Structured Parking Feasibility Study
for the
Milford Railroad Station
Milford, CT

Submitted to:

MILFORD TRANSIT DISTRICT
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ENGINEERS, SURVEYORS, PLANNERS & LANDSCAPE ARCHITECTS

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EXECUTIVE SUMMARY

Desman Associates with Clough Harbour Associates were selected by the Milford Transit District to conduct a Parking Site Feasibility Study for a 500 space parking structure to serve the Milford rail Station.

The initial site contemplated for development of this facility was the existing commuter lot west of High Street and north of the railroad right-of-way on the Railroad Avenue extension. After some study this site was rejected due to existing utility issues, its very narrow dimension and its proximity to the condominium complex.

Desman/CHA subsequently evaluated six (6) additional sites, three of which were dropped due to issues regarding ownership and distance to the rail station.

This report summarizes our study of the three remaining sites and options for development of each one as follows:

- Senior Center – Options Scheme A & B
- Rail Station Parking Lot – Scheme C
- Courthouse Parking Lot – Options Scheme A,B & C

To develop a net 525 commuter spaces on existing parking lots, we were required to replace existing surface spaces resulting in increasing capacity in the new facility to 650 to 675 spaces.

Judicial Department spaces will be controlled at the entry and exits within the garage. These will be located in the east bay adjacent to the courthouse on levels one and two.

Parsons Government Center is currently served by two existing parking lots that satisfy its demand and will not impact this garage; however the garage will have spaces available on evenings and weekends for public parking.

After evaluating each option it was determined that the preferred options were Scheme D-2 and D-3 situated on the Courthouse site, as shown on SK-06.

- each plan generated 540 new spaces or more;
- maintained low building profiles;
- fit into the adjacent area in terms of usage;
- were easily accessible by auto;
- are in close proximity to the rail station and had minimal impact on streets;

To further illustrate how this site might look when developed we constructed an Alternate Site Map on drawing SK-09.

Projected revenues versus operating expenses show net revenue potential for a typical operating year to be in the range of $213,317 based on $60 per month and $5 per day commuter parking this assumes construction being funded through a grant.

As the Courthouse plans for expansion onto the Post Office site and has an option to acquire the property which is subject to this study in 2007.In addition a traffic study, environment impact, and a geotechnical engineering study must be completed to prepare the site and confirm any impacts on the project. Designers will need to coordinate these projects in an effort to compliment and respond to program issues relating to development of this new campus

INTRODUCTION

Previous studies and reports regarding the Milford Rail Station identified the need to create 500 new parking spaces in proximity to the station. A preferred site was identified at the existing commuter parking lot north of the Metro North right-of-way and west of High Street.

Desman Associates and Clough Harbour were retained by the Milford Transit District to perform a Parking Feasibility Study of the preferred site. As we began investigating the preferred site we immediately recognized that two (2) Force Mains (20" diameter and 24" diameter) run the length of the site. Early attempts to position a garage on this site could not avoid relocation of the mains as they continuously conflicted with foundations of the structure. Additionally, providing height easements for the maintenance and repair of these mains created issues with the ramping system within the garage. These factors combined with the potential cost associated with relocating the mains, the fact that the site was only 120' wide, very close to the condominium building and railroad embankment, determined that other more suitable sites be studied.

In all, Desman/CHA evaluated six sites. Three were eliminated early on due to ownership and property issues, while three of the remaining sites offered more than one functional alternative. The sites studied after the initial round were:

1. Senior Center facility parking lot south of Jepson Dr. (2 alternatives A & B)
2. Surface lot west of the station on Railroad Ave. and High St. (Alternative C)
3. The surface lot between Constitution Dr. to the north and Darina Place to the south, west of the Court House and West River Street (3 alternatives D1, D2 and D3)

Refer to Aerial Site Plan SK-01 to locate sites evaluated within this study area. A matrix containing the features of each of these sites appears on SK-7, while details of each appear in the individual scheme sheets SK-2 through SK-6.

EVALUATION OF SHORT LISTED SITES

Senior Center Facility Parking Lot

Scheme A (SK-02) West of High Street, South of Jepson Drive.

Orientation of the footprint runs North/South in a two bay configuration with 105 spaces per level. The garage would be sited adjacent to the western most property line maintaining surface parking in front of the Senior Center Facility. The building would be accessed from Jepson Drive and through the Railroad Avenue parking lot.

The 55 foot height of the structure and its proximity to residences immediate to the west, along with complications of monitoring commuter parking while providing parking for the senior citizens residents and visitors placed this site at the mid-range of desirability

Scheme B (SK-03) Oriented East/West just north of the Railroad Ave. Parking Lot.

This site does not have the length of Scheme A. Therefore it requires 8 levels of parking resulting in the building being 80' +/- high. It is also very close to the condominium high rise to the east and at 80' negatively impacts light and views of the condominium residents. Additionally due to the short building, parking ramps would show on both of the exterior elevations.

Railroad Parking Lot

Scheme C (SK-04) Located between Railroad Ave. on the South and the rear of private residences on Darina Place.

This is a long narrow single bay site partially used for parking. A private entity owns a significant portion of the eastern half of the site. Decking over and excavating down one half level yields 205 spaces. The lower level has access from High Street while the upper level

would communicate with Railroad Avenue. It's proximity to the station is ideal. However, significant issues will be encountered with the home owners at Darina Place because of the facilities impact on their rear yards. The site does not yield the desired 500 + spaces.

Scheme D (SK-05 -06) This site is situated west of the rear of the Courthouse on West River St. and east of the Harborside School, between Constitution Drive and Darina Place.

It is bounded on the north by Constitution Drive and on the south by Darina Place. Several options exist for vehicular access to the site. High Street to Darina Place or to High St. and West River Street to Constitution Drive or Darina Place. The site is currently a 117 space parking lot owned by the City and serving both the Courthouse and Post Office and is non-regulated except for signage. There are three functional options to siting a facility at this location.

Option D1 – (SK-05)

A two bay facility with a footprint providing 100 spaces per level. Vehicular access points are located on Constitution Drive and Darina Place. To accomplish replacement of surface spaces while adding 500 new spaces this building must be 70' high which is out of scale with adjacent structures. Functionally it is on the outer limit of capacity for a 2 bay scheme as it will take 11 – 180 degree turns to reach the top level.

Option D2 - (SK-06)

This building occupies the entire surface lot without impacting the portion adjacent to the Harbor side School. It is a 3 bay design which delivers a building height of 48 feet. Access can be directly from Constitution Drive or Darina Place either from West River Street or High Street. The grade level can be segregated for either metered or assigned parking, providing flexibility in operational procedures. Pedestrian access to the station would be provided through a stair and elevator core located in the Southeast corner. This configuration results in walking distance of approximately 660 feet to the station (SK-08) over an easement area required by code to provide a construction setback on adjacent property. Without the more direct easement walking distance will be 100 linear feet to the station. As an option this facility could potentially support courthouse expansion while providing secured access to the courthouse as shown on SK-6.

Option D3 (SK-6)

The concept for this building configuration is to span Constitution Drive and occupy air rights over the Parsons Government Center surface lot. This results in several positive features such as; lowering the profile of Option D2 building to 38 feet; developing a longer more efficient parking plate; providing stair access in the northeast corner to the Parsons Community Center building while still maintaining other positive aspects of the D2 plan.

After several meetings with the MTD committee and a public presentation it was determined that Site D would be designated the preferred site particularly concept D2 or D3.

RENDERED SITE PLAN (SK-09)

To illustrate how the preferred option (D2 or D3) look in context to the site, we have developed an illustrated site plan addressing access, circulation and enhancement features from West River Street to High Street and Constitution Drive to Darina Place.

We are suggesting a reconfigured Harborside Middle School Drop-Off and surface parking area along with pedestrian access ways and landscaped areas throughout the site. Based on our conceptual site work cost estimate the stand alone cost of this work is $2,102,231, however, when combined with the total project cost it is projected to be $1,509,704. The reduced budget cost is predicated on overlap and duplication of fees contained in the basic project budget.

ECONOMIC FEASIBILITY

Economic, or financial, feasibility is an estimate of a proposed facility's performance. Generally, a parking facility's economic performance is evaluated in terms of its ability to generate revenues equal to, or in excess of any debt service and the cost to operate and maintain the facility. The debt service is the repayment of the cost of construction including interest payments calculated over the term of the loan or bond, in this case we assumed the garage construction cost would be funded by a grant resulting in no debt service requirement. The following sections illustrate how the various components of the financial analyses have been calculated.

PROJECT COSTS

Overall project costs include; the garage construction costs, site development costs, professional services and contingencies associated with this project.

For the purpose of this study based on our experience and "Structural systems and Life Cycle Cost Evaluation", we have developed construction budgets anticipating that the garage would be constructed using pre-stressed pre-cast concrete columns, beams and double tee floor slabs, which is a standard in the industry. We have found the total costs, excluding land acquisition but including construction, professional services and contingencies for a project similar to that being considered would be in the range of $17,750 to $20,500 per space. These construction cost budgets are developed based on our knowledge of ongoing construction projects similar in size and scope to the Milford project.

MILFORD TRANSIT DISTRICT

RAIL STATION GARAGE

SCHEME D-2 -3

PROJECT BUDET SUMMARY

1.	Garage Construction Costs (rounded)	$13,000,000
2.	Site Development	$ 1,569,704*
3.	Design Fee & Owners Contingencies 20% and Inspection & Testing	$ 3,055,514
Sub Total		**$17,625,218**
4.	Escalation on construction 3.5% x 1 year	$ 532,609
Total Project Budget		**$18,157,827**

*Adjusted site development cost

Note:

Projected construction costs (page 9 & 10) includes a 10% contingency which is industry standard for a project at this stage of development. In addition we have included in this summary an owner's contingency of 20%. Department Of Transportation has suggested that the construction contingency (10%) should be increased to 45%. The results of this increase are inflected on the following two pages.

MILFORD TRANSIT DISTRICT
MILFORD RAILROAD STATION PROJECT BUDGET SCHEME D2
PROJECTED CONSTRUCTION COST

Garage Statistics:

Supported Slab:	179,576	Square Feet
Slab-on-Grade:	45,864	Square Feet
Total:	225,440	Square Feet

	Work Item	Square Foot Cost		Square Footage			Project Budget
1	General Conditions & Mobilization	$1.50	x	225,440.00	SF	=	$338,160
2	Site Improvements	$0.50	x	225,440.00	SF	=	$112,720
3	Excavation	$1.75	x	225,440.00	SF	=	$394,520
4	Foundation	$5.00	x	225,440.00	SF	=	$1,127,200
5	Precast and C-I-P Structure	$35.00	x	179,576.00	SF	=	$6,285,160
6	Slab on Grade	$5.50	x	45,864.00	SF	=	$252,252
7	Stairs	$0.25	x	225,440.00	SF	=	$56,360
8	Block, Rough Carp., WP, Roof	$0.40	x	225,440.00	SF	=	$90,176
9	Glass, HM HW, Misc. Metals	$0.85	x	225,440.00	SF	=	$191,624
10	Mechanical/Plumbing	$2.00	x	225,440.00	SF	=	$450,880
11	Electrical	$3.00	x	225,440.00	SF	=	$676,320
12	Misc. Grills & Screens	$0.45	x	225,440.00	SF	=	$101,448
13	Paint/Graphics/Striping	$0.35	x	225,440.00	SF	=	$78,904
14	Elevators	$1.20	x	225,440.00	SF	=	$270,528
15	Caulk Joints and Sealer	$0.55	x	225,440.00	SF	=	$123,992
16	Non Garage Construction	$0.55	x	225,440.00	SF	=	$123,992
17	Equipment	$0.90	x	225,440.00	SF	=	$202,896
18	Bonds	$0.45	x	225,440.00	SF	=	$101,448

Construction Cost	$48.70	SF	$10,978,580
Construction Contingency (10%)	$4.87	SF	$1,097,858
Contractors Overhead & Profit (5%+ 5%)	$4.87	SF	$1,097,858
Total Construction Cost	$58.44		**$13,174,296**
Number of Parking Spaces	657		
Cost Per Parking Space	$20,052		

DOT Suggested Construction Contingency (45%-10% already included = 35% increase)	$17.05	$3,842,503
Total Construction Cost with DOT	$75.49	$17,016,799
DOT Cost per Parking Space	$25,900	

MILFORD TRANSIT DISTRICT
MILFORD RAILROAD STATION PROJECT BUDGET SCHEME D3
PROJECTED CONSTRUCTION COST

Garage Statistics:

Supported Slab:	167,786	Square Feet
Slab-on-Grade:	45,864	Square Feet
Total:	213,650	Square Feet

	Work Item	Square Foot Cost		Square Footage			Project Budget
1	General Condition & Mobilize	$1.50	x	213,650.00	SF	=	$320,475
2	Site Improvements	$0.50	x	213,650.00	SF	=	$106,825
3	Excavation	$1.75	x	213,650.00	SF	=	$373,888
4	Foundation	$7.00	x	213,650.00	SF	=	$1,495,550
5	Precast and C-I-P Structure	$35.00	x	167,786.00	SF	=	$5,872,510
6	Slab on Grade	$5.50	x	45,864.00	SF	=	$252,252
7	Stairs	$0.25	x	213,650.00	SF	=	$53,413
8	Block, Rough Carp., WP, Roof	$0.40	x	213,650.00	SF	=	$85,460
9	Glass, HM HW, Misc. Metals	$0.85	x	213,650.00	SF	=	$181,603
10	Mechanical/Plumbing	$2.00	x	213,650.00	SF	=	$427,300
11	Electrical	$3.00	x	213,650.00	SF	=	$640,950
12	Misc. Grills & Screens	$0.45	x	213,650.00	SF	=	$96,143
13	Paint/Graphics/Striping	$0.35	x	213,650.00	SF	=	$74,778
14	Elevators	$1.20	x	213,650.00	SF	=	$256,380
15	Caulk Joints and Sealer	$0.55	x	213,650.00	SF	=	$117,508
16	Non Garage Construction	$0.55	x	213,650.00	SF	=	$117,508
17	Equipment	$0.90	x	213,650.00	SF	=	$250,000
18	Bonds	$0.45	x	213,650.00	SF	=	$96,143

Construction Cost	$50.64		SF	$10,818,682
Construction Contingency (10%)	$5.06		SF	$1,081,868
Contractors Overhead & Profit (5%+ 5%)	$5.06		SF	$1,081,868
Total Construction Cost	$60.76			**$12,982,418**
Number of Parking Spaces	661			
Cost Per Parking Space	$19,641			

DOT Suggested Construction Contingency (45%-10% already included = 35% increase)	$17.72	$3,786,538
Total Construction Cost with DOT	$78.48	$16,768,956
DOT Cost per Parking Space	$25,369	

Milford Transit District Parking Garage

Date: 2/13/06

Site D, Alt. #2 - Constitution Drive, Milford, CT

Conceptual Sitework Cost Estimate

Rev. Date:

General Conditions / Site Preparation/ Demolition	**$153,000**
Sedimentation / Erosion Control	**$19,850**
Earthwork	$81,250
Pavements / Curbs/ Walks	**$398,420**
Storm Sewers	**$167,800**
Planting, Site Lighting and Misc. Site Amenities	**$350,500**
Utilities (sanitary, water, gas, electric, telecomm.)	**$133,100**
Construction Subtotal:	**$1,303,920**
Contractor General Conditions/OH&P (15%):	$195,588
Mobilization/Demob. (5%)	$65,196
Coordination with Utility Companies	$5,000
Design and Construction Contingencies (25%):	$325,980
Construction Total:	**$1,895,684**
Escalation (3.5%/year x 2 years)	$132,698
Traffic Control (Allowance)	$7,500
Construction Inspection/Testing (3.5%):	$66,349
Project Total:	**$2,102,231**

Assumptions:

1. No rock will be encountered in mass excavations or trenches.
2. Dewatering of trenches will not required.
3. No costs to establish new utility easements are included.
4. Potential off-site utility and traffic improvements (e.g. STC requirements) not included.
5. Survey, engineering and design services not included.
6. Owner's administrative and soft costs not included.

CONSTRUCTION BUDGET ASSUMPTIONS

1. No rock will be encountered
2. Soil conditions for spread footings will be no less than two (2) ton bearing capacity.
3. No dewatering of site is anticipated.
4. No major off-site traffic improvements will be required.
5. Owner's soft costs not included.
6. No purchase of land is required.

PARKING REVENUES

Assumptions and projections for parking income and revenues for the facility have been estimated based on the anticipated users of the facility and existing and projected parking occupancy rates. For daily activity, we have assumed, based on the space available for parking demand that on average approximately 80% of the designated "daily" allotment of spaces will be occupied by commuter parkers in a combination of all-day and contract parkers (a contract parker buys a long term pass usually 1 month, 3 months, 6 months or 1 year). All-day trippers will buy day passes equivalent to 15% of the remaining spaces. In addition revenue will be generated from weekend day trippers occupying 25% of the spaces on one of the weekend days.

We conducted a survey of four rail station garages to determine appropriate rates. The rate comparison chart illustrates that on the low end, the Bridgeport commuter monthly rate is just under $2.00 per day while the South Norwalk facility commuter monthly rate is $3.33 per day.

Our revenue projections look at 3 different rates $3.00, $3.25 and $3.50 per day. Each are measured against the operating cost of $337,405 resulting in varying levels of net operating revenue

RATE COMPARISON

Facility	Commuter Monthly	Day Equiv.	Non-Commuter Monthly	Day Equiv.	Day	Hourly
Bridgeport	$40	$1.90	$64	$3.05	NA	
So. Norwalk[(1)]	$70	$3.33	NA		$7	
Stamford	$65	$3.10	NA		$8 (24 hrs)	
					$6 (16 hrs)	
New Haven[(2)]	$70	$3.33	NA		$10	
Milford	$60	$2.86			$5	

(1) 670 space facility – 25% of monthly commuters holding passes do not show up on any given weekday. They sell an average of 200 daily trip tickets each weekday.

(2) 1187 spaces (887 in garage 300 in lot). 330 monthly commuter cards sold, balance is day trippers. Garage and lot are full after 8 a.m. most weekdays.

MILFORD TRANSIT DISTRICT

REVENUE PROJECTION FROM RAIL

525 COMMUTER SPACES

Base

- Sel1 125% (656) @ $60 (20% Do not show up)
  (260 days Monday thru Friday)
- 20% (105) Day trips – 5 days a week, Monday thru Friday @ $5.00
- 25% (131) day trips on one weekend day @ $3.00.

	Proposed		
Rate	**$2.86**	**$3.25**	**$3.50**
Contract Trips M-F	$ 472,230	$ 527,264	$ 578,592
Day Trips – 4 Days	$ 136,500	$ 136,500	$ 136,500
Day Trips – Weekends	$ 19,650	$ 19,650	$ 19,650
Total Revenue	$ 628,470	$ 683,414	$ 734,742
Operating Cost	$ 415,153	$ 415,153	$ 415,153
Net Operating Revenue	**$ 213,317**	**$ 268,261**	**$ 319,589**

Note 1: Revenue does not consider income from adjacent users generated by spaces in excess of the commuter base of 525 (i.e. courthouse)

OPERATION & MAINTENANCE COSTS

Based on transit demand patterns in the area, it is envisioned that the parking facility will be available for patron parking 24-hours a day and it is assumed that this facility will be staffed from 8:00 a.m. until 9:00 p.m. on weekdays; 8:00 a.m. to 3 p.m. on Saturdays and through the use of revenue control equipment be fully automated at all other times. Operating and maintenance expenses for the proposed facility have been derived based on industry-accepted operating line-item budgets and our experience with similar facilities

Based on our research and analyses, we estimate for the first full year of operation that the operating budget will be approximately $415,153 with a maintenance budget of $115,750 including a $50,000 reserve for structural maintenance. This estimate also assumes the use of revenue control equipment to manage the garage, pay-on-foot stations and a self-management approach. Total operating expenses for year one of operation is estimated to be at $415,153 or $629 per space.

Using 3.0% compounded annually the operating and maintenance budget in Year 5 is estimated to be approximately $466,003, or $666 per space. Year ten's operating and maintenance budget is estimated to be approximately $528,254 or $755 per space.

MILFORD RAIL STATION
Parking Garage
Projected Operating Budget

660 (+/-)Car Total Count
Operating Expense
(3% Increase Per Year Based on Congressional Budget Office CPI Data)

Estimate of Annual Operating Expense	Year 1	Year 2	Year 3	Year 4	Year 5	Year 7	Year 10
SALARIES/ADMINISTRATIVE COSTS							
Supervisor ($20.25 inc. benefits)	43,740	45,052	46,404	47,796	49,230	50,707	52,228
Payroll (Attendant Labor)	58,188	59,934	61,732	63,584	65,491	69,480	75,922
($12.00 per hour + 30% benefits)							
Security ($15.00 per hour contracted)	87,600	90,228	92,935	95,723	98,595	104,599	114,298
Payroll Total:	**189,528**	**195,214**	**201,070**	**207,102**	**213,315**	**224,785**	**242,448**
REPAIR & MAINTENANCE							
Snow/Ice Removal (Sweeping/Striping)	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Repair & Maintenance	30,000	30,900	31,827	32,782	33,765	35,822	39,143
Maintenance Reserve (structural)	50,000	51,500	53,045	54,636	56,275	57,964	59,703
Equipment Maintenance	25,750	26,523	27,318	28,138	28,982	30,747	33,598
Repair & Maintenance Total:	**115,750**	**118,923**	**122,190**	**125,556**	**129,023**	**134,532**	**142,444**
OTHER OPERATIONAL EXPENSES							
Electric Service	75,000	77,250	79,568	81,955	84,413	89,554	97,858
Water Service	3,000	3,090	3,183	3,278	3,377	3,582	3,914
Sewer Service	1,875	1,931	1,989	2,049	2,110	2,239	2,446
Waste Disposal Service	7,500	7,725	7,957	8,195	8,441	8,955	9,786
Telephone Service	1,500	1,545	1,591	1,639	1,688	1,791	1,957
Insurance	15,000	15,450	15,914	16,391	16,883	17,911	19,572
Printing Services (Cards & Tickets)	5,000	5,150	5,305	5,464	5,628	5,970	6,524
Office Supplies	1,000	1,030	1,061	1,093	1,126	1,194	1,305
Other Operational Expenses Total:	**109,875**	**113,171**	**116,566**	**120,063**	**123,665**	**131,196**	**143,362**
Grand Total Operating Expenses	**$415,153**	**$427,308**	**$439,827**	**$452,722**	**$466,003**	**$490,514**	**$528,254**
Cost per space (660) per year	**$629**	**$610**	**$628**	**$647**	**$666**	**$701**	**$755**

Equipment Maintenance Includes:
Elevator Maintenance Contract
2 cars @ $550.00 per car per month/$13,200 annually
Revenue Control Maintenance Contract
5% X total initial installation cost/estimated at $250,000 =$12,500

Administrative Cost:
One (1) Full-time Attendant 8AM-9 p.m. Mon-Fri / 13 hrs @ $15.60 per hour.
One (1) Full-time Attendant 8:00 AM-3 PM Sat - 7 hrs. @ $15.60 per hour
One (1) Full-time Supervisor 8 Hrs/Per Day $20.25 per hour (Mon-Fri)
One (1) Full-time Security person contracted 16 Hrs/Per Day $15 per hour (7 days)

OPERATIONS MANAGEMENT ALTERNATIVES

There are three different approaches the Milford Transit District can take for the daily operation of this garage. These approaches include:

1. Self-management approach using parking access and revenue control systems.
2. Self-management approach using parking meters and permit systems.
3. Contracted Management using parking access and revenue control systems.

Each of these approaches has its operational advantage and disadvantages.

A. Self-Management-Parking Access & Revenue Control Systems

The first method of operation available is a conventional public approach to managing the garage. This approach requires the Milford Transit District to take full responsibility for the short and long-term operation and maintenance of the garage. These responsibilities include staffing the facility during peak periods of operation, performing daily cleaning/janitorial duties required to maintain a pristine facility, and the development of a long-term maintenance program that includes such critical tasks as performing an annual "wash down" of the facility to remove road salts from the facility to maintain its structural integrity.

Advantages to this approach include:

- Greater levels of quality control. This method of operation requires staff members to be on-site and as a result insure that the level of service desired is provided to the user on a real-time basis.

- Increased levels of financial accountability are achieved since employees place a greater value on their position and are less apt to commit fraud or allow for the theft of services.

Disadvantages to this approach include:

- Labor costs associated with public employees can be somewhat higher than private-sector personnel.

- Operational cost issues related to staffing such as sick and vacation time.

- Lengthy timeframe associated with the dismissal of undesirable employees especially with service union presence.

B. Self-Management – Parking Meters & Permit Systems

This approach resembles Approach A but would utilize parking meters to manage the daily demand for parking at this facility and would rely on a monthly permit parking program to manage monthly parking users instead of automated access and revenue control systems.

Advantages to this approach include:

- Lower initial capital cost for parking meters versus automated access and revenue control systems.

- No annual maintenance contract required for meter maintenance versus automated access and revenue control system.

Disadvantages to this approach include:

- Control of parking patrons not as effectively controlled as through the use of automated access and revenue control systems.

- Facility usage data supplied by automated access and revenue control system not available using parking metes and permit system.

C. Contracted Management – Parking Access & Revenue Control System

Another approach available is the "privatization" or private-sector approach to garage management. Using this approach the MTD would contract with a private=sector entity specializing in the operation of parking garages. The contracted firm would be responsible for the appropriate staffing and maintenance of the facility. Using parking industry jargon this is referred to as an "O & M" contract.

Advantages to this approach include:

- Allows MTD to remove itself from labor issues related to attendant staffing and allows for daily janitorial duties to be completed by lesser paid private sector staff.

- Could allow MTD to remove itself from managing the demand for the parking garage. Monthly parking arrangements would be made through the private operator. The "O & M" contract for operation generally allows for the operator to maximize the spaces available through creative measures such as vehicle stacking to also maximize revenue and more easily meet the peak demand for the facility.

Disadvantages to this approach include:

- Loss of direct control of the facility. This can often lead to lower quality standards.

- Inaccuracy in revenues reported to the MTD due to "entrepreneurial" employees. State-of-the-art revenue control systems can lessen this possibility. This could be important since there will be no prior revenue stream to compare initial revenues to.

OPERATING BUDGET ASSUMPTIONS

1. Sweeper is purchased by Owner - $24,000 capital cost.
2. No Management Fee
3. No Data Processing Fees
4. No Taxes
5. High Pressure Sodium Lighting System
6. Operating Hours: 24 x 7 pay on foot stations operation 24 x 7.
7. Gate and control equipment capital purchase budget at $250,000 installed.
8. Payroll includes cashier/attendant, and manager. Cleaning and maintenance people are contracted.
9. Repairs and Maintenance include service a contract for garage elevators as well as vehicle and revenue control equipment and general maintenance.
10. A reserve for structural maintenance line items is included.
11. Snow expenses will be determined by the severity of each season.
12. Typical year after warranties.

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Parking Garage
Maintenance Checklist

A. Cleaning:	Daily	Weekly	Monthly	4 Month Interval	6 Month Interval	Yearly	Other
1. Sweeping - Localized	R	M					
2. Sweeping - All Areas *(including curbs)*		R	M				
3. Empty Trash Cans	R	M					
4. Restrooms:							
a. Floors	R	M					
b. Fixtures	R	M					
c. Walls		R	M				
5. Cashier's Booths:							
a. Floors	R	M					
b. Fixtures	R	M					
c. Walls		R	M				
d. Windows		R	M				
6. Stairs:							
a. Floors		R	M				
b. Handrails		R	M				
c. Windows:							
- Interior Window Surfaces			R	M			
- Exterior Window Surfaces *(inclusive of exterior of*							
elevator shaft if glass back elevator)						R/M	
7. Offices (Management/Security):							
a. Floors	R	M					
b. Windows:							
- Interior Surfaces		R	M				
- Exterior Surfaces			R	M			
8. Electrical/Mechanical Rooms							
9. Wash Down Parking Decks					*R	*M	
10. Wash Down Revenue Control Equipment		R	M				Note 3

Frequency

R = Recommended
M = Minimum

R* = Spring & Fall
M* = Spring

B. Doors & Door Hardware:	Daily	Weekly	Monthly	4 Month Interval	6 Month Interval	Yearly	Other
1. Doors Close & Latch Properly	R	M					
2. Mechanized Doors:							
a. Pedestrian Doors	R	M					
b. Rolling Grill Doors	R	M					
3. Panic Hardware at Security Doors	R	M					
4. Lubricate Mechanized Doors:							
a. Pedestrian Doors			R		M		
b. Rolling Grill Doors			R		M		
C. Electrical System:	**Daily**	**Weekly**	**Monthly**	**4 Month Interval**	**6 Month Interval**	**Yearly**	**Other**
1. Check Lighting Fixtures		R	M				
2. Relamp Fixtures		R		M			
3. Replace Fixture Ballasts			R	M			
4. Inspect - Specialized Electrical Equipment:							
a. Time Clocks				R	M		Note 3
b. Photo Cells				R	M		Note 3
c. Lighting Control Equipment				R	M		Note 3
d. Other						R/M	Note 1
5. Electrical Distribution Panels					R	M	
6. Surface Mounted Conduit					R	M	
7. Sprinkler System Compressor					R	M	
8. Fire Alarm System				R	M		Note 2
D. Heating, Ventilation & Air Conditioning:	**Daily**	**Weekly**	**Monthly**	**4 Month Interval**	**6 Month Interval**	**Yearly**	**Other**
1. Check for Proper Operation:							
a. Heating Equipment		R		M			Note 3
b. Ventilation Equipment		R	M				Note 3
c. A/C Equipment		R		M			Note 3
2. Check Filters						R/M	Note 1
3. HVAC Service - Preventive Maintenance						R/M	Note 1

Frequency

R = Recommended
M = Minimum

R* = Spring & Fall
M* = Spring

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Parking Garage
Maintenance Checklist

E. Painting:	Daily	Weekly	Monthly	4 Month Interval	6 Month Interval	Yearly	Other
1. Check for Paint Failure & Rusting:							
a. Doors & Door Frames				R	M		
b. Handrails & Guardrails				R	M		
c. Steel Bollards/Pipe Guards				R	M		
d. Exposed Piping (fire suppression system & storm drainage)					R	M	
e. Other Miscellaneous Metals				R	M		
2. Check for Appearance:							
a. Striping				R	M		
b. Curbs			R		M		
c. Walls				R	M		
d. Ceilings					R	M	
e. Signs			R	M			
f. Touch-up Painting			R		M		
3. Repainting						R/M	Note 1
F. Parking/Revenue Control Equipment:	**Daily**	**Weekly**	**Monthly**	**4 Month Interval**	**6 Month Interval**	**Yearly**	**Other**
1. Check for Proper Operation	R	M					
2. Parking/Revenue Control Equipment - Preventive Maintenance							Note 3
G. Plumbing/Drainage Systems:	**Daily**	**Weekly**	**Monthly**	**4 Month Interval**	**6 Month Interval**	**Yearly**	**Other**
1. Check for Proper Operation:							
a. Sanitary Facilities	R	M					
b. Potable Water System			R		M		
c. Deck Washdown System							
d. Floor Drains/Storm Risers					R	M	
e. Fire Suppression Systems:							
- Sprinkler System						R/M	Note 3
- Dry Fire Standpipe System						R/M	Note 3
2. Drain Down Systems for Winter						R/M	Note 3

Frequency

R = Recommended
M = Minimum

R* = Spring & Fall
M* = Spring

H. Roofing & Waterproofing:	Daily	Weekly	Monthly	4 Month Interval	6 Month Interval	Yearly	Other
1. Check for Leaks:							
a. Roofing			R		M		
b. Joint/Crack Sealants			R		M		
c. Expansion Joints			R		M		
d. Windows, Doors & Walls			R		M		
e. Parking Deck Waterproofing Membrane			R		M		
2. Check for Deterioration:							
a. Roofing					R	M	
b. Joint/Crack Sealants					R	M	
c. Windows, Doors & Walls					R	M	
d. Parking Deck Waterproofing Membrane					R	M	
I. Safety Checks:	**Daily**	**Weekly**	**Monthly**	**4 Month Interval**	**6 Month Interval**	**Yearly**	**Other**
1. Handrails & Guardrails			R	M			
2. Emergency Exit Signs		R	M				
3. Emergency Lights		R	M				
4. Tripping Hazards:							
a. Supported Concrete Slabs	R	M					
b. Concrete Slab-on-Grade	R	M					
c. Stairs (Interior & Exterior)	R	M					
d. Sidewalks & Curbs (Interior & Exterior)	R	M					
J. Security System:	**Daily**	**Weekly**	**Monthly**	**4 Month Interval**	**6 Month Interval**	**Yearly**	**Other**
1. Check for Proper Operation							
a. Intercom System	R	M					
b. CCTV Surveillance System	R	M					
K. Pedestrian & Vehicular Signage:	**Daily**	**Weekly**	**Monthly**	**4 Month Interval**	**6 Month Interval**	**Yearly**	**Other**
1. Check Signs:							
a. Proper Placement/Positioning		R	M				
b. Clean				R	M		
c. Legibility			R	M			
d. Illuminated Signs or Changeable Information Signs	R	M					

Frequency

R = Recommended
M = Minimum
R* = Spring & Fall
M* = Spring

L. Snow & Ice Removal:	Daily	Weekly	Monthly	4 Month Interval	6 Month Interval	Yearly	Other
1. Check for Icy Spots (in season)	R/M						
2. Remove Snow & Ice (in season)	R/M						
M. Structural System:	**Daily**	**Weekly**	**Monthly**	**4 Month Interval**	**6 Month Interval**	**Yearly**	**Other**
1. Check Structure for:							
a. Soffit (overhead) Deterioration			R	M			
b. Floor Surface Deterioration (See also Safety Checks)				R	M		
c. Wall & Column Deterioration			R	M			
d. Cracking Concrete				R	M		
e. Water Leakage				R	M		
f. Rusting Structural Steel				R	M		
g. Rusting Embedment within Concrete				R	M		
h. Unusual and/or Unequal Settlement					R	M	
N. Repair	**As Per Engineer's Recommendations**						
O. Repair and/or Replace Protective Concrete Coatings	**As Per Engineer's Recommendations**						
	Frequency **R = Recommended** **R* = Spring & Fall** **M = Minimum** **M* = Spring**						

Notes for Maintenance Checklist:

1. A frequency should be selected that is appropriate for that element in the specific parking garage. Spot repairs or replacements should be performed as needed.

2. This equipment should be under a service contract for regular preventative maintenance and emergency service. The equipment manufacturer's recommendations for inspection and preventative maintenance should be followed.

3. This equipment should either be under a service contract for regular preventative maintenance and emergency service, or in-house staff should be specifically trained to provide the required service. The equipment manufacturer's recommendations for inspection and preventative maintenance should be followed.

STRUCTURAL SYSTEMS AND LIFE CYCLE COST EVALUATION

Prepared for

The Milford Transit District
Milford, CT

Site Selection Study

April 2006

Prepared by

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Introduction

Over the years, many different structural systems have been used for parking structures. Performance of these various systems used in northern climates have varied from very good to poor. Structural systems for parking garages generally consist of either a cast-in place concrete, pre-cast concrete or structural steel frame with cast-in-place or pre-cast concrete floor slabs. Some garages utilize a combination of steel, pre-cast and cast-in-place concrete, but typically, most garages are either structural steel or concrete frame with concrete slab systems.

Each of the various structural systems has characteristics that are better suited for a particular project. These characteristics include availability, constructability, schedule impact, fire resistance, durability, construction cost, life cycle cost, operational requirements and aesthetics or appearance. Therefore, a comparison of the primary structural systems most often used is provided below.

I. Cast-in-Place Concrete and Pre-Cast Concrete:

Pre-cast pre-tensioned concrete and cast-in-place post-tensioned concrete are two commonly used construction methods for parking structures. Within these two categories of construction methods there are many different products and framing systems in use.

A well selected framing system properly designed for parking structure use can be achieved with either construction method. Thus, the choice of construction method is not clear-cut and is dependent on many factors, some of which are interrelated. The principal factors affecting the choice of construction method include the following:

- Cost
- Time
- Appearance of the resulting structure
- Performance of the resulting structure

In comparing the two construction methods, it appears desirable to compare on the basis of specific framing systems rather than on general terms. The specific framing systems discussed are the types most commonly used for parking structures. Also, they are usually the lowest cost systems of each type for parking structures with spans of 55' to 62' (60' is used in the text to represent this range of spans).

The typical pre-cast concrete system consists of pre-cast columns, pre-cast beams and double tees that span the 60' direction. Typical column spacing is 36' by 60'. The typical cast-in-place post-tensioned system consists of columns, beams spanning 60' and one-way slabs spanning about 20'. Thus, the usual bay size is about 20' by 60'.

In comparing costs of these two systems, there are no absolutes. The costs are a function of the current construction market in a given area. Over the past twenty years, there have been several cycles, with each of the systems at some time having the lowest construction cost. Although there have been exceptions in general, in times of low construction volumes the cast-in-place systems have tended to produce the lower cost, while in periods of high construction volumes, the pre-cast system has often had the lower cost. Continued development of construction techniques such as forming systems for cast-in-place concrete and

connection details and available widths of double tees for the pre-cast concrete system have also played a role in the relative cost of the two systems for many market areas.

For any given project, research is needed to predict with any certainty which system will produce the lowest construction cost. This research on cost is done during the early stages of the design by reviewing the current market with pre-cast and cast-in-place contractors. With that cost information, the designer and owner can evaluate cost along with the other design factors to determine which system is best suited for that specific project. An alternative is to prepare partial plans for each structural system and put both out to bid.

In comparing time for the two construction methods, it has been determined that there is usually very little difference in total construction time between the two methods. That is, with the normal process of bidding the complete construction as a unit, the time from award of contract to having the facility open, is about the same with either method, assuming proper weather conditions and qualified contractors in both cases. The time that the site is out of use can be minimized with pre-cast concrete, if the pre-cast concrete work in the plant begins before foundation work at the site. In that situation, the pre-cast erection can begin as soon as the foundations are ready.

However, the total time from contract award to completion does not change. Only the time that construction is underway at the site is reduced. Thus, for most cases, the construction method has little effect on the time to complete the project, but the time in the field varies between systems.

In comparing the appearance of the pre-cast double tee system with the cast-in-place beam and slab system, there are several aspects to compare. Of course, appearance is subjective. Both interior and exterior views change between these two structural systems.

In the interior, the principal difference is the pre-cast double tee stems (or joists) at 4' to 6' on center compared to cast-in-place beams at 20' on center with a flat slab between. These spacing of joists or beams create a distinctly different appearance and affects perceptions of openness, quality of lighting and visibility of signage. Most people agree that the beam and slab system creates a more open feeling which is preferable even though the joist appearance is acceptable. Also, the structural system affects the lighting and readability of signage. The double tee system requires more careful placement of light fixtures to achieve uniform lighting than with the beam and slabs, because the double tee stems create baffles for the light.

On the exterior, the pre-cast concrete system requires that the exterior spandrel beams be about two feet deeper than with the cast-in-place system. Depending on the architectural effect desired, this could be an advantage or disadvantage. Some owners prefer to allow as much natural light into the parking structure as possible during the day, which would favor the cast-in-place system with the less deep spandrels.

There are several aspects of performance that must be considered. These include some items that are more in the province of the designer than the structural system. Performance aspects include:

- Durability
- Fire Resistance
- Vibration
- Long term deflections

- Water leakage
- Response to temperature and other volume changes.

Long-term durability is of particular importance in the Northeast where de-icing salts are used during the wintertime. The principal causes of deterioration are de-icer salts and water combined with inadequate design details, poor quality control during construction and lack of a maintenance program by the owner of the facility. A good designer will address all of these aspects and create structures using either method that initially meet performance criteria. The apparent differences between the two structural systems do not show up for several years, thus, there are differences in probably long-term maintenance costs. The two performance aspects that do show differences on a long-term basis between the two systems when both are well designed are durability and water leakage.

Fire resistance is readily achievable with a concrete framing system. The concrete cover over the reinforcing steel provides fire resistance without the additional cost of fireproofing or additional fire suppression systems.

In order to achieve initial water tightness, joints filled with sealant are created in the pre-cast system over every joint between pre-cast units. This is typically twelve feet on center at the long edge of the double tees, over each side of each beam and at the juncture of floor and spandrel beams. The joint sealant typically has a life expectancy of five to fifteen years, depending on ultra violet exposure, traffic and the quality of material. When the joint sealant fails, it must be replaced or water leakage and reduced durability occur.

In the cast-in-place post-tensioned beam and slab systems there are a lesser number of construction joints. These joints have a similar sealant that must be replaced similarly to those in the pre-cast system. Also, in the cast-in-place post-tensioned system, a few random cracks sometimes occur within the first two or three years that must be routed and filled with sealant. However, the total lineal feet of sealant is considerably less in the cast-in-place post-tensioned structure than in a similar size pre-cast structure.

The other long-term performance difference between the two systems occurs in the connections of the pre-cast concrete system. The current trend is to use stainless steel for these connections with the expectation of improved durability performance. The stainless steel connections also increase the cost, which was reflected in the earlier comments on probable current costs. The cast-in-place structure has very limited exposed steel elements, thus would not have similar long-term durability concerns.

Other durability concerns, such as drainage, concrete cover and protective concrete sealers, are judged to be equal for both systems and thus not a subject of comparison. However, for other structural systems there are wide varieties in how those structural systems perform in parking structures.

In summary, both the pre-cast concrete double tee system and the cast-in-place post-tensioned beam and slab system work well in parking structures. The choice probably hinges about which has the lowest initial cost, provided the owner has no preference in the aspect of appearance and the pre-cast concrete cost is sufficiently lower than the cast-in-place cost to account for the probable difference in long term maintenance cost, if the long term cost is a consideration. The probable initial cost of both systems can be determined during the initial design phase so that the designer and owner can jointly make an enlightened choice with consideration of all the factors for that project.

II. Structural Steel System

In the structural steel system, columns, beams and girders are made of structural steel, and slab is comprised of concrete. Parking floors or slabs can be either pre-cast or cast-in-place. If the slab is cast-in-place, it can be either reinforced concrete or post-tensioned.

A structural steel system is often preferred in areas where pre-cast is not available or when the cast-in-place concrete system is not economical due to the high cost of forming and placing rebar. In certain parts of the country, even if pre-cast is readily available, it still may not be cost-effective, because the site is very small and restricted for the delivery of large concrete members. Structural steel framing is also often used where there is non-typical framing geometry not easily achieved with a pre-cast system. In structural steel systems, generally the spans are 20' by 60'; and some of the advantages regarding electrical/mechanical are similar to cast-in-place. Structural steel can be pre-fabricated and erected similar to the pre-cast framing system.

Structural steel has been used very efficiently with different types of concrete slab systems. However, the durability of the steel framing is less than a concrete framing system and will require maintenance of the coating system more frequently. Therefore, in this part of the country, structural steel is not recommended unless high performance paint systems, and waterproofing membranes over the slab are used to reduce the penetration of water and resulting moisture related deterioration.

The use of a structural steel framing system must also consider the building code requirements for fire resistance. Structural steel framing without fire protection is Type IV construction. Some building codes limit the size of parking structures constructed of Type IV construction to a footprint of 50,000 s.f. unless the structure is open on all sides or automatic sprinklers are provided.

In general, the following advantages and disadvantages can be typically associated with different structural systems.

III. Advantages and Disadvantages

Advantages to Cast-In-Place Post Tensioned Concrete

- Most durable system, if properly executed.
- Inherent fire resistance provided by the concrete members.
- Requires the least amount of maintenance over time, because of fewer joints in the structure. This results in less down time and less maintenance costs over the lifetime of the garage.
- Can span greater distances without continual support, creating a more open and inviting feeling inside the garage.
- Because of the open affect of this method of construction, the garage appears to have more headroom, because of less support members on the underside of the elevated structure.

Disadvantages to Cast-In-Place Post Tensioned Concrete

- More expensive to construct than a pre-cast system, based on current market conditions.
- Approximately 30% longer field construction time than a pre-cast system.
- More difficult and costly to continue construction through the winter. All concrete forming and pouring is done on site. Therefore if construction is to continue through the winter, the contractor must enclose structure and provide heating to enable curing.

Advantages of the Pre-Cast Concrete

- Generally less expensive than the cast-in-place process, based on current market conditions.
- Inherent fire resistance provided by the concrete members.
- Construction of concrete support members takes place indoors, then shipped to the job site. It is therefore easier to ensure a high quality of the concrete product and the curing process.
- Only assembly of the structure takes place on site, this enables construction to take place through the winter.
- This field process is quicker because as support members are being constructed off site, others are being assembled on site.

Disadvantages of the Pre-Cast Concrete

- Inside the garage, large double tee support members extend down from the ceiling almost 2 feet. These members occur approximately every 6 feet on center giving the garage a less open/inviting feeling.
- Because of the support members every few feet, illumination becomes more challenging. The lighting must hang lower so that it diffuses further past these structural members. The illumination cost is higher, because generally more lighting fixtures are required for proper illumination levels.
- More joints occur with this method, because each cast member is butted side by side. Unlike the cast in place process where greater distances are poured at once, eliminating many of these joints. Joints that are created on the supported floors must be caulked periodically, creating additional maintenance costs.

Advantages of Structural Steel

- Cost-effective.
- Site Time is similar to pre-cast framing system.
- Long span framing similar to the pre-cast system

Disadvantages of Structural Steel

- Prone to corrosion due to rusting of steel.
- Maintenance cost is high due to painting of steel.
- On a long-term basis, life is shorter and life cycle cost is more.
- Fireproofing or automatic fire suppression (sprinklers) may be necessary for structures greater than 50,000 s.f. footprint.

VI. First Costs for Structural Framing and Life-Cycle Cost of Sealants, Painting Systems and Concrete Repairs

An analysis has been prepared to compare the first or construction costs and the life-cycle costs of the various framing options. For the purpose of these analyses, the decking for the structural steel frame option was assumed to be cast-in-place post tensioned concrete. First costs considered the structural framing only and did not include such elements as foundations, exterior spandrels, architectural treatments, MEP system, grade slabs or pedestrian stairs/cores/elevators.

Attached are tables which compare the first cost and the life-cycle costs for concrete repairs, sealants and painting for the various structural systems. These items were selected because they tend to be the major components that vary between systems. The tables take into account escalation rates and cost of money. It tabulates total costs over 40 years and the net present value of those costs. These costs are comparative only and have not been specifically prepared for any of the concepts being considered.

The results indicate that the combination of first costs and long-term maintenance costs would favor the Pre-Cast system followed by Cast-in-Place Post-tensioning with a Structural Steel system being last.

Milford Transit District

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Table 1: Estimate of joint sealant & waterproofing

	Precast - (Pre-topped)			Cast-in-place			Steel Frame/ PT Slab		
Amount of Sealant/Space in LF	87.5			15			15		
Sealant Cost & Waterproofing	$4.00			$3.00			$7.00		
Escalation Rate	3.50%			3.50%			3.50%		
Cost of Money	7%			7%			7%		
YEAR	% to be replaced in year	Length to be replaced	Estimated cost $	% to be replaced in year	Length to be replaced	Estimated cost $	% to be replaced in year	Length to be replaced	Estimated cost $
1									
2									
3									
4									
5									
6									
7									
8	35%	31	$ 161	35%	5	$ 21	35%	5	$ 48
9									
10									
11									
12									
13									
14									
15									
16	100%	88	$ 607	100%	15	$ 78	100%	15	$ 182
17									
18									
19									
20									
21									
22									
23									
24	35%	31	$ 280	35%	5	$ 36	35%	5	$ 84
25									
26									
27									
28									
29									
30									
31									
32	100%	88	$ 1,052	100%	15	$ 135	100%	15	$ 316
33									
34									
35									
36									
37									
38									
39									
40	35%	31	$ 485	35%	5	$ 62	35%	5	$ 146
Total Estimated Joint Sealant Cost per Space			$ 2,585			$ 332			$ 776

Net present value of Year 8 maintenance	**$ 94**	**$ 12**	**$ 28**
Net present value of Year 16 maintenance	**$ 206**	**$ 26**	**$ 62**
Net present value of Year 24 maintenance	**$ 55**	**$ 7**	**$ 17**
Net present value of Year 32 maintenance	**$ 121**	**$ 16**	**$ 36**
Net present value of Year 40 maintenance	**$ 32**	**$ 4**	**$ 10**

Total net present value over 40 years	**$ 508**	**$ 65**	**$ 152**

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Table 2: Estimate of Painting

	Precast - (Pre-topped)			Cast-in-place			Steel Frame/ PT Slab		
Area of Steel per Space	3			5			160		
Painting Cost (SF)	$1.50			$1.50			$4.50		
Escalation Rate	3.50%			3.50%			3.50%		
Cost of Money	7%			7%			7%		
YEAR	% to be replaced in year	Area to be painted	Estimated cost $	% to be replaced in year	Area to be painted	Estimated cost $	% to be replaced in year	Area to be painted	Estimated cost $
1									
2									
3									
4									
5									
6									
7									
8									
9									
10	100%	3	$ 6	100%	5	$ 11	100%	160	$ 1,016
11									
12									
13									
14									
15									
16									
17									
18									
19									
20	100%	3	$ 9	100%	5	$ 15	100%	160	$ 1,433
21									
22									
23									
24									
25									
26									
27									
28									
29									
30	100%	3	$ 13	100%	5	$ 21	100%	160	$ 2,021
31									
32									
33									
34									
35									
36									
37									
38									
39									
40	100%	3	$ 18	100%	5	$ 30	100%	160	$ 2,851
Total Estimated Painting Cost per Space			$ 45			$ 76			$ 7,320

Net present value of Year 10 maintenance	**$ 3**	**$ 5**	**$ 516**
Net present value of Year 20 maintenance	**$ 2**	**$ 4**	**$ 370**
Net present value of Year 30 maintenance	**$ 2**	**$ 3**	**$ 265**
Net present value of Year 40 maintenance	**$ 1**	**$ 2**	**$ 190**

Total net present value over 40 years	**$ 8**	**$ 14**	**$ 1,342**

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Table 3: Structural Repairs

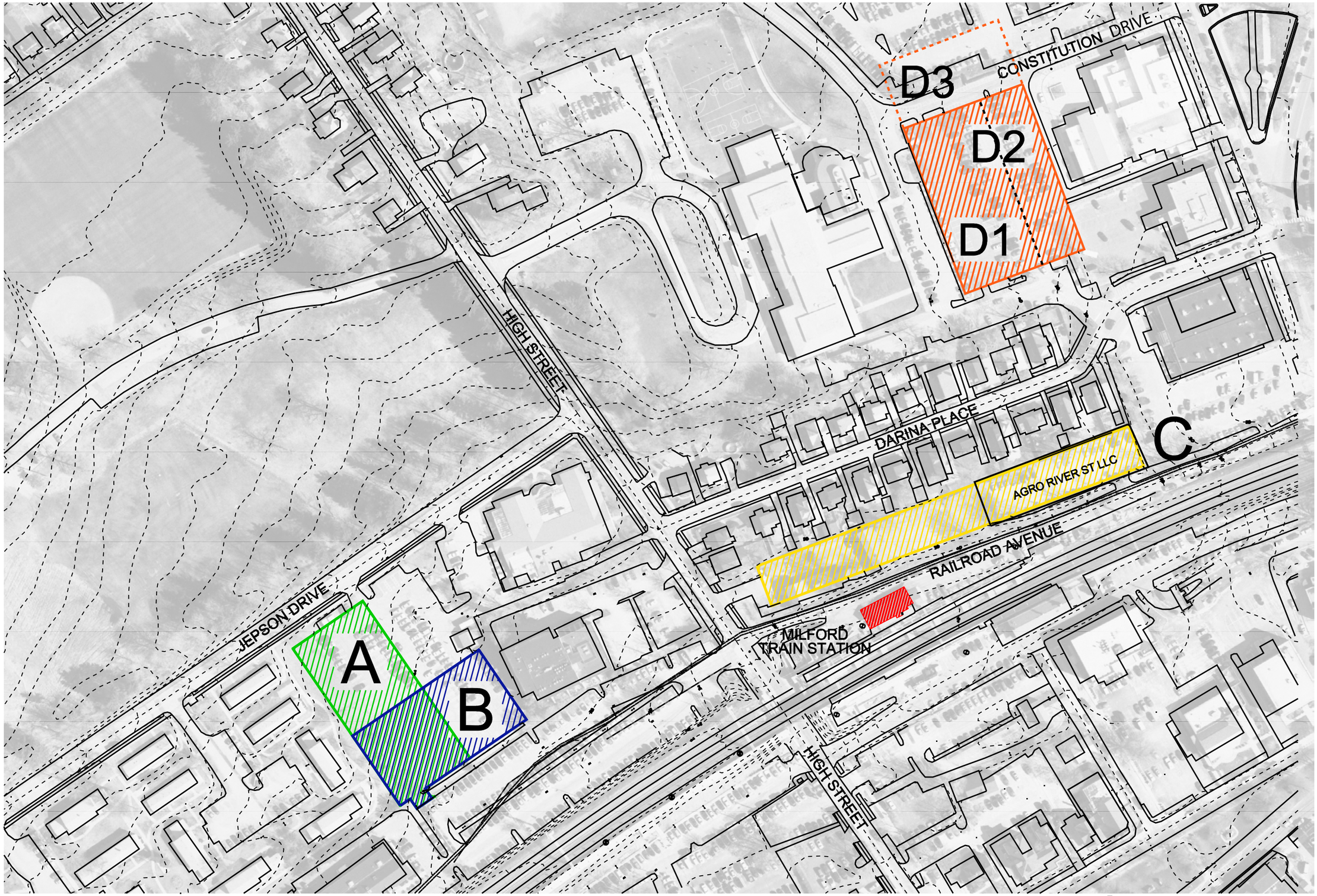
	Precast - (Pre-topped)			Cast-in-place			Steel Frame/ PT Slab		
Amount of Square Feet per Space	300			300			300		
Life Cycle Repair Cost/SF	$21.00			$24.00			$20.00		
Escalation Rate	3.50%			3.50%			3.50%		
Cost of Money	7%			7%			7%		
YEAR	% to be replaced in year	Area to be replaced	Estimated cost $	% to be replaced in year	Area to be replaced	Estimated cost $	% to be replaced in year	Area to be replaced	Estimated cost $
1									
2									
3									
4									
5									
6									
7									
8	35%	105	$ 2,904	15%	45	$ 1,422	15%	45	$ 1,185
9									
10									
11									
12									
13									
14									
15									
16	65%	195	$ 7,101	30%	90	$ 3,745	30%	90	$ 3,121
17									
18									
19									
20									
21									
22									
23									
24	35%	105	$ 5,035	60%	180	$ 9,864	60%	180	$ 8,220
25									
26									
27									
28									
29									
30									
31									
32	65%	195	$ 12,312	25%	75	$ 5,412	25%	75	$ 4,510
33									
34									
35									
36									
37									
38									
39									
40	35%	105	$ 8,730	60%	180	$ 17,104	60%	180	$ 14,253
Total Estimated Repair Cost per Space			$ 36,082			$ 37,548			$ 31,290

Net present value of Year 8 maintenance	**$ 1,690**	**$ 828**	**$ 690**
Net present value of Year 16 maintenance	**$ 2,405**	**$ 1,269**	**$ 1,057**
Net present value of Year 24 maintenance	**$ 993**	**$ 1,945**	**$ 1,621**
Net present value of Year 32 maintenance	**$ 1,413**	**$ 621**	**$ 517**
Net present value of Year 40 maintenance	**$ 583**	**$ 1,142**	**$ 952**

Total net present value over 40 years	**$ 7,083**	**$ 5,804**	**$ 4,837**

Milford Transit District
Milford, CT
Table 4: Summary of First Costs & Selected Life Cycle Costs on a per Space Basis

	Precast - (Pre-topped)	Cast-in-place	Steel Frame/ PT Slab
FIRST COSTS (based on 300 sf/space)	$10,500	$11,700	$10,800
Cost per Square Foot for structural frame only	$35	$39	$36 (includes waterproofing)
LIFE CYCLE COSTS PER SPACE			
Total Cost over 40 Years:			
Est. Joint Sealant over 40 years	$ 2,585	$ 332	$ 776
Est. Painting over 40 years	$ 45	$ 76	$ 7,320
Est. Structural Repairs over 40 years	$ 36,082	$ 37,548	$ 31,290
Total over 40 years	$ 38,712	$ 37,956	$ 39,385
Total Net Present Value over 40 Years:			
Est. Joint Sealant over 40 years	$ 508	$ 65	$ 152
Est. Painting over 40 years	$ 8	$ 14	$ 1,342
Est. Structural Repairs over 40 years	$ 7,083	$ 5,804	$ 4,837
Total over 40 years	$ 7,600	$ 5,884	$ 6,332
Total Net Present Value of First Costs & Selected Life Cycle Costs	$ 56,812	$ 55,540	$ 56,517



AERIAL SITE PLAN
SCALE: 1:60

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MILFORD TRANSIT DISTRICT PARKING FEASIBILITY STUDY

MILFORD, CONNECTICUT

NO.	DATE	BY
REVISIONS		

DRAWING TITLE
AERIAL SITE PLAN

DRAWING NO.
SK-01

SCALE:	AS NOTED
DATE:	05-31-06
PROJECT NO.	40-04139.00-3

DESIGN	DRAWN	CH'KD.
N.L.G.	A.S.	N.L.G.

PROJECT STATISTICS
SITE A 630 TOTAL PARKING SPACES

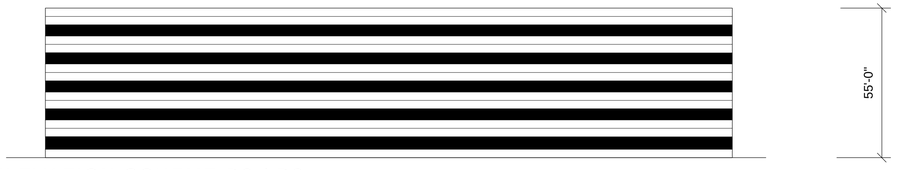
PROS:

1) DISTANCE TO STATION
2) CONSTRUCTABILITY ISSUES
3) ACCESS TO TWO STREETS
4) SPERATION OF COMMUTERS & SENIOR CENTER PARKING
5) CITY OWNED SITE

CONS:

1) HEIGHT VARIANCE REQUIRED - 55'0" - 6 LEVELS HIGH
2) PROXIMITY TO SENIOR HOUSING

PLAN SCHEME D2 / D3
SCALE: 1"=30'



ELEVATION SCHEME D2 / D3
SCALE: 1"=30'

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MILFORD TRANSIT DISTRICT
PARKING FEASIBILITY STUDY
MILFORD, CONNECTICUT

NO.	DATE	BY
REVISIONS		

DRAWING TITLE
SCHEME A

DRAWING NO.
SK-02

SCALE: AS NOTED
DATE: 05-31-06
PROJECT NO. 40-04139.00-3

DESIGN	DRAWN	CH'KD.
N.L.G.	T.J.A	N.L.G.

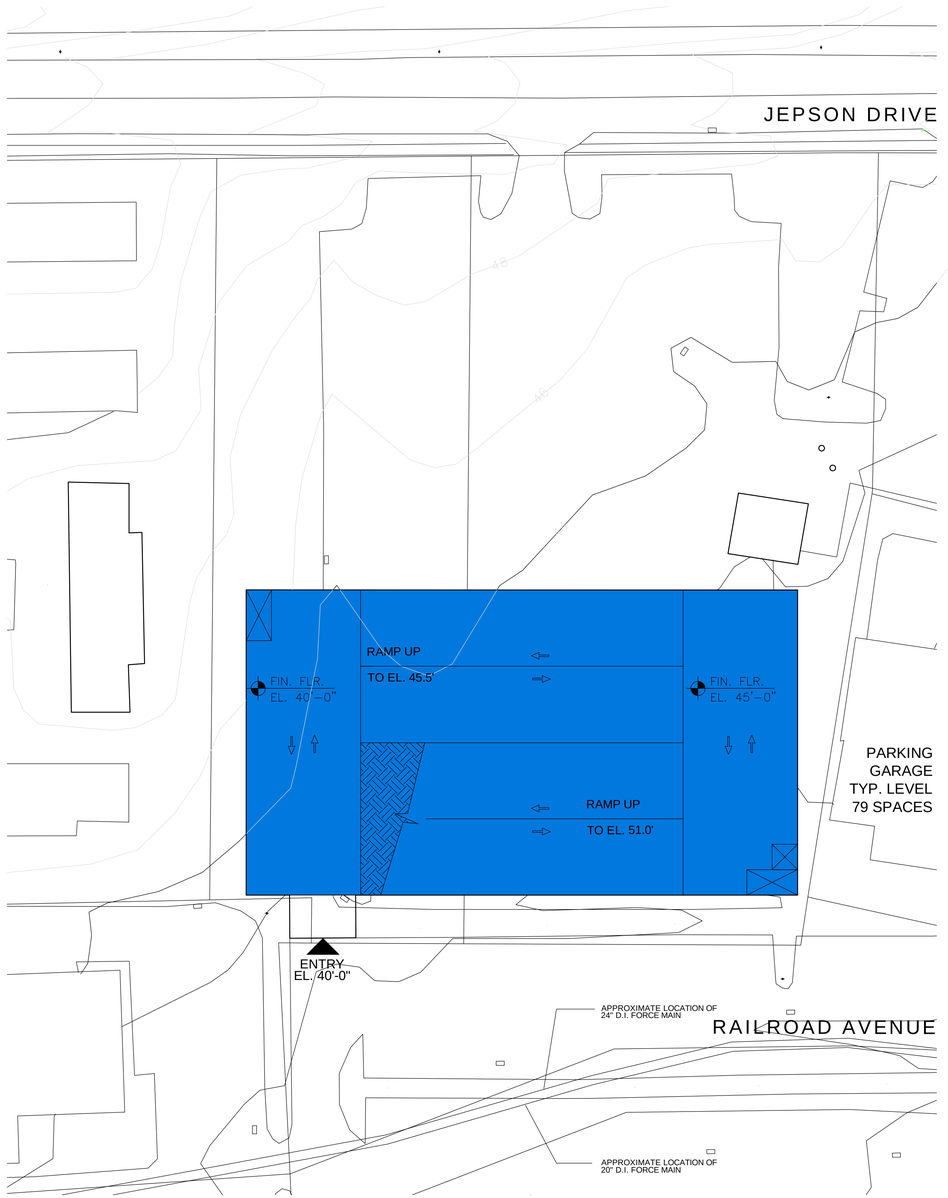
PROJECT STATISTICS
SITE B 629 TOTAL PAKRING SPACES

PROS:

1) PROXIMITY TO STATION
2) CITY OWNED SITE
3) ACCESS THROUGH D.O.T. LOT

CONS:

1) HEIGHT VARIANCE REQUIRED - 81'0"
   - 8 LEVELS HIGH
2) PROXIMITY TO CONDOS & SENIOR HOUSING
3) PARKING MODULE CONFLICTS WITH
   SURFACE LOT
4) SLOPING RAMPS ON BOTH SIDES



PLAN SCHEME B
SCALE: 1"=30'

ELEVATION SCHEME B
SCALE: 1"=30'

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PARKING FEASIBILITY STUDY
MILFORD, CONNECTICUT

NO.	DATE	BY
REVISIONS		

DRAWING TITLE
SCHEME B

DRAWING NO.
SK-03

SCALE: AS NOTED
DATE: 05-31-06
PROJECT NO. 40-04139.00-3

DESIGN	DRAWN	CH'KD.
N.L.G.	T.J.A	N.L.G.

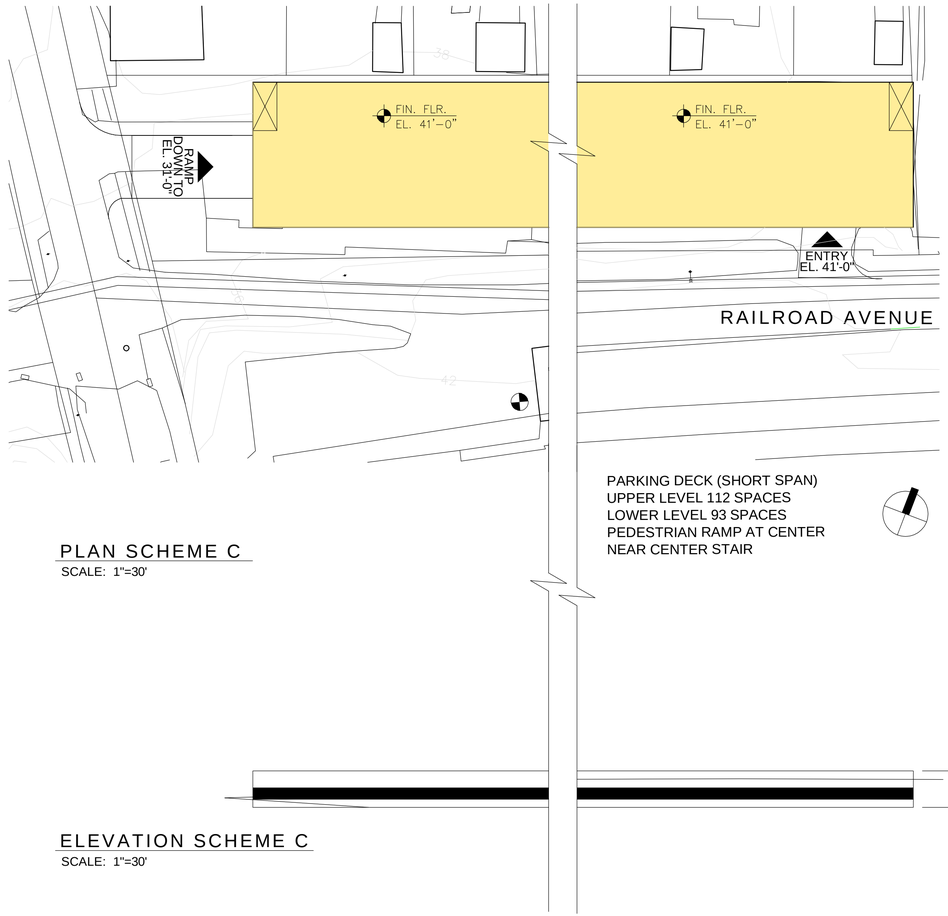
PROJECT STATISTICS
SITE C 205 TOTAL PARKING SPACES

PROS:

1) PROXIMITY TO STATION
2) NO VARIANCE REQUIRED

CONS:

1) CITY DOES NOT OWN PART OF THE SITE
2) PROXIMITY TO PRIVATE PROPERTY
3) SINGLE BAY LAYOUT
4) PORTION BELOW GRADE
5) CONSTRUCTABILITY ISSUES
6) HIGH COST PER CAR
7) VEHICULAR / PEDESTRIAN ACCESS
8) NUMBER OF SPACES- ONLY ONE
   ELEVATED LEVEL



PLAN SCHEME C
SCALE: 1"=30'

ELEVATION SCHEME C
SCALE: 1"=30'

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MILFORD TRANSIT DISTRICT
PARKING FEASIBILITY STUDY
MILFORD, CONNECTICUT

NO.	DATE	BY
REVISIONS		

DRAWING TITLE
SCHEME C

DRAWING NO.
SK-04

SCALE: AS NOTED
DATE: 05-31-06
PROJECT NO. 40-04139.00-3

DESIGN	DRAWN	CH'KD.
N.L.G.	T.J.A	N.L.G.

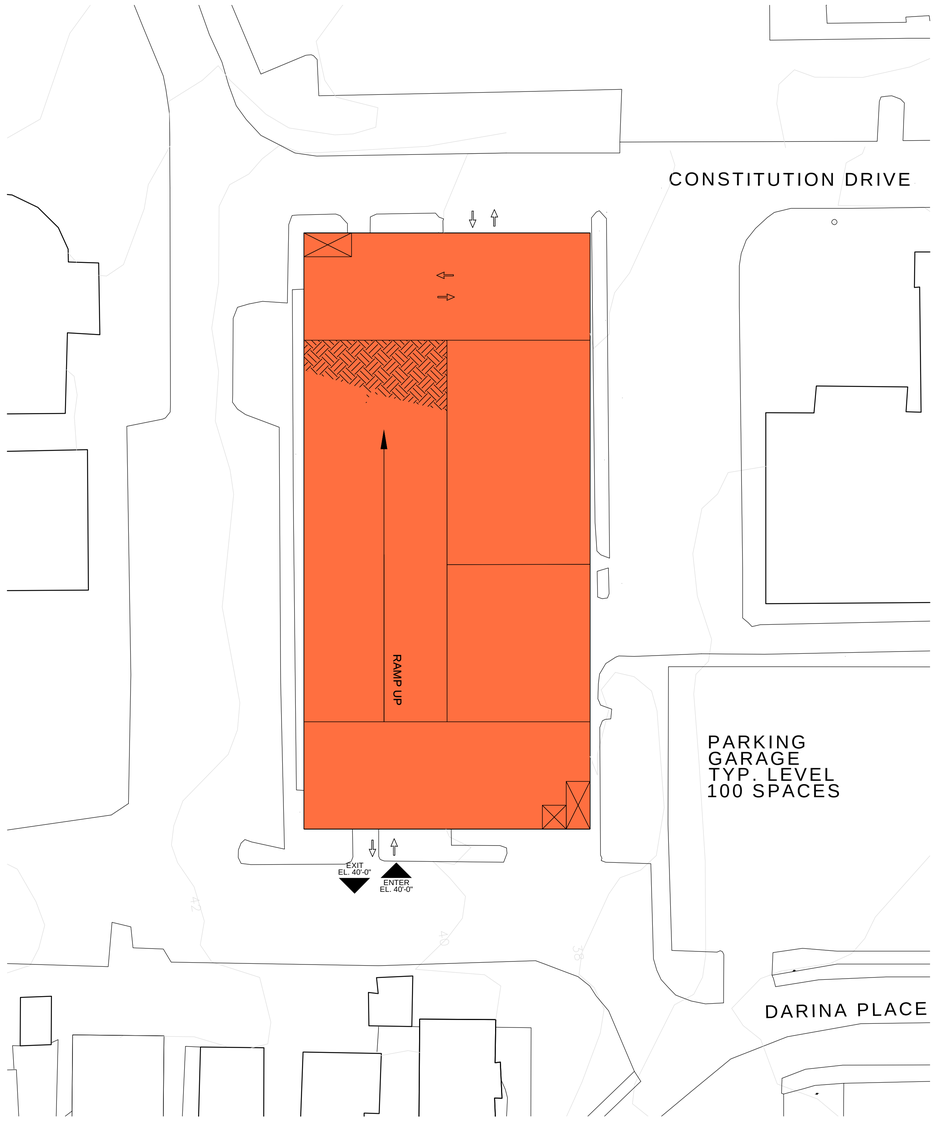
PROJECT STATISTICS
SITE D1 624 TOTAL PARKING SPACES

PROS:

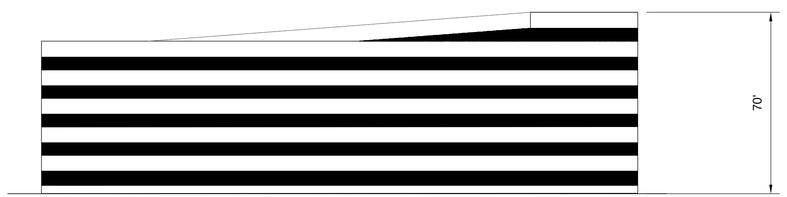
1) MINIMIUM VISUAL IMPACT ON STREETS
2) CURRENTLY A CITY OWNED SITE
3) ACCESS TO SEVERAL STREETS
4) SUPPORT POTENTIAL COUTHOUSE EXPANSION
5) NO IMPACT ON SCHOOL PARKING / DROP-OFF

CONS:

1) HEIGHT VARIANCE REQUIRED - 70'0"
   - 6.5 LEVELS HIGH
2) DISTANCE TO STATION (WITHOUT
   PROPERTY EASEMENT)
3) TALLER THAN ADJACENT BUILDINGS
4) LIMITED EXPANSION CAPABILITY



PLAN SCHEME D1
SCALE: 1"=30'



ELEVATION SCHEME D1
SCALE: 1"=30'

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MILFORD TRANSIT DISTRICT
PARKING FEASIBILITY STUDY
MILFORD, CONNECTICUT

NO.	DATE	BY
REVISIONS		

DRAWING TITLE
SCHEME D1

DRAWING NO.
SK-05

SCALE: AS NOTED
DATE: 05-31-06
PROJECT NO. 40-04139.00-3

DESIGN	DRAWN	CH'KD.
N.L.G.	T.J.A	N.L.G.

PROJECT STATISTICS
SITE D2 657 TOTAL PARKING SPACES

PROS:

1) MINIMIUM VISUAL IMPACT ON STREETS
2) CURRENTLY A CITY OWNED SITE
3) ACCESS TO SEVERAL STREETS
4) SUPPORT POTENTIAL COUTHOUSE EXPANSION
5) PROVIDES SECURE COURTHOUSE ACCESS

CONS:

1) HEIGHT VARIANCE REQUIRED - 48'0"
   - 4 LEVELS HIGH
2) DISTANCE TO STATION (WITHOUT PROPERTY EASEMENT)
3) ADDITIONAL COST IN SITE WORK

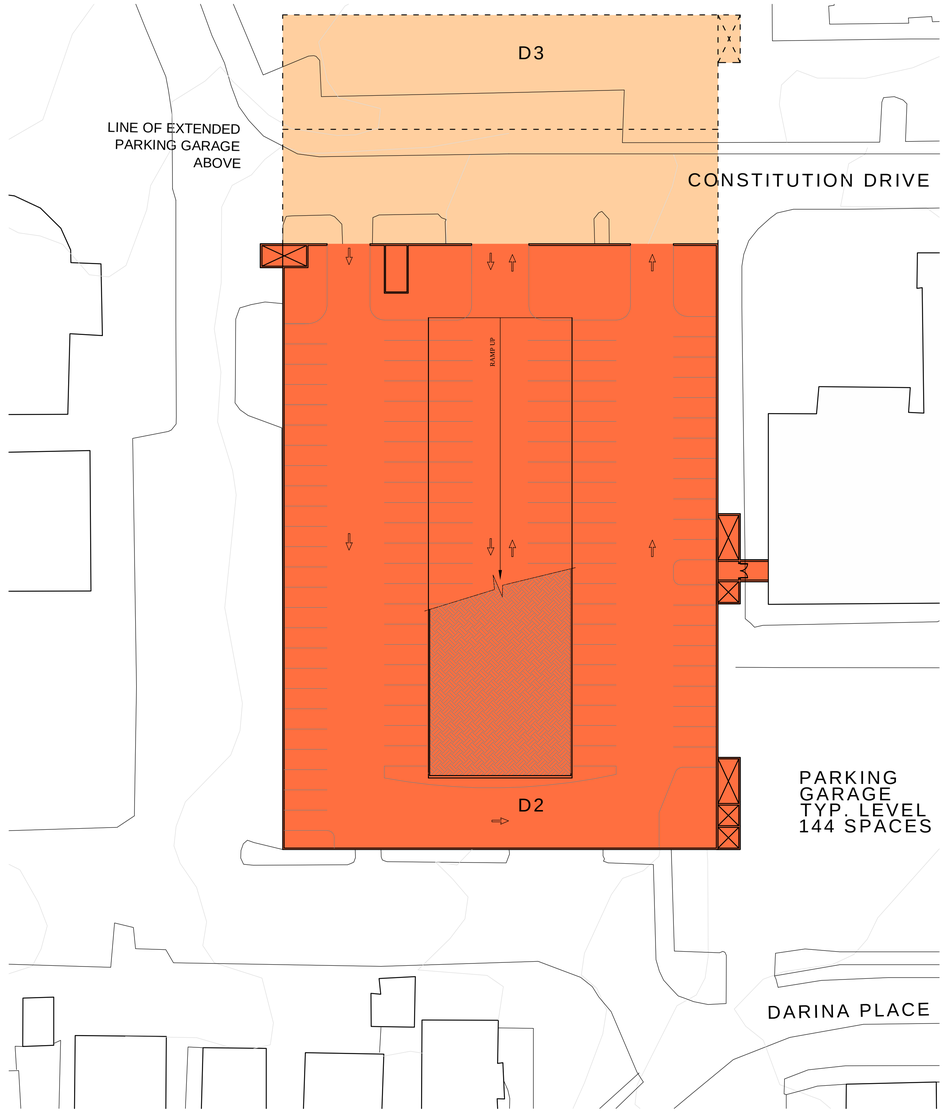
SITE D3 661 TOTAL PARKING SPACES

PROS:

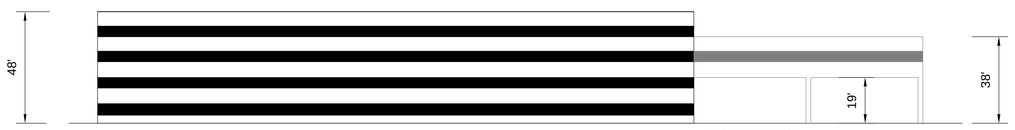
1) MINIMIUM VISUAL IMPACT ON STREETS
2) NO VARIANCES REQUIRED 38'0" HIGH
3) CURRENTLY A CITY OWNED SITE
4) ACCESS TO SEVERAL STREETS
5) SUPPORT POTENTIAL COUTHOUSE EXPANSION
6) PROVIDES SECURE COURTHOUSE ACCESS
7) PROVIDES PEDESTRIAN ACCESS TO PARSONS
8) SITE PLAN PROVIDES NEW SEPARATE SCHOOL DROP-OFF AND PARKING AREAS

CONS:

1) DISTANCE TO STATION (WITHOUT PROPERTY EASEMENT)
2) ADDITIONAL COST IN SITE WORK



PLAN SCHEME D2 / D3
SCALE: 1"=30'



ELEVATION SCHEME D2 / D3
SCALE: 1"=30'

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MILFORD TRANSIT DISTRICT
PARKING FEASIBILITY STUDY
MILFORD, CONNECTICUT

NO.	DATE	BY
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DRAWING TITLE: SCHEME D2 / D3

DRAWING NO.: SK-06

SCALE: AS NOTED
DATE: 05-31-06
PROJECT NO. 40-04139.00-3

DESIGN	DRAWN	CH'KD.
N.L.G.	T.J.A	N.L.G.

Proposed Parking Garage
Milford, Connecticut

Table of Zoning Compliance for MCDD
(Milford Center Design Development District)

Zoning Parameter	*MCDD Requirement*
Maximum Permitted Floor Area Ratio (Sec. 3.21.4.3)	**3.0**
Maximum Building Height (Sec. 3.21.4.3)	**Three stories or 40'**
Minimum Required Lot Area (Sec. 3.21.4.3)	**2,000 sq. ft.**
Minimum Required Lot Width (Sec. 3.21.4.1)	**20 feet**
Minimum Required Lot Depth (Sec. 3.21.4.1)	**70 feet**
Min. Front Yard (Sec. 3.21.4.2)	**None required**
Min. Side Yards (Sec. 3.21.4.2)	**None required** (but at least 4' if provided)
Min. Rear Yard (Sec. 3.21.4.2)	**None required** (but at least 4' if provided)
Required Parking	**Not applicable**

Project requires following local reviews/permits:
- Site Plan Approval (Sec. 7.1 of Zoning Regulations)
- Coastal Site Plan Review (Sec. 5.12 of Zoning Regulations)

Architect should be aware of:
- MCDD Design Guidelines (Appendix B of Zoning Regulations)
- Min. parking space size of 8' width by 18' length for parking structures (9' x 18' for surface parking).
- Exterior Lighting Regulations (Sec. 5.2)
- Sign Regulations (Sec. 5.3)

MILFORD TRANSIT DISTRICT

COMPARISON OF SITES

SITE	LOCATION	SPACES Total/Level Net/Existing	SQ.FT.	LEVELS	HEIGHT	CONSTRUCTION COST	COST/CAR	DISTANCE	ACQUISITION OF PRIVATE PROPERTY REQ'D	ZONING VARIANCE FOR BLDG HEIGHT REQ'D
A	Jepson Dr.	630/110 +518/112	199,260	6	59'	$11,955,600	$18,977	750'	NO	YES
B	Jepson Dr. / Railroad Ave	629/79 +554/75	208,100	8	81'	$12,486,000	$19,850	750'	NO	YES
C	Railroad Ave	205/90 +131/74	67,632	2	16'	$4,396,080	$21,444	400'	YES	NO
D	**1)** Constitution Dr	624/100 +552/102	199,875	6.5	70'	$11,992,500	$19,218	660'	NO	YES
	2) Constitution Dr	657/142 +540/117	225,440	5	48	$13,174,296	$20,052	660'	NO	YES
	3) Constitution Dr	661/142/215 +544/117	213,650	4	38'	$12,982,418	$19,641	660'	NO	NO

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MILFORD TRANSIT DISTRICT
PARKING FEASIBILITY STUDY
MILFORD, CONNECTICUT

NO.	DATE	BY
REVISIONS		

DRAWING TITLE
PARKING GARAGE MATRIX

DRAWING NO.
SK-07

SCALE: AS NOTED
DATE: 05-31-06
PROJECT NO. 40-04139.00-3

DESIGN	DRAWN	CH'KD.
N.L.G.	T.J.A	N.L.G.

LEGEND

BUILDING/LAND USE

- STATE AND FEDERAL PROPERTY
- MUNICIPAL PROPERTY
- SCHOOL
- PRIVATE INSTITUTIONS
- RETAIL SALES/SERVICE (GENERAL)
- OFFICE
- BANK
- RESIDENTIAL (SINGLE FAMILY)
- RESIDENTIAL (TWO FAMILY)
- RESIDENTIAL (APARTMENT/CONDOMINIUM)
- MISCELLANEOUS OPEN SPACE

FUNCTIONAL ROAD CLASSIFICATIONS

- MAJOR COLLECTOR (MINOR ARTERIAL)
- COLLECTOR
- ONE-WAY TRAFFIC
- TWO-WAY TRAFFIC
- PEDESTRIAN ROUTE

0 50 100
SCALE IN FEET

PARSONS GOVERNMENT CENTER
MILFORD CITY HALL
HARBORSIDE MIDDLE SCHOOL
ZONE
AREA
MANAGEMENT
CONSTITUTION DRIVE
WEST RIVER STREET
SUPERIOR COURTHOUSE
U.S. POST OFFICE
PROPOSED PARKING GARAGE
POSSIBLE ALTERNATE DRIVE TO SCHOOL PARKING
COASTAL
JEPSON DRIVE
HIGH STREET
SENIOR CENTER
ST. PETER'S CHURCH
DARINA PLACE
PEDESTRIAN ROUTE B = 1,100' +/-
COMMERCIAL BUILDING
CONDOMINIUM
LIMIT
MILFORD HIGH STREET LLC
MILFORD HIGH STREET LLC
AGRO RIVER STREET LLC
AGRO RIVER STREET LLC
PEDESTRIAN ROUTE A = 660' +/-
RAILROAD AVENUE
APPROXIMATE
MILFORD TRAIN STATION
CENTER FOR THE ARTS
RAILROAD AVENUE (SOUTH)
RIVER STREET
54/395
State of Connecticut
Railroad Ave. Southeast
84

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MILFORD TRANSIT DISTRICT PARKING FEASIBILITY STUDY

MILFORD, CONNECTICUT

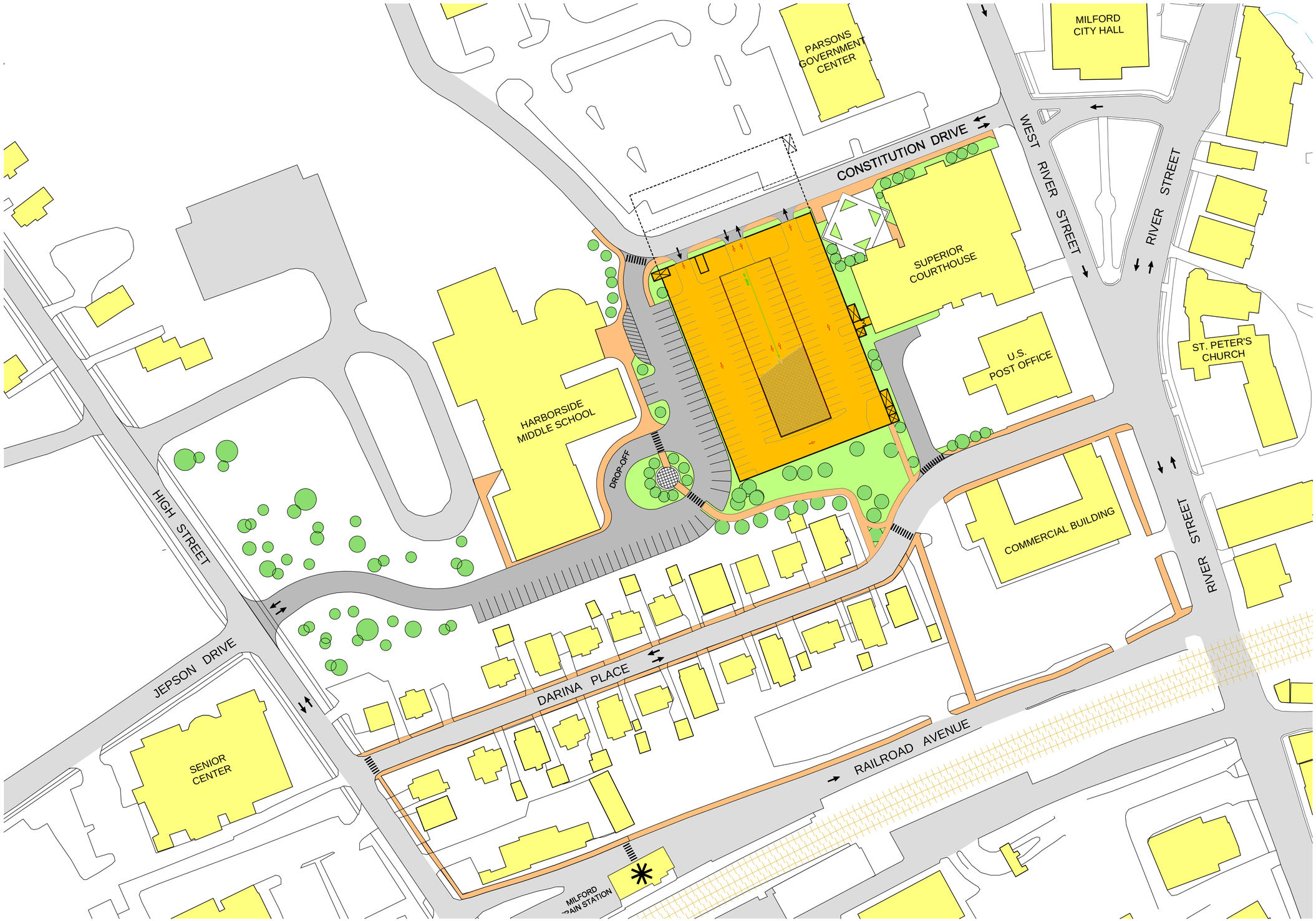
NO.	DATE	BY
REVISIONS		

DRAWING TITLE
SITE ANALYSIS MAP

DRAWING NO.
SK-08

SCALE: AS NOTED
DATE: 05-31-06
PROJECT NO. 40-04139.00-3

DESIGN	DRAWN	CH'KD.
N.L.G.	T.J.A	N.L.G.



SITE LAYOUT
SCHEME D2 / D3

SCALE: 1"=40'

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MILFORD TRANSIT DISTRICT PARKING FEASIBILITY STUDY

MILFORD, CONNECTICUT

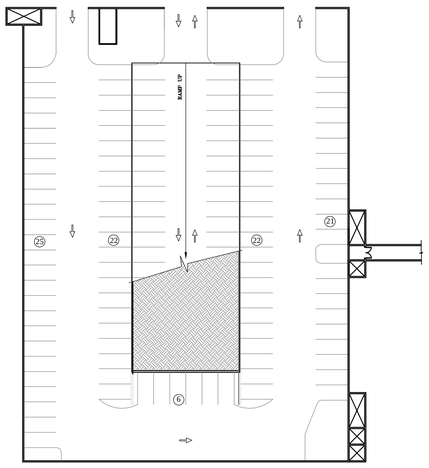
NO.	DATE	BY
REVISIONS		

DRAWING TITLE
ALTERNATIVE SITE REDESIGN MAP

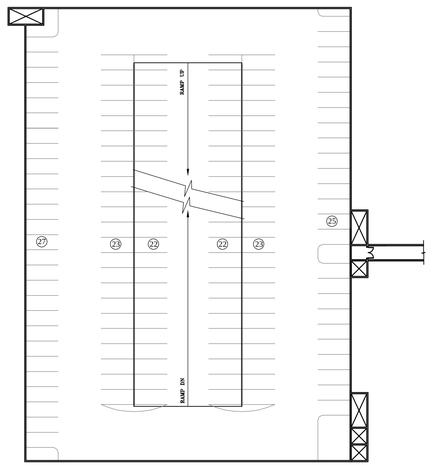
DRAWING NO.
SK-09

SCALE: AS NOTED
DATE: 03-31-06
PROJECT NO. 40-04139.00-3

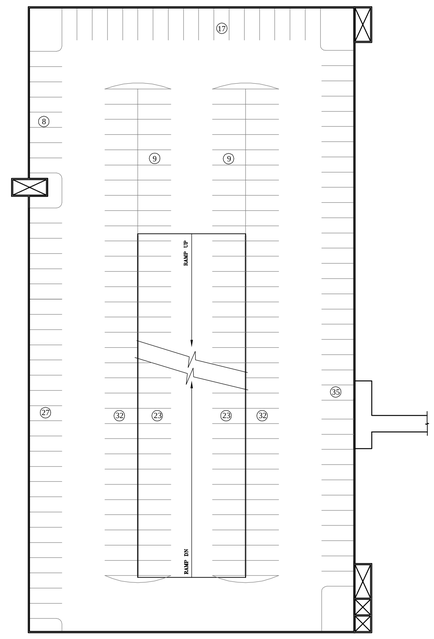
DESIGN	DRAWN	CH'KD.
N.L.G.	T.J.A	N.L.G.



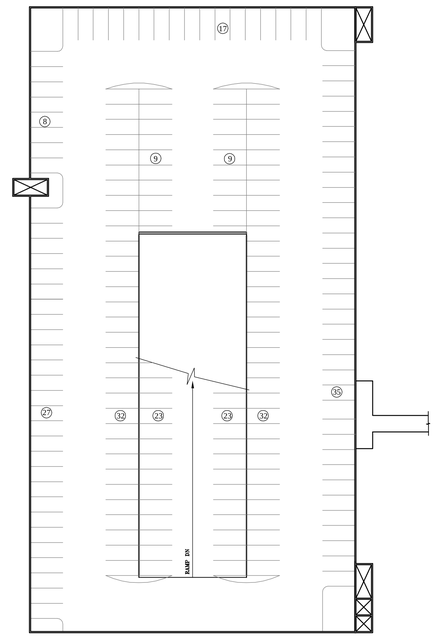
SCHEME D3
GRADE LEVEL LAYOUT
SCALE: 1"=40'



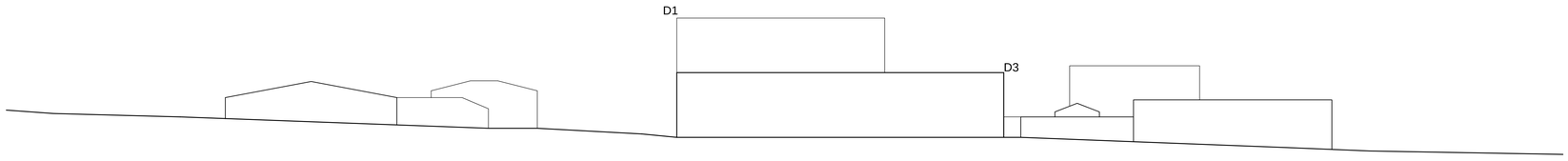
SCHEME D3
SECOND LEVEL LAYOUT
SCALE: 1"=40'



SCHEME D3
THIRD LEVEL LAYOUT
SCALE: 1"=40'



SCHEME D3
FOURTH LEVEL LAYOUT
SCALE: 1"=40'



SITE SECTION
SCALE: 1"=40'

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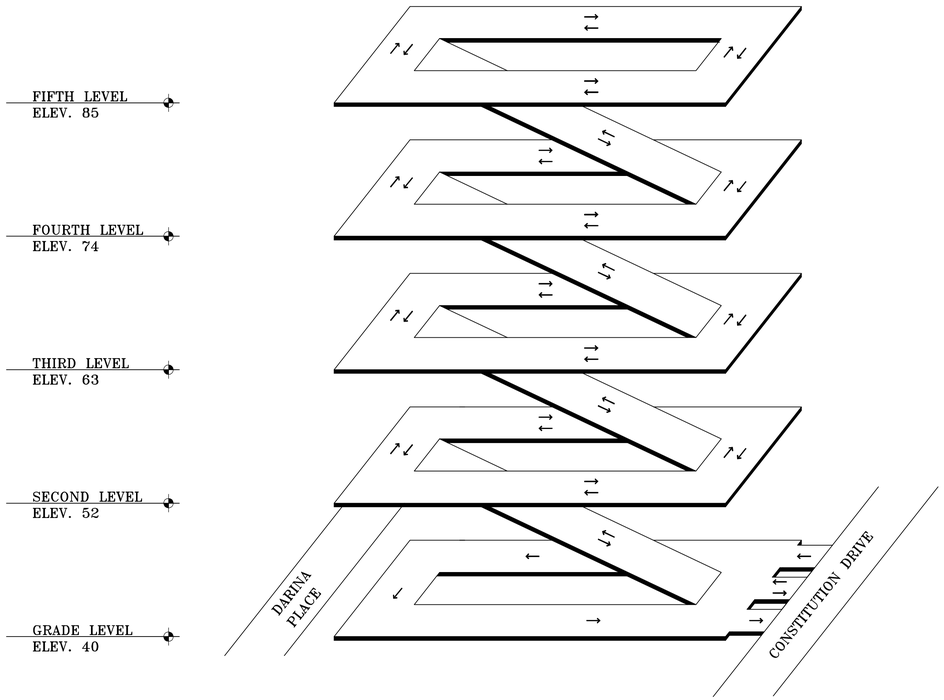
PARKING FEASIBILITY STUDY
MILFORD, CONNECTICUT

NO.	DATE	BY
REVISIONS		

DRAWING TITLE
SCHEME D3 LAYOUTS

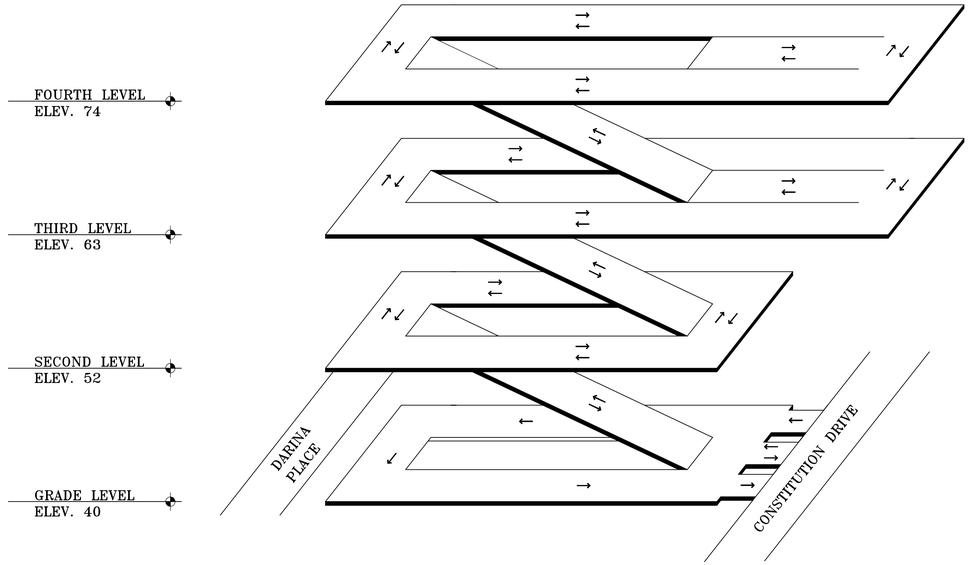
DRAWING NO.
SK-10

SCALE: AS NOTED		
DATE: 05-31-06		
PROJECT NO. 40-04139.00-3		
DESIGN N.L.G.	DRAWN T.J.A	CH'KD. N.L.G.



ISOMETRIC SCHEME D2

SCALE: NTS



ISOMETRIC SCHEME D3

SCALE: NTS

PARKING SUMMARY CHART SCHEME D2

8'-6" WIDE SPACES

LEVEL	TOTAL S.F.	TOTAL CARS
GROUND LEVEL	36,520 S.F.	96
SECOND LEVEL	47,230 S.F.	142
THIRD LEVEL	47,230 S.F.	142
FOURTH LEVEL	47,230 S.F.	142
FIFTH LEVEL	47,230 S.F.	142
TOTAL	225,440 S.F.	664

TOTAL PARKING SPACES: 664 SPACES
(Not including 13 H.C. Spaces)

APPROX. TOTAL SPACES: 657 SPACES

TOTAL PARKING AREA: 225,440 S.F.

EFFICIENCY: 344 S.F./CAR

PARKING SUMMARY CHART SCHEME D3

8'-6" WIDE SPACES

LEVEL	TOTAL S.F.	TOTAL CARS
GROUND LEVEL	36,520 S.F.	96
SECOND LEVEL	47,230 S.F.	142
THIRD LEVEL	64,950 S.F.	215
FOURTH LEVEL	64,950 S.F.	215
TOTAL	213,650 S.F.	668

TOTAL PARKING SPACES: 668 SPACES
(Not including 13 H.C. Spaces)

APPROX. TOTAL SPACES: 661 SPACES

TOTAL PARKING AREA: 213,650 S.F.

EFFICIENCY: 324 S.F./CAR

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MILFORD TRANSIT DISTRICT
PARKING FEASIBILITY STUDY
MILFORD, CONNECTICUT

NO.	DATE	BY
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DRAWING TITLE
SCHEME D2/D3

DRAWING NO.
SK-11

SCALE: AS NOTED
DATE: 05-31-06
PROJECT NO. 40-04139.00-3

DESIGN	DRAWN	CH'KD.
N.L.G.	T.J.A	N.L.G.

SCHEME D3 PERSPECTIVE

SCALE: N.T.S.

DESMAN ASSOCIATES
A DIVISION OF DESMAN, INC.
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MILFORD TRANSIT DISTRICT
PARKING FEASIBILITY STUDY
MILFORD, CONNECTICUT

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SCHEME D3 PERSPECTIVE

DRAWING NO.
SK-12

SCALE: AS NOTED		
DATE: 05-31-06		
PROJECT NO. 40-04139.00-3		
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SCHEME D3 PERSPECTIVE
SCALE: N.T.S.

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DRAWING TITLE
SCHEME D3 PERSPECTIVE

DRAWING NO.
SK-13

SCALE: AS NOTED		
DATE: 05–31–06		
PROJECT NO. 40-04139.00-3		
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