the city. Highway officials conceded that no economic study was made in the area (although) detailed economic studies were made in other, non-Negro, sections of greater Nashville."

What is at issue in Nashville may be in part a deliberate case of race discrimination. What is certainly at issue, however, is the need to require a combined and comprehensive design and decision-making process that reconciles for all our cities the broadest

Paper sponsored by Department of Urban Transportation Planning and presented at the 47th Annual Meeting.

possible spectrum of economic and social needs—only one of which in the process of urban highway design is that of automotive transport.

FAILURE AT RESPONSIVE DESIGN

Design at every scale has become a national political issue. For example, we all now realize that the automobile in its present form stands to be the world's greatest single source of accidental violent death. According to Robert Brenner (3), for every three lives lost in auto accidents due to other causes, one additional life is lost due simply to the backward art of steering wheel design. Similarly, today's automobile engines contribute most to our air pollution, yet, effective remedies have not been designed.

In this age of moon shots and the SST, Americans are certainly not held back by technology in solving such small-scale design problems. The failure must be in deliberate evasion and neglect on the part of us all—from decision-maker to designer to consumer. Evidently no one assumed these types of design responsibilities.

As a rule, in America our large-scale public construction projects have also been designed unresponsively. Until recently human needs rarely have been considered. Thus, in the design of urban highways, "user needs" was merely one of those euphemistic semantic tools that clouded an issue. "Auto needs" were what was meant.

The concept of "user needs" has meant very simply the needs of the automobile system—a system in which the human being is significant either as machinery (termed the "operator") or as cargo (termed the "passenger") or occasionally as an obstruction (termed the "pedestrian"). Meanwhile, the auto did not feel. It did not enjoy, suffer, need, misjudge, overindulge nor did it become attached to neighborhoods, parks, quiet, fresh air—though here the auto does require oxygen—nor for that matter did it design anything.

We cannot blame the auto for becoming the greatest single source of violent death and air pollution; it did not design itself. Yet, the new concepts required in automotive design are ones that involve the focus of our whole system of government, industry, mass media and public awareness.

Given design failure at this colossal scale, it may prove impossible to create new concepts that make design responsive to human needs, but the evidence of some more humane concepts in the development of urban highways may be reason to hope that the entire system of automotive transport may become both responsive to and responsible toward basic human needs. Let us look then at these new concepts.

THE JOB TO BE DONE

There is a job to be done in urban highway design, yet a problem confronts hundreds of American cities. How does local government deal with a malignant physical environment—an unresponsive environment that has already alienated large segments of society?

We must realize that the point of departure for any comprehensive remedy must be the circulation systems. The life of each city depends on these publically owned transport arteries. A city's physical investments of public and private building are anchored to these systems.

Nationally, a major change is overdue in the process used for selecting transportation corridors, in delineating their specific location, and in executing their design. When freeways are constructed many values (both social and economic) are destroyed and many others are created. Monetary and social consequences can be accurately predicted if a few simple steps are undertaken. However, these opportunities have gone unexplored in a fragmented freeway program. A new process is needed to overcome every city's endemic pattern of controversy between local agencies, business, and neighborhood civic groups over highways. We must succeed in breaking these deadlocks and getting on with the job of building a comprehensive urban transportation system.

Several cities, deadlocked for years and unable to adopt any development plans due to disagreement on almost all basic issues, have turned to a new method of planning in which city officials and citizens participate in a decision-making process that produces the final design. As one city official put it (4), "It will be a waste of time to work on a new plan without a process for resolving differences, step-by-step, before the work has crystallized into proposals. Consequently, a process should be established in which all agencies concerned can work together, step-by-step, in creating a new mechanism which will lead up a ladder of planning decisions until a plan is developed which will be acceptable to all sides. The ladder of decisions would become an educational process as well as a decision-making process."

A NEW CONCEPT FOR DECISIONS AND DESIGN

A new concept has emerged that could apply to any urban planning problem, a three-part planning team which can be funded by 90 percent highway trust funds. It consists of a decision team (city and federal agency representatives), a citizen's or community team (business and neighborhood representatives) and a design team (consulting highway and traffic engineers, architects, landscape architects, economists, sociologists, acoustic engineers, illuminating engineers, graphic artists, etc.). Archibald Rogers has considerably expanded this concept in several recent documents (5).

This plan proved itself in Cincinnati, for example, which had been unable to accept a succession of proposed plans for its downtown for almost ten years. With the planning teams, Cincinnati achieved a downtown plan in less than a year's time that, because of the participation of city officials, was a legal document fully agreed upon in all its detail and ready to be implemented. Because citizen groups were informed and were permitted to advise on all decisions, the plan enjoyed almost total public acceptance (4).

Design decisions are made only after evaluating the full spectrum of costs and benefits. This spectrum includes social factors, real estate economics, potential industrial growth, preservation of historic and open space features, and neighborhood and downtown revitalization.

The evidence is clear that the confidence of our fellow citizens is gained by using design, decision, and community teams. The progress made in Cincinnati, in Rockville and in New Haven indicates the willingness of citizens to bear with a complex working review process in which they can be shown that they are genuinely represented. In varying degree, the governments of Baltimore, New York, Chicago, and Seattle, among others, have seized upon the virtues of this process specifically to deal with their own highway problems. Basically, it can be said to agree with a process recently adopted by the government of the District of Columbia for the National Training School site, a federal surplus property project. In addition, developmental highways for regions are being examined for the opportunities these teams present. A new highway for the Upper Great Lakes Region, for example, may be designed to do more than deliver lumber to market.

The significance of this new approach has been widely applauded in the major hearings currently under way before Senator Jennings Randolph's Subcommittee on Public Roads. Witnesses supporting the team approach before these hearings on urban transportation have already included spokesmen for Urban America, the American Institute of Architects and the professional engineering societies, the American Road Builders' Association and numerous individuals, such as Mayor Yorty of Los Angeles who looks to this process as a means for respecting the citizen's best interests while proceeding with the requirements for new urban highways.

A SUMMARY OF RECOMMENDATIONS

It is recommended then that responsive decision-making and design be provided by (a) a decision-making team established, empowered and staffed to implement these design and procedural goals, and that the local government affected determine the specific composition of this team and establish its mission and its procedures; (b) a representative community team established by the local government; and (c) a multidisciplined design team accepted as the appropriate vehicle to appraise the comprehensive urban freeway system of the locality.

TOWARDS SOCIALLY RESPONSIVE DESIGN METHODOLOGY

Urban transportation systems that neglect their profound social and economic impacts can no longer be accepted. New concepts for design methodology in these areas, however, have not been pursued, despite enormous investment by the government in highway and other transportation modes.

Ralph Morrill (6) of the University of Alabama compared this neglect of design methodology with the acceptance in our country of the need for progress in the field of health. In a letter to John Eberhard, Director of the Institute for Applied Technology of the National Bureau of Standards, he wrote, "In medicine, doctors have talked the public into paying for their workshops and research centers in the form of hospitals and clinics, in the name of mankind and charity. Have not the urban riots shown people yet that this is a form of 'cancer' that must be treated in physical architectural form with all the implications of social and economic study that proper . . . design is based on?"

In a reply to this issue, Eberhard (7) recently wrote me, "I am fully conscious of our lack of sufficient knowledge and/or analytical techniques for factoring into cost-benefit analyses the impacts which are sociological in nature. There is a huge void which exists between the tools of analyses of engineering economics and the satisfaction of human values. Because this void exists, I do not believe this gives us the prerogative of ignoring value systems that are not presently capable of being measured in an analytic sense."

URBAN DESIGN METHODOLOGY

The point here is that responsive urban design methodology can be applied today. A specific example is the report of the Potomac Task Force, which the President set up in connection with the Secretary of the Interior and the American Institute of Architects a few years ago (8). I will discuss the job they did very briefly. They attempted to set forth a contextual basis for planning around a river. They identified the river in a different way from any of the previous river studies, such as the Hudson Valley Report (9), by defining the river visually. This they did by dividing it into three sections—the river, the riverside, and the setting—rather than simply saying that the river is the watershed. Then in doing that, they began finding characteristics of these three sections, and they outlined ecological principles. They suggested, for example, some places which should not be developed.

The report on the Potomac is a conceptual framework that would lend itself to a good deal of other technical studies that are coming up or have already been delivered. An example would be Philip Lewis' ecological systems for Wisconsin, which includes his report on the Wisconsin recreation plan. A study being done for HUD on open space land-use controls by Anna Louise Strong (10) would similarly apply. Some of the studies by Tito Patrie (11) in California, or research at the University of Southern California (12) regarding land contours and the way the wind blows, ecology and livability, and the erosion of a site would be applicable. Also the very important Delmarva study of the Conservation Foundation should be mentioned. This is an ecological inventory, one of the first being done (13).

What is being called for, generally, by all the ecologically oriented environmental designers is a wholesale ecological inventory of the country, so that we can know what we are talking about.

This brings me to the transportation corridor study of I-95 in New Jersey by Ian McHarg (14). Graphics were set up that showed on the same map overlays shaded to indicate social values. This was a cost-benefit analysis. One of the values would be topography. Others covered land values, urbanization, residential quality, historic value, and susceptibility to erosion. Thus, they had a composite of all social values in the area. It was an attempt to try to find a rational basis for route selection in a region or state.

McHarg's study happened to be based on an earlier study done in 1962, which was funded by BPR and the State of Massachusetts. This was done by Christopher Alexander and Marvin L. Mannheim (15), and it made extensive use of computer programming.

An MIT report (16) in 1962 was one of the early precursors of the use of the computer, which so largely now is a question of status quo trip generation, and not really based upon potential. For example, what would be the implications of resettlement in new towns on trip generation?

A further example would be the report that Ralph Morrill of the University of Alabama did for the Northeast Corridor Transportation Study (17). He calls this "ROUTE." It, too, is a computer-oriented analysis. It has sections on aesthetics, definition of criteria, and data collection. It tries to integrate the design questions and the aesthetic values that are inherent in any highway route selection process. In addition, there is the TALUS study, which employed the computer; it is for the Detroit region. TALUS stands for Transportation and Land Use Study (18).

A major document, which is going to be published soon (19), was developed by Oscar Newman and Roger Montgomery of Washington University in St. Louis for the city of Chicago. It is an analysis of about a dozen community renewal programs critiquing the methodologies that were used. This report is one of the first to analyze the methodology of what is meant by urban design.

I am sure these inquiries are going to become more important in the decision-making process for the environment, but this methodology is late in coming, and it could have been encouraged considerably more than it was (20). It is very difficult to come by this material. Perhaps a lot could be done to make innovation, such as Ian McHarg's study of two years ago, something that is available to anybody who wants it.

In this connection it should be mentioned that a visual information system is being attempted now at MIT. It is attuned to the idea that design processes themselves are, at base, processes concerned with the handling of information. Called by some "communication theory," this concept has applications in design (how do you represent words, numbers, costs, social values, behavioral needs?) or in transportation or even in stock market evaluations (how do you represent graphically the significances and trends of the day's activity?). It would appear from this that a significant field may be emerging which may enable the creation of design methodologies we now lack.

CONCLUSION

Viewed as a whole, urban highway planning decisions will determine the form and substance of the entire urban fabric. A constructive approach consistent with a city's real needs for transportation is to employ urban design techniques for comprehensive social and economic analysis. The underlying questions here are not those of traffic volume statistics. They go beyond these to the urban design of cities themselves.

These questions of urban design have been excluded by circumstance from the fragmented process of urban highway planning. Comprehensive urban design analysis is now possible and therefore imperative.

REFERENCES

1. Randolph, Jennings, Chairman, Senate Committee on Public Works. The Highway as Catalyst, remarks before the U.S. Senate on Nov. 8, 1967.
2. MacKenzie, John P. Nashville Negroes' Plea Halts Interstate 40 Link. Washington Post, Jan. 1968.
3. Brenner, Robert, Deputy Director of the National Highway Safety Bureau. Remarks before the American Association for the Advancement of Science in New York City, Dec. 30, 1967.
4. Barnett, Jonathan, AIA. A New Planning Process With Built-in Political Support. Architectural Record, May 1966.
5. Rogers, Archibald C., FAIA. Organization for Design of Urban Freeway System in Baltimore City—Draft Proposal, June 10, July 20 and Sept. 6, 1966. Also, Exhibit C: Urban Design Policy. Prepared for the AIA for presentation before the Senate Subcommittee on Executive Reorganization of the Government, April 19, 1967. Also, Linear City and Cross Brooklyn Expressway—Plan for Planning Report. For the New York City Planning Commission, Sept. 1967.

6. Morrill, Ralph K., AIA. Environmental Research Associates, Inc., Auburn, Ala. Letter to John P. Eberhard, Director, Institute for Applied Technology, National Bureau of Standards, Dec. 14, 1967.
7. Eberhard, John P. (See Ref. 6.) Letter to Andrew F. Euston, Jr., AIA, Director of Urban Programs, the American Institute of Architects, Dec. 28, 1967.
8. The Potomac. Potomac Planning Task Force report to the President and the Department of the Interior. Washington, 1967.
9. The Hudson. Hudson River Valley Commission report to Governor Nelson A. Rockefeller and the Legislature of the State of New York, 1966.
10. Strong, Anna Louise. Metropolitan Open Space from Natural Process Report. Prepared for the office of the Assistant Secretary for Metropolitan Redevelopment, HUD.
11. Patrie, Tito. Landscape Architecture, 1966-1967.
12. Hurst, Sam T., FAIA. Land Development Control in Hillside and Mountain Areas. Southern California Chapter, AIA, 1963-1964. Also, other researches at the University of Southern California, School of Architecture and Fine Arts.
13. Belknap, Raymond K., and Furtado, John G. Three Approaches to Environmental Resource Analysis. Sponsored and published by The Conservation Foundation, Washington, Nov. 1967.
14. McHarg, Ian L. A Comprehensive Highway Route Selection Method Applied to I-95 Between the Delaware and Raritan Rivers, New Jersey, 1966.
15. Alexander, Christopher, and Manheim, Marvin L., MIT. The Use of Diagrams in Highway Route Location, an Experiment. Prepared for the State of Massachusetts, 1962.
16. Roberts, Paul O., and Suhrbier, John H. Highway Location Analysis—An Example Problem. MIT Rept. No. 5, MIT Press, 1962.
17. Morrill, Ralph K., AIA. Final report on "ROUTE." Prepared for U. S. Department of Commerce, National Bureau of Standards, Institute for Applied Technology, May 1967.
18. Rubin, Irving J. Director, Detroit Regional Transportation and Land Use Study. Major report of 1967.
19. Newman, Oscar, and Montgomery, Roger, AIA. Design in Community Renewal Programs. A critical survey prepared for the Chicago City Planning Commission in 1966 (publication expected in 1968).
20. Euston, Andrew F., Jr., AIA. Exhibit B: Socio-Physical Design Policy. Prepared for the AIA for presentation before the Senate Subcommittee on Executive Reorganization of the Government, April 19, 1967.

Baltimore Urban Design Concept Team

NORMAN KLEIN, Skidmore, Owings and Merrill, Washington

•I WOULD like to share with you our experiences on a project in action. One of the best ways of doing research is to get going and do it and see what one runs into. This case is the Baltimore Urban Design Concept Team, which began October 3, 1967. It is a 2-year project. The client is the Maryland State Roads Commission, Interstate Division. The Team is composed of four primary firms, with consultants: Skidmore, Owings and Merrill; Wilbur Smith and Assoc.; Parsons, Brinckerhoff, Quade and Douglas; and the J. E. Greiner Co.

There is a good deal of new methodology on the far horizon. For now we believe that we have an initial start on what promises to be the best way of going about the design of highways and cities. I am reminded of Hans Blumenfeld, a planner in Toronto, who described to a city planning student the most important thing for a planning student to learn: "Know when to jump from the frying pan of inconclusive research into the fire of arbitrary decision." I think we have come a good distance from that, but there is still not quite the systematic, total process that we all wish were here.

The central issue is to plan the urban highway not in isolation, but in full relation to the needs of the surrounding area and the city as a whole. Our work corresponds, in a way, to the public recognition that issues of mobility are inseparable from quality of place. In the book, "Traffic in Towns," Colin Buchanan made the analogy of designing a hospital in which one first designs the corridors and then later thinks about the rooms. This is obviously ridiculous, but it has, unfortunately, been the case in many cities. The simple intent is to do the thing right—to plan the corridors and rooms simultaneously.

To accomplish this in fact and not in theory is the goal. This requires a new kind of design team, a new design process, and a new vehicle for implementation. The design team is composed of city planners, architects, engineers, urban designers, social scientists, and specialists in acoustics and lighting—each bringing his own special skill plus a deep interest in making the whole greater than the sum of its parts. The forming of an interdisciplinary team is much easier said than done. It is a tremendous challenge to communication and we are beginning to see it take shape. It is hard, but as we have seen in the three months that we have worked on it, it is certainly possible. Today, the process of urban highway planning must focus on three aspects of what is really a single product: the road, joint development, and urban programs.

The road includes the highway in relation to the complete transportation system, taking into account rapid transit, parking, parkways, city streets, and pedestrian movement.

Joint development defines multiple facilities within and adjacent to the rights-of-way for schools, recreation, housing, and commerce, and other functions vital to urban areas. They link both sides in what has been in many cities a massive barrier. These developments must not only replace things taken by the road, but must provide needed sites for improved urban development.

The idea of joint development was first articulated in a memorandum under Rex Whitton in a speech by Frank Turner. He says, "How do we get started?" In order to make a start in this activity, it is necessary to focus almost immediately on specific problems in specific areas. Otherwise we can generalize from now until doomsday and nothing much would happen. I suggest that you identify those projects where you are having, or may anticipate having, relocation problems, and where redevelopment is

Paper sponsored by Department of Urban Transportation Planning and presented at the 47th Annual Meeting.

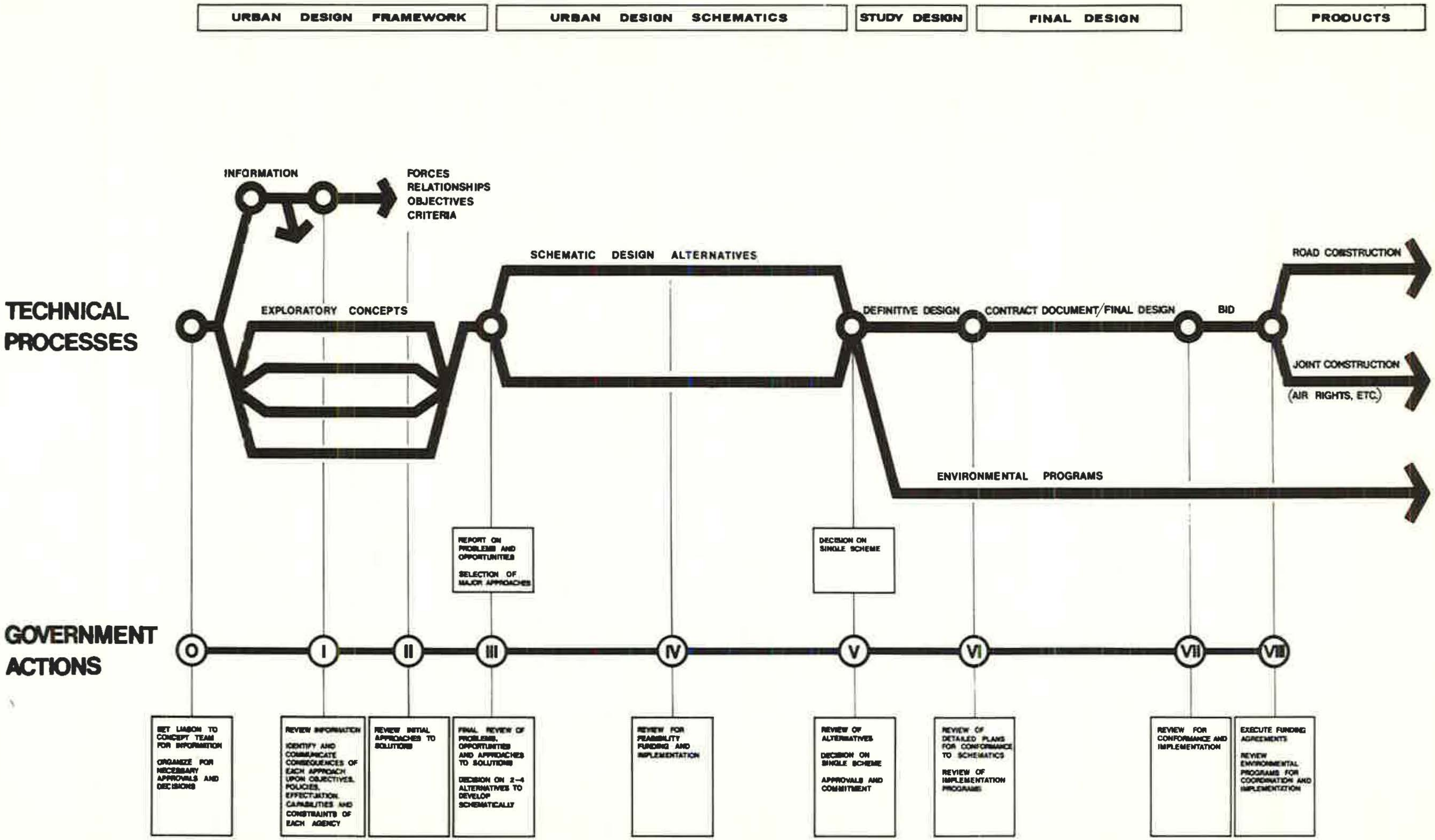


Figure 1. The Baltimore Urban Design Concept Team process, showing the parallel actions by the government and by the Design Team. The final work product has three components: road construction (integrated with an overall transportation system); joint construction (in air-rights and contiguous areas); and environmental programs (education, housing, recreation, employment, etc).

otherwise desirable. In Baltimore we are defining the specific problems and beginning to recommend specific action.

Urban programs consist of environmental programs such as relocation, employment, education, housing, and neighborhood improvement, which must be accomplished in the highway environs. Today it is not sufficient merely to replace functions dislocated. Rather, cities must aim for a far higher level of development potential. Historic, architectural, natural, and visual qualities must be identified, respected, and made a living part of the environment.

In this we work not as a concept team alone, obviously. We work closely with the City Government, the City Planning Department, the Urban Renewal Agency, the Greater Baltimore Development Corp., and the State of Maryland. This cannot just happen in a vacuum, and when concept teams, which really are consultants, leave, the work must be carried on by the community itself. Therefore, throughout its process, the city, the state, and the federal government must be vitally linked partners.

As the process begins to be applied to a real city, Baltimore, the Concept Team has to deal with the problem of mobility and place—each in a state of change. It must backtrack as well as go forward. The team must of necessity look at, adjust to, and correct that which has been happening before it arrived, as well as design for difficult-to-predict future developments.

In Baltimore, the proposed corridor would represent a 24-mile slice of life of an average American city—going through park, ghetto, waterfront, historical areas, center city, and industrial areas. The Maryland State Roads Commission contract with the Team explicitly identifies its objectives as follows: "It is the objective of the Commission and the City to assure that the Interstate system within the city will provide for the social, economic, and aesthetic needs of the city's environment, as well as provide an efficient transportation facility." It requires the best development of the highway facilities on established rights-of-way, development of joint use potentials for highway rights-of-way for other than highway purposes, and the best use and development of land adjacent to the highway for development and redevelopment of the urban area according to established or proposed land uses.

The general process itself is very complex. To oversimplify, I would say that the 2-year project is divided into three equal phases. The first phase, approximately 7 to 9 months, consists of analyzing and researching the social needs, the neighborhood needs, transportation problems, architectural, historic and visual problems and opportunities, economic resources and limitations, and the governmental actions in implementing the project. At the end of the first phase, a statement of major problems and approaches to the solution will be the product.

The second phase, which is called urban design schematics, will consist of a more detailed development of alternative options for the road itself, whether it be below-grade, on-grade or above-grade, and will include economic feasibility studies. The cost and benefits will be analyzed over a full range of factors, including social costs, impact on the city's future tax base, and long-range development opportunities, as well as acquisition and construction costs. Evaluation of alternatives will take into account both the driver and people in the highway environs. The product of the second phase will be to display options for community choice. It will display options of the road integrated with its surroundings, delineate the benefits and costs, and itemize which government agency and which private agency would be likely to commit funds for the joint city and highway development. A crucial decision will be made at this point. The determination must be made as to what joint development, road alignment alternatives, and environmental options are fundable, and which may be postponed or deleted. An intensive feasibility study will have preceded this commitment point.

The last phase will be the execution of the chosen alternative. Preliminary engineering design will be developed for the road itself. Detailed design will also be undertaken for coordinated joint development projects within the rights-of-way, and public and private agencies will begin to implement the environmental programs during this phase of "Study Design."

I have given a very simple view of the steps dividing the project into three parts. You will see, however, that life is not that simple. Some things have got to go faster.

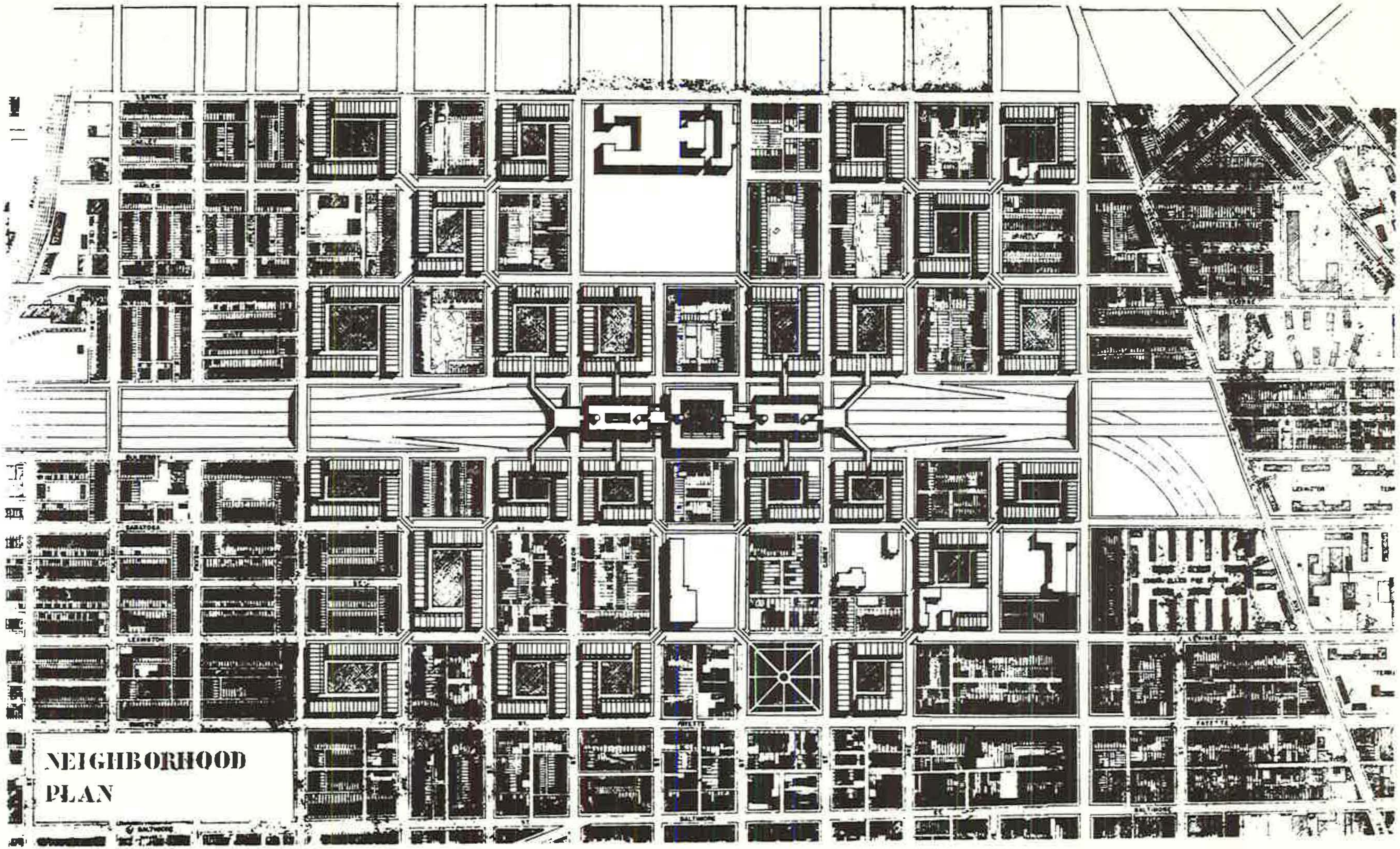


Figure 2. Neighborhood plan exploratory concept—Franklin-Mulberry corridor, showing a multi-service community center together with housing and shops above a portion of a depressed highway. Pedestrian movement is at a level above the present streets tying together the new facilities with the existing neighborhood.

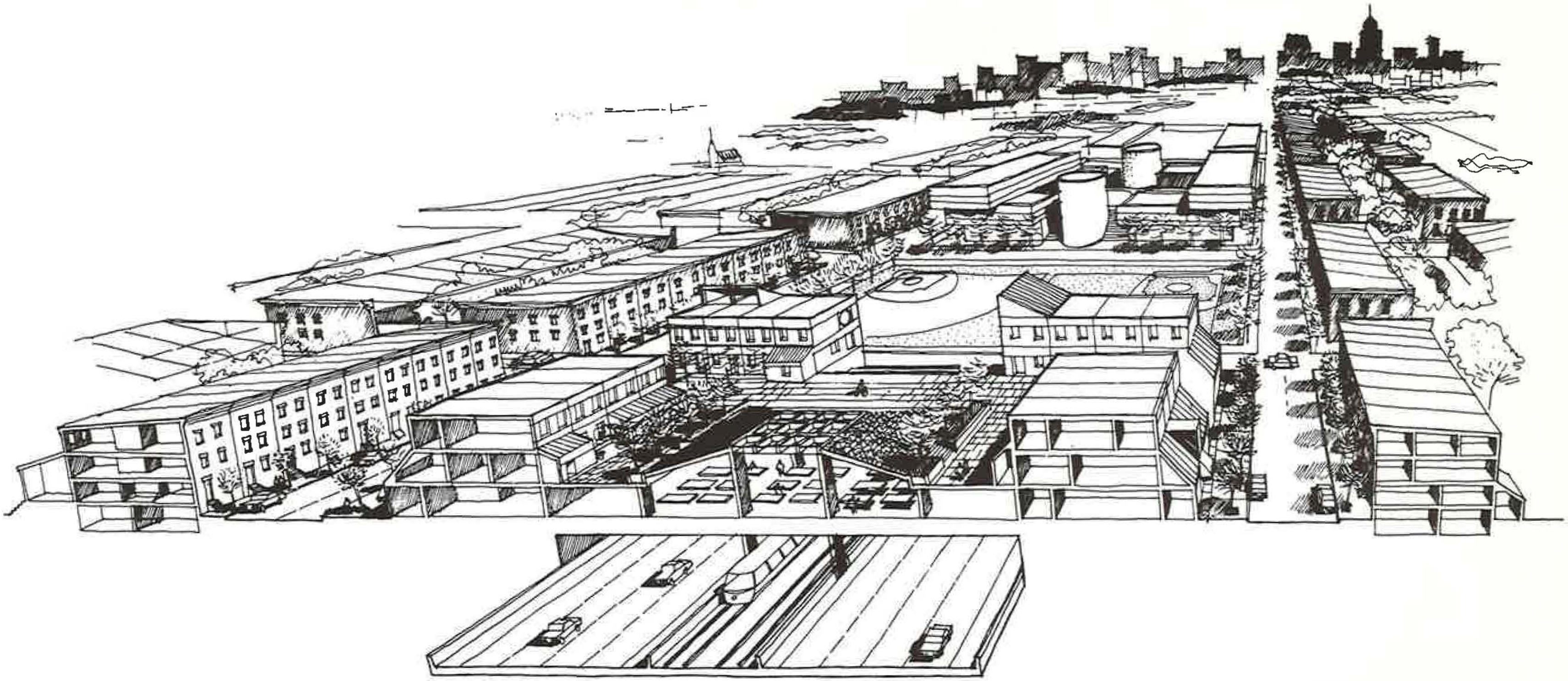


Figure 3. Exploratory concept of the Franklin-Mulberry corridor looking toward downtown, showing a total redevelopment of a street-level surface of the highway corridor for community use—housing, employment, recreation, education. On this scheme the highway and rapid transit would be in a tunnel.

Some segments of the road are needed early to accommodate early traffic pressures and other pressures. This full schedule will, however, apply to the major critical areas of Baltimore.

It is obvious from the start that throughout the short range of this 24-month project, the potential public agencies and private investors who must commit funds and program to the joining together of the highway and the city must be included as participants in the process. I would like to stress, having worked in urban renewal projects and knowing how long they take, historically, in this country, that to think of 24 miles of a freeway in 24 months will take an absolutely new kind of an accelerated, coordinated decision-making team. Basic to the achievement of the goals stated are the following critical points:

1. People—Individual participation in the decision-making by the people in the affected communities. How do we do this?
2. Flexibility—Opportunity for flexibility in design exploration. It is well known that in Baltimore condemnation laws have been passed delineating the route of the freeway. The question of flexibility is one of vital importance.
3. Timing—Accelerated process of coordinated public and private participation in advance of the commitment point.
4. Funding—A program and funding commitment for all programs identified, not the road alone. The private-sector commitment together with that of other public agencies will, in all probability, be two or three times the $300 million allocated for the road by the Department of Transportation. I would like to stress that you cannot just talk about fitting a road into a city without paying for it. Right now funds are there for the road only; but if this project is to succeed, the commitment of funds to all the other things I have been talking about—the relocation, the housing, development of the surroundings—must be concurrent. The problem is great.

We are grateful to the State of Maryland, the City of Baltimore, and the U. S. Department of Transportation for establishing this important experiment, and hope that its outcome will bring value to general planning and research, more by successful techniques than by some inevitable mistakes, and that it will help give Baltimore a better highway and a better city. The key to this effort is the working together of architects, engineers, planners, urban designers, economists, sociologists, and government experts in a framework which permits them to pull in the same direction, at least most of the time.

Joint Development Concept: Chicago Crosstown Expressway

MILTON PIKARSKY, Commissioner of Public Works, Chicago Department of Public Works

•HIGHWAY construction has destroyed whole neighborhoods, ruined or buried parks and waterfronts, and displaced entire communities without all the alternatives having been explored.

Proposed new expressways are regarded by many as rivers of noise, exhaust gas, and constant motion: A "River to be kept away from my door!" When residential areas, park areas, or areas of scenic vistas have been under discussion for a new highway, great numbers of citizens have signed petitions and stormed City Hall in opposition. Can we really blame them? Certainly, we can expect more of the same across the nation.

To date, our road transportation networks have all too often been built at the expense of civic and human values. They have scarred and divided our neighborhoods, have displaced the poor, and have been built at the expense of other means of transportation. The highway engineer has, indeed, become the villain! Does it matter that in hundreds of urban areas, urban highway projects have been satisfactorily completed and are serving the public? We have forgotten that our affluent society is largely the result of mobility obtained through locating, designing, and building the world's finest highway system.

It is true that there have been criticisms and limited mistakes, but when you consider the accomplishments and the magnitude of the work, you must agree that the criticisms and mistakes are almost minor in comparison.

More important than ever is the need to clarify the concept of the "public good" in expressway planning. To illustrate how the interpretation of the public good affects the process of expressway planning, it is necessary to review how highway decisions were originally made and how the process has evolved up to this time.

In the early days of highway construction, the concept of the public good, although not always stated explicity, was nevertheless there. In 1919, Oregon passed a special tax on the sale of gasoline and tied the rate of highway construction to the receipt of these taxes. This was very much in keeping with the traditional concept of a market mechanism of supply and demand. The supply of highway improvements was determined by the demand for improved roads as expressed by the amount of motor fuel taxes collected, which in turn reflected the volume of traffic on existing roads. This approach could not at that time have raised much controversy as to whether or not it reflected the public good, because within a decade all other states had established motor-vehicle user taxes for financing highway improvements.

Again, it was Oregon that developed the process one step further because, while the amount of highway construction was governed by the amount of funds available, that did not resolve the problem of where the improvements were to be made, how much demand justified the expenditure, and why one particular improvement was chosen over another. In 1937, Oregon began to relate the costs of highway improvements to the benefits to be derived from alternative alignments or routes. Maintenance of the highway was included in the costs, and savings in motor fuel were included in the benefits. This development, too, was in keeping with good business practice.

Paper sponsored by Department of Urban Transportation Planning and presented at the 47th Annual Meeting.

In 1945, a national survey was made of the methods used by the different states to justify highway expenditures. The purpose was to develop some uniformity in procedures and standards across the country. As a result, the road-user benefit analysis was further refined and eventually adopted as standard practice by the U. S. Bureau of Public Roads.

Except for times of national crisis, when large federal expenditures on roads are made for other reasons—such as to give employment during the depression, and for defense purposes during wartime—this philosophy, based on the costs and benefits to the road-user, has prevailed until recent years.

As time went on, however, non-road-user considerations, such as changes in property values and land use, were added to the criteria for expressway alignments. Although the consideration of effects on the non-road-user broadened the basis for decision, the fundamental philosophy did not take into account the gulf that was developing between the road-user on the one hand and the general public on the other.

The public was becoming more aware of the disruption caused by expressway construction and less impressed by its ability to keep up with traffic demands. In the early days, much expressway construction occurred in rural areas. Therefore, the displacement of residents and businesses was slight compared with what happened when expressways were built in developed urban areas.

Highway engineers are unfairly bearing the brunt of the inadequacies of the traditional mechanism of supply and demand as a basis for resolving long-range public decisions. It is emphasized that yesterday this approach was synonomous with the public good. Today, however, the public good involves fundamental questions of goals and priorities, of the accounting of costs and benefits, of the adequacy or lack of adequacy of our approach to public investments, and of the building of cities populated by human beings having aspirations for the quality of life in which to work, live, and raise their children. All of these questions become critical and explosive issues when the highway meets the city, and they cannot just be painted or landscaped over.

Today we realize that urban highways head the list of public works that have been planned with too narrow a purpose in mind. The reason they head the list is not that they have been planned with less heed than other public improvements, but because their performance and power have such an impact on the urban scene. They are far too powerful simply to glide through the city unnoticed, no matter how prettily dressed.

Today we are exploring an approach that puts highways to strategic use in the building of a better physical and social environment for our cities.

We must apply a full accounting not only to land acquisition, design, and construction, but also to such other real and tangible costs as the additional street and storage capacity required at interchanges; the taking of land from the tax rolls; the dislocation of people in the highway's path; the possible reduction in value of adjacent property; the division and disruption of neighborhoods stemming from insensitive location; and the visual blight resulting from insensitive design. In Chicago's Crosstown Expressway study, our goal is to put the power of the highway to positive use.

It is the intent of the Crosstown design team to:

1. Design the Crosstown Expressway to be a quality highway;
2. Design the Crosstown Expressway and its environs to implement the City's plans for the future; and
3. Recommend methods for the implementation of the construction of the expressway and its environs.

Most urban problems have no clear-cut, well-defined solutions. The goals, however, are clear:

1. Guarantee decent housing for every family,
2. Remove the slums,
3. Eliminate poverty,
4. Achieve a balanced transportation system,
5. Terminate crime,
6. Nourish quality education for all,

7. Effect equal opportunity in employment,
8. Secure better health services, and
9. Stimulate adequate recreational development.

To achieve greatness, a city must set its goals high. It must aim to achieve the impossible. It must not compromise essentials.

We are confident that Chicago has both the political leadership and the professional talent to develop and achieve a new urban expressway with related community developments. We will establish new standards for other urban communities to emulate. The "I will" spirit of Chicago will permit no less.

The Urban Freeway: An Experiment in Team Design and Decision-Making

A. C. ROGERS, Rogers, Taliaferro, Kostritsky, Lamb, Baltimore

THE MULTIPLE FUNCTION OF THE HIGHWAY

•HIGHWAYS are, and have always been, more than single-purpose conduits for the movement of goods and people. They are, in addition:

1. Determinants of uses flanking the corridor (e.g., the crossroads country store, which is today the regional shopping center at a freeway interchange).
2. Determinants, therefore, of land values along the route (e.g., a farm may cease to have value as such because of severance, but may have instead ten times more value as a subdivision, due to access).
3. But one element in the system of transportation: (a) To "close" the system of transportation modes using the highway, garages and pedestrian paths are required, as are terminals for trucks and depots for buses; (b) To "close" the total transportation system, interchange points are also required between the highway modes of transport and the nonhighway modes, such as air, sea, and rail pathways.
4. An essential element of the "public skeleton" (i.e., the armature of concentrated public investment in streets, buildings, utilities, open spaces, etc.), which is the basic framework for urban or city design and which, if skillfully developed, will determine urban form around it for the foreseeable future, as this form is fleshed out by the incidental addition of architectural elements.

THE FAILURE OF SINGLE-PURPOSE DESIGN AND DECISION-MAKING

Given the preceding definition, highway design has often failed, but not so much because of insensitivity on the part of administrative officials and designers (a charge that is often advanced but may not be always fair). Rather this failure has been due to the narrow interpretation of their charge by responsible officials, which narrow interpretation has been, in turn, passed on to (and accepted by) those whom these officials employ as designers. Under this narrow interpretation, the major public highway programs are thought of as:

1. Serving a limited sector of the public who drive cars or trucks, or ride interstate buses. (Yet this public must park their cars and become pedestrians at some point in their journey, if their journey is to be successfully completed; the competition between automobile, truck, and bus is often abrasive and destructive on the highway and its debouchments.)
2. Being in aggressive competition with other pathways serving other modes of transportation. (Thus issues are often oversimplified with battle lines drawn between highways and railroads, instead of establishing complementary relationships such as, for example, making available median rights-of-way within the freeways for the construction of railroad lines.)
3. Being paid for by someone called a "highway user" and thus with benefits restricted only to this shadowy individual. (Am I not a highway user when I buy a bag of groceries? Even though I have no car, some of the cost of my purchases may well have gone into the highway trust fund, since it is used to defray the costs of distributing the goods I buy, including in such costs the gasoline taxes paid by the trucker.)

Paper sponsored by Department of Urban Transportation Planning and presented at the 47th Annual Meeting.

4. In the interest of serving the highway user and the highway user only, the cost and benefit spectrum has been reduced to consideration of highest efficiency (measured in terms of maximum speed and minimum distance of travel) and minimum first cost (to spread the highway user's tax dollar as far as possible). Even the safety of the highway user is subordinated to these consideration (witness the traditional design of overpasses, with columns in the median; this reduces the span and thus the cost of the overpass but, of course, greatly increases the hazard for the drivers below).

In the present approach to highway design and decision-making, little, if any, attention is paid to the effect of highways on other modes of transportation and the interconnection between these; to the actual development of terminals (garages, etc.) at the time the highways themselves are planned and built; or to the economic effects of the highways. (Other than citing the general benefit to the economy by the fact of a highway per se, there has been little effort to design the highway so as to maximize these presumed benefits, and equally little effort to minimize its opposite effects, even when these are admitted.) Almost totally ignored has been the social impact of the highway and the matter of aesthetic value for those who view it and those who travel upon it. Yet one of the greatest public works of any civilization, which is our Interstate Freeway System, could have been a great civic monument, comparable to the great engineering works of the past, such as the Roman Aqueducts.

THE URBAN FREEWAY

The foregoing description of the nature of the highway and of its design and decision-making failures thus far are "doubled in spades" when these are freeways to be built in urban areas. So much social, political, and economic controversy has developed that it is clear that, unless a new approach is taken, the Interstate Freeway System will simply not be completed as regards its urban mileage.

This new approach, moreover, is not only essential to the resolution of the conflicts plaguing the urban interstate program; it is equally important to the overall solution of urban planning problems in general. Since the typical interstate highway within a city will "slice through" a cross section of the physical and social fabric of that city, it is clear that a solution to the highway problem will be applicable far beyond the concern of the interstate program per se.

Recommended New Approach to the Urban Highway

A new approach to the design of, and decision-making for, the urban highway is elaborated in Appendix B, "Urban Design Policy." As applied to urban highways, it may be summarized as follows:

1. The urban highway, and the funds therefor; should be used to provide for the redevelopment of the entire highway corridor by planning for joint construction of the highway and of other uses beside its right-of-way and over or under its roadbed. The highway is a catalyst, and this catalytic effect should be used to benefit the urban environment, rather than to blight it as has so often been the case to date.
2. This linear development objective requires that the highway be designed by the broadest kind of multidisciplinary teams. These teams should be headed by a qualified urban designer drawn from any of the several design disciplines. It should include all of these design disciplines (engineering, architecture, landscape design, and planning). It should also include all relevant non-design disciplines such as real estate, economics, sociology, architectural history, acoustical engineering, lighting, and graphic specialties.
3. The multidisciplined design team must be responsible to a decision-making team, including representatives plenipotentiary of all levels of government involved (federal, state, local), of all public programs involved (highways, housing, recreation, education, etc.), and of all private interests involved.
4. In addition to the above two legs of the three-legged development team, there is the general public, which, in a democratic society, must ratify the decisions taken if these are to become reality. Instead of the secrecy which has traditionally surrounded

highway planning, this planning should be conducted in a "fishbowl." At the very least, the alternatives considered by the decision-making teams should be publicized by the news media before a selection is made. At the most, an organized community representative group should be encouraged to participate with the design and decision-making team (see Appendix A).

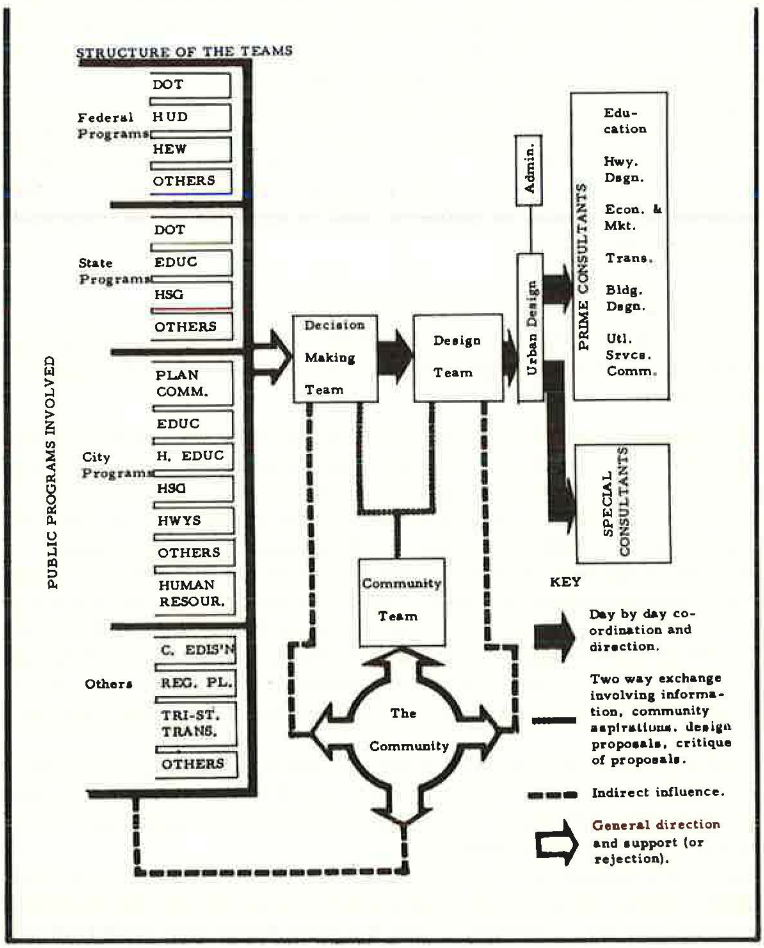
5. The evaluation of all alternatives should be made against the total spectrum of costs and benefits including, but only in proper perspective, the traditional values of first cost and efficiency. Other values must also be included, even though these are not thus far quantifiable, such as considerations of social impact and aesthetic opportunities.

6. The decision-making team must be the source for "pooling" not only decisions but also funds for joint development. A highway dollar and a housing dollar spent separately may only buy half of what these two dollars spent together would buy.

7. Finally, the highway itself should be viewed as potentially a great work of civic architecture, a source of pride and pleasure for those who drive it and those who see it from the outside.

Appendix A

STRUCTURE OF THE TEAMS



Appendix B

URBAN DESIGN POLICY

A paper prepared for presentation to the Senate Subcommittee on Executive Reorganization of the Government

Archibald C. Rogers, Chairman, Committee on Urban Design, American Institute of Architects

Ends are shaped by means and process shapes its product. The end product of the physical design process is our physical environment. Today, this end product is clearly chaos—a chaos developed during our present century, explosively expanded during its three middle decades and promising continued acceleration in the decades ahead.

The process which produces chaos is itself chaotic. Our failure to create an orderly physical environment is due first to the absence of a coordinated series of goals to be accomplished by the design process and second to the absence of a mechanism for depicting such goals.

The failure of the end product of physical environment is clearly recognized. The failure of process is not yet recognized.

FAILURE OF CURRENT PROGRAMS

Expensive environmental programs have been sponsored by government since the thirties ranging from public housing to highway beautification. Each program is aimed at a sore spot in our physical fabric. Most programs are well administered and indeed have created occasional islands of environmental order. (Constitution Plaza and the Washington-Baltimore Parkway are examples.) Yet, the total impact of these corrective programs has thus far been negligible.

Their failure is due to their discreteness and their discreteness is due to the absence of coordinated national goals.

A program having as its aim the provision of new single family housing quickly and at a massive scale may most expediently achieve its purpose at the sacrifice of open space surrounding the city. The creation of a national highway system having as its single purpose the movement of vehicles will, quite properly within the limits of its mission, ignore the goals of other programs. It counters the national purpose of housing the poor by de-housing the poor and the objective of creating new neighborhoods through urban renewal by disrupting such neighborhoods.

The attempt to coordinate these discrete programs through the creation of new departments (HUD and DOT) is a belated recognition of this programmatic defect. Yet, this approach to coordination, while certainly justified, will not of itself correct the basic defect, which is that these programs, even so coordinated, remain product rather than process-oriented.

So long as our environmental programs deal with the physical end product without evolving a coordinating design process, we are unlikely to create a form for our physical environment that will come close to matching in quality the high level of our national aspirations and resources.

ENVIRONMENTAL FORM

Environmental form is the result of the total decision-making process that ends with the "putting in place" of each component of our national physical fabric. Its embryo is found in the very beginning of the process—in goal-setting; in economic feasibility decisions; and in site selection decisions. Its final form is forecast in the words of a program statement and in the dollars of a capital program budget.

When "designing" starts—when the planner, architect or engineer begins his sketches—all that remains is to test alternative design concepts against the previously recorded decisions (generally only one foreordained concept is found to fit) and the minor decisions as to the decor that will clothe this concept. It is no surprise that the design professionals are today regarded as cosmeticians—decorators called in at the last moment to embellish concepts developed prior to their involvement. Nor should it be a surprise that each new product of such process makes its contribution to chaos; that the users of this product often react to it adversely despite the obvious intention of most sponsors to benefit these users; and that the sponsor himself is so often disappointed by the final result of what may have been years of costly effort on his part.

Design is inherent at every stage of the decision-making ladder, whether it is recognized or not. But, if it is not recognized by the decision-makers, if it is left latent until the topmost rung of the ladder is reached, its potential for creative physical synthesis is lost.

DESIGN

Design is the conscious synthesis of each family of alternatives posed for evaluation and decision at each stage of the decision-making process. It is the depiction of the formal image that is inherent in each family of alternative decisions. It is the fitting together of the separate pieces of our physical environment at each stage of decision-making:

1. Relating man-made to natural elements of our environment.
2. Ranging from the microscale of a single building to the broadest scale of a metropolis or region.
3. Coordinating the tangible program requirements, such as functions and costs, with the less visible but more important intangibles—the social and psychological needs of those who will use and experience the final product.
4. Coordinating these requirements not only horizontally as a two-dimensional plan but vertically as a three-dimensional architectural concept from the smallest to the largest scale of development.

Design is finally the creation, through each such concept at any scale, of that enduring architectural art which should properly be the final purpose of each segment of our physical environment.

THE LESSON OF THE PAST

The design process of past ages produced a certain order and beauty as seen in the historic buildings and cities that are our heritage. Our respect for this heritage is reflected in our tourist tradition and in our efforts at historic preservation. And, this respect is as much a condemnation of our contemporary achievements as it is a tribute to the achievements of the past. But, the scale of past undertakings was so much simpler than those of today that the earlier design process is not really applicable to our own circumstances.

In the simpler past, the sponsor was normally an individual—a monarch, magnate, or minister who acted as patron of the art of architecture. The designer was also an individual whether he was titled architect, military engineer, or simply "artist." He conceived and executed for his patron the full range of physical elements—palaces, parks, bridges, boulevards, and cities.[1]

We are faced today with the urgent need to evolve a new design process fitting our complex circumstances as that of the past fitted the simplicity of prior circumstances.

THE CIRCUMSTANCES OF TODAY

Despite the overwhelming complexity of our age, there is concrete evidence that a new design process fitting this complexity can be articulated and can achieve significant results. Two examples illustrate this point. The first example is the utilization of this process in planning for the renewal of downtown Cincinnati in 1963 ("Process for

---

[1]The designer of the excellent plans for Annapolis and Williamsburg was also their sponsor—Sir Francis Nicholson, the colonial governor of Virginia and Maryland.

Action," by Jonathan Barnett, from the May 1966 issue of the Architectural Record, reports on this example). The second example is the organization in 1966 of a concept team to design the Interstate Freeway System in Baltimore City (John Schmidt reports on this example in the January 1967 issue of Baltimore Magazine).

These two examples point the way toward the evolution of a design process that fits the circumstances of our time and that can be applied to every element at every scale in the building and rebuilding of our physical environment. The circumstances that must be satisfied by this process are:

1. The new scales of complexity, geography, and time that typify most of today's projects.
2. The fact that the individual sponsor has now become the exception rather than the rule for such projects. Today's sponsor is generally impersonal—a school board, a government agency, a corporation—and behind this impersonal sponsor, whether private or public, there is the direct or indirect involvement of government through its regulatory function as an anonymous co-sponsor.
3. The fact that the individual designer of such projects has also become the exception. As the complexity of our social and economic organization has increased and as the multiplication of knowledge has accelerated, the singular design profession of the past has spawned its specialties and sub-specialties in order to manage its facet of social organization and of accumulated knowledge.

Given these circumstances, the new design process requires:

1. An articulation of the process to fit the project complexities and the adaptability of the process so articulated to fit the full range of scales and types of projects.
2. A new form of sponsor that will reintroduce the personal commitment of the past into the design process as well as a new concern for, and involvement of, the user in the decision-making process.
3. A new form of designer that will reintegrate today's specialties into a design team or group capable of developing a creative conceptual synthesis.

THE ARTICULATED DESIGN PROCESS

The design process is articulated to match the several levels of decision-making. For clarity, these levels are labeled in accordance with military planning custom. Decisions are customarily rendered by the sponsor upon proposals offered by the designer. Decisions are customarily rendered at an increasing level of detail and decreasing scale of compass:

1. Vertically, starting with basic objectives and ending with detailed design.
2. Horizontally, starting with a broad geographic frame of reference (the environment) and ending with intensive study of the project area itself (the focus).

The sequence of decision-making steps will normally involve the following stages in the design process, stages that presuppose the initial and all important establishment of goals.

Stage I—Reconnaissance

A generalized appraisal by the designer to define the environment and the focus and, within these definitions, to draw their profiles—their salient features and trends both physical and functional. The objectives of the reconnaissance are to distinguish factors that cannot be changed from those that can; to identify, for factors capable of change, those that constitute problems to be corrected and opportunities to be capitalized in the design synthesis; to forecast the near-term and long-term future of these factors; to prepare a coordinated depiction of the environment and its focus; and to conclude with a generalized functional, social and physical program for the focus within the limitations imposed by the resources inherent in the environment.

Decisions by the sponsor at the conclusion of the reconnaissance are essentially judgments as to the validity of the findings submitted by the designer.

Stage II—Strategic Objectives

The designer translates the reconnaissance findings, in their approved form, into a range of attainable alternative objectives. Each alternative objective is technically analyzed to confirm its compatability with the reconnaissance findings. Each alternative found to be compatible is subjected to a comparative evaluation of its costs and benefits.[2] The family of subordinate objectives which relate to each major strategic objective are identified and similarly evaluated.

The designer, in order to give image to the latent physical form, diagrams the design implications of each alternative family of objectives for both the focus and the environment. He compares the relative costs and benefits and recommends as to which alternative is judged technically best from the viewpoint of design implications and the ability to solve the problems and to capitalize the opportunities identified in the reconnaissance.

Decisions by the sponsor at the conclusion of this stage involve his selection of the strategic design objective from among the alternatives posed. This selection may not conform to the technical recommendation of the designer as there are considerations of a nontechnical nature that may override. Moreover, the selected objective may not precisely conform to any of the alternatives but may rather represent a compromise decision. The important thing is that a decision be made to which the sponsor is fully committed; that he clearly understand the design implications of this decision; that it not be changed by the sponsor later in the design process; and that it be completely accepted also by the designer, whether or not it conforms to his technical recommendation and whether or not it involves a compromise.

Stage III—Alternative Strategies

The author prepares sketch diagrams of alternative design concepts covering the geographic area of the frame[3] and the focus. These diagrams are normally two-dimensional where large areas are being studied. Each alternative concept incorporates the program agreed to at the conclusion of the reconnaissance, as amended to fit the strategic objective selected. Each is evaluated as in Stage II to judge its ability to attain the strategic objective selected. A technical recommendation is prepared by the sponsor and decisions rendered as in the case of the strategic objectives.

Stage IV—Alternative Tactics (Design)

The concept selected is developed in the third dimension. The design incorporates the final space and use program detailed on the basis of the Stage III decisions. The design is normally limited to the area of the focus—the development project itself.[4]

The alternatives in this stage are more limited and are posed to the sponsor for decision at check points throughout the evolution of the final three-dimensional design. The costs and benefits of these tactical alternatives are, as in previous stages, presented to the sponsor for guidance in decision-making. During this design stage the sponsor becomes directly involved in architectural design decisions. This involvement must be accepted and encouraged by the designer.

Stage V—Implementation

The sponsor and designer must continue their involvement during this phase. At the smallest scale of focus this may be the preparation of construction documents and construction supervision of a single building over a time period of a few months. At

---

[2]The spectrum of costs and benefits considered is far broader than the customary evaluation of least first cost for greatest functional efficiency. Consideration is given to impact on social systems, area economy, and design opportunities as well as cost and efficiency.

[3]By "frame" is meant the area of the "environment" immediately abutting the "focus."

[4]Note that the focus may be the site of a single building, an entire city set within its region or the region itself.

the larger scale, decades may be required to implement the design. The important point is that implementation is the culmination of the entire design process and it must be carried through to this stage once it is started. If the decision-making process is interrupted, momentum may be lost and the entire design process aborted.[5]

THE NEW SPONSOR

For small-scale design, an individual representing the sponsor is normal. For large-scale projects affecting diverse areas of interest, a team or committee is often required. In any case, the sponsor must be constituted so that he can function effectively within the urban design process as articulated above.

The key attributes of the new sponsor must be:

1. The ability to make decisions when they are posed and to make them well: (a) As a group or an individual he must have sufficient knowledge (or have it available through staff) to act intelligently upon the technical proposals of the designer and to relate these to the original goals established for the process; and (b) He must, at the point of decision, receive the designer's proposals in their totality and be capable of responding totally through his decisions as a synthesizer of all the sponsor's requirements.
2. The power to make binding decisions, regardless of employment or contractural relationships with the designer, as power is the key attribute of the sponsor.
3. The time to devote to the design process and to prompt decision-making.
4. The willingness to participate as an individual (or as a group of individuals) in personal involvement with, and commitment to, the design process.
5. Continuity throughout the process. To change the individual or individuals constituting the sponsor during the design process can be just as damaging as changing the designer.

One form of this new sponsor is Cincinnati's Working Review Committee for its downtown redevelopment—a committee that, by virtue of its membership and staff, has all of the above attributes even though it has no employment or contractural relationship to the designer.

The new sponsor contrasts with the situation as it often exists today—particularly within a public agency but often including private sponsors also. In this situation, the designer may submit his proposals for decision to an agent not vested with decision-making power. His proposals are often reviewed, not by that agent, but by others—committees or bureau employees. The reviewers are normally concerned with separate segments of the proposal with no one responsible for review of the whole.[6] The designer often is not permitted to discuss his proposals directly with those who review them. In the end he receives his decision in the form of a consensus report ratified by the individual in the heirarchy of the sponsor who does have decision-making power but who often has not even seen the proposals upon which he is rendering his decisions.

THE NEW DESIGNER[7]

As in the case of the sponsor, the designer too must reorganize if he is to function effectively within the design process. He is the technical master of this process and

---

[5] This loss of momentum, together with the failure to utilize an articulated design process, may account for the large proportion of design proposals that are never implemented.

[6] The designer in this situation must substitute his design synthesis as a means of coordinating these separate decisions. The equally important synthesis of sponsor's requirements is often lost in this process.

[7] The term designer is used as a comprehensive designation of the professional physical designer—it signifies the architectural and landscape architecture professionals in their entirety since these professions are involved almost completely in the design of elements of the physical environment. It signifies those branches of the engineering profession similarly involved (the civil, structural, and mechanical-electrical engineering disciplines). It signifies finally the physical planner and urban designer in all of the above professions as well as within the body of professional planners.

must be able to administer it and to adapt it to fit the particularities of each project. Regardless of the scale of project the designer today is generally a team. Each team is made up of differing specialties tailored particularly to the requirements of each project. This team may be for a small project no more than an architect, mechanical-electrical engineer and landscape architect. For a large urban design project fifteen or twenty different specialists may be required (traffic engineering, sociology, political science, systems engineers, etc.). The latter case is illustrated in the Concept Team established to design the Baltimore Interstate System.

While such a team of specialists requires a coordinator, it functions best as a co-equal group of peers when developing or testing concepts. It is this group which, in fact, is the designer in the sense that the designer is the generalist who synthesizes all the specialties.

If the chief attribute of the sponsor is power, that of the designer is creative conceptualization and imagination—the ability to forecast the image of decisions. Although each individual member of the team may have an isolated area of expertise, he must be capable of contributing toward this attribute which must be inherent in the team as a whole.

The architect is often best qualified as team coordinator as he is by experience an individual generalist rather than a specialist. Yet, in this role he should not take upon himself the sole responsibility for synthesis, which is rightly the role of the team itself.

A NATIONAL DESIGN POLICY

Given the results of the absence of process—or at least from an incoherence of process—as we see these today in our physical environment; given the initial demonstration that the process proposed above, with its new sponsor and designer, can achieve far better results where offered the chance; given the involvement of government in the public and private decision-making process that shapes our environment today; and given the leadership role inherited by the federal establishment in this governmental influence on decision-making, it is today feasible to consider the adoption of the recommended process as a national design policy.

This process is adaptable to all types of physical design projects and to all scales—including the scale of the nation. By modifying the process and carefully structuring the sponsor's team and the designer's team to fit each situation, it can be applied to the model cities program; to the development of new towns; to public planning programs from the neighborhood to the regional scale; to community renewal programs; to urban renewal and rehabilitation projects; to area economic development activities; and to highway planning. It can and should be applied to the development of individual structures and facilities—to private and public buildings, parks, and systems.

This process holds out the hope of producing order to replace our present chaos, of creating a framework for the art of architecture in place of our present artistic impoverishment. This, as a national goal, is attainable if the process is correctly understood and applied; if the sponsor and designer are concerned with the social realities of the citizenry who must live within the end product; and if the citizenry is involved in the process by making public the decision-making and the image of its design that is today normally withheld from public view. Beyond these conditions is the fundamental precondition that there be developed a set of coordinated national objectives, and strategies to achieve same, as these relate to our physical environment.

The federal government can apply the recommended design process to eatablish these national objectives and strategies. It can adapt the process to its current public programs. It can encourage the use of this process in all areas of activity outside of its direct jurisdiction.

The goal of constructing a national physical environment matching the quality of our national aspirations and resources is clearly attainable. The complexities of programming and planning for this goal are no greater than those faced in our exploration of space or in our successful prosecution of a world war. It has been achieved by less resourceful nations in the past.

The first step toward such a goal is to reintegrate design into the decision-making process and to apply the enlightened process at every scale of endeavor consistently and creatively as we add to and rebuild our national physical fabric.

Project ROMULUS

Introduction

SIEGFRIED M. BREUNING, Massachusetts Institute of Technology

•THIS paper is the result of a team effort in urban design undertaken in an interdisciplinary systems course at MIT. About 30 MIT graduate students from various engineering departments—city planning, architecture, economics, political science and mathematics—collaborated last spring in devising a solution to the problem of how to build at high density while preserving adaptability. The problem statement grew out of a concern that despite our technological achievements in other fields, there appears to be no way of building a mile of road without destruction on a huge scale; and that changes in the social and economic environment are responded to by the physical environment, if at all, only with enormous economic and social cost.

The systems engineering course in which the ROMULUS scheme was developed deals with the design of complex, large-scale systems involving both social and technological issues. The faculty selects the problem to be studied, brings in speakers, and is available as consultant/critic, but the organization of the group into a functional team, assignment of tasks, scheduling of work and creation of solutions are left entirely to the students.

In order to focus the effort on urban adaptability, the faculty required that adaptability be a primary goal and assigned an abstract area of a square mile, which was to contain 100, 000 places of work or residence (a density found in few places as large as a square mile outside of Manhattan). The system developed was to be prototypical, not tailored to a particular site. Halfway through the term the students decided to illustrate and calibrate their system by using a real site. They chose Thompson Island in Boston Harbor as a convenient locale of about the right scale, lack of encumbrance, and proximity. Directing themselves to the design of an adaptable, densely populated city region, the team created a closely integrated city and transportation structure.

The primary characteristics of the interdisciplinary systems approach should be clear in the ambitious definition of how much is subject to design and how little is taken as "given"; in the interdependency of such components of the solution as the intrepreneurial organization proposed and the building system suggested; and in the emphasis upon relatively concrete and explicit demonstrations of feasibility of both the component subsystems and the system as a whole.

Now that the exercise is a year old, we have experienced—as we have in previous years—the crystallization of those parts of the problem that are of lasting value. Some of the following concepts will, we believe, become important constituents for further development of better design for cities:

1. Adaptable and flexible structures with separation of the living module from the megastructure—This can be done economically and attractively. While you may not agree with it at first, it may grow on you as it did on us.
2. Multiple use of surface area—By multiple level construction of transportation and recreational areas we can very effectively increase the utility of the limited surface area available.

Paper sponsored by Department of Urban Transportation Planning.

3. Comprehensive transportation system design—Transportation for this city represents a set of components—both old and new—which give integrated service geared dynamically to the evolving needs of the users.

4. Total view of a city design—There are many new ways to put ideas together, and we believe the total system is worth much more than the sum of its component parts.

5. Acceptance of the new designs—Maybe the boldest concept here is the deliberate attempt to identify and optimize the fundamental wishes of a prospective population, rather than assume that they are fully expressed in the conventional market. We have thus anticipated the growth of more sophisticated tastes, and our design is intended to accommodate that growth. We are creatures of habit and at the same time adventurers for the new. We must combine the proper amounts of each to produce a successful design.

The total team effort has resulted in a relatively detailed report on Project ROMULUS, which is being published as a book by the MIT Press.

Physical Systems

WILLIAM L. VERPLANK, Massachusetts Institute of Technology

THE sites chosen for demonstration—Thompson and Spectacle Islands in Boston Harbor, just six miles from downtown Boston—are shown in Figure 1. There are several important characteristics of this site that make our recommendations fairly general: first, the proximity to the central core of a major city; second, the provisions for high density, based on projections of future city growth; and finally, the waterfront site, a feature common to many large cities.

Figure 2 shows what the city might look like at a future point in time: that point where it serves 100, 000 people. It is connected to the mainland by a bridge and extends out to Spectacle Island. It has spread out into the bay and covers approximately a square mile.

Some of the basic aspects of the city form are evident from the simple outline in Figure 3. It is organized as a linear city, with the main activities and residential densities concentrated along the central spine and transportation artery. The major activity and transportation systems are thus coincident—providing a strong orientation and continuity of form throughout the city and continuity over time as the city grows and expands. The degree of continuity tends to become quite important in an ever more mobile and changing environment. We should emphasize the strong "waterrelatedness" of the city and the contribution this makes to the city character. The central business district opens onto a marina and numerous small canals penetrate the shoreline communities.

We looked in some detail at what might be required for a population of 100, 000 in one square mile. Figure 4 shows a distribution of activities and residential densities. Our projections involve a primarily residential community of 70, 000 residents and 30, 000 jobs.

The CBD commercial area is shown with other commercial areas also being concentrated along the central artery. Next to the central park and marina complex would be a large college (most likely a University of Massachusetts extension). Industrial areas would be in the pierlike structures on the northern shore of the island and in large portions of the lower levels (or underground) of the city (along with warehousing, parking, and utilities). Residential areas would be of varying density, depending upon the closeness to the central artery and proximity to the canals and shoreline.

We also looked at a possible (or most likely) evolution over time (Fig. 5)—starting with a first phase of approximately 10, 000 people on Thompson Island alone (Fig. 6), the eventual extension of Spectacle Island (Fig. 7), and the construction of the marina. The same sort of development was also projected for some of the other islands of Boston Harbor (Fig. 8).

Figure 1. Thompson and Spectacle Islands, Boston Harbor.

Figure 2. Thompson and Spectacle Islands serving 100,000 people.

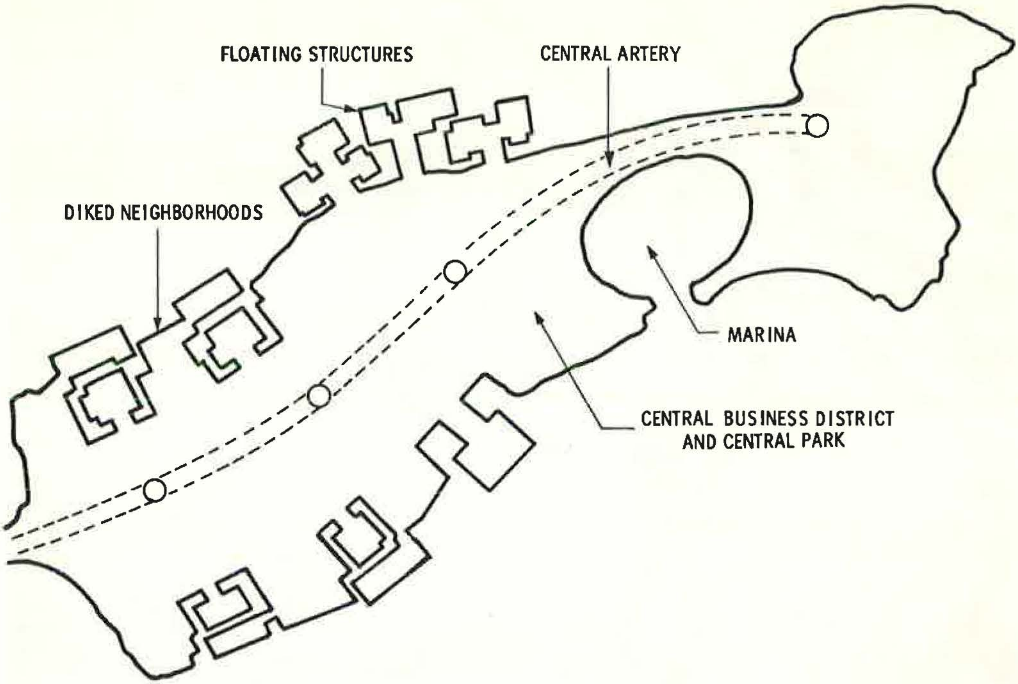


Figure 3. Form of city with activities and residential densities concentrated along central artery.

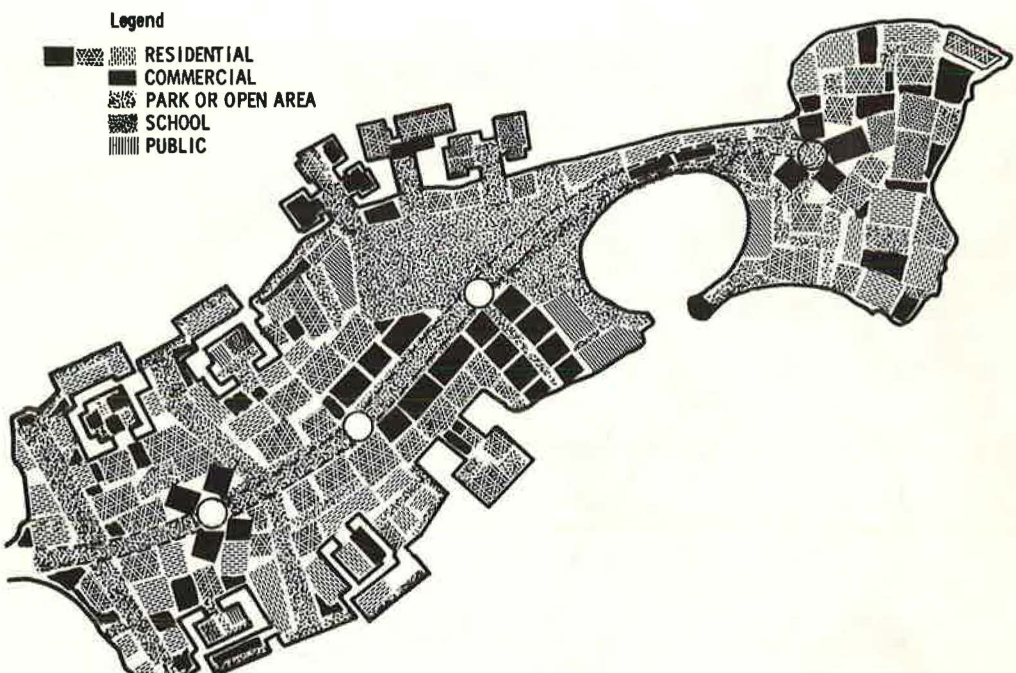


Figure 4. Land-use plan.

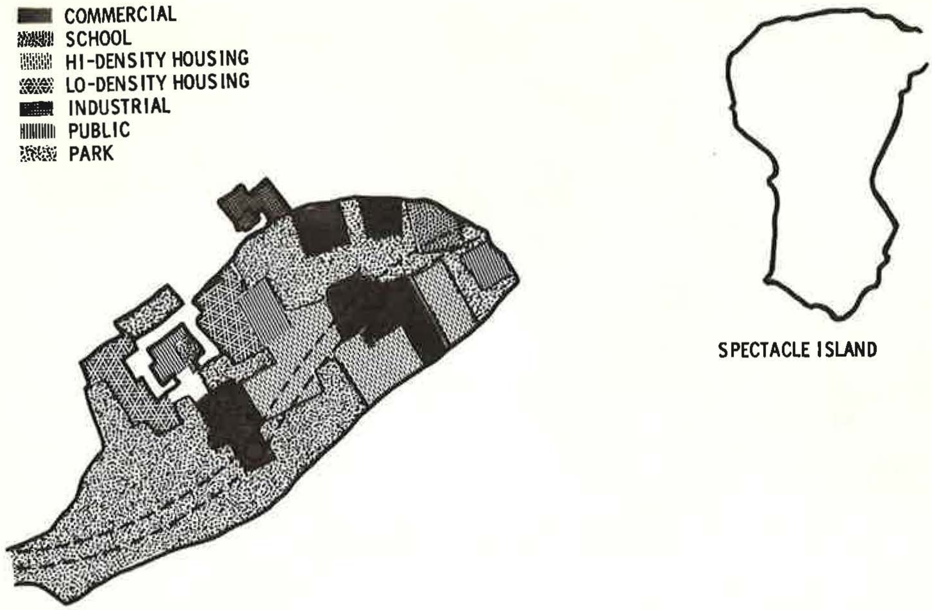


Figure 5. Phase I, 10,000 people ±.

STRUCTURAL SYSTEM

These static, two-dimensional representations are inadequate, for in reality many of the activity areas would overlap in a three-dimensional manner; and, over time, many areas and buildings would serve multiple evolving functions in this mobile environment. An important element in this mobility is the modular construction of appropriate residential and office structures. In the portions of the city where we want this high

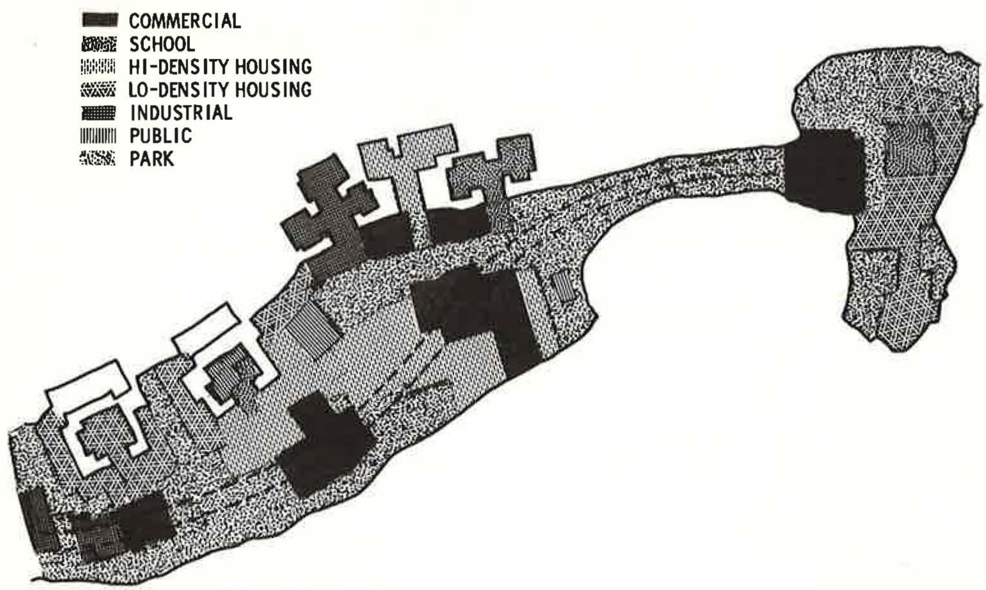


Figure 6. Phase II, 30,000 people ±.

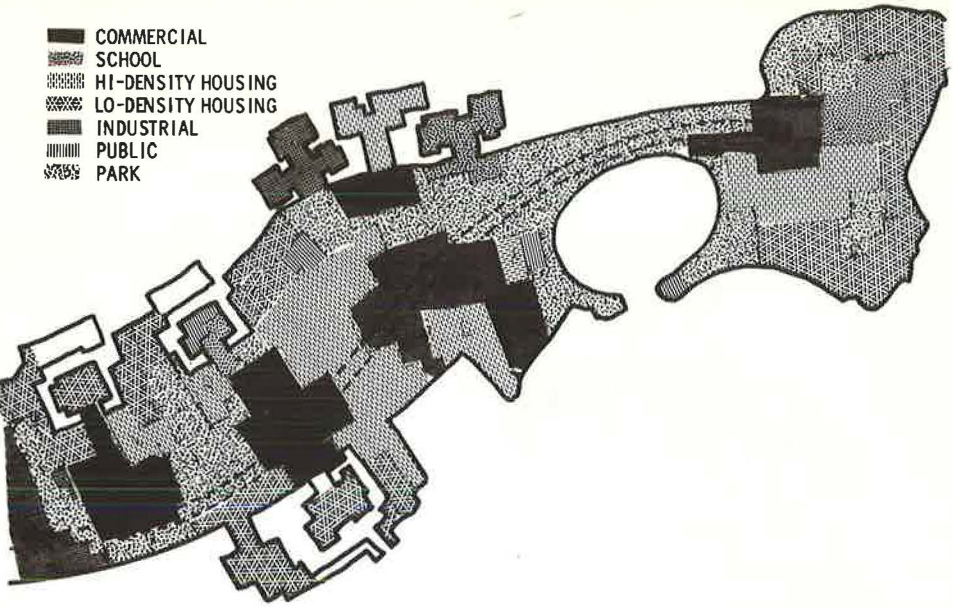


Figure 7. Phase III, 60,000 people ±.

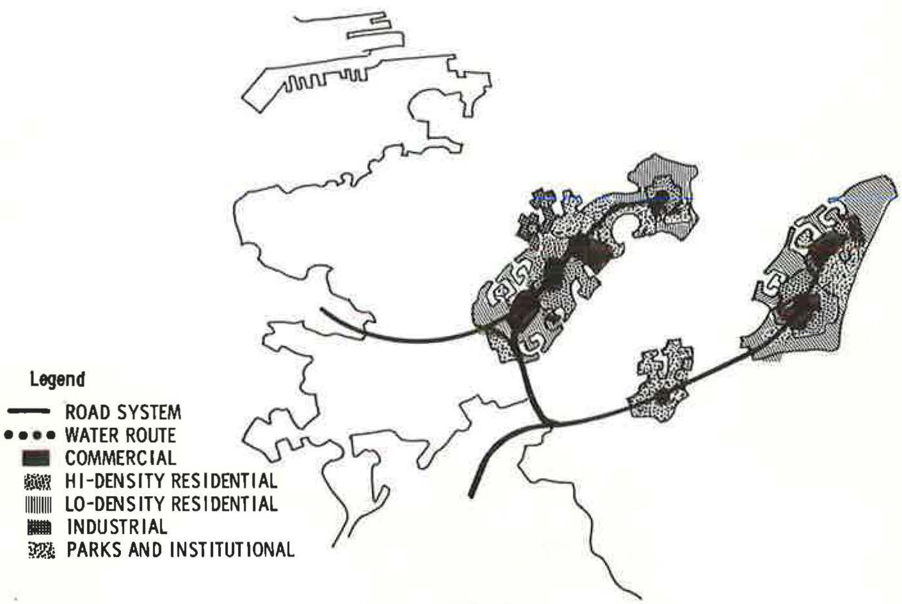


Figure 8. Population growth, upper limit.

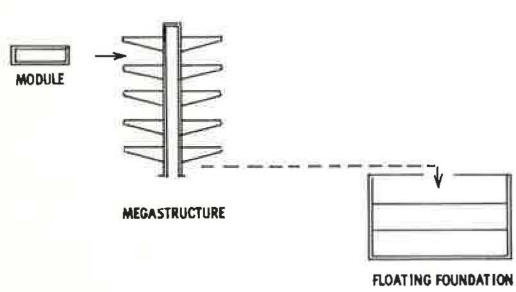


Figure 9. Structural system.

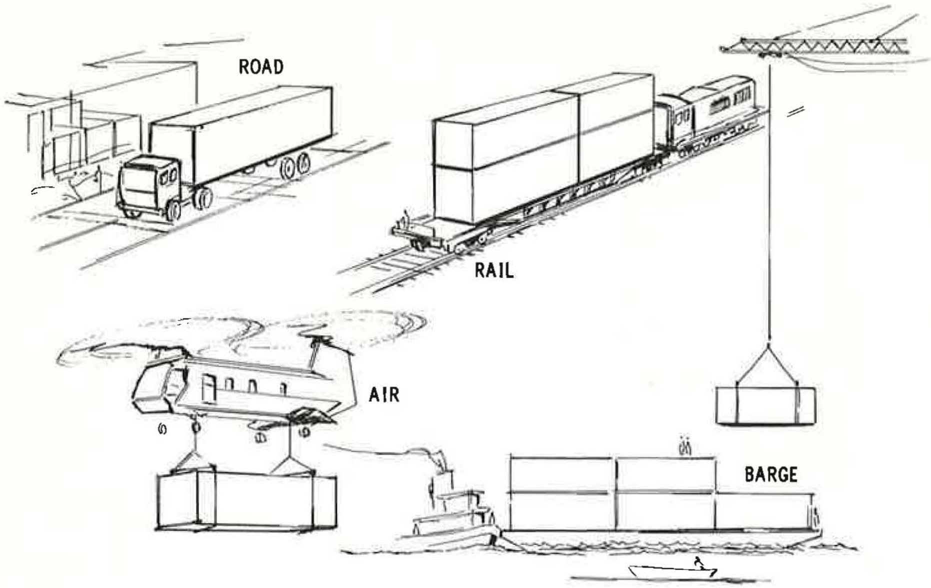


Figure 10. Housing module, transportation.

adaptability, we are proposing this structural system (Fig. 9):

1. A factory-built activity module—an easily transportable, self-contained living or office unit;
2. A megastructure or module tree—consisting of structural frame, utilities, and access; and
3. Floating foundations for the water-based areas of the city to provide the possibilitiy of moving entire buildings.

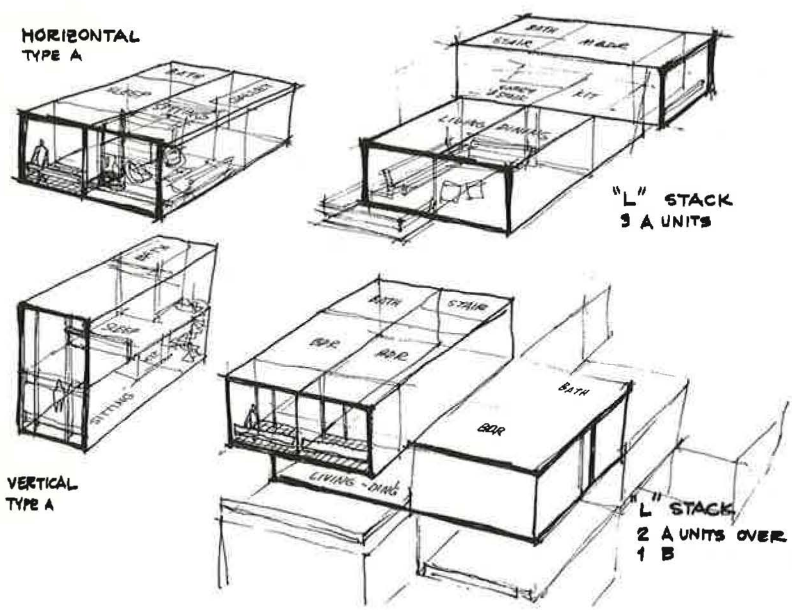


Figure 11. Housing module, combinations.

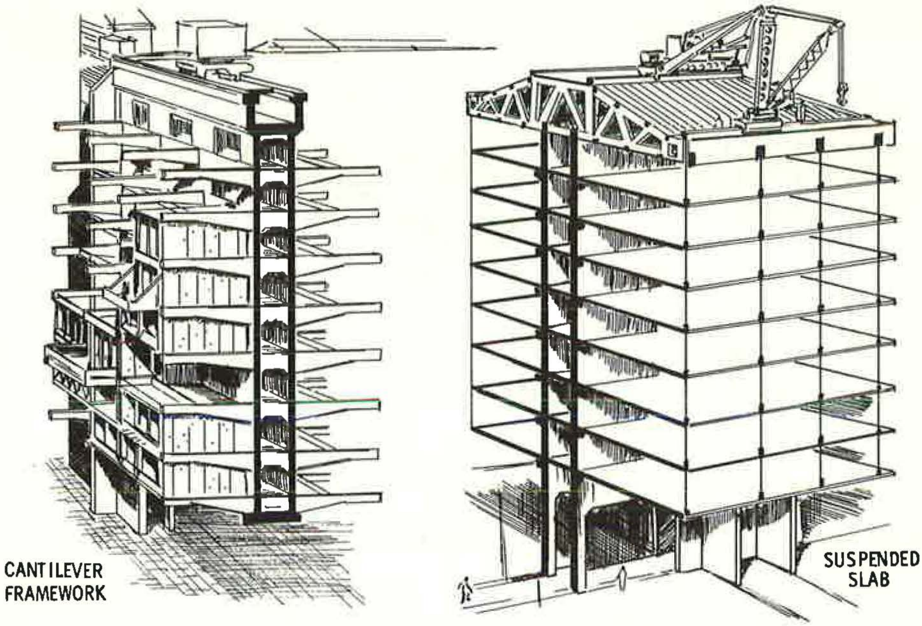


Figure 12. Structural systems.

The living units would be highly portable and could be transported by road, rail or barges, or even by helicopter (Fig. 10). The modulus could be assembled in a number of configurations, allowing quite a bit of flexibility (Fig. 11). The module living unit might become a housing version of the automobile—a mass produced item with the potential for distinctly personalized qualities and identifications. Obsolescence of modules might be both necessary and considerable so that a strong market of high quality secondhand modules might exist just as many good, inexpensive automobiles exist on the secondhand car market.

This system (Fig. 12) of apartment and office modules would be supplemented by appropriately designed large megastructures or module trees that would carry the modules either on platforms or beams. The core of the structure would supply structural support, utilities, and access. Figure 13 shows how a mix of structural systems might be used. The upper part is a module tree for plugging in residential units. The lower part would be offices or a school.

Approximately 20 to 30 percent of our structures would be on moveable floating foundations (Fig. 14). Some would rest on the bottom, others would actually float. Those buildings in the deeper parts of the surrounding water might have large basements used as parking garages and access provided by ramps to the ground-based areas. This floating structure could be moved simply by disconnecting it from the mainland, releasing the cables, and floating the whole thing to its new location. Where there would not be sufficient depth to build out into the sea, we propose dredging and damming large basins.

These next figures show the development of the dredged and diked areas. Dredging operations would open up a channel depth of 10 to 20 feet (Fig. 15); the foundations could be floated into place, forming the canal network (Fig. 16); the superstructure installed; and the dike section constructed so that the enclosed region is now non-tidal (Fig. 17). This birds-eye view of the diked neighborhood shows the possible movement of a floating foundation from the seaward side of the island. A section of the dike would be temporarily floated up and swung out of the way (Fig. 18).

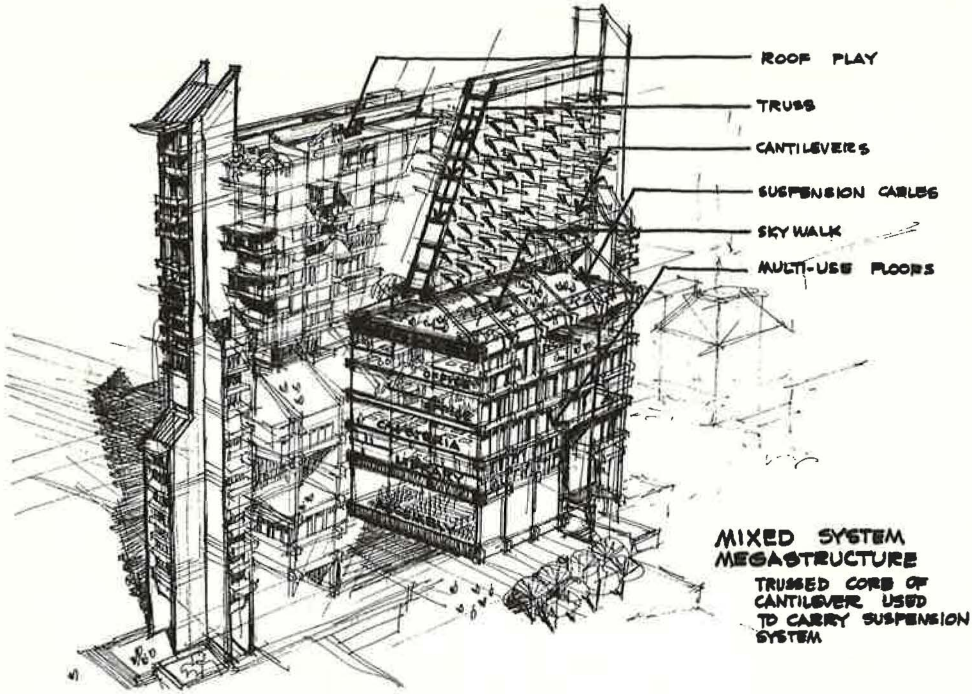


Figure 13. Structural systems.

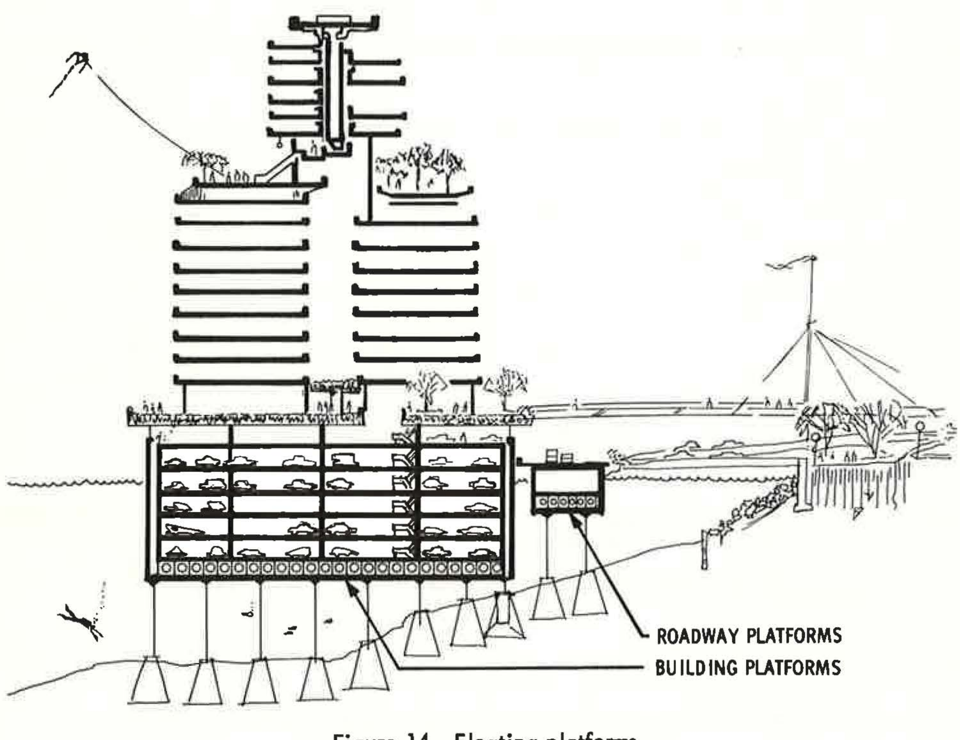


Figure 14. Floating platforms.

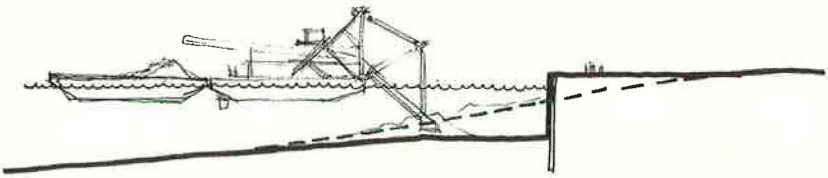


Figure 15. Diked neighborhood, Stage I—preparation.

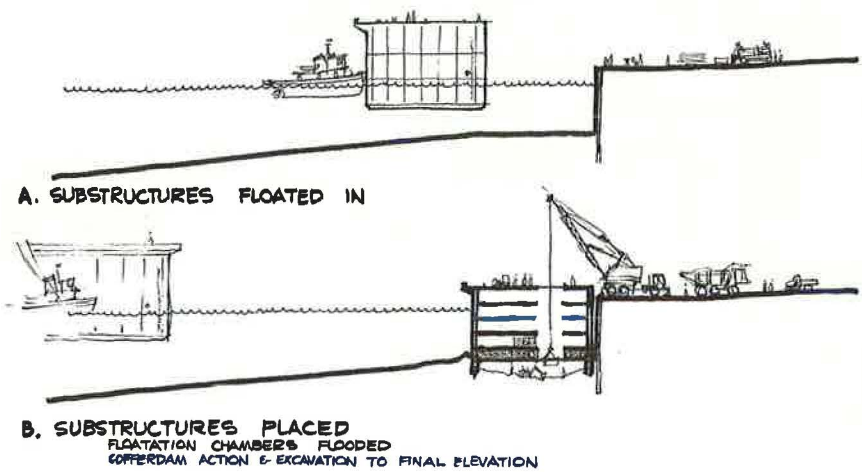


Figure 16. Diked neighborhood, Stage II—substructure placement.

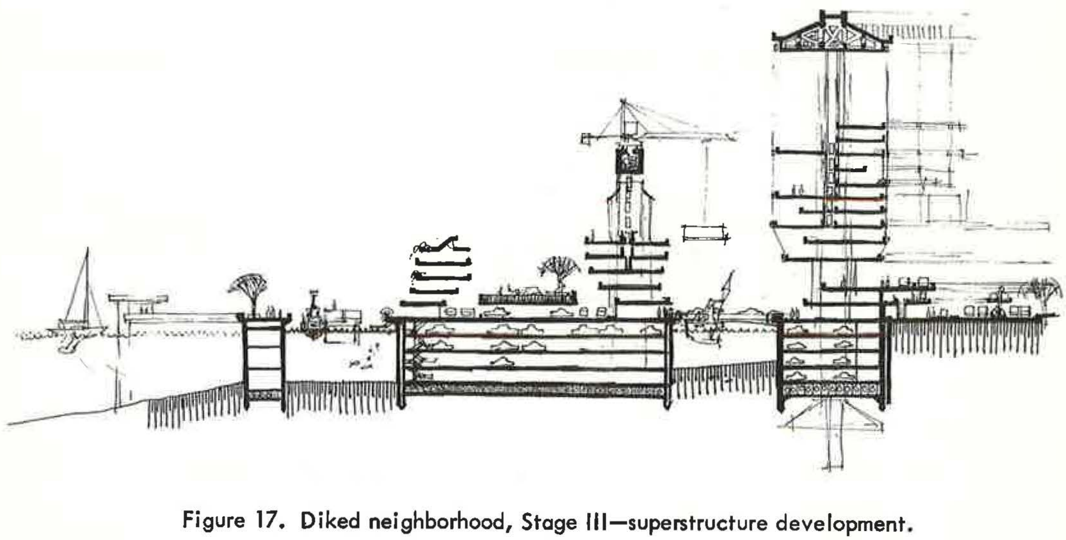


Figure 17. Diked neighborhood, Stage III—superstructure development.

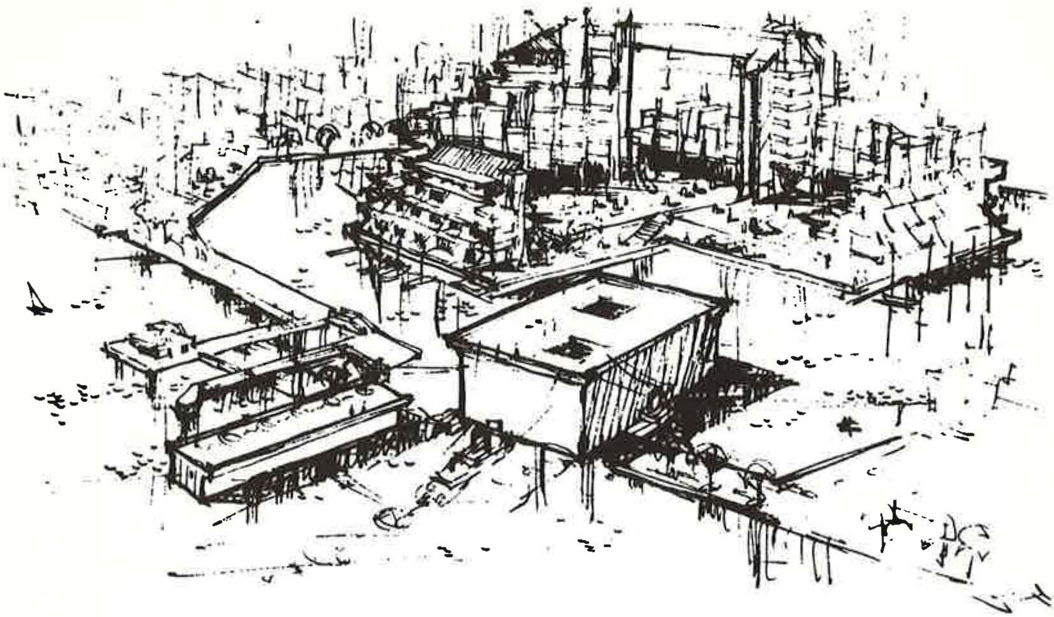


Figure 18. Diked neighborhood, Stage IV—expansion.

TRANSPORTATION SYSTEM

We are not proposing a particularly revolutionary transportation system—perhaps evolutionary would be a better word. We would rely, much as today, on cars, trucks, and buses; the buses would handle all mass transit in bus-only lanes. We envision an evolution to automated roadways, with "dual-mode" vehicles able to be guided automatically on a guideway or manually on conventional roads.

The main features of our road system are the central artery coming from the mainland over a bridge and extending the length of the island (Fig. 19), and distribution loops branching off the artery. These would at first be bus-only lanes and would be the first roads to be automated. There would also be a conventional network of streets for manual distribution (Fig. 20).

How does all this fit together, especially in the highly complex central portion of the island? Figure 21 shows a section through the central artery giving the relationship of artery, distribution loops, pedestrian, and distribution levels. Manual distribution is provided on what we call a "transportation plane." Over the central third of the island, this entire level of the city would be devoted to transportation. It would be covered by a pedestrian mall with stores, parks, and the first floor of apartment and office buildings (Fig. 22). Because one-third of the island is covered in this fashion, the salable land area is increased by an estimated 22 percent.

This region is an important interface between our transportation and building systems. The idea behind the transportation plane is one of functional dependence with structural independence, i. e., distribution routes can be rearranged to meet shifting demands, with relative independence of building locations (Fig. 23). The plane would be penetrated only by structural columns, elevator shafts, and of course ramps for access. Also, temporary parking and storage areas could be allowed.

We are attempting to achieve a certain degree of structural independence of the transportation and building systems, to allow a significantly greater degree of growth and reorganization potential of either transit or buildings alone. We would need to have

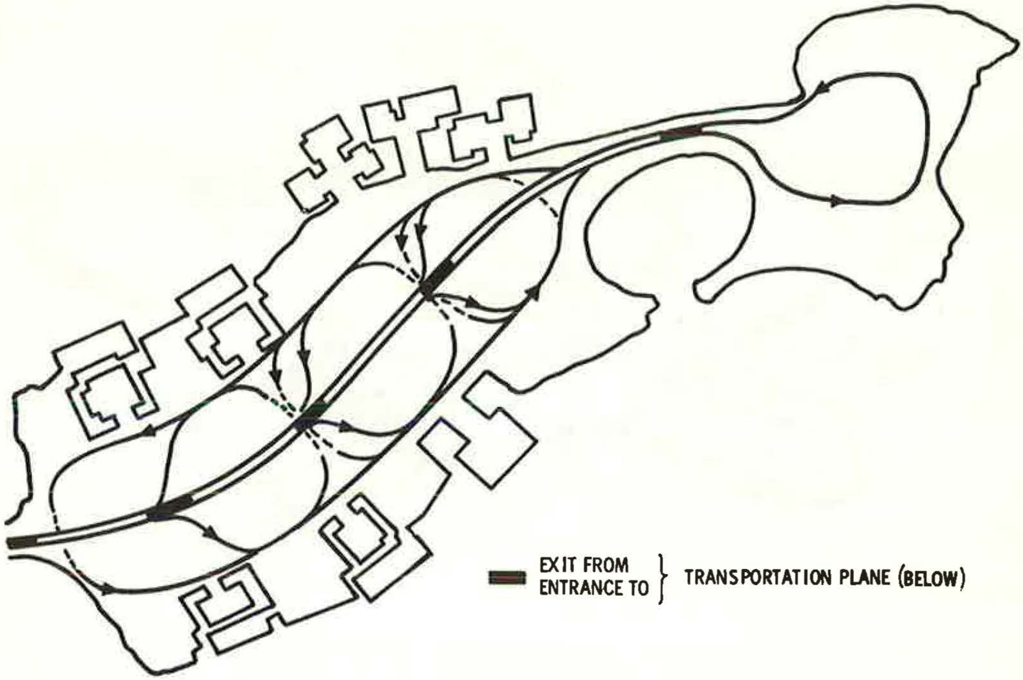


Figure 19. Primary transportation network.

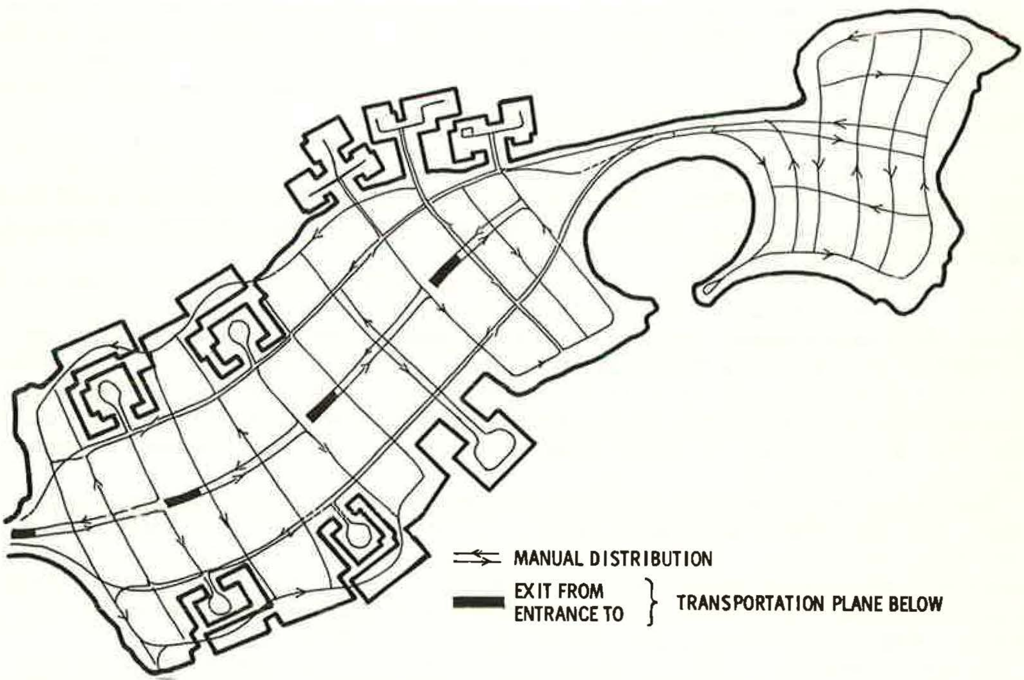


Figure 20. Secondary transportation networks.

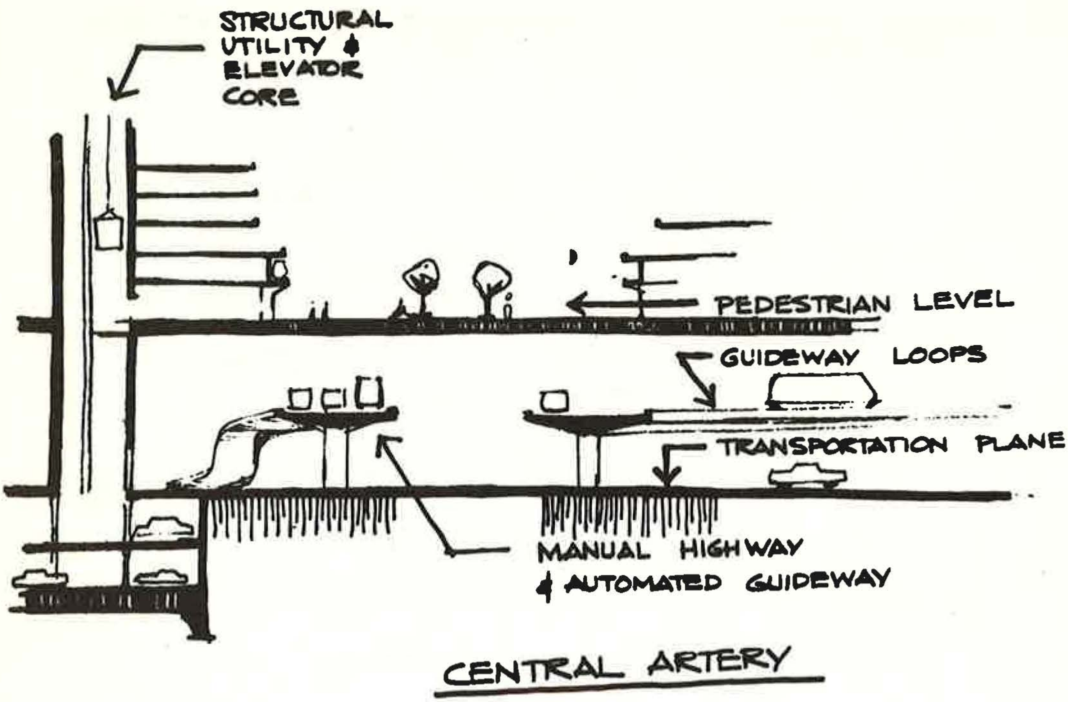


Figure 21. Central artery.

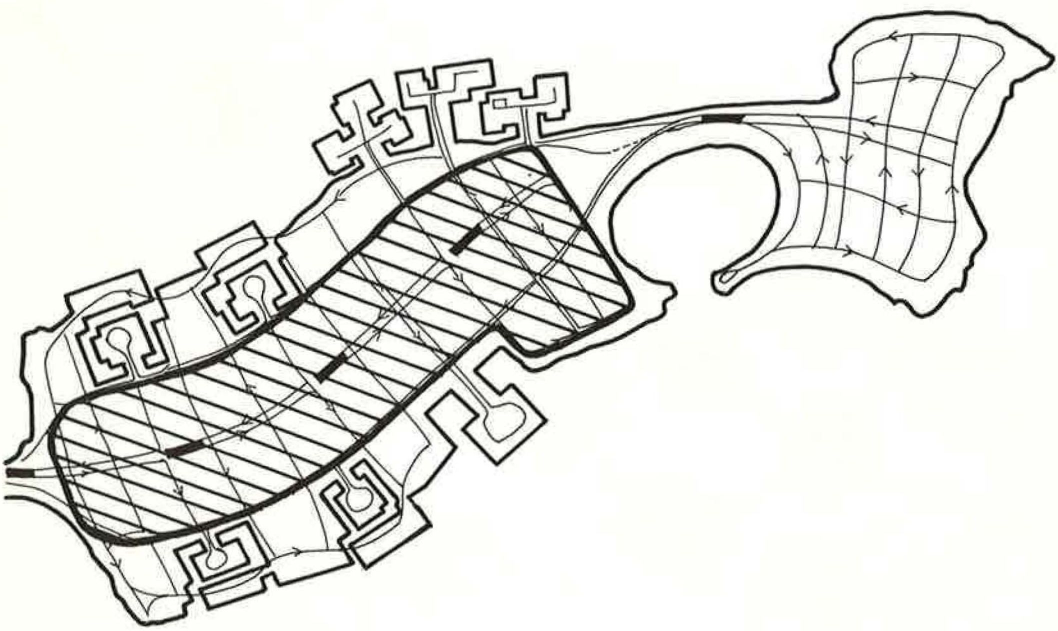


Figure 22. Extent of pedestrian mall.

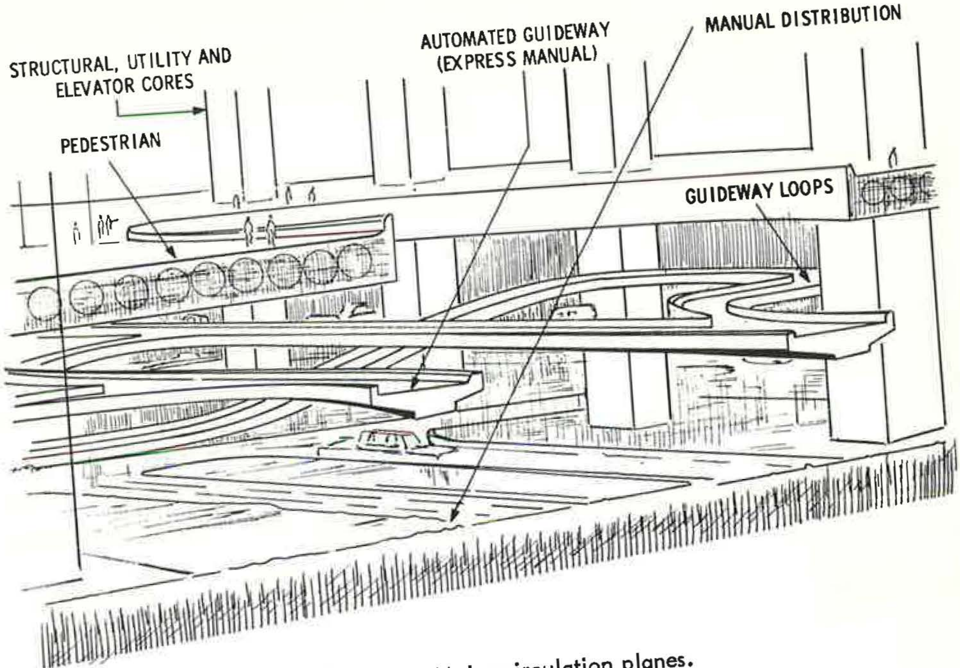


Figure 23. Major circulation planes.

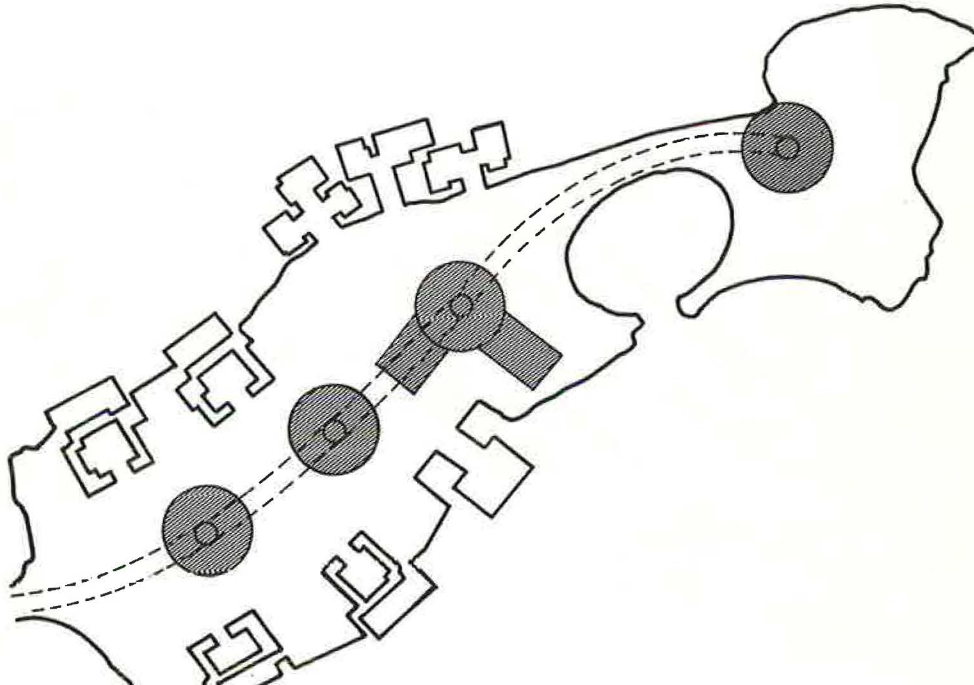


Figure 24. Covered areas.

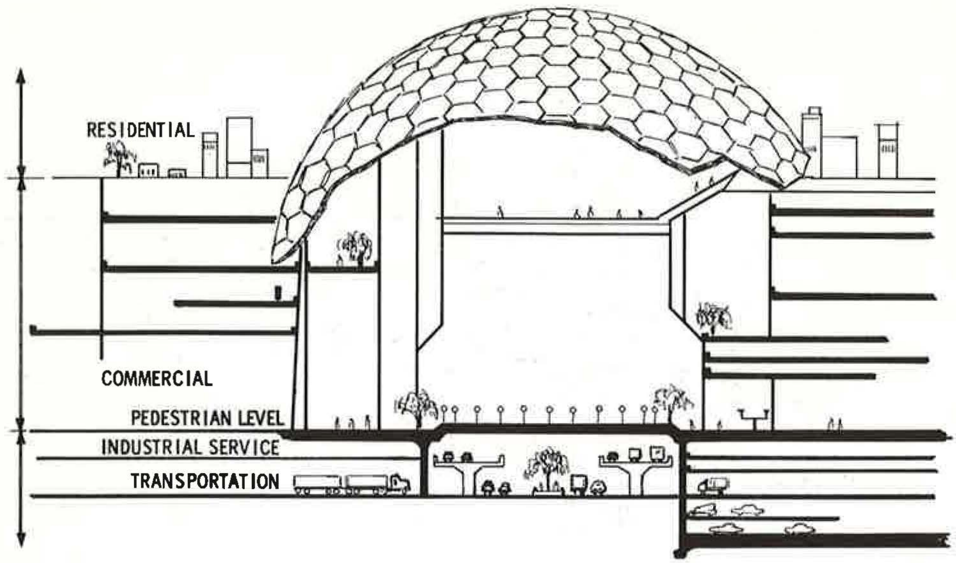


Figure 25. Section through main artery.

channels expandable or relocatable (within the bounds of column location) and allow structures to be rebuilt or extended without choking traffic flow.

The character of the central artery should be such as to allow good access without a major loss of orientation or direction. At the primary node points, about every ½ mile or so, the intersections and bus stations could be highlighted by large openings or

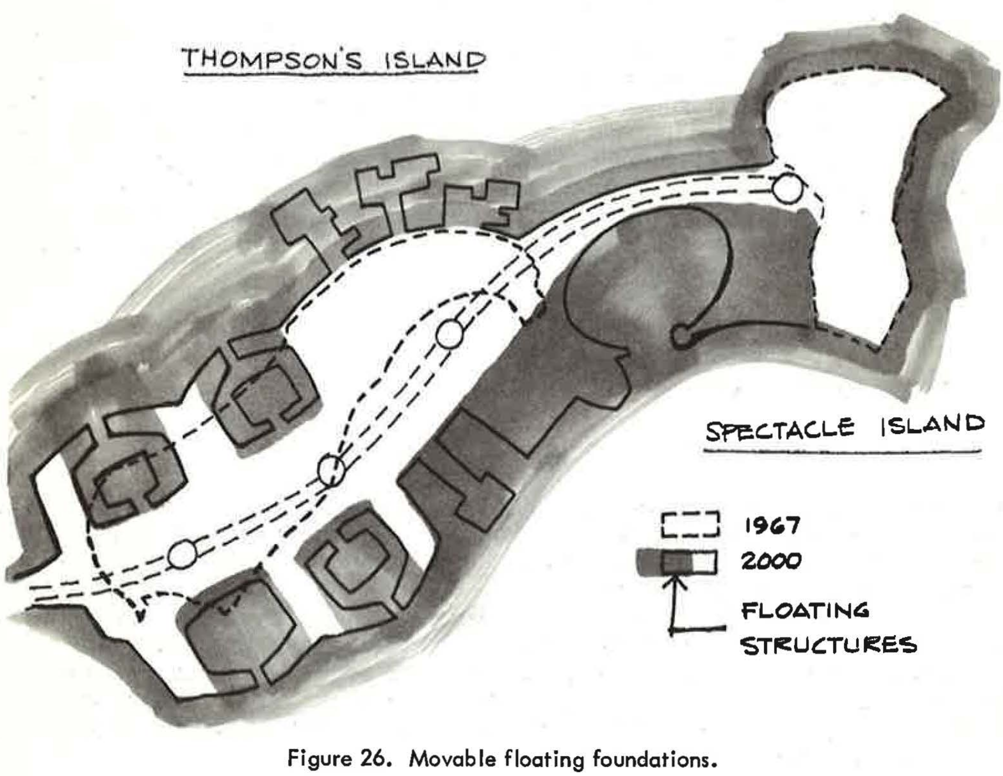


Figure 26. Movable floating foundations.

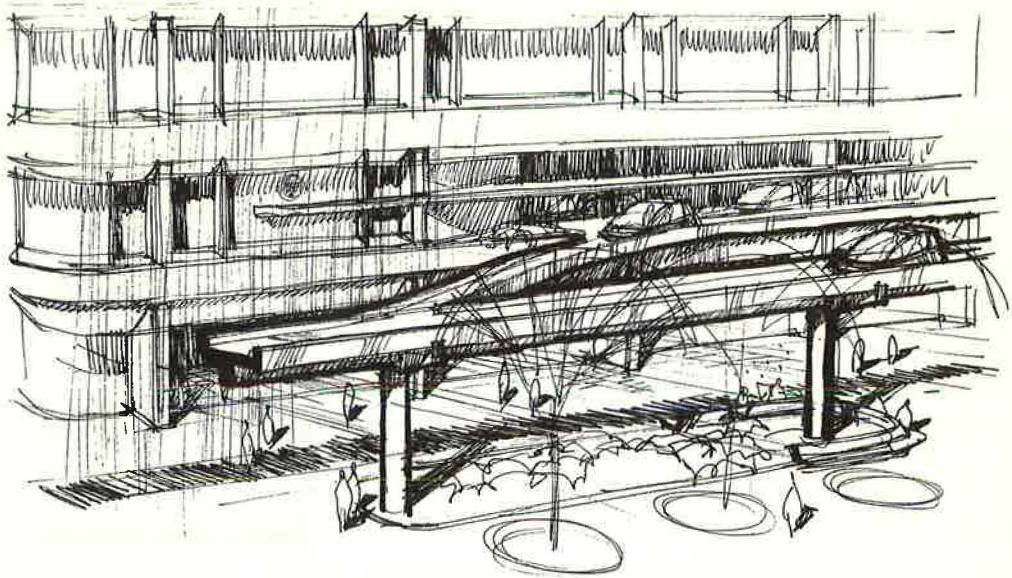


Figure 27. Independent transportation plane.

cut-outs (Fig. 23) in the pedestrian plaza to allow fresh air ventilation, easy access between levels, and visual orientation to the upper plaza level.

We also investigated the possibility of large domed structures in our city, including the suggestion of doming the entire island. However, the analyses that we have made of costs and benefits suggest that only smaller domed regions should be used for special areas. Figure 24 shows the suggested extent of covered areas.

The transportation nodes and plaza openings could be covered for all-weather protection by a dome (Fig. 25), which would also cover major office and residential structures and possibly include some cultural and recreational areas. The internal use of space in the dome is shown as an example of one possible combination of uses. This figure gives an indication of the overlapping and interdependence of urban functions necessary for high density and also a reminder of the necessity for adaptability, which we would hope to provide with modular construction of living and office units, with movable floating foundations (Fig. 26) along the edges of the island, and with an independent transportation plane (Fig. 27) extending beneath the central portions of the city.

Nonphysical Systems

ANTHONY KETTANEH, Massachusetts Institute of Technology

HAVING seen what an island city might look like, and what might be the quality of life within, we now need to examine the needs and possibilities for creating such a city. What advantages can we foresee, for Boston or any other comparable city, in the intensive development for such lands?

One part of the answer lies in the nature and geography of the real estate we are discussing, for these relatively extensive undeveloped lands lie half a dozen miles from the metropolitan center. This proximity, which ultimately makes cities possible, is one compelling reason for considering the integration of the islands into the total metropolitan development. We cannot ignore the economic consequences of population dispersal. According to Senator Ribicoff:

> ...the separating of the people from the jobs—is a major characteristic of American cities. The central city as an economic unit is getting weaker and weaker. More than the middle class moves away. The jobs and factories disappear, too (1).

Another consideration is that these are the types of lands that will be available for development near urban cores. Just before Labor Day, 1967, President Johnson called on the various agencies of the federal government (especially the Defense Department) to cede such lands for use in urban development, initiating the program with a 355-acre grant in Washington, D. C. From the Brooklyn Navy Yard and Ellis Island to perhaps even Alcatraz, there is a wealth of obsolescent facilities that will be ripe for new town developments.

The next question we might ask is whether new towns are the proper answer to the quantitative and qualitative urban demands of the future. Redevelopment has been the one major institutional contribution to this field, and even it falls short in some respects:

1. Because it deals in bits and pieces of existing urban centers, it is hobbled in its potential for innovative technology. Any redevelopment project must revert to the existing technological state—and that is often obsolete—at all links with its unredeveloped surroundings. The opportunity for creating and exploiting a new, fully integrated urban technology simply does not exist.
2. In order to function at all, and with the best intentions for the common good, redevelopment must often displace persons and destroy viable and closely knit neighborhoods. As often as not, the displaced persons cannot be satisfactorily resituated, and the time between destruction of existing structures and occupancy of the new ones is too long to wait.

The development of new areas, i. e., urban development rather than redevelopment, permits the creation of technologically progressive cities while avoiding abrasive dislocations of existing populations. These new areas will also serve as kernels for modernization from which new techniques, if proven successful, can spread to existing metropolitan areas.

Having touched on some of the needs for creating such a city, let us turn now to the possibilities. It is no exaggeration to say that the real foundations of this city are neither concrete nor steel, but, as in all major products, money and policy.

We readily note that men as far apart—geographically and politically—as California's Governor Reagan and New York's Senator Kennedy agree as to the absolute necessity for involving the private sector of the economy in the solution of urban problems.

Sharing that belief, we propose as a fostering institution, an association of private corporations, which, for conveniences' sake, we shall refer to as the Consortium (Fig. 28). It is to be composed of perhaps a dozen members who are willing to provide the risk capital for development, with the expectation of realizing profits and benefits, both jointly and severally, on the venture as a whole.

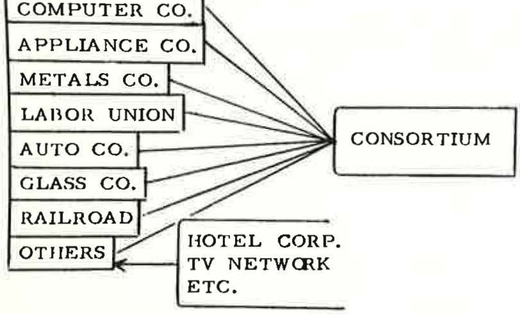


Figure 28. Consortium.

An article (2) points out that the use of interest leverage and tax shields contributes to the possibilities of high returns on investment for such corporate ventures and that there is a further possible "fallout" of profits in sales increases of corporations' products. We share their conviction that there is "... an attractive opportunity for many corporations... to move into the real estate area" and "... take advantage of what promise to be quite profitable investment opportunities." Such activity, albeit on a somewhat smaller financial scale, has precedence, for instance, in Pittsburgh and St. Louis where industry, labor unions, and even individuals have invested jointly in civic redevelopment.

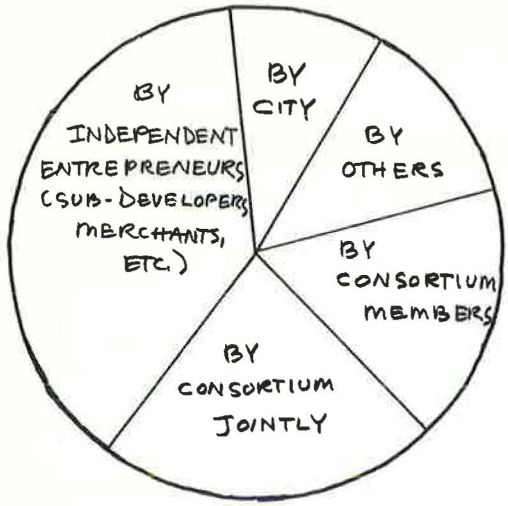


Figure 29. Developmental activities.

The crux of the case for the Consortium is to provide the capital for primary development on a scale sufficient for the project and still well within normal investment size for the corporations. It is not intended, however, that all developmental activities be carried on directly by the Consortium (Fig. 29). The dangers of monopoly and monotony are evident enough, and it seems doubtful whether the Consortium would find it desirable to undertake the totality of such a financial commitment. Rather, it would seem appropriate that the Consortium develop (a) the general site, including land-fill; (b) the arterial facilities and utilities systems, or infrastructure; and (c) especially in the early stages, a certain number of exemplary residential and commercial facilities.

The individual members might well be interested in building corporate or regional headquarters for themselves, and in commercial or residential developments that, besides providing sound real estate investments, would also serve as outlets and showcases for their products. Thus corporations might participate on two levels: as Consortium members and sub-developers. It is to these, then, as well as especially to the independent sub-developers that we look for diversity of design and purpose in providing for the needs of the citizenry. Theirs is the bulk of the developmental effort: residences, offices, wholesale and retail establishments, cinema and amusement. Further, in the later stages of development as the city grows, we can foresee the incrementation and expansion of public facilities to be undertaken by the city. Finally, we may reasonably anticipate the participation of sundry other organizations such as churches and their schools as well as various government agencies. Any or all of these might be expected to apply for such government aid as might be available for their projects.

The financial feasibility of the project depends on the participants' earning an attractive return on their investments. We shall try to briefly demonstrate that this is valid by showing the gross results of our financial analysis.

In general, when we made cost and return comparisons, the time stream of costs and revenues were discounted to a common point in time, using 6 percent interest rate and individually determined service life for each facility.

Applying the unit prices of land (Table 1), the total revenues from sale of land are $110 million. This, together with the municipal bonds, gives a total return on the development corporation's investment in the infrastructure of 8.7 percent. Financial feasibility for developers and individual residents requires that rents of typical residences be competitive. The yearly cost of providing space for a sample apartment of 1000 sq ft in these structures is given in Table 2. The construction cost, with $2000 to cover land acquisition, is estimated at $8000. Amortizing this first cost over 40 years, and including annual taxes, insurance, maintenance

TABLE 1

CONSORTIUM CAN MAKE PROFIT

TOTAL INVESTMENT	$151.6 M	
COVERED BY SALE OF LAND	95.2	
COVERED BY MUNICIPAL BONDS	56.4	
REVENUES FROM SALE OF LAND		
35 ACRES COMMERCIAL @ $20/SQ. FT.		$30.4 M
170 ACRES IND. & PARKING @ $5/SQ. FT.		37.0
330 ACRES RESIDENTIAL @ $3/SQ. FT.		43.1
		$110.5 M
MUNICIPAL BONDS		57.8
		$168.3 M

RETURN ON INVESTMENT 8.7%

TABLE 2

DEVELOPERS CAN MAKE PROFIT

MEGASTRUCTURE FOR 1000 SQ. FT. MODULE	$6000
LAND COST	$2000
AMORTIZATION	$ 150
INTEREST	240
TAXES	280
INSURANCE	80
MAINTENANCE	160
	$ 910
MANAGEMENT	50
VACANCY	90
PROFIT	90
SPACE COST	$1140

TABLE 3

DWELLING UNIT COSTS ARE COMPETITIVE

PURCHASE PRICE OF 1000 SQ. FT. MODULE	$8000
AMORTIZATION	$400
INTEREST	240
TAXES	280
INSURANCE	80
MAINTENANCE	160
SPACE CHARGE	1140
YEARLY RENT	$2380
OR	$200/MONTH

and management, we arrive at an annual space rent of $1140. We demonstrate next that this cost leads to reasonable monthly rents for the proposed apartment developments.

Our best estimate for the module purchase price is $8 per sq ft, or $8000 for the 1000-sq-ft apartment. Note that this is for a "finished" apartment, including kitchen utilities and carpeting; large-scale production should bring this down. An amortization over 20 years for the modules, and accounting for other costs as shown, leads to a monthly rent of 200 dollars. A strong second-hand module market would eventually reduce this figure, too (Table 3).

Our calculations indicate that Boston can benefit from the development financially as well as in other respects, and that the sub-city thus satisfies the next criterion of financial feasibility (Table 4). To determine all real costs of the sub-city operation was clearly intractable in the available time. Our approach was to determine some major costs that we could approximate, namely, the physical facilities cost, and the cost of operating a first-class school system. Then, what was left of the annual tax revenues for other services was found by assembling the value of the taxable real estate for the sub-city and assuming the equalized Boston tax rate to be about what it is today. This could be compared with similar costs for other cities on a per capita basis; for Boston, the sub-city could thus be shown to be a very real asset.

There are elements in our design that we have not included in the cost calculations. Churches and colleges are self-supporting and nontaxable facilities that may bring the total development cost to ¾ billion dollars, but not change the economic feasibility of the design. Module factories, a power plant, and general computer facilities are self-supporting optional facilities that may or may not locate on the island. If so, they may be considered part of the industry previously accounted for.

While we have given a great deal of attention to the initiating mechanisms for development, we should by no means ignore the perpetuating mechanisms. Such a step would include the city's acquisition of the public facilities developed by the Consortium. It is expected that the city would float bonds to pay the Consortium for things like the transportation system—as opposed to just roads—and it is conceivable that the Consortium might agree to buy a a certain number of the bonds (Fig. 30).

With this step, the Consortium's active role virtually ends and the city administration becomes of prime interest. It was originally felt that the

TABLE 4

TAX PAYMENTS EXCEED SERVICE COST

TAXABLE REAL ESTATE:		
RESIDENCES	$294	
OFFICES	37	
COMMERCIAL	30	
INDUSTRY, R&D	45	
PARKING	44	
LAND	110	TOTAL $560

	TOTAL	/CAPITA
YEARLY EXPENDITURES:		
SCHOOLS ($1000/STUD.)	$ 11.2 M	$160
DEBT SERVICE	3.2	46
OTHER SERVICES	19.2	274
YEARLY TAX REVENUES	$33.6 M	$480

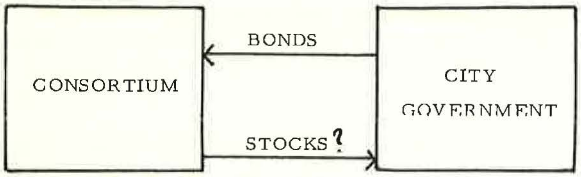


Figure 30. Means of payment for Consortium activities.

creation of a separate city government was the measure best indicated to insure the success of the development, being, as the suburbs have shown, the best way to obtain citizen participation in government and attract the middle classes. Reflection on the disadvantages to overall metropolitan planning of such a separation leads us to suggest instead a measure of administrative autonomy whereby the sub-city will be linked to the larger city at the highest level, i. e., directly under the mayor, and the operational functions of both kept separate. Indeed some of the proposed model cities legislation seems to envisage such an arrangement.

Within the sub-city, government would be by a city council to be elected conventionally. This body would appoint a professional administration to manage the city. Besides the city council, there would be a city commission elected by the citizens, not in their residential capacities (Fig. 31) as doctors, lawyers, union members, consumers, etc. This body would have three principal powers (Fig. 32):

1. To initiate legislation without referendum or petition,
2. To investigate, and
3. To send back legislation for reconsideration and delay its passage for a limited time.

Finally, there are some specific considerations flowing from the nature and elements of our design that we need to consider. We are, after all, aware that our course achievement is not really the generation of new ideas—perhaps there is no such thing as a new idea—rather it is the new environment created by the hopefully judicious juxtaposition of existing ideas, and the simultaneous, parallel consideration and interaction of these ideas toward a single end.

One implication of the new environment is a change in the existing concepts of house owner vis-a-vis apartment dweller. Our apartment dweller is often a house owner, or, at least, a module owner, who rents space in a structure. He may also own both his modules and a share of the structure on a condominium or cooperative basis and, conceivably, he might rent the module. Assuming, however, that module ownership will be the most common case, this mitigates the inequity of federal tax laws that currently discriminate against the apartment dweller. The module owner will be able to deduct the interest portion of his module payment from his income tax.

Another implication for the consumer will be the possibility of dividing his costs between accommodations and location to suit his personal preference; i. e., he may for instance allocate identical resources either to an inexpensive module with a magnificent view, or to a plush module in the back. The static situation where location determines the quality of accommodations loses its force.

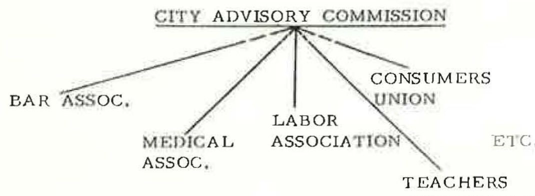


Figure 31. Government administration.

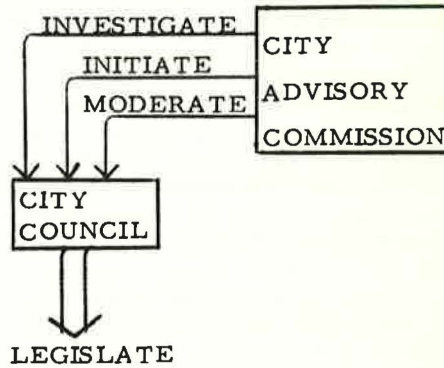


Figure 32. Governmental powers.

All these are really fringe benefits of the far-reaching adaptability systematically built into the city, where a home can grow or shrink or move to suit the family's needs.

Because of the innumerable varieties of human needs and experiences, we built for variety as well as adaptability. We sought endless permutations of life styles to recapture those who have fled the cities. Some will, I think, return: middle classes, responding to comforts, conveniences and security; retired persons, responding to easy travel and module maintenance—a small unit, quiet and peaceful but close to things and not so lonely; young marrieds, both working, grateful for easy commuting and home maintenance and the closeness to the city's fun and excitement. And others we do not even know yet who will find an unprecedented opportunity to mold the urban environment to their particular tastes and wishes. For, above all, we are eclectic. You may choose and change and choose again. Live on a canal this year, under a dome next. We have taken the discomfort out of change and left its fascination.

REFERENCES

1. The Congressional Record, Jan. 23, 1967.
2. Hayes, S. L., III, and Harlan, L. M. Real Estate as a Corporate Investment. Harvard Business Review, p. 144, July-Aug. 1967.