

PROTOTYPE DESIGNS FOR THE USE OF SPACE
AROUND AN EXISTING URBAN EXPRESSWAY IN CHELSEA

by

JOHN ALBERT KIEDAISCH, III

B. Arch., Arizona State University

(1963)

SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE

DEGREE OF MASTER IN

CITY PLANNING

at the

MASSACHUSETTS INSTITUTE OF

TECHNOLOGY

July, 1967

Signature of Author _____
Department of City and Regional Planning
July 21, 1967

Certified by _____
Thesis Supervisor

Accepted by _____
Chairman, Departmental Committee
on Graduate Students

Prototype Designs for the Use of Space Around an Existing
Urban Expressway in Chelsea
John Albert Kiedaisch, III
Submitted to the Department of City and Regional Planning
on July 19, 1967, in partial fulfillment of the
requirement for the degree of Master of City Planning.

The purpose of this thesis was to present design ideas for the use of space immediately around existing urban expressways. This study was prompted by the feeling that the sensuous effects of existing urban expressways were quite often negative and could be considered undesirable. The design proposals were concerned with ameliorating these negative effects, at the same time providing facilities for needed activities and taking advantage of special opportunities offered by the space immediately around the expressway.

A brief investigation of the information available revealed that very little study had been done on the possible effects of existing urban expressways. The only extensive investigation that was found involved noise conditions and their general effects.

Next, sensuous criteria for conditions around existing urban expressways were developed. These criteria dealt with allowable levels of noise, fumes, vibration, artificial and natural light; conditions for flow, visual, and psychological connections or barriers; the aesthetic quality of the visible elements of the expressway; the degree of visual exposure and legibility of the structure and activity of the expressway; utilization of right-of-way space according to the needs and criteria of the surrounding environment; the degree of visual clarity of the flow interconnections between the local environment and the expressway; and the degree of adaptability required of the facilities within the space around the expressway.

In order to test the criteria in a real situation, an existing urban expressway in Chelsea, Massachusetts, a two-mile sector of the Northeast Expressway (I-95), was chosen for analysis. The description and analysis of this sector was then used as a basis for design proposals, under the additional constraint of a limited budget.

In conclusion the author discussed the possible applications of this study and also noted its limitations. The further work that needs to be done was pointed out.

Thesis Supervisor: Kevin Andrew Lynch
Title: Professor of City Planning

Table of Contents:

I.	Introduction	1
II.	Research on the Conditions Around Existing Urban Expressways and their Sensuous Effects on the Adjacent Environment	6
III.	Sensuous Criteria for the Design of Space Around Existing Urban Expressways	15
IV.	Description and Analysis of an Existing Urban Expressway	28
	Illustrations	55
V.	Design Proposals for Use of the Space Around the Expressway Study Sector	84
	Illustrations	110
VI.	Conclusion	122
Appendices:		
	Photographs	124
	City of Chelsea Zoning Ordinances, Sections Five through Ten	139
	Footnotes	144
	Bibliography	149
	Maps	151

Illustrations:

Map IV-1	Regional Expressways	55
Map IV-2	Study Sector	56
	Legend for Maps IV-3 to IV-9	57
Map IV-3	Study Sector, 1"=600'	58
Maps IV-4 to IV-9	Detailed Plans of the Study Sector, 1"=100'	59
Map IV-10	Basic Activities	65
Map IV-11	Daytime Population	66
Map IV-12	Nighttime Population	67
Map IV-13	Flow Intensity	68
Map IV-14	Zoning Districts	69
Figures IV-1 to IV-6	Representative Cross-Sections of Expressway and Adjacent Environment, 1"=20'	70
Diagram IV-1	Activity Changes	75
	IV-2 Undesirable Noise, Fumes, Light	76
	IV-3 Social Interactions	77
	IV-4 Economic Interactions	78
	IV-5 Service Interactions	79
	IV-6 Flow Conditions	80
	IV-7 View Conditions	81
	IV-8 Conceptual Structure	82
	IV-9 Activity Needs	83
Diagram V-1	Acoustical Panels, Typical Cross-Sections and Perspectives	110
Diagram V-2	Earth Berm as Acoustical Barrier, Cross- Sections	111

Diagram V-3	Design Proposals for Everett Avenue Area	112
Diagram V-4	Design Proposals for Fifth Street Area	113
Diagram V-5	Design Proposals for Beacon Street Area	114
Diagram V-6	Design Proposals for Section One: the Naval Hospital-Waterfront Area	115
Diagram V-7	Design Proposals for Carter Playground Area and Adjacent Industrial Area	116
Diagram V-8	Design Proposals for Section Four: the Powder Horn Hill Area	118
Diagram V-9	Design Proposals for Section Six: the Chelsea-Revere Line	119
Diagrams V-10 and V-11	Design Proposals for Section Five: Interchange	120

Chapter I: Introduction

Many presently existing urban expressways have negative effects on their surrounding environments. Expressways, as they cut through highly built-up urban areas, are often the source of disturbing noise and glaring lights; they produce unwanted dark areas both day and night, interrupt important views and flows, create waste space, and are, in many cases, aesthetically unsatisfying. Examples of such effects may be found around the Central Artery and the Northeast Expressway in Boston, the Embarcadero Freeway in San Francisco, the Brooklyn-Queens Expressway in Brooklyn, and the Eisenhower Expressway in Chicago. The above are the obvious examples but they typify conditions which exist to varying degrees in urban areas all across the country.

Very little has been done to ameliorate the negative effects of existing urban expressways. The assumption seems to be that the above are the effects expressways must inevitably have. It is important to understand, however, that such conditions exist largely because of the fact that the expressways were planned and designed to meet only one set of criteria, those concerned with moving large numbers of vehicles "efficiently". Criteria dealing with the effects of urban expressways on their adjacent environment seem rarely to have been included in the planning or design

process. This study takes the position that the conditions associated with existing urban expressways not only can but should be made to meet criteria relevant to the existing adjacent environment.

Such an approach is not concerned with changing the adjacent activity pattern to one which is more "compatible" with the existing urban expressway. Instead, it accepts the existing facilities and activities adjacent to the expressway; any changes in these facilities and activities will have to be based on more comprehensive sets of local, area-wide, or regional conditions and needs. This approach also implies that we are concerned with more than amelioration of the negative effects of existing urban expressways. It means that the characteristics of the expressway must be exploited for all their relevant positive qualities. For example, urban expressways can be useful landmarks and desirable edges to or barriers between districts. Space within their rights-of-way may be used to accommodate activities which are needed in urban areas but are difficult to provide. Such activities might include recreation, vehicle storage, and low-income family housing. Also, the activities provided within the urban expressway right-of-way might form desirable linkages between activities on either side of that right-of-way. These sorts of opportunities for urban expressways have not been widely exploited. Again, this

is true largely because the expressway has been thought of only in terms of moving traffic.

It was not possible within the scope of this study to investigate and propose design alternatives for all the various conditions found around existing urban expressways. It was necessary to limit the study in a relevant way if a level of solution which included alternative design proposals were to be obtained. The decision was made to study the conditions around an expressway located in a predominantly medium to medium-high density residential community near the downtown core of an urban area. Areas like this are often seriously affected by expressways; at the same time, they have needs which might be met through the imaginative use of the space around the expressway. But such communities have in fact not only had significant difficulty in seeing this potential and supporting the imaginative development of it: they have not even been able to overcome the most negative effects of the expressway.

A condition which is no doubt involved in this lack of action and which will continue to be of critical importance is the limited amount of money available to help solve the problems around existing urban expressways. The major part of government and private funds is being and will probably continue to be applied to higher priority problems. One way to deal with this situation

is to propose solutions which have low overall costs. This particular technique will be emphasized in the following study. The most elaborate proposals will be of a type that could be supported by demonstration grants from governmental or private sources. In summary, this report will be concerned with studying possible low-cost design proposals which attempt to deal with the problems and opportunities of the space immediately around an existing expressway in a predominantly medium to medium-high density residential community near the downtown core of an urban area.

In order to develop a realistic set of design criteria, test their workability in an actual situation, and provide a realistic basis for design proposals, it seemed reasonable to study a specific existing urban expressway. Accordingly, a two-mile section of the Northeast Expressway (I-95) located in Chelsea and Revere, Massachusetts, was chosen as a local example of the specific study area conditions described above.

The main body of this report will begin with a brief discussion of documented conditions around existing urban expressways and their effects on the adjacent environment. Then a set of design criteria for desired conditions will be presented. Next, the section of the existing urban expressway chosen for detailed study will be described and analyzed according to the design criteria. Following this, a series of alternative design proposals for the

study sector will be presented. The report will conclude with a summary and evaluation of the contribution of the work done.

Chapter II: Research on the Conditions Around Existing
Urban Expressways and their Sensuous Effects
on the Adjacent Environment

In order to help produce designs which may improve the sensuous environment around urban expressways, it is necessary to consider the conditions which actually exist and their sensuous effect on the surrounding area. The levels and related effects of noise, fumes, vibrations, and artificial and natural light conditions created under various physical and activity configurations must be documented. We must understand the effects of the existing urban expressway on the potential flow, visual, and psychological structures of the surrounding environment. We must be able to judge the aesthetic quality of the expressway and should consider the effects of visual exposure of the expressway structure and activity. Conditions of the interconnections between local and expressway flows and their effects can be studied. And finally, the potential uses of the expressway right-of-way itself should be explored.

Most of the above have not been studied at all. There may be speculation about what effects an existing expressway has on a particular environment, but there are few studies to back up these hypotheses. My research indicates there is a fair amount of study completed and being done on noise conditions and one short report on

the fume conditions around expressways. No studies of the other conditions were found, however. There is obviously a vast body of literature on aesthetics. The ideas considered in this literature can be applied in the aesthetic judgement of the urban expressway.

Some of the conditions themselves are obvious--like the restriction of views or flows--but the possible effects are not so obvious. For instance, how does a restricted flow affect the potential economic or social interactions between activity areas on opposite sides of the expressway? To answer such questions will require more study. We do, however, have the work done on fume and noise levels to refer to in this study. Let us first consider the work on fume levels.

A recent article was found in Traffic Quarterly in which reference was made to an earlier study done about ten years ago in which levels of fumes around expressways in the Los Angeles area were measured. The earlier study indicated that "...so far there seems to have been no relationship suggested between concentrations of vehicles as against carbon monoxide in any given area."¹ But this study was done so long ago in terms of history of traffic flow and in an area where expressways are not closely surrounded by structures, so that it is difficult to consider it as describing the possible conditions of fumes adjacent to an expressway today in a built-up urban

area. It would seem, then, that additional research is needed on the existing fume conditions around urban expressways.

There are some rather specific fume levels which are considered to be maximum. The American Standards Association suggests that carbon monoxide should not be present in more than one part in ten thousand for periods of eight hours or less, or more than four parts in ten thousand for periods of one hour or less.² There is still, however, no indication as to whether or not these levels occur adjacent to urban expressways.

Existing noise levels adjacent to expressways have been more extensively documented. An extensive study was done in London by the Committee on the Problem of Noise.³ A recent study has also been completed in New York, Boston, and Los Angeles.⁴ Acoustical engineers have even constructed a mathematical model which simulates through statistical methods the conditions of free flowing traffic on a multi-lane highway.⁵

The above material reveals the following group of facts: Noise levels around urban expressways depend upon several variables. Noise levels increase as distance to source decreases, as volume and speed of traffic increase, as percentage of trucks increases, percentage of up-grade increases, and roughness of texture of road surface increases. The type and condition of vehicle mufflers and tires also affects the noise level. Finally, the

cross-section of the expressway and its surrounding environment affects the pattern of sound wave dispersal. Although these are obvious relationships, their exact quantitative interdependence requires further documentation.

The most specific information found deals with the variables of distance from source and general cross-section. The combination of data from several similar studies indicates the noise level immediately adjacent to the road surface of an urban expressway with a relatively fast moving, high volume of traffic averages between seventy-five and eighty-five decibels on the A-scale weighting network.⁶

A report on one sample gathered as part of the London noise study indicates the noise levels around an urban expressway elevated about twenty feet vary as follows:

"The average noise level at the edge of the flyover was generally found to be of the order of 76-79 dB(A), and the average of the 15-second peaks 83-88 dB(A). The levels decreased by approximately 3 to 4 decibels at 50 feet from the edge of the flyover and then a further 3 decibels for every additional 50 feet, until at about 200 feet the general background level of 64-68 dB(A), was reached. The peak-levels are reduced slightly more than the average levels, as the former are due to individual vehicles and follow the inverse square law for noise reduction more closely than the average levels which are due to the integration of traffic noise from an extended source....

The results appear to indicate that the noise radiates outwards and upwards

with a sharp decrease in sound levels just below the surface level of the flyover. The points most affected are those level with the surface and up to about 30 feet higher, within 100 feet of the edge."⁷

Another report on observations made along the Ventura Freeway in Los Angeles includes estimated noise levels adjacent to on-grade expressways. At one hundred feet from the middle of the expressway the average level is estimated at about 76 dB(A) and at one hundred fifty feet, around 75 dB(A).⁸ Although no estimates are given for noise levels within one hundred feet of the expressway, by using the inverse square law quoted above, which this Los Angeles study also ascribes to, the noise level immediately adjacent to the road surface works out to be about 80 dB(A). This is not too different from the 76-79 dB(A) noted in the London report.

The report on the Ventura Freeway also made the following statement regarding truck noise, the usual source of "peaks" in noise level:

"Field observation indicates that the truck noise sources that are generally observed in residential areas are those with a muffler in a somewhat deteriorated condition. For prediction purposes it is suggested the the A-scale sound pressure level at 100 feet be taken as 77-82 dB, and that occasional peaks as much as 10 dB higher than this be expected."⁹

This basic figure of 77-82 dB(A) as a peak at one hundred feet from the source is again not too different than the 75-79 dB(A) peaks at one hundred feet observed

in the London study.

Although no reports were available on the noise levels adjacent to below-grade urban expressways, it is possible to make a reasonable guess about these levels based on the information that was available. Noise levels will probably be in the 75-80 dB(A) range immediately adjacent to and above the expressway. A substantial drop in noise level will be noted just back from the edge of the cut out of sight of the traffic flow. With no nearby building to reflect the sound waves back into this "masked" space, noise level drops can be up to 10 or even 20 dB(A). This same 10-20 dB(A) reduction was observed in the Los Angeles studies where residential structures blocked the line of sight between source and receiver.¹⁰

In addition to measuring traffic noise, several studies have considered its effect. Here again the London noise report is the prime source. The Boston-New York-Los Angeles study also includes some information on the effects of noise. In the London study, listings of official complaints to police were checked and a survey of about fourteen hundred people was conducted to find out what disturbed people in the metropolitan area of London. The report makes several remarks about the effects of noise in general. First, measurement of effect involves one's feelings and values--it is not strictly objective. The nuisance of a noise cannot be

determined by its volume alone: it varies according to the "information" it contains, the attitudes and emotions it arouses, and the activity the receiver is taking part in. The London report also noted that "there is a considerable amount of evidence that, as living standards rise, people are less inclined to tolerate noise."¹¹

The London survey indicated that people were most disturbed by noise when at home, next when outdoors, and finally when at work (other than work at home). Traffic was by far the most annoying source of noise at home and outdoors. Industrial and construction noises were slightly more annoying than traffic noise when people were at work away from home. It was also noted that "whether people live in noisy or in quiet places does not affect the proportion of them who are seriously disturbed [by traffic noise]."¹² The Boston-New York-Los Angeles report also noted that traffic noise was considered the most annoying except for low-income people for whom neighbors' and children's noise were slightly more bothersome.¹³

The London report also indicated that noise was found to prevent sleep, induce stress, interfere with verbal communication, disturb concentration, and perhaps reduce efficiency and the sense of personal safety.¹⁴ These are not unexpected effects but they are rather generally stated. More specific statements are needed as to the type and level of noise that is crucial for

each effect. The London study does include some rather tentative estimates of crucial noise levels for the following activities and facilities:

1. Bedroom in urban areas, 50 dB(A) by day, 35 dB(A) at night;
2. Livingroom in urban areas, 50 dB(A) by day, 35 dB(A) at night;
3. Conversation is interrupted at 55 dB(A); and
4. Neighbors' noise is disturbing at 30 or 35 dB(A).¹⁴

This is a very limited list but it is not unreasonable that the report make recommendations most concerned with noise levels around residential areas, since these were the areas where noise was found to be most disturbing.

This completes our discussion of existing noise levels around urban expressways. As can be seen from this brief summary, additional study of these noise conditions and particularly of maximum noise levels for various activities would be useful. For the time being, a level equal to that of the normal "background" noise of a given activity can probably be considered to be the allowable level of intruding noise.

The only other characteristic of urban expressways beside fume and noise levels about which we have information is aesthetic quality. This is such a vast and complex subject that we shall not attempt to discuss it here. We shall merely indicate that aesthetic judgements may just as well be brought against urban

expressways as against any building. In many respects, the standards for both are similar. The emphasis here is on the idea of applying aesthetic standards to expressways, not on what those standards might be.

This completes our consideration of the research that is available concerning conditions around existing urban expressways and their sensuous effects on the adjacent environment. The next step is to consider what conditions should exist around an urban expressway. The desirable conditions will be expressed as a set of sensuous criteria which can be applied to an existing expressway.

Chapter III: Sensuous Criteria for the Design of Space Around Existing Urban Expressways

In the preceding chapter we considered briefly the research that has been done concerning existing conditions around urban expressways. The main purpose of this section is to propose sensuous criteria for the desired conditions along these existing expressways. In addition, methods for evaluating the environment according to each criterion will be discussed.

It will be noted that there are varying degrees of precision among the criteria. The differences occur for two basic reasons. First, as noted in the preceding chapter, there are differing amounts of research and empirical knowledge available in relation to the conditions associated with each criterion. For instance, there seems to be much more information available on the causes and effects of the noise levels adjacent to urban expressways than there is on the causes and effects of the relative visual dominance of urban expressways. It is obvious that the more detailed and comprehensive the cause and effect information is, the more precise the statement of criterion can be.

Secondly, the conditions associated with the sensuous criteria vary in terms of their objective and subjective natures. As an example, it can be seen that the conditions and effects of flow linkages or barriers will always be more objective than will the

conditions and effects of the aesthetic quality of the urban expressway. Again, the more objective the cause and effect information is, the more precise the sensuous criterion statement can be.

The following, then, are the criteria I have developed:

1. Noise levels resulting from urban expressway traffic shall be:
 - a. less than 30 dB(A) whenever people are participating in activities which involve complete relaxation and/or concentration (sleeping, recuperating, studying, reading, meditating, etc.) or involve rather high standards of technical or aesthetic sound production, reproduction, and/or reception (dramatic, operatic, and symphonic performances, radio and TV broadcasting, etc.);
 - b. less than 55 dB(A) whenever people are participating in activities which involve verbal communication and/or intermittent or mild relaxation and/or concentration (listening to conversation, a lecture, radio, TV; doing household work, office work, etc.);
 - c. less than 70 dB(A) whenever people are participating in activities which do not

involve extensive verbal communication, relaxation, or concentration (recreating, shopping, doing indelicate assembly or repair work, etc.);

- d. may be greater than 70 dB(A) whenever people seldom participate in an activity (vehicle, goods, bulk storage, warehousing, etc.) or whenever the normal "background" sound of an activity is above 70 dB(A) (sheet metal work, bottling, iron smelting, etc.).

These conditions are relatively easy to test using sound level measuring equipment. Although more research seems to be needed, it is quite possible to establish objectively the specific ranges of allowable noise levels for different activities.

2. Vehicular exhaust fumes and odors shall not be humanly detectable. At no time shall carbon monoxide exceed one part in ten thousand for periods of eight hours or less, or four parts in ten thousand for periods of one hour or less.²

As was true of the noise conditions, fume levels are relatively easy to measure with presently available equipment and techniques. Human surveillance can also be used to check for simple undesirable fume and odor levels. More extensive interviews might be conducted to determine public reactions and attitudes

toward certain fume and odor conditions. Physiological research would also contribute valuable data.

3. Vibration levels resulting from urban expressway traffic shall be:
 - a. nondetectable with instruments whenever delicate equipment is being used (astronomic and seismographic measurements, etc.);
 - b. humanly nondetectable whenever people are participating in activities which involve complete relaxation and/or concentration (sleeping, recuperating, studying, meditating, etc.) or which involve detailed assembly or repair work (watchmaking, electronic equipment assembly and testing, surgery, etc.).

Although this criterion is stated in very general terms, it is possible to accurately measure vibration levels using technical equipment. The more obvious conditions of vibration can of course be detected by the human senses and judged on a simple acceptance or nonacceptance basis. What is needed ultimately is a more accurate knowledge of what vibration levels are critical for various activities.

4. Artificial light penetrating from an urban expressway into an adjacent activity area shall not exceed the normal operational light level of that activity, unless the activity

involves very few people (vehicle, goods, or bulk storing, etc.) or the area is unoccupied. Avoid low light intensities which prevent clear vision in the space within and around urban expressways if this space is frequently used by people.

In general, the intensity of artificial light is quite easy to measure, while the determination of the effect of various intensities will require more complicated techniques. The task of determining the effect of light quality, something not included in the above criterion, will be even more difficult.

Additional information is required in order to at least associate general activity types with desirable levels of lumens. This information might be obtained by studying the behavior and attitudes present under different levels of light intensity for all relevant activities. This of course would be a lengthy process and made more difficult by the problems of controlling multiple variables. Testing for effects of quality of light, a vague term as it is, could proceed on the same general lines as those described above.

Another alternative to making the criterion more explicit, and this technique really applies to all the criteria, is to rely on experienced personnel, such as lighting engineers, theatrical lighting specialists, and urban designers to create the desired effects.

But these experts too need the findings of additional research to improve the effectiveness of their work.

5. Increase the amount of direct and indirect sunlight in all areas frequently occupied by people except whenever the average temperature exceeds eighty-five to ninety-five degrees Fahrenheit.

Rather simple, direct human observations of calculations can be used to establish the amount of direct sunlight which is received by activity areas within and adjacent to an existing urban expressway. Continued observation of behavior and attitudes associated with these varying conditions of sunlight for various activities will have to be used to establish more accurately the most desirable type, amount, and timing of natural light intensities.

6. Maintain or replace and improve the flow, visual, and psychological connections which would exist in the environment if the Expressway were not present. Likewise, maintain and improve the breaks that would exist in the flow, visual, and psychological structure of the environment if the Expressway did not exist.

An analysis of the flow, visual, and psychological conditions which exist in the presence of the Expressway is only one, and not the first, of the

steps required by this criterion. As the criterion itself states, it is necessary to consider the flow, visual, and psychological conditions which would exist without the Expressway.

Flow conditions without the Expressway may be determined by studying those characteristics which structure flow--social, economic, and service interdependencies. Social interdependencies may be described by noting friendship,³ extended family, and organization membership patterns. Economic interdependence is expressed by transferring supplier-consumer and employer-employee relationships into a spatial pattern based on the locations of the different activities. Finally, service structure may be determined by noting the location and size of the "source area" for various public facilities such as schools, playgrounds, libraries, public transportation, etc. All of these characteristics, then, would define the possible flow conditions.

The visual structure which would exist without the Expressway may be determined by both field survey and diagrammatic analysis of plans and cross-sections of the facilities around the Expressway right-of-way.

The possible psychological structure which would exist without the Expressway would be more difficult to determine. To do so requires the construction by a person who has knowledge of how psychological images

are formed of one or several "conceptual maps" of the environment. The maps would be based on information about the potential functional and visual structure of the environment as formulated by its users.

With the description completed of flow, visual, and psychological structures which might exist if the Expressway were not present, it is possible to consider the structures which actually do exist in the presence of the Expressway. A comparison of the two, then, will make it possible to determine where the linkage criterion is or is not met.

7. Improve the aesthetic quality of the visible elements of the urban expressway (lights, signs, handrails, supporting structures, retaining walls, pavement, etc.).

Obviously, the conditions associated with this criterion are not objective in nature. Aesthetics is a matter of intellectual and emotional attitudes and is ultimately an individual decision. Nonetheless, it is possible to indicate general characteristics which are important in judging aesthetic quality. Some of these characteristics are appropriateness, coherence, completeness, articulation, efficiency, sensuous pleasure. It seems reasonable to assume that a designer is most capable of deciding how this criterion may best be met and whether it has in fact been met in an existing expressway.

8. Increase the visual exposure and legibility of the overall structure of the urban expressway and the activity on it.

Field observations, "image" surveys, and interviews may be used to explore the existing conditions of visual exposure and legibility of an expressway. The location and expanse of view of the overall structure and activity are relatively easy to document through field studies and diagrammatic analysis of plans, elevations, and cross-sections of the existing environment. Models and drawings of proposed changes may be studied in a similar way to determine the possible visible exposure and legibility.

9. Increase the use of the space within the existing urban expressway right-of-way appropriate to the criteria and needs of the adjacent environment and to the relevant needs of other parts of the urban environment (city, sector, or region-wide needs in recreation, housing, and educational facilities, etc.).

In order to meet this criterion, it is necessary to describe both the activity potential of the expressway right-of-way and the activity needs of the surrounding environment. The "activity potential" may be determined by design exploration. "Activity needs" may be made explicit through additional analysis

of the conditions adjacent to an existing urban expressway, e.g., flow, visual, and psychological structure, adequacy of local, city, sector, and regional activities and facilities. By comparing the activity potential of the expressway right-of-way and the activity needs of the surrounding environment, it will be possible to map what may be called "maximum opportunity areas", i.e., areas where the proper site conditions exist or potentially exist for an activity of high priority need.

Additional mapping could indicate areas where proper site conditions exist for an activity of low priority need or where proper conditions exist for presently unneeded activities. Costs of converting sites to proper conditions for various needed activities must then be determined. Also included in this analysis would be priority listings of the conditions required for various activities so that sites with only some of the proper conditions may be rated.

Finally, continued survey and analysis of the surrounding environment activity and facility adequacy will be necessary to maintain the maximum positive use of the space within the right-of-way of the existing urban expressway.

10. Increase the visual clarity of the flow interconnections which exist between the

local environment and the urban expressway.

Field survey must be used to determine the existing clarity of flow interconnections. This would include observing the amount of effort required by drivers to properly locate and use these interconnections. "Effort" may be measured by the amount of time, confusion, maneuvering, etc. involved in this process. New designs may be studied for similar conditions. One would use plans, sections, perspectives, models, and movies which show proposed flow interconnections and the proposed approaches to them.

11. Within the constraints of the other criteria listed herein, maximize the physical adaptability of the facilities supporting the activities and functions of the existing urban expressway and its adjacent environment. This is to be done in order that minimum effort be required to meet changes in criteria and/or needs which might be brought about by the change in any facility, activity, or function of the expressway or its adjacent environment.

This criterion obviously refers to new proposals which might be made for facilities within and around

the existing expressway right-of-way. In assessing the type and amount of adaptability that might be required in these new facilities, it would be desirable to determine the possible future activities in both the expressway and the surrounding environment. This, however, is difficult and sometimes impossible to do. It may even be unnecessary in cases where the proposed new facility is designed to be highly adaptable to new requirements. It is probably best to utilize such flexible facilities in any area where future activities are hard to determine.

If the possible future activities, their probability of occurrence, and their location in time can be determined, it will then be possible to state in general terms the resulting needs and criteria. The new facility can then be designed with these future needs and criteria as some of its constraints. It would also be possible to judge any proposed design to determine how much effort (in time, money, manpower, skill, etc.) would be required to adapt it in varying degrees to the possible future needs and criteria.

These, then, are the sensuous criteria for the external characteristics of existing urban expressways. But they are not the only criteria which may influence the use of the space within and around existing urban expressways. Every local government will require certain construction, zoning, health, fire, and other standards

or codes which must be met. In addition, restrictions may be imposed by the particular department having responsibility for the expressway and its right-of-way. The federal government can also require certain standards which must be met when it is involved in the funding of any of the projects. Finally, the proposed facilities will have to meet economic, social, educational, and other criteria as well as the sensuous criteria discussed in this chapter.

Having stated sensuous criteria for the external characteristics of existing urban expressways, we will now apply them in an analysis of a real expressway.

Chapter IV: Description and Analysis of an Existing Urban Expressway

In order to apply the criteria developed above to a real environment, a portion of an existing urban expressway in the Boston metropolitan area expressway system was chosen for study. See Map IV-1.¹ The expressway system in the Boston region basically is made up of several radials and three concentric belt ways (one complete, one half complete, one proposed). Part of one of the radials, I-95 (the Northeast Expressway), will be used for this study. The study portion of the Northeast Expressway is almost entirely within the city of Chelsea, Massachusetts. Chelsea is an older, working class city; most of its labor force commute to work outside of Chelsea. Chelsea's main industries today are manufacturing, retail trade and wholesaling.² There are, however, plans for the relocation in Chelsea of the Boston wholesale produce market. There are also urban renewal plans to replace the Chelsea rag/junk industries with industry which would be more desirable from the tax standpoint and also more visually satisfying. Although Chelsea has been losing population and has been plagued by low property tax incomes and unsightly industry, it seems to be moving into a period of revitalization as pressure continues in the Boston region for close-in industrial sites and moderate-cost housing.³

The study sector of the Northeast Expressway is about two miles long and runs from the Chelsea side of the Mystic River to a point about one-half mile north of the interchange between the Expressway and the Revere Beach Parkway. See Map IV-2. This section of I-95 includes an alignment which is above, on, and below ground level, the double-deck high-level approach to the Mystic River Bridge, a major interchange, and several minor on/off ramps. At the same time, this part of the Expressway goes through low and middle income residential areas and between some residential and industrial areas. In general, most of the conditions existing elsewhere in our urban regions are found around this expressway.⁴

We shall begin this part of the study by describing the relevant physical characteristics along the Expressway. This will be followed by a discussion of the existing activity pattern. Finally, various aspects of the Expressway and the adjacent environment will be evaluated in relationship to the criteria listed above.

Relevant Physical Characteristics of the Expressway Study Sector

It is not necessary to use too many words in describing the basic physical characteristics of the Expressway study sector. Map IV-3 shows the Expressway route alignment and entrance/exit points, the basic land forms, local street pattern, and major public facilities.

On it the Expressway is divided into six sections according to major physical configurations:⁵

- Section 1: 70'/120' high, double-decked lanes, column supported
- Section 2: 20'/70' high, double-decked lanes, column supported
- Section 3: 20' high, side-by-side lanes, column supported
- Section 4: 20'/40' cut, side-by-side lanes, vertical retaining walls
- Section 5: partial cloverleaf interchange
- Section 6: 20'/40' high, side-by-side lanes, embankment supported.

The different configurations in the physical form of the Expressway together with the varying activities and facilities of the adjacent environment affect the design proposals.

A more detailed look at segments of the Northeast Expressway is provided in Maps IV-4 through IV-9.⁶ These maps show more detailed plans of the Expressway and its ramps, local streets, adjacent structures, property ownership (private or public, the latter including M.D.C., Port Authority, and city), and basic land use.⁷ Locations of related photographs numbered one through 45 are also indicated on these maps. Typical cross-sections, Figures IV-1 through IV-6, taken at

representative points within each section of the study sector, as shown on Map IV-3, complete the physical description of the Expressway and its immediate surroundings.⁸

Relevant Activity Characteristics of the Expressway Study Sector

For a complete understanding of the content and context of the study sector it is necessary to describe the relevant activity characteristics. Here, as with the physical characteristics, we shall rely mainly on graphic illustrations to show the required information. Map IV-10 describes the location of the basic activities of the Expressway and its adjacent environment.⁹ These are only the formal locations of existing activities--not included are informal or potential activities and their locations. These will be considered in the analysis of the study sector.

In addition to the activities and their location it is important to describe the intensity of activity. Our main concern here is with the number of people taking part in the various activities at different hours of the day. This information can, and in fact should, be specifically documented. For this study, however, it was necessary to rely heavily on personal field observations.

Maps IV-11 and IV-12 show the estimated day and night population distributions. The nighttime population distribution was based for the most part on census data.¹⁰ It was necessary to adjust this information in the area west of Everett Avenue where many of the buildings had been torn down since the last census survey. In that area it was estimated there were on the average three people per dwelling unit.

The daytime population distribution was obtained as follows: The census population figures were reduced by two-thirds and these reduced numbers were taken to represent the daytime residential population. School population was obtained from enrollment lists and were increased by ten per cent to include staff. Distribution of shoppers was estimated by counting the number of people in part of a store or on part of a sidewalk and expanding that number to represent the total store or sidewalk area; these observations were made on several weekdays and at various times during each day. All the numbers were increased by ten per cent to include commercial staffs. Finally, industrial worker distribution was determined by simply asking at each location how many people worked there.

Map IV-13 indicates the estimated average number of vehicular passengers per day for the major paths and estimated daytime pedestrian distributions.

Vehicular volume per day was available for the major routes--the Northeast Expressway, Revere Beach Parkway, Everett Avenue, Second Street, Broadway, Washington Avenue, County Road, Webster Avenue and Garfield Avenue. Field surveys were conducted to estimate the vehicular flows on the other streets in the study sector (fifteen minute counts made on several days were expanded to give daily volumes). These vehicular volumes were translated into person volumes by multiplying them by two in the case of the Expressway and Revere Beach Parkway and by one and one-half for all other volumes.¹¹ Pedestrian volumes were estimated by counting people passing certain points and expanding these to daily volumes.

Finally, Map IV-14 indicates the officially permitted activities in and around the study sector, i.e., the zoning. Although these districts and/or their respective regulations may be changed, they must be taken to represent the currently desired activity pattern. Additional information such as past trends or changes in zoning, urban renewal plans, and pressure for certain new or additional activity facilities may be used to estimate possible or probable changes in the permitted and actual activity pattern. In addition to the zoning ordinances, local building, fire, and health codes will also regulate the more detailed configuration of proposed facilities. These codes have not had major revisions since 1929 and as a result are

rather archaic and restrictive in many instances.¹² Along with these local regulations, there will be similar use and building conditions specified by the organization having responsibility for a particular Expressway section.

Within the study sector two authorities own part of the right-of-way. The Massachusetts Port Authority owns the Mystic River Bridge approach beginning at Fourth Street west and the Massachusetts Department of Public Works owns the remainder from Fourth Street east. Neither of these organizations, however, has any regulations governing uses of the right-of-way other than for moving traffic and both indicated that something would have to be "drawn up". The Department of Public Works said they would have to check with the federal government for standards but they had no general set at the moment (according to the Massachusetts Department of Public Works, the federal government is currently preparing such a general set of standards).¹³

Having completed our description of the physical characteristics and activity patterns of the study sector, we may go on to an analysis related to the criteria of Chapter Three.

Study Sector Analysis

We shall now begin an analysis of the conditions in and around the study sector of the Northeast Expressway which are relevant to the criteria. This analysis must of necessity be relatively simple: as was suggested in the discussion in Chapter Three, many of the analytic techniques which are required by the criteria are highly technical, complicated processes demanding special expertise and equipment. In some cases the required processes are still rather obscure and thorough research is lacking. So what we shall do will actually be only a beginning. We are not saying, however, that an elaborate and detailed analysis is necessary in order to make design explorations of the Expressway environment. Part of the design process did in fact involve studying the potential of the Expressway without considering any constraints. What we are saying here is that ultimately more detailed analysis will be necessary in order to propose specific designs.

First it is necessary to analyze potential activity changes in the study sector since we want to consider future as well as present conditions when applying the criteria.

1. Potential Future Activities

Diagram IV-1 indicates which activities around the Expressway may change and which are likely to remain the same for various time periods. This information is based

on a number of sources. The "known changes", the new produce market and the new swimming pool for the Carter Playground, have been officially announced by the city. The city has also made a survey and planning application for urban renewal in the area indicated in the diagram as "probable change". The survey and planning application calls for total clearance of the structures in the project. The land is to be reused for industrial and wholesaling purposes, in an attempt to improve the tax base and the visual quality of the physical environment of Chelsea.¹⁴

Several areas are shown as "possibly" experiencing a change in activity. In some instances the type and amount of change which may occur is not determinable. For example, the areas adjacent or near to the proposed urban renewal area may very well contain more industry and wholesaling than they now do. Industrial and residential activities are already mixed in parts of these areas and the physical condition, of the residential structures in particular, is poor. Also, if trends continue, most of the now vacant usable land near the core of the Boston metropolitan area will be occupied by the early 1970s.¹⁵ This would mean that areas with deteriorating and inadequate facilities would be most likely to be redeveloped. The above reasons support the possibility of a change within seven to ten years of those areas adjacent or near to the urban renewal area and

suggest that the new activity will most likely be nonresidential. Another area in which change in activity may occur is the presently vacant hillside near the Revere Beach interchange. It would probably be developed for low to medium density residential purposes. This, however, will probably not occur for some time, as building sites would be on a fairly steep slope.

The activities which are designated as being stable for at least ten years involve facilities which represent substantial financial investment, are in good physical condition, and seem to serve their purposes fairly well. In general, there is not now sufficient space within any of these stable activity areas to allow for a substantial increase in the amount of activity. The Naval Hospital grounds do offer some possibilities for expansion.¹⁶

It is assumed that the rest of the activities around the Expressway will for the most part be stable for the next ten to fifteen years, but not to the same degree as the activities specifically designated as stable. Although no up-to-date economic statistics were available for the Chelsea Central Business District, there seems to be a fair amount of economic confidence in the area around Broadway east of Everett Avenue. This commitment to the commercial future of the area is indicated by recent construction and extensive renovation of the stores and by the present near one hundred per cent occupancy of the retail space available.¹⁷

The location and basic activity of the Expressway itself is also considered to be stable for at least the next ten to fifteen years. There may, however, be some changes in the on and off ramp locations if the location of activities and concentrations in the areas adjacent to the Expressway changes. Intensity of activity on the Expressway will probably increase during the next ten years.¹⁸ This may mean the eventual construction of additional capacity.¹⁹

These, then, are the conditions of potential change or stability of the activity pattern around the Expressway study sector. Potential future activities must be kept in mind when considering other conditions to be analyzed below.

2. Conditions of Noise, Fumes, Artificial and Natural Light

Diagram IV-2 shows the location of undesirable noise, fume, artificial and natural light conditions. Estimates of noise levels were made based on the research described in Chapter Two. Personal observations in the study sector were also made to see if the various areas were noisy or quiet. The actual conditions of fumes and artificial and natural light were also determined by personal observation in the study sector. Vibration was not noticed in any of the area adjacent to the Expressway, but was easily discernable in all the steel structure supporting the Expressway.²⁰

According to Diagram IV-1 and the possible future activities section above, the undesirable noise and fume levels may increase along the Expressway. The increase in noise will not be so much a matter of volume as of duration. Maximum noise levels produced by vehicles in the ten to fifteen year future will probably not be any higher than those produced today--they may in fact be slightly lower. (See Chapter Two.) Noise level, however, is also a function of volume of traffic and most probably higher volumes will be experienced for longer periods of time within the ten to fifteen year future. Finally, Diagram IV-2 shows that allowable noise levels may increase in certain areas of the Expressway, because of increased industrial uses.

3. Functional Structure

Diagrams IV-3, 4, and 5 show social, economic, and service structures in the study sector. These structures are composed of two elements, activity areas and the relationships between them. "Activity area" has been defined as a continuous area having a basic function--residential, commercial, recreational, etc. The relationships shown in the diagrams are created by the social, economic, and service interactions which take place between activity areas. It should be noted that the Expressway may divide what would otherwise be one activity area into two areas. I have in this case drawn what is,

two areas, rather than what would be without the Expressway, in order to clearly diagram what would otherwise be an internal relationship within a single area.

The relative strength of the interactions is based on rough estimates of the number of person-trips which would be made between the activity areas if the Expressway were not present. In other words, the interactions are the lines of desired movement. Obviously, complicated techniques are needed to precisely define these potential interactions and their relative strengths, techniques involving complex theories of social structure and extensive data-gathering. Interviews would have to be used for information not obtainable from census and other sources. For this study, however, it was necessary to simplify the method.

Potential social interactions are shown in Diagram IV-3. I know of no clear and precise way to determine what the social interaction might be were it not for the Expressway. It might be possible through interviews with local residents to determine what social interactions existed before the Expressway was built. Questions could be asked about the location of friends and about how often and under what circumstances (planned or unplanned) they saw them. The locations of the clubs and organizations they participated in could also be determined. It would seem to be equally difficult to discover how the

Expressway may have affected the potential for these interactions to occur. One of the difficulties is in controlling variables which seem to influence social interaction. If more lines of interaction existed between two areas (or within a single area cut by the Expressway later) before an Expressway was built than existed after the Expressway was in place, and there were no changes in the ethnic and economic conditions which existed in the two areas before the Expressway was built, then we might be able to establish what effect the Expressway had on social interaction.

As we have said, such complicated techniques were impossible to apply in this study. Instead, a series of assumptions was used to determine the potential social interactions. The assumptions are as follows:

1. All residential activity areas which represent at least two hundred families have an interrelationship equal to one;
2. For every two hundred families above this, add one to the strength of the relationship;
3. If their centers are within one-quarter mile of each other, add one to the strength of the relationship;
4. If the residents of both have similar occupations, add one;
5. If the residents of both are of the same race, add one; and

6. If the residents of both are of the same ethnic background, add one to the strength of the relationship.

Admittedly, these assumptions are crude, particularly in the fact that they assign equal importance to each of the different factors, population, distance, income, and ethnic origin. It may also be argued, for example, that race and ethnic differences will tend to cancel out the possibilities for an interaction based on similar occupations or at least that the factors should be ranked in order of importance. I would have to say that it has been my assumption that if we do not rank the factors in any scale of priority, we leave open the greatest number of possibilities for social interaction. We in this way may be able to avoid merely providing for the continuation of the status quo.

The diagram also shows only relative strengths of social interaction between activity areas. It does not indicate how many person-trips each line stands for. We are limited to saying which seem to be the strongest socially related areas and so on down to the socially unrelated areas. This means the recommendations can only say which social interrelationships to provide for first, second, etc. Additional work will have to be done in order to discover what the actual strength of the relationship is and how it may be stated.²¹

Future conditions must again be taken into account.

Diagram IV-3 also indicates which interactions will "probably" not exist and which will "possibly" not exist in the future due to changes in the residential activity areas as shown in Diagram IV-1.

Diagram IV-4 shows the potential economic interactions which might take place if the Expressway did not exist. These include employer-employee and supplier-consumer relationships.

The relationships shown between residential and job locations are the actual relationships which exist with the Expressway in place.²² The assumption which allows us to use this current data is that people do not consider the location of their place of work in relation to the place of residence in terms of whether or not an expressway exists between the two. In other words, the locations of workers' houses and jobs would be the same with or without the Expressway.

In addition to home-work relationships, the economic structure also includes interactions between supplier and consumers. Possible market areas for the major commercial concentrations are shown on Diagram IV-4. Personal observation was used to determine the basic type of commercial functions in each commercial area--sub-regional, Central Business District, and neighborhood. It was then simply assumed that substantial convenience shopping would be done at the commercial area closest to the location of home. This is of course a broad and

simplified assumption but time and skill limitations did not permit elaborate studies. When such time and skill were available, these more extensive studies of the variety of goods and prices, parking facilities, required travel times if Expressway did not block flows, etc., of each commercial area could be done and then used to more accurately determine the possible market areas.

The final set of interactions to be considered are those involving activities such as education, recreation, transportation, government administration and maintenance. These have been called service interactions and they are illustrated in Diagram IV-5. Again, these have been very simply described. Each public facility was identified by field survey and by studying a city map published by the local newspaper.²³ School capacities were obtained from the office of the School Board.²⁴ Interrelationships were then drawn between each residential area and the public facilities its residents would probably use. These were purely intuitive judgements.

More complete and objective data could be developed to represent the service relationships. For example, interrelationships between residential areas and churches, public transportation facilities, fire protection facilities could be shown as well as interrelations between industrial and commercial areas and these service facilities and those listed above. Also, by more detailed study of the population of the residential areas

(number and density, age groups, time distance to various public facilities, etc.) and of the actual kinds and capacities of equipment offered at each public facility, it should also be possible to indicate how strongly the activity areas might interact with one another. For this study, however, we can only say which residential areas may use which service facilities.

Finally, Diagram IV-5 indicates where and how activities might change in the future. This is based, again, on the information in Diagram IV-1.

These service interrelationships, together with the social and economic structures considered above, complete our study of the functional structure of the activities around the Expressway study sector. All the interactions discussed imply a physical movement of people and/or goods between the interrelated activity areas. As such they may be considered as desire lines connecting flow generators. It is now possible, with the functional structures, the noise, fume, artificial and natural light conditions, and the physical and activity conditions as background, to consider the effects the existing Northeast Expressway has on the conditions of flow which might exist if the Expressway were not present.

4. Effect of the Expressway on Flow Structure

We are again going to rely on a diagram to illustrate the analysis of the effects of the Expressway on the

flow structure. Diagram IV-6 shows the results of the analysis.

We have already presented information on the plan, cross-section, activity pattern and intensity, and the noise, fume, natural and artificial light conditions along the study sector of the Northeast Expressway. These factors will determine what effect the total expressway environment has on the flow structure. By analyzing the functional structures around the study sector, we are also able to say between which activity areas the major, secondary, and minor flows may occur.

It should be noted that Chelsea has only a little over seven-tenths of an automobile per dwelling unit, which is the third lowest in the metropolitan region as defined by the Boston Regional Planning Project. Also, Revere has almost one auto per dwelling unit.²⁵ With these facts in mind, the following assumptions were made:

1. Most school trips under one-half mile are made by foot or on bicycle; most others are made by bus;
2. Most recreational trips under one-half mile are made by foot or bicycle; many under one mile are made by foot or bicycle; and most others are made by bus;
3. Most trips from a low- and medium-skilled area which are under one-half mile are made on foot and most other trips by bus; and

4. Many work trips under one-quarter mile from a highly-skilled or professional area are made by foot; most other trips by car.

In addition to showing the effect of the Expressway on the potential flows, Diagram IV-6 indicates where the interconnections between local and Expressway flows is confusing. These conditions were discovered in part by personal observation of people trying to get to and from both the on and off ramps and the major activity or flow facilities in the environment surrounding the Expressway study sector. Along with this, I tried to judge the individual clarity of the interconnections by trying to imagine the decision-making process required for a person trying to go to or from the interconnections to various locations in the surrounding environment.

Finally, Diagram IV-6 shows where future changes may occur in the potential flows across the right-of-way of the Expressway. Again, these future conditions are based on the potential changes in activity presented in Diagram IV-1.

5. Effects of the Expressway on Visual Connections

Diagram IV-7 shows how potential views across the study sector are affected by the Expressway structure. Field surveys were conducted to determine where views between areas on opposite sides of the Expressway could

occur if the Expressway were not present. At the same time, the views which actually do occur were noted in order to determine the effect of the Expressway on the potential visual connections. The potential views were also classified according to their relative importance. Major views are those toward activity concentrations of city or regional import, prominent landmarks, or along potentially major paths. Secondary views were considered to be those of relatively large expanses of the city or those along potentially secondary paths. Minor views include those of limited expanse, between adjacent activity areas.

In addition to showing the various conditions of visual connection in the study sector, Diagram IV-7 indicates the forms and activities of the Expressway which are highly visible close at hand from the existing major public vantage points--i.e., from the local path system. Also indicated are areas which provide distant overall views of the Expressway structure and activity. These conditions were determined by personal field observation.

Finally, Diagram IV-7 notes where the conditions of view may change in the future. It is very difficult to say where important views may be located at that time as they depend so much on the particular facility and activity pattern. Although a predicted change in activity from mostly residential to entirely industrial and

wholesaling uses can have meaning for the prediction of changes in flow type and intensity, such a general statement tells us little about the look of the future facilities or if and where important concentrations of activity may occur. Since even tentative, preliminary plans have not been developed for the area of change, and it will involve total clearance as indicated under section one of this chapter, it is not possible to say much more than that change may occur from one use to another.

6. Effects of the Expressway on Conceptual Structure

The effects of the Expressway on the conceptual structure or image of the environment around the study sector as held by the users of that environment have again been simply studied in this report. First, we have assumed that when views and flows across the Expressway right-of-way are restricted, areas on either side of the Expressway will be less likely to be associated with one another, even if they have a similar visual and functional character. By field survey, then, we have established possible district boundaries in the area around the study sector. These boundaries are shown on Diagram IV-8 and they represent the structuring of the overall environment that might occur if the Expressway had no effect on conceptual image making. We have then indicated on the diagram where the Expressway may cause a disassociation

between parts of an otherwise single visual and functional district. It should be noted that the Expressway is in some cases located between two distinct visual districts and here it may very well heighten the sense of difference between the two districts.

Also shown on Diagram IV-8 are places where the Expressway itself could be a landmark in the visual environment. This is the only other consideration we shall give in this report to the potential effects of the Expressway on conceptual structure. Obviously, more extensive work is required. It would be most useful to develop a complete conceptual structure of the environment assuming the Expressway had no effect and then compare that with the "public" conceptual image of the environment which actually exists. In this way it would be possible to see how the Expressway influences the potential conceptual structure. This conceptual structure which could exist if the Expressway were neutral would probably have to be developed by trained people in a manner similar to that described in The Image of the City except that the possible effect of the Expressway would have to be discounted. Actual conceptual structures could also be discovered by the techniques indicated in The Image of the City.²⁶

7. Aesthetic Qualities of the Expressway

Based on field surveys, it is my opinion that the Expressway study sector has few positive aesthetic qualities.

Two parts of it, however, do engender some sense of aesthetic pleasure. The high level approach to the Mystic River Bridge at the west end of Broadway (see photos four to seven, and nine) presents a dramatic view. This is due to the fact that it is a very high, large scale structure set in an open site. Its proportions, color, or individual components are not particularly outstanding.

The second part of the Expressway that has positive aesthetic qualities is where the path surface is cut into a hillside and passes next to the Revere Beach Parkway (see photos thirty-three to thirty-six). Here the complicated changes in road level, intermixed flow of traffic, and the fact that the view of the scene is from above, help to create a feeling of aesthetic pleasure. Again, however, the components and details of the structure are not particularly high in aesthetic quality.

Finally, the distant views of the Expressway (see photos two and three) form and activity are rather enjoyable, especially at night when the movement of many vehicles on the large scale, curving Expressway as indicated by their headlights contrasts with the less active, dark portions of the environment. The views are usually from tops of local hills as indicated on Diagram IV-7.

8. Activity Needs of the Environment

This final section of the analysis of the factors relevant in making design proposals for the improvement of the space around existing urban expressways considers the need for additional or improved activity facilities. The predicted activity changes discussed in section one for the study sector are relevant to these activity needs. My own personal assessment of the situation was the basis for the statements to follow, as no official statements, other than the Murray Industrial Area Survey and Planning Application, were found.

Diagram IV-9 shows the location of the various needs which seem to exist. The need for neighborhood recreational facilities was based on population figures noted earlier and on an assumed minimum of about one to one and one-half acres per thousand people.²⁷ Field surveys and studies of the plans of the area along the study sector were then used to determine how much space is now being provided for recreational purposes. The recreational needs were then compared with the now available space.

A similar procedure was used to determine the need for commercial and residential parking space. I assumed that an average ratio of three to one between commercial parking and retail floor space should exist.²⁸ For residential parking, I used the earlier cited figure of seven-tenths of a car per dwelling.²⁹ Only that space

specifically adapted to parking--i.e., space that is at least paved--was counted as part of the existing parking facilities.

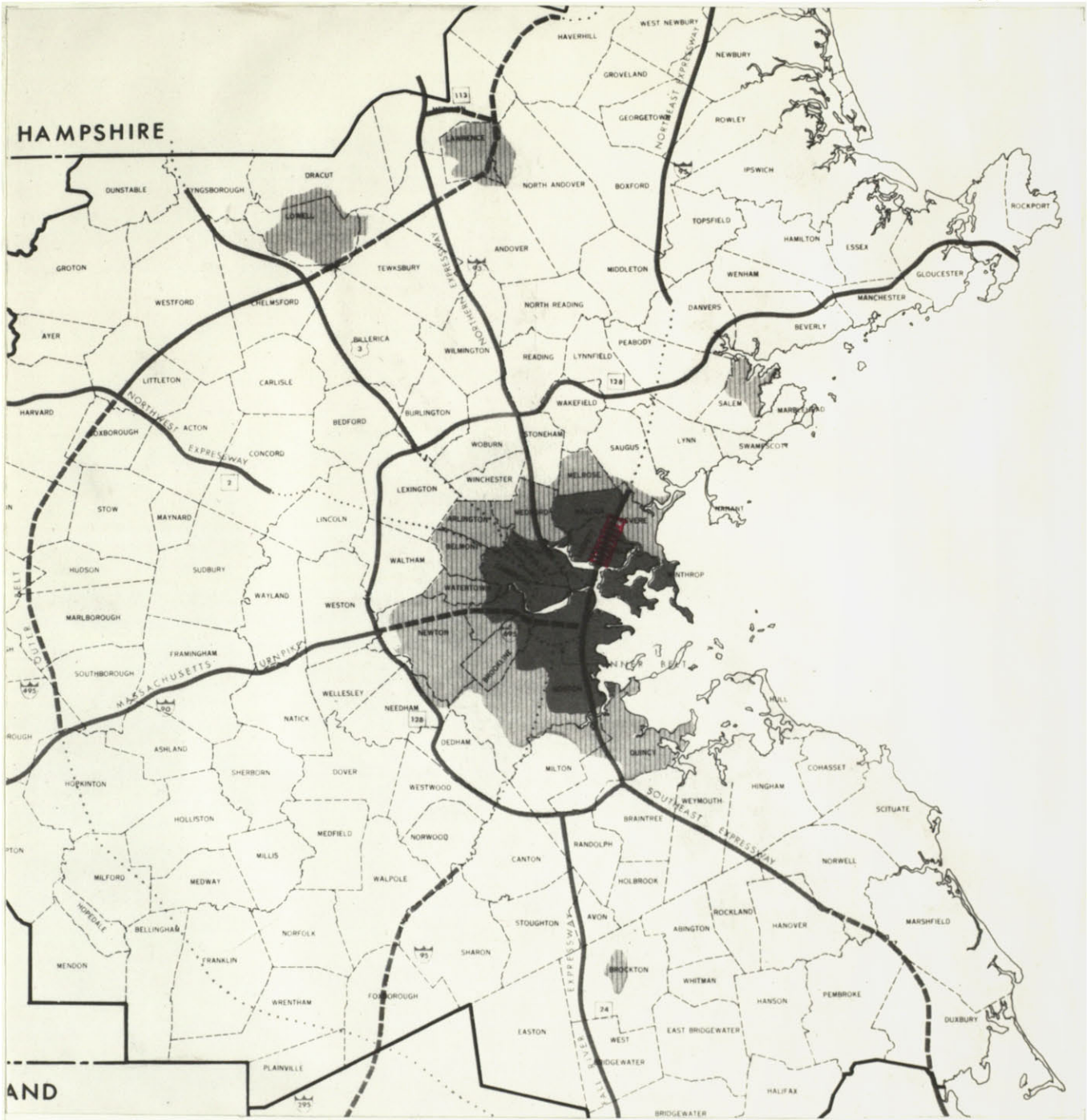
It was also estimated that additional educational facilities for about three hundred students were needed in the Prattville/Woodlawn section of Chelsea (the part north of the Revere Beach Parkway). The capacity of the only school in that section is three hundred students, while the current enrollment is near six hundred. In addition, I am assuming that if the activity along Walnut Street in Chelsea changes from residential to industrial/wholesaling and if the Williams School is closed, about five hundred students will have to be relocated. The enrollment there is now around six hundred fifty students. I estimated that one hundred fifty of them came from the area around Walnut Street, which will no longer be residential.

In addition to these local activity needs, there are factors of a broader nature which may influence the use of the space around the study sector of the Northeast Expressway. We might assume a continued need in the core of the region for low-income residential facilities and for large scale, year round recreational facilities. Diagram IV-9 does not indicate these regional needs, but they should be included when making design studies for the use of an expressway right-of-way.

The activity needs we have considered are of a general nature. Obviously, more elaborate estimates of activity needs would be helpful. In particular, it would be useful to have a statement from the City of Chelsea government of the role they see for Chelsea and the obligations they feel toward Chelsea residents. For this report, however, we must assume that Chelsea will continue to be mostly a working class community with manufacturing and wholesaling as her main economic support.

This completes our analysis of the factors relevant in making design proposals for the study sector. In many instances this analysis has been very superficial and intuitive. Lack of time, equipment, and expertise has been the overriding cause of this. It must be emphasized that the descriptions and analyses presented above should be considered to represent only the first stages of a more extensive, comprehensive, and objective study of the conditions around the study sector of the Northeast Expressway. This chapter does, however, indicate what groups of information and analysis would be required and also what should in general be known about each.

We now have the criteria, description, and analysis which form a basis for making some preliminary design explorations for the use of the space around the Expressway study sector. This will be the topic of the next chapter.



REGIONAL EXPRESSWAYS STUDY SECTOR



MAP IV-1
NORTH ↑ **SCALE: 1" = 8 MILES**












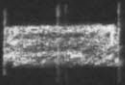

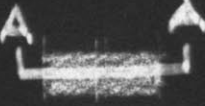


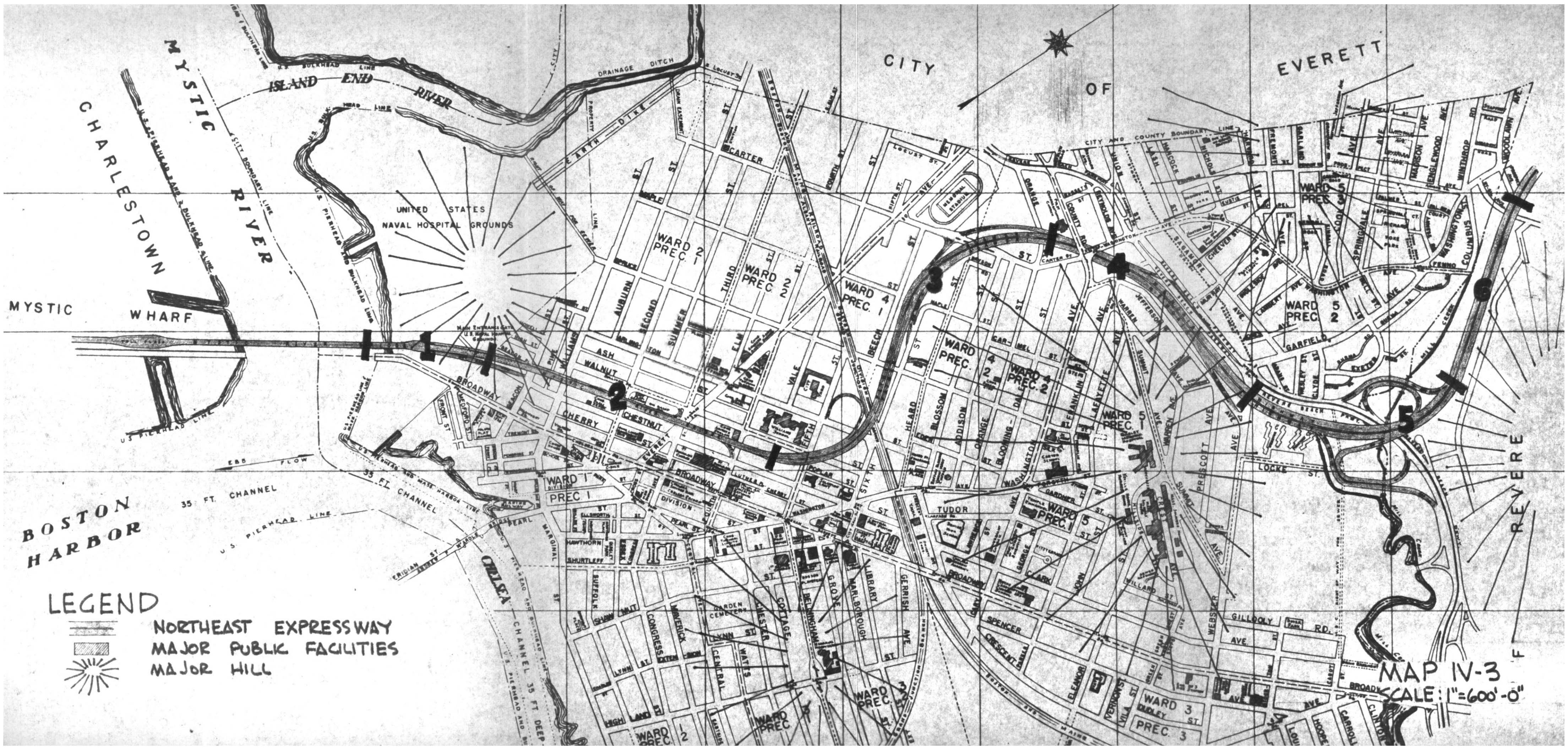
MAP IV-2
NORTH ↑

STUDY SECTOR



LEGEND FOR MAPS IV-3 TO IV-9

	STRUCTURE
	PROPERTY LINE
	BASIC ACTIVITIES
	RESIDENTIAL
	COMMERCIAL
	RESIDENTIAL/COMMERCIAL
	RECREATIONAL
	EDUCATIONAL
	RELIGIOUS
	GOVERNMENTAL SERVICE
	MANUFACTURING
	WAREHOUSING OR STORING
	PROPERTY OF PORT AUTHORITY AND STATE D.P.W. (SEE TEXT)
	LOCATION OF PHOTOGRAPH
	LOCATION OF CROSS-SECTION



CITY OF

EVERETT

CHARLESTOWN

MYSTIC RIVER

ISLAND END

UNITED STATES NAVAL HOSPITAL GROUNDS

WARD 2 PREC. 1

WARD 3 PREC. 2

WARD 4 PREC. 1

WARD 4 PREC. 2

WARD 4 PREC. 3

WARD 5 PREC. 1

WARD 5 PREC. 2

WARD 1 PREC. 1

WARD 5 PREC. 1

WARD 5 PREC. 2

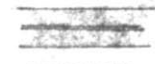
WARD 3 PREC. 3

BOSTON HARBOR

35 FT. CHANNEL

35 FT. CHANNEL

LEGEND



NORTHEAST EXPRESSWAY

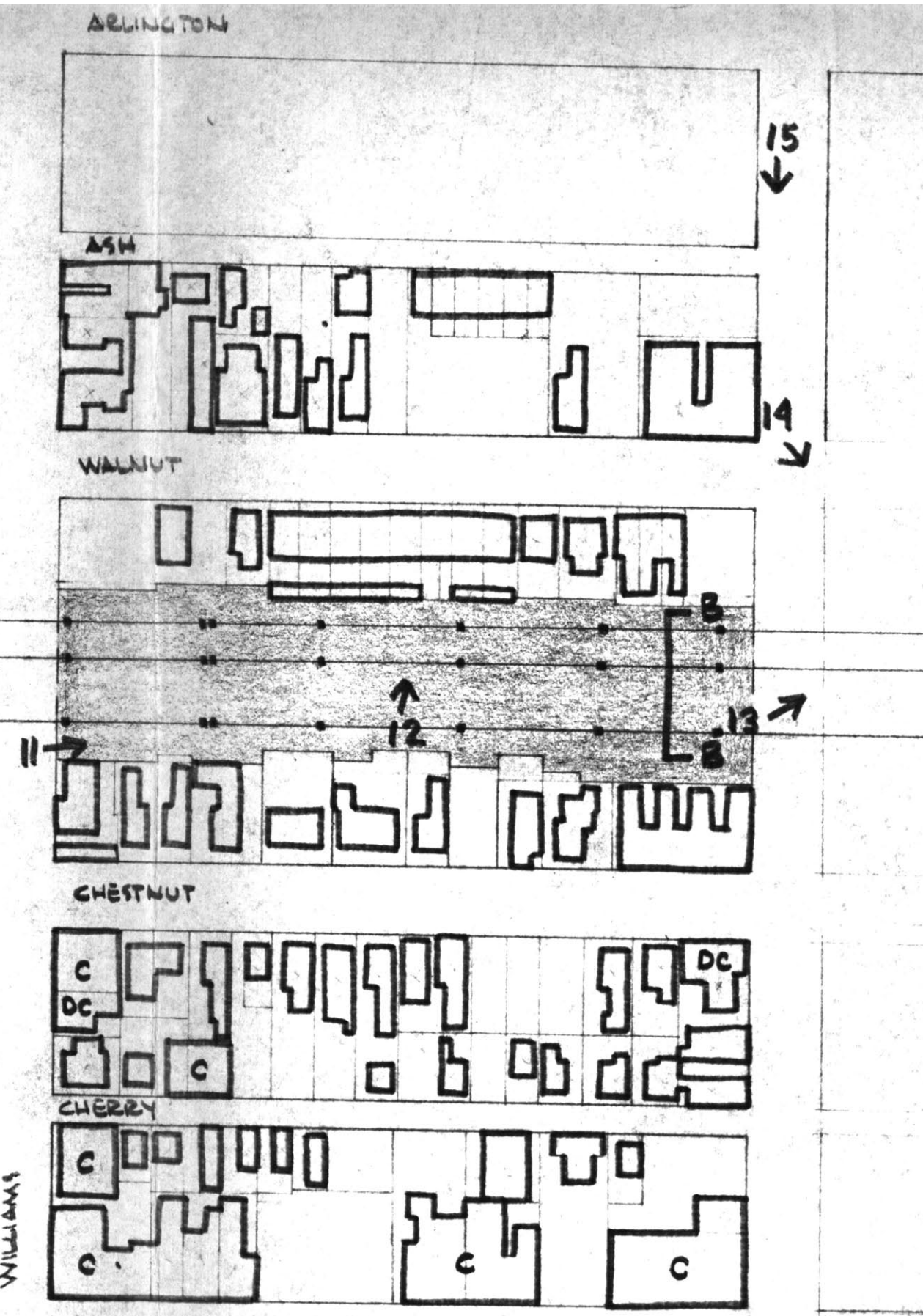
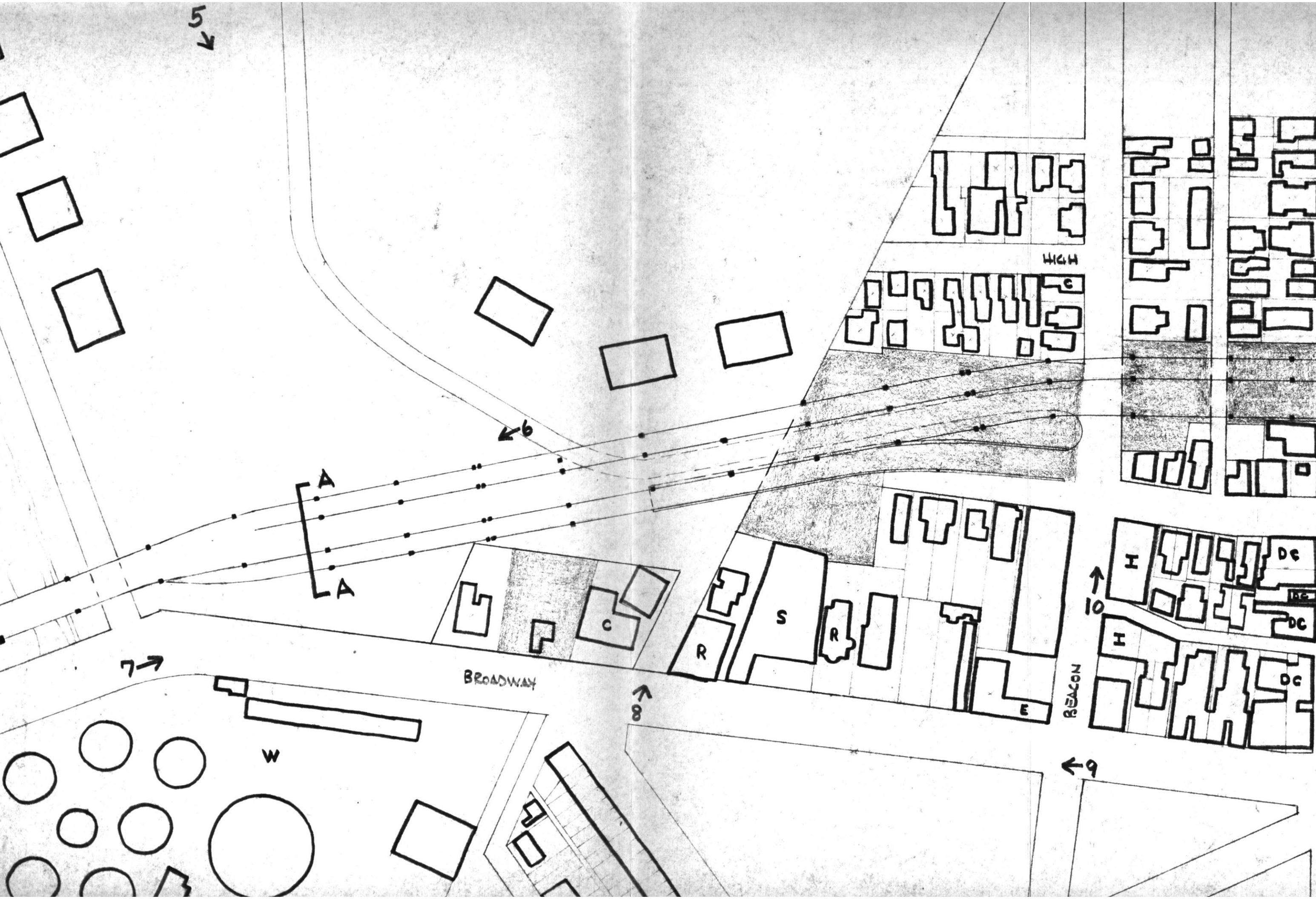


MAJOR PUBLIC FACILITIES



MAJOR HILL

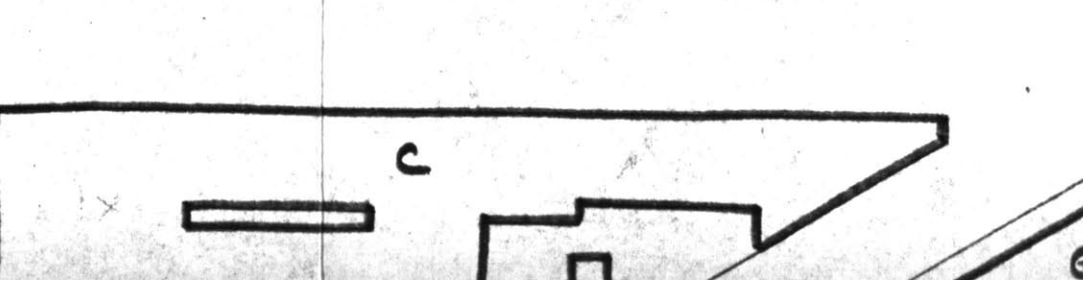
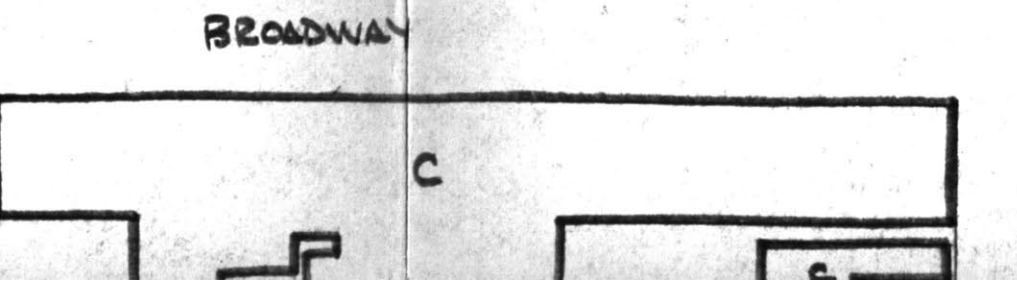
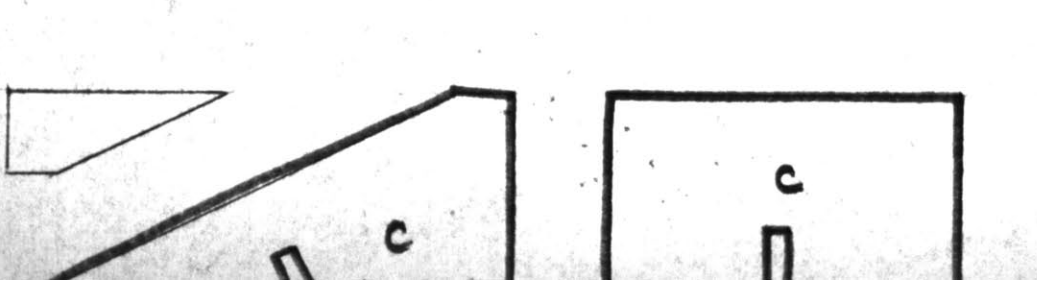
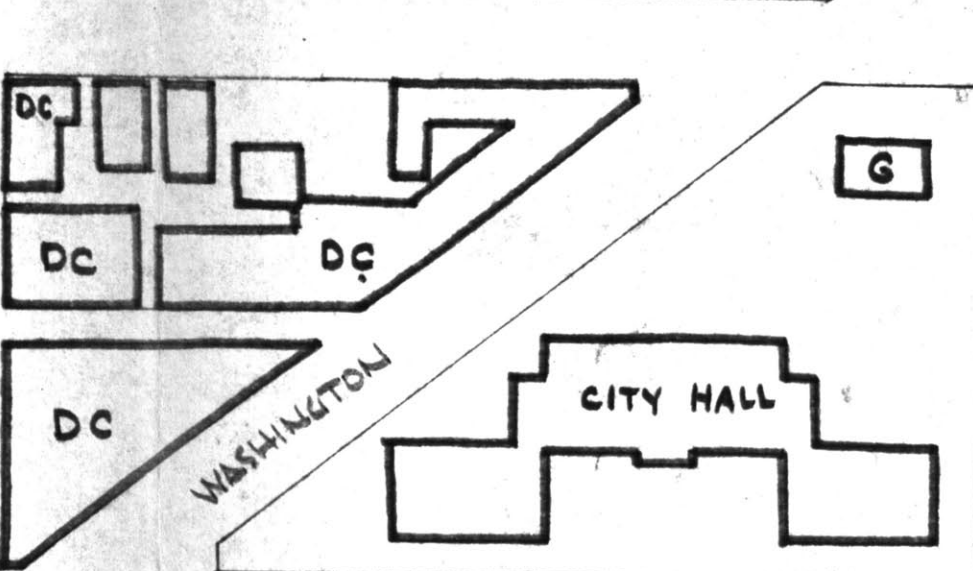
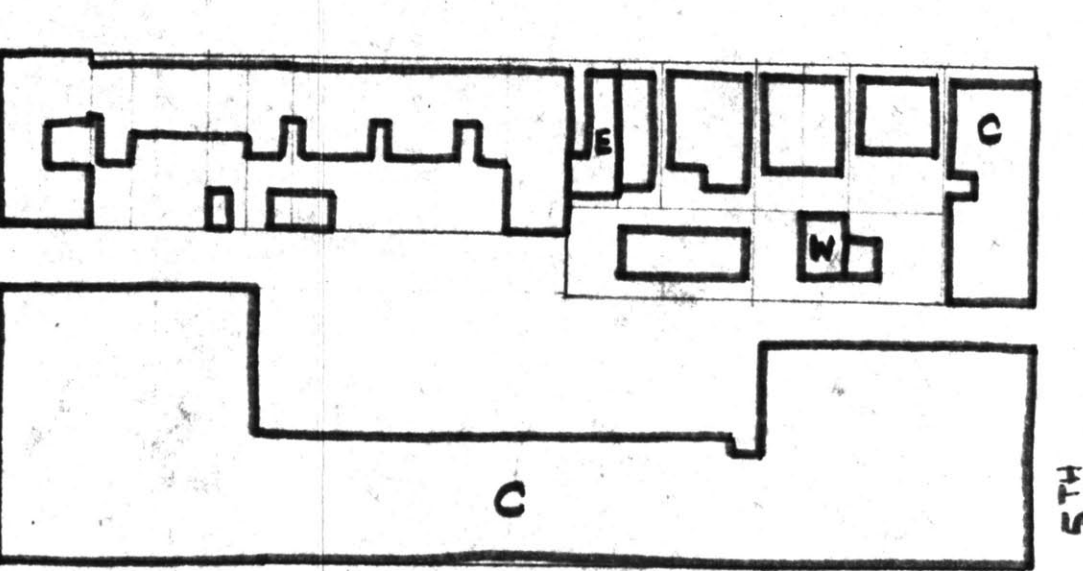
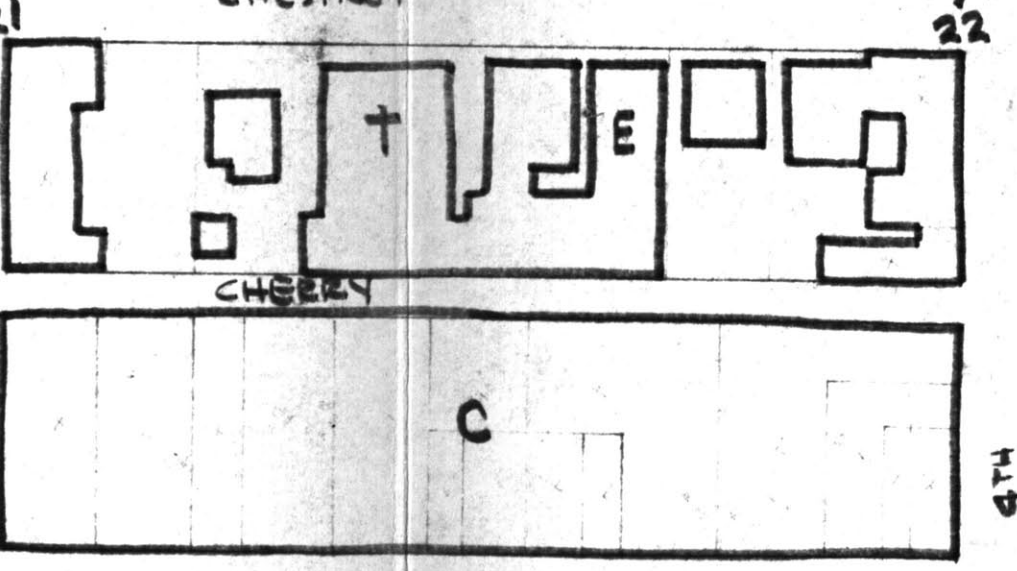
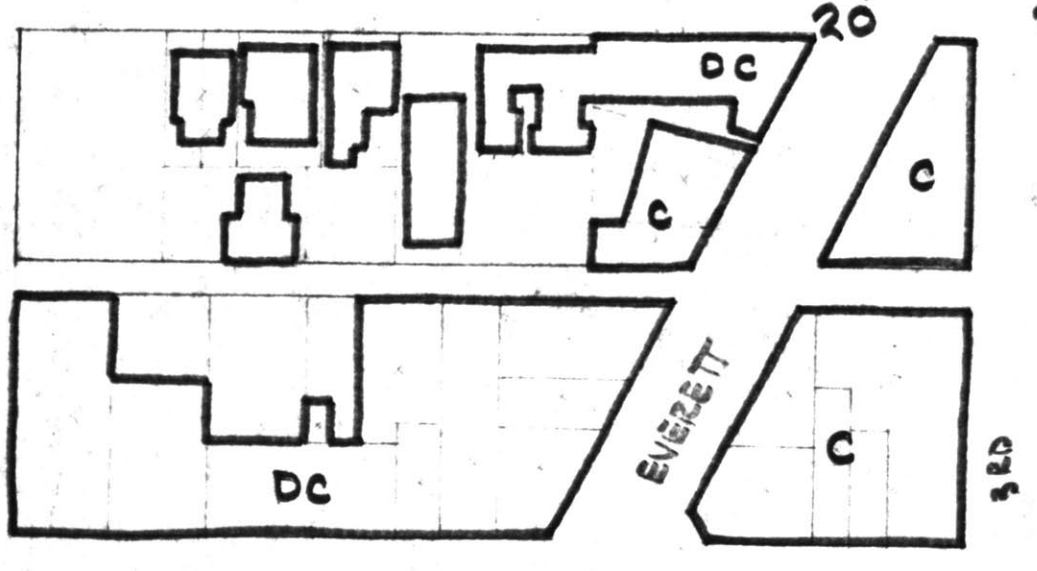
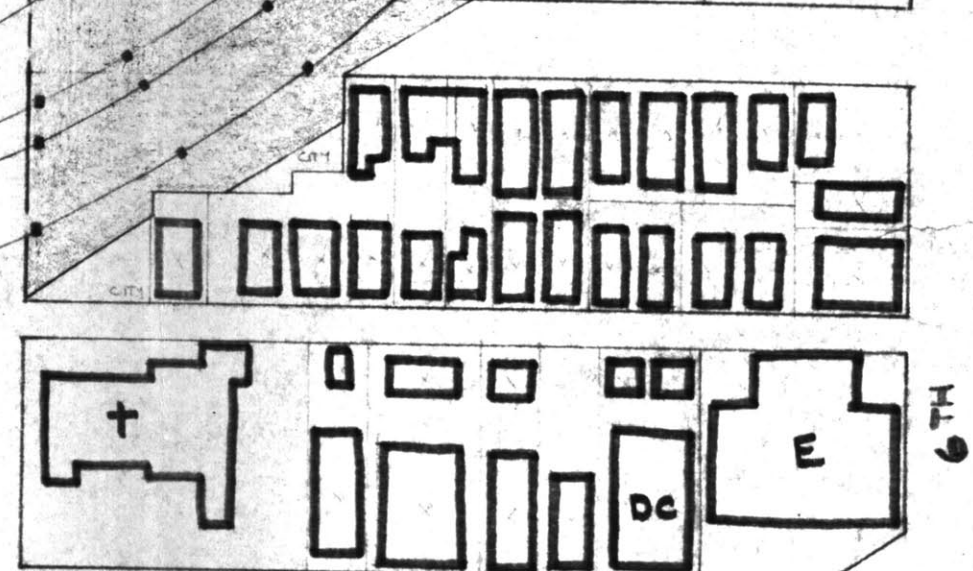
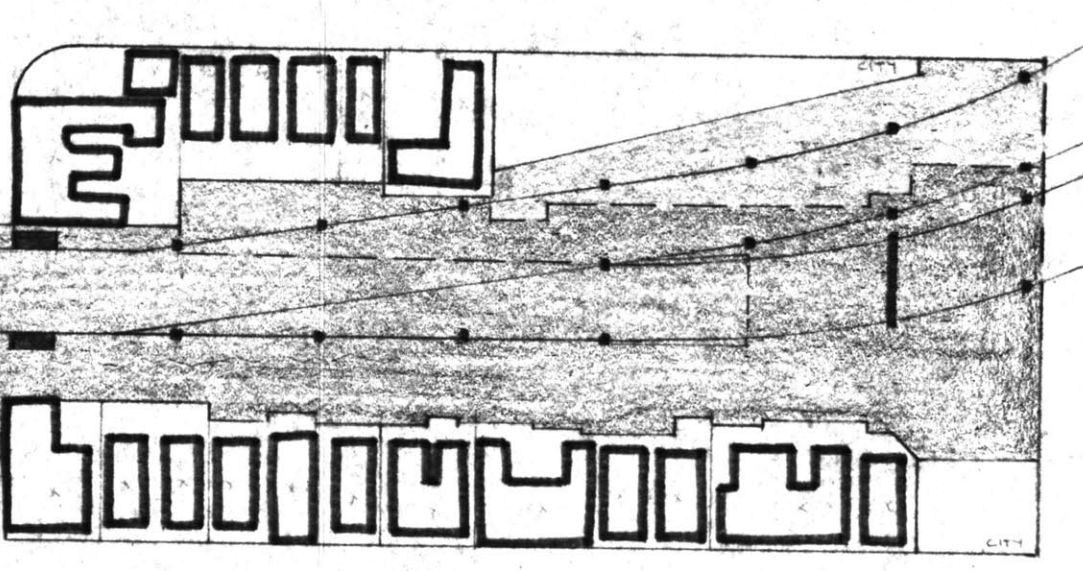
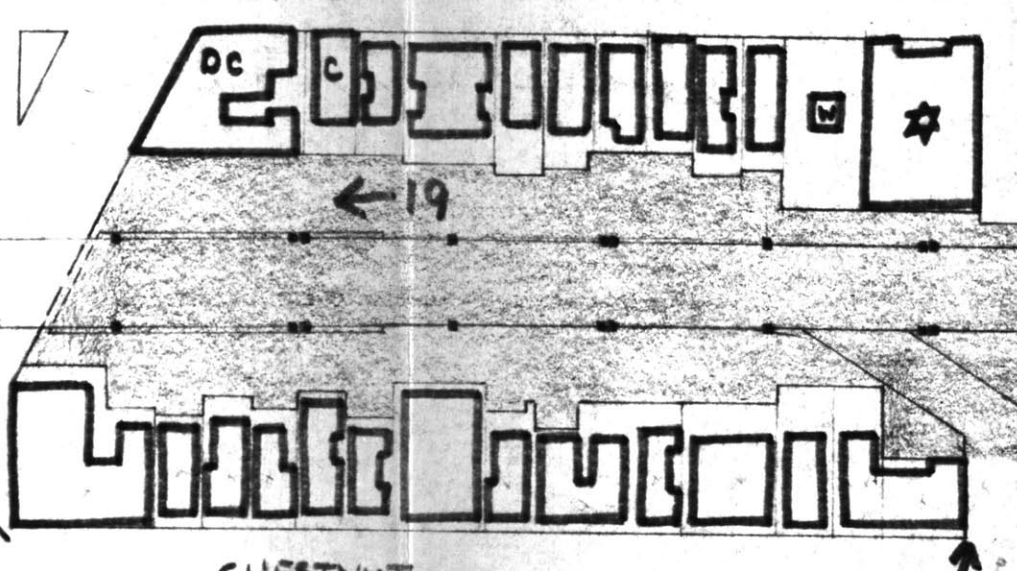
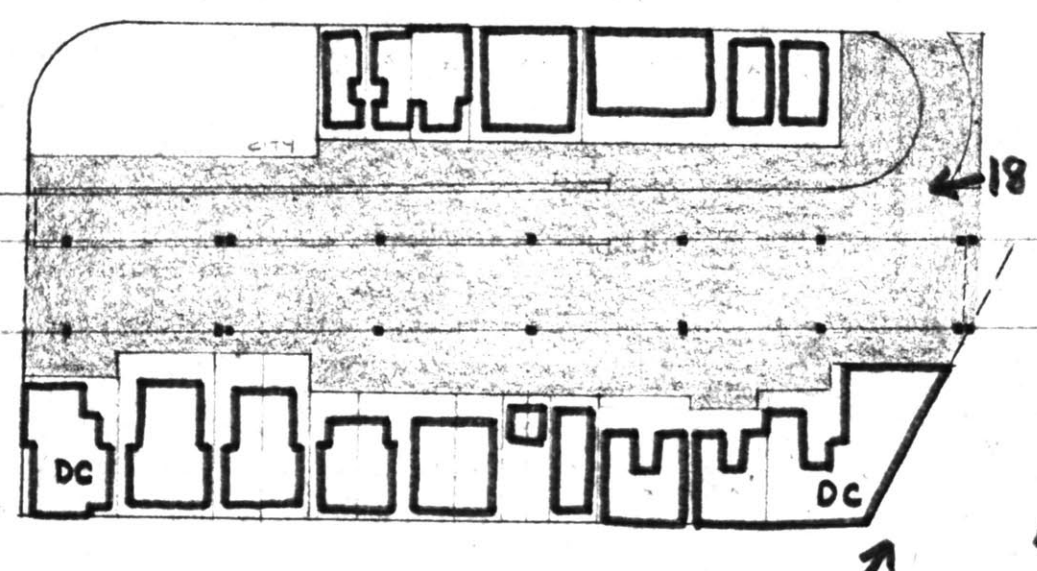
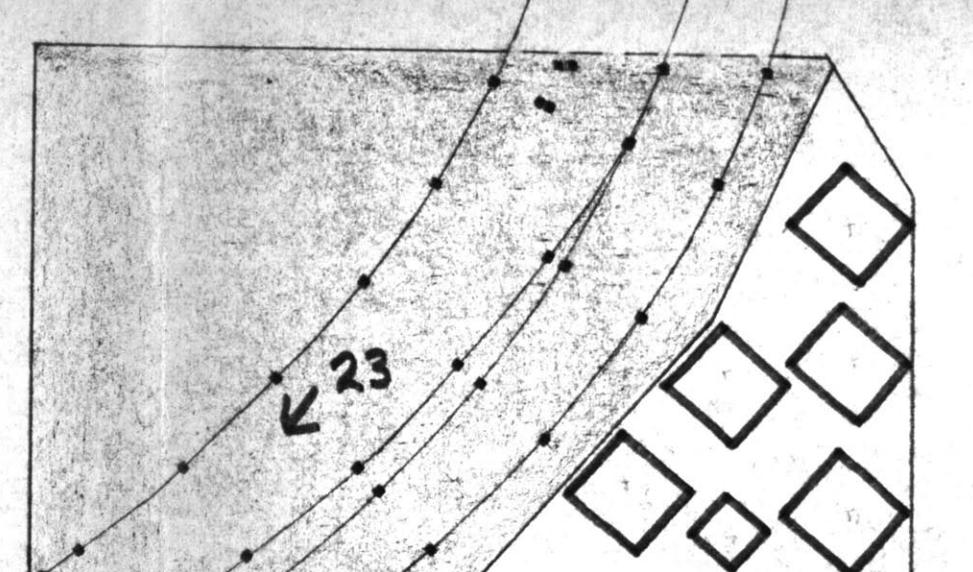
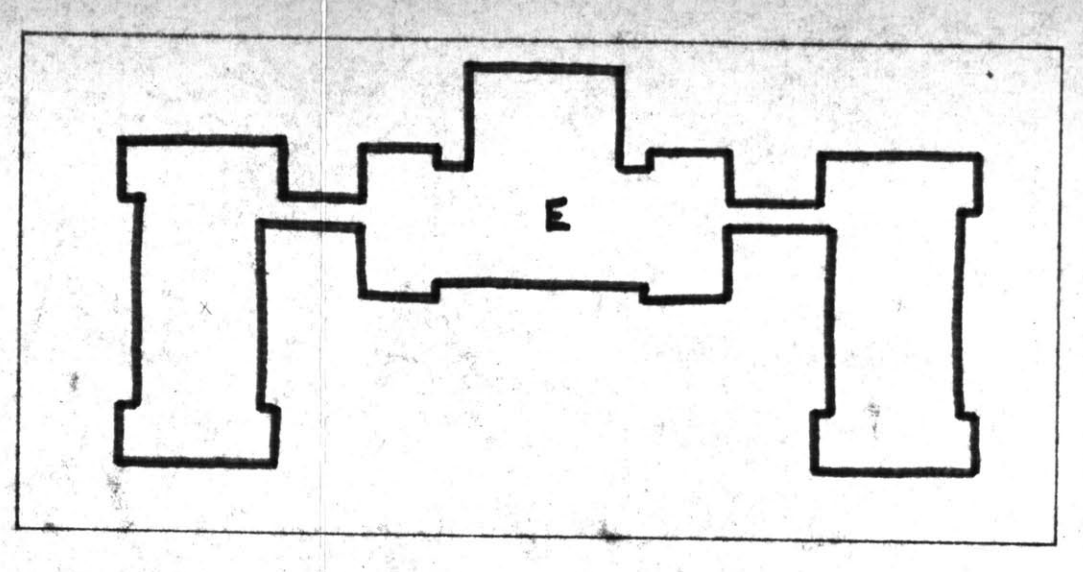
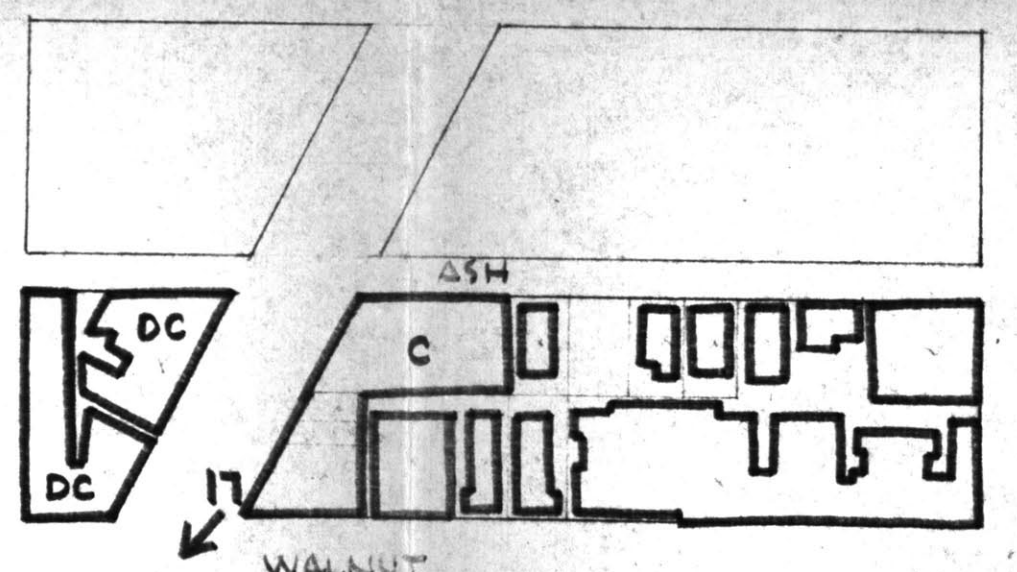
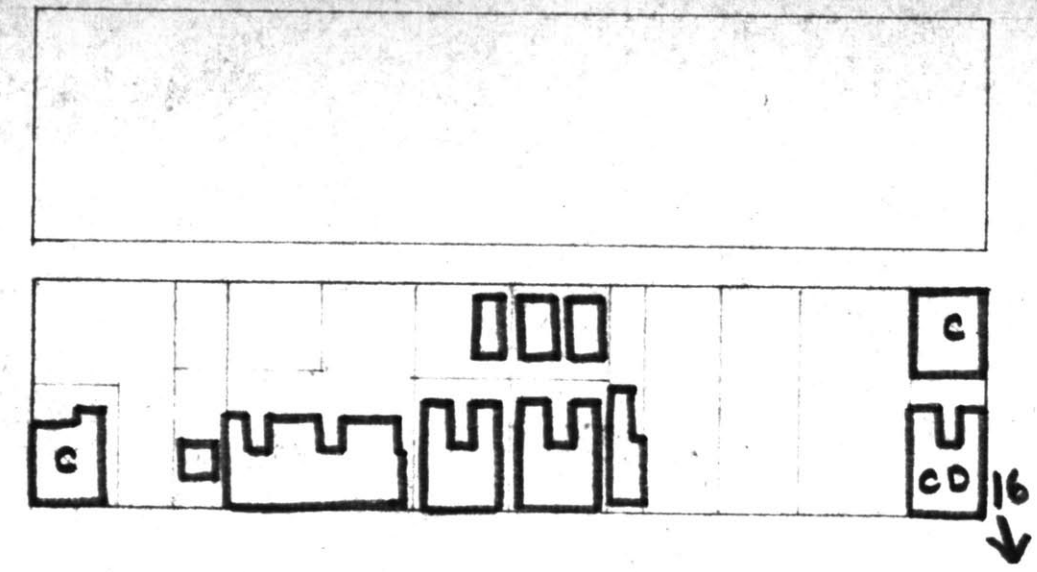
MAP IV-3
SCALE: 1"=600'-0"



MAP IV-4
 SCALE: 1" = 100'-0"

ARLINGTON

← 24



CHESTNUT

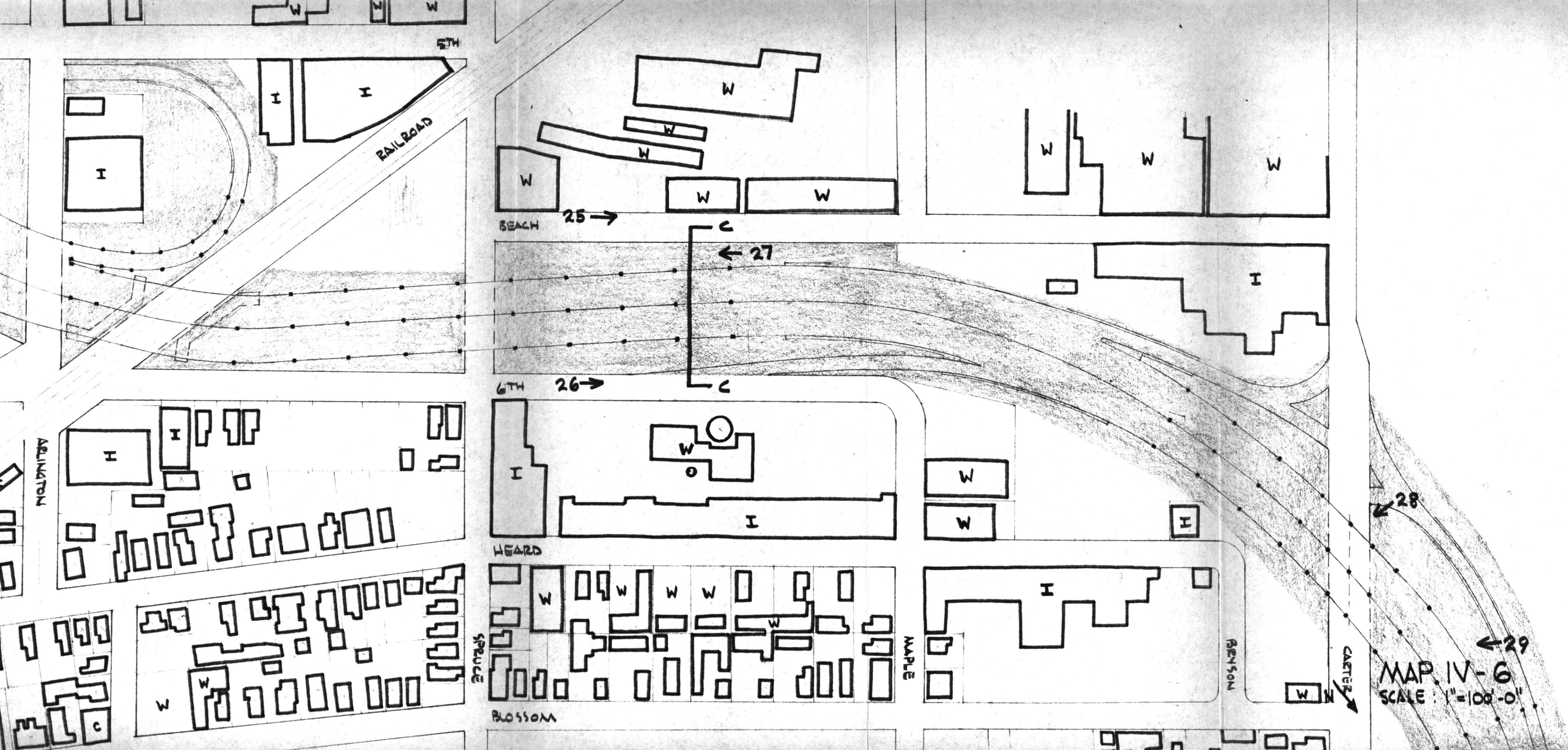
CHERRY

EVERETT

BROADWAY

CITY HALL

MAP IV-5
SCALE: 1" = 100'-0"





R

BASSETT COUNTY

WASHINGTON

SAGAMORE

CHEEVER

REVERE BEACH PARKWAY

MURRAY

JEFFERSON

WINTHROP

WARREN

WASHINGTON

BLOOMINGDALE

ORANGE

ADDISON

BLOSSOM

CARTER

32

33

34

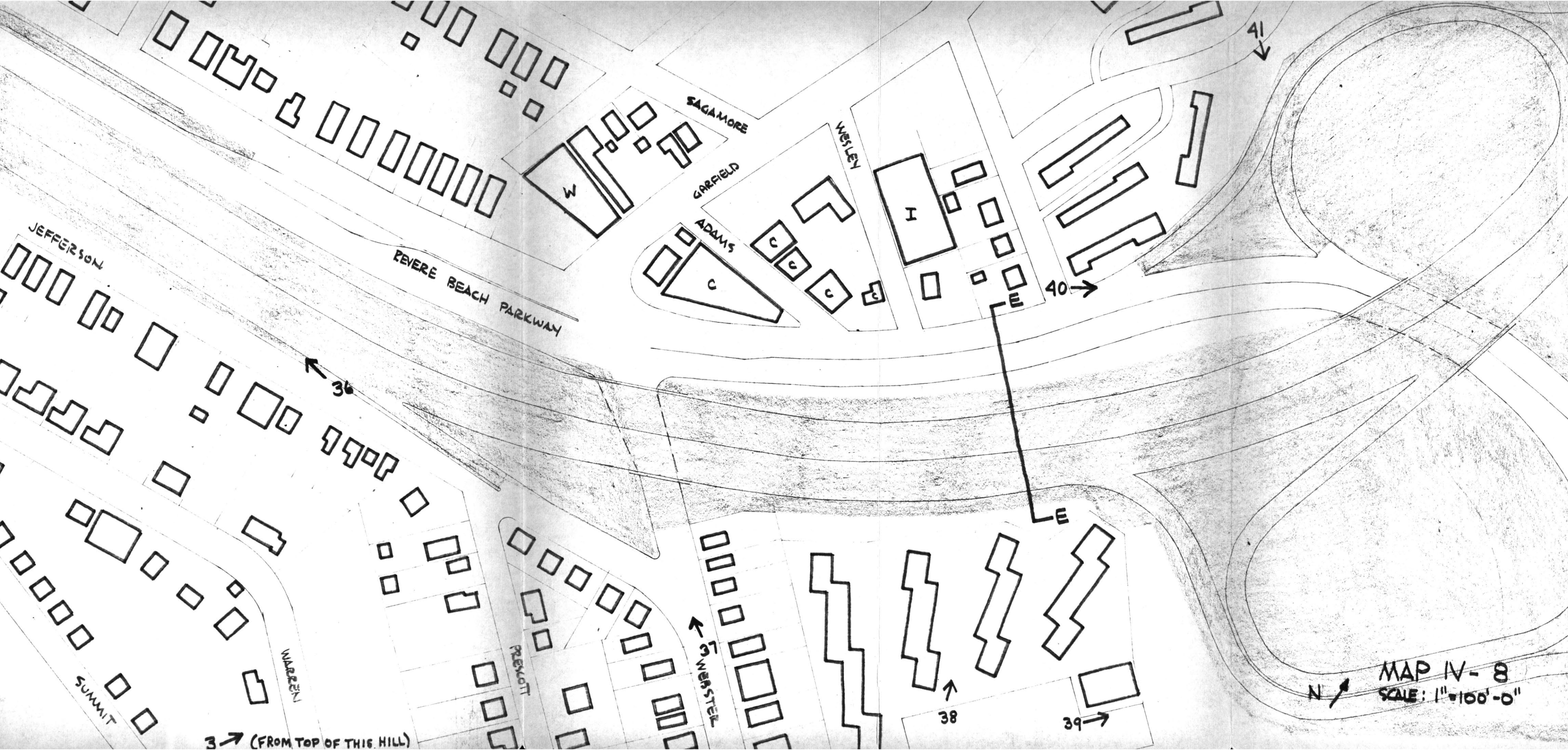
35

31

30

29

MAP IV
SCALE: 1" = 100' - 0"



SAGAMORE

WESLEY

GARFIELD

ADAMS

PEVERE BEACH PARKWAY

JEFFERSON

WARREN

PRESCOTT

WABSTER

SUMMIT

3 → (FROM TOP OF THIS HILL)

W

I

C

C

C

E

40 →

41 ↘

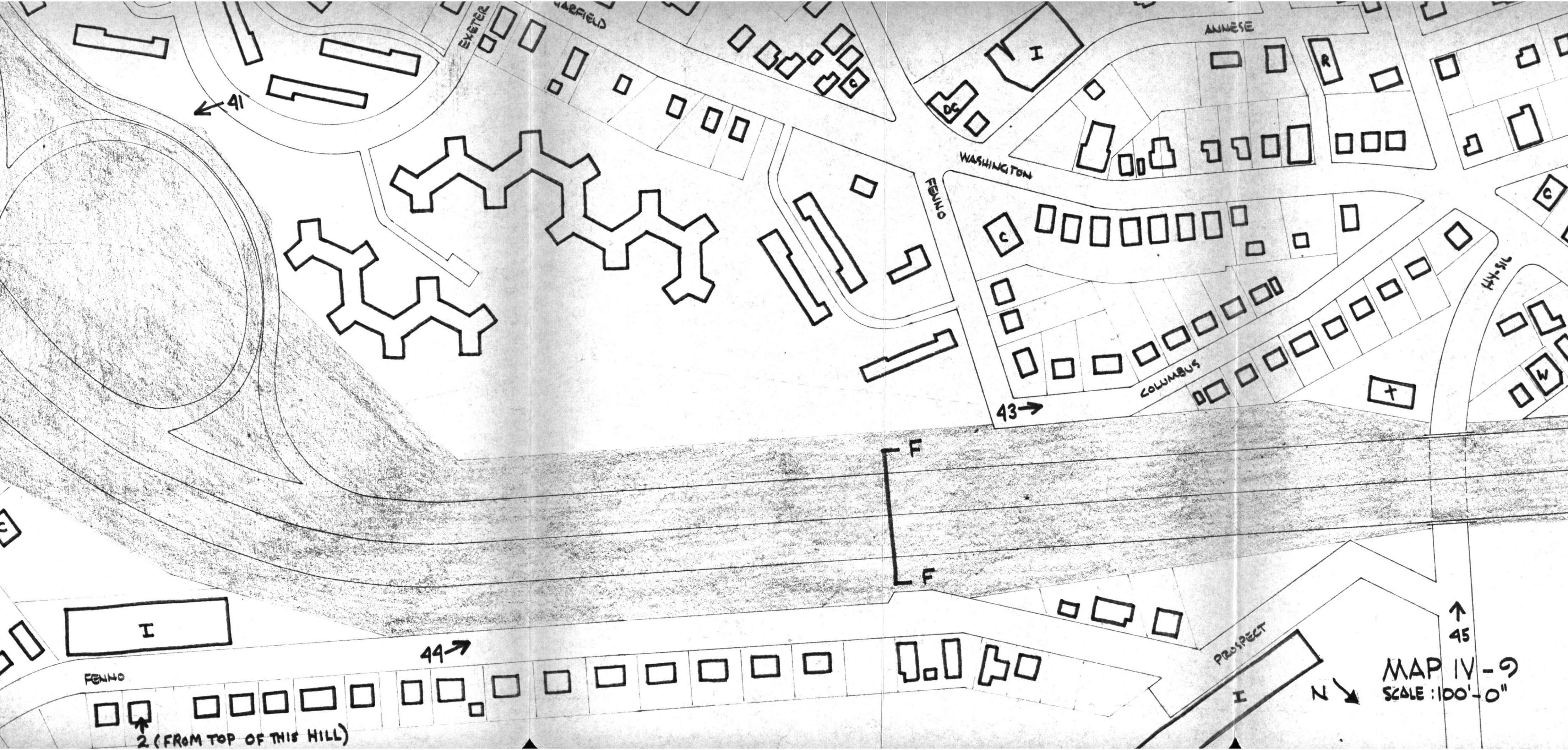
E

38 ↑

39 →

N ↗

MAP IV - 8
SCALE: 1" = 100'-0"



41 →

44 →

43 →

↑ 45

MAP IV-9
SCALE: 100'-0"

N ↘

2 (FROM TOP OF THIS HILL)

FENNO

PROSPECT

COLUMBUS

WASHINGTON

ANNISE

EVETER

MARFIELD

I

I

R

C

C

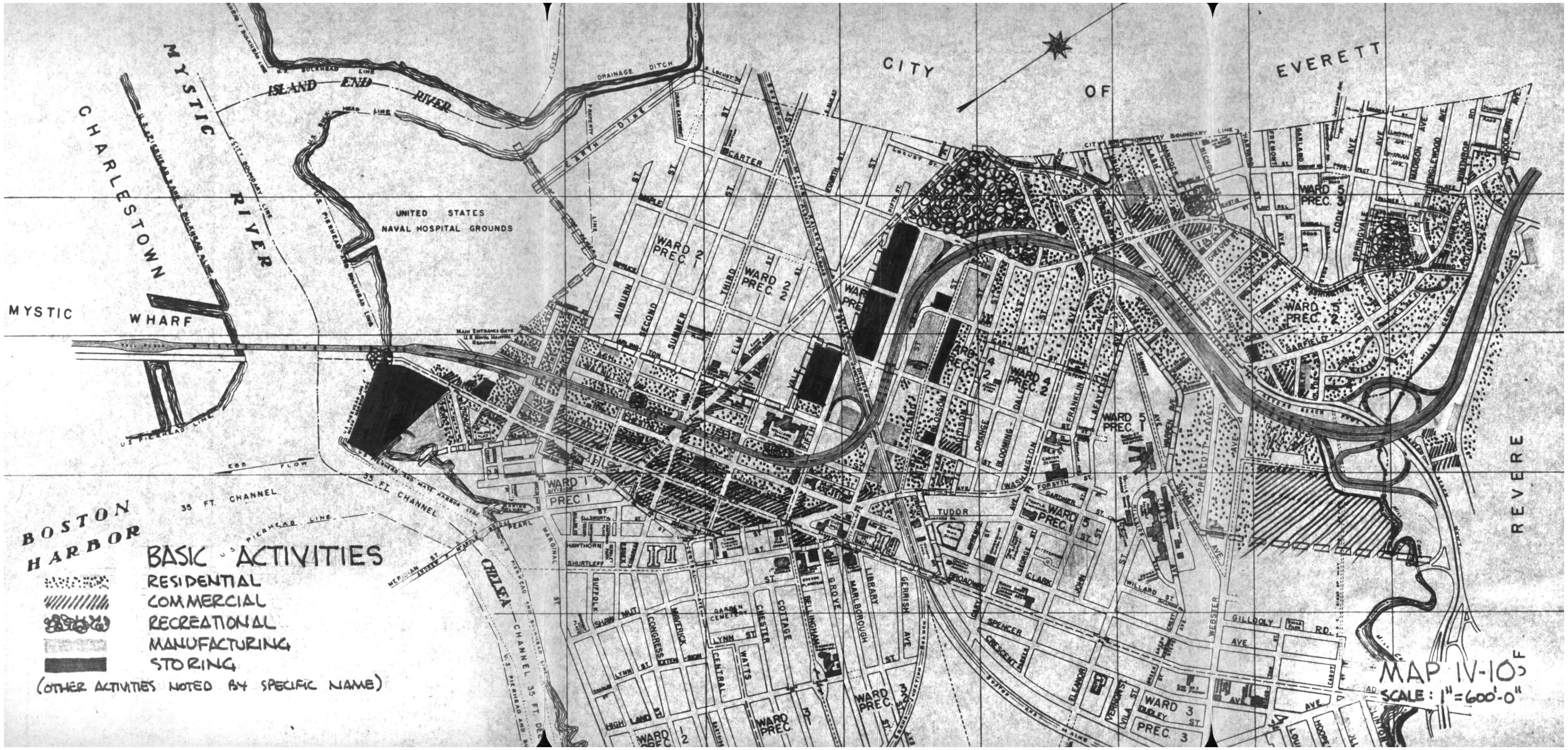
+

W

E






F

F

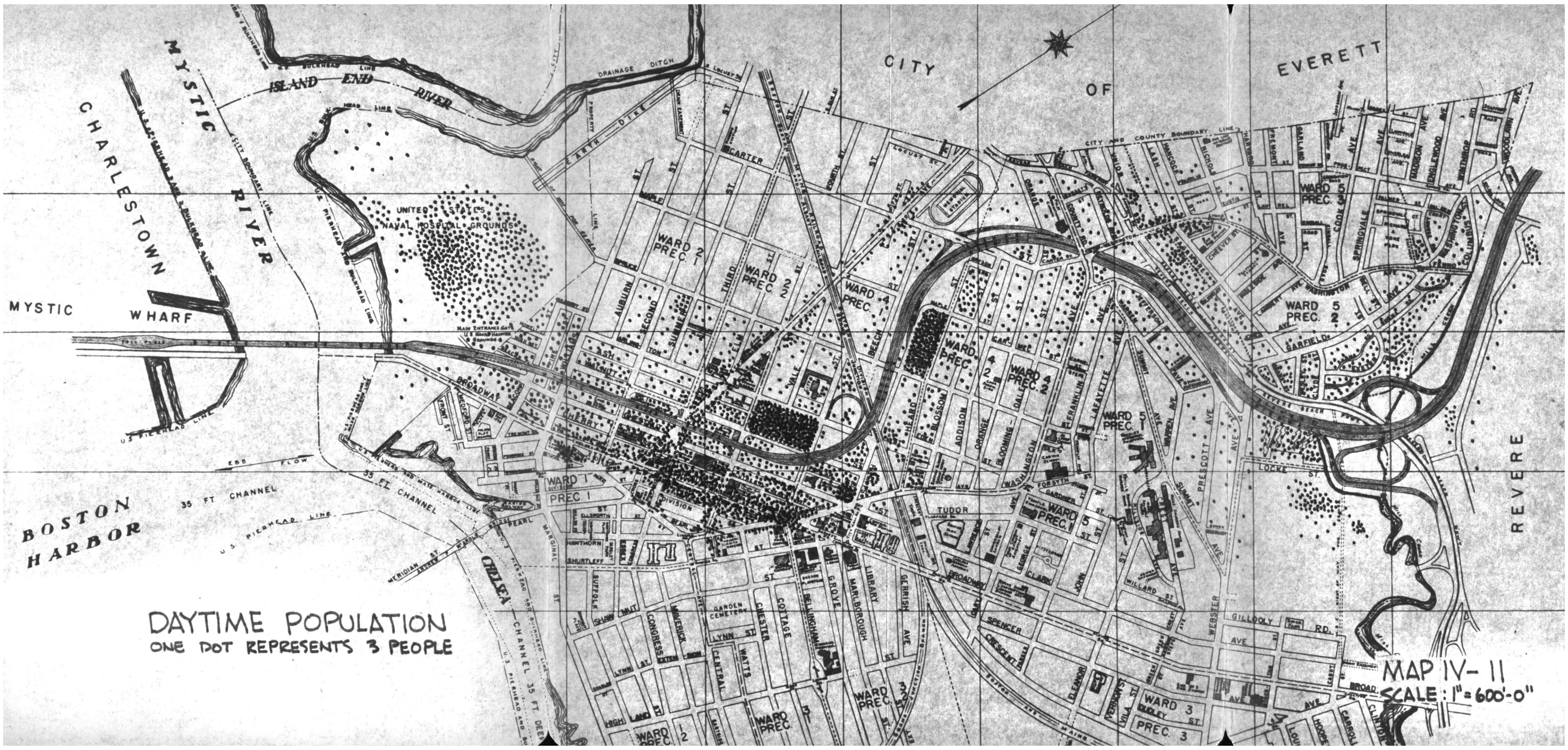


BOSTON HARBOR

BASIC ACTIVITIES

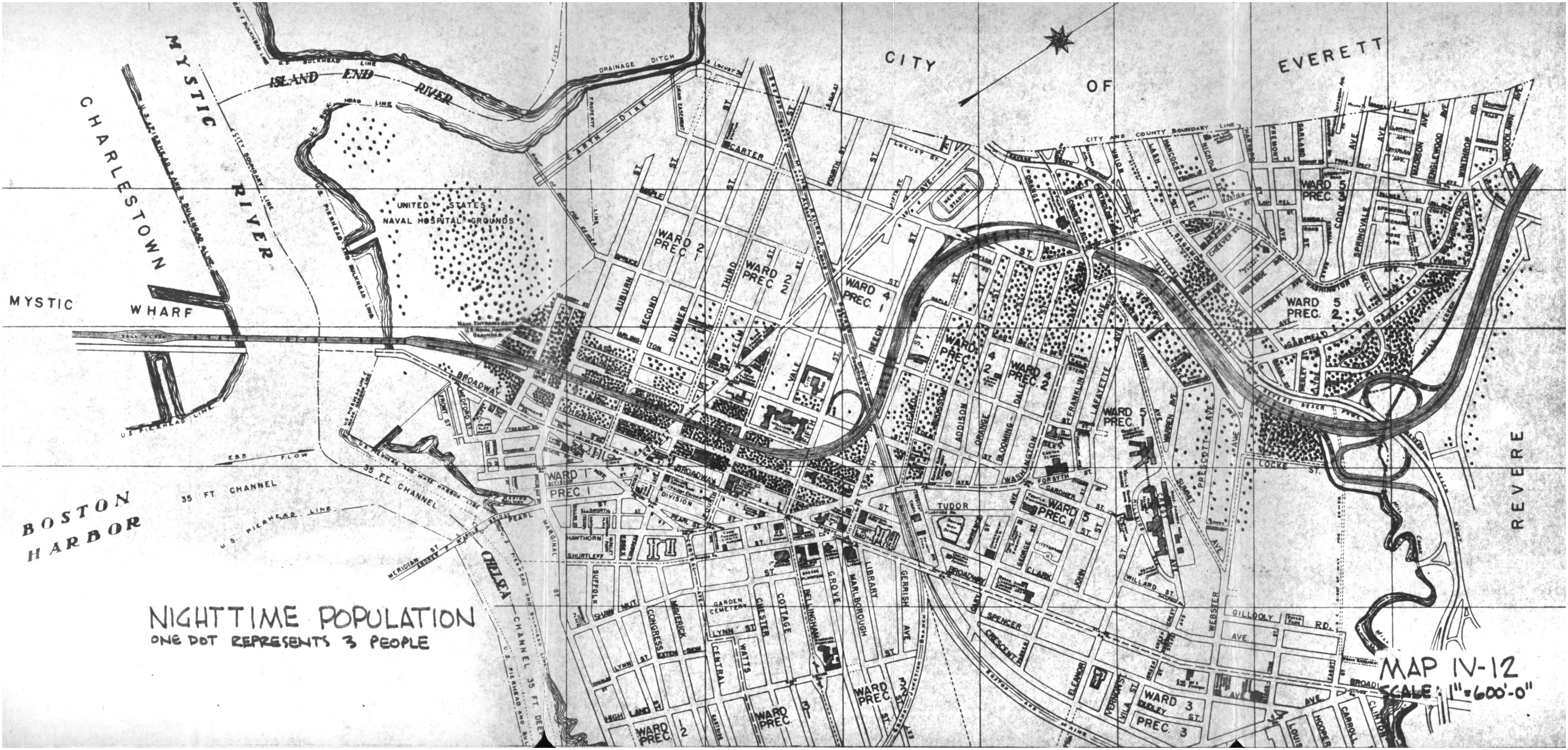
-  RESIDENTIAL
 -  COMMERCIAL
 -  RECREATIONAL
 -  MANUFACTURING
 -  STORING
- (OTHER ACTIVITIES NOTED BY SPECIFIC NAME)

MAP IV-105
SCALE: 1" = 600'-0"



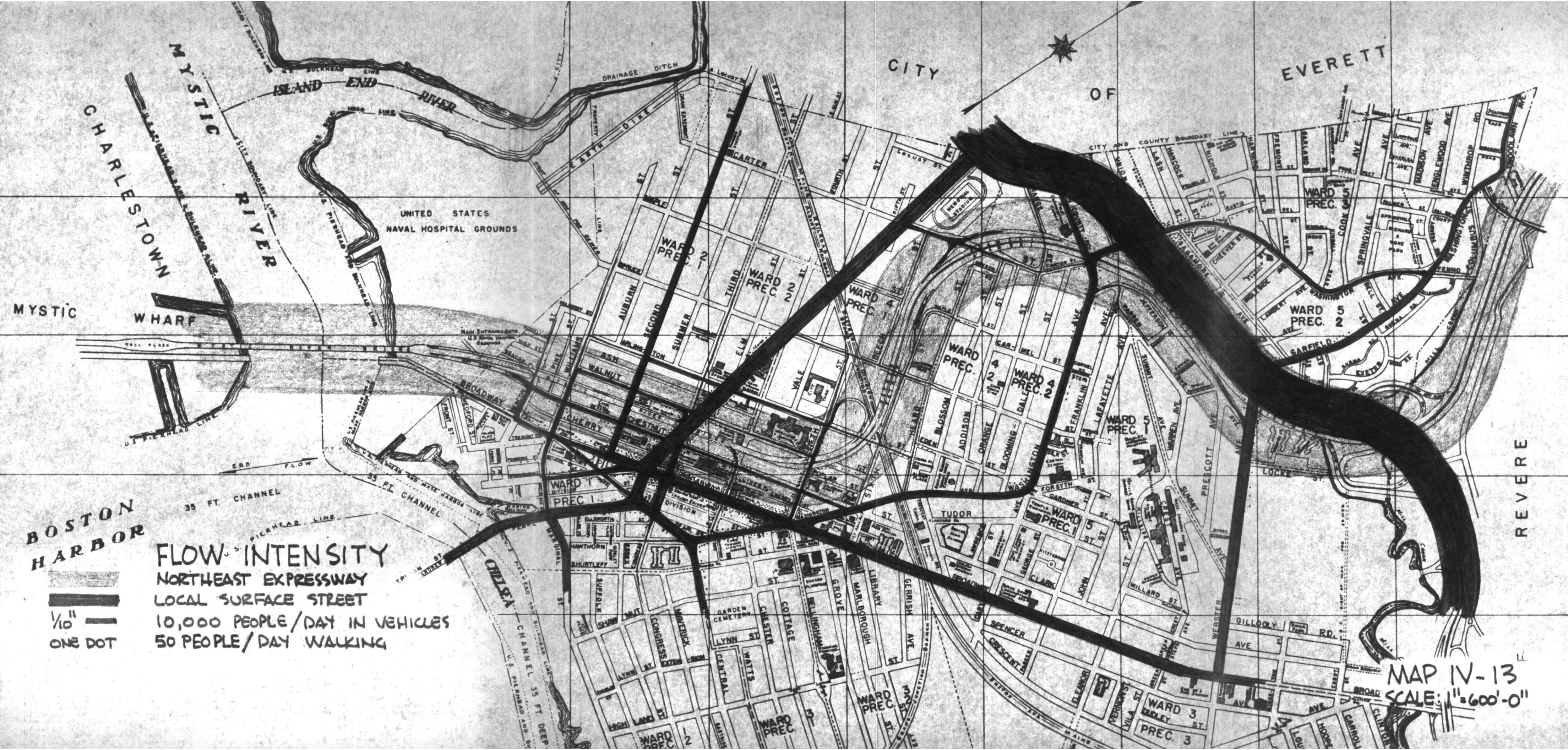
DAYTIME POPULATION
ONE DOT REPRESENTS 3 PEOPLE

MAP IV-11
SCALE: 1" = 600'-0"



NIGHTTIME POPULATION
 ONE DOT REPRESENTS 3 PEOPLE

MAP IV-12
 SCALE: 1" = 600'-0"



CITY OF BOSTON
EVERETT

BOSTON HARBOR

FLOW INTENSITY
NORTHEAST EXPRESSWAY
LOCAL SURFACE STREET
10,000 PEOPLE/DAY IN VEHICLES
50 PEOPLE/DAY WALKING

1/10" —
ONE DOT

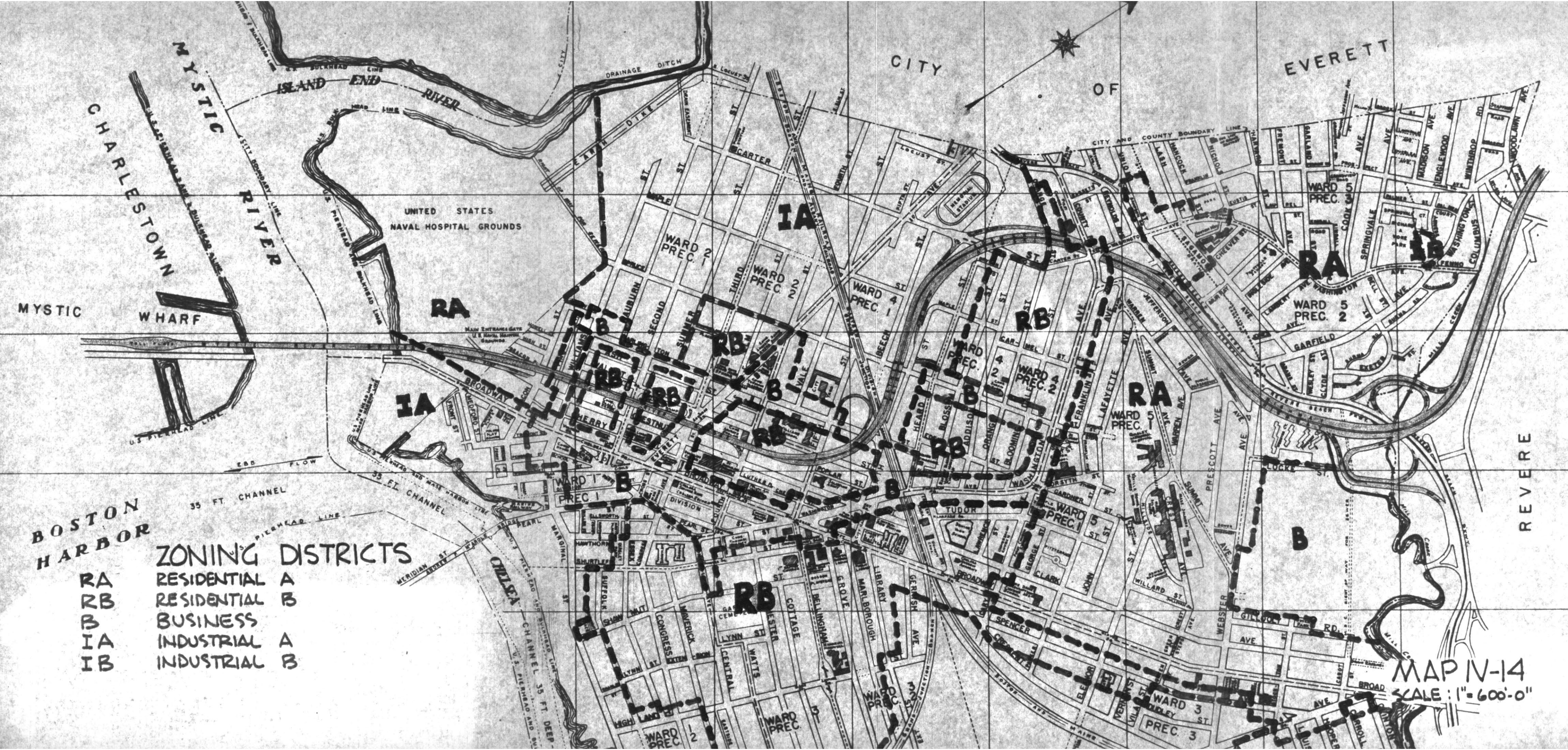
MAP IV-13
SCALE: 1" = 600'-0"

CHARLESTOWN
MYSTIC RIVER
ISLAND END

WARD PREC. 2
WARD PREC. 1
WARD PREC. 4
WARD PREC. 5
WARD PREC. 3

WARD PREC. 5
WARD PREC. 2
WARD PREC. 1
WARD PREC. 3

REVERE



CITY OF

EVERETT

REVERE

MYSTIC WHARF

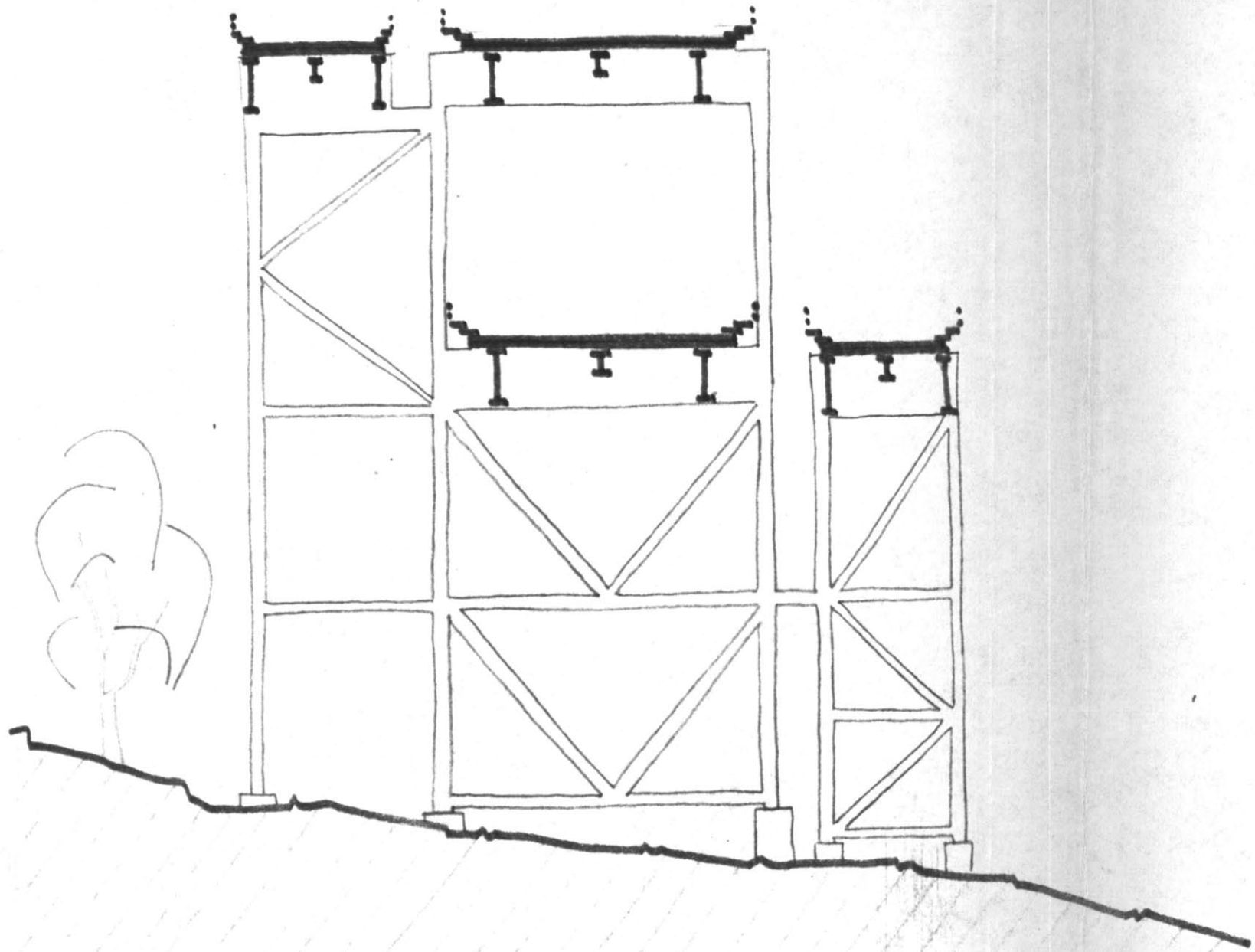
BOSTON HARBOR

UNITED STATES NAVAL HOSPITAL GROUNDS

ZONING DISTRICTS

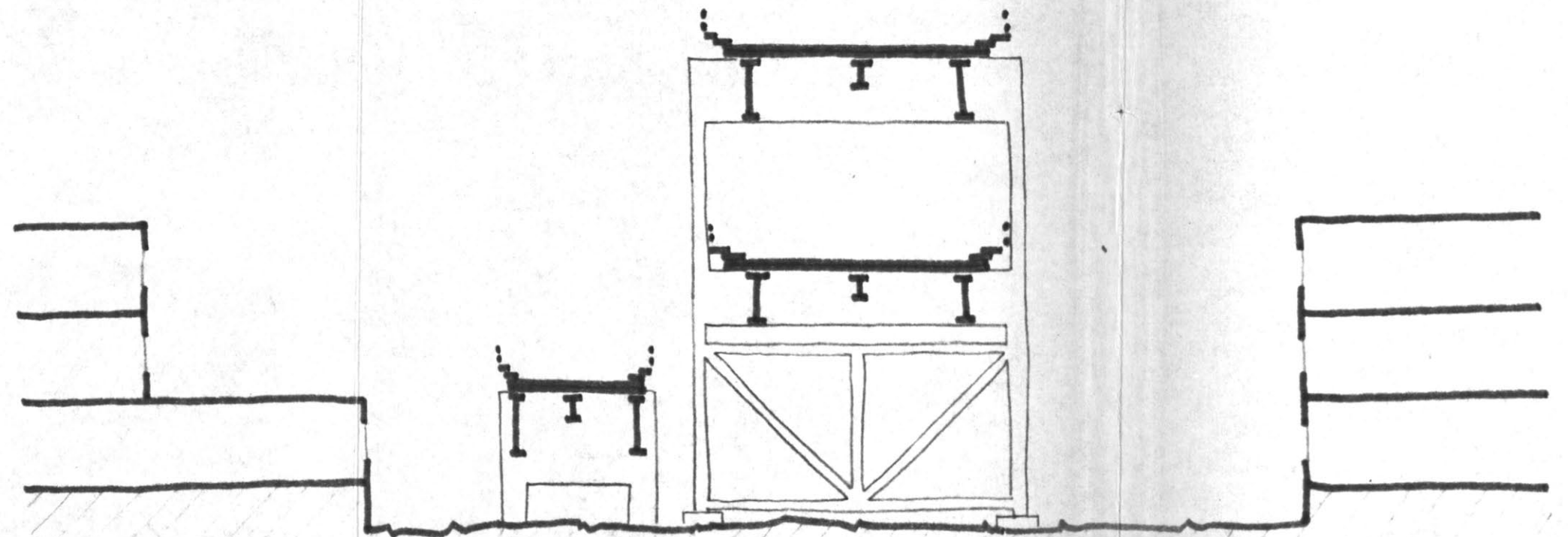
- RA RESIDENTIAL A
- RB RESIDENTIAL B
- B BUSINESS
- IA INDUSTRIAL A
- IB INDUSTRIAL B

MAP N-14
SCALE: 1" = 600'-0"



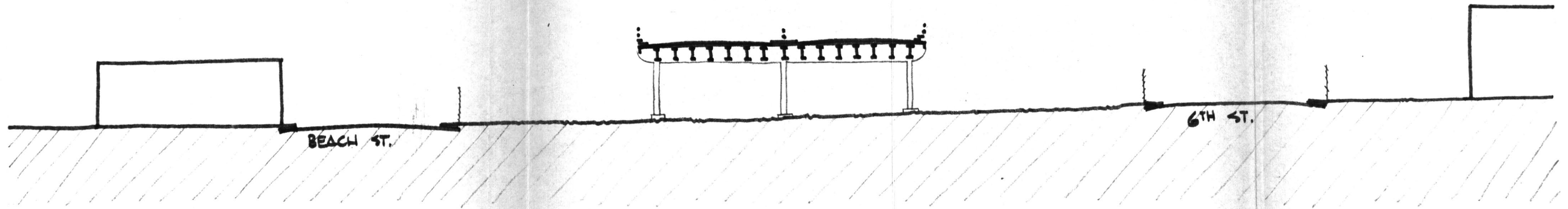
CROSS-SECTION A-A

FIGURE IV-1
SCALE: 1" = 20'-0"



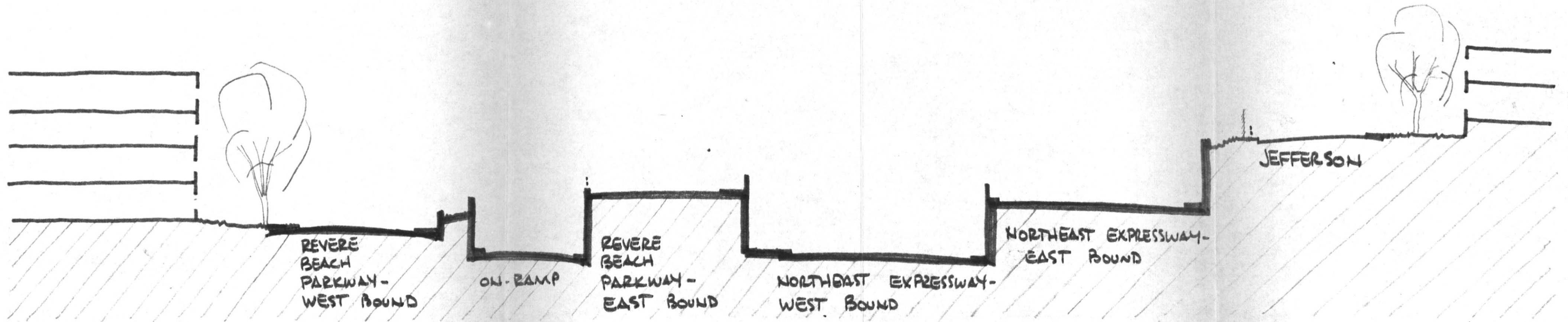
CROSS-SECTION B-B

FIGURE IV-2
SCALE 1" = 20'-0"



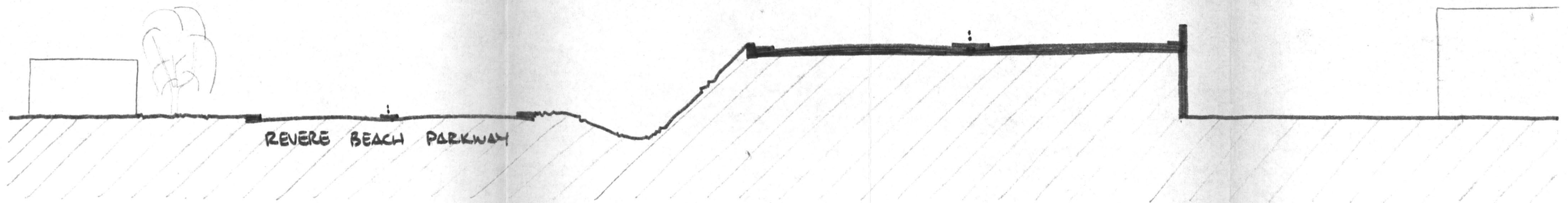
CROSS-SECTION C-C

FIGURE IV-3
SCALE: 1" = 20'-0"



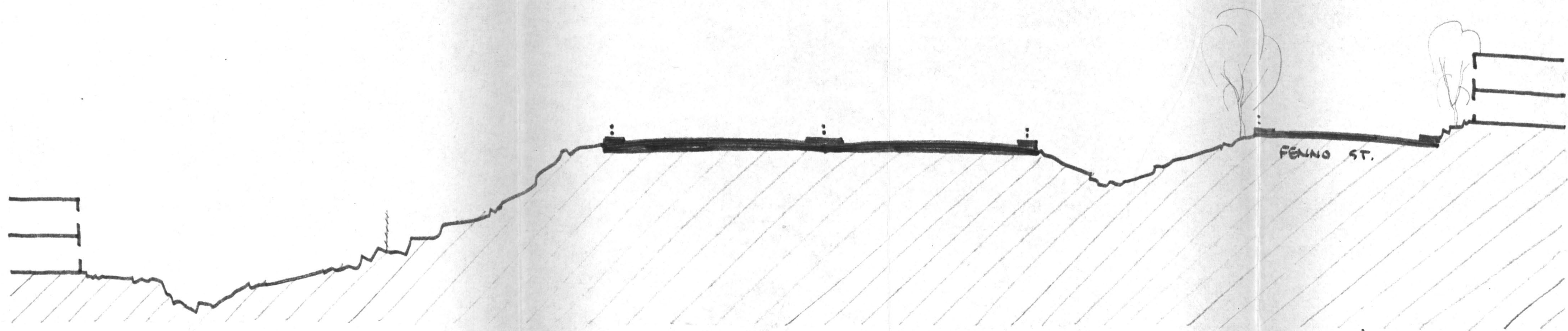
CROSS-SECTION D-D

FIGURE IV-4
SCALE: 1" = 20'-0"



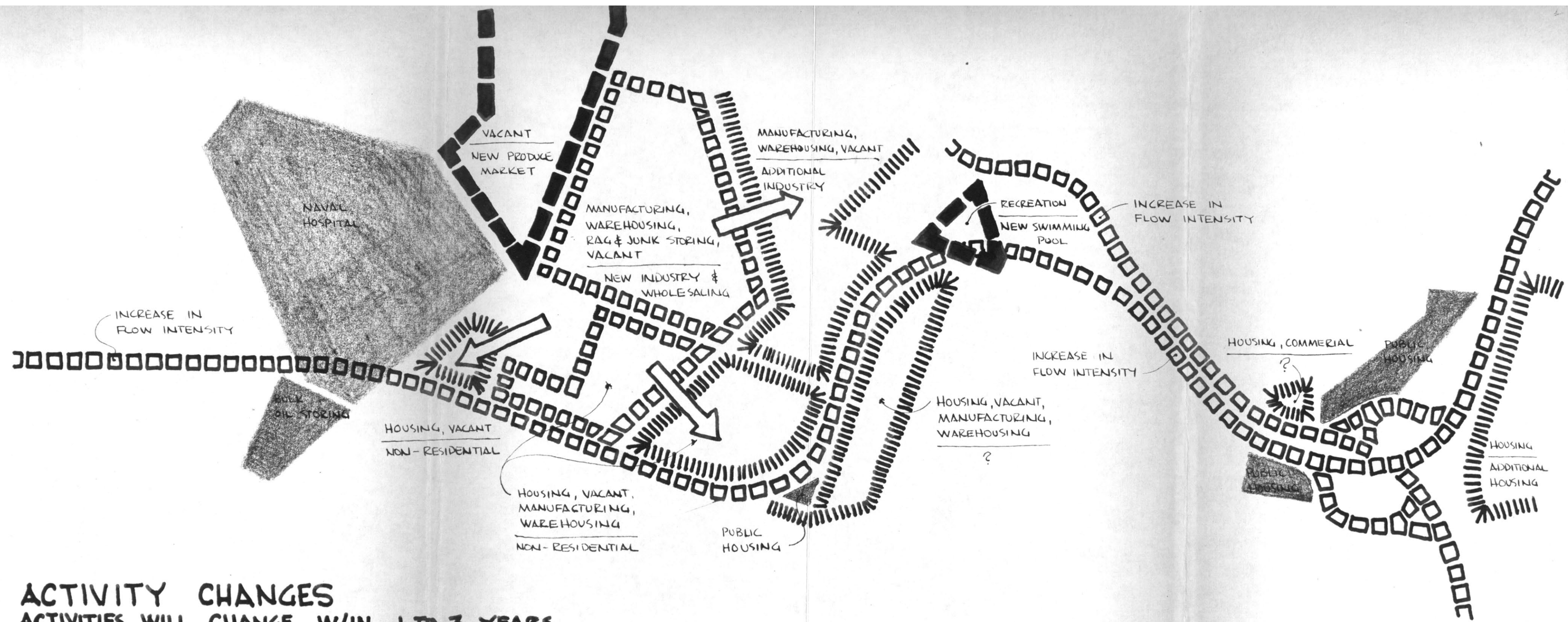
CROSS - SECTION E-E

FIGURE IV-5
SCALE: 1" = 20'-0"








CROSS-SECTION F-F

FIGURE IV-6
SCALE: 1" = 20'-0"



ACTIVITY CHANGES

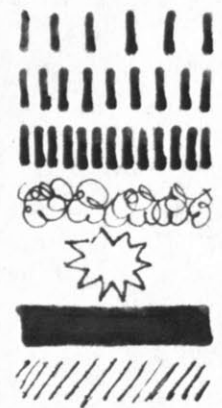
- ACTIVITIES WILL CHANGE W/IN 1 TO 3 YEARS
- ACTIVITIES PROBABLY CHANGE W/IN 3 TO 5 YEARS
- ACTIVITIES POSSIBLY CHANGE W/IN 7 TO 10 YEARS
- NO MAJOR ACTIVITY CHANGE W/IN 10 TO 15 YEARS
- POSSIBLE INFLUENCE ON FUTURE ACTIVITY

EXISTING ACTIVITY

FUTURE ACTIVITY

DIAGRAM IV-1
SCALE OF BASE MAP: 1"=600'



UNDESIRABLE NOISE, FUMES, LIGHT
NOISE ABOVE ALLOWABLE LEVEL BY:
10-20 dB (A)
20-30
30+
FUMES DETECTABLE
UNDESIRABLY HIGH ARTIFICIAL LIGHT
UNDESIRABLY LOW ARTIFICIAL LIGHT
DIRECT SUNLIGHT BLOCKED

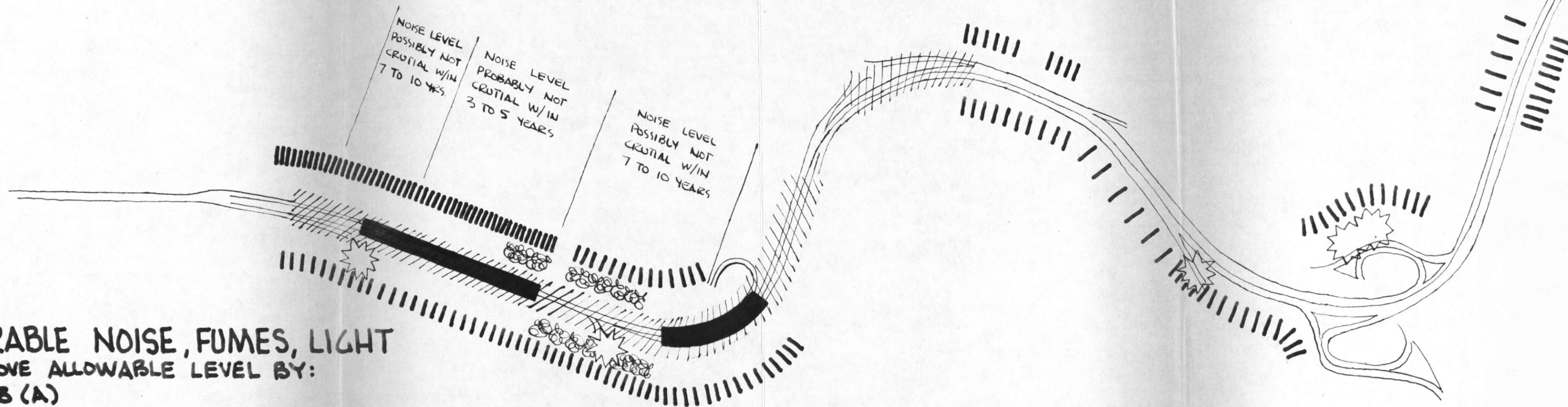
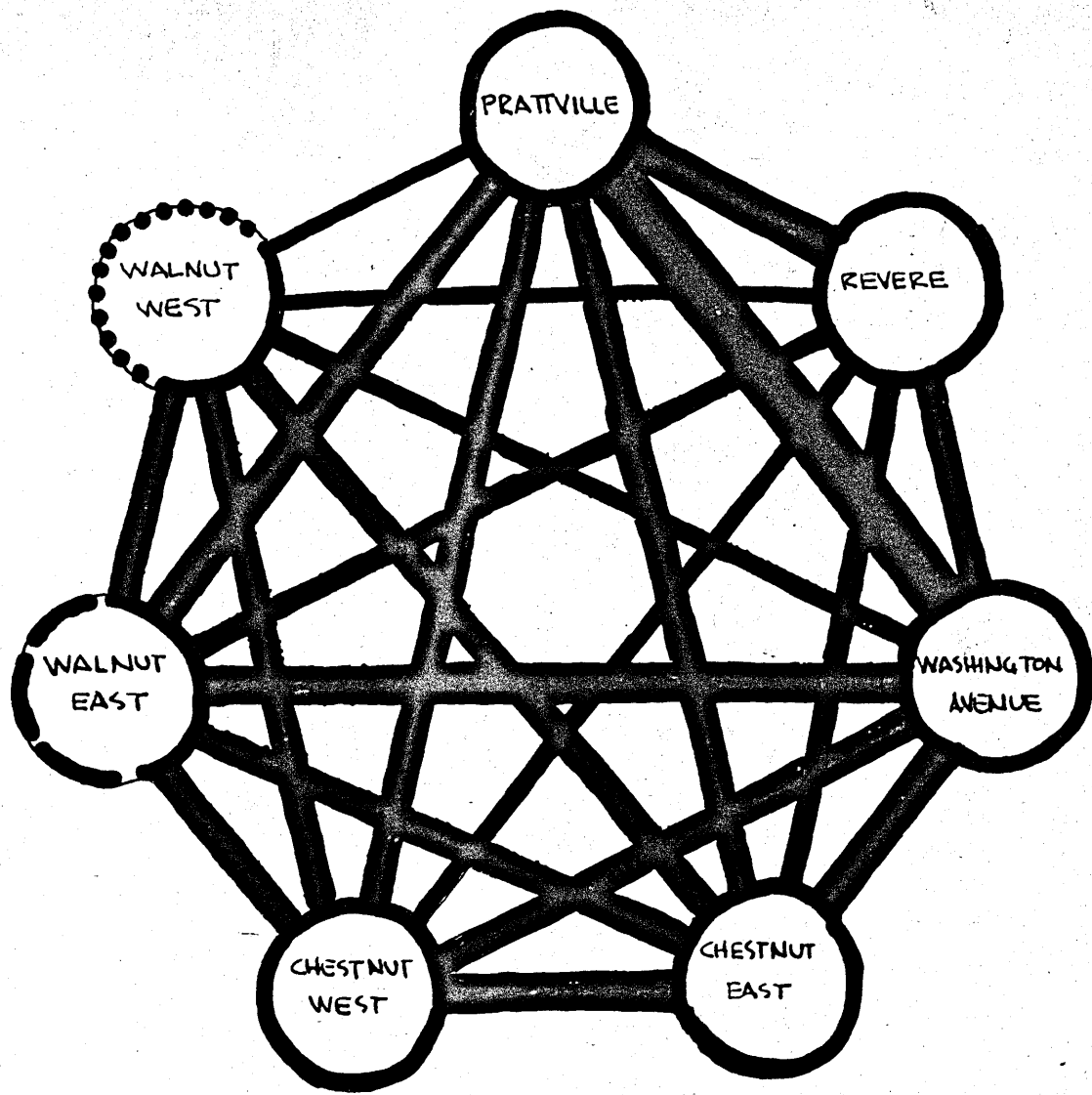


DIAGRAM IV-2
SCALE OF BASE MAP: 1"=600'



SOCIAL INTERACTIONS
RESIDENTIAL AREAS
 ACTIVITY WILL NOT CHANGE
 POSSIBLY NOT EXIST 7 TO 10 YRS.
 PROBABLY NOT EXIST 3 TO 5 YRS.
 RELATIVE STRENGTH OF
 INTERACTION

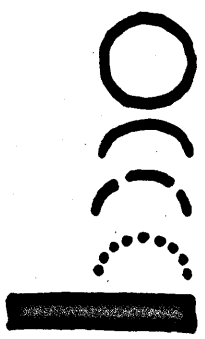


DIAGRAM IV-3

NUMBER OF JOBS AVAIL-
 ARLE PROBABLY INCREASE
 W/IN 3 TO 5 YEARS

NUMBER OF RESIDENTS
 PROBABLY DECREASE BY
 ABOUT HALF W/IN 3 TO
 5 YEARS, POSSIBLY NO
 LONGER RESIDENTIAL W/IN
 7 TO 10 YEARS

ECONOMIC INTERACTIONS
 RESIDENTIAL AREAS
 EMPLOYMENT AREAS
 200 EMPLOYEES
 COMMERCIAL AREAS
 SUBREGIONAL
 C.B.D.
 NEIGHBORHOOD
 ESTIMATED MARKET AREA
 POTENTIAL CHANGE IN ACTIVITY
 LOCATION OF EXPRESSWAY

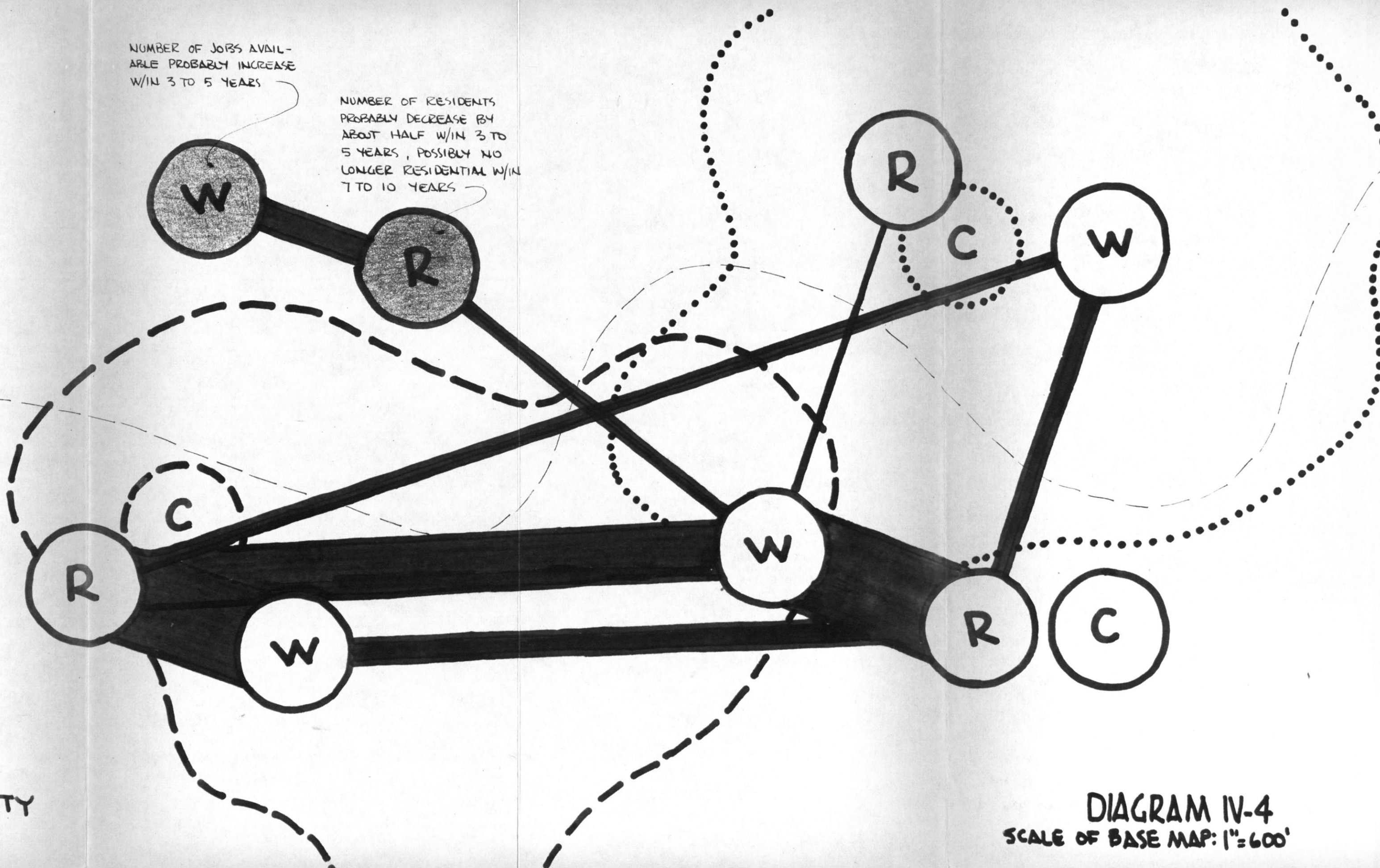
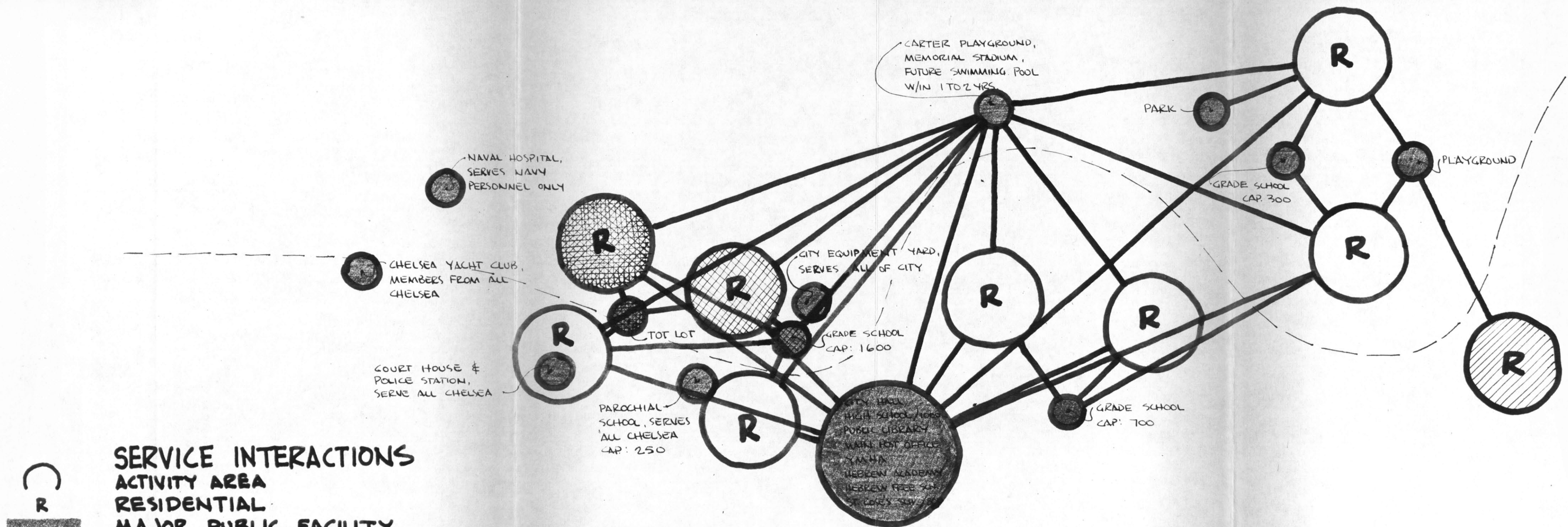


DIAGRAM IV-4
 SCALE OF BASE MAP: 1"=600'



SERVICE INTERACTIONS

- ACTIVITY AREA
- RESIDENTIAL
- MAJOR PUBLIC FACILITY
- POSSIBLE INCREASE IN PRESENT ACTIVITY W/IN 7 TO 10 YRS.
- PRESENT ACTIVITY POSSIBLY NOT EXIST W/IN 7 TO 10 YRS.
- PRESENT ACTIVITY PROBABLY NOT EXIST W/IN 3 TO 5 YRS.
- LOCATION OF EXPRESSWAY



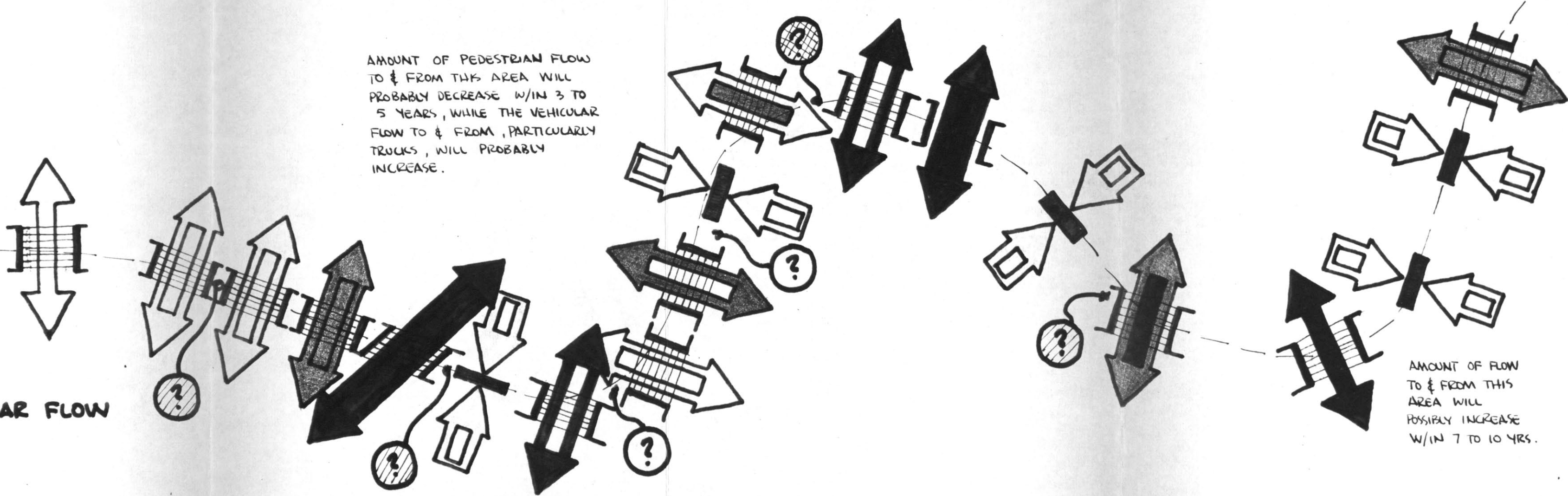
DIAGRAM IV-5
SCALE OF BASE MAP: 1"=600'



FLOW CONDITIONS

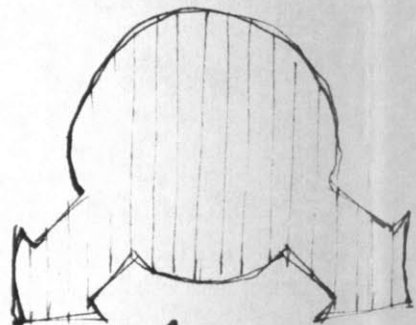
- VEHICULAR FLOW
- PEDESTRIAN & VEHICULAR FLOW
- MAJOR FLOW
- SECONDARY
- MINOR
- BARRIER TO FLOW
- SIDE RESTRICTIONS
- OVERHEAD RESTRICTIONS
- CONFUSING CONNECTION TO EXPRESSWAY
- CONFUSING CONNECTION FROM EXPRESSWAY
- CONFUSING CONNECTION BOTH TO & FROM EXPRESSWAY
- LOCATION OF EXPRESSWAY

AMOUNT OF PEDESTRIAN FLOW TO & FROM THIS AREA WILL PROBABLY DECREASE W/IN 3 TO 5 YEARS, WHILE THE VEHICULAR FLOW TO & FROM, PARTICULARLY TRUCKS, WILL PROBABLY INCREASE.

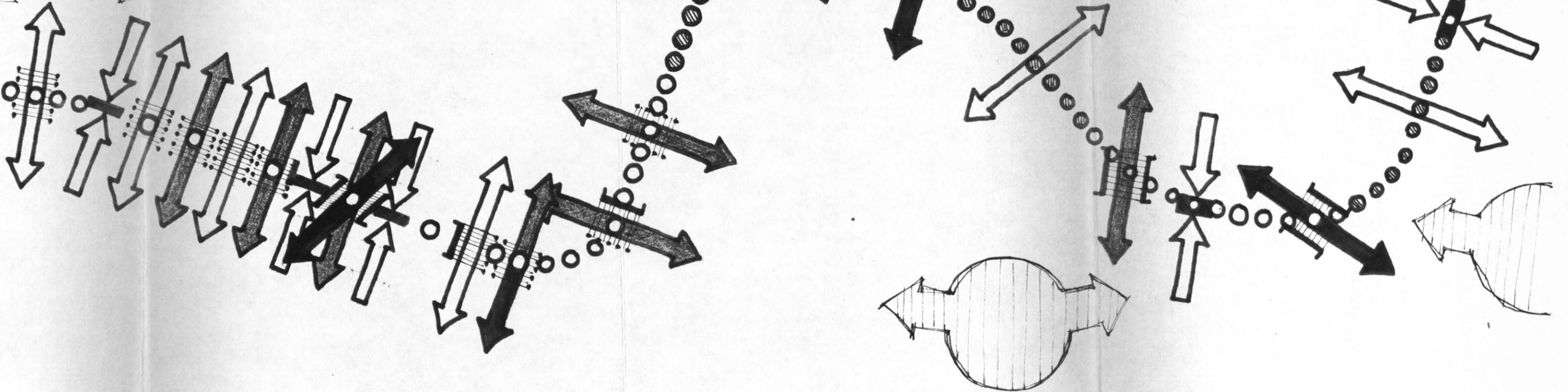


AMOUNT OF FLOW TO & FROM THIS AREA WILL POSSIBLY INCREASE W/IN 7 TO 10 YRS.

DIAGRAM IV-6
SCALE OF BASE MAP: 1"=600'



DESIRABLE VIEW
CONDITIONS OF THIS
AREA WILL PROBABLY
CHANGE W/IN 3 TO
5 YEARS.



VIEW CONDITIONS

DESIRABLE VIEW

MAJOR VIEW

SECONDARY

MINOR

VIEW BLOCKED

SIDE RESTRICTIONS - SOLID

SIDE RESTRICTIONS - SCREEN

OVERHEAD RESTRICTIONS

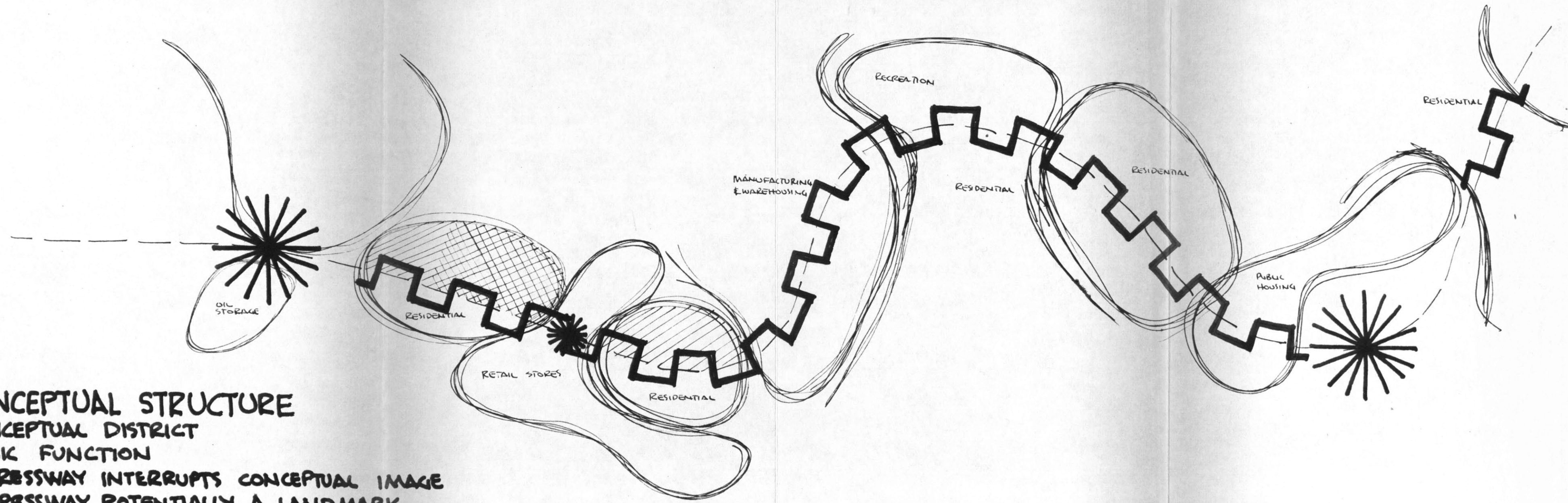
EXPRESSWAY FORM HIGHLY VISIBLE

EXPRESSWAY FORM & ACTIVITY HIGHLY VISIBLE

DISTANT VIEW OF EXPRESSWAY POSSIBLE

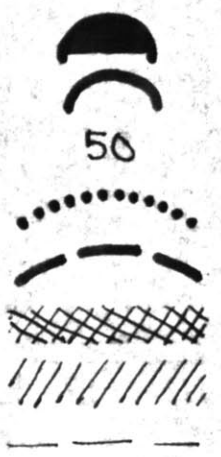


DIAGRAM IV-7
SCALE OF BASE MAP: 1" = 600'



CONCEPTUAL STRUCTURE
CONCEPTUAL DISTRICT
BASIC FUNCTION
EXPRESSWAY INTERRUPTS CONCEPTUAL IMAGE
EXPRESSWAY POTENTIALLY A LANDMARK
LOCATION OF EXPRESSWAY
PROBABLE CHANGE IN CONCEPTUAL DISTRICT W/IN 3 TO 5 YRS.
POSSIBLE CHANGE IN CONCEPTUAL DISTRICT W/IN 7 TO 10 YRS.

DIAGRAM IV-8
SCALE OF BASE MAP: 1" = 600'



ACTIVITY NEEDS

COMMERCIAL PARKING
RESIDENTIAL PARKING
REQUIRED CAPACITY

RECREATIONAL SPACE NEEDED W/IN THIS AREA
EDUCATIONAL SPACE NEEDED W/IN THIS AREA
PROBABLE ACTIVITY CHANGE W/IN 3 TO 5 YRS.
POSSIBLE ACTIVITY CHANGE W/IN 7 TO 10 YRS.
LOCATION OF EXPRESSWAY

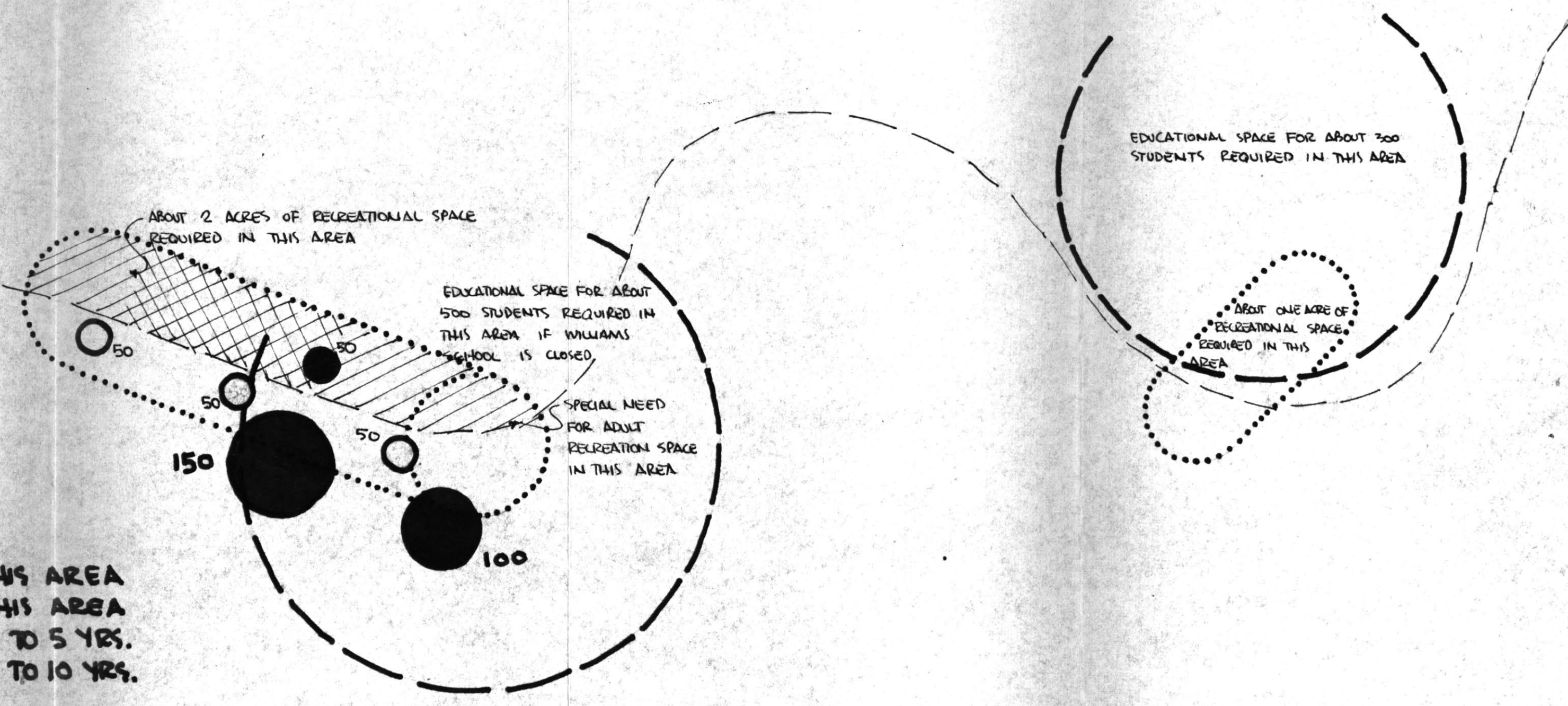


DIAGRAM IV-9
SCALE OF BASE MAP: 1" = 600'

Chapter V: Design Proposals for Use of the Space Around the Expressway Study Sector

The purpose of this chapter is to present various design ideas for improving the environment adjacent to an urban expressway, causing the expressway and its right-of-way to contribute positively to the larger pattern of form and activity around it. As indicated in Chapter One, these design ideas are controlled by two suppositions in addition to the sensuous criteria presented in Chapter Three. First, we shall limit ourselves mainly to making design proposals for the space within the Expressway right-of-way. Secondly, we shall attempt to make proposals involving minimum in-place cost. Since it was not possible to estimate and compare actual costs of design proposals, I had to rely on my background and intuition while developing the proposals. The design ideas to be presented in this chapter, then, may not be the least costly possible but they are probably at the low-cost end of the scale.

When we were discussing the relevant physical characteristics of the Expressway study sector in the last chapter, it was indicated that there were six sections of the study sector distinguishable from one another by differences in their basic cross-sections. (See Map IV-3.) These same study sector sections will be referred to when presenting the design ideas. We shall

begin by discussing Expressway section two, the double-decked, elevated, column supported portion between high density residential areas. This part of the study sector seems to have the most problems associated with it and it is also similar in cross-section to many other urban expressways.

1. Design Ideas for Section Two of the Study Sector

Noise is a problem all along this section of the Expressway. Noise level can be controlled at three places--at the noise source, at the noise receiver, or along the path the noise travels from one to the other. The source of the noise, the vehicles, is not under our control nor is the receiver, the individual person. In addition, it is difficult to reduce the noise level of existing vehicles a significant amount and it will be some time before more quiet electric engines are feasible economically. It seems reasonable, then, to control the noise level by affecting the path. Since we have taken the environment adjacent to the Expressway as a given, it is not possible to increase the distance between the source and the receiver thus lengthening the path. We must therefore block the path of the sound, either close to the source or close to the receiver.

The obvious block which occurs is formed by the wall and windows of a building. Any new building around the Expressway should have external walls which in all will be able to reduce the noise level between outside and inside

by up to 20-30 dB(A). This reduction is possible with contemporary construction and materials. It is also possible to install new windows in the existing buildings but this would be costly. Since many of the existing buildings in this area are in poor physical condition and may be torn down in the near future, this rebuilding of windows seems somewhat unsatisfactory. In addition, if the noise is to be reduced significantly by the window, it must be kept closed and this means some type of air-conditioning would have to be provided in the building. All of this can be expensive and complicated to administrate or control and obviously we have not affected the noise level of the space adjacent to the Expressway. We suggest, then, that the most effective barrier would be located close to the source so as to reduce the noise level in the outside space adjacent to the Expressway and at the same time reduce the amount of insulation required at the building surface.

Since the required noise level maximums may increase along one side of the Expressway, it would be permissible to remove the sound barrier at that time. Diagram V-1 shows the type of acoustical barrier that could be used. Its width is based on the distance between the existing handrail supports. If the handrails were removed, this panel could be attached between the uprights and easily removed at a later date. The height of the barrier is determined by the relationship between the location of

noise source and receiver--it must block the direct path between these two points.

We suggest that this type of panel be used on both sides of the Expressway as it seems to be a simple and relatively inexpensive way to block the noise and yet it is completely removable if need be (if the Expressway needs expanding, if maximum allowable noise levels increase, etc.). Where there were no handrails, as along the lower parts of the off/on ramps and where one level of the Expressway is on grade, it would be necessary to install supports similar to those of the existing handrail to hold the acoustical panels. Where less change of criteria and needs was foreseen for the future, the barrier could be poured-in-place concrete at the locations without handrails or in the case where the Expressway is at ground level, simply an earth berm. Such a berm and its possibilities are shown in Diagram V-2.

In addition to blocking the noise with an acoustical barrier, sound absorbing material should be applied to the surfaces of the Expressway structure which may otherwise reflect sound into the adjacent environment. A spray-on variety of insulation would be most adaptable to the complicated forms of the Expressway structure.

It cannot be denied that the type of solution being suggested here can limit the view of the person on the Expressway. However, all the panels need not be of a solid material. At locations where views from the road

were important--views of the destination of off ramps or of major landmarks--it would be possible to use transparent panels. This type of panel, however, would probably cost more to begin with and would require special maintenance to be kept clean.

Another technique which might be used would be reduction of the height of the acoustical panels to permit a view over them. This would of course reduce their effectiveness for blocking noise. In some places it may only be necessary to reduce the noise on one side of the Expressway, while letting in sun and air and permitting a view on the other side. A change in the adjacent land uses might make this a possibility. It should finally be remembered that the part of the Expressway in this built-up residential area that requires such drastic solutions to the noise problem is only one-half mile long and so would not necessarily be unbearable to drive through. Panels could be colored and lit to provide a pleasant atmosphere.

Obviously, the problems created by the conflict in values between the person on the Expressway and the person adjacent to it need special attention. We must be aware of where such conflicts might occur and what they imply for the attainment of various objectives. Our main intent here, however, is to consider what may be done to the Expressway from the point of view of the person adjacent to it.

In addition to blocking the noise, these acoustical barriers we are suggesting will help reduce fume levels adjacent to the Expressway. Calculations would have to be made to then determine the fume levels which might build up within the space enclosed by the barriers. It may be necessary to provide ventilation to remove excessive fumes. This ventilation could be provided by occasionally leaving out acoustical barriers. Such openings would also provide at least brief views of the adjacent environment. They could occur where the noise problem was least critical and where the fumes coming out of them would not be disturbing to people. In areas which do not easily allow for such openings, it is possible to ventilate the Expressway by more elaborate means such as self-drawing chimneys or exhaust fans similar to those used in tunnels. These types of equipment increase the cost of solving the problems of the Expressway and making such expenditures when conditions might change significantly as in this part of the Expressway seems unwise.

The amount of natural light in the area around the Expressway is also affected by the proposed acoustical panels. Our field research has indicated that very little sunlight reaches the ground around this part of the Expressway. Adding the panels will not change that condition much. They might, however, provide opportunity to increase the amount of indirect sunlight by using light

toned reflecting colors on the surface of the panels. Occasionally there are deteriorated or unused buildings adjacent to the Expressway which might be removed, thereby increasing the direct and indirect sunlight in the right-of-way. This technique seems to be about the only significant way to increase the amount of direct sunlight.

There are also conditions of undesirable artificial light levels in this part of the study sector. The undesirable high light intensities in the study sector are caused by the headlights of vehicles as they come off the Expressway. This occurs at two specific points in the section we are now considering and at these two points it will be necessary to screen the lights close to the activities they disturb. (See Diagram IV-2.) This screening might be accomplished by evergreen planting or by use of a man-made screen. At Beacon Street a screening wall might form the back of a bus-stop shelter. At the Fourth Street off ramp location, available space for a screen is limited. There is, however, space now devoted to a sidewalk which could as easily accommodate a screen.

A screen cannot always be provided within the space under the control of the Expressway authority and so this must be done by other public or private interests. At Beacon Street there is both private and city-owned space available; at Fourth Street, only the Expressway

authority has the space to provide such a light screen for residents.

Low light intensity is much more common along the study sector. At night both pedestrians and drivers need light at those points where they pass under the Expressway and, as shown in Diagram IV-2, those points are now dimly lit. How the necessary light is provided is related to the design proposals for the flow, visual, and psychological linkage and barrier conditions and specific proposals will be made in that section which is to follow.

Improved flow, visual, and psychological connections across the Expressway are needed at two locations in this part of the study sector: at Everett Avenue and at Fifth Street. The Everett Avenue connection is the most important in terms of volume of movement and it will probably continue to be so in the ten to fifteen year future.

Diagram V-3 illustrates what might be done at the Everett Avenue location. These proposals contain a number of ideas. First, I tried to draw a clear distinction between the flow facilities for pedestrians and those for vehicles. The various required turning movements for vehicles have been clarified and the interconnection between the local and Expressway flow has been emphasized. I have also included certain amenities for pedestrians such as a widened and covered

walkway, an increased amount of light at improved locations, and bus-stop waiting areas.

Next, visual connections have been improved in two ways: The Expressway structure has been treated as a landmark common to activities on both sides of the Expressway. This has been done by using prominent vertical forms which include well lit and brightly colored signs calling attention to the vehicular flow interconnections. At the same time, horizontal elements which extend from one side of the Expressway to the other express visually the interrelationship between the respective activity areas.

In addition to manipulating conditions of flow and visual connections at this point, it is possible to deal directly with the activity pattern to strengthen the interconnections. Facilities for activities besides those which accommodate flow can be provided and these may be made to continue across the Expressway right-of-way. These facilities might include public telephones, mailboxes, trash containers, drinking fountains, public announcement and advertising displays, newspaper stands, and retail and office space. It should be noted that the Expressway support structure limits the amount of space which can be easily and inexpensively developed for retail and office facilities. It might be possible, however, for the Expressway authority itself to construct facilities and then subsidize rents to private interests.

They might also make the land available at low costs for private development.

Another way to manipulate the activity pattern to improve interconnections is to place interdependent activities on opposite sides of the Expressway. This is of course what created the need for the interconnections in the first place but reinforcing the original need can help strengthen the relationship. To produce such an interdependent activity pattern, however, requires more control than is available to the authority in charge of the Expressway. The city itself will have to regulate development outside the right-of-way and such a specific activity pattern may in fact require rather tight land use and development controls.

Finally, the strengthening and improving of the flow and visual interconnections and continuity of the activity pattern can help make the Expressway less of a barrier psychologically. There would then be more of a chance for a public conceptual image of the environment which included an interconnection between activity areas at this location.

The proposed facilities at Everett Avenue must be able to meet the future as well as present requirements for flow, view, and psychological connections across the Expressway right-of-way. The possible activity changes indicated in Diagram IV-1 can effect all three. First, for example, the location and intensity of vehicular and

pedestrian flow may change. Also, with relation to visual connections, new facilities will provide an opportunity to build for strong visual linkages across the Expressway. As a final example, relating to the psychological interconnections of the future, with the change from similar residential activities on both sides of the Expressway to a situation where there is a residential activity on one side and industrial on the other, the Expressway right-of-way facilities will need to serve as more of a transition than a link.

The possible activity changes imply that several levels of adaptability are required. The facilities which affect the flow and view interconnections, and through them the psychological structure, must be able to change both overall and in their various parts. Diagram V-3 indicates how this adaptability may be accomplished.

The other location of a major connection across this section of the study sector is at Fifth Street. Diagram V-4 indicates what might be done at this location. These design proposals involve ideas similar to those discussed for the Everett Avenue connections. It should be noted again that some of these proposals involve areas outside the jurisdiction of the Expressway authority. This seems inevitable for an adequate solution to some of the problems.

Other connections across this part of the study sector are minor compared to Everett Avenue and Fifth Street. The Williams Street connection is now the most important of these other links and it could be improved rather simply by using a series of prefab, column supported roof structures to form a covered walk under the Expressway. These same structures could form a shelter for the local bus-stop, could support a nighttime street and sidewalk lighting system, mailboxes, public telephone, street direction signs, etc. This overall facility could improve the flow conditions, particularly for pedestrians, and could also provide a visually continuous facility across the Expressway right-of-way. As we explained earlier, these strengthened and clarified flow and visual connections will make it more possible for a public conceptual image of the environment to include a connection at this and other similarly treated locations.

Finally, it should be noted that at Fourth Street the Expressway completely blocks a minor pedestrian and vehicular flow. Since it would be extremely costly to re-establish these flows, the best solution would seem to be to indicate visually that the flow is blocked and to redirect the flow to Everett Avenue and Fifth Street. The acoustical barriers which I have proposed would here start at the ground and be eighteen feet high and thus provide the needed visual block.

The aesthetic quality of the Expressway in this part of the study sector is not particularly high, as we indicated in the previous chapter. Many of the individual components (lights, light standards, signs, handrails, etc.) could of course be replaced but this can be an expensive solution. All new facilities to be erected within the Expressway right-of-way, however, should be of the highest possible design quality. A review board made up of representatives of the local citizenry, the Expressway authority, the city government, and the design professions should make recommendations or final decisions concerning proposed designs. These recommendations or decisions should apply to both public and private projects.

In addition, a more imaginative use of color for the support structure, which is so predominant in this part of the study sector, could at least lessen the dull, oppressing, institutional quality of the Expressway. Also, color might be used to call attention to various basic parts of the Expressway structure such as columns, tension braces, compression braces, beams, plates, or rivets, and artificial light might be used to similarly highlight the structure at night. Finally, it should be noted that it is often important for the Expressway environment to meet the other sensuous criteria first; high aesthetic quality can be incorporated into these solutions.

We come now to the criterion of visual exposure, which indicates that it is important to make the Expressway activity and structure visible in a way that clarifies its function and location in the environment. This means that we do not want to provide special viewing facilities but rather that we want to provide views from within the activity pattern surrounding the Expressway.

Within this part of the study sector it would be very difficult to increase the visual exposure of the Expressway activity, since we are proposing the use of acoustical panels which would block the view to such activity. In this case I believe it is more important to reduce the noise levels substantially than it is to maximize the visibility of the activity on the Expressway. It will still be possible to view with relative ease the flow entering and leaving the Expressway from locations at Everett Avenue and Fifth and Beacon Streets.

It might be possible to include views of the Expressway activity with other facilities such as restaurants or elevated pedestrian paths. But even these types of activity are difficult to justify in terms of cost and number of potential users for this part of the study sector. For the time being then, I suggest that other needed facilities such as bus waiting areas and parks be placed to take advantage

of views of the Expressway activity. (See Diagrams V-3 and V-4 for examples of this.)

In addition to visibility of the Expressway activity, we must consider visibility of the Expressway structure. The structure is now visible at each street which crosses the right-of-way as well as at the Fourth Street off ramp. The strength of this visual image would be increased by making the structure more opaque and solid-looking with the acoustical panels and by utilizing color, artificial lighting, and acoustical panels for improving the aesthetic quality of the structure. Also, the locations which provide views of the activity on the Expressway at the same time expose its structure. In general, it seems that no additional action to increase the visibility of the Expressway structure is feasible.

The visibility from the north of the Expressway structure may be substantially increased in the future. Since the new industrial and wholesaling facilities will most likely be one storey structures, it will be possible to see over them to the three to four storey high Expressway from locations adjacent to the study sector.

As the ninth criterion in Chapter Three indicates, design proposals for the study sector should increase the use of the right-of-way appropriate to the needs and criteria of the surrounding environment. In many cases, satisfaction of the other sensuous criteria will include

fulfilling some of these needs and demands. Any needs not so provided for must be considered here.

Diagram IV-9 indicates that public and private parking and recreational facilities are needed now for adjacent activities. Both the Everett Avenue and Fifth Street sites are appropriate locations for some of these facilities. The recreational and parking facilities in turn might help meet the other Chapter Three criteria which are relevant at these two locations. The designs shown in Diagrams V-3 and V-4 include proposals for parking and recreational facilities at these two locations. Similar parking and recreational facilities should also be provided near Beacon Street. Diagram V-5 indicates how this might be accomplished.

Public funds provided by the city would have to be used to construct and maintain these facilities. At present the off-street public parking facilities provided by Chelsea near the Central Business District are free and those provided within the right-of-way would probably also have to be free for some time to come.

At present then commercial parking facilities would not seem feasible although future activities near the study sector may increase the need for parking to the point where a charge might be made. It may be possible in the future for the city to rent parking space within the right-of-way to nearby industrial, business, or commercial firms. These firms might be induced to pay

for this parking if they were allowed to count the rented spaces as part of the parking they are required to provide for employees and customers. This revenue might even make possible the construction of additional parking levels either publicly or privately financed, within the existing Expressway structure. It should be remembered, however, that such multi-level parking facilities and the ramps or equipment to move the vehicles into and out of them would exist immediately adjacent to residential areas and could increase the problems of noise, fumes, and natural light intensity. Any design proposals for multi-level parking facilities would have to be judged by standards similar to those for the whole urban expressway as well as by the possible contribution to the economy of the city.

In the ten to fifteen year future there may also be the need for new educational space to accommodate about five hundred students living near this section of the study sector. No detailed design proposals are being made for this facility, but I would suggest that a possible site might be the space now vacant between Fifth and Arlington Streets and the Northeast Expressway. The suitability of this location would depend upon a number of factors including future need for the parking and recreational facilities proposed for that site; availability, in terms of time and money, of other adequate sites; the proposed size of the educational

facility; the educational methods to be used in the school; and comparative construction costs at this and other possible sites.

As is true of other facilities provided within the Expressway right-of-way, the parking and recreational facilities must be easily adaptable to criteria of future activity patterns. In accordance with this, the facilities provided to accommodate these activities are designed to be removed relatively easily in order to make room for future facilities.

The final criterion that must be met by the facilities within the right-of-way requires that the connections between the local and Expressway flow be clearly expressed. An artificial lighting system might be provided which was visibly different from the normal street lighting in Chelsea and which ran from the local to the Expressway flow systems. Also, as has been suggested in the discussion of flow, visual, and psychological linkages, the proposed acoustical panels could be used to support high vertical signs calling attention to the on ramp locations. Sketches of such facilities are shown in Diagrams V-3 and V-4.

In addition to marking the location of the on ramps, it would also be useful to clearly express the turning movements required to get onto each ramp. This might be accomplished by painting the entire surface of the lanes and turning areas leading to the on ramps bright colors.

Similar markings might be used to direct flow from the off ramps toward the major local activity and flow facilities. Also, direction signs at those off ramp locations could be placed on the screens which block vehicle headlights from the houses. These signs and markings would have to be provided by the city, with the exception of the signs which are part of the acoustical panels and mark the on ramp locations. These would be provided by the Expressway authority.

This completes our discussion of the design proposals for section two of the study sector. Many of the ideas discussed above are applicable to other sections of the Expressway; for this reason we will now be able to rely more completely on diagrams to present design proposals. We turn now to proposals for section one, the double-decked, high level, column supported portion located in the sloping open space adjacent to the Naval Hospital and including the shoreline of the Mystic River.

2. Design Ideas for Section One of the Study Sector

There is only one major problem associated with this section of the Expressway study sector, the disturbing noise level which occurs near the staff quarters of the Naval Hospital. This noise level might be sufficiently reduced through use of the acoustical barriers described earlier.

The design proposals illustrated in Diagram V-6 include recreational facilities of city and sub-regional importance and take advantage of certain opportunities provided by the Expressway structure. It should be noted that the overall development of this area involves cooperation among a number of different groups--the Port Authority, U.S. Naval Hospital, City of Chelsea, the Chelsea Yacht Club, and private interests. If a demonstration grant for recreational space development were applied for, the federal and state governments would also become involved. The ultimate success of this development would be affected by public or private actions taken toward improving the environment adjacent to the south of this section. Action should be taken by the city to repair and improve Broadway for vehicular and pedestrian flow and to revitalize the activity pattern along the main street.

Finally, it is necessary to conduct more extensive studies to determine the degree to which the existing Expressway structure could be used to support any new facilities. I have had to assume that with an increase in the amount of bracing for the existing structure, many of the proposed facilities could be supported by it.

This completes our discussion of the proposals for section one of the study sector. The next consideration is section three where the traffic lanes are side by side

and column supported at about twenty feet above ground level and where the two areas on either side of the Expressway are industrial.

3. Design Proposals for Section Three of the Study Sector

This section runs from Arlington Street to Washington Avenue, and it contains no major problem areas. The disturbing noise level near Washington Avenue might be reduced by acoustical barriers similar to those described previously. The design proposals for improving the flow, visual, and psychological connections at Carter Street are shown in Diagram V-7. These proposals are similar to those discussed in the first section of this chapter. Since other points of connection are minor, they do not require extensive facilities. The most pronounced need is for increased artificial light at these minor connections.

As in sections one and two, it may be possible to improve the aesthetic quality of the Expressway structure through an imaginative use of color. Again, it would be helpful to maintain high aesthetic standards for any of the additional facilities to be constructed around the Expressway in the future.

Diagram V-7 also shows additional facilities which might be provided for within the Expressway right-of-way. Vehicular parking and the industrial, wholesaling, and warehousing space could be developed by the city, then

rented or sold to private firms or it might be constructed directly by private groups under the development control of the city. The vehicular storage facilities for the city would obviously be city-financed as would be the recreational facilities.

Finally, Diagram V-7 indicates how the interconnections between local and Expressway flows might be more clearly expressed. These same ideas were utilized in section two of the study sector. In addition to providing lights which lead from the local to the Expressway flow, it would be useful and relatively simple to indicate by the color of the lights in which direction each on ramp leads (Boston or north). The colors to be used for the lights, for traffic signs, and for designating traffic lanes should be coordinated so that a particular color meant a particular direction.

These then are the design proposals for section three, which is the last of the sections of the Expressway supported on freestanding column structures. In the other three sections, the road surface is directly supported by earth. In section four, the discussion of which follows, the Expressway lanes are side by side and pass through a cut in the side of Powder Horn Hill.

4. Design Proposals for Section Four of the Study Sector

The design proposals for this section of the Northeast Expressway are shown in Diagram V-8. Again we have based

many of our proposals on the ideas discussed in association with section two of the study sector.

It should be noted that no method was found to reduce sufficiently the noise level in the outdoor space just north of the Expressway adjacent to the Revere Beach Parkway. My only suggestion is to insulate the buildings against noise so that at least the interior activities would not be disturbed. Also, extensive air rights construction has not been proposed because the complicated level changes within the right-of-way and the probable necessity of constructing special footings to support an air rights structure would mean high development costs. All other design proposals are I think made clear in the diagram.

We next consider design proposals for section six of the Expressway study sector. This part of the Expressway has lanes side by side supported by an earth berm and it is located between medium to low density residential areas in two different towns. In addition, there is substantial vacant land, particularly on the Chelsea side, between the Expressway and the residential areas.

5. Design Proposals for Section Six of the Study Sector

Again we are going to rely mainly on the diagrams to illustrate design proposals, but two important points need to be made here. First, it should be noted that the

City of Revere owns the land on both sides of the Expressway. On the Chelsea side of the right-of-way this Revere-owned land is very narrow and isolated. It lies between City of Chelsea and state Department of Public Works property. It would be my suggestion that either of these two buy the Revere-owned land in order that it be more usable.

Secondly, we might note that this seems to be the one section of the study sector where provision of low-income housing might be possible were it not for the existence of the large veterans public housing project adjacent to the Expressway. I am very reluctant to suggest that additional low-income housing be built here even though land is available. If, however, pressure increases substantially for slightly higher income housing, it would be possible to develop part of the Chelsea side of the Expressway for such a facility as shown in Diagram V-9. This housing might be created under a program similar to those used in urban renewal areas for encouragement of private development. The recreational facilities could be provided through a joint venture of Chelsea, Revere and the state Department of Public Works, by the cities alone, or with the help of the federal government programs for urban open space development.

Having completed a consideration of section six of the Expressway study sector, we come finally to design

proposals for section five, the interchange between the Northeast Expressway and the Revere Beach Parkway.

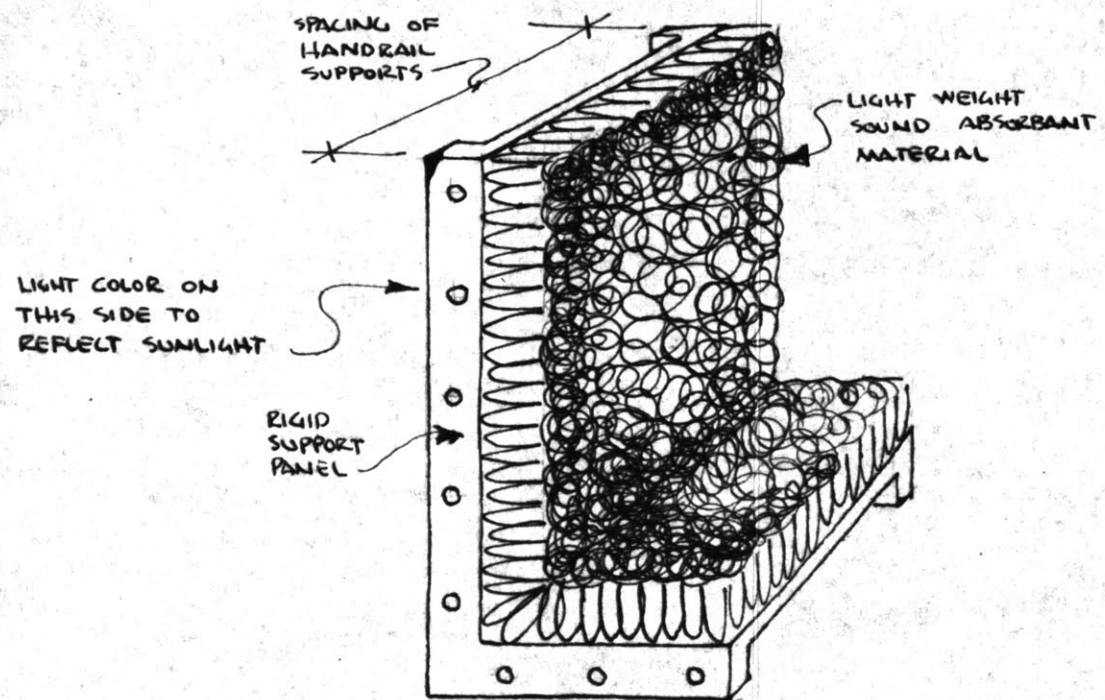
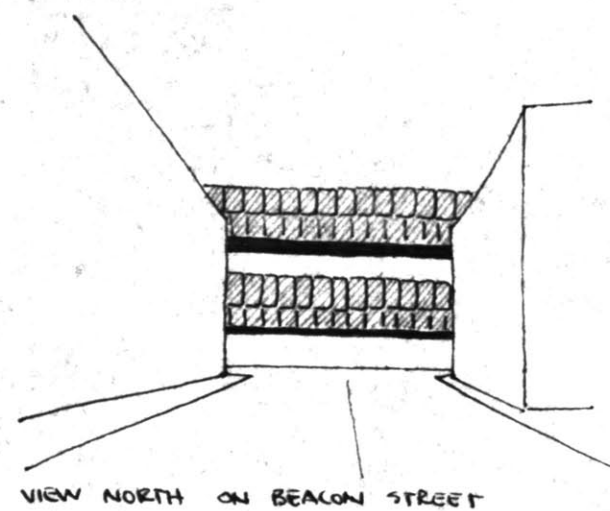
6. Design Proposals for Section Five of the Study Sector

This part of the Expressway is unique within the study sector but may be considered typical of many of the interchange facilities of other urban expressways. There are several possibilities for the use of this space as shown in Diagrams V-10 and V-11. The proposals for local recreational facilities could be carried out by Chelsea alone or with the help of federal urban recreation space development funds. If the more elaborate proposal were to be developed it would probably necessitate a joint venture among the city, the state Department of Public Works, and private interests. It would of course also be helpful to gain federal aid for this project in the form of a demonstration grant.

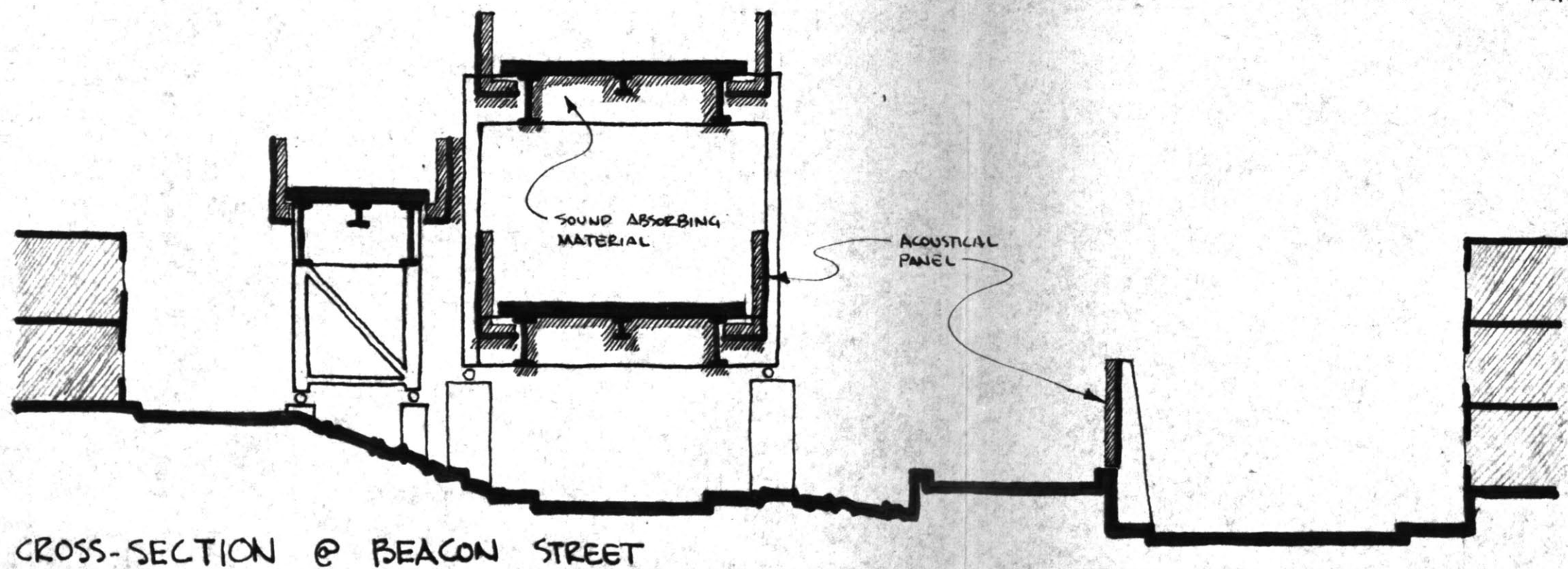
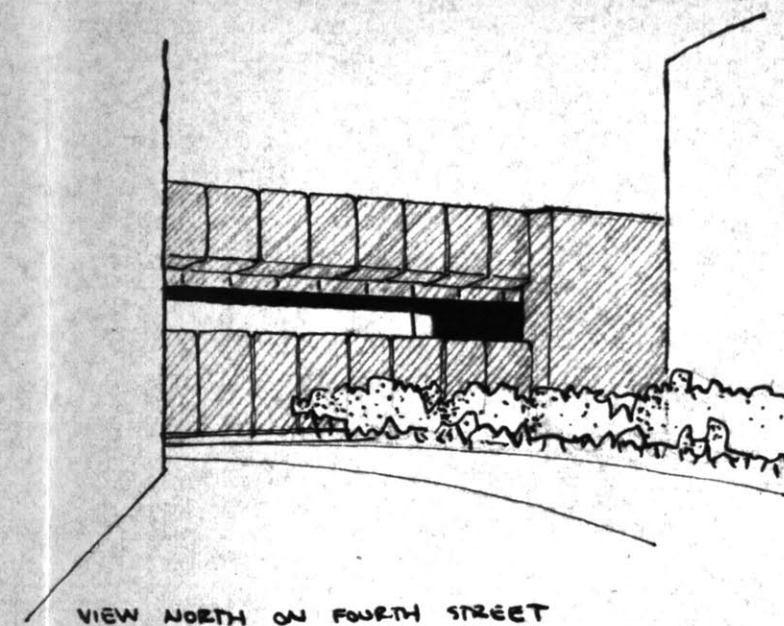
This concludes our discussion of design proposals for the six sections of the study sector. These design ideas are not meant to represent all that might be done within the Expressway right-of-way to meet the sensuous criteria presented in Chapter Three. They may be considered to be preliminary proposals for ways of meeting the sensuous criteria.

Obviously more detailed work is needed not only on the physical designs themselves, but also on how they might be accomplished, what public or private funds might be used, what staging should occur in constructing each

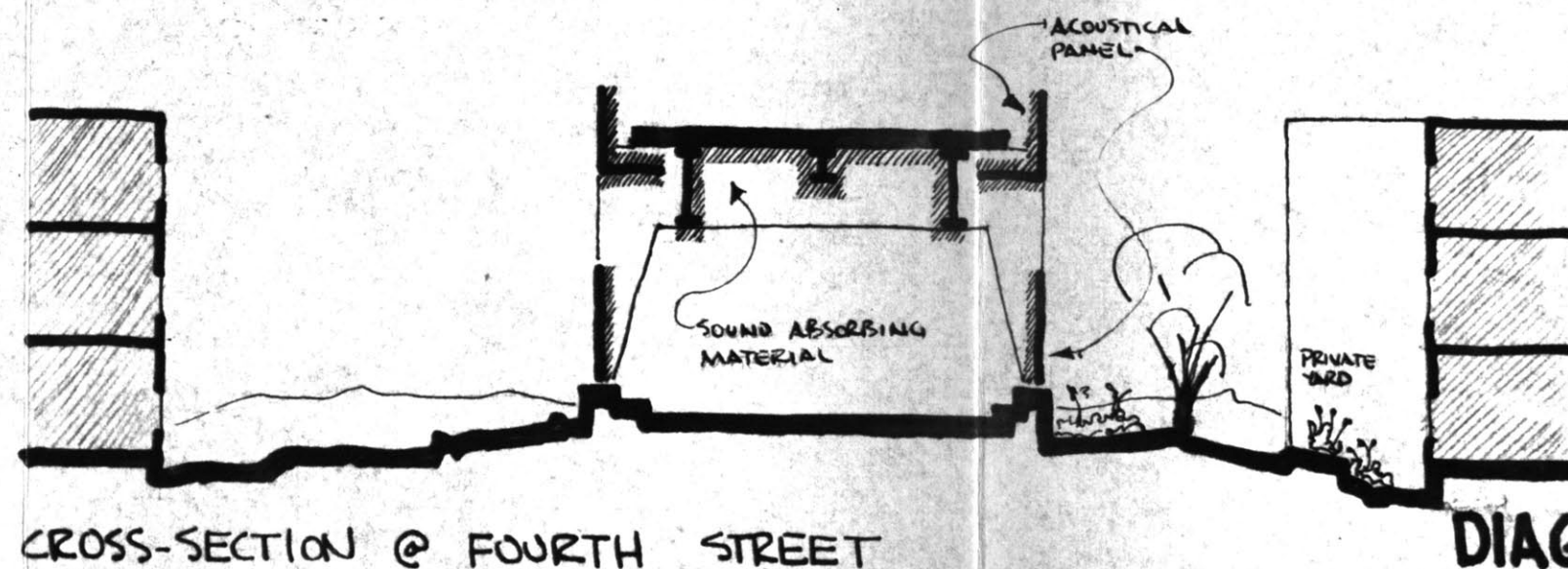
facility, and, possibly most important, what order of priority exists among the various proposals themselves and among the projects of the city, state, and federal authorities who would be participating. With the general design proposals of this report as a basis, it is hoped that viable methods of improving the environment adjacent to existing urban expressways may be found.



ACOUSTICAL PANEL
NOT TO SCALE

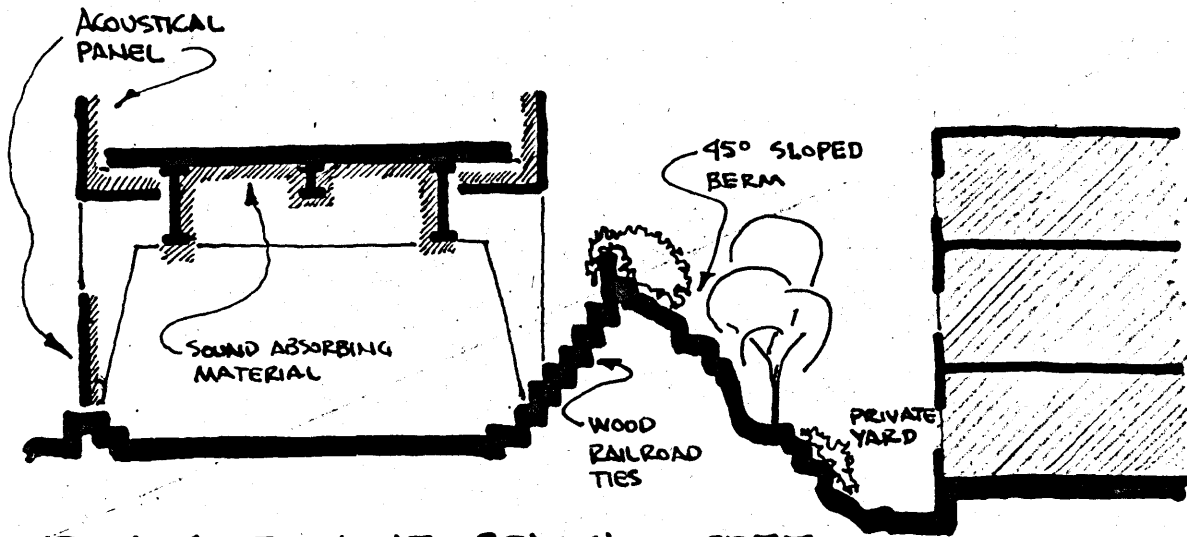


CROSS-SECTION @ BEACON STREET

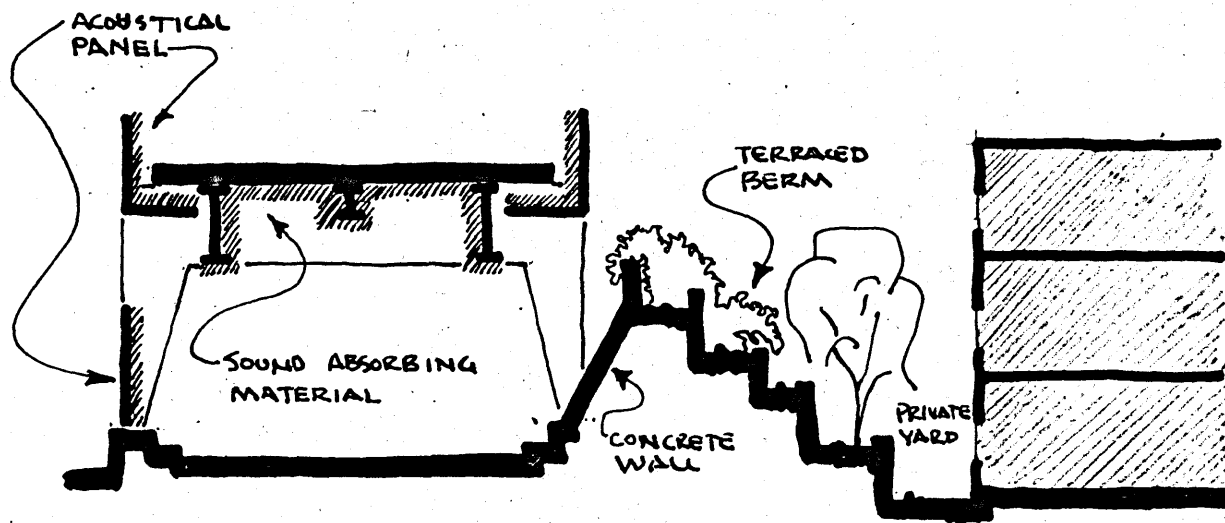


CROSS-SECTION @ FOURTH STREET

DIAGRAM V-1
CROSS-SECTION SCALE: 1"=20'-0"



CROSS-SECTION AT BEACON STREET



CROSS-SECTION AT FOURTH STREET

DIAGRAM V-2

CROSS-SECTION SCALE: 1" = 20'-0"

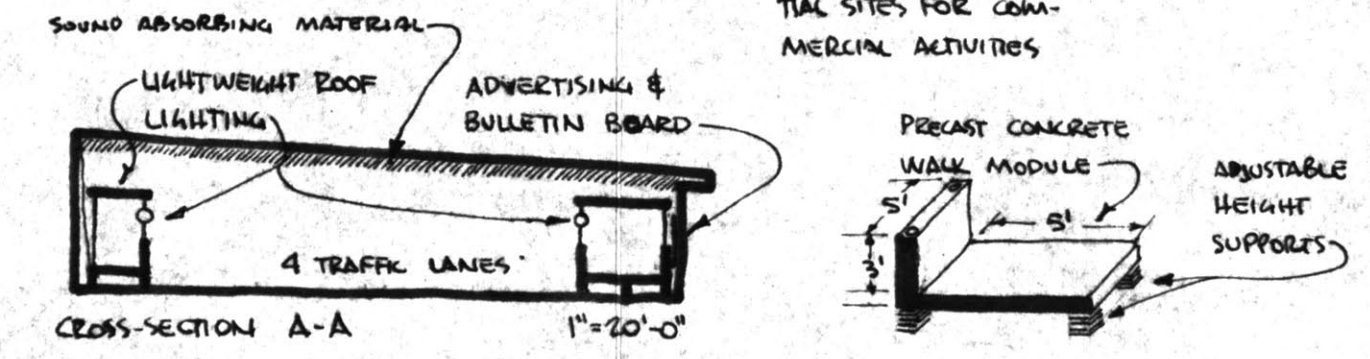
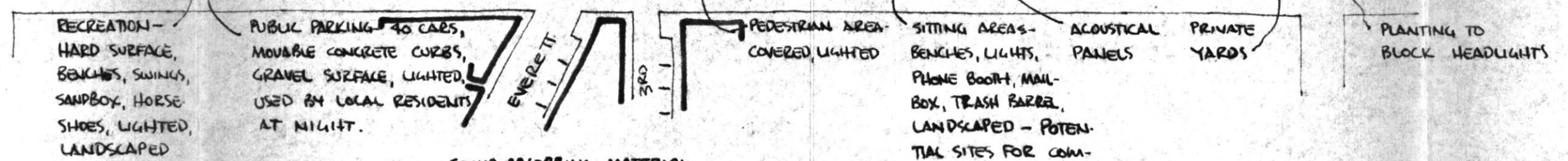
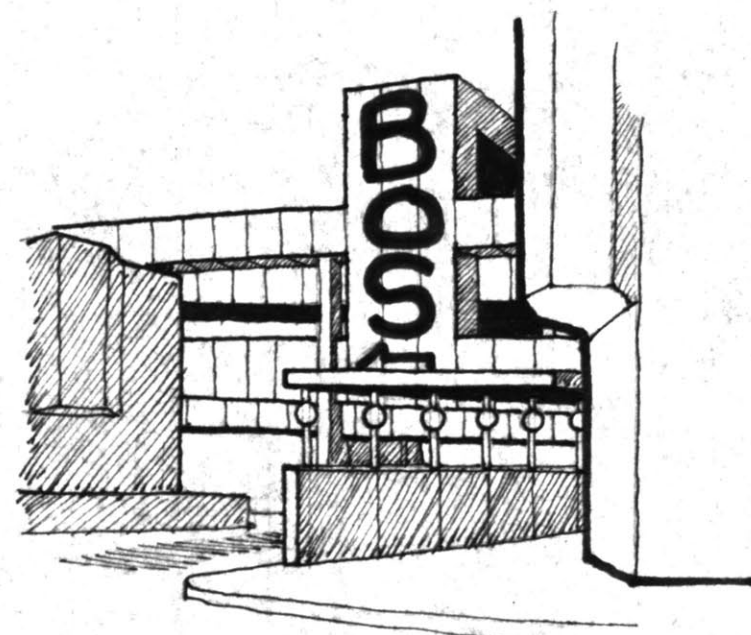
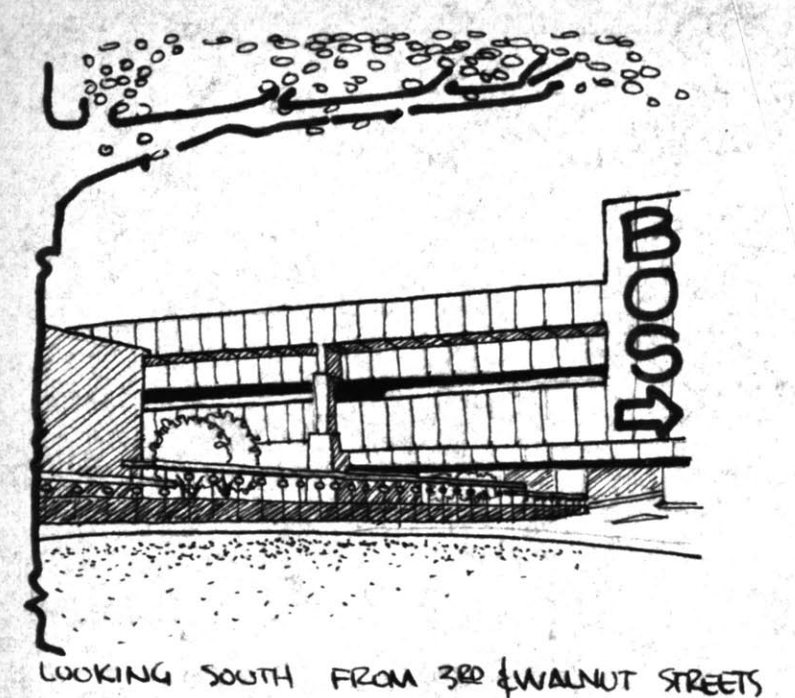
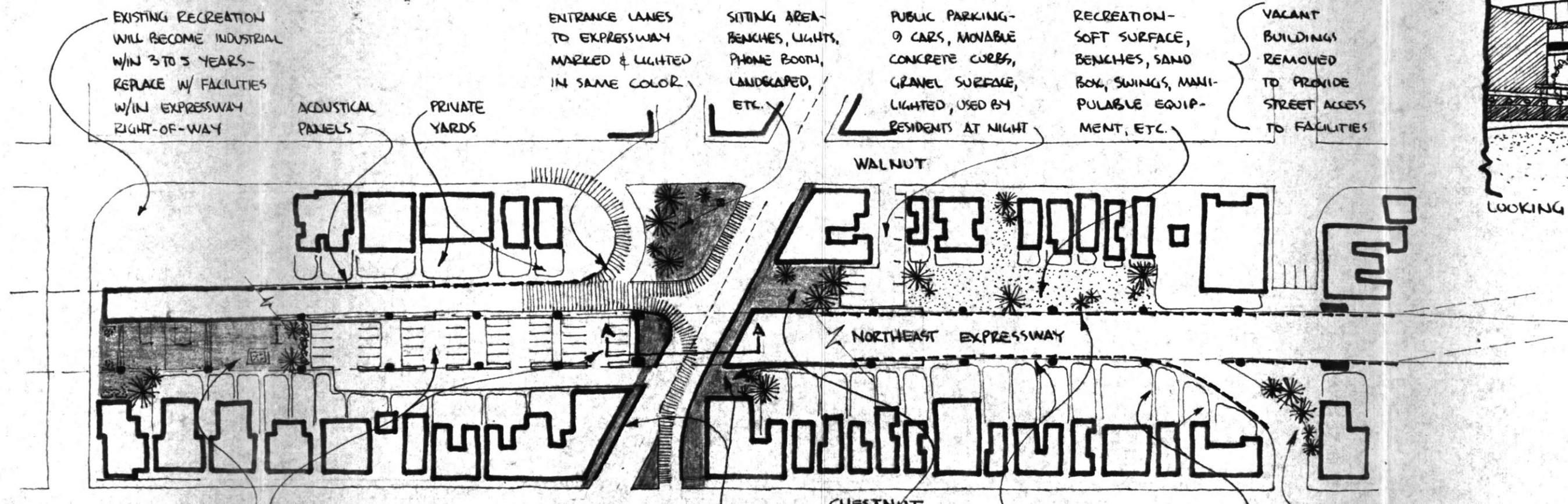
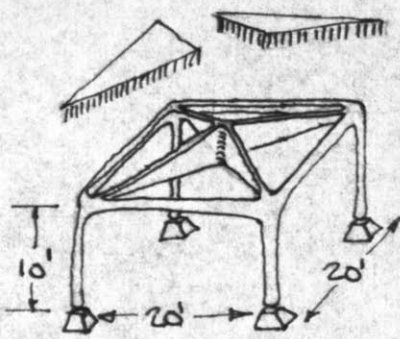


DIAGRAM V-3
 NORTH ↗ SCALE: 1" = 100'-0"



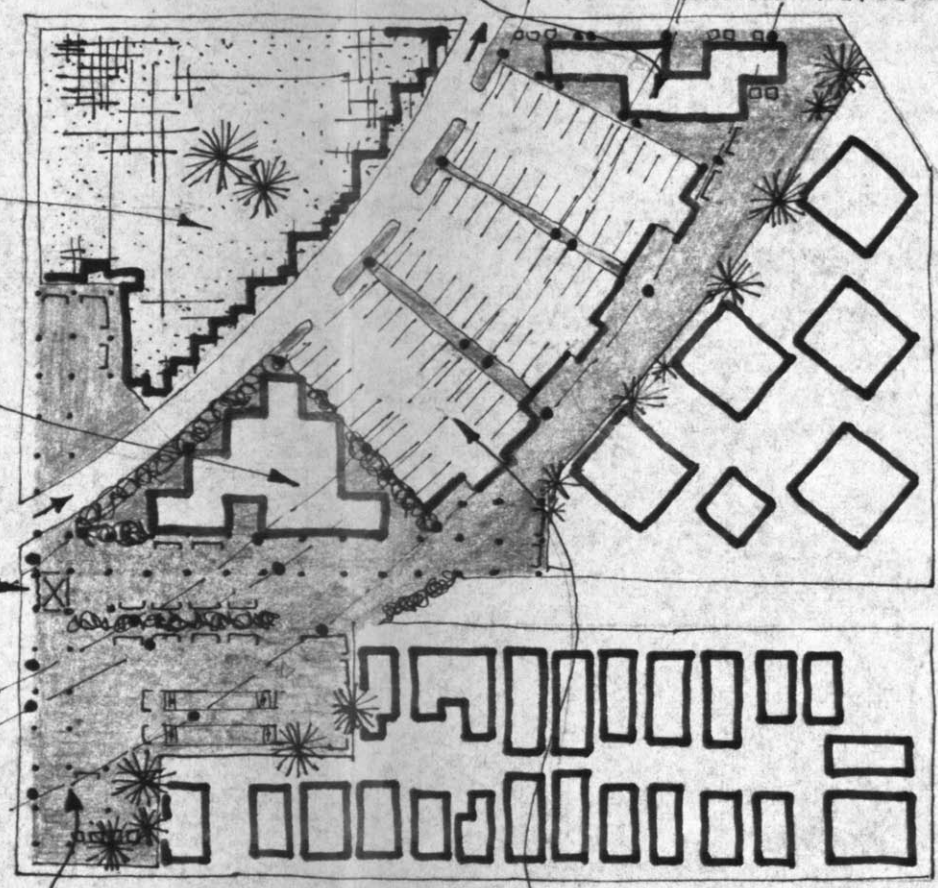
RECREATION - MANIPULABLE MATERIALS, DIRT SURFACE, WALL OF OLD LUMBER & RAILROAD TIES, TREES ARE EXISTING

NURSERY SCHOOL, INDOOR RECREATION FOR ADULTS, MEETING ROOMS

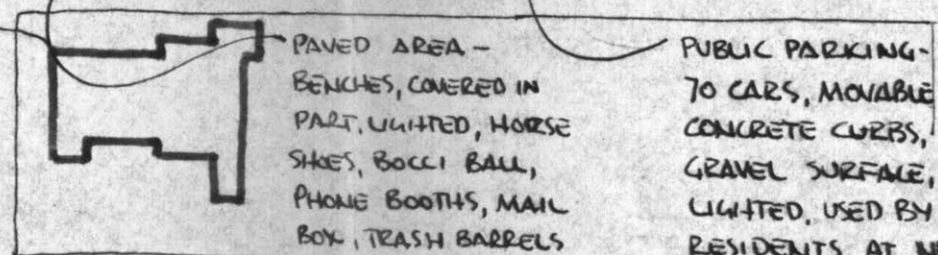
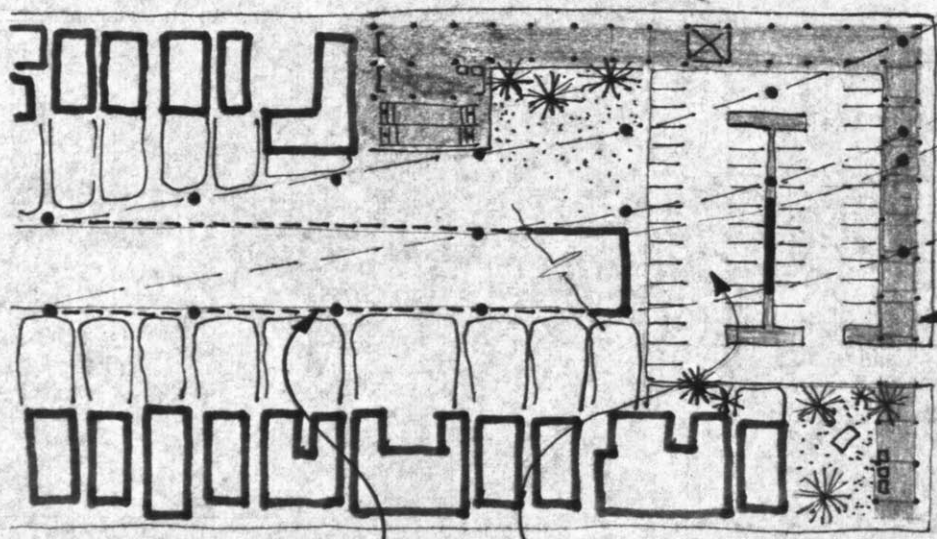
PRE-FAB, LIGHT WEIGHT ARCADE
SEPARATE ROOF INFILL PANELS CAN BE OPAQUE, TRANSLUCENT, TRANSPARENT, LOUVERED, OR OPEN

ARLINGTON

POTENTIAL LOCATION FOR INDUSTRIAL ORIENTED RETAIL BUSINESS



WALNUT



PAVED AREA - BENCHES, COVERED IN PART, LIGHTED, HORSE SHOES, BOCCI BALL, PHONE BOOTHS, MAIL BOX, TRASH BARRELS

PUBLIC PARKING - 70 CARS, MOVABLE CONCRETE CURBS, GRAVEL SURFACE, LIGHTED, USED BY RESIDENTS AT NIGHT

ACOUSTICAL PANELS

PUBLIC PARKING - 50 CARS, GRAVEL SURFACE, MOVABLE CONCRET CURBS, LIGHTED, USED BY RESIDENTS AT NIGHT

CHESTNUT

5TH

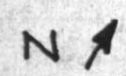


DIAGRAM V-4
SCALE: 1" = 100'-0"

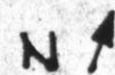
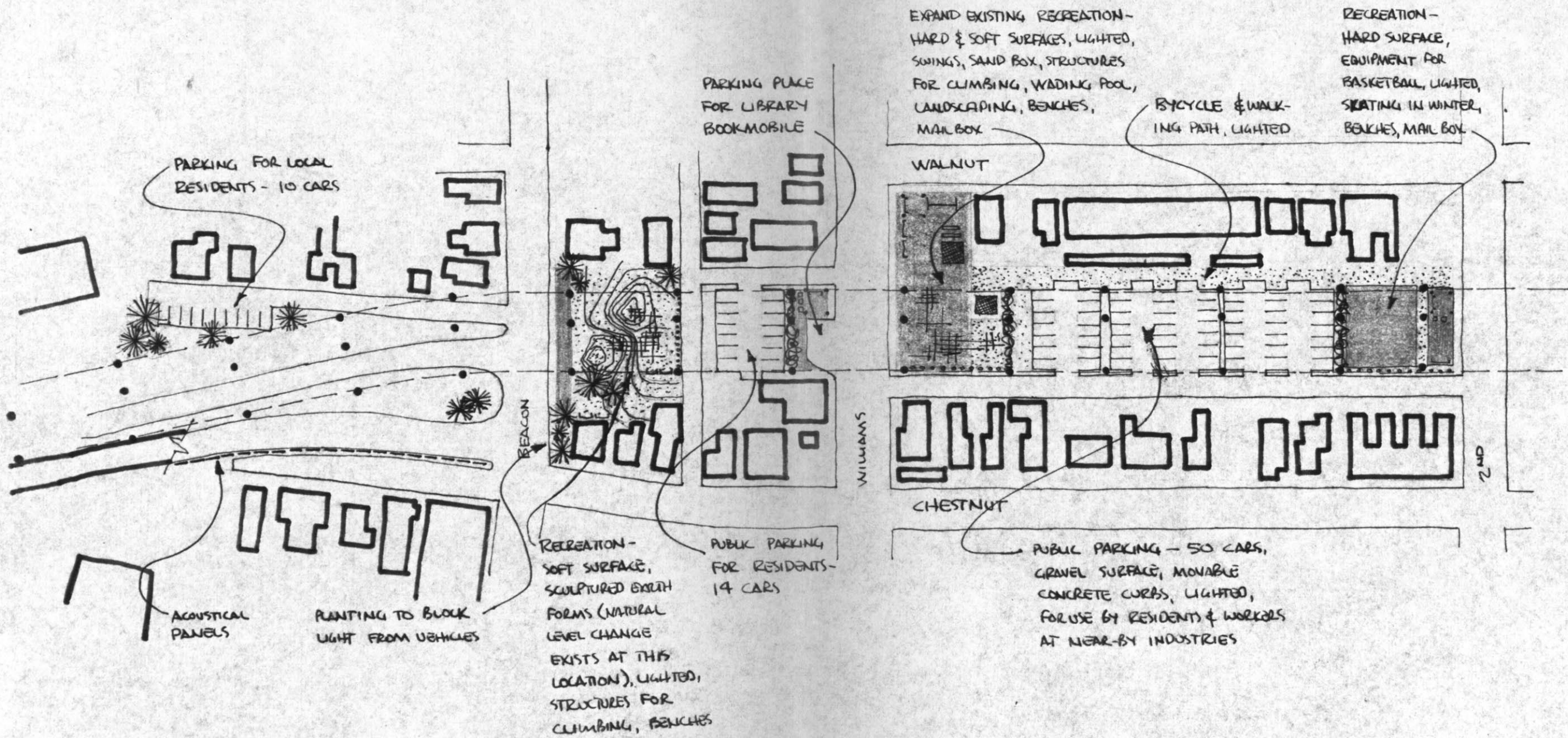
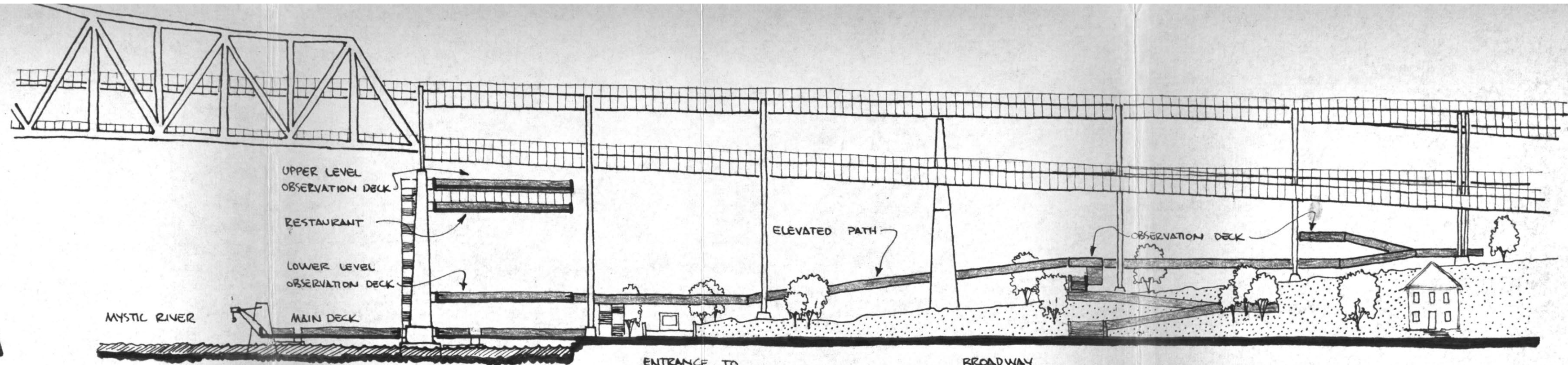
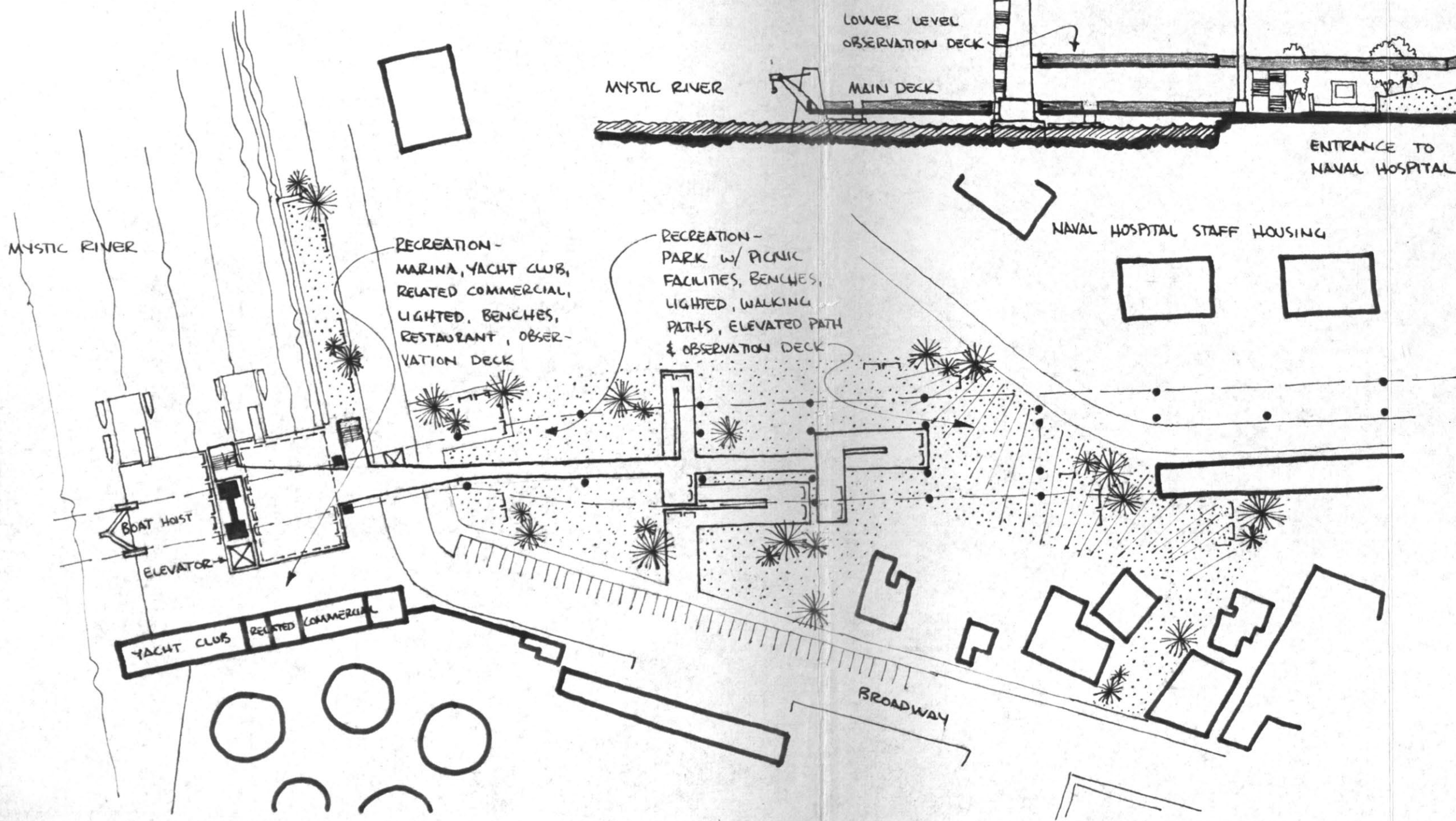


DIAGRAM V-5
SCALE: 1" = 100'-0"

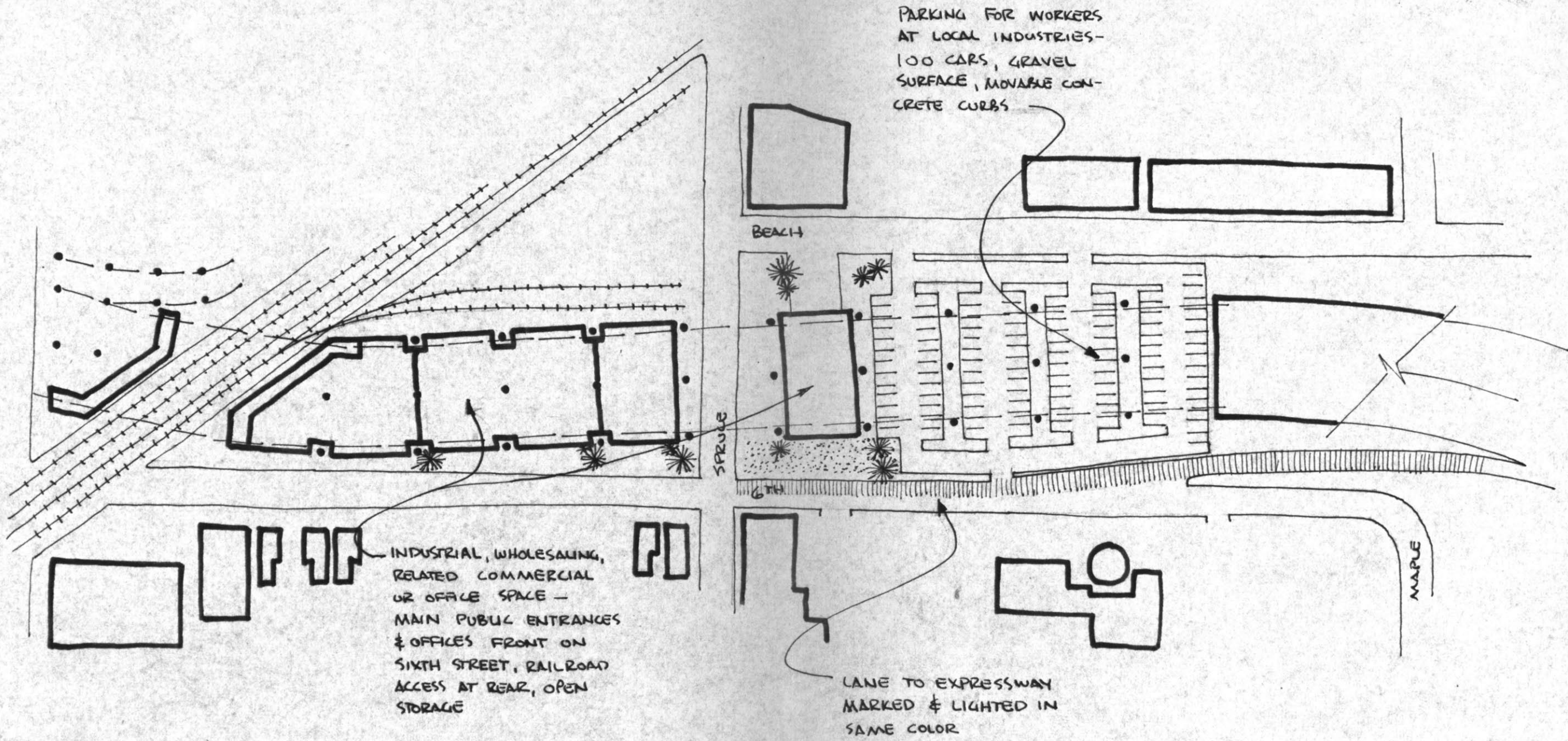


ELEVATION SCALE: 1" = 50'-0"



N ↗

DIAGRAM V-6
SCALE OF PLAN: 1" = 100'-0"



N ↓

DIAGRAM V-7a
SCALE: 1" = 100'-0"

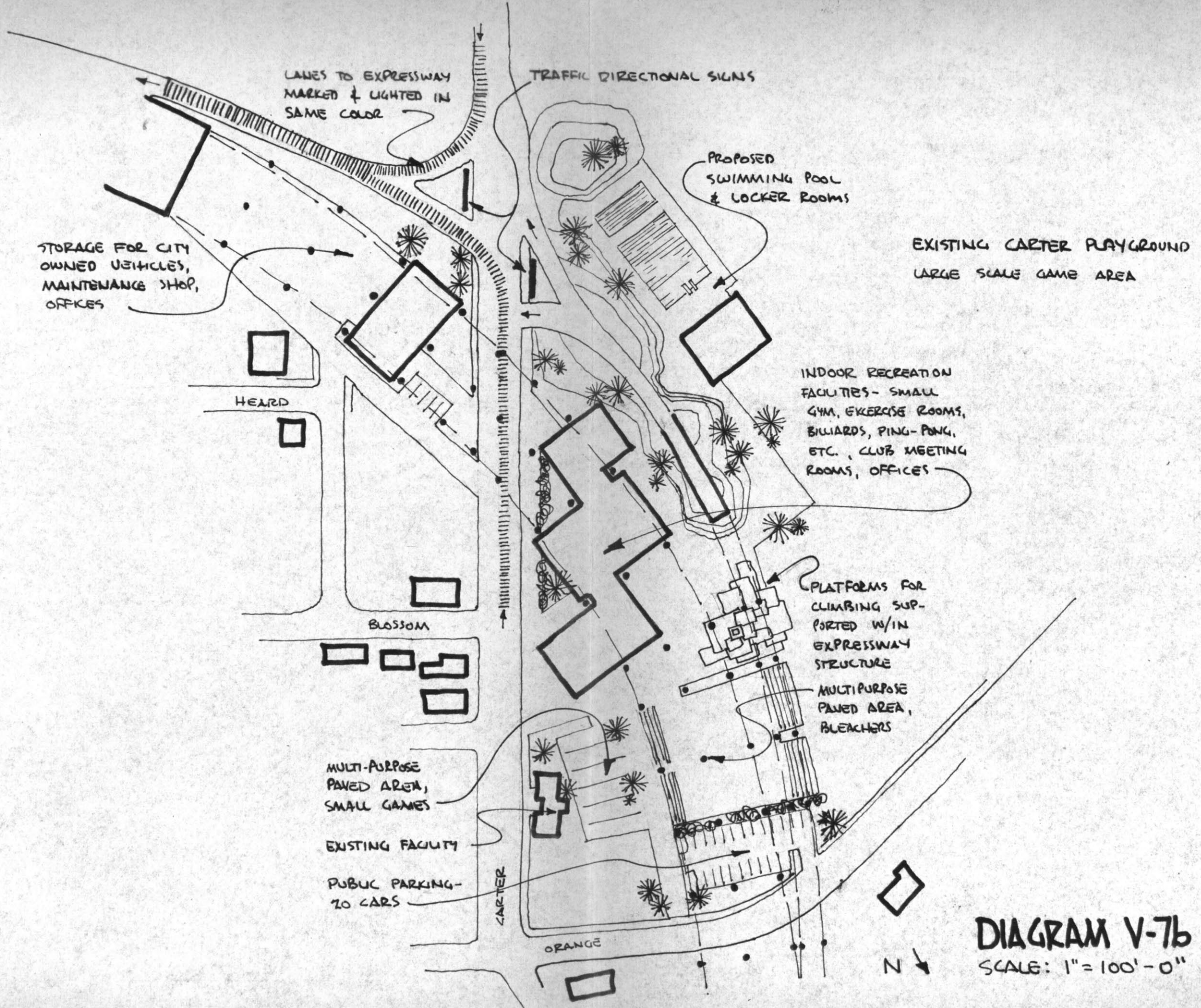
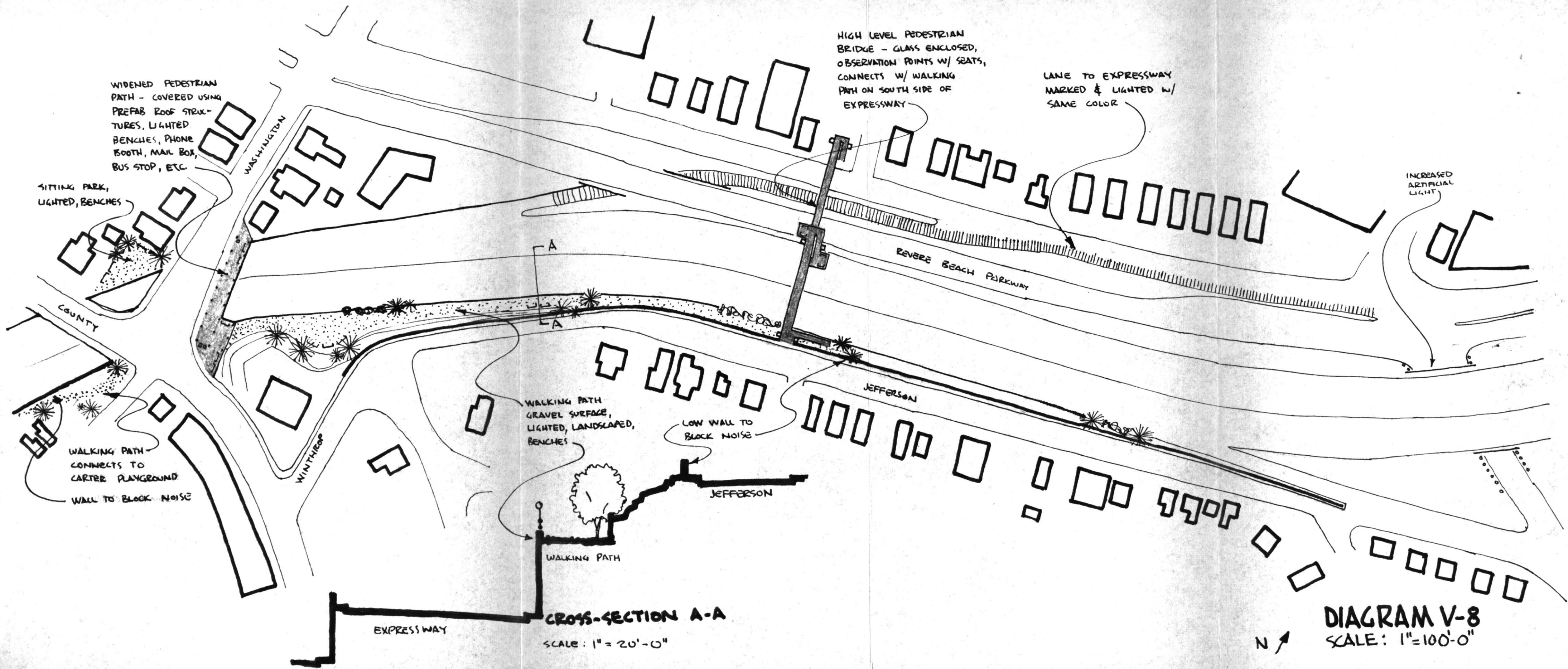


DIAGRAM V-7b
SCALE: 1" = 100' - 0"



WIDENED PEDESTRIAN PATH - COVERED USING PREFAB ROOF STRUCTURES, LIGHTED BENCHES, PHONE BOOTH, MAIL BOX, BUS STOP, ETC.

SITTING PARK, LIGHTED, BENCHES

HIGH LEVEL PEDESTRIAN BRIDGE - GLASS ENCLOSED, OBSERVATION POINTS W/ SEATS, CONNECTS W/ WALKING PATH ON SOUTH SIDE OF EXPRESSWAY

LANE TO EXPRESSWAY MARKED & LIGHTED W/ SAME COLOR

INCREASED ARTIFICIAL LIGHT

REVERE BEACH PARKWAY

JEFFERSON

WALKING PATH GRAVEL SURFACE, LIGHTED, LANDSCAPED, BENCHES

LOW WALL TO BLOCK NOISE

WALKING PATH CONNECTS TO CARTER PLAYGROUND
WALL TO BLOCK NOISE

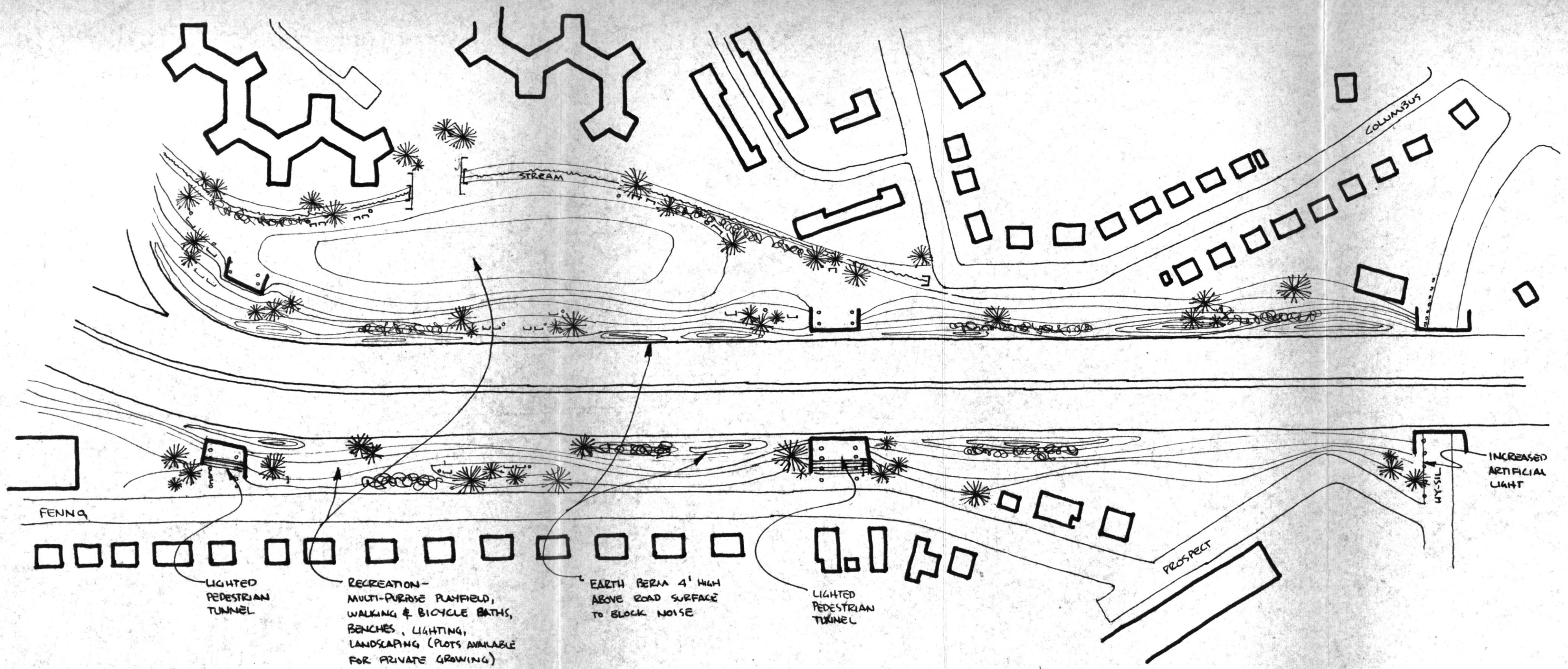
CROSS-SECTION A-A

SCALE: 1" = 20'-0"

DIAGRAM V-8

SCALE: 1" = 100'-0"

N



FENNA

COLUMBUS

PROSPECT

STREAM

INCREASED
ARTIFICIAL
LIGHT

LIGHTED
PEDESTRIAN
TUNNEL

RECREATION -
MULTI-PURPOSE PLAYFIELD,
WALKING & BICYCLE PATHS,
BENCHES, LIGHTING,
LANDSCAPING (PLOTS AVAILABLE
FOR PRIVATE GROWING)

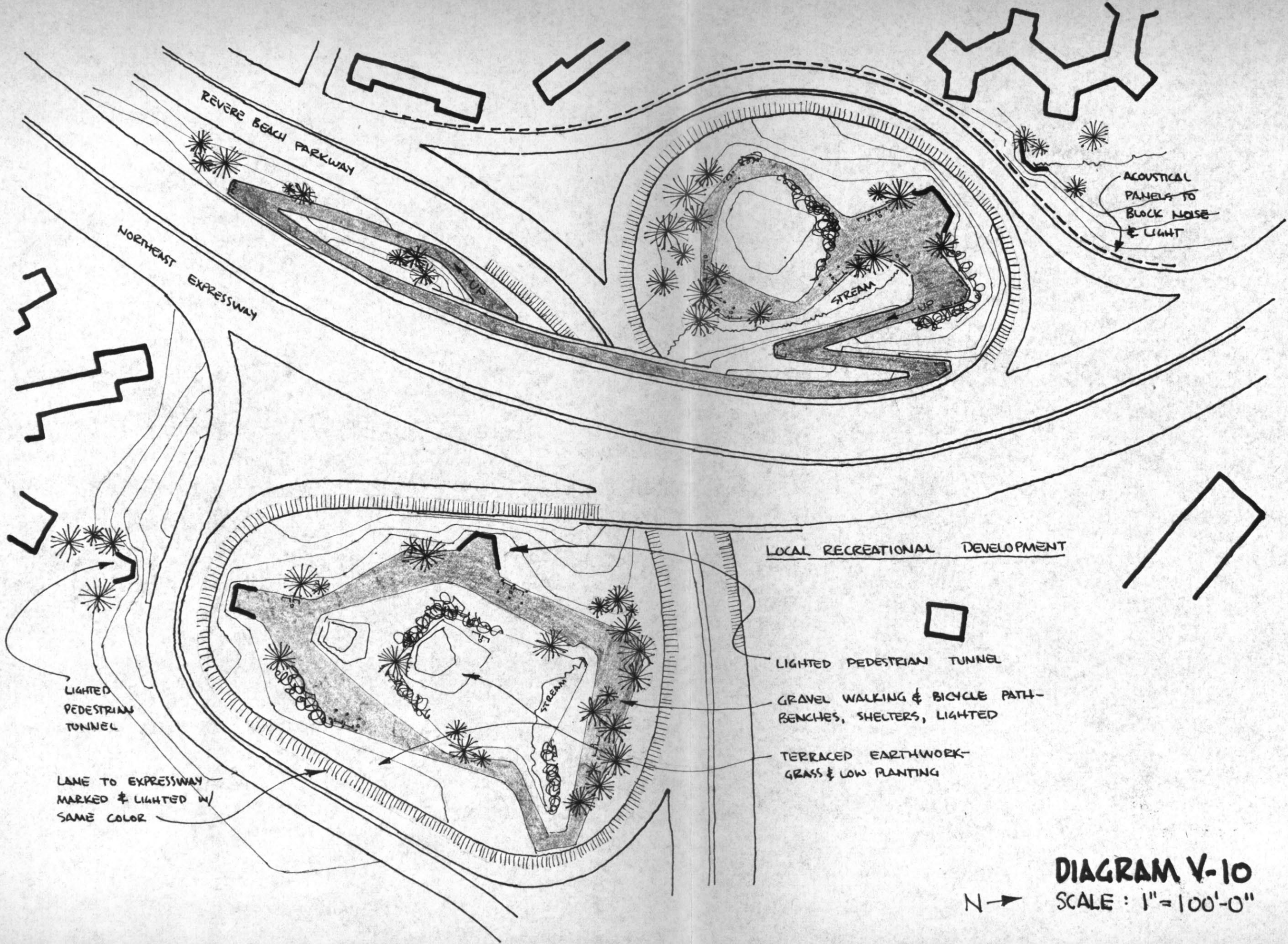
EARTH BERM 4' HIGH
ABOVE ROAD SURFACE
TO BLOCK NOISE

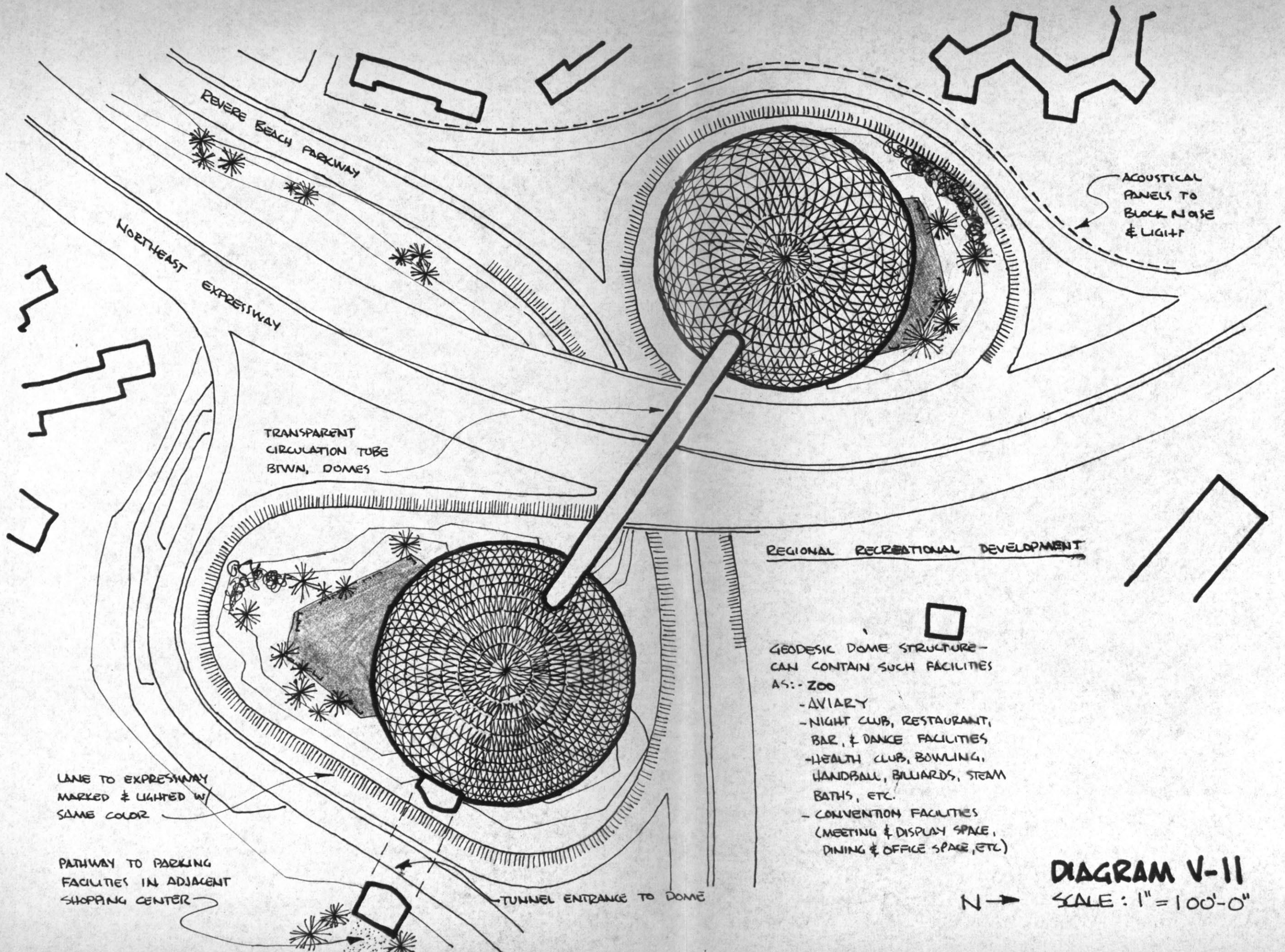
LIGHTED
PEDESTRIAN
TUNNEL

DIAGRAM V-9

N ↘

SCALE OF PLAN: 1"=100'-0"





REVERE BEACH PARKWAY

NORTHEAST EXPRESSWAY

TRANSPARENT CIRCULATION TUBE BTWN, DOMES

ACOUSTICAL PANELS TO BLOCK NOISE & LIGHT

LANE TO EXPRESSWAY MARKED & LIGHTED W/ SAME COLOR

PATHWAY TO PARKING FACILITIES IN ADJACENT SHOPPING CENTER

TUNNEL ENTRANCE TO DOME

REGIONAL RECREATIONAL DEVELOPMENT

GEODESIC DOME STRUCTURE - CAN CONTAIN SUCH FACILITIES AS:-

- ZOO
- AVIARY
- NIGHT CLUB, RESTAURANT, BAR, & DANCE FACILITIES
- HEALTH CLUB, BOWLING, HANDBALL, BILLIARDS, STEAM BATHS, ETC.
- CONVENTION FACILITIES (MEETING & DISPLAY SPACE, DINING & OFFICE SPACE, ETC)

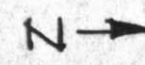


DIAGRAM V-11
SCALE: 1" = 100'-0"

Chapter VI: Conclusion

In this report a number of things have been done. First, the limited amount of research on the effects of existing urban expressways was summarized. Secondly, a preliminary set of sensuous criteria for the desirable conditions around an existing urban expressway were presented. Thirdly, it was demonstrated how a real urban expressway, a study sector of the Northeast Expressway located in Chelsea, Massachusetts, may be described and analyzed using these sensuous criteria as a basis. As the expressway analysis was being presented, suggestions for further research were made. Finally, a series of preliminary design proposals for the study sector were described. It was suggested that these proposals serve as a basis for further design exploration.

This whole study--summary of research, development of sensuous criteria, description and analysis of real expressway, and presentation of design proposals--represents one stage in a continuing process aimed at improving the environment adjacent to existing urban expressways. Additional work must be done on each of the parts of this study. As indicated in Chapter Four, research is required concerning conditions and their effects around existing urban expressways. Particular effort should be made to determine the effect of the expressways on the economic, social, service, and conceptual structures of the environment.

The sensuous criteria also need to be reworked. The additional research on the effects of the expressway on the economic, social, service, and conceptual structure may help in improving the statement of desirable flow, visual, and psychological linkage and barrier conditions. It is also important to consider criteria which deal with the relative visual dominance of the expressway structure and with the visual transition between the facilities and activities of the urban expressway and those of its surrounding environment. Neither of these was dealt with in this study because no way was found to state valid and usable criteria for visual dominance and transition.

The techniques of analysis should be developed further. Additional research as to the effects of urban expressways will help to clarify the process of analyzing an environment for these effects. Also, presently existing methods should be used when the necessary time and skill are available. Many of the conditions which were looked at so briefly in this report might be studied in much greater depth with current techniques.

Finally, design studies must be continued. There are many conditions we have not dealt with which exist around other urban expressways. What we have tried to show here is that there are a number of ways to deal with the problems and opportunities around an existing urban expressway in an inexpensive way. We have produced design proposals for a specific sector of an existing expressway.



1.



2.



3.



4.



5.



6.



7.



8.



9.



10.



11.



12.



13.



14.



15.



16.



17.



18.



19.



20.



21.



22.



23.



24.



25.



26.



27.



28.



29.



30.



31.



32.



33.



34.



35.



36.



37.



38.



39.



40.



41.



42.



43.



44.



45.

The following is an excerpt from the City of Chelsea Zoning Ordinances (amended 7/20/66) which describe in more detail the activities permitted in each zoning district:

. . .

S E C T I O N 5

RESIDENCE "A" USES

Within any Residence "A" district no building shall be constructed, no alterations or enlargements of existing buildings shall be designed, arranged or constructed, and no land or buildings or parts thereof shall be used excepting for:

- A. Residential purposes.
- B. Churches and other places of worship.
- C. Schools, public libraries, and public museums.
- D. Parish houses.
- E. Hospitals, sanitariums and philanthropic institutions.
- F. Municipal buildings, playgrounds, parks and beaches.
- G. A garage for not more than 2 automobiles in the same lot or in the same building, to which it is accessory; provided, that no industry or business may be conducted therein. The Board of Appeal may allow additional garage or parking space over 2 automobiles to the extent of one additional automobile for each housekeeping unit or family that occupies the premises provided that the use is accessory, and it does not injure or adversely affect the neighborhood or district.
- H. Real Estate signs not over 8 sq. ft. in area which may be used to advertise only the sale, rental or lease of the property upon which they are placed.
- I. Announcements or professional signs not over 2 sq. ft. in area except that religious institutions and municipal buildings may have bulletin boards or signs of any area upon their own lot for accessory uses or purposes.
- J. No billboards or other advertising signs than the foregoing shall be permitted.
- K. Home occupation - office of doctors, lawyers, dentists.
 - (a) such office shall be situated in the same dwelling used by the profession as his private residence.

- (b) office shall not occupy more than 25% of gross area of building.

S E C T I O N 6

RESIDENCE "B" USES

Within any Residence "B" district no building shall be constructed, no alterations or enlargements of existing buildings shall be designed, arranged or constructed, and no land or buildings, or parts thereof shall be used excepting for:

- A. All Residence "A" uses.
- B. The renting of rooms of furnishing table board in a dwelling used as a private residence.
- C. Lodging houses and hotels with accessory services maintained wholly within the building.
- D. Funeral homes and chapels.
- E. Community garages; provided that no business or industry may be conducted therein.
- F. Private clubs not operated for profit and not selling or dispensing liquors unless approved by the Board of Appeal.
- G. Community houses.
- H. Public service corporations necessary for the convenience and welfare of the public; provided the proposed uses do not include storehouses or outside storage yards, garages, repair or manufacturing establishments, or headquarters for large forces of outside warehouses.
- I. Storage of petroleum or petroleum products in quantities not exceeding 10,000 gals.

S E C T I O N 7

BUSINESS DISTRICTS

Within any Business District no building shall be constructed, no alteration or enlargements of existing buildings shall be designed, arranged or constructed, and no land or buildings, or parts thereof, shall be used excepting for:

- A. All Residence A and B uses.
- B. Banks and offices.
- C. Any retail or wholesale business or service or display and necessary incidental manufacturing, providing that it is not in any way a nuisance or hazard.

D. LOADING AND UNLOADING FACILITIES - In business districts any building erected shall be designed in such a way that loading and unloading of motor vehicles delivering or receiving goods to or from such premises shall take place in a manner that will not obstruct or

interfere with the free pedestrian or vehicular movement on the public right of way.

E. Places of amusement or recreation conducted for gain.

F. Any light manufacturing approved by the Board of Appeal that is not offensive or hazardous.

G. Restaurants, taverns, cafes and stores for sale of packaged goods liquors.

H. Public garages for storage and repairs.

I. Gasoline filling station, service stations and parking lots.

J. No garage or filling station shall have any entrance or exit or driveway with 10 feet of any residential districts.

K. Billboards and advertising signs in accordance with definite specifications established by ordinance.

L. PROHIBITED USES: NONE OF THE FOLLOWING USES SHALL BE ALLOWED:

(a) Storage of petroleum or petroleum products in quantities exceeding 10,000 gallons.

(b) Storage, processing or sorting of waste materials and junk.

M. Railroad stations, bus, street car and other transportation, waiting rooms.

S E C T I O N 8

INDUSTRIAL DISTRICT A

Within Industrial District "A" any land or building may be used, altered, enlarged, constructed, arranged and designed for the use of Residential A and B uses, trade, business, industry or purpose of any kind that will not be offensive by reason of the emission of odor, dust, refuse matter, cinders, wastes, vapor, gas, smoke, noise, vibration, corrosive or toxic fumes even though not specifically excluded in the following list of prohibited uses:

None of the following uses shall be allowed:

Stone crusher

Ammonia manufacture

Raw or green salted hides or skins, their curing, dressing or tanning.

Stock yards

Acetylene gas manufacture, or storage of bulk

Asphalt manufacturing or refining

Coke ovens

Refining of petroleum or petroleum products.

Magnesium and its products

Match manufacturing, ore reduction,

potash works.
 Abbatoir or slaughter house
 (excepting for poultry incidental
 to retail trade) or stock yards.
 Explosives or fireworks manufacture.
 Fertilizer manufacture from organic
 materials.
 Glue or size manufacture or processes
 involving recovery from fish or
 animal offal.
 Incineration, reduction or dumping
 of offal, dead animals, garbage or
 refuse on a commercial basis, or
 loading and transfer platforms
 therefor.
 Bone distillation.
 Animal rendering or refining.
 Wool pulling or scouring.
 Oilcloth or linoleum manufacture.
 Hazardous, corrosive, or offensive
 manufacturing, storage or use,
 excepting under conditions specified
 by the Board of Appeal.

S E C T I O N 9

INDUSTRIAL DISTRICT B

Within any Industrial District B no building shall be constructed, or enlargements of existing buildings shall be designed, arranged, or constructed, and no land or buildings, or parts thereof, shall be used excepting for:

- A. Business District and Industrial A uses.
- B. Wool pulling or scouring.
- C. Oilcloth or linoleum manufacture.
- D. Storage, processing or sorting of waste materials and junk.
- E. All prohibited uses under Section 8 for Industrial District 'A' uses shall apply to Industrial District 'B' uses unless specifically set forth as a permissive use in this section.
- F. All residential uses in Residential Districts 'A' and 'B' are prohibited in this district.
- G. In Wards One, Three and Five, only, the sorting, storage and processing of metals shall be permitted.

S E C T I O N 10

In Industrial Districts 'A' and 'B' any building erected or altered for commercial or manufacturing purposes shall be designed in such a way that loading and unloading of motor vehicles or freight cars, or receiving goods to

or from such premises shall take place in a manner that will not obstruct or interfere with the free pedestrian or vehicular movement on the public right of way.

• • •

Footnotes to Chapter II:

1. David M. Winterbottom, "The Nuisances of Traffic in Residential Areas," Traffic Quarterly, Vol. XIX, No. 3, July 1965, p. 389.
2. Ibid., p. 389.
3. Committee on the Problem of Noise, "Noise: Final Report Presented to Parliament by the Lord President of the Council and Minister for Science by Command of Her Majesty," London, Her Majesty's Stationery Office, July 1963.
4. Bolt Beranek and Newman Inc., "Noise in Urban and Suburban Areas: Results of Field Studies," January 1967.
5. Jack B. C. Purcell, "Keeping Out Street Noise," Architectural and Engineering News, March 1964, p. 23.
6. Both the Committee on the Problem of Noise (op. cit.) and Bolt Beranek and Newman (op. cit.) concur on these figures. According to Bolt Beranek and Newman (op. cit., p. 8), the A-scale network is one of several one-number physical measures of noise which correlate quite well with the subjective response to present day surface automotive noise as established by laboratory testing.
7. R. J. Stephenson and G. H. Vulkan, "Noise from Elevated Trunk Roads," The Town Planning Review, Vol. XXXIV, No. 2, July 1963, pp. 149-150.
8. Bolt Beranek and Newman Inc., op. cit., Figure 3-1.
9. Bolt Beranek and Newman Inc., op. cit., p. 12.
10. Noise level reductions of this amount are indicated in information from Jack B. C. Purcell (op. cit., p. 25) and Bolt Beranek and Newman (op. cit., p. 11).
11. Committee on the Problem of Noise, op. cit., p.5.
12. Committee on the Problem of Noise, op. cit., p.26.
13. Bolt Beranek and Newman Inc., op. cit., p. 24.
14. Committee on the Problem of Noise, op. cit., p. 7.

Footnotes to Chapter III:

1. These levels have been derived by combining the general recommendations of the Committee on the Problem of Noise with personal intuition.

2. These are American Standards Association figures quoted by David M. Winterbottom, op. cit., p. 389.

Footnotes to Chapter IV:

1. This map was taken from Melvin R. Levin, "The Boston Regional Survey," prepared for the Massachusetts Transportation Commission, April 1963, p. 19.
2. "Town and City Monographs, No. 16, City of Chelsea," Massachusetts Department of Commerce and Development, Revised February 1965, Section IV B 1.
3. "Survey and Planning Application," Murray Industrial Park, Chelsea Redevelopment Authority, Chelsea, Massachusetts.
4. Field surveys were the source of this information. Those field surveys cited here and subsequently were all made by the author in February, March, and April, 1967.
5. These divisions were established by field survey and from information on the City of Chelsea map published by The Chelsea Record, 1965.
6. These maps are all taken from Insurance Maps of Chelsea, Massachusetts, published by Sanborn Map Company, New York, 1955, Revised 1965.
7. Information was taken from Insurance Maps of Chelsea (op. cit.); plans, sections, and elevations prepared for the construction of the Mystic River Bridge and its approach ramps for the Mystic River Bridge Authority; and sections and right-of-way plans prepared by the Department of Public Works of the Commonwealth of Massachusetts for the construction of a state highway in the Cities of Chelsea and Revere.
8. Ibid. Cross-sections were compiled based on information from these three sources.
9. Field survey, February 1967.
10. U.S. Population Census, 1960.
11. Traffic volumes for major routes were taken from a map prepared by the Boston Regional Planning Project based on information by Wilbur Smith and Associates in "Comprehensive Traffic and Transportation Inventory," September 1965. The figures used to translate vehicular volumes into person volumes were derived from information in the same report, Table 30, p. 88.
12. This conclusion was reached after a brief study of the City of Chelsea Ordinances.

13. The author interviewed the Assistant Manager of the Mystic River Bridge and also several staff members of the Departments of Planning and Records of the state Department of Public Works in March 1967.

14. "Survey and Planning Application," op. cit.

15. Melvin R. Levin, op. cit., pp. 42-43.

16. This is based on field survey, March 1967.

17. Field survey, March 1967.

18. Melvin R. Levin, op. cit., p. 107.

19. Assuming a capacity per lane of an expressway is 1500 vehicles per hour, this means 4500 vehicles in each direction can be accommodated per hour on the study sector of the Northeast Expressway. The present flow, according to Boston Regional Survey data (Levin, op. cit., Table 42, p. 106), is 58,340 vehicles per day on the average. If thirty per cent of this flow occurs during four peak hours in the morning and afternoon, the average flow in each direction is 4375, which is already close to capacity. The capacity estimate and distribution percentage was from Mattson, Smith, and Hurd, Traffic Engineering, New York, McGraw-Hill, 1955.

20. Field survey, March 1967.

21. Reference was made throughout the study of social interrelationships to James M. Beshers, Urban Social Structure, New York, The Free Press of Glencoe, Inc., 1962, Chapter 5, pp. 87-108.

22. Information gathered by Wilbur Smith and Associates for the "Comprehensive Traffic and Transportation Inventory" was put on computer tapes. These tapes were used to construct a series of data tables on Chelsea, Massachusetts, for use in the Fall Term 1965 of M.I.T. course 4.241. Table 3 showed commuting between zones of work and zones of residence and was the basis for the relationships shown here.

23. City of Chelsea map published by The Chelsea Record, 1965.

24. This information was obtained in an interview with a member of the administrative staff of the Chelsea School Board.

25. Wilbur Smith and Associates, op. cit., Appendix I, Table B-1, p. 12A.

26. Kevin Lynch, The Image of the City, Cambridge, Massachusetts, The M.I.T. Press, 1960, Appendix B, pp. 140-159.

27. This information is based on National Recreation Association figures given by John T. Howard in a mimeographed class memo for M.I.T. City Planning course 4.53, City Planning Techniques, Spring 1966, pp. 67-68.

28. Ibid., p. 92.

29. Wilbur Smith and Associates, op. cit., Appendix.

Bibliography:

- Appleyard, Donald, Lynch, Kevin, and Myer, John R., The View from the Road, Cambridge, Massachusetts, The M.I.T. Press, 1964.
- Beshers, James M., Urban Social Structure, New York, The Free Press of Glencoe, Inc., 1962.
- Bolt Beranek and Newman Inc., "Noise in Urban and Suburban Areas: Results of Field Studies," January 1967.
- City of Chelsea Ordinances.
- Committee on the Problem of Noise, "Noise: Final Report Presented to Parliament by the Lord President of the Council and Minister for Science by Command of Her Majesty," London, Her Majesty's Stationery Office, July 1963.
- Halprin, Lawrence, Cities, New York, Reinhold Publishing Corporation, 1963.
- Halprin, Lawrence, Freeways, New York, Reinhold Publishing Corporation, 1966.
- Howard, John T., class memo for M.I.T. City Planning course 4.53, City Planning Techniques, Spring 1966.
- Humphreys, Henry R., "Noise and the Motorways," The Architect's Journal, Vol. 136, No. 2, July 11, 1962, pp. 91-94.
- Levin, Melvin R., "The Boston Regional Survey," prepared for the Mass Transportation Commission, April 1963.
- Lynch, Kevin, The Image of the City, Cambridge, Massachusetts, The M.I.T. Press, 1960.
- Mattson, Smith, and Hurd, Traffic Engineering, New York, McGraw-Hill, 1955.
- Miller, Richard A., "Expressway Bright," Architectural Forum, Vol. III, No. 4, October 1959, pp. 159-163.
- Purcell, Jack B.C., "Keeping Out Street Noise," Architectural and Engineering News, March 1964, pp. 22-25.
- Smith, Wilbur, and Associates, "Comprehensive Traffic and Transportation Inventory," prepared for the Boston Regional Planning Project, Department of Public Works, September 1965.

Stephenson, R.J., and Vulkan, G.H., "Noise from Elevated Trunk Roads," The Town Planning Review, Vol. XXXIV, No. 2, July 1963.

"Survey and Planning Application," Murray Industrial Park, Chelsea Redevelopment Authority, Chelsea, Massachusetts.

Taylor, Harry A., and Associates, "Study and Report: East-West Freeway, F.A.I. 165, East Orange, New Jersey," Vols. 1,2,3, January 30, 1959.

"Town and City Monograms, No. 16, City of Chelsea," Massachusetts Department of Commerce and Development, Revised February 1965.

Tunnard, Christopher and Pushkrev, Boris, Man-Made America: Chaos or Control?, New Haven and London, Yale University Press, 1963.

U.S. Population Census, 1960.

Winterbottom, David M., "The Nuisances of Traffic in Residential Areas," Traffic Quarterly, Vol. XIX, No. 3, July 1965.

Maps:

Appleyard, Donald, Lynch, Kevin, and Myer, John R., The View from the Road, Cambridge, Massachusetts, The M.I.T. Press, 1964, map p. 28.

City of Chelsea map published by The Chelsea Record, 1965.

Department of Public Works, Commonwealth of Massachusetts, sections and right-of-way plans for the construction of a state highway in the Cities of Chelsea and Revere.

Insurance Maps of Chelsea, Massachusetts, published by Sanborn Map Company, New York, 1955, Revised 1965.

Levin, Melvin R., "The Boston Regional Survey," prepared for the Mass Transportation Commission, April 1963, population density map.

Mystic River Bridge Authority, plans, sections, and elevations for the construction of the Mystic River Bridge.