THE EFFECT OF THE FITZGERALD PARKING GARAGE ON THE TENT CITY TASK FORCE GOALS

by

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Submitted to the Department of Architecture on June 2, 1980, in partial fulfillment of the requirements for the degree of Master of Architecture.

ABSTRACT

Development is a sensitive issue in the urban areas of our cities. It can contribute to the economic and social enrichment of the community affected. Often it has aggrevated urban problems and has contributed to the decay of the community. This effect is major in areas with racial tension and economic instability such as the South End area of Boston where displacement and gentrification are happening.

The different South End community groups have over time developed a self help ethic about problem solving and goals. They have concentrated their efforts on alleviating past displacement, providing affordable housing, and promoting development that is responsive to the community needs and culture. They understand that a development that will address social and economic community problems has to be controlled by the affected residents. The Tent City Corporation has evolved from this ideology.

Tent City Corporation has produced a development proposal for mixed income housing. This proposal was developed through citizen participation, and advocates citizen control of decision making, management, design and financial allocation.

The Fitzgerald family operate a parking business and hold land parcels throughout Boston. They own a portion of the land where the proposed Tent City project will be developed. The Fitzgerald family are also interested in developing the site and have produced a development proposal.

This thesis will examine these two proposals. I focused my attention on the major differences of both proposals: the parking "solution or problem".

I have examined the construction techniques and structural requirements of the garage and have arrived at an independent cost estimate for its construction. I have analyzed the financial feasibility and have concluded that the garage is not financially sound or in a position to help subsidize the housing.

These figures can be examined by the community and the developer and can be used as a starting point for negotiations.

Thesis Supervisor: Tunney F. Lee, M.Arch
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Introduction

In the 1950's-1960's the South End area of Boston was affected by Urban Renewal. The area was categorized by many planners and observers as an undesirable place in which to live. There was much displacement of the residents especially the poorer and black populations. The South End residents getting more disappointed and angered by urban renewal organized many groups that evolved over-time each struggling with different issues of displacement and demolition of communities. From these struggles the development of the Tent City Task Force evolved, named after the Tent City Site where in 1968 a mass demonstration occured. South End residents demonstrated against displacement. The Tent City Task Force which has focused its efforts on creating affordable and better quality housing for the South End resident has now been in existence over six years and has gained the respect of both the public and private sectors in Boston.

In 1978 M.I.T.'s total studio helped the Tent City Task Force prepare a set of design guidelines for developing the Tent City site. Tent City is located near the Back Bay area of Boston and is the gateway to the South End. The Tent City Task Force has developed into the Tent City Corporation. The Tent City Corporation's goal is to develop Tent City site into mixed income housing. The Tent City Task Force had assumed that the B.R.A. would acquire the land by eminent domain from the Fitzgerald family who owns a large

percentage of the site, and receive an income from the parking lot they operate on the Tent City site. The remaining land is owned by the B.R.A. and the City of Boston.

The Tent City Corporation has chosen an architect and developer to put together a development proposal for the Tent City site. This proposal was submitted to the B.R.A. for approval and was asked to designate Tent City Associates, the Tent City Corporation and its team as the developer. Two weeks after the submittal by Tent City the Fitzgerald family also submitted a proposal for development of the site to the B.R.A., their team is called Dartmouth Crossing Associates. The B.R.A. suggested that both the Tent City Associates and Dartmouth Crossing Associates merg, this way they would not have to choose between them and the acquisition of the land by eminent domain can be avoided.

The Tent City Corporation went through a process of community participation and analysis of user needs in developing their design. The major difference in both proposals stem from the differences in ideology. This is most apparent in both schemes where the Tent City proposal has designed residential parking only and the Dartmouth Crossing proposal has designed a 355 primarily commercial underground parking garage.

I see this as the major difference between the proposals and the main problem with Dartmouth Crossing. This major and massive underground structure can create such technical difficulties and expense that it can make the project fail.

I will focus on the technical requirements of underground construction and the cost of the garage and the effect the cost has on the project.

If the project accrues a huge construction cost, the Tent City Corporation will fail in its efforts to provide affordable mixed income housing for the residents of the South End.

Chapter 1 Background of Urban Renewal in the South End

1.1 Legislation.

In 1949 the Federal Government launched an urban renewal program aimed at providing housing through spot renewal of residential slums. In 1954, in response to some deficiencies of the 1949 Act, amendments were made that allowed the programs to be more concerned with rehabilitation and conservation of existing housing stock, rather than the demolition of residential slums.

1.2 History of Urban Renewal in the South End Area of Boston.

The South End is a large neighborhood located just south of downtown Boston. It is the largest area ever designated as an urban renewal project in the United States (616 acres). The South End is an integrated community of many ethnic, racial and income groups. Besides the traditional ethnic mixture of stable neighborhood people and the more recent middle-class "gentrifiers," there is also a significant population of lodging house roomers, transients, skid row alcoholics and "night people."

The major architectural feature of the South End is the 19th-century row house: brick, bow-front, three to five stories in height. The overall character of the neighborhood is residential, even after more than twenty years of pressure from the neighboring colossus of downtown Boston.

Planning started for urban renewal here in 1960. At that time the area offered housing for low income people. It also held great potential of revitalization for middle class people seeking city living. Geographically the area was, and still is, very desirable, only one mile from the center of Boston and close to new development complexes.

In 1961 a South End urban renewal committee was organized, which eventually became the South End Federation of Citizens' Organizations. It's purpose was to represent the South End community in dealing with the urban renewal proposal of the Boston Redevelopment Agency (B.R.A.). This committee (SEFCO) which had grown out of an older civic association, was reorganized as a coalition of interest groups, representing homeowners and leaders of social service agencies such as the United South End Settlements (working with the areas social problems). This organization did not represent tenants or the poorer segments of the community, or the areas major ethnic groups. SEFCO surveyed the needs of the area and represented the interests of the residents in dealings with the B.R.A.

A plan put forward by the B.R.A. was withdrawn in 1963 after the community reacted against it. There had been inadequate representation of significant elements of the community, and information about the B.R.A. plans had not filtered down to the neighborhood and street level.

A plan was finally approved by the community after two more years of negotiations with the urban renewal coalition,

(SEFCO) which now represented 15-20 individual neighborhood associations. The main issue in the negotiations was whether the plan would renew the area for the existing residents or offer the area to the middle-class and upper-income home buyers. As a result of these negotiations, the B.R.A. made a major public decision, supported and demanded by the neighborhood organizations, to maintain the area for the existing residents.

Because the necessary subsidies did not become available, the housing that was promised in the plan was not built. The result was long delays and broken agreements and a hardening of community sentiment against further development of the area. The plan had called for major development, but without the guarantees of subsidized rent, the community groups opposed the new construction. They were not able to halt a great deal of land acquisition and demolition, however, and significant dislocation of residents did occur in the middle and late 1960's.

In 1967, CAUSE, the Community Assembly for a United South End (Slogan: "We will not be Moved."), was organized by Mel King, a community activist who later took a major role in the development of the Tent City organization. CAUSE's goal was to give tenants a voice in the urban renewal plans for the South End. CAUSE originally applied for membership in SEFCO, but the older group adopted a voting structure which gave the organizations representing property owners more weight than the tenant groups. CAUSE, therefore, did not

join, and developed its tenant constituency separately from the ownership groups.

In CAUSE's early stages there was no immediate crisis recognized. CAUSE devoted its efforts to educational and research projects, notably a study that showed the effects of urban renewal to be detrimental to the community. A group of volunteer professionals, called the Urban Planning Aid, analyzed the South End renewal plan more systematically, and pointed especially to the impact that the Plan had on the dislocation of blacks and other community elements.

1.3 Tent City

In April, 1968, a group of community residents organized by CAUSE, occupied an urban renewal parcel where several buildings had been demolished. The site was what thereafter became known as "Tent City." Part of the parcel was owned by B.R.A. and part was owned by the Fitzgerald family who operated several parking lots, one of them on this site. The Boston Police arrested the sit-in participants, but they returned, and overnight they created a squatter campsite of over 100 people, and renamed the parcel "Tent City." The occupation lasted four days before the squatters were forced to leave. By this time, community support had been mobilized, the City had promised to include this new community force in the renewal process, and the foundation was laid for long-term community involvement in the development of this site.

1.3.1 Tent City Task Force/Tent City Corporation

In 1974 the Tent City Task Force (TCTF), a subcommittee of the South End Project Area Committee (SEPAC) was formed, composed of residents (and abutters) of the Tent City site and of adjacent neighborhoods. Their goal was to alleviate displacement and relocation of the South End residents by providing affordable housing options on the Tent City site.

The TCTF established a set of development guidelines. These "Fundamental Principles of Development" which were revised in 1978 have also been adopted by SEPAC and publicaly endorsed by the BRA. They called for mixed income housing, with units available to families, elderly, and single individ - uals, a secure viable and socially intergrated design,provision for homeownership opportunity, particulary for moderate income residents, and sensitivity to the surrounding environment and architectural character. The TCTF advocates a design process which builts citizens participation into all stages of design and decision-making, and assures that the prospective residents will own and control the management of the development.

TCTF grows out of local citizens groups who have pursued various strategies over the years to protect the South End from redevelopment and dislocation of residents, so that although TCTF's explicite goals are limited to the development of the site, it is part of a broader community struggle to maintain the character of the South End.

Realizing that a legal recognized entity was required to

undertake actual development of the Tent City site, the TCTF incorporated the Tent City Corporation (TCC). It became evident that the most viable alternative to develop the site was for TCC to form a partnership with a developer. After intensive screening TCC chose a co-general partner. The partnership entity calling itself Tent City Associates submitted a development proposal to the BRA.

1.3.2 Fitzgeralds

William Fitzgerald was Fire Commissioner under Mayor Collins, who is his uncle. Fitzgerald began buying parcels of land in downtown Boston in the 1950's. Often he would demolish any structure on them and turn the parcels into parking lots, both as a holding action and to decrease their property assessments. From this speculation grew a chain of parking lots in the Back Bay and downtown areas. In late 1978, Fitzgerald offered to sell his portion of the Tent City site to a developer but the developer was not interested.

William Fitzgerald is bequeathing his land holdings to his son and daughter in-law. He wants to launch his son's career in real estate development. In 1979 the son and daughter in-law had requested to the BRA to be designated developers.

At the BRA's suggestion the Fitzgeralds had agreed to abide by the TCTF's "Fundamental Principles of Development".

1.3.3 The Proposals: TCA/DCA

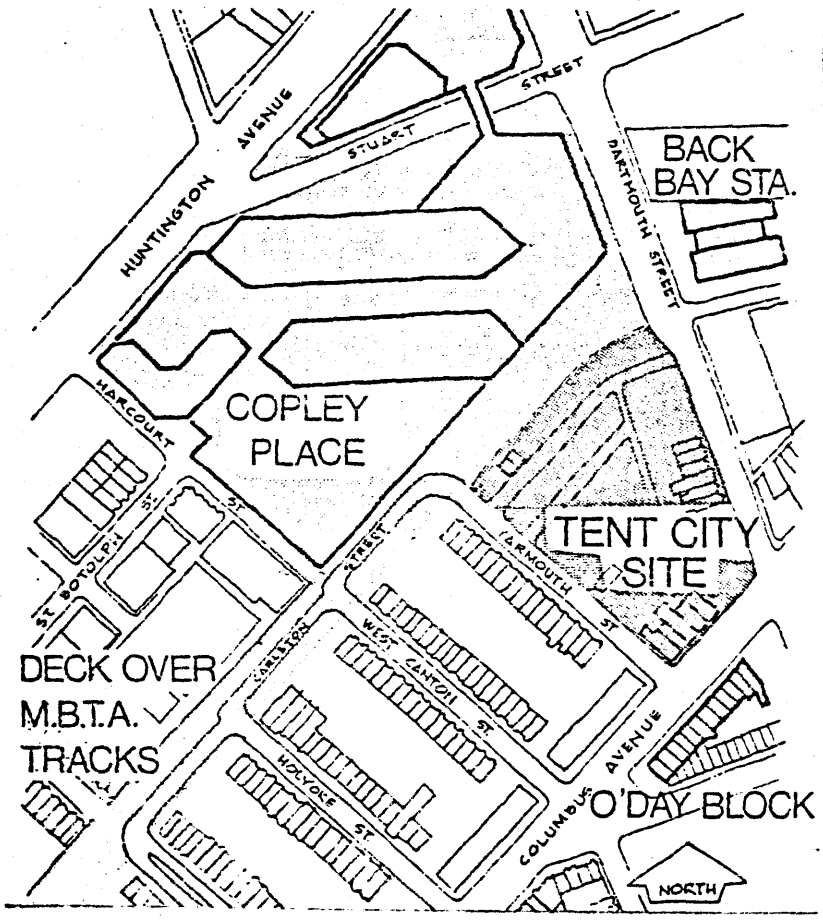
Since late February 1980 the TCC and the Fitzgeralds have

been negotiating with the goal of reconciling the fundamental differences between their respective plans. The city would like to see the conflict resolved in the form of a partnership between the two parties. The BRA is not likely to grant designation to either seperately, since it cannot afford to alienate either TCC or the Fitzgeralds.

Chapter 2 Development Conditions and Comparison of Two Proposals

2.1 Tent City site is strategically located at the entry to the South End from Back Bay. Back Bay is an upper middle-class neighborhood. It has been designated as a historic preservation district and is primarily residential with major shopping areas, close to the Tent City site. Across the street from Tent City is Back Bay Station now closed for reconstruction and added service.

Tent City Site and Surrounding Environment



a) site description: The Tent City site is 3.3 acres bordered by Dartmouth St., R.R. tracks, Yarmouth St. and Columbus Ave. Presently there are fourteen 5-story buildings on the site, a community garden and a paved parking lot.

b) soil conditions: During the latter part of the nineteenth century, major portions of the Back Bay and South End neighborhoods were developed through the land fill of marshes and tidal basins. The Tent City site, as many others was built by draining and dumping of land fill, creating poor soil conditions. Piles are required to support most buildings. The existing buildings on the site are on wood piles.

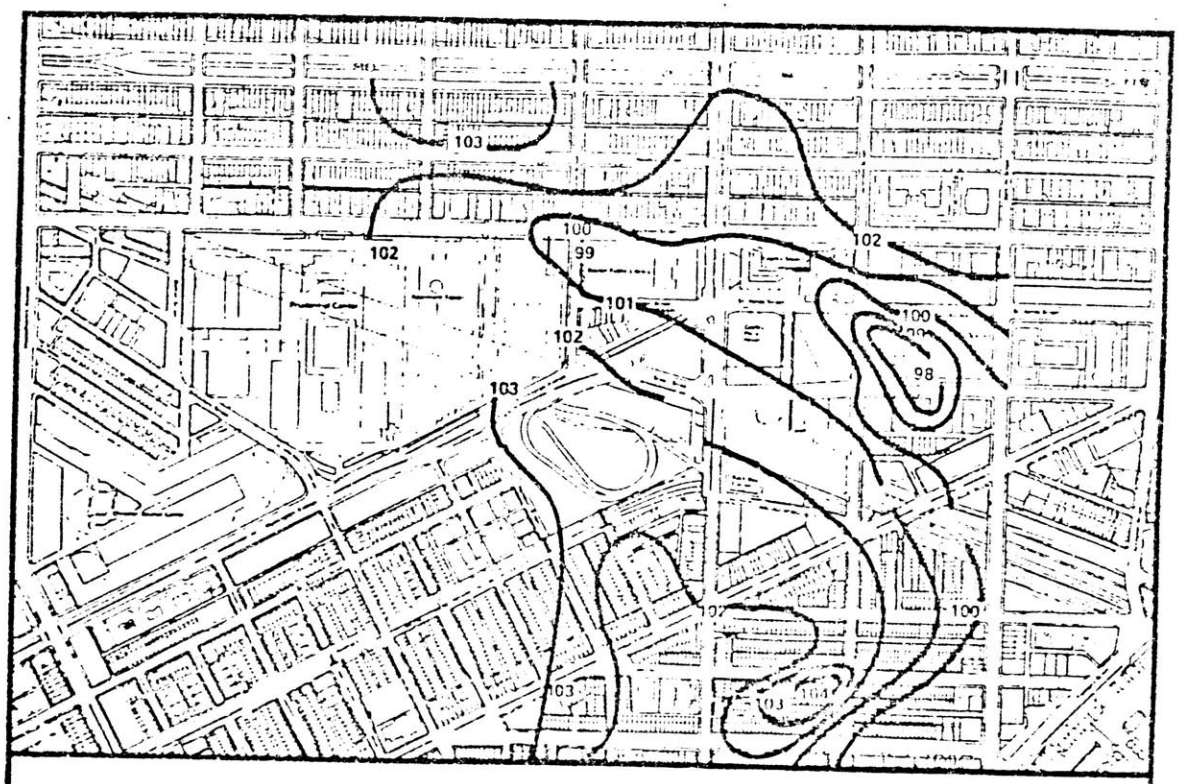
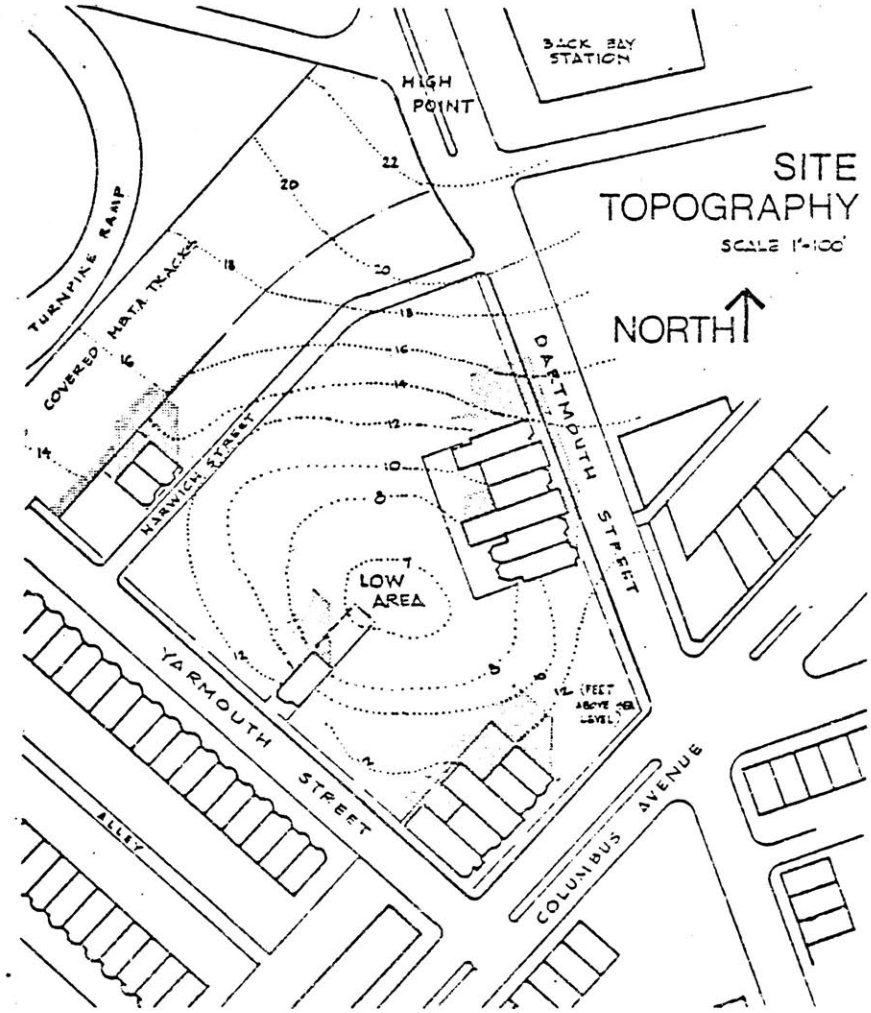


FIGURE 6.9-2 - HIGH WATER TABLE LEVELS

c) topography: The site is generally flat except along the R.R. tracks where it rises approximately 10 ft. above the average level of the site to meet the grade at the bridge. The site has a low point of approximately 6 ft. below the average level of the perimeter.

Site

Topography



d) Zoning: The Tent City site is a B-2 zone, business and housing uses are allowed. Housing needs to conform to the nearest H (housing district). The Boston Zoning code allows 2 times the site area of square ft. that can be built, on 280,000 sq. ft.

e) Parking: Off street parking requirements as prescribed in the zoning code are 0.7 spaces per dwelling unit for new construction, and 0.2 spaces per unit for subsidized elderly housing. For rehabilitated or existing structures if there is no increase in occupancy, no additional parking is required.

f) Traffic Conditions:

Dartmouth Street . . . . . Heavy traffic

Columbus Avenue . . . . . Semi-Heavy traffic

Yarmouth Street . . . . . Residential/light traffic

Railroad Tracks . . . . . No traffic

Auto access to the site is from three sides.

2.2 Surrounding Environments.

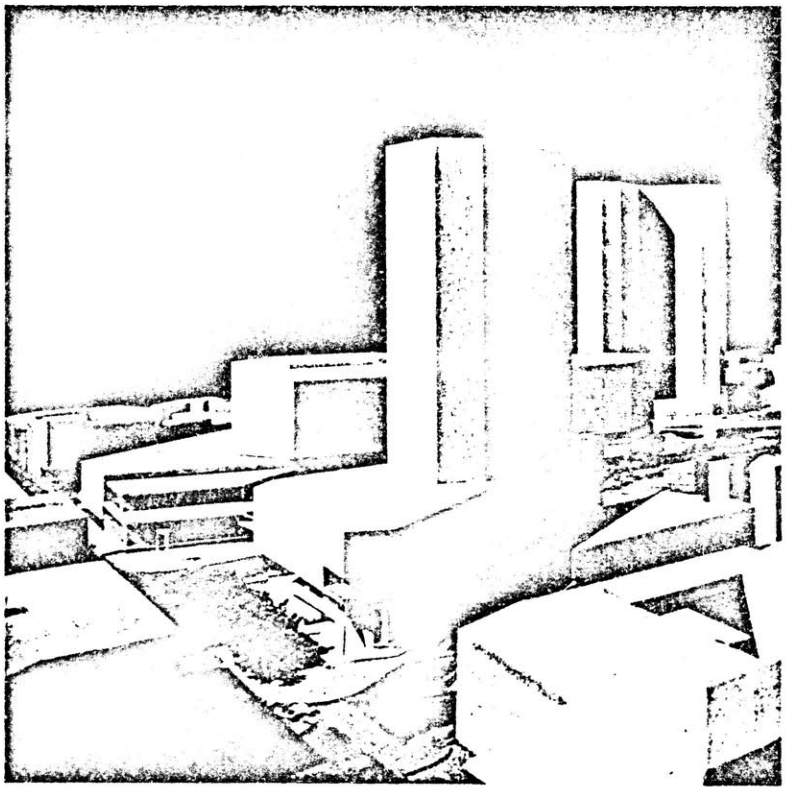
The surrounding environment around Tent City has very diverse, uses and mixed neighborhoods. To the south of the site is the South End, a residential and ethnically mixed neighborhood. To the north is the proposed South-West Corridor Project now vacant railroad tracks and unused railroad station. Across the tracks is vacant land and highway ramps, that land has a proposed development for a major commercial project. Tent City is within a few minutes walk to Prudential Plaza,

John Hancock, and Copley Plaza all major commercial shopping and office spaces.

2.2.1 Copley Place

Directly across the railroad tracks from Tent City is the proposed major commercial development of Copley Place.

Photograph of Proposed Coply Place Model



a) Goals: The goals of Copley Place are to encourage commercial development on presently blighted property, to stimulate the rebuilding of adjacent neighborhoods currently divided by the turnpike, and to reclaim the property for the City of Boston's tax rolls.

b) Development: The Urban Investment and Development Company (UIDC), the developer of Copley Place, has a 99-year lease from the owner of the land, the Massachusetts Turnpike Authority. UIDC has prepared a set of preliminary design proposals for Copley Place, consisting of these components:

a) 2 major hotels - 960-room convention hotel,
800-room luxury hotel

b) 1 large department store

c) retail shopping mall

d) 4 office buildings

e) 100 - 150 units of housing (25% low & moderate income)

f) 1500-car parking garage.

c) Land Description and Use: The Copley Place site covers approximately 9.5 acres of land owned by the Massachusetts Turnpike Authority. Most of the site is on air rights over the existing turnpike and access ramps.

The site consists of two parcels, separated by Stuart Street. The smaller parcel is a triangular vacant lot, clear and graded. The larger parcel is traversed by the Massachusetts Turnpike, its ramps and the railroad right of way. The site is crossed from east to west by a 42-inch water main. The parcel slopes steeply and is obstructed by various other rights of way and two bridge structures. It also contains a small parking lot.

d) Zoning is for business zones B-2 and B-8; a small part is apartment zone H-2.

e) Major changes to the existing envoronment. The Copley Place Project would entail the relocation of the turnpike off-ramps. The relocation of existing streets and the 42-inch water main (providing service to a larger area of the city) would also be required. A pedestrian bridge over Huntington Avenue would be constructed.

2.2.2 Southwest Corridor Project

Bordering the Tent City site and separating it from Copley Place, is a Penn Central railroad bed, designated as the Southwest Corridor Project.

Goals: To relocate the existing orange line subway, to reconstruct the Boston Washington Street subway, Amtrak, and commuter lines railroad tracks, and to renovate the old Back Bay station to include the commuter rail service and subway line service, for use as a major transit stop.

Proposal: The design calls for the lowering and expansion of the tracks, to include the orange line and commuter rails including Amtrak. The tracks are to be covered with a useable deck.

Major Changes to the Transportation Pattern: This line will service the Tent City and Copley Place sites. By providing them access to public transportation. This has a major impact to the area strengthening Tent City's proposal on street parking without the need for a major parking garage. The Tent City proposal suggests a variance on parking spaces

because they feel less on site parking than required by zoning is sufficient, because of the orange line service added to Back Bay station.

2.3 Development Proposals

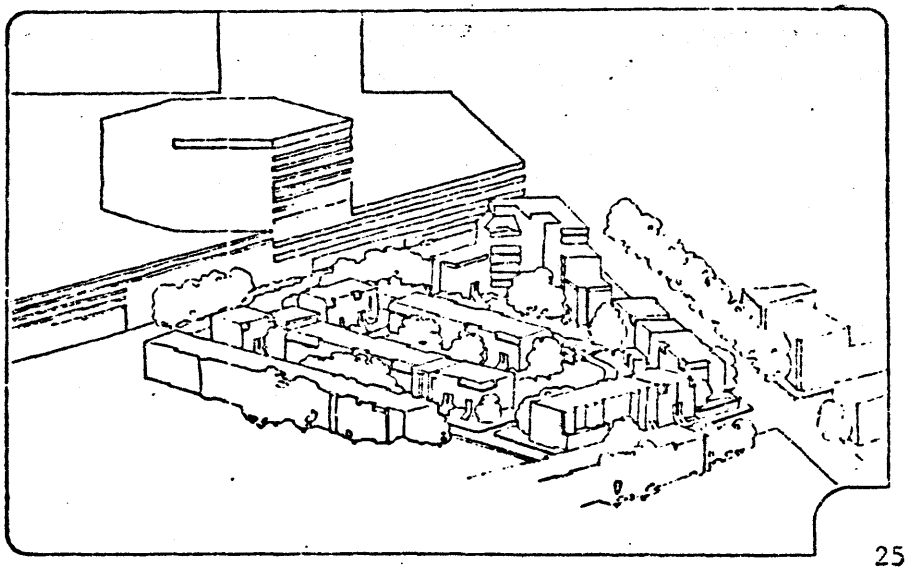
One site, two development proposals. Approximately half of the land owned by the B.R.A. the other half owned by the Fitzgerald's.

The Tent City proposal representing the community addresses long term community concerns and issues. The Dartmouth Crossing proposal representing the long time standing land speculator and parking lot operator throughout Boston, the Fitzgerald family.

The B.R.A. must decide who to designate developer of the project.

2.3.1 Tent City Proposal

Tent City
Site Development
Rendering by
David Conover



a) Development Proposal.

Housing Breakdown: 270 units

110 townhouses, (17)1br, (60)2br, (26)3br, (7)4br.

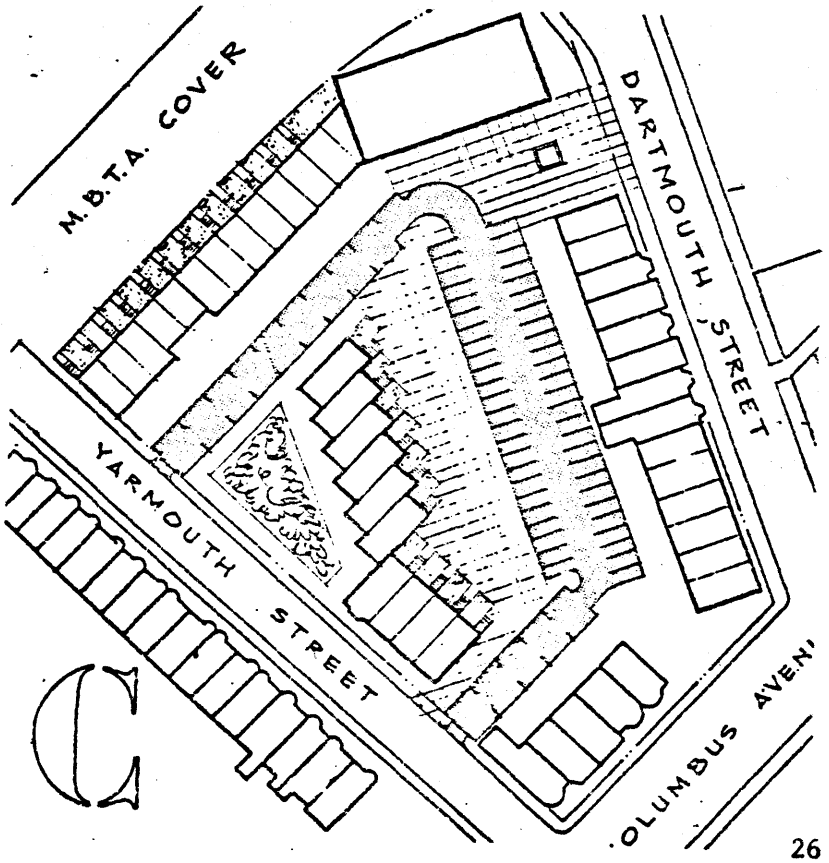
120 midrise (90) br, (10) br, (15) br, (5) br.

40 rehabilitated buildings (8)1br, (10)2br. (19)3br, (3)4br.

270 units total *55 might be congregate units

80 on grade parking
20 - 50 underground parking spaces (optional

b) Security: Tent City feels that use of space creates a more secure environment. This security is provided by the residents themselves and by the pedestrians and vehicular traffic. To make resident surveilliance, careful design and site planning of viewing distances and relationships has been worked out, to promote resident feeling of "control of their space."



Tent City Proposed
Site Plan
by David Conover

c) Response to Surrounding Environment: The typical South End housing type is the row house. Each building is approximately 20 ft. wide by 40 ft. deep, 4 1/2 stories above grade in the front with the top story contained in a mansard roof. Wide stone steps leading up to the main floor one level above grade. Schemes with less density than prescribed by the zoning law were rejected because they resulted in a site plan that had more space, which was uncharacteristic of the South End.

d) Parking: The SouthEnd has a parking ratio of .5 spaces per unit, Tent City desires to continue this ratio. Zoning requires 111 parking spaces for this type of unit breakdown, as a response to the environment tent city will seek a variance to allow the limit on parking to avoid large parking lots in favor of on street parallel parking.

e) M.B.T.A. Cover: It is crucial to Tent City that the cover over the train tracks be useable for the viability, security and interaction of the project. With Copley Place the cover must be developed as an active pedestrian street. The cover must be designed to carry pedestrian, landscaping and automobile loads.

f) Mass Transit: The existing Back Bay station across the street from the Tent City site is under renovation for the installation of the orange line subway. Also the Dartmouth Street bus stops on the Tent City site make the access to mass transit desirable and easy to the residents. With this

reasoning it is projected that the majority of the residents will use mass transit and the need to own a vehicle won't be pressing, thus the on site parking has been limited. The proposal has located the elderly housing midrise units close to the Back Bay Station and Mass Transit.

g) Cost: Total development cost is estimated at $16.7 million.

2.3.2 Dartmouth Crossing Proposal

a) Development Proposal

Housing Breakdown

75 market rental: 19(1br), 37(2br), and 19(3br)
(16 story building)

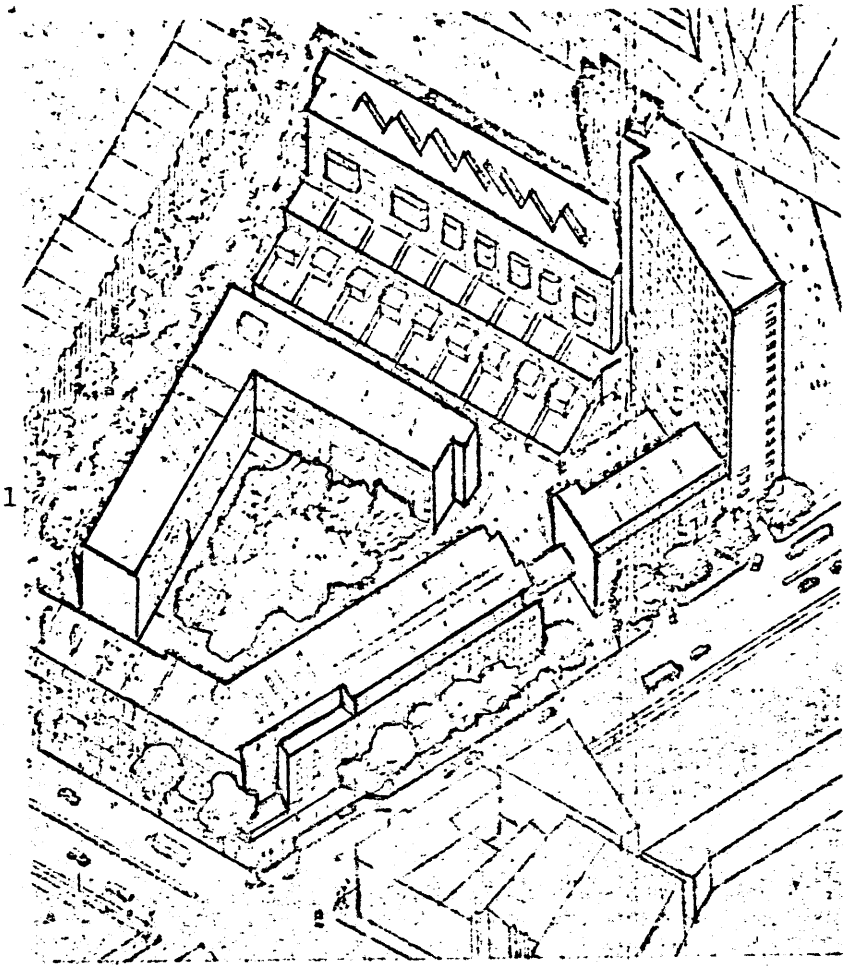
84 low income rental: 74(1br)
Elderly only, subsidized units, walk up townhouses

141 moderate income: 35(1br), 71(2br), 35(3br)
rental/home ownership

300 units total

355 car parking garage below grade

Dartmouth Crossing
Development Proposal
Rendering
by M. Bergmeyer



According to the Dartmouth Crossing Associates Proposal:

The Fitzgerald's feel that housing for the rich and the poor is insufficient and has been built before in the South End, while not enough housing was available to middle class. It is the middle group that are forced out and it is impossible for them to build affordable housing to buy or rent. The Fitzgeralds feel it is difficult to market and manage or get community support for projects that are entirely market or entirely subsidized.

Because Tent City is the only one of 4 undeveloped renewal sites in the South End they would like to use this development as a prototype to be used in any location or circumstance.

b) Response to the surrounding environment: Response to Coply Place: They feel that because of the site's location so close to the proposed Copley Place the largest commercial development ever planned in Boston this is an opportunity to develop Tent City, into mixed income housing, in addition the reality of Copley Place will force up adjoining residential property values. They feel that at least 1000 of the projected 6,300 Copley Place employees will seek housing in the vicinity of the site. They believe that Tent City will absorb some of the housing demand generated by Copley Place while also providing housing for the South End resident.

c) Response to Mass. Transit: From the proposal and the site plan no special design issues have addressed mass transit.

d) Response to parking: The response to parking is outward to capture the commercial and business clientel of the proposed Copley Place.

e) Costs: Total development cost is estimated at $26 million dollars.

2.3.3 Comparison:

a) Ideology: Tent City Corporation has gone through a complex and time consuming process to select architects, developers and other professionals where the community residents were educated to evaluate professional skills.

Even though the Dartmouth Crossing proposal mentions the need to work with the community through a process of review, the actual approach has been a traditional client, developer, architect relationship without benefit of consultion with the community residents in the preliminary stages of selection of professionals.

b) Participation: The Tent City Proposal has aggressively addressed resident and surrounding environmental needs such as parking spaces, security, social interaction and elderly needs.

Dartmouth Crossing: since the development proposal was developed in the traditional roles, the design reflects the standard class structure allocation of resources, assigned by income levels. For instance, the market tenants are placed in a high rise tower nearest to public transportation and downtown on the site.

The Fitzgerald family historically has owned and operated parking lots throughout the city. As their business income is generated from managing garages they have proposed a major underground parking garage of 355 parking spaces.

c) Parking: Tent City with 80 on grade parking spaces and an optional 20-50 space garage is a very modest solution based on user needs.

Dartmouth Crossing - The 355 parking garage is under ground in which two levels are under the water table. Since the Dartmouth Crossing Proposal hinges on the feasibility of the parking garage. In the following chapter, I will explore the different techniques of construction and cost analysis of deep excavations under the water table, necessary for such construction.

2.4 Problems with Dartmouth Crossing Garage:

Once the architect sets the main requirements for the superstructure, not much can be done to economize. The best use design is the one that accepts the site conditions and adapts the building to it. A building design that fights the site will be more costly, especially in the foundation design. The relationship of the building and the ground is crucial.

Any excavation in a simple open cut with equipment moving horizontally is relatively inexpensive. However, that cost can skyrocket if the excavation is even slightly complicated, such as in the extreme case of a deep excavation with complicated ground water control and vertical debri removal, where the cost to remove a cubic yard of material may be ten times the cost in an open cut.

2.5 Will Technical Problems Affect the Feasibility of the Project?

The following section explains some of the procedures and methods of construction underground in wet conditions. By understanding the procedure we can analyse it for costs and thus for the feasibility or viability of the underground parking concept for a housing project of this scope.

Chapter 3 Technical Problems

The most difficult condition to evaluate for labor and cost in the construction of a building is the foundation excavation and subsurface work. One never knows what to encounter in underground exploration: For that reason we try to find out what the subsurface material is before designing below-grade structures. The presence of large quantities of water in the soil and soft soils below the water table complicates the process of excavation and calls for special construction methods and devices.

Aside from the physical difficulty of removing earth and water to arrive at a void for construction, the other problem is to find soil that can support the structure and provide adequate bearing material for the footings. The depth of the bearing material can add to the difficulties of construction and increase cost of the project if the acceptable material is too deep.

For the purposes of the Tent City site, certain assumptions will be made based on adjacent new construction core borings and water tables. The Southwest Corridor Project and the Copley Place Project have supplied information on soil conditions and water tables.

Soil conditions and water levels will be assumed from Copley Place and Southwest Corridor core borings and topographical information in the EIS and EIR packages. Core borings no. 17 and 18 in

Copley Place are the ones bordering the Tent City site. The water level shows at 9'-9" at the NW area of the site and 15'-0" at the NE area of the site. Soil conditions are poor except for a strata of stiff clay at approximately 60 ft. below grade. Bedrock is 120 ft. below grade.

3.1 Excavation

In conventional excavation as the soil is removed from a spot the sides has to be held or shaped so as to keep the soil from sliding down the sides and filling up the void. With the presence of water one way to keep the void from filling up with water or keeping the muddy earth from flowing, is to build a retaining wall to support the sides. This method called sheeting, which support the side earth pressure and if deep enough will keep the water out also. When the water is still present then it has to be pumped out. Other methods used where digging occurs in wet areas are cofferdam and caissons.

3.2 Cofferdam

Where the entire area is surrounded with a watertight construction ahead of the excavation, the digging is then carried on in the dry. Any watertight construction such as sealed sheet piling is a cofferdam, except that the term usually applies to a more elaborate structure of large parts of a building site. For depths greater than ten feet, piling of steel must be used instead of wood pilings that are used for lesser depths.

When piers have to be sunk below the floor level, structural cylinders are used and filled with concrete. This requires the soil inside the cylinder to be removed and the bottom of the cylinder to be sealed off with concrete to prevent water from entering. If the footings are large, open or pneumatic caissons are used.

3.3 Caissons

Caissons are watertight compartments that are sunk as the excavation proceeds, and the digging is done inside the compartment.

There are open and closed caissons. A caisson is a box of watertight, wood, steel or concrete that can accommodate a person digging in it. The box may be open both on the top and the bottom this is an open caisson, or may be open only at the bottom and closed on the top - this is a pneumatic caisson with compressed air.

While the digging is carried on inside the box, the box sinks down of its own weight as the earth is removed under its edge. Open caisson are used when sufficient water on the inside interferes with the digging but when little enters under the lower edge.

The excavation is carried on by hand or by dredging machinery, and pumps are used to remove the surplus water.

The caissons become part of the foundation when in place. Pneumatic caissons; the same as the open caisson except it has a top for the purpose of confining compressed air within

the box. This is used when the water pressure is so great that a large amount enters under the cutting edge, whereby it interferes with the progress of the excavation and also draws material away from the surrounding area, creating a dangerous condition to the surrounding buildings. By introducing compressed air into the interior of the caisson the pressure is raised to a higher degree than the material outside preventing water from entering. Since the maximum air pressure a person can work in for limited period is 50 psi the maximum depth is 100 feet at which pneumatic caissons can be effective.

3.4 Sheeting

Most sheet piles are steel, also used are timber and concrete. The sheet pile is a flat sheet driven into the earth. As the site is excavated, the inside face of the sheeting is exposed and horizontal bracing or soil anchors called tie backs have to be installed. The bracing is usually made up of steel beams. Where the excavation is too wide to allow cross bracing diagonal rakers are installed. Diagonal rakers usually interfere more with the permanent construction. Most rakers bear against a footing or pile cap or a berm of earth is left inside the sheeting to support the face, and after the footing or pile caps are constructed and the diagonal rakers installed, the berm is removed until the sheeting is exposed.

3.5 Diaphragm Walls

Diaphragm Walls, also known as slurry wall, is used to cut off seepage and seal the excavation pit in water bearing strata. This has a double purpose because it can be used as a foundation wall for the structure above.

A trench is excavated mechanically from the surface. During the excavation the stability of the trench walls is ensured by filling the trench walls with slurry to dispense with sheeting or bracing. (Slurry is bentonite). When the trench is completed, the slurry is displaced by means of tremie concrete, this is a relatively quiet system which is an advantage within cities.

Structural diaphragm walls are used as retaining walls for the perimeter walls of deep foundations or underground parking facilities.

3.6 Foundations

In conventional foundations the footings rest on bearing soil or bedrock, but when the soil conditions are poor or a wet condition is encountered and the acceptable bearing soil is very deep below the structure, piles have to be used. There are two types of piles, friction and end bearing pile. Where the soil strata changes and has layers of stiff dense soil the friction pile can be used, the pressure of the soil around the perimeter of the pile is sufficient to support it. If the soil is poor throughout then the pile has to reach bedrock to bear on. This can be over a hundred feet below the structure.

Piles can be wood, concrete or steel or a combination of steel and concrete. The weight it has to support and the distance it has to span dictates what type of pile should be used, also the method of placing.

At times when end bearing is not practical and friction piles can't be used, a foundation mat may be designed instead. A foundation mat is when the entire bottom slab acts as one large footing and all the weights are distributed evenly. In this manner, a building may be floated by balancng soil weight to building weight.

When the footings of a structure are located very deep below the ground water level, the foundation mat to be used must be very thick because the mat must resist the uplift pressures of the water, while the building is being constructed over it and there isn't sufficient weight to hold it down.

One way to counteract the water uplift pressure before the foundation is weighted down is to dewater under the mat to relieve the uplift pressures, until the building is constructured. This is assuming that the mass of the building weighs enough to hold the underground structure down and will prevent it from floating up. Other techniques can be used which tie the structure down with pipes that are drilled and ancored into bedrock. This is called tension piles. If the bedrock is too deep and the building is not heavy enough, then the foundation mat has to be very thick and heavy so the foundation will hold itself down.

3.7 Pumping and Dewatering

To depress the water table the methods used are drainage ditches, sumps, and wellpoints. On large projects wellpoints are normally used.

Dewatering is done by laying a pipe around the building site and tapping into this line at regular intervals with smaller vertical pipes with well points at their lower ends. The lower end of the well points are perforated. A pump is connected to the pipe line and removes the water from the soil. This method may lower the ground water level by 15 feet. If greater depths are required, the pumping is done in two or more stages byusing another well point circuit at each succeeding stage. The distance well points are placed apart depend on the permeability of the soil.

Pumping may occur day and night until the foundations are completed. The problem with well points is that the water has to be pumped back into the ground at some distance outside the excavation, because if the water table is lowered too much it can rot any existing wood piles that are affected.

Alternative ground water control are sheet pilings as mentioned in section 3.4 and slurry trench walls section 3.5 The advantage of slurry walls is that it maintains the existing water table outside the excavation.

3.8 Drainage

One way to keep water out of a structure is to drain it away. This method is usually preferred because if technically

feasible, it is less expensive than waterproofing, and also more reliable. Another advantage is that the contractor can shut down the temporary dewatering immediately after the drainage is installed. When pumping or dewatering methods are used for a waterproof structure, the technique has to be maintained until enough of the building is in place to offset the water pressures against the bottom of the slab. If water returns to its natural elevation before the substructure is anchored with a compensating weight, the entire structure may rise out of the ground, to float on the ground water.

The drain system dumps into a storm sewer, or the water can be collected in a sump pit and pumped into the storm sewer. This preferred method may not be practical in very deep foundations where large areas are under water, and massive amounts of water has to be drained away.

3.9 Waterproofing

The waterproofing here is for the final space. This is unlike the waterproofing mentioned that was for the prevention of water interfering with the construction.

The first requirement for waterproofing a substructure is that all the walls and slabs must have enough strength to withstand the water pressures.

a) Different types of waterproofing are: A waterproof barrier can be installed on the exterior of the structure so as to prevent the water from entering, this is usually a film of plastic sheet. The problem is the exterior water-

proofing is hard to install readily because it is easily punctured during construction and when gone undetected it is impossible to repair after the concrete is in place.

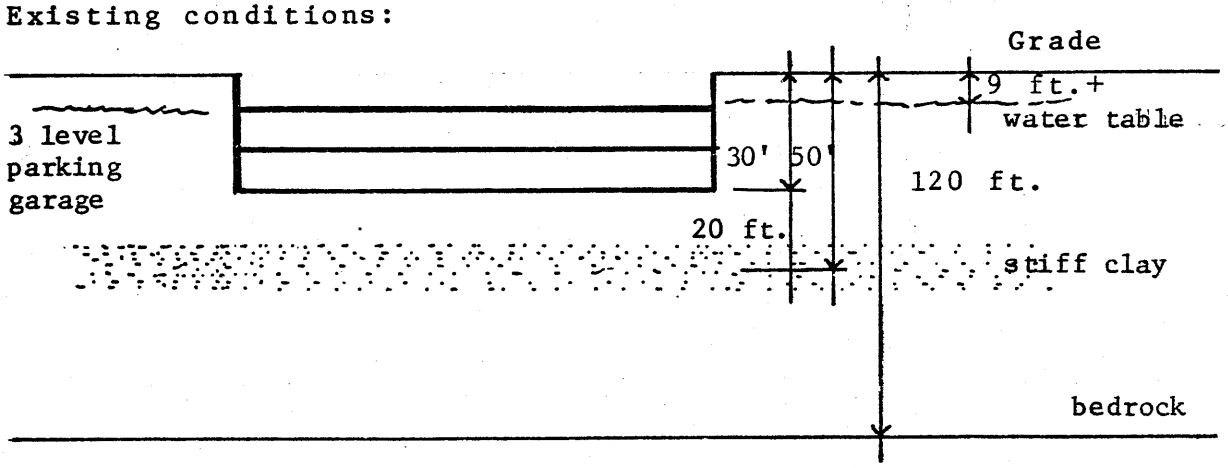
b) A waterproof barrier can be installed on the interior which prevents the water from entering into the space. Interior waterproofing is easily accessible to repair and usually guaranteed for years, but more expensive than exterior waterproofing.

c) The structure itself can be dense enough to become waterproof. This is accomplsihed by designing a concrete structure in the ultimate strength design method and prestressing or post tentioning the concrete mass.

Chapter 4 Analysis of Dartmouth Crossing Garage

This section looks at specific conditions and problems with the Tent City site and the Dartmouth Crossing proposal for three parking levels underground.

Existing conditions:



4.1 Excavation

Deep excavation required of at least 30 feet below grade, in which approximately 20 feet will be below the water level.

Previous building on the site used pilings. There is a possibility that during excavation existing piles will have to be removed from the site excavation.

4.1.1 Soil Conditions

Soil conditions are poor for the top 60 feet from grade. Not recommended for bearing

Approximately 60 feet below grade is a stiff hard soil strata good for bearing.

Bedrock is approximately 120 feet below grade recommended for bearing. (See soil borings)

4.1.2 Foundation

The bottom slab of the structure will be approximately 30 feet below grade which makes it only 20 or 30 feet to the bearing strata and 90 feet to bedrock.

Soil pressures uplift pushing up on the bottom slab of the structure making it want to float up.

4.1.3 Water

Water protection methods must be used during excavation such as cofferdam, slurry walls, sheet piling.

Permanent water protection has to be provided for the underground garage structure.

4.2 Recommended Construction Method

After analyzing the different methods used for construction in underground water conditions I have eliminated systems of construction that seemed impractical for the Tent City site. I recommend the following techniques for the specific condition in the Dartmouth Crossing proposal.

4.2.1 Dewatering

Because the existing building on the site are on wood piles, I do not recommend the lowering of the water level. The use of a diaphragm wall (slurry wall) would be best but

its most expensive so I recommend temporary sheet piling with a retaining wall inside.

The side retaining wall can act as the foundation bearing wall for the structure above.

4.2.2 Uplift Pressures

Because the excavation is deep the hydrostatic uplift pressure will be great. A thick massive foundation mat type slab should be used. The foundation mat can be keyed into the retaining wall and be water tight. The slab will require reinforcing and a thickness of approximately 6 feet for a 30 foot depth. The foundation mat will distribute the weight evenly on the soil. This will do away with any need for piles.

4.2.3 Water-proofing

The structure shall be water-proofed on the inside walls.

4.2.4 Soil Borings

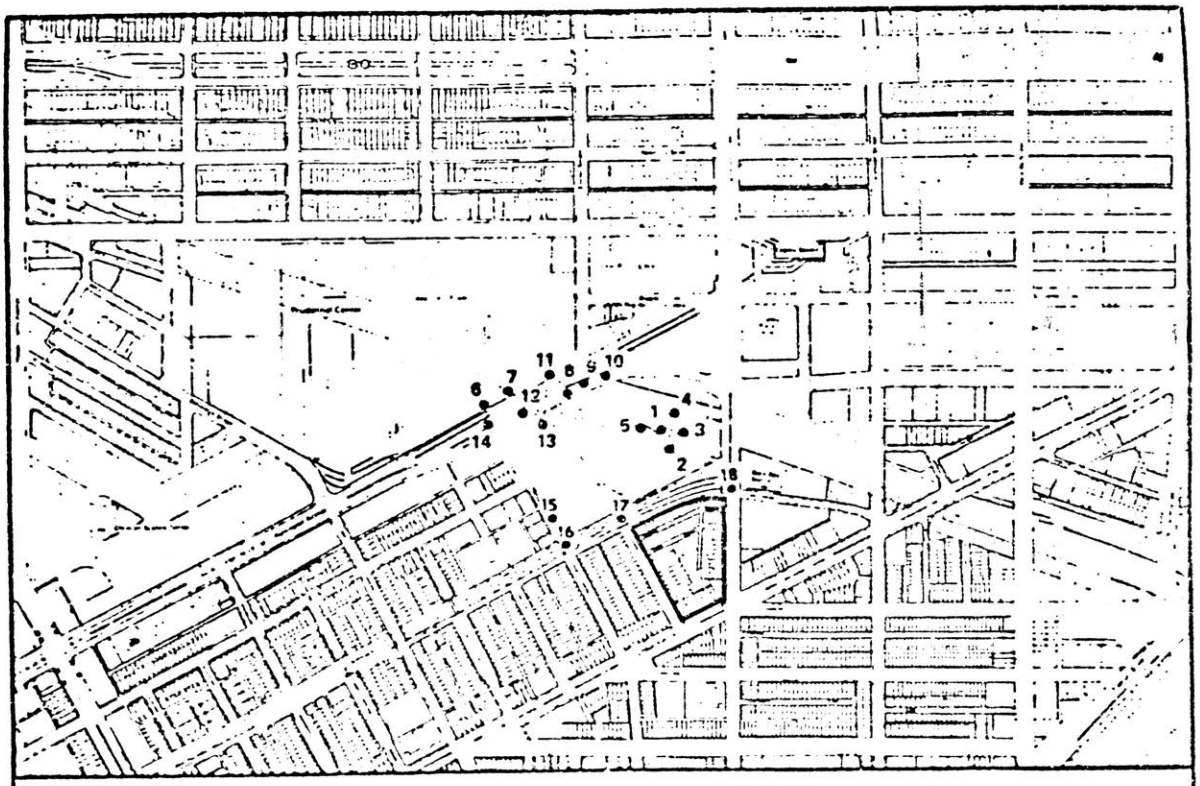


FIGURE 6.9-1 - LOCATIONS OF SOIL BORINGS

Boring from Copley Place EIS, EIR Statement

Boring #17 & #18 Adjacent to Tent City Site

4.2.4.1 Test Boring No. 17 part 1

HALEY & ALDRICH, INC
CAMBRIDGE MASSACHUSETTS

TEST BORING REPORT

HOLE NO. 17

PROJECT [illegible]
CLIENT Kaiser Engineers, Inc.; Fay, Spofford & Thorndike, Inc.
CONTRACTOR Gulf Drilling Company, Inc.

FILE NO. 3226
SHEET NO. 1 of 2
LOCATION N490,851; E714,172
ELEVATION 12.0
DATE START 9/13/77
DATE FINISH 9/13/77
DRILLER E. Cook
INSPECTOR T. Cavanagh

GROUNDWATER DATE	TIME	DEPTH TO WATER	DEPTH TO CASING	DEPTH TO BOTTOM OF HOLE		CASING TYPE	CASING SIZE	SAMPLER SIZE	CORE BARREL SIZE
9/13	1515	3.9'	35.0	26.0'		3.25"	2"	1" S/S	--

"An" Drill Rods

SCALE OF FEET	STRATA CHANGE	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
		8				6" Bituminous concrete at surface
		16	11 17 13	S1	0.5 - 2.0	Compact, brown silty medium to fine SAND, little coarse to fine gravel, trace coarse sand, cement - FILL -
		27				
		27				
		31				
5		12	10 10 9	S2	5.0 - 6.5	Medium compact, brown silty medium to fine SAND, little medium to fine gravel, trace coarse sand, brick, ash, metal, asphalt - FILL -
		19				
		22				
		23				
		26				
10		10	16 16 15	S3	10.0 - 11.5	Compact, brown to black coarse to fine SAND, little coarse to fine gravel, silt, trace wood, cobbles - FILL -
		8				
		39				
		40				
		12				
15		10	8 4 4	S4	15.0 - 16.5	Medium compact, black coarse to fine SAND, little gravel, trace brick - FILL -
	16.5	9				
		13				
		12				
		11				
20		9	P P P	S5	20.0 - 21.5	
		9				
		11				
		12				Very soft, dark gray ORGANIC SILT, trace shells (OL)
		12				
25		14	P P P	S6	25.0 - 26.5	
		15				
		13				
		14				
		14				

BLOWS PT.	DENSITY	BLOWS PT.	CONSISTENCY	SAMPLE IDENTIFICATION	SUMMARY
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	OVERBURDEN [illegible] FT.
4-10	LOOSE	2-4	SOFT	T — THIN WALL TUBE	ROCK --
10-30	MEDIUM COMPACT	4-8	MEDIUM STIFF	U — UNDISTURBED PISTON	SAMPLES 14.5
30-50	COMPACT	8-15	STIFF	O — OPEN END CUB	
50+	VERY COMPACT	15-30	VERY STIFF	W — WASH SAMPLE	HOLE NO. [illegible]

4.2.4.2 Test Boring No. 17 part 2

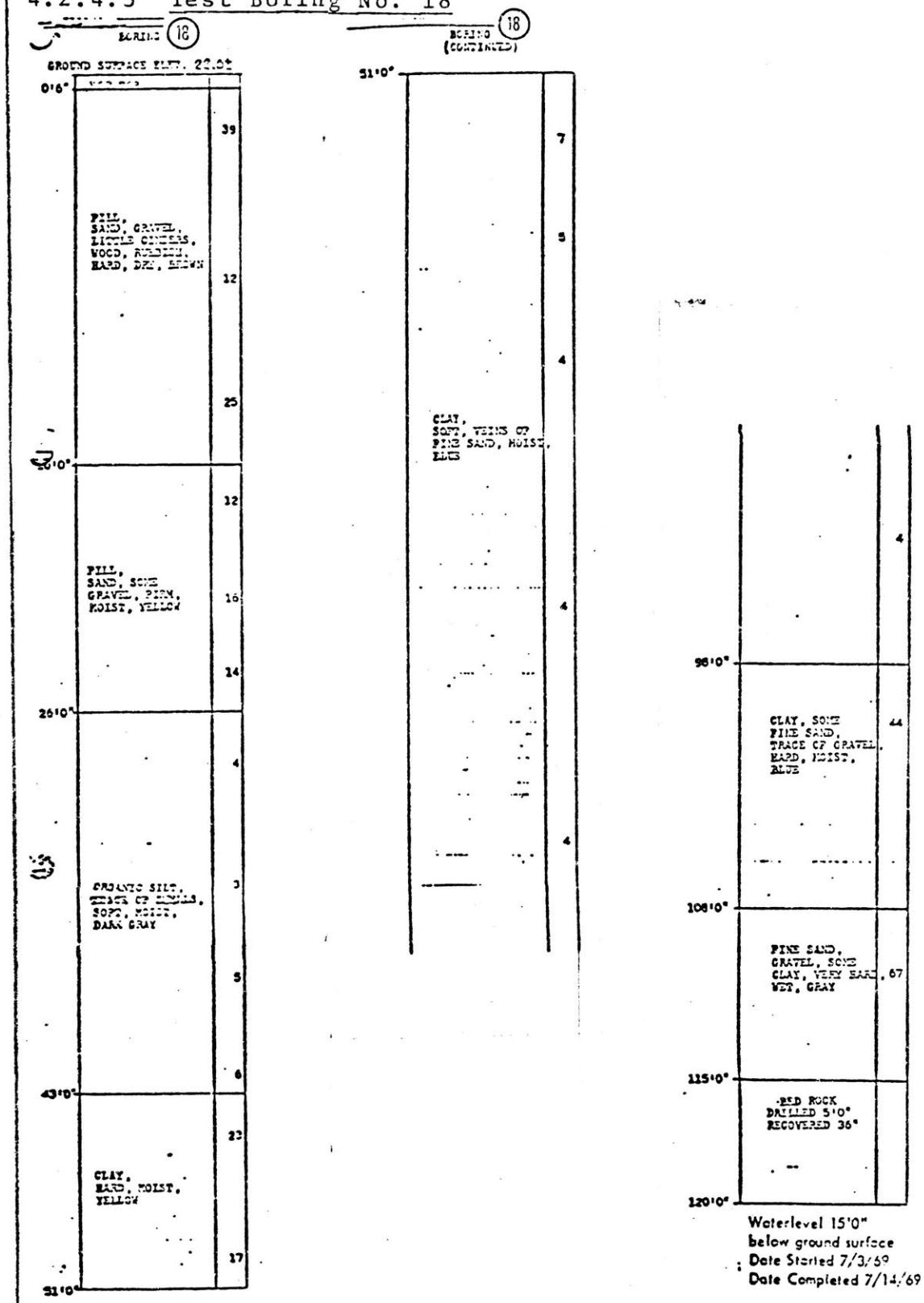
HALEY & ALDRICH, INC
CAMBRIDGE MASSACHUSETTS

TEST BORING REPORT HOLE NO. 17 PAGE 2 OF 2

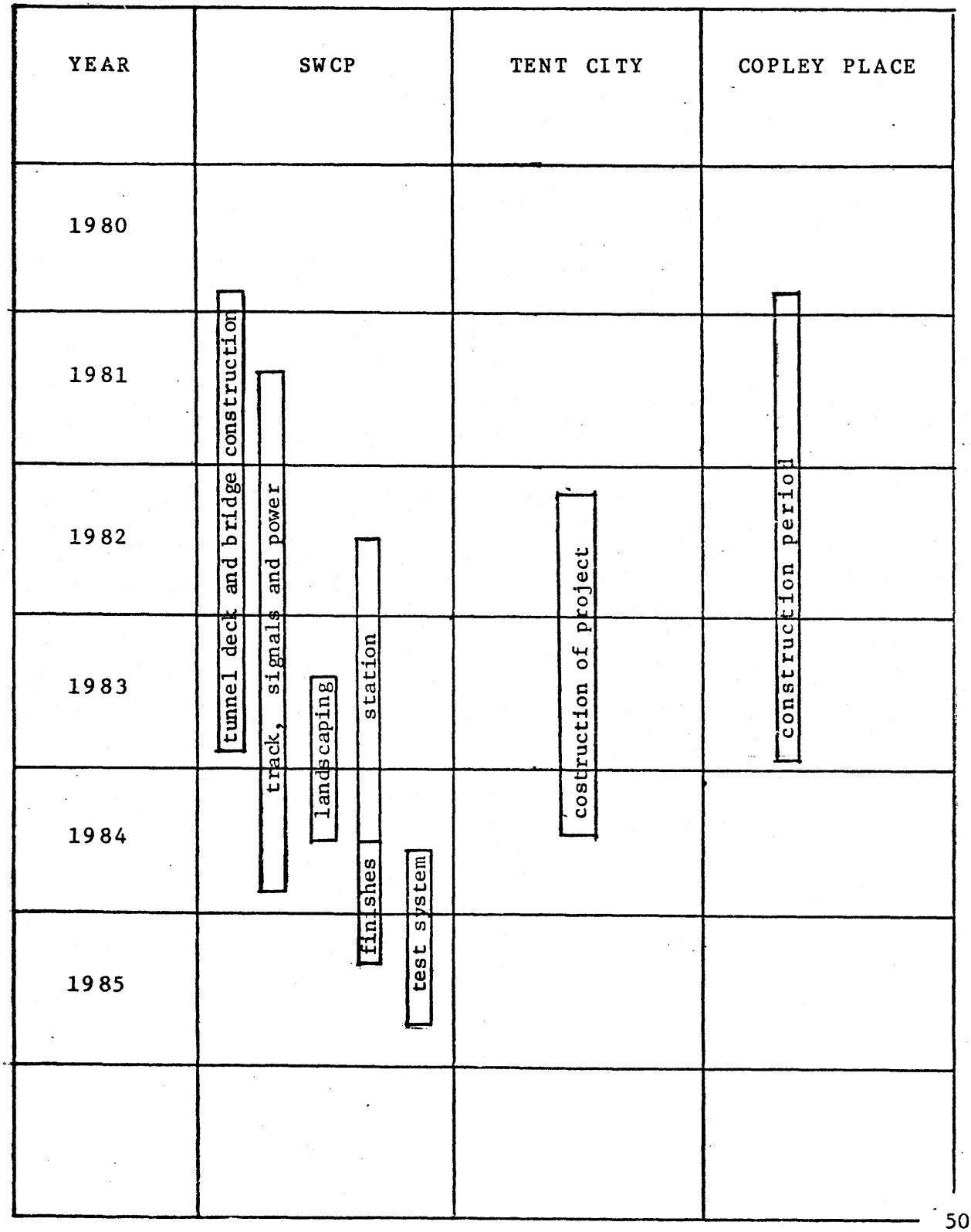
SCALE IN FEET	STRATA CHANGE	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 IN.	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
		21	P P P	S7	30.0 - 31.5	Very soft, dark gray ORGANIC SILT, little fine sand, trace shells, fine sand partings (OL)
	31.5	17				
		18				Medium compact, gray coarse to fine SAND, little gravel, trace silt (SP)
		21				
		40				
35			4 8 12	S8	35.0 - 36.0	
	36.0			S8A	36.5	Stiff to very stiff, yellow-gray silty CLAY (CL)
40			5 10 13	S9	40.0 - 41.5	
45			3 5 7	S10	45.0 - 46.5	
	46.5					Medium stiff to very stiff, gray silty CLAY, trace fine gravel (CL)
50			2 3 4	S11	50.0 - 51.5	
55			4 6 7	S12	55.0 - 56.5	
60			6 10 11	S13	58.5 - 60.0	
						Bottom of Exploration at 60.0 ft.

BLOWS/FT	DENSITY	BLOWS/FT	CONSISTENCY	SAMPLE IDENTIFICATION	SUMMARY
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	OVERBURDEN —
4-10	LOOSE	2-4	SOFT	T — THIN WALL TUBE	ROCK —
10-30	MEDIUM COMPACT	4-8	MEDIUM STIFF	P — CHD STUFFED PISTON	SAMPLES —
30-50	COMPACT	8-15	STIFF	O — OPEN END ROD	
50	VERY COMPACT	15-30	VERY STIFF	W — WASH SAMPLE	HOLE NO. —

4.2.4.3 Test Boring No. 18



4.3.2 Scheduling



4.4 Cost Analysis

Several types of cost estimates can be made; two which are relevant to this project are: Square foot and quantity take-off.

Square foot costing is useful in the conceptual stage when no details are available. As soon as details are available in the project design, the square foot approach should be discontinued and the project then priced by its quantity of material.

To determine a preliminary cost estimate for the garage, three procedures need to be done.

1) Using the cost per square foot and cost per space method, determine garage cost. (see page 53)

2) Using the quantity take-off method, determine any added cost factors based on conditions peculiar to the site. (see page 52)

3) These two added will give preliminary total cost for the garage assuming current construction cost figures.

The square foot cost will be based on a typical 350 s.f. required per parking space. The added cost will include any specific site problems such as water levels and removal of existing piles. As designed, added cost will also include deep excavation and the increased construction cost based on the recommendations in Section 4.2. Since the garage walls will act as foundations for the apartment building, the apartment building foundation cost must be deducted from the garage cost, the remainder is the adjusted garage cost.

4.4.1 Square Foot

Dartmouth Crossing has a 355 space parking garage. A typical garage uses 350 square foot per parking space.

350 s.f. x 355 = 124,250 s.f. total

4.4.2 Range of Cost

According to Building Construction Cost Data 1980, the cost range for a parking garage structure varies from $5,300 to $12,000 per space.

range:

$ 5,300 x 355 spaces = $1,881,500.00 = $1.9 million (lowest)

$ 7,000 x 355 = $2,485,000.00 = $2.5 m (Dartmouth Crossing)

$ 9,541 x 355 = $3,387,055.00 = $3.4 m (breakdown pg.53)

$12,500 x 355 = $4,437,500.00 = $4.4 m (highest)

Adjusted garage cost: (garage cost - apt. blg. foundation cost)

$ 3,387,055.00 *

\+ 937,300.00 (foundation structure cost adjusted according to Section 4.4-3) **

$ 4,324,355.00 = 4.3 million

Actual garage cost:

$ 3,387,055.00 *

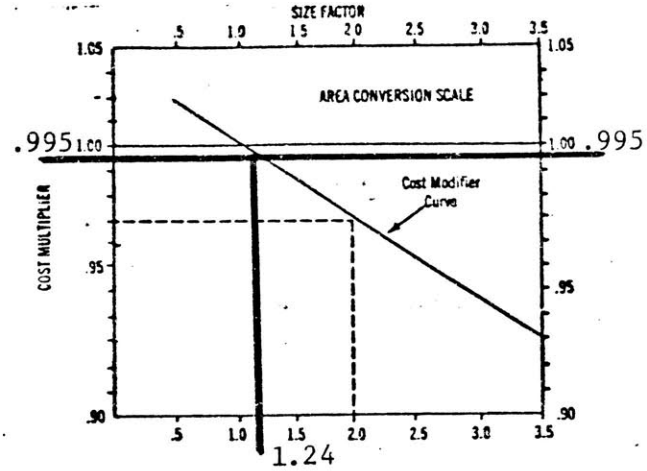
\+ 1,396,000.00 (foundation structure not adjusted) ***

$ 4,783,055.00 = $4.8 million (this will be the figure used for calculating feasibility)

Either figures can be used for calculating the feasibility of the project but I used $4.8 m for my calculations.

* calculations detailed on following page.
** calculations detailed on page 53.
*** calculations detailed on page 53.

4.4.2.1 Square Footage Cost Calculations



Enter Area Conversion scale at 2.0, intersect curve, read horizontally the appropriate cost multiplier of 0.97. Size adjusted cost becomes 0.97 × $24.90 = $24.15 based on national average costs.

Square Foot Base Size							
Building Type	Median Cost Per S.F.	Typical Size Gross S.F.	Typical Range Gross S.F.	Building Type	Median Cost Per S.F.	Typical Size Gross S.F.	Typical Range Gross S.F.
Apartments	$24.90	30,000	12,000 - 95,000	Ice Rinks	$42.20	30,000	27,000 - 36,000
Auditoriums	45.25	25,000	12,000 - 37,000	Jails	70.65	14,000	7,000 - 85,000
Auto Sales	27.75	20,000	12,000 - 29,000	Libraries	46.45	11,000	7,000 - 27,000
Banks	63.40	4,000	2,500 - 7,000	Medical Clinics	46.45	7,000	4,000 - 16,000
Churches	42.35	9,000	2,300 - 34,000	Medical Offices	41.35	6,000	4,000 - 15,000
Clubs, Country	42.15	6,000	3,000 - 20,000	Motels	33.95	35,000	17,000 - 63,000
Clubs, Social	38.30	35,000	13,000 - 45,000	Nursing Homes	44.50	25,000	16,000 - 40,000
Coll. (Class)	57.10	50,000	25,000 - 100,000	Offices	40.85	9,000	5,000 - 23,000
Coll. (Science Lab.)	53.30	40,000	16,000 - 80,000	Police Station	61.30	10,000	4,000 - 20,000
Coll. (Student Union)	58.30	40,000	16,000 - 85,000	Post Offices	54.25	12,000	7,000 - 21,000
Community Center	41.55	10,000	4,000 - 19,000	Religious Education	34.60	8,000	6,000 - 12,000
Convents	48.35	10,000	7,000 - 16,000	Research	67.50	19,000	6,000 - 39,000
Court Houses	58.15	25,000	17,000 - 70,000	Restaurants	48.60	5,000	3,000 - 6,000
Dept. Stores	22.10	100,000	52,000 - 137,000	Retail Stores	23.95	8,000	4,000 - 22,000
Dormitories	43.30	40,000	22,000 - 88,000	Elementary Schools	37.40	45,000	30,000 - 60,000
Factories	18.00	30,000	13,000 - 52,000	Jr. High Schools	37.70	93,000	58,000 - 125,000
Fire Stations	47.05	6,000	4,000 - 8,000	High Schools	37.15	110,000	52,000 - 190,000
Frat. Houses	38.35	13,000	11,000 - 15,000	Voc. Schools	35.35	38,000	22,000 - 85,000
Funeral Homes	37.10	8,000	5,000 - 11,000	Supermarkets	24.95	20,000	16,000 - 28,000
Garages, Commercial	27.40	10,000	6,000 - 16,000	Swimming Pools	58.55	16,000	2,600 - 28,000
Gar., Municipal	26.55	8,000	5,000 - 14,000	Telephone Exchange	70.50	5,000	2,000 - 11,000
Gar. (Parking)	14.85	185,000	142,000 - 326,000	Terminals	25.35	12,000	7,000 - 20,000
Gymnasiums	36.35	20,000	12,000 - 47,000	Theaters	37.90	11,000	9,000 - 18,000
Hospitals	72.45	52,000	27,000 - 120,000	Town Halls	48.70	11,000	5,000 - 24,000
Housing (Elderly)	40.95	30,000	19,000 - 43,000	Warehouses	15.10	20,000	10,000 - 40,000
Housing (Public)	25.95	46,000	19,000 - 100,000				

(Building Construction Cost Data 1980, page 355)

To arrive at the square foot cost:

1) using formula A : $\frac{\text{proposed garage area} = 124{,}250 \text{ s.f.}}{\text{typical size from table} = 10{,}000 \text{s.f.}} = 124.5$

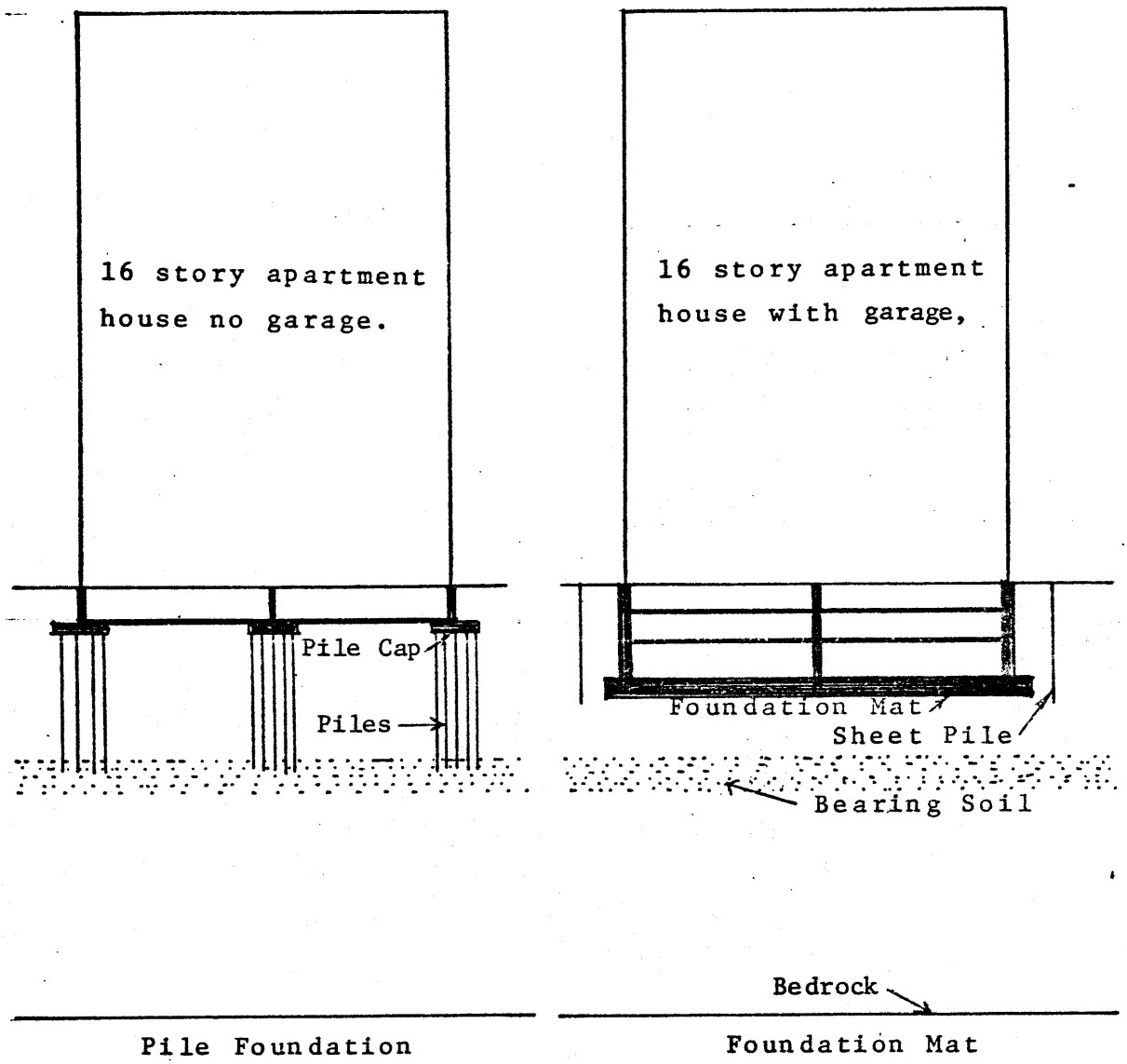
2) using area conversion scale, plot 124.5 along "size factor" draw a vertical line up to "cost modifier curve". And then draw a horizontal line at that point to achieve the "cost multiplier" (.995).

3) multiply "cost multiplier" x "median cost per s.f." from this table to yield cost per s.f.

.995 x $27.40 = $ 27.26 per s.f.

This cost is for a typical commercial garage which does not encounter the underwater, excavtion problems of Dartmouth Crossing.

4.4.4 Cost Analysis of Design Alternative



Pile Foundation

max. 8 ft. ht. bsmt. on conc. piles.

cost. $458,700 *

Foundation Mat

3 levels underground parking foundation mat.

cost. $1,395,600 *

* calculations detailed on next page.

4.4.5 Quantity Takeoff of Foundation Costs

a) foundation for building without a garage:

excavation	$ 3.19	cy x	14,800	cy =	$ 51,000.00
backfilling	¢ .80	cy x	840	cy =	$ 700.00
piles, 250 pre-stressed @ 50 ft. ea. - total load 50,000K	$ 13.00	lf x	12,500	lf =	$162,500.00
pile caps	$ 9.40	ea x	40	=	$ 34,600.00
concrete incl. reinf. forms					
slab	$ 68.50	cy x	1,422	cy =	$ 97,400.00
walls	$221.00	cy x	280	cy =	$ 61,900.00
underslab drainage					
gravel	¢ .37	cy x	2,000	cy =	$ 750.00
piping	$ 3.38	lf x	5,700	lf =	$ 19,300.00
sump pit	$ 15.75	lf x	150	lf =	$ 2,400.00
pump	$210.00	ea x	3	=	$ 650.00
waterproofing					
floors and walls	¢ .44	sf x	55,560	sf =	$ 24,500.00

Total foundation cost (no garage) $458,700.00

b) foundation for building with a garage:

steel sheet piling	$ 12.55	sf x	24,000	sf =	$301,200.00
excavation (in cofferdam)	$ 15.43	cy x	55,555	cy =	$857,200.00
pumping	$ 80.00	day x	20	=	$ 1,200.00
backfiling	¢ .80	cy x	3,150	cy =	$ 2,500.00
concrete, incl. reinf.					
foundation mat	$ 88.00	cy x	11,000	cy =	$968,000,00
retaining wall	$205.00	cy x	2,100	cy =	$ 43,000.00
tie backs	$805.00	ea x	42	=	$ 33,000.00
waterproofing					
floors and walls	¢ .44	sf x	76,350	sf =	$ 33,600.00
removal of piles	$ 35.00	ea x	400	=	$ 14,000.00

Total foundation cost (with garage) $1,396,000.00

note: cy= cubic yard ea. = each
sf= square foot lf. = linear foot

Chapter 5 Summary and Conclusions

The income the garage will produce is determined by examining neighboring garage rates, volume and rate of turnover since one assumes the Dartmouth Crossing garage will charge competitive rates. Unlike many of the nearby commercial garages, the Dartmouth Crossing garage would be situated in a residential complex housing elderly persons and families with children. This condition creates a social restriction on the rate of turnover and the business,noise and pollution generated by most commercial garages. Therefore, two rates are analyzed; Option A shows the income generated if run as a long term garage (primarily residential and office parkin), and Option B shows income if run on a short term commercial basis (primarily shopping and business parking).

5.1 Prevailing Rates and Conditions

A typical commercial garage in the area has 30%-50% long term parking at $ 80.00 month.

The remainder is short-term parking:

35% daily rate

65% less than 4 hours; 1/2hr.-3hrs.

0% vacancy

Rates:	first hour	= $ 1.00
	each 1/2 or fraction	= .75¢
	10 hr. max.	= $ 4.00
	24 hrs.	= $ 7.75
Night rate:	6pm - 2am	= $ 2.50
Monthly rate:		= $80.00

5.2 Option A Operated for Long Term Resident and Office Use

50% long term office = 178 spaces x $80.00 month x 12 = $170,880 yr.

30% long term residential = 107 spaces x $80.00 month x 12 = $102,720 yr.

20% short term (see breakdown below)
= 70 spaces @ $2384.00 week x 52 = $123,968 yr.

25 spaces all day x $4.00 day	= $100 day
18 spaces less than 3 hours: $3.25 x 3 shifts	= $175 day
14 spaces less than 2 hours: $1.75 x 4 shifts	= 98 day
13 spaces less than 1 hour: $1.00 x 8 shifts	= $104 day
70 spaces Total	= $477 day x 5=$2384 wk.

100% Total = 355 spaces Total Income = $397,568 yr.

(assuming current income figures no inflation added.)

5.2.1 Option B Operated for Commercial/Residential Use

25% long term = 100 spaces x $80.00 month x 12 = $ 96,000 year

75% short term = 255 spaces x $11,960 week x 52 = $ 621,920 year

Short term breakdown:

35% daily rate = 89 spaces x $4.00/day = $ 356.00 day

65% short duration = 116 spaces less than 4 hrs.
$ 3.25 x 3 shifts = $1131.00 day

25 spaces less than 2 hrs.
$ 2.50 x 4.5 shifts= $ 280.00 day

25 spaces less than 1 hr.
$ 1 x 9 shifts = $ 625.00 day

Week day - - - 255 spaces commercial = $2392.00 day x 5 = $11,960 wk.

100% 355 spaces Total Income = $ 717,920 year

Night rate 100% vacancy of commercial rate

Weekend rate 100% vacancy of commercial rate

(assuming current income figures no inflation added.)

5.3 Summary of Garage Finances

Income

Option A, Income from long term 80% long term
20% short term = $397,600.00 yr.

Option B, Income from short term 75% short term
25% long term = $717,900.00 yr.

Construction cost = $4.8 million

Expense - Garage construction cost total = $4.8 million

Option A,

* Projected maintenance expense	= $282.000.00 yr.
debt service 10% at 40 yrs.	= $440,000.00 yr.
* real estate tax 121A 35% of income	= $139,160.00
Total expense	= $861,160.00 yr.

Option B,

* Projected maintenance expense	= $282,000.00 yr.
debt service 10% at 40 yrs.	= $440,000.00 yr.
* real estate tax 121A 35% of income	= $251,265.00 yr.
Total expense	= $973,265.00 yr.

* Dartmouth Crossing's figures

5.4 Summary of Garage Cash Flow

Option A, long term:	yearly income	$ 397,600.00
	yearly expense	$ 861,160.00
	Cash Flow	$-463,560.00
Option B, short term:	yearly income	$ 717,900.00
	yearly expense	$ 973,265.00
	Cash Flow	$-255,365.00

5.5 Conclusions

Since the added cost for going under the water table (sec. 4.4.5b) makes the proposed garage exceptionally expensive, one must answer the following questions to evaluate the affect of garage cost on the Tent City project as a whole.

5.6.1 Will the garage make money?	No
5.6.2 Will the garage lose money?	Yes
5.6.3 Will the garage subsidize the housing?	No
5.6.4 Will the garage need to be subsidized?	Yes
5.6.5 What are the non-financial advantages and disadvantages that need to be considered?	

Since financially the garage doesn't prove itself, one ought to investigate other consideration such as congestion, pollution, noise, safety and security. The parking garage will attract more cars to the area than existing facilities will support. Therefore, congestion, noise and pollution will be aggravated by a commercial parking garage. Volume of cars would create added hazards for pedestrian traffic, especially

children and elderly. This hazard is increased by the location of the entrance and exit on the corner leading to mass transit. An underground parking facility would be more secure against car theft and vandalism.

5.6.6 Should the garage be built?

Based on the various factors considered here, one can conclude that the preponderant community interest is best served by no garage.

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